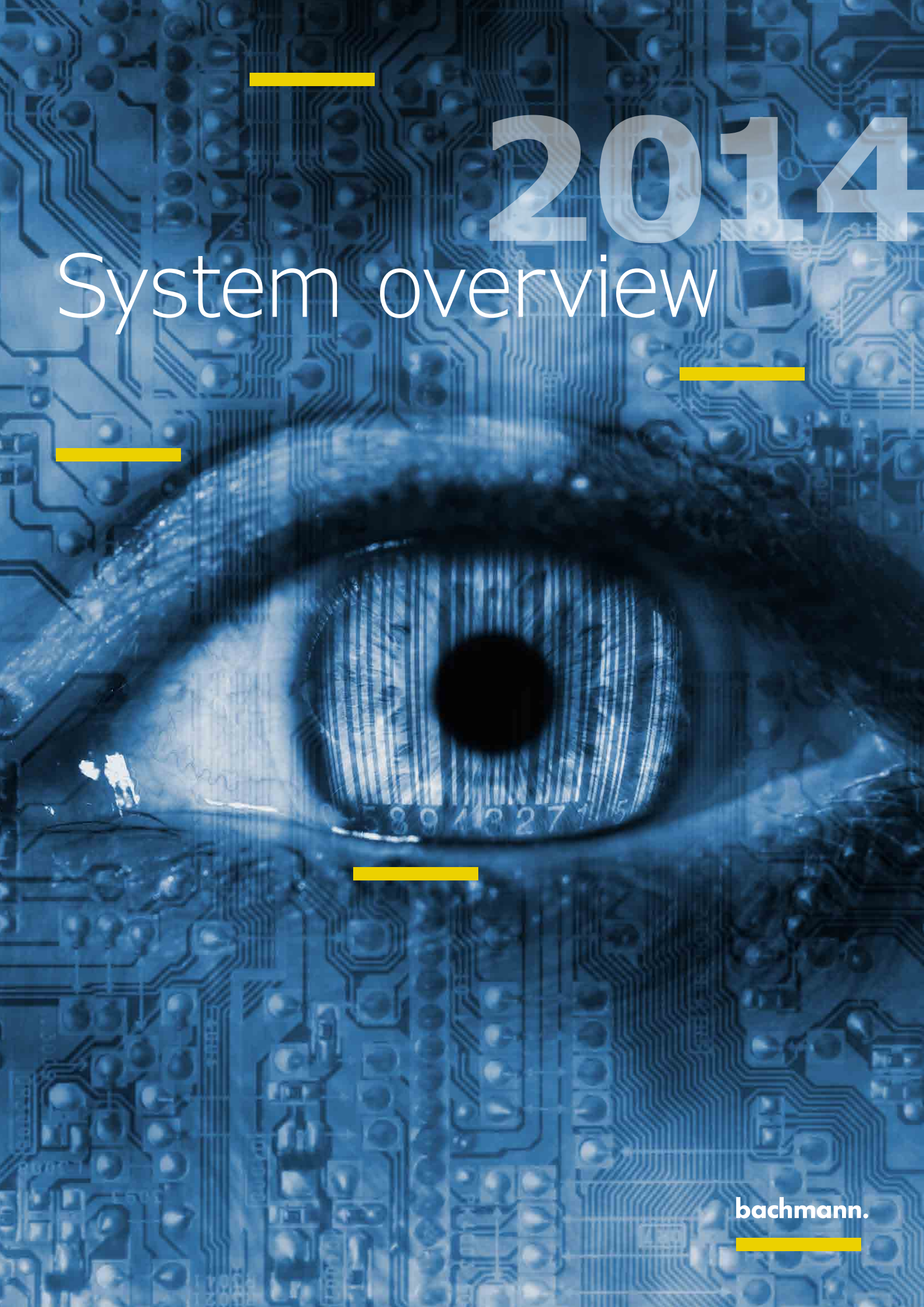




---

# 2014

## System overview

---

---

---

**bachmann.**

---

System overview

# Content

## M1 controller hardware 8

### Processor modules

|               |    |
|---------------|----|
| ME203 series  | 11 |
| MX200 series  | 13 |
| MPC200 series | 16 |
| MC200 series  | 18 |
| MH200 series  | 20 |

### Digital input/output modules

|                                             |    |
|---------------------------------------------|----|
| Digital input modules DI212/216/232         | 25 |
| Digital output modules DO216/232            | 27 |
| Digital relay output modules DOR206/230     | 29 |
| Digital input/output modules DIO216/232     | 31 |
| Digital input/output modules DIO248/264/280 | 33 |

### Analog input/output modules

|                                          |    |
|------------------------------------------|----|
| Universal input/output module GIO212     | 40 |
| Universal input/output module AIO208/216 | 44 |
| Analog input modules AI202/SI, AI204/SI  | 47 |
| Analog input modules AI208/SI            | 49 |
| Analog input modules AI204/x             | 51 |
| Analog output module AO202               | 53 |
| Analog output module AO208/I             | 54 |
| Analog output modules AO202/SI, AO204/SI | 55 |
| Analog input/output modules AIO288/x     | 56 |
| Temperature input module PTAI216         | 59 |
| Temperature input modules TI214/x        | 61 |
| Strain gauge input module DMS202         | 63 |

### Function modules

|                                      |    |
|--------------------------------------|----|
| Counter modules CNT204/x             | 67 |
| Encoder interface modules ISI222/x   | 69 |
| Pulse width modulation module PWM202 | 72 |
| Axis controller module ACR222/2      | 73 |

### Grid measurement module

|                                                                |    |
|----------------------------------------------------------------|----|
| Grid measurement, protection and synchronization module GSP274 | 77 |
| Grid measurement and protection module GMP232                  | 84 |
| Grid measurement module GM260                                  | 90 |

### System modules

|                                  |     |
|----------------------------------|-----|
| Power supply module NT255        | 95  |
| Power supply module NT250/48     | 97  |
| Distributor modules VP200/x      | 98  |
| Dummy module LM201               | 99  |
| Rail adapter S202                | 100 |
| Backplane BS200 series           | 101 |
| Backplanes BS200* series         | 102 |
| Backplanes BS200/S series        | 103 |
| Bus bar Adapters BS200/ET series | 104 |

### Storage media

|                                       |     |
|---------------------------------------|-----|
| PC cards PCC201/xx                    | 106 |
| Compact Flash memory CF200/xx         | 107 |
| CFast memory CFA200/xx                | 108 |
| Bachmann System Maintenance Stick BSM | 109 |

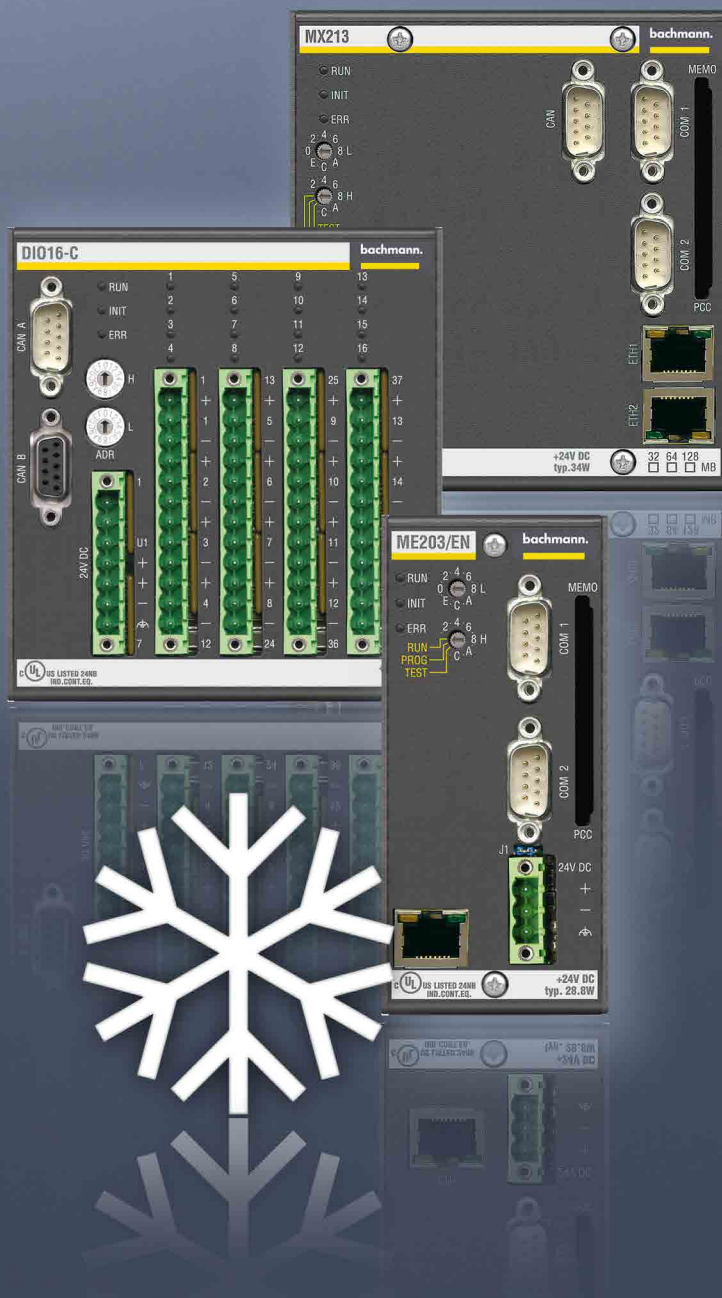
|                                                 |     |
|-------------------------------------------------|-----|
| <b>Networking</b>                               | 112 |
| <b>Interfaces</b>                               |     |
| Industrial Ethernet master EM2x3                | 115 |
| Interface modules RS204                         | 117 |
| <b>Ethernet</b>                                 |     |
| Industrial Ethernet Switch SWI205               | 121 |
| Ethernet Remote Station ERS202                  | 123 |
| Media convertor – unmanaged switch FCS214/x     | 125 |
| <b>Bus expansion</b>                            |     |
| Bus expansion modules BEx200 series             | 129 |
| <b>FASTBUS</b>                                  |     |
| FASTBUS module Fx210 series                     | 133 |
| FASTBUS module Fx220 series                     | 135 |
| <b>CANopen</b>                                  |     |
| CANopen master module CM202                     | 141 |
| CANopen slave modules CS200/x                   | 143 |
| Digital input/output modules DIOxxx-C           | 145 |
| Analog and digital input/output module DA3284-C | 147 |
| Temperature I/O modules TCO2xx-C                | 150 |
| CANopen configurator                            | 152 |
| <b>DeviceNet</b>                                |     |
| DeviceNet master DNM201                         | 153 |
| <b>EtherCAT</b>                                 |     |
| EtherCAT master                                 | 156 |
| ECS200 EtherCAT Slave Module                    | 157 |
| EtherCAT configurator                           | 159 |
| <b>PROFIBUS</b>                                 |     |
| PROFIBUS DP master module DPM200                | 162 |
| PROFIBUS configurator                           | 164 |
| <b>PROFINET</b>                                 |     |
| PROFINET IO (RT)                                | 166 |
| PROFINET configurator                           | 167 |
| <b>M-BUS</b>                                    |     |
| MBUS201 master                                  | 169 |
| <b>MODBUS TCP/UDP/RTU</b>                       |     |
| Modbus master                                   | 172 |
| Modbus slave                                    | 175 |
| <b>Telecontrol/field level</b>                  |     |
| MMS client (IEC61850 / IEC61400-25)             | 178 |
| <b>SERCOS</b>                                   |     |
| SERCOS master module SEM201                     | 182 |
| <b>bluecom</b>                                  | 183 |
| <b>Communication – control room networking</b>  |     |
| OPC UA Server                                   | 191 |
| M1 OPC standard server                          | 195 |
| M1 OPC enterprise server                        | 199 |
| MMS server (IEC61850 / IEC61400-25)             | 203 |
| IEC60870-5 Server (Slave)                       | 207 |



|                                                      |     |
|------------------------------------------------------|-----|
| <b>Security</b>                                      | 214 |
| Communication and information security               | 216 |
| <b>Safety technology</b>                             | 224 |
| <b>Safety modules &amp; Safety Developer</b>         |     |
| Safety processor module SLC284                       | 227 |
| Safety input module SDI208                           | 230 |
| Safety output modules SDO204                         | 232 |
| Safety Developer Engineering tool                    | 235 |
| <b>Redundancy</b>                                    | 240 |
| Hot-standby redundancy                               | 243 |
| Warm-standby redundancy                              | 247 |
| Network redundancy                                   | 251 |
| <b>HMI devices</b>                                   | 256 |
| <b>Operator terminals</b>                            |     |
| Operator terminal OT100 series                       | 259 |
| Operator terminal OT200 series                       | 261 |
| Operator terminal OT1300 series                      | 264 |
| <b>Industrial PC</b>                                 | 270 |
| Industrial PC IPC1400 series                         | 272 |
| <b>Headless IPCs and remote displays</b>             |     |
| Remote displays DD900 series                         | 279 |
| Remote displays DF900 series                         | 281 |
| Cabinet PC IPM1400                                   | 283 |
| <b>Engineering software</b>                          | 288 |
| <b>Project engineering made easy: SolutionCenter</b> |     |
| M-Base                                               | 291 |
| <b>Configuration</b>                                 |     |
| Device Manager                                       | 293 |
| <b>Test and diagnostics</b>                          |     |
| Scope 3                                              | 295 |
| <b>Programming</b>                                   |     |
| M-PLC programming interface                          | 302 |
| C/C++ Developer                                      | 305 |
| <b>Model-based design/Simulation</b>                 |     |
| M-Target for Simulink®                               | 308 |

|                                                    |     |
|----------------------------------------------------|-----|
| <b>Visualization/SCADA</b>                         | 314 |
| atvise® scada                                      | 316 |
| M1 webMI pro                                       | 326 |
| Vis Designer                                       | 331 |
| M-JVIS, M-JSYS tool library                        | 336 |
| <b>Motion Control</b>                              | 340 |
| <b>Control</b>                                     |     |
| M-SMC Software Motion Control                      | 343 |
| M-SHAFT Shaft controller                           | 345 |
| M-CNC Three-dimensional motions                    | 347 |
| Drive Middleware                                   | 349 |
| M-TEMP Temperature controller                      | 351 |
| <b>Condition Monitoring</b>                        | 354 |
| Vibration sensor input module AIC212               | 357 |
| Ω-Guard® System variants                           | 361 |
| Remote service via WebLog Expert                   | 363 |
| Acceleration sensors BAM100 / BAM500               | 364 |
| μ-bridge sensor                                    | 365 |
| Structure Vibration Monitor SVM300 series          | 366 |
| <b>Sector-specific solutions</b>                   | 368 |
| Wind Turbine Essentials WTE                        | 369 |
| Wind Power Scada WPS                               | 375 |
| <b>Directives and certificates</b>                 | 380 |
| <b>Standards and approvals</b>                     | 381 |
| <b>ColdClimate</b>                                 | 389 |
| <b>CAE/CAD data</b>                                | 391 |
| ePLAN library                                      | 392 |
| 3D-CAD model library                               | 394 |
| <b>Installation in the control cabinet/housing</b> | 395 |
| <b>Dimensions</b>                                  | 397 |
| <b>Bachmann training</b>                           | 400 |
| <b>Imprint</b>                                     | 401 |







## **M1 controller hardware - industrial controller with a future**

Individual requirements can be met easily with a wide range of powerful CPUs based on industrial (Pentium) processors and with an extensive range of I/O modules. Real-time capable bus systems enable the automation to be decentralized without any loss of performance.

The M1 controller perfectly combines the openness of a PC-based controller with the reliability of industrial hardware platforms. Designed for the toughest ambient conditions, they guarantee fault-free operation with a fanless installation up to an ambient temperature of 60 °C.

State of the art system architecture designed for seamless networking capability enables the M1 to be integrated easily in the area of the controller and system peripherals. Real-time Ethernet enables real-time controller networking and the support of all currently available fieldbus systems enables external components to be connected via standard interfaces.

## Processor modules

### Maximum performance and unrivalled robustness.

The processor modules of the M1 automation system stand out on account of their optimum performance and unrivalled robustness. Integrated into Bachmann CPU boards and I/O systems, industrial Pentium processors in an embedded design ensure absolute deterministic real-time behavior.

Even the most rigorous demands in terms of flexible data exchange and networking can be met without costly additional modules: M1 processor modules offer the full range of interfaces already »on-board«. This offers the automation engineer total freedom and ensures cost efficient and compact design. Ample power reserves for networking and communication-intensive applications are provided as basic features. The mass storage of the device is also fully scalable.

As Programmable Automation Controllers (PAC), M1 CPUs combine flexibility, open standards and the performance of the PC / IT-world with the industrial robustness of classical PLC.

The comprehensive scope of Bachmann electronic software enables it to be used as a PLC, motion controller or communication and data centre.

Consistent compatibility of the PACs application software protects the user's investments for future expansions.



### Processor modules ME203 series

#### Features

|                                                |
|------------------------------------------------|
| Intel 80386 EX, 33 MHz                         |
| Integrated power supply, 17 W / 24 V           |
| SRAM: 512 kB (battery backed)                  |
| DRAM: 8 MB                                     |
| FLASH: 8 MB file-flash, 2 MB boot flash        |
| 1x Ethernet 10 / 100 Mbit /s or 1x CAN/CANopen |
| 1x RS232, 1x RS232/422/485                     |
| Slots: PCC201/xx                               |



## Processor modules MX200 series

### Features

CPU x86 66 MHz / CPU 133 MHz / CPU 200 MHz  
Pentium class  
Integrated power supply 17 W / 24 V  
nvRAM: 512 kB, DRAM: 256 MB,  
FLASH: 16 MB internal  
2x Ethernet 10 / 100 Mbit/ s  
1x CAN/CANopen  
1x USB, 1x RS232, 1x RS232/422/485  
Slots: PCC201/xx, CF200/xx



## Processor modules MPC200 series

### Features

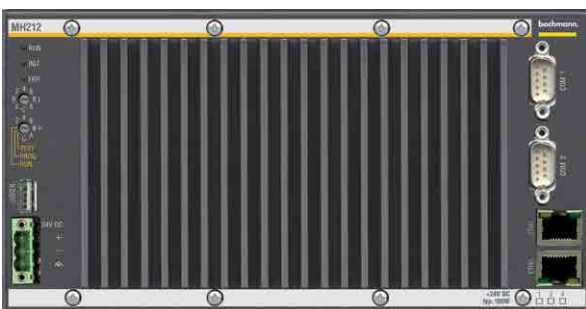
CPU 400 / 650 / 700 / 933 MHz Pentium class  
SRAM: to 512 kB (battery backed)  
DRAM: 64 or 128 MB, FLASH: 8 MB internal  
nvRAM-0: 64 kB (no battery necessary)  
1x USB, 1x RS232, 1x RS232/422/485  
2x Ethernet 10 / 100 Mbit / s  
Slots: PCC201/xx, CF200/xx



## Processor modules MC200 series

### Features

CPU 600 MHz ATOM E620 / 1,6 GHz ATOM E680  
DRAM: 1 GB DDR2  
nvRAM0 (data memory): 512 kB  
1x USB-Host, 1x Service USB interface, 1x RS232,  
1x RS232/422/485  
2x Ethernet 10 / 100/1000 Mbit/ s with IEEE1588  
Slots: CFast200/xx



## Processor modules MH200 series

### Features

CPU 1.2 GHz Celeron  
nvRAM: 512 kB  
FLASH: 16 MB internal  
2x Ethernet 10/100/1000 Mbit/s  
1x RS232, 1x RS232/422/485  
1x USB 2.0  
Internal mass memory: CFast card  
Slot: CFA200/xx  
Integrated power supply

# Processor modules



## Processor modules ME203 series

The processor modules of the ME203 series extend the range of the M1 controller family in terms of reduced power consumption and moderate cycle times. With an extremely slim design of only one module width, ME203 CPUs offer all the essential features of larger type series but with a lower power consumption.

Several networking and power supply options scale the module ideally for smaller applications. As fully-fledged M1 CPUs, ME203 processor modules are not only configured with the same tools as the high-end families MX and MPC, but are also fully code and application compatible, although they have less memory and fewer interfaces.

All modules have two serial interfaces and a front slot for one PC card. The optional Ethernet interface allows integration in 10 / 100 Mbit / s networks at full data rate. With the retentive program and data storage devices, also larger projects can be handled without the need for external media. In addition to the supply of the processor module, an integrated optional power supply provides 17 W for extra I/O modules.

- 80386 EX processor
- 2 serial interfaces
- Optional integrated power supply, 17 W / 24 V DC
- Optional CAN bus interface or Ethernet 100 Mbit 100 Mbit / s interface
- RAM 8 MB DRAM
- Data memory 512 kB SRAM, (battery backed)
- Integrated program memory
- Removable memory:
  - PC cards with 8 / 16 / 32 / 64 MB
- Battery backed real-time clock (RTC)
- Status displays for RUN, INIT and ERROR
- Watchdog

| Item      | Item no.    |
|-----------|-------------|
| ME203/EN  | 00013177-00 |
| ME203/EN* | 00015985-00 |
| ME203/CN  | 00013176-00 |
| ME203/CNW | 00013191-00 |
| ME203/CN* | 00016336-00 |

## Processor modules

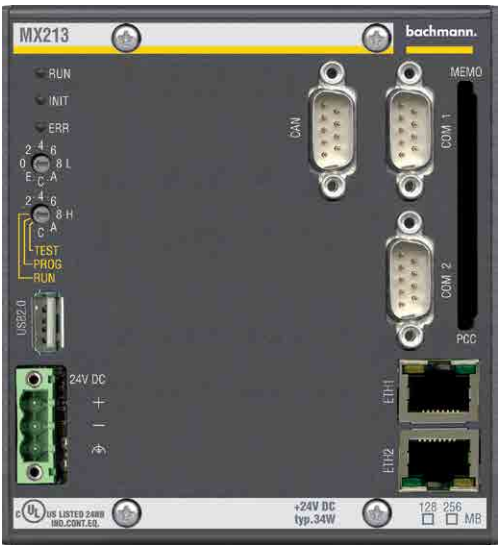
| ME203 series                                       |                                                                                                                             |                                                                                                                                                                     |                             |                             |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|
| Processor + memory                                 |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| CPU                                                | Intel 80386 EX, 33 MHz                                                                                                      |                                                                                                                                                                     |                             |                             |
| SRAM (data memory)                                 | 512 kB (battery backed)                                                                                                     |                                                                                                                                                                     |                             |                             |
| DRAM (working memory)                              | 8 MB                                                                                                                        |                                                                                                                                                                     |                             |                             |
| PC card **                                         | PCC201 / xx with 16 / 32 / 64 MB                                                                                            |                                                                                                                                                                     |                             |                             |
| Boot FLASH                                         | 2 MB (reserved by system software)                                                                                          |                                                                                                                                                                     |                             |                             |
| Program FLASH ***                                  | 8 MB                                                                                                                        |                                                                                                                                                                     |                             |                             |
| Interfaces                                         |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| Serial (standard)                                  | 1x RS232 + 1x RS232 / 422 / 485, 64 byte FIFO                                                                               |                                                                                                                                                                     |                             |                             |
| Ethernet (optional)                                | 1x 10/100 Mbit / s                                                                                                          |                                                                                                                                                                     |                             |                             |
| CAN (optional)                                     | 1x 10 k .. 1 Mbaud*                                                                                                         |                                                                                                                                                                     |                             |                             |
| Power supply                                       |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| External power supply module**                     | 5 V, ±15 V via backplane                                                                                                    |                                                                                                                                                                     |                             |                             |
| Internal power supply module (optional)            | Own supply and 17 W for I/Os<br>modules: +5 V / 2 A, +15 V / 250 mA, -15 V / 200 mA<br>supply voltage: 24 V DC (18 .. 34 V) |                                                                                                                                                                     |                             |                             |
| Galvanic isolation                                 | Supply to the system 500 V                                                                                                  |                                                                                                                                                                     |                             |                             |
| Additional features                                |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| Watchdog                                           |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| Real-time clock with battery                       |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| Status indication via 3 LEDs                       |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| CPU-ID selectable with rotary hexadecimal switches |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| Ambient conditions                                 |                                                                                                                             | Standard                                                                                                                                                            | Cold Weather (W)            | ColdClimate (❄)             |
| Operating temperature                              |                                                                                                                             | -30 .. +60 °C fanless                                                                                                                                               |                             |                             |
| Rel. humidity operation                            |                                                                                                                             | 5 .. 95 % without condensation                                                                                                                                      |                             | 5 .. 95 % with condensation |
| Storage temperature                                |                                                                                                                             | -40 .. +85 °C                                                                                                                                                       |                             |                             |
| Rel. humidity storage                              |                                                                                                                             | 5 .. 95 % without condensation                                                                                                                                      | 5 .. 95 % with condensation |                             |
| Execution variants                                 |                                                                                                                             |                                                                                                                                                                     |                             |                             |
| ME203/EN                                           |                                                                                                                             | CPU module 386EX (33MHz); 8MB DRAM; 512kB SRAM; 8MB file-flash; 1x Eth100; 1x RS232; 1x RS232/422/485; integrated power supply 17W; PCC slot                        |                             |                             |
| ME203/EN❄                                          |                                                                                                                             | Like ME203/EN; ColdClimate (❄)                                                                                                                                      |                             |                             |
| ME203/CN                                           |                                                                                                                             | CPU module 386EX (33MHz); 8MB DRAM; 512kB SRAM; 8MB file-flash; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; integrated power supply 17W; PCC slot                   |                             |                             |
| ME203/CNW                                          |                                                                                                                             | CPU module 386EX (33MHz); 8MB DRAM; 512kB SRAM; 8MB file-flash; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; integrated power supply 17W; PCC slot; Cold Weather (W) |                             |                             |
| ME203/CN❄                                          |                                                                                                                             | Like ME203/CN; ColdClimate (❄)                                                                                                                                      |                             |                             |

\* TCP / IP protocol can also be run via CAN

\*\* not included in delivery

\*\*\* depending on the configuration, a part of the program memory is reserved for the system software

# Processor modules



## Processor modules MX200 series

The processor modules of the MX200 series are Module based on PC technology for the M1 controller system. Depending on the type, the modules are equipped with a power supply and an integrated CAN master, and have 100 Mbit Ethernet ports that allow the simple integration of the controller in physically separated networks. The processor module with integrated floating point unit (FPU) is suitable for control applications. The MX200 modules are equipped with non-volatile RAM which provides maximum data security for more than 10 years without battery back-up.

Depending on type, the following features are:

- 2 serial interfaces
- 2 Ethernet-interfaces 10 / 100 Mbit / s with status displays
- 1 CAN interface
- 1 USB interface
- Status indicating LEDs for RUN, INIT and ERROR
- Mass storage (Compact Flash)
- RAM 256 MB DRAM
- Data memory 512 kB nvRAM
- Program memory of 16 / 32 / 64 MB FLASH on PC card and 16 MB internal FLASH (4 MB for system software, 12 MB for applications)
- Integrated power supply

| Item   | Device  | Item no.    |
|--------|---------|-------------|
| MX207  |         | 00014445-00 |
| MX213  | CF512MB | 00018594-00 |
| MX213  | CF4GB   | 00018594-10 |
| MX213* | CF512MB | 00018597-00 |
| MX213* | CF4GB   | 00018597-10 |
| MX220  | CF512MB | 00018593-00 |
| MX220  | CF4GB   | 00018593-10 |
| MX220* |         | 00019210-00 |
| MX220* | CF512MB | 00017689-00 |
| MX220* | CF4GB   | 00017689-10 |



## Processor modules

| MX200 series                                                               | MX207                                          | MX213/x                                | MX220/x                     |                 |
|----------------------------------------------------------------------------|------------------------------------------------|----------------------------------------|-----------------------------|-----------------|
| Processor + memory                                                         |                                                |                                        |                             |                 |
| CPU                                                                        | x86                                            | x86                                    | x86                         |                 |
| Performance<br>(Pentium equivalent)                                        | 66 MHz                                         | 133 MHz                                | 200 MHz                     |                 |
| CF (mass storage)                                                          | -                                              | Without restriction                    |                             |                 |
| nvRAM (data memory)                                                        | 512 kB                                         |                                        |                             |                 |
| DRAM (working memory)                                                      | 256 MB                                         |                                        |                             |                 |
| PC card (program memory)**                                                 | -                                              | PCC201 / xx with 16 / 32 / 64 MB FLASH |                             |                 |
| FLASH (program memory)**                                                   | 16 MB internal                                 |                                        |                             |                 |
| Interfaces                                                                 |                                                |                                        |                             |                 |
| Serial                                                                     | 1x RS232                                       | 1x RS232 + 1x RS232 / 422 / 485        |                             |                 |
| Ethernet                                                                   | 1x 10 / 100 base-Tx                            | 2x 10 / 100 base-Tx                    |                             |                 |
| USB                                                                        | 1x USB 2.0                                     |                                        |                             |                 |
| CAN                                                                        | 1x 10 k .. 1 Mbit/s                            |                                        |                             |                 |
| Power supply for I/O                                                       |                                                |                                        |                             |                 |
| Supply voltage                                                             | 24 VDC (18 .. 34 V)                            |                                        |                             |                 |
| Nominal power                                                              | 17 W for I/O                                   |                                        |                             |                 |
| Module                                                                     | +5 V / 2000 mA; +15 V / 250 mA; -15 V / 200 mA |                                        |                             |                 |
| Additional features                                                        |                                                |                                        |                             |                 |
| Watchdog                                                                   |                                                |                                        |                             |                 |
| Synchronizing pulse also for Ethernet and fieldbuses SERCOS and CAN        |                                                |                                        |                             |                 |
| Real-time clock with battery                                               |                                                |                                        |                             |                 |
| Status indication via 3 LEDs                                               |                                                |                                        |                             |                 |
| CPU-ID selectable with rotary hexadecimal switches                         |                                                |                                        |                             |                 |
| Operating system VxWorks with Bachmann system extensions on internal FLASH |                                                |                                        |                             |                 |
| Ambient conditions                                                         |                                                | Standard                               |                             | ColdClimate (❄) |
| Operating temperature                                                      | -30 .. +60 °C fanless                          |                                        |                             |                 |
| Rel. humidity operation                                                    | 5 .. 95 % without condensation                 |                                        | 5 .. 95 % with condensation |                 |
| Storage temperature                                                        | -40 .. +85 °C                                  |                                        |                             |                 |
| Rel. humidity storage                                                      | 5 .. 95 % without condensation                 |                                        | 5 .. 95 % with condensation |                 |

\* not included in delivery

\*\*\* depending on the configuration, a part of the program memory is reserved for the system software

## Processor modules

| MX200 series       |                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Execution variants |                                                                                                                                                                                       |
| MX220              | CPU module LX700 (433MHz); 256MB DRAM; 512kB nvRAM; 16MB file-flash; 2x Eth100; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; 1x USB2.0; integrated power supply 17W; PCC slot; CF slot |
| MX220*             | Like MX220; ColdClimate (*)                                                                                                                                                           |
| MX213              | CPU module LX700 (266MHz); 256MB DRAM; 512kB nvRAM; 16MB file-flash; 2x Eth100; 1x CAN/CANopen; 1x RS232; 1x RS232/422/485; 1x USB2.0; integrated power supply 17W; PCC slot; CF slot |
| MX213*             | Like MX213; ColdClimate (*)                                                                                                                                                           |
| MX207              | CPU module LX700 (266MHz); without Cache; 256MB DRAM; 512kB nvRAM; 16MB file-flash; 1x Eth100; 1x CAN/CANopen; 1x RS232; 1x USB2.0; integrated power supply 17W                       |



## Processor modules MPC200 series

The processor modules of the MPC200 series are modules for the M1 Controller System with Pentium class III processors, based on PC technology. They are available with various processor clock rates and in several configurations.

- Flexibility thanks to PC technology
- Pentium III class processors
- Various processor clock rates
- 2 serial interfaces
- 2 Ethernet-interfaces 10 / 100 Mbit/s with status displays
- 1 USB interface V1.1 functionality
- Real time clock, status displays for RUN, INIT, ERROR
- Mass storage Compact Flash type I
- RAM 128 MB DRAM
- Data memory 512 kB SRAM, battery backed
- Data memory 64 kB nvRAM
- Program memory 32 / 64 MB FLASH on PC card

| Item     | Device  | Item no.    |
|----------|---------|-------------|
| MPC240   |         | 00012711-40 |
| MPC240   | CF512MB | 00018591-00 |
| MPC240   | CF4GB   | 00018591-10 |
| MPC240*  |         | 00016338-40 |
| MPC240*  | CF512MB | 00020547-00 |
| MPC240*  | CF4GB   | 00020547-10 |
| MPC240/W |         | 00013127-40 |
| MPC240/W | CF512MB | 00021018-00 |
| MPC240/W | CF4GB   | 00018372-00 |
| MPC265   |         | 00012708-40 |
| MPC265   | CF512MB | 00018587-00 |
| MPC265   | CF4GB   | 00018587-10 |
| MPC270   |         | 00012710-40 |
| MPC270   | CF512MB | 00018589-00 |
| MPC270   | CF4GB   | 00018589-10 |
| MPC270*  |         | 00016180-40 |
| MPC270*  | CF512MB | 00020413-00 |
| MPC270*  | CF4GB   | 00020413-10 |
| MPC270/W |         | 00013129-40 |
| MPC270/W | CF512MB | 00023264-00 |
| MPC270/W | CF4GB   | auf Anfrage |
| MPC293   |         | 00014274-40 |
| MPC293   | CF512MB | 00017629-00 |
| MPC293   | CF4GB   | auf Anfrage |
| MPC293/W |         | 00017332-40 |
| MPC293/W | CF512MB | 00020575-00 |

## Processor modules

| MPC200 series                                                  | MPC240                                                                                                                                                   | MPC265                      | MPC270                      | MPC293  |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|---------|
| Processor + memory                                             |                                                                                                                                                          |                             |                             |         |
| CPU                                                            | Celeron / Pentium III architecture (embedded), 400 / 650 / 700 MHz                                                                                       |                             |                             |         |
|                                                                | 400 MHz                                                                                                                                                  | 650 MHz                     | 700 MHz                     | 933 MHz |
| CF (mass storage)                                              | Without restriction                                                                                                                                      |                             |                             |         |
| nvRAM-0 (data memory)                                          | 512 kB SRAM, battery backed                                                                                                                              |                             |                             |         |
| nvRAM-1 (data memory)                                          | 64 kB nvRAM (no battery necessary)                                                                                                                       |                             |                             |         |
| DRAM (working memory)                                          | 128 MB                                                                                                                                                   |                             |                             |         |
| PC card (program memory)**                                     | PCC201 / xx with 32 / 64 MB FLASH                                                                                                                        |                             |                             |         |
| Internal FLASH (program memory)**                              | 8 MB, 4 MB for system software                                                                                                                           |                             |                             |         |
| Interfaces                                                     |                                                                                                                                                          |                             |                             |         |
| Serial                                                         | 1x RS232 + 1x RS232 / 422 / 485                                                                                                                          |                             |                             |         |
| Ethernet                                                       | 2x 10 / 100 base-TX                                                                                                                                      |                             |                             |         |
| USB                                                            | 1x                                                                                                                                                       |                             |                             |         |
| Power supply                                                   |                                                                                                                                                          |                             |                             |         |
| External power supply module                                   | 5 V, ±15 V via backplane                                                                                                                                 |                             |                             |         |
| Additional features                                            |                                                                                                                                                          |                             |                             |         |
| Watchdog                                                       |                                                                                                                                                          |                             |                             |         |
| Synchronizing pulse also for SERCOS and CAN, Ethernet fieldbus |                                                                                                                                                          |                             |                             |         |
| Real-time clock with battery                                   |                                                                                                                                                          |                             |                             |         |
| Status indication via 3 LEDs                                   |                                                                                                                                                          |                             |                             |         |
| CPU-ID selectable with rotary hexadecimal switches             |                                                                                                                                                          |                             |                             |         |
| Ambient conditions                                             | Standard                                                                                                                                                 | Cold weather                | ColdClimate (☼)             |         |
| Operating temperature                                          | 0 .. +60 °C fanless                                                                                                                                      |                             | -30 .. +60 °C fanless       |         |
| Rel. humidity operation                                        | 5 .. 95 % without condensation                                                                                                                           |                             | 5 .. 95 % with condensation |         |
| Storage temperature                                            | -40 .. +85 °C                                                                                                                                            |                             |                             |         |
| Rel. humidity storage                                          | 5 .. 95 % without condensation                                                                                                                           | 5 .. 95 % with condensation |                             |         |
| Execution variants                                             |                                                                                                                                                          |                             |                             |         |
| MPC240                                                         | CPU module P III (400MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot                   |                             |                             |         |
| MPC265                                                         | CPU module Cel (650MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot                     |                             |                             |         |
| MPC270                                                         | CPU module P III (700MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot                   |                             |                             |         |
| MPC240/W                                                       | CPU module P III (400MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot; Cold Weather (W) |                             |                             |         |
| MPC240☼                                                        | Like MPC240; ColdClimate (☼)                                                                                                                             |                             |                             |         |
| MPC270☼                                                        | Like MPC270; ColdClimate (☼)                                                                                                                             |                             |                             |         |
| MPC293                                                         | CPU module P III (933MHz); 512kB SRAM; 64kB nvRAM; 8MB file-flash; 2x Eth100; 1x RS232; 1x RS232/422/485; 1x USB1.1; PCC slot; CF slot                   |                             |                             |         |
| MPC293☼                                                        | Like MPC293; ColdClimate (☼)                                                                                                                             |                             |                             |         |

\* not included in delivery

\*\* depending on the configuration, a part of the program memory is reserved for the system software



## Processor module MC200 series

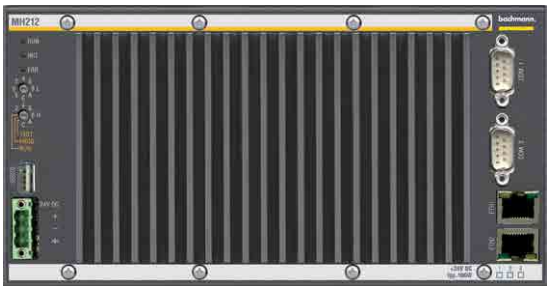
The powerful processor modules of the MC200 series offer maximum performance for demanding applications of your M1 control system. The CPUs are based on the latest embedded ATOM technology, consequently they are ideally suited for the most demanding regulating tasks, process control, signal processing and complex communication protocols. Through the use of state-of-the-art technology in a robust design, a compact powerhouse with a long service life and a broad temperature range (-30 to +60 °C) is available. The supplemental integrated, autonomous process image controller significantly offloads the processor and the I/O bus. This enables a new dimension in data transmission speed to the inputs and outputs for the fastest possible process cycles. Fast single accesses in the  $\mu$ s range for precise control and regulating tasks are also available. For efficient networking and state-of-the-art fieldbuses, two independent Gigabit Ethernet interfaces, including IEEE-1588 hardware support, are available. An internal CFast card enables fastest access speeds via the modern SATA (Serial Advanced Technology Attachment). Non-volatile memory of 512 kB is available as a drive and securely stores machine data for longer than 10 years, without an external energy supply or battery.

- 2 serial interfaces
- USB 2.0 host interface
- USB device service interface
- 2 Ethernet interfaces 10/100/1000 Mbit/s with IEEE 1588
- Process image controller
- 1 GB DRAM DDR2
- Data memory 512 kB non-volatile
- Internal mass storage CFast card
- internal 64 MB program memory

| Item   | Device | Item no.    |
|--------|--------|-------------|
| MC205  |        | 00018805-10 |
| MC205  | CFA4GB | 00018805-12 |
| MC205* |        | 00020513-10 |
| MC205* | CFA4GB | 00020513-12 |
| MC210  |        | 00018806-10 |
| MC210  | CFA4GB | 00018806-12 |
| MC210* |        | 00020514-10 |
| MC210* | CFA4GB | 00020514-12 |

## Processor modules

| MC200 series                                                               | MC210, MC210❄                                                                                                                                              | MC205, MC205❄               |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Processor + memory                                                         |                                                                                                                                                            |                             |
| CPU                                                                        | 1.6 GHz ATOM E680                                                                                                                                          | 600 MHz ATOM E620           |
| I/O bus                                                                    | Process image controller                                                                                                                                   |                             |
| CFast (mass storage)                                                       | 1 x integrated (accessible from the side) / > 8 GB                                                                                                         |                             |
| RAM                                                                        | 1 GB DRAM DDR2                                                                                                                                             |                             |
| nvRAM-0 (data memory)                                                      | 512 kB                                                                                                                                                     |                             |
| Internal FLASH (program memory)                                            | 64 MB, 40 MB free for application program                                                                                                                  |                             |
| Interfaces                                                                 |                                                                                                                                                            |                             |
| Serial                                                                     | 1x RS232 + 1x RS232 / 422 / 485 (SW configurable)                                                                                                          |                             |
| Ethernet                                                                   | 2x 10 / 100 / 1000 Base-T with IEEE1588                                                                                                                    |                             |
| USB host                                                                   | 1x USB 2.0                                                                                                                                                 |                             |
| Service USB interface                                                      | 1x USB device                                                                                                                                              |                             |
| Additional features                                                        |                                                                                                                                                            |                             |
| Watchdog                                                                   |                                                                                                                                                            |                             |
| Synchronizing pulse also for I/O bus, fieldbuses SERCOS and CAN, Ethernet  |                                                                                                                                                            |                             |
| Real-time clock with battery                                               |                                                                                                                                                            |                             |
| Status indication via 3 LEDs                                               |                                                                                                                                                            |                             |
| CPU ID selectable with rotary hexadecimal switches                         |                                                                                                                                                            |                             |
| Operating system VxWorks with Bachmann system extensions on internal FLASH |                                                                                                                                                            |                             |
| Ambient conditions                                                         |                                                                                                                                                            |                             |
|                                                                            | Standard                                                                                                                                                   | ColdClimate (❄)             |
| Operating temperature                                                      | -30 .. +60 °C, fan-free                                                                                                                                    |                             |
| Rel. humidity operation                                                    | 5 .. 95 % without condensation                                                                                                                             | 5 .. 95 % with condensation |
| Storage temperature                                                        | -40 .. +85 °C                                                                                                                                              |                             |
| Rel. humidity storage                                                      | 5 .. 95 % without condensation                                                                                                                             | 5 .. 95 % with condensation |
| Design variants                                                            |                                                                                                                                                            |                             |
| MC210                                                                      | CPU module ATOM E680 (1,6GHz); 1GB DRAM, 512kB nvRAM; 64MB file-flash; 2x Eth100/1000; 1x RS232; 1x RS232/422/485; 1x USB2.0; 1x USB2.0 Device; CFast slot |                             |
| MC205                                                                      | CPU module ATOM E620 (600MHz); 1GB DRAM, 512kB nvRAM; 64MB file-flash; 2x Eth100/1000; 1x RS232; 1x RS232/422/485; 1x USB2.0; 1x USB2.0 Device; CFast slot |                             |
| MC210❄                                                                     | Like MC210; ColdClimate (❄)                                                                                                                                |                             |
| MC205❄                                                                     | Like MC205; ColdClimate (❄)                                                                                                                                |                             |



## Processor modules MH200 series

The high-performance MH212/S processor module Celeron M offer maximum performance for demanding applications with an M1 controller. The CPU is based on the latest PC technology, consequently it is ideally suited for demanding computation tasks, databases, signal processing or extensive network applications. With integration of the power supply and the generously dimensioned passive cooling system, a compact powerhouse with long service life and an extensive temperature range (-30 °C to +60 °C) is ready. The additional integrated autonomous process image controller results in a significant offload of the processor and enables a new speed dimension for data transmission to the inputs and outputs for the fastest process cycles. For efficient networking and the state-of-the-art fieldbusses, two independent Gigabit Ethernet interfaces including IEEE-1588 hardware support are ready. An internal CFast card enables fastest access speeds via the modern SATA (Serial Advanced Technology Attachment). Non-volatile memory of 512 kB is available as a drive and stores machine data for longer than 10 years, without an external energy supply or battery.

- 2 serial interfaces
- USB 2.0 interface
- 2 Ethernet interfaces 10/100/1000 Mbit/s with IEEE 1588
- Process image controller
- Data memory 512 kB non-volatile
- Program memory internal 16 MB Flash
- Internal mass storage CFast card
- Power supply 100 watt, power for I/O modules 30 watt

| Item     | Device | Item no.    |
|----------|--------|-------------|
| MH212/S  |        | 00016370-00 |
| MH212/S  | CFA4GB | 00016370-02 |
| MH212/S✱ |        | 00018652-00 |
| MH212/S✱ | CFA4GB | 00018652-02 |

## Processor modules

| MH200 series                                                                  |                                                                                                                                                                                       | MH212/S, MH212/S✱ |                             |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------|
| Processor + memory                                                            |                                                                                                                                                                                       |                   |                             |
| CPU                                                                           | 1.2 GHz Celeron M ULV 722                                                                                                                                                             |                   |                             |
| I/O processor                                                                 | process image controller                                                                                                                                                              |                   |                             |
| CFast (mass storage)                                                          | 1 x integrated (accessible via side cover)                                                                                                                                            |                   |                             |
| nvRAM-0 (data memory)                                                         | 512 kB                                                                                                                                                                                |                   |                             |
| DRAM                                                                          | 2 GB                                                                                                                                                                                  |                   |                             |
| Internal FLASH (program memory)                                               | 16 MB                                                                                                                                                                                 |                   |                             |
| Interfaces                                                                    |                                                                                                                                                                                       |                   |                             |
| Serial                                                                        | 1x RS232 + 1x RS232 / 422 / 485 (SW configurable)                                                                                                                                     |                   |                             |
| Ethernet                                                                      | 2x 10 / 100 / 1000 base-T                                                                                                                                                             |                   |                             |
| USB                                                                           | 1x USB 2.0                                                                                                                                                                            |                   |                             |
| Power supply                                                                  |                                                                                                                                                                                       |                   |                             |
| Internal power supply module                                                  | CPU supply and 30 watt for I/Os                                                                                                                                                       |                   |                             |
| Supply voltage                                                                | 24 V DC (18 V ... 34 V)                                                                                                                                                               |                   |                             |
| Nominal power                                                                 | 17 W                                                                                                                                                                                  |                   |                             |
| Module                                                                        | +5 V / 3 A; +15 V / 500 mA; -15 V / 500 mA                                                                                                                                            |                   |                             |
| Additional features                                                           |                                                                                                                                                                                       |                   |                             |
| Watchdog                                                                      |                                                                                                                                                                                       |                   |                             |
| Synchronizing pulse also for I/O busses, fieldbusses SERCOS and CAN, Ethernet |                                                                                                                                                                                       |                   |                             |
| Real-time clock with battery                                                  |                                                                                                                                                                                       |                   |                             |
| Status indication via 3 LEDs                                                  |                                                                                                                                                                                       |                   |                             |
| CPU-ID selectable with rotary hexadecimal switches                            |                                                                                                                                                                                       |                   |                             |
| Operating system VxWorks with Bachmann system extensions on internal FLASH    |                                                                                                                                                                                       |                   |                             |
| Ambient conditions                                                            |                                                                                                                                                                                       | Standard          | ColdClimate (✱)             |
| Operating temperature                                                         | 0 .. +60 °C                                                                                                                                                                           |                   | -30 .. +60 °C               |
| Rel. humidity operation                                                       | 5 .. 95 % without condensation                                                                                                                                                        |                   | 5 .. 95 % with condensation |
| Storage temperature                                                           | -40 .. +85 °C                                                                                                                                                                         |                   |                             |
| Rel. humidity storage                                                         | 5 .. 95 % without condensation                                                                                                                                                        |                   | 5 .. 95 % with condensation |
| Execution variants                                                            |                                                                                                                                                                                       |                   |                             |
| MH212/S                                                                       | CPU module Celeron M ULV 722 (1,2GHz); 2GB DDR; 512kB nvRAM; 16MB file-flash; 2x Eth100/1000; 1x RS232; 1x RS232/422/485 isolated; 1x USB2.0; integrated power supply 30W; CFast slot |                   |                             |
| MH212/S✱                                                                      | Like MH212/S; ColdClimate (✱)                                                                                                                                                         |                   |                             |





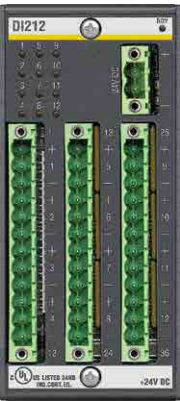
# Digital input/output modules

## Efficiency for all channel types.

The M1 Automation System's wide range of digital I/O modules means there is a module for any channel type. A selection from the standard 6-channel variant up to the ultra-compact 80-channel module guarantees the right module for every purpose.

Combined I/O modules allow the operating mode (DI / DO) of each individual channel to be configured by the user. As well as the global standard 24 V DC input signal, 48 V DC modules are also available for the power station sector.

Bachmann electronic's M1 I/O modules not only allow the process image access typical of PLCs but also direct access at any point in the program. This makes it possible to configure individual digital inputs and their status changes as interrupt sources so that programs can respond to process-controlled inputs. All modules support transmission via FASTBUS (fiber optic cable), CAN or PROFINET and offer a high degree of flexibility in the design of sophisticated automation solutions.



## Digital input modules DI212/216/232

| Features                                |                             |
|-----------------------------------------|-----------------------------|
| Number of inputs:                       | 12 / 16 / 32                |
| Input voltage:                          | nom. 24 V DC / nom. 48 V DC |
| Separate single groups                  |                             |
| Interrupt inputs:                       | max. 2                      |
| Sink/source inputs                      |                             |
| Galvanic isolation                      |                             |
| Status display for each channel via LED |                             |

## Digital input/output modules



### Digital output modules DO216/232

#### Features

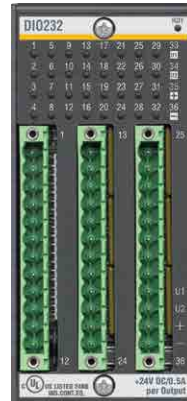
- Number of outputs: 16 / 32
- Output voltage:  
nom. 24 V DC / nom. 48 V DC
- Output current: depends on  
type 2.5 / 1 / 0.5 A
- Total current depends on type:  
8 / 16 A
- Galvanic isolation
- Status display for each channel  
via LED



### Digital relay output modules DOR206/230

#### Features

- 6 relays
- Standard socket for SIL relays
- Electromechanical or solid  
state relays
- Mechanically locked relays
- Galvanic isolation measured for  
system to  
channel 2500 V AC
- Status display for each channel  
via LED



### Digital input/output modules DIO216/232

#### Features

- Total channel number: 16 / 32,  
nom. 24 V DC
- Number configurable inputs/  
outputs: 16
- Number of inputs: 8 / 16 / 32
- Number of outputs: 16
- Configurable interrupt inputs
- Galvanic isolation from system
- Status display for each channel  
via LED

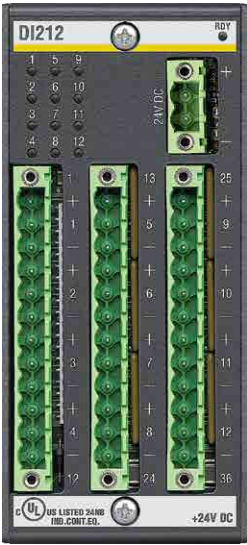


### Digital input/output modules DIO248/264/280

#### Features

- Total channel number: 16 / 32 / 48 / 64 / 80,  
nom. 24 V DC
- Number configurable inputs/outputs: 16
- Number of inputs: 16 / 32 / 48
- Number of outputs: 16 / 32 / 48
- Configurable interrupt inputs
- Configurable 32 Bit counter
- PDM output mode
- Galvanic isolation from system
- Status display for each channel via LED

# Digital input/output modules



## Digital input modules DI212/216/232

The digital input modules DI212, DI216, DI232, DI232\*, DI232 /np1 and DI232 /48 are used to connect up to 12, 16 or 32 digital sensors to the M1 controller.

- Digital input modules with 12, 16 or 32 inputs
- Current sinking logic > 2 mA acc. to EN61132 type 1
- DI212, DI216, DI232, DI232\*, DI232 / np: input voltage: nom. 24 V DC (18 .. 34 V DC)
- DI232 /48: input voltage: nom. 48 V DC (30 .. 58 V DC)
- Inputs 1 and 2 configurable as interrupt inputs
- Galvanic isolation of inputs from the system
- Status display for each channel via LED
- Sink / source inputs (DI232 /np1)

| Item      | Item no.    |
|-----------|-------------|
| DI212     | 00010281-00 |
| DI216     | 00009002-00 |
| DI232     | 00008997-00 |
| DI232*    | 00016411-00 |
| DI232/np1 | 00011516-00 |
| DI232/48  | 00012162-00 |

## Digital input/output modules

|                                   | DI212          | DI216          | DI232, DI232*    |
|-----------------------------------|----------------|----------------|------------------|
| Inputs                            |                |                |                  |
| Number of inputs                  | 12             | 16             | 32               |
| Isolated input groups             | 1 (1-12)       | 2 (1-8 / 9-16) | 2 (1-16 / 17-32) |
| Input voltage                     | 24 V DC        | 24 V DC        | 24 V DC          |
| Internal resistance               | Approx. 6 kΩ   | Approx. 6 kΩ   | Approx. 6 kΩ     |
| Low level                         | -34 V .. +5 V  | -34 V .. +5 V  | -34 V .. +5 V    |
| High level                        | +15 V .. +34 V | +15 V .. +34 V | +15 V .. +34 V   |
| Input delay (normally via filter) | 3 ms           | 3 ms           | 3 ms             |
| Interrupt inputs                  | Max. 2         | Max. 2         | Max. 2           |
| Input delay (normally)            | 50 μs          | 50 μs          | 50 μs            |
| Galvanic isolation from system    | 500 V          | 300 V          | 300 V            |
| Galvanic isolation of groups      | -              | 500 V          | 500 V            |

|                                   | DI232/np1                       | DI232/48         |
|-----------------------------------|---------------------------------|------------------|
| Inputs                            |                                 |                  |
| Number of inputs                  | 32                              | 32               |
| Isolated input group              | 4 (1-8/9-16), (17-24/25-32)     | 2 (1-16 / 17-32) |
| Input voltage                     | 24 V DC                         | 48 V DC          |
| Internal resistance               | < 4,7 kΩ                        | < 7,5 kΩ         |
| Low level                         | $ U_C - U_{IN}  < 5 \text{ V}$  | -34 V .. +10 V   |
| High level                        | $ U_C - U_{IN}  > 15 \text{ V}$ | +30 V .. +58 V   |
| Input delay (normally via filter) | 100 μs                          | 3 ms             |
| Interrupt inputs                  | Max. 2                          | Max. 2           |
| Input delay (normally)            | 50 μs                           | 20 μs            |
| Galvanic isolation from system    | 500 V                           | 500 V            |
| Galvanic isolation of groups      | 500 V                           | 500 V            |
| Current consumption (via BS2xx)   | 80 mA at 5 V                    | 88 mA at 5 V     |

| Ambient conditions      | Standard                       | ColdClimate (✱)             |
|-------------------------|--------------------------------|-----------------------------|
| Operating temperature   | -30 .. +60 °C                  |                             |
| Rel. humidity operation | 5 .. 95 % without condensation | 5 .. 95 % with condensation |
| Storage temperature     | -40 .. +85 °C                  |                             |
| Rel. humidity storage   | 5 .. 95 % with condensation    |                             |

|                    |                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------|
| Execution variants |                                                                                                                  |
| DI212              | Digital input module; 12x 24V; 3ms filter; 1 group; 2 interrupt channels; 50μs delay; 3-wire system; isolated    |
| DI216              | Digital input module; 16x 24V; 3ms filter; 2 groups; 2 interrupt channels; 50μs delay; isolated                  |
| DI232              | Digital input module; 32x 24V; 3ms filter; 2 groups; 2 interrupt channels; 50μs delay; isolated                  |
| DI232*             | Like DI232; ColdClimate (✱)                                                                                      |
| DI232/np1          | Digital input module; 32x 24V; 100μs filter; sink / source; 4 groups; 2 interrupt channels; 50μs delay; isolated |
| DI232/48           | Digital input module; 32x 48V; 3ms filter; 2 groups; 2 interrupt channels; isolated                              |

# Digital input/output modules



## Digital output modules DO216/232

The digital output modules DO216, DO232, DO232\* and DO232/48 are suitable for connecting up to 16 or 32 digital signal receivers (relays, contactors, signal lamps, valves, etc.) to the M1 controller.

- Digital output modules with 16 or 32 outputs
- Outputs 24 V DC (DO216, DO232, DO232\*)
- Outputs 48 V DC (DO232 / 48)
- 16 outputs with 2.5 A or 32 outputs with 1 A/0.5 A
- Outputs parallel connectable
- Monitoring of short circuit, wire break and overload
- Compact design
- Status display for each channel via LED

| Item     | Item no.    |
|----------|-------------|
| DO216    | 00009004-00 |
| DO232    | 00009003-00 |
| DO232*   | 00016414-00 |
| DO232/48 | 00012176-00 |

## Digital input/output modules

| DO216                                |                                                                      | DO232, DO232✱               |                             | DO232/48                     |  |
|--------------------------------------|----------------------------------------------------------------------|-----------------------------|-----------------------------|------------------------------|--|
| Description                          |                                                                      |                             |                             |                              |  |
| Number of outputs                    | 16                                                                   | 32                          |                             | 32                           |  |
| Output current / channel*            | 2.5 A                                                                | 1 A                         |                             | 0.5 A                        |  |
| Groups with different power supplies | 2 (1-8 / 9-16)                                                       | 2 (1-16 / 17-32)            |                             | 2 (1-16 / 17-32)             |  |
| Total current / group                | Max. 8 A                                                             | Max. 8 A                    |                             | Max. 8 A                     |  |
| Switching delay (resistive load)     |                                                                      |                             |                             |                              |  |
| 0 -> 1                               | Normally 80 µs<br>(at 1 A)                                           | Normally 80 µs<br>(at 1 A)  |                             | Normally 25 µs<br>(at 0.5 A) |  |
| 1 -> 0                               | Normally 250 µs<br>(at 1 A)                                          | Normally 250 µs<br>(at 1 A) |                             | Normally 25 µs<br>(at 0.5 A) |  |
| Galvanic isolation from system       | 500 V                                                                | 500 V                       |                             |                              |  |
| Ambient conditions                   |                                                                      | Standard                    |                             | ColdClimate (✱)              |  |
| Operating temperature                | -30 .. +60 °C                                                        |                             |                             |                              |  |
| Rel. humidity operation              | 5 .. 95 % without condensation                                       |                             | 5 .. 95 % with condensation |                              |  |
| Storage temperature                  | -40 .. +85 °C                                                        |                             |                             |                              |  |
| Rel. humidity storage                | 5 .. 95 % with condensation                                          |                             |                             |                              |  |
| Execution variants                   |                                                                      |                             |                             |                              |  |
| DO216                                | Digital output module; 16x 2.5A / 24V DC outputs; 2 groups; isolated |                             |                             |                              |  |
| DO232                                | Digital output module; 32x 1A / 24V DC outputs; 2 groups; isolated   |                             |                             |                              |  |
| DO232✱                               | Like DO232; ColdClimate (✱)                                          |                             |                             |                              |  |
| DO232/48                             | Digital output module; 32x 0.5A / 48V DC outputs; 2 groups; isolated |                             |                             |                              |  |

\* rated

# Digital input/output modules



## Digital relay output modules DOR206/230

Relays are the simplest way of controlling galvanically isolated power circuits. The output module's direct plugability relays drastically reduce wiring work, save valuable control cabinet space and facilitate troubleshooting. The locking mechanism keeps the relay in place even when subjected to shocks and vibrations. The relays offer maximum flexibility for implementation in control cabinets thanks to possibilities offered by standard relay types with a voltage range from 24 V/48 V DC or 230 V AC, a broad power range and the selection of valuable electro-mechanical relays or solid state for high make-and-break cycles.

Quick and easy serviceability without the use of tools is won by availability, clear status and error display (thanks to LED) and a locking/ejecting mechanism of relays as service parts.

- 6 relays
- Normally open contact (NO), normally closed contact (NC), change-over contact (CO)
- Standard socket for SIL relays
- Electromechanical or solid state relays
- Mechanically locked relays
- Coil current monitoring
- Status display for each channel via LED
- Galvanic isolation measured for voltages from system to channel 2500 V AC
- Backplanes BS2xx/S with protection class 1 for other voltages than SELV are available
- Cost effective and space saving through direct wiring to the consumer without relay and terminal

| Item       | Item no.    |
|------------|-------------|
| DOR206/230 | 00014497-10 |



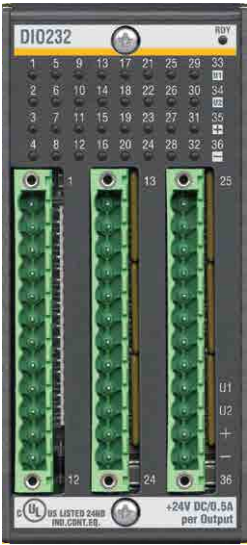
## Digital input/output modules

| <b>DOR206/230</b>                              |                                                                                                                                                                      |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output relays                                  |                                                                                                                                                                      |
| Quantity                                       | 6 relay outputs; 3 groups with 2 output relays each are together on an output plug                                                                                   |
| Relay socket                                   | For SIL relays 28 x 5 x 15 mm                                                                                                                                        |
| relay coil                                     | Coil voltage 24 V DC, power rating 170 mW                                                                                                                            |
| Relay contact                                  | 230 V AC, 24 V DC depending on relay type                                                                                                                            |
| Switching capacity per channel (max.)          | Ohm resistive load up to 2 A AC<br>AC 15 230 VA (230 V AC / 1 A AC)<br>DC 13 12 W (24 V DC / 0.5 A DC)                                                               |
| Status indication (LED)                        | Green                                                                                                                                                                |
| Switching rate (max. load in Ohms)             | 1 Hz                                                                                                                                                                 |
| RC circuit                                     | Depending on relay and load complete externally                                                                                                                      |
| Input voltage, rated                           | 230 V AC, 24 V DC depending on relay type (current consumption not allowed)                                                                                          |
| Internal power supply                          |                                                                                                                                                                      |
| Galvanic isolation relay outputs to the system | 2500 V AC / 5.5 mm                                                                                                                                                   |
| Galvanic isolation between the groups          | 1500 V AC / 3 mm (between the three relays output groups and to the Cabinet)                                                                                         |
| Galvanic isolation between relay outputs       | 800 V AC / 1 mm (between every two relay outputs)                                                                                                                    |
| Ambient conditions                             |                                                                                                                                                                      |
| Operating temperature                          | -30 .. +60 °C                                                                                                                                                        |
| Rel. humidity operation                        | 5 .. 95 % without condensation                                                                                                                                       |
| Storage temperature                            | -40 .. +85 °C                                                                                                                                                        |
| Rel. humidity storage                          | 5 .. 95 % with condensation                                                                                                                                          |
| Execution variants                             |                                                                                                                                                                      |
| DOR206/230                                     | Digital relay output module 6x sockets with relay 24V/230V; AC15 230 VA; DC13 12W; change-over contact; BS2xx protection class 1 necessary with 230V working voltage |

### Safety instruction for operation

If higher voltages than safe low voltages are connected, then a backplane with BS2xx/S protective grounding for protection class 1 must be used. Safe low voltages and dangerous voltages may not be connected together on a relay module. In addition a suitable safeguard against accidental contact must be provided: for example, installation in a control cabinet. While in operation all sockets must have a relay plugged in. Cage clamps are the best method for protecting against accidental contact by technicians. It is not permissible to use these relays as safety relays or for safety related applications.

# Digital input/output modules



## Digital input / output modules DIO216/232

The digital input / output modules DIO2xx/x can be used to operate receivers of digital control devices such as contactors, relays, pneumatic and hydraulic valves as well as for reading signals from digitally operating sources such as sensors, photocells or switches.

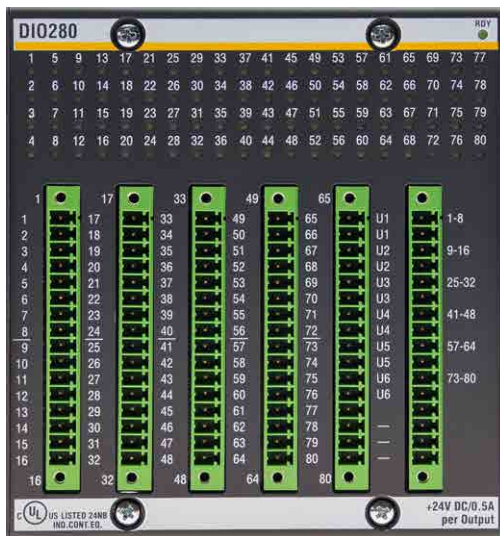
- 16 / 32 / 48 / 64 or 80 digital channels
- 16 channels can be configured as input or output
- Configurable interrupt inputs
- Status display for each channel via LED
- Supply voltage 18 .. 34 V DC
- Supply voltage protected against reverse polarity
- Cost effective and space saving
- Full wiring without extra potential rails (3-wire, only DIO216)

| Item      | Item no.    |
|-----------|-------------|
| DIO216    | 00010615-00 |
| DIO216/4  | 00010892-00 |
| DIO216/4✳ | 00016141-00 |
| DIO232    | 00013034-00 |
| DIO232✳   | 00019502-00 |

## Digital input/output modules

| DIO216                                    |                                                                                                                                                | DIO216/4<br>DIO216/4✳ | DIO232<br>DIO232✳           |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------|
| Inputs                                    |                                                                                                                                                |                       |                             |
| Quantity                                  | Max. 16                                                                                                                                        | Max. 16               | 16 .. 32                    |
| Input voltage range (H)                   | 15 .. 34 V DC                                                                                                                                  |                       |                             |
| Input voltage range (L)                   | 0 .. 5 V DC                                                                                                                                    |                       |                             |
| Input delay (normally)                    | 600 µs                                                                                                                                         | 600 µs                | 0 .. 365 ms                 |
| Internal resistance                       | 6.8 kOhm                                                                                                                                       |                       |                             |
| Status indication (LED)                   | Green                                                                                                                                          |                       |                             |
| Interrupt inputs                          | 1                                                                                                                                              | 1                     | 8                           |
| Outputs                                   |                                                                                                                                                |                       |                             |
| Quantity                                  | Max. 16                                                                                                                                        | Max. 16               | 16 .. 32                    |
| Output voltage range                      | 18 .. 34 V DC                                                                                                                                  |                       |                             |
| Output current per channel (max.)         | 1 A                                                                                                                                            | 1 A                   | 0.5 A                       |
| Total current (max.)                      | 12 A                                                                                                                                           | 16 A                  | 8 A                         |
| Status indication (LED)                   | green                                                                                                                                          |                       |                             |
| Switching frequency<br>(max., ohmic load) | 1 kHz                                                                                                                                          |                       |                             |
| External power supply                     |                                                                                                                                                |                       |                             |
| Reverse polarity protection               | Yes                                                                                                                                            |                       |                             |
| Galvanic isolation from system            | 500 V                                                                                                                                          |                       |                             |
| Ambient conditions                        | Standard                                                                                                                                       |                       | ColdClimate (✳)             |
| Operating temperature                     | -30 .. +60 °C                                                                                                                                  |                       |                             |
| Rel. humidity operation                   | 5 .. 95 % without condensation                                                                                                                 |                       | 5 .. 95 % with condensation |
| Storage temperature                       | -40 .. +85 °C                                                                                                                                  |                       |                             |
| Rel. humidity storage                     | 5 .. 95 % with condensation                                                                                                                    |                       |                             |
| Execution variants                        |                                                                                                                                                |                       |                             |
| DIO216                                    | Digital input/output module; 16x DIO; 24V / 1A; 600µs filter; 1 group; 3-wire system; 1 interrupt channel; 50µs delay; isolated                |                       |                             |
| DIO216/4                                  | Digital input/output module; 16x DIO; 24V / 1A; 600µs filter; 4 groups; 3-wire system; 1 interrupt channel; 50µs delay; isolated               |                       |                             |
| DIO216/4✳                                 | Like DIO216/4; ColdClimate (✳)                                                                                                                 |                       |                             |
| DIO232                                    | Digital input/output module; 16x DI; 40µs..365ms filter configurable; 16x DIO; 24V / 0.5A; 2 groups; 8 interrupt channel; 35µs delay; isolated |                       |                             |
| DIO232✳                                   | Like DIO232; ColdClimate (✳)                                                                                                                   |                       |                             |

## Digital input/output modules



### Digital input / output modules DIO248/264/280

The input/output module DIO2xx are used for controlling digital consumer like contactors, relays, pneumatic and hydraulic valves, as well as for reading signals of digital working sensors, detectors or switches. On events can be reacted expressly via 8 available interrupt inputs. Alternatively there are available up to four counters, for detecting e.g. positions or counting goods. For the energy-saving operation of inductivities all outputs can be operated as PWM. Especially for the PWM operation of valves a hold time is additionally configurable between 0 up to 2s. Outputs are parallel connectable, in case it is operated in the same operation mode.

- 16 / 32 / 48 / 64 or 80 digital channels
- 16 channels can be configured as input or output
- Configurable interrupt inputs
- Configurable 32 bit counter
- Mode: event counter, incremental encoder, gate measurement, cycle time or frequency measurement
- PWM output mode for e.g. valve economy mode
- Status display for each channel via LED
- Supply voltage 18 .. 34 V DC
- Supply voltage protected against reverse polarity
- Cost effective and space saving

| Item    | Item no.    |
|---------|-------------|
| DIO248  | 00019116-00 |
| DIO264  | 00019115-00 |
| DIO280  | 00019114-00 |
| DIO280* | 00019119-00 |

## Digital input/output modules

| DIO248                                 |                                                                                           | DIO264   |                            | DIO280<br>DIO280* |  |
|----------------------------------------|-------------------------------------------------------------------------------------------|----------|----------------------------|-------------------|--|
| Inputs                                 |                                                                                           |          |                            |                   |  |
| Quantity                               | 16 .. 32                                                                                  | 24 .. 40 | 32 .. 48                   |                   |  |
| Input voltage range (H)                | 15 .. 34 V DC                                                                             |          |                            |                   |  |
| Input voltage range (L)                | 0 .. 5 V DC                                                                               |          |                            |                   |  |
| Input delay (normally)                 | Standard: 600 µs<br>Settable 10 µs ... 270 ms                                             |          |                            |                   |  |
| Internal resistance                    | 8 kOhm                                                                                    |          |                            |                   |  |
| Status indication (LED)                | Green                                                                                     |          |                            |                   |  |
| Interrupt inputs                       | 8, configurable as counter inputs or interrupt inputs                                     |          |                            |                   |  |
| Counter                                |                                                                                           |          |                            |                   |  |
| Quantity                               | up to 4                                                                                   |          |                            |                   |  |
| Resolution                             | 32 Bit                                                                                    |          |                            |                   |  |
| Operating mode                         | event counter, incremental encoder, gate measurement, cycle time or frequency measurement |          |                            |                   |  |
| Encoder types                          | incremental encoder with A and B channel and one-channel pulse encoder                    |          |                            |                   |  |
| Input signal                           | A, B, Initiator (interrupt inputs configurable)                                           |          |                            |                   |  |
| Signal evaluation                      | 1 / 2 / 4-fold edge evaluation or pulse direction mode                                    |          |                            |                   |  |
| Max. input frequency                   | one-channel: 50 kHz                                                                       |          | dual-channel (A/B): 20 kHz |                   |  |
| Outputs                                |                                                                                           |          |                            |                   |  |
| Quantity                               | 16 .. 32                                                                                  | 24 .. 40 | 32 .. 48                   |                   |  |
| Output voltage range                   | 18 .. 34 V DC                                                                             |          |                            |                   |  |
| Output current per channel (max.)      | 0,5 A                                                                                     |          |                            |                   |  |
| Total current (max.)                   | 16 A                                                                                      | 20 A     | 24 A                       |                   |  |
| Status indication (LED)                | Green                                                                                     |          |                            |                   |  |
| Switching frequency (max., ohmic load) | 1 kHz                                                                                     |          |                            |                   |  |
| Inductive breaking capacity            | 1,15 H                                                                                    |          |                            |                   |  |
| PWM                                    |                                                                                           |          |                            |                   |  |
| Quantity                               | Like outputs                                                                              |          |                            |                   |  |
| Pulse duty ratio / resolution          | 0 .. 100 % / 13 Bit                                                                       |          |                            |                   |  |
| Frequency                              | 1 Hz .. 1 kHz                                                                             |          |                            |                   |  |
| Holding time (valve mode)              | 0 .. 2s configurable                                                                      |          |                            |                   |  |
| Start/Stopp                            | By dedicated output                                                                       |          |                            |                   |  |
| Internal power supply                  |                                                                                           |          |                            |                   |  |
| Galvanic isolation from system         | 500 V                                                                                     |          |                            |                   |  |
| Internal power supply                  | BS2xx                                                                                     |          |                            |                   |  |
| Internal current consumption (at 5 V)  | 180 mA                                                                                    |          |                            |                   |  |

## Digital input/output modules

| DIO248                      |  | DIO264                                                                                                                                            |  | DIO280<br>DIO280✱           |  |
|-----------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------|--|
| External power supply       |  |                                                                                                                                                   |  |                             |  |
| Reverse polarity protection |  | Yes                                                                                                                                               |  |                             |  |
| Energetic recovery          |  | Sensor energetic recovery of DIO by switched-off supply                                                                                           |  |                             |  |
| Input voltage               |  | Nominal 24 V DC                                                                                                                                   |  |                             |  |
| Ambient conditions          |  | Standard                                                                                                                                          |  | ColdClimate (✱)             |  |
| Operating temperature       |  | -30 .. +60 °C                                                                                                                                     |  |                             |  |
| Working temperature         |  | -40 .. +60 °C                                                                                                                                     |  |                             |  |
| Rel. humidity operation     |  | 5 .. 95 % without condensation                                                                                                                    |  | 5 .. 95 % with condensation |  |
| Storage temperature         |  | -40 .. +60 °C                                                                                                                                     |  |                             |  |
| Rel. humidity storage       |  | 5 .. 95 % with condensation                                                                                                                       |  |                             |  |
| Design variants             |  |                                                                                                                                                   |  |                             |  |
| DIO248                      |  | Digital input/output module; 16x DI; 600µs filter; 16x DIO; 16x DO; 24V / 0.5A; 4 groups, 600µs filter; 8 interrupt channel; 50µs delay; isolated |  |                             |  |
| DIO264                      |  | Digital input/output module; 24x DI; 600µs filter; 16x DIO; 24x DO; 24V / 0.5A; 5 groups; 600µs filter; 8 interrupt channel; 50µs delay; isolated |  |                             |  |
| DIO280                      |  | Digital input/output module; 32x DI; 600µs filter; 16x DIO; 32x DO; 24V / 0.5A; 6 groups; 600µs filter; 8 interrupt channel; 50µs delay; isolated |  |                             |  |
| DIO280✱                     |  | Like DIO280; ColdClimate (✱)                                                                                                                      |  |                             |  |

## Digital input/output modules

## Analog input / output modules

### The appropriate accuracy for each task.

The diverse requirements of industrial and plant automation in the field of analog signal processing can be ideally covered by the M1 Automation System's signal modules.

Pt100 temperature sensors or DMS sensors with perfectly scalable channel quantities, modules of various standard levels for general analog transmission are available. Beside commonly supplied

modules, the scope of products also comprises models with single channel isolation, wire break detection and much more. Resolutions from 12-bit to 16-bit offer perfect accuracy for every task. Fast sampling times in some cases adjustable input filters and support of spontaneous single accesses are also ideally suited for dynamic applications.



### Universal input/output module GIO212

#### Features

- Number of in- and outputs: 12 (analog und digital)
- Resolution: input 16 Bit, output 14 Bit
- Input voltage: to  $\pm 10$  mV
- Input current: 0(4) .. 20 mA
- Digital input 24 V
- Digital 32-bit counter
- Digital output 100 mA
- Filter from 4 kHz to 0.5 Hz
- Temperature sensor Pt 2-,3-,4-wire Thermoelements J, K, T, N, E, R, S, B
- Galvanic isolation from system: 500 V
- Condensation-proof ColdClimate design (✱)



### Universal input/output module AIO208/216

#### Features

- Number of in- and outputs: 8 (AIO208) / 16 (AIO216)
- Resolution: input 16 Bit, output 14 Bit
- Input voltage:  $\pm 10$  V to  $\pm 10$  mV
- Input current: 0(4) .. 20 mA
- Filter from 4 kHz to 0.5 Hz
- Temperature sensor Pt 2-,3-,4-wire Thermoelements J, K, T, N, E, R, S, B
- Galvanic isolation from system: 500 V
- Condensation-proof ColdClimate design (✱)



### Analog input modules AI202/SI, AI204/SI

#### Features

- Number of inputs: 2 / 8
- Input current: 0 .. 20 mA
- Differential inputs
- Resolution: 13...16 bit
- Galvanic isolation from system: 500 V
- Galvanic isolation of channels: 500 V



### Analog input module AI208/SI

#### Features

- Number of inputs: 8
- Input current: 4 .. 20 mA, 0 .. 20 mA, -20 .. +20 mA
- Resolution: 13...16 bit
- Galvanic isolation from system: 500 V
- Galvanic isolation of channels: 500 V



## Analog input / output modules



### Analog input modules AI204/x

#### Features

- Number of inputs: 1 / 2 / 4
- Input voltage:  $\pm 10$  V DC
- Differential inputs
- Resolution: 16 bit
- Inputs can be synchronized
- Galvanic isolation from system: 500 V
- Galvanic isolation of channels: 500 V



### Analog output module AO208/I

#### Features

- Number of outputs: 8
- Output current: 0 .. 20 mA or 4 .. 20 mA
- Resolution: 13 bit
- Galvanic isolation from system: 500 V
- Galvanic isolation of channels: 500 V



### Analog output module AO202

#### Features

- Number of outputs: 2
- Output voltage:  $\pm 10$  V DC
- Differential and short circuit proof outputs
- Resolution: 16 bit
- Outputs can be synchronized
- Galvanic isolation from system: 500 V
- Galvanic isolation of channels: 500 V



### Analog output modules AO202/SI, AO204/SI

#### Features

- Number of outputs: 2 / 4
- Output current: 0 .. 20 mA
- Differential outputs
- Short circuit proof outputs
- Resolution: 16 bit
- Galvanic isolation from system: 500 V
- Galvanic isolation of channels: 500 V



### Analog input/output modules AIO288/x

#### Features

- Number of inputs: 8 ( $\pm 10$  V DC /  $\pm 1$  V DC or 0 .. 20 mA)
- Number of outputs: 8 ( $\pm 10$  V DC)
- Resolution: 14 bit
- Connection: single-ended or differential
- Number of Pt100 sensors: 4
- Connection: 2- or 4-wire technology
- Optional galvanic isolation from system: 500 V

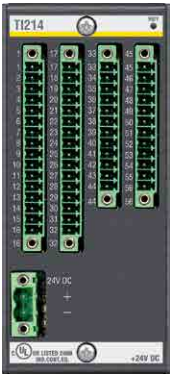


### Temperature recording module PTAI216

#### Features

- Number of inputs: 4 ( $\pm 10$  V DC /  $\pm 1$  V DC or 0 .. 20 mA)
- Connection: single-ended or differential
- Resolution: 14 bit at AI
- Number of Pt100/Pt1000 sensors: 12
- Connection: 2-wire technology
- Resolution: 12 bits with Pt100/Pt1000
- Galvanic isolation from system: 500 V

# Analog input / output modules



## Temperature recording modules TI214/x

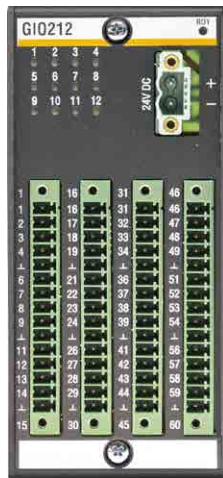
- Features
- TI214: 14 inputs for Pt100 / Pt1000 sensors as well as type J or K thermocouples
  - TI214/2: thermal couples type N or S
  - Resolution 14 bit (16 bit with measured value filtering)
  - Wire break detection on the measurement inputs
  - Galvanic isolation from system: 500 V



## Strain gauge module DMS202

- Features
- Number of strain gauge (DMS) measuring inputs: 2 (full bridge)
  - Industrial connectors (LEMO)
  - Analog measuring outputs: 2
  - Automatic measuring range selection
  - Wire break detection on the measurement inputs
  - Resolution: 12 bit
  - Galvanic isolation from system: 500 V

## Analog input / output modules



### Universal input/output module GIO212

The GIO212 is a module that can measure and output various types of signals. Each channel can be used as analog or digital output or input. With the standard signals current (0..20 mA and 4..20 mA) and Voltage ( $\pm 10$  V), various sensors and actuators can be connected. A resolution of at least 14 bits allows measurement results from signals that do not completely use the measuring range (e.g. 0.. 5 V). Temperatures are playing a significant role in ever more processes, which is why this module supports Pt1000, Pt100 in 2-, 3-, and 4-wire measurement, as well as all standard type thermoelements. Similarly, the channels can be used as digital inputs, which can also be configured as interrupt input and digital 32-bit counters. The quick digital 24V output can be selected as Push-Pull, High-Side or Low-Side. The output can be controlled as simple output or as PWM.

Up to two signal types can be used simultaneously per channel. Analog sensors can be supplied via the digital output (short circuit-proof and monitored), actuator signals read back and digital signals monitored analog. Thus, this is a single universal module for countless applications instead of different modules for each signal type. A cost-effective solution that simplifies logistics and service.

Various modes can be combined and set easily via a configuration wizard in the SolutionCenter engineering tool.

| Item    | Item no.    |
|---------|-------------|
| GIO212  | 00020620-00 |
| GIO212* | 00020623-00 |

- 12 channels
- Analog and digital inputs and outputs
- Modes that can be selected per channel:
  - Analog voltage input to  $\pm 10$  mV
  - Analog current input 0(4) .. 20 mA
  - Temperature sensor Pt elements as 2-,3-,4-wire
  - Thermoelements type J, K, T, N, E, R, S, B
  - Analog voltage output  $\pm 10$  V
  - Analog current output 0(4) .. 20 mA
  - Digital input 24 V
  - Digital 32-bit counter, A and A/B operation
  - Digital output 100 mA
    - Low-Side, High-Side, Push-Pull
    - Digital output as 16-bit PWM
- Resolution: Input 16-bit with filter, output 14-bit
- Filter adjustable from 4 kHz to 0.5 Hz per channel
- Digital status display for analog channels
- Digital inputs in accordance with IEC 61131 Type 1,2,3
- Digital outputs up to 10 kHz
- All outputs overload, short circuit and external voltage-proof
- Measuring range monitoring freely adjustable ( $\pm 105$  %)
- Error message on overload and overtemperature and undervoltage of the supply
- Galvanic isolation from the system 500 V
- Condensation-proof ColdClimate design (\*)

## Analog input / output modules

### GIO212

#### Inputs/Outputs

|                   |                                                                                       |
|-------------------|---------------------------------------------------------------------------------------|
| Quantity          | 12 channels, individually configurable as input or output                             |
| Modes per channel | Analog input                                                                          |
|                   | Temperature measurement input for Pt elements and thermoelements                      |
|                   | Analog output                                                                         |
|                   | Digital input                                                                         |
|                   | Counter input                                                                         |
|                   | Digital output                                                                        |
| SYNC signal       | PWM output                                                                            |
|                   |                                                                                       |
| In                | Analog input, digital input, temperature measurement, counter (depending on the mode) |
|                   |                                                                                       |
| Out               | Analog output, digital output                                                         |

#### Analog inputs in general

|                             |                                                                                              |
|-----------------------------|----------------------------------------------------------------------------------------------|
| Digital resolution          | 16-bit                                                                                       |
| Measuring range             | $\pm 105\%$ of nominal range                                                                 |
| Measuring range monitoring  | Lower and upper measuring range limit, error message as status or measuring range monitoring |
| Allowed common mode voltage | Max. $\pm 1$ V                                                                               |
| Refresh cycle time          | 100 $\mu$ s                                                                                  |
| Cut-off frequency (3 dB)    | 4 kHz to 0.5 Hz adjustable channel by channel                                                |
| Filtering slope             | > 80 dB/decade                                                                               |

#### Voltage inputs

|                         |                                                  |
|-------------------------|--------------------------------------------------|
| Input voltage           | $\pm 10$ V, $\pm 1$ V, $\pm 100$ mV, $\pm 10$ mV |
| Basic accuracy at 25 °C | Max. $\pm 0.05\%$ of output voltage range        |

#### Current inputs

|                               |                                          |
|-------------------------------|------------------------------------------|
| Input current                 | $\pm 20$ mA or 0 .. 20 mA or 4 .. 20 mA  |
| Basic accuracy at 25 °C       | Max. $\pm 0.2\%$ of output voltage range |
| Input impedance               | Max. 300 Ohm                             |
| Shunt short-circuit proof     | To +24 V                                 |
| Interference voltage strength | +24 V                                    |

#### Temperature inputs PTC

|                         |                                                        |
|-------------------------|--------------------------------------------------------|
| Temperature inputs PTC  | Pt100, Pt1000 selectable                               |
| Connection type         | 2-, 3- or 4-wire, optional                             |
| Input impedance         | > 100 kOhm                                             |
| Temperature range       | -100 .. +800 °C                                        |
| Basic accuracy at 25 °C | Up to 300 °C $\pm 0.25\%$ precisely of the input range |
| Value of the LSB        | 0.1 K, measurement values in 1/10 Kelvin               |

## Analog input / output modules

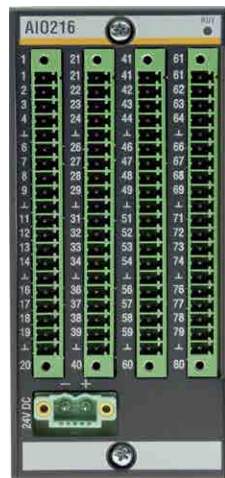
| GIO212                                           |        |                                                                                    |
|--------------------------------------------------|--------|------------------------------------------------------------------------------------|
| Temperature inputs TE                            |        |                                                                                    |
| Temperature elements                             |        | Types J, K, T, N, E, R, S, B can be selected                                       |
| Temperature ranges per type                      | J      | -100 .. +1200 °C                                                                   |
|                                                  | K      | -100 .. +1370 °C                                                                   |
|                                                  | T      | -100 .. +400 °C                                                                    |
|                                                  | N      | -100 .. +1300 °C                                                                   |
|                                                  | E      | -100 .. +1000 °C                                                                   |
|                                                  | R      | -50 .. +1768 °C                                                                    |
|                                                  | S      | -50 .. +1768 °C                                                                    |
|                                                  | B      | +600 .. +1820 °C                                                                   |
| Ground                                           |        | Up to $\pm 3$ V                                                                    |
| Basic accuracy at 25 °C                          |        | Input range max. $\pm 0.15$ % of input current range<br>(S, R, T max. $\pm 0.3$ %) |
| Value of the LSB                                 |        | 0.1 K, measurement values in 1/10 Kelvin                                           |
| Analog outputs in general                        |        |                                                                                    |
| Digital resolution                               |        | 14-bit                                                                             |
| Output signal range                              |        | $\pm 105$ % nominal range                                                          |
| Voltage outputs                                  |        |                                                                                    |
| Output voltage                                   |        | $\pm 10$ V                                                                         |
| Output current                                   |        | Max. 10 mA                                                                         |
| Basic accuracy at 25 °C                          |        | Min. 1 kOhm, max. $\pm 0.05$ % of output current range                             |
| Current outputs                                  |        |                                                                                    |
| Output current                                   |        | 0(4) .. 20 mA                                                                      |
| Basic accuracy at 25 °C                          |        | Max. $\pm 0.25$ % of the output current range                                      |
| Apparent ohmic resistance                        |        | Up to 600 Ohm                                                                      |
| Digital inputs                                   |        |                                                                                    |
| Input voltage                                    |        | Nom. 24 VDC                                                                        |
| Low level                                        |        | 0 V .. 5 V                                                                         |
| High-level                                       |        | +11 V .. +34 V                                                                     |
| According to IEC61131-2<br>Input current at 24 V | Type 1 | 2 mA .. 6 mA                                                                       |
|                                                  | Type 2 | 6 mA .. 10 mA                                                                      |
|                                                  | Type 3 | 2 mA .. 6 mA                                                                       |
| Input type "source"                              |        | 2 mA .. 6 mA                                                                       |
| Input type "comparator"                          |        | Typ. 2.5 V                                                                         |
| Prof. filter for digital inputs                  |        | 16 $\mu$ s .. 262 ms, default 1 ms                                                 |
| Digital counter                                  |        |                                                                                    |
| Modes                                            |        | Count direction                                                                    |
|                                                  |        | 1, 2, 4x evaluation                                                                |
|                                                  |        | Period duration measurement                                                        |
|                                                  |        | Pulse duration measurement                                                         |
|                                                  |        | Combination with 2nd channel: pulse/direction mode or quadrature encoder           |

## Analog input / output modules

### GIO212

| Digital counter                    |                                                                                                                                                                                                                                                                                                                 |                             |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Counter                            | Counter up or down (in combination with 2nd channel)                                                                                                                                                                                                                                                            |                             |
|                                    | 32-bit                                                                                                                                                                                                                                                                                                          |                             |
| Input type                         | 24 V, like digital input                                                                                                                                                                                                                                                                                        |                             |
| Trigger (2nd channel)              | Save value                                                                                                                                                                                                                                                                                                      |                             |
| Reset (2nd channel)                | Reset counter                                                                                                                                                                                                                                                                                                   |                             |
| Digital output                     |                                                                                                                                                                                                                                                                                                                 |                             |
| Output type                        | Low-Side, High-Side or Push-Pull (half bridge)                                                                                                                                                                                                                                                                  |                             |
| Output current / channel*          | 0.1 A (briefly 0.5 A for < 10 s)                                                                                                                                                                                                                                                                                |                             |
| Short-circuit current/channel      | 800 mA                                                                                                                                                                                                                                                                                                          |                             |
| Max. switching frequency           | 10 kHz                                                                                                                                                                                                                                                                                                          |                             |
| Broken wire detection              | Yes                                                                                                                                                                                                                                                                                                             |                             |
| Short circuit, overload            | Yes                                                                                                                                                                                                                                                                                                             |                             |
| PWM output                         |                                                                                                                                                                                                                                                                                                                 |                             |
| Output                             | Specification like digital output                                                                                                                                                                                                                                                                               |                             |
| Frequency range                    | 0.95 Hz .. 10 kHz                                                                                                                                                                                                                                                                                               |                             |
| Pulse range                        | 100 µs (10 µs) .. 8.192 ms                                                                                                                                                                                                                                                                                      |                             |
| Frequency resolution               | 16 bit (LSB is 125 ns or 16 µs)                                                                                                                                                                                                                                                                                 |                             |
| Internal power supply              |                                                                                                                                                                                                                                                                                                                 |                             |
| Supply internal                    | Via backplane BS2xx                                                                                                                                                                                                                                                                                             |                             |
| Current consumption internal       | 80 mA                                                                                                                                                                                                                                                                                                           |                             |
| Power supply external              |                                                                                                                                                                                                                                                                                                                 |                             |
| Voltage range external             | 18 .. 34 VDC                                                                                                                                                                                                                                                                                                    |                             |
| Current consumption external 24 V  | Typically 200 mA without external load                                                                                                                                                                                                                                                                          |                             |
| Galvanic isolation from the system | 500 V                                                                                                                                                                                                                                                                                                           |                             |
| Ambient conditions                 |                                                                                                                                                                                                                                                                                                                 |                             |
|                                    | Standard                                                                                                                                                                                                                                                                                                        | ColdClimate (✱)             |
| Operating temperature              | -30 .. +60 °C                                                                                                                                                                                                                                                                                                   |                             |
| Rel. humidity operation            | 5 .. 95 % without condensation                                                                                                                                                                                                                                                                                  | 5 .. 95 % with condensation |
| Storage temperature                | -40 .. +85 °C                                                                                                                                                                                                                                                                                                   |                             |
| Rel. humidity storage              | 5 .. 95 % with condensation                                                                                                                                                                                                                                                                                     | 5 .. 95 % with condensation |
| Design variants                    |                                                                                                                                                                                                                                                                                                                 |                             |
| GIO212                             | Universal input/output module; 12x analog In ±10V ±20mA Pt TC; 16bit; analog Out ±10V 20mA; 14bit; digital In DI 5V / 24V, 125kHz, sink/source, counter; digital Out 24V/100mA, 10kHz, highside/lowside/pushpull, pwm; configurable DI/AI filter; 100µs sample and refresh time; threshold monitoring; isolated |                             |
| GIO212✱                            | Like GIO212; ColdClimate (✱)                                                                                                                                                                                                                                                                                    |                             |

## Analog input / output modules



### Universal input/output module AIO208/216

The AIO208 and AIO216 modules enable the measuring or output of all standard analog signals. The AIO208 offers 8 channels and the AIO216 16 channels compactly in a single module. The standard signal types for current (0 .. 20 mA and 4 .. 20 mA) and voltage ranges ( $\pm 10$  V ..  $\pm 10$  mV) allow the connection of a wide range of sensors and actuators. A minimum 14-bit resolution makes it possible to also measure signals that do not fully utilize the measuring range (e.g. 0 .. 5 V) with a sufficiently high resolution. Temperatures are playing an important role in an increasing number of processes. These modules therefore also support Pt100, Pt1000 in 2, 3 and 4-wire measuring circuits, as well as all standard thermocouples. For each channel, a second channel with unused signal types can be used in addition to the primary configured signal type. For example, a current output can be assigned to a voltage input so that up to twice the number of channels per module are provided.

This enables one module to cover virtually all analog signal measuring tasks instead of having to use many different modules for each signal type. A cost-effective solution that simplifies logistics and servicing. Different modes can be combined and set simply using a configuration wizard in the Solution-Center engineering tool.

| Item    | Item no.    |
|---------|-------------|
| AIO208  | 00020628-00 |
| AIO208* | 00020632-00 |
| AIO216  | 00020627-00 |
| AIO216* | 00020631-00 |

- 16 channels AIO216, 8 channels AIO208
  - Analog inputs and outputs
- Modes that can be selected per channel:
  - Analog voltage input  $\pm 10$  V to  $\pm 10$  mV
  - Analog current input 0(4) .. 20 mA
  - Temperature sensor Pt elements as 2-,3-,4-wire
  - Thermo couples type J, K, T, N, E, R, S, B
  - Analog voltage output  $\pm 10$  V
  - Analog current output 0(4) .. 20mA
- Resolution: 16-bit input with filter, 14-bit output
- Filter adjustable from 4 kHz to 0.5 Hz per channel
- All outputs overload, short circuit and external voltage-proof
- Measuring range monitoring freely adjustable ( $\pm 105$  %)
- Error message on overload and overtemperature and undervoltage of the supply
- Galvanic isolation from the system 500 V
- Optional condensation-proof ColdClimate (\*)

## Analog input / output modules

### AIO208/216

| Inputs/Outputs                |     | AIO208                                                                                       | AIO216      |
|-------------------------------|-----|----------------------------------------------------------------------------------------------|-------------|
| Quantity                      |     | 8 channels                                                                                   | 16 channels |
| Modes per channel             |     | Analog input                                                                                 |             |
|                               |     | Temperature measurement input for Pt elements and thermo couples                             |             |
|                               |     | Analog output                                                                                |             |
| SYNC signal                   | In  | Analog input, temperature measurement                                                        |             |
|                               | Out | Analog output                                                                                |             |
| Analog inputs in general      |     |                                                                                              |             |
| Digital resolution            |     | 16-bit                                                                                       |             |
| Measuring range               |     | ±105 % of nominal range                                                                      |             |
| Measuring range monitoring    |     | Lower and upper measuring range limit, error message as status or measuring range monitoring |             |
| Allowed common mode voltage   |     | Max. ±1 V                                                                                    |             |
| Refresh cycle time            |     | 100 µs                                                                                       |             |
| Cut-off frequency (3 dB)      |     | 4 kHz to 0.5 Hz adjustable channel by channel                                                |             |
| Filtering slope               |     | > 80 dB/decade                                                                               |             |
| Voltage inputs                |     |                                                                                              |             |
| Input voltage                 |     | ±10 V, ±1 V, ±100 mV, ±10 mV                                                                 |             |
| Basic accuracy at 25 °C       |     | Max. ±0.05 % of input voltage range                                                          |             |
| Current inputs                |     |                                                                                              |             |
| Input current                 |     | ±20 mA or 0 .. 20 mA or 4 .. 20 mA                                                           |             |
| Basic accuracy at 25 °C       |     | Max. ±0.2 % of input voltage range                                                           |             |
| Input impedance               |     | Max. 300 Ohm                                                                                 |             |
| Shunt short-circuit proof     |     | Up to +24 V                                                                                  |             |
| Interference voltage strength |     | +24 V                                                                                        |             |
| Temperature inputs PTC        |     |                                                                                              |             |
| Temperature inputs PTC        |     | Pt100, Pt1000                                                                                |             |
| Connection type               |     | 2-, 3- or 4-wire                                                                             |             |
| Input impedance               |     | > 100 kOhm                                                                                   |             |
| Temperature range             |     | -100 .. +800 °C                                                                              |             |
| Basic accuracy at 25 °C       |     | Up to 300 °C ±0.25 % of input range                                                          |             |
| Value of the LSB              |     | 0.1 K, measurement values in 1/10 Kelvin                                                     |             |
| Temperature inputs TE         |     |                                                                                              |             |
| Temperature elements          |     | Types J, K, T, N, E, R, S, B can be selected                                                 |             |
| Temperature ranges per type   | J   | -100 .. +1200 °C                                                                             |             |
|                               | K   | -100 .. +1370 °C                                                                             |             |
|                               | T   | -100 .. +400 °C                                                                              |             |
|                               | N   | -100 .. +1300 °C                                                                             |             |
|                               | E   | -100 .. +1000 °C                                                                             |             |
|                               | R   | -50 .. +1768 °C                                                                              |             |
|                               | S   | -50 .. +1768 °C                                                                              |             |
|                               | B   | +600 .. +1820 °C                                                                             |             |



## Analog input / output modules

| AIO208/216                        |                                                                                                                                                                                                     |                             |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Temperature inputs                |                                                                                                                                                                                                     |                             |
| Ground                            | Up to ±3 V                                                                                                                                                                                          |                             |
| Basic accuracy at 25 °C           | Max. ±0.15 % of input current range<br>(S, R, T max. ±0.3 %)                                                                                                                                        |                             |
| Value of the LSB                  | 0.1 K; measurement values in 1/10 Kelvin                                                                                                                                                            |                             |
| Analog outputs in general         |                                                                                                                                                                                                     |                             |
| Digital resolution                | 14-bit                                                                                                                                                                                              |                             |
| Output signal range               | ±105 % nominal range                                                                                                                                                                                |                             |
| Voltage outputs                   |                                                                                                                                                                                                     |                             |
| Output voltage                    | ±10 V                                                                                                                                                                                               |                             |
| Output current                    | Max. 10 mA                                                                                                                                                                                          |                             |
| Basic accuracy at 25 °C           | Min. 1 kOhm, max. ±0.05 % of output range                                                                                                                                                           |                             |
| Current outputs                   |                                                                                                                                                                                                     |                             |
| Output current                    | 0(4) .. 20 mA                                                                                                                                                                                       |                             |
| Basic accuracy at 25 °C           | Max. ±0.25 % of the output range                                                                                                                                                                    |                             |
| Apparent ohmic resistance         | Up to 600 Ohm                                                                                                                                                                                       |                             |
| Power supply                      |                                                                                                                                                                                                     |                             |
| Supply internal                   | Via backplane BS2xx                                                                                                                                                                                 |                             |
| Current consumption internal      | 80 mA                                                                                                                                                                                               |                             |
| Voltage range external            | 18 .. 34 VDC                                                                                                                                                                                        |                             |
| Current consumption external 24 V | Typically 200 mA without external load                                                                                                                                                              |                             |
| Galvanic isolation I/O to system  | 500 V                                                                                                                                                                                               |                             |
| Ambient conditions                |                                                                                                                                                                                                     |                             |
|                                   | Standard                                                                                                                                                                                            | ColdClimate (❄)             |
| Operating temperature             | -30 .. +60 °C                                                                                                                                                                                       |                             |
| Rel. humidity operation           | 5 .. 95 % without condensation                                                                                                                                                                      | 5 .. 95 % with condensation |
| Storage temperature               | -40 .. +85 °C                                                                                                                                                                                       |                             |
| Rel. humidity storage             | 5 .. 95 % with condensation                                                                                                                                                                         | 5 .. 95 % with condensation |
| Design variants                   |                                                                                                                                                                                                     |                             |
| AIO208                            | Universal analog input/output module; 8x analog In ±10V ±20mA Pt TC; 16bit;analog Out ±10V 20mA; 14bit; configurable analog filter; 100µs sample and refresh time; threshold monitoring; isolated   |                             |
| AIO208❄                           | Like AIO208; ColdClimate (❄)                                                                                                                                                                        |                             |
| AIO216                            | Universal analog input/output module; 16x analog In ±10V ±20mA Pt TC; 16bit; analog Out ±10V 20mA; 14bit; configurable analog filter; 100µs sample and refresh time; threshold monitoring; isolated |                             |
| AIO216❄                           | Like AIO216; ColdClimate (❄)                                                                                                                                                                        |                             |

# Analog input / output modules



## Analog input modules AI202/SI, AI204/SI

The analog input module AI20x / SI offers two or four high resolution analog 16 bit current input channels. Single channel isolation, high immunity to interference, as well as integrated signal filtering (delta-sigma converter) make this module particularly interesting for process technology.

- 2 or 4 analog inputs
- Input current 0 .. 20 mA
- Input impedance 75  $\Omega$
- Resolution: 16 bit
- Refresh cycle time 250 ms/channel
- Galvanic isolation of channels
- Galvanic isolation from system
- Monitoring of internal voltages

| Item     | Item no.    |
|----------|-------------|
| AI202/SI | 00012245-10 |
| AI204/SI | 00012245-00 |

## Analog input / output modules

| AI202/SI, AI204/SI                    |                                                               |
|---------------------------------------|---------------------------------------------------------------|
| Current inputs                        |                                                               |
| Quantity                              | 2 (AI202 / SI) or 4 (AI204 / SI)                              |
| Input current range                   | 0 .. 20 mA                                                    |
| Input impedance                       | 75 $\Omega$                                                   |
| Digital resolution                    | 16 bit                                                        |
| Value of the LSB                      | 509 nA (Vref = 2.5 V to 75 $\Omega$ )                         |
| Cross-talk attenuation                | > 100 dB between the channels                                 |
| Signal suppression 50 Hz / 60 Hz      | > 60 dB                                                       |
| Error at 25 °C                        | $\pm 0,1\%$                                                   |
| Error at the entire temperature range | $\pm 0.5\%$                                                   |
| Sample frequency                      | 4 measurements per second/channel                             |
| Input filter                          | fg (3dB) delay time 1ms, Low-pass filter: 1st order           |
| Galvanic isolation of channels        | 500 V                                                         |
| Galvanic isolation from system        | 500 V                                                         |
| Ambient conditions                    |                                                               |
| Operating temperature                 | -30 .. +60 °C                                                 |
| Rel. humidity operation               | 5 .. 95 % without condensation                                |
| Storage temperature                   | -40 .. +85 °C                                                 |
| Rel. humidity storage                 | 5 .. 95 % with condensation                                   |
| Execution variants                    |                                                               |
| AI202/SI                              | Analog input module; 2x In 20mA; 16bit; 0.1%; single isolated |
| AI204/SI                              | Analog input module; 4x In 20mA; 16bit; 0.1%; single isolated |

# Analog input / output modules



## Analog input modules AI208/SI

The compact analog input module AI208 / SI offers eight individual galvanically isolated current inputs. The measuring range is +/- 24.6 mA and covers standards 4 .. 20 mA, 0 .. 20 mA and -20 .. +20 mA.

Via adjustable measuring range limits errors, such as short circuit, sensor defect or wire break can be easily detected. Threshold values that can be configured within the measuring range permit monitoring of the process factor without having to sample it. The shunt is protected against short circuit of the 24 V supply, which can easily occur with the sensor wiring. Robustness and above-average diagnostic capabilities are the outstanding characteristics of this input module.

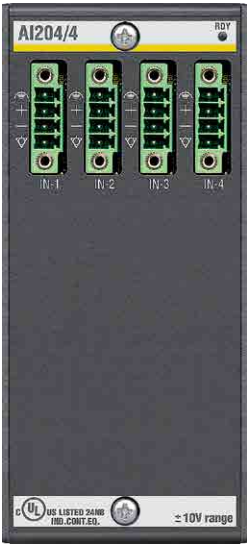
- 8 analog inputs
- Input current 0 .. 20 mA, 4 .. 20 mA, -20 .. +20 mA
- Input impedance approx. 200 Ω
- Resolution: 13 .. 16 bit
- Adjustable input filter 2.5 kHz .. 2.5 Hz

| Item      | Item no.    |
|-----------|-------------|
| AI208/SI  | 00017772-00 |
| AI208/SI* | 00018843-00 |

## Analog input / output modules

| AI208/SI                         |                                                                                                                         |                             |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Current inputs                   |                                                                                                                         |                             |
| Quantity                         | 8                                                                                                                       |                             |
| Input current range              | 0 .. 20 mA, 4 .. 20 mA, -20 .. +20 mA                                                                                   |                             |
| Measuring range                  | ±24.6 mA                                                                                                                |                             |
| Input impedance                  | Normally 200 Ω                                                                                                          |                             |
| Digital resolution               | 13 bit (2.5 kHz filter) .. 16 bit (10 Hz filter)                                                                        |                             |
| Value of the LSB                 | 751,202 nA                                                                                                              |                             |
| Cross-talk attenuation           | > 80 dB between the channels                                                                                            |                             |
| Signal suppression 50 Hz / 60 Hz | 75 dB / 80 dB at 2.5 Hz filter                                                                                          |                             |
| Sample frequency                 | Maximum 10 kHz (filter 2.5 kHz)                                                                                         |                             |
| Filtering slope                  | From cutoff frequency (3 dB) with 60 dB/decade                                                                          |                             |
| Input filter                     | Adjustable: 2.5 kHz, 1.2 kHz, 640 Hz, 320 Hz, 160 Hz, 80 Hz, 40 Hz, 20 Hz, 10 Hz, 5 Hz, 2.5 Hz                          |                             |
| Galvanic isolation of channels   | 500 V                                                                                                                   |                             |
| Galvanic isolation from system   | 500 V                                                                                                                   |                             |
| Ambient conditions               | Standard                                                                                                                | ColdClimate(❄)              |
| Operating temperature            | -30 .. +60 °C                                                                                                           |                             |
| Rel. humidity operation          | 5 .. 95 % without condensation                                                                                          | 5 .. 95 % with condensation |
| Storage temperature              | -40 .. +85 °C                                                                                                           |                             |
| Rel. humidity storage            | 5 .. 95 % with condensation                                                                                             |                             |
| Execution variants               |                                                                                                                         |                             |
| AI208/SI                         | Analog input module 8x IN; +-20 mA /13 .. 16bit; 0.1%; sample time configurable up to 100µs; threshold; single isolated |                             |
| AI208/SI❄                        | Like AI208/SI; ColdClimate (❄)                                                                                          |                             |

# Analog input / output modules



## Analog input modules AI204/x

The analog input module AI204/x offers two or four high-resolution 16 bit analog input channels depending on the model. The extraordinarily high accuracy with integrated temperature calibration predestine this unit for demanding measurement applications for industrial processes.

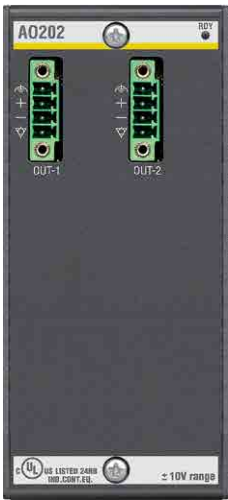
- 1, 2, or 4 analog inputs
- Input voltage -10 V .. +10 V
- Resolution: 16 bit
- Sample time from 20 µs
- Inputs can be synchronized
- Galvanic isolation of channels
- Galvanic isolation from system
- Temperature calibration
- Connection possibility differential
- Internal voltage generation is monitored

| Item     | Item no.    |
|----------|-------------|
| AI204/1  | 00010693-20 |
| AI204/2  | 00010693-10 |
| AI204/4  | 00010693-00 |
| AI204/4✱ | 00017447-00 |

## Analog input / output modules

| AI204/x                               |                                                                                                                         |                             |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Voltage inputs                        |                                                                                                                         |                             |
| Quantity                              | 1, 2 or 4                                                                                                               |                             |
| Input voltage                         | ±10 V                                                                                                                   |                             |
| Input impedance                       | > 33 kΩ                                                                                                                 |                             |
| Digital resolution                    | 16 bit                                                                                                                  |                             |
| Value of the LSB                      | 305 µV                                                                                                                  |                             |
| Allowed common mode voltage           | Max. ±2 V                                                                                                               |                             |
| Cross-talk attenuation                | > 66 dB                                                                                                                 |                             |
| Cross-talk attenuation                | > 120 dB between the channels                                                                                           |                             |
| Error at 25 °C                        | ±1mV (±0.005 %)                                                                                                         |                             |
| Error at the entire temperature range | ±1mV (±0.005 %)                                                                                                         |                             |
| Sample time                           | 20 / 160 / 320 / 640 µs at<br>1- / 8- / 16- / 32-times sampling                                                         |                             |
| Temperature calibration               | Normally 500 µs per calibration                                                                                         |                             |
| Input filter                          | 0.33 kHz / 4 kHz selectable by software                                                                                 |                             |
| Galvanic isolation of channels        | 500 V                                                                                                                   |                             |
| Galvanic isolation from system        | 500 V                                                                                                                   |                             |
| Ambient conditions                    | Standard                                                                                                                | ColdClimate (❄)             |
| Operating temperature                 | -30 .. +60 °C                                                                                                           | -30 .. +60 °C               |
| Rel. humidity operation               | 5 .. 95 % without condensation                                                                                          | 5 .. 95 % with condensation |
| Storage temperature                   | -40 .. +85 °C                                                                                                           | -40 .. +85 °C               |
| Rel. humidity storage                 | 5 .. 95 % with condensation                                                                                             | 5 .. 95 % with condensation |
| Execution variants                    |                                                                                                                         |                             |
| AI204/1                               | Analog input module; 1x In +-10V; 16bit; high precision 0.005 %; 20µs sampling time; digital averaging; single isolated |                             |
| AI204/2                               | Analog input module; 2x In +-10V; 16bit; high precision 0.005 %; 20µs sampling time; digital averaging; single isolated |                             |
| AI204/4                               | Analog input module; 4x In +-10V; 16bit; high precision 0.005 %; 20µs sampling time; digital averaging; single isolated |                             |
| AI204/4 ❄                             | Like AI204/4; ColdClimate (❄)                                                                                           |                             |

# Analog input / output modules



## Analog output module AO202

The analog output module AO202 offers two high-precision 16 bit analog output channels.

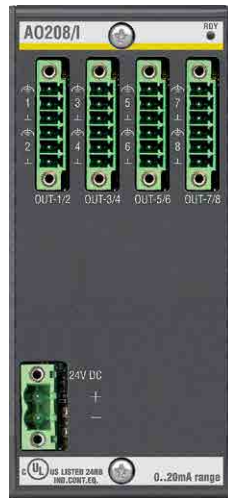
- 2 analog outputs
- Output voltage -10 V .. +10 V
- Resolution: 16 bit
- Outputs can be synchronized
- Galvanic isolation of channels
- Galvanic isolation from system
- Differential connection
- Short circuit proof
- Monitoring of internal power supply

| Item  | Item no.    |
|-------|-------------|
| AO202 | 00010692-00 |

| AO202                                 |                                                                                                        |
|---------------------------------------|--------------------------------------------------------------------------------------------------------|
| Voltage outputs                       |                                                                                                        |
| Quantity                              | 2                                                                                                      |
| Output voltage                        | ±10 V                                                                                                  |
| Output impedance                      | output is corrected to ±2 mA                                                                           |
| Digital resolution                    | 16 bit                                                                                                 |
| Value of the LSB                      | 305 µV                                                                                                 |
| Cross-talk attenuation                | > 120 dB between the channels                                                                          |
| Error at 25 °C                        | ±2.5 mV (±0.0125 %)                                                                                    |
| Error in the entire temperature range | ±12 mV (±0.06%)                                                                                        |
| Refresh cycle time                    | 10 µs per channel                                                                                      |
| Galvanic isolation of channels        | 500 V                                                                                                  |
| Galvanic isolation from system        | 500 V                                                                                                  |
| Ambient conditions                    |                                                                                                        |
| Operating temperature                 | -30 .. +60 °C                                                                                          |
| Rel. humidity operation               | 5 .. 95 % without condensation                                                                         |
| Storage temperature                   | -40 .. +85 °C                                                                                          |
| Rel. humidity storage                 | 5 .. 95 % with condensation                                                                            |
| Execution variants                    |                                                                                                        |
| AO202                                 | Analog output module; 2x Out +-10V; 16bit; high precision 0.0125%; 10µs refresh cycle; single isolated |



## Analog input / output modules



### Analog output module AO208/I

The analog output module AO208/I offers eight 13 bit current outputs.

- 8 analog outputs
- Output current 0 .. 20 mA or 4 .. 20 mA
- Resolution: 13 bit
- Apparent ohmic resistance  $\leq 500\Omega$
- Galvanic isolation from system
- Monitoring of internal voltages
- Short circuit proof

| Item     | Item no.    |
|----------|-------------|
| AO208/I  | 00011244-00 |
| AO208/I* | 00017441-00 |

| AO208/I                                        |                                                                                     |                             |
|------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------|
| Current outputs                                |                                                                                     |                             |
| Quantity                                       | 8                                                                                   |                             |
| Output current                                 | 0 .. 20 mA / 4 .. 20 mA                                                             |                             |
| Digital resolution                             | 13 bit                                                                              |                             |
| Apparent ohmic resistance                      | $\leq 500\Omega$                                                                    |                             |
| Value of the LSB                               | 2.44 $\mu$ A                                                                        |                             |
| Cross-talk attenuation                         | > 70 dB between the channels                                                        |                             |
| Error at 25 °C                                 | $\pm 100 \mu$ A ( $\pm 0.5$ %)                                                      |                             |
| Error at the entire temperature range          | $\pm 160 \mu$ A ( $\pm 0.8$ %)                                                      |                             |
| Setting time of 1% of the output current range | Max. 500 $\mu$ s                                                                    |                             |
| Refresh cycle time                             | 500 $\mu$ s                                                                         |                             |
| Galvanic isolation of channels                 | No isolation                                                                        |                             |
| Galvanic isolation from system                 | 500 V                                                                               |                             |
| Ambient conditions                             | Standard                                                                            | ColdClimate (*)             |
| Operating temperature                          | -30 .. +60 °C                                                                       |                             |
| Rel. humidity operation                        | 5 .. 95 % without condensation                                                      | 5 .. 95 % with condensation |
| Storage temperature                            | -40 .. +85 °C                                                                       |                             |
| Rel. humidity storage                          | 5 .. 95 % with condensation                                                         | 5 .. 95 % with condensation |
| Execution variants                             |                                                                                     |                             |
| AO208/I                                        | Analog output module; 8x Out 20mA; 13bit; 0,5%; 500 $\mu$ s refresh cycle; isolated |                             |
| AO208/I*                                       | Like AO208/I; ColdClimate (*)                                                       |                             |

# Analog input / output modules



## Analog output modules AO202/SI, AO204/SI

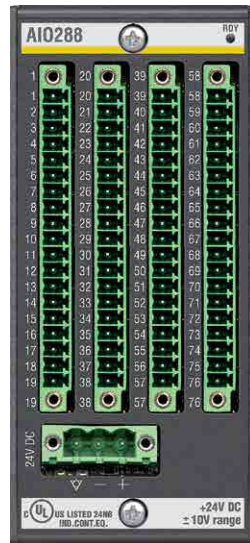
The analog input module AO20x / SI offers two or four high resolution analog 16 bit current output channels.

- 2 or 4 analog outputs
- Output current 0 .. 20 mA
- Resolution: 16 bit
- Galvanic isolation of channels
- Galvanic isolation from system
- Short circuit proof outputs

| Item     | Item no.    |
|----------|-------------|
| AO202/SI | 00012246-10 |
| AO204/SI | 00012246-00 |

| AO202/SI, AO204/SI                                |                                                                 |
|---------------------------------------------------|-----------------------------------------------------------------|
| Analog outputs                                    |                                                                 |
| Quantity                                          | 2 (AO202 / SI) or 4 (AO204 / SI)                                |
| Output current                                    | 0 .. 20 mA                                                      |
| Apparent ohmic resistance                         | Up to 500 Ω                                                     |
| Digital resolution                                | 16 bit                                                          |
| Value of the LSB                                  | 305 nA                                                          |
| Cross-talk attenuation                            | > 100 dB between the channels (50 .. 60 Hz)                     |
| Error at 25 °C                                    | ±0,2%                                                           |
| Error at the entire temperature range             | ±0,6%                                                           |
| Setting time of 0.1 % of the output current range | Max. 3 ms                                                       |
| Galvanic isolation of channels                    | 500 V                                                           |
| Galvanic isolation from system                    | 500 V                                                           |
| Ambient conditions                                |                                                                 |
| Operating temperature                             | -30 .. +60 °C                                                   |
| Rel. humidity operation                           | 5 .. 95 % without condensation                                  |
| Storage temperature                               | -40 .. +85 °C                                                   |
| Rel. humidity storage                             | 5 .. 95 % with condensation                                     |
| Execution variants                                |                                                                 |
| AO202/SI                                          | Analog output module; 2x Out 20mA; 16bit; 0.2%; single isolated |
| AO204/SI                                          | Analog output module; 4x Out 20mA; 16bit; 0.2%; single isolated |

## Analog input / output modules



### Analog input/output modules AIO288/x

The analog input/output module AIO288/x offers eight analog input channels as well as eight analog output channels.

- 8 analog inputs
- 8 analog outputs
- Connection possibility single-ended or differential
- Power supply for up to 4 potentiometers
- Temperature inputs for up to 4 Pt100/Pt1000 sensors
- 2-wire or 4-wire inputs for Pt100/Pt1000 sensors
- Wire break detection for the inputs (for voltage and temperature)
- Short circuit proof outputs
- Overload detection for potentiometer power supplies
- Monitoring of the external supply voltage

| Item     | Item no.    |
|----------|-------------|
| AIO288   | 00014470-00 |
| AIO288*  | 00016157-00 |
| AIO288/1 | 00014470-10 |

#### AIO288/x

| Voltage inputs              |                                          |
|-----------------------------|------------------------------------------|
| Quantity                    | Max. 8                                   |
| Input voltage               | $\pm 1$ V or $\pm 10$ V                  |
| Input impedance             | $> 100$ k $\Omega$                       |
| Digital resolution          | 14 bit                                   |
| Allowed common mode voltage | Max. $\pm 1$ V                           |
| Basic accuracy at 25 °C     | Max. $\pm 0.05$ % of input voltage range |
| Input cutoff frequency      | 1.5 kHz (3 dB)                           |
| Cross-talk attenuation      | $> 60$ dB                                |
| Sample time                 | 200 $\mu$ s                              |

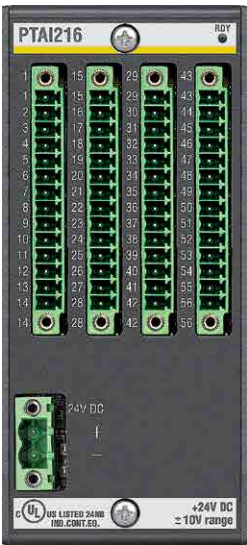
## Analog input / output modules

| AIO288/x                                         |                                                                                                                            |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Voltage outputs                                  |                                                                                                                            |
| Quantity                                         | Max. 8                                                                                                                     |
| Output voltage                                   | ±10 V                                                                                                                      |
| Digital resolution                               | 14 bit                                                                                                                     |
| Allowed common mode voltage                      | Max. ±1 V                                                                                                                  |
| Basic accuracy at 25 °C                          | Max. ±0.025 % of output voltage range                                                                                      |
| Settling time of 1 % of the output current range | Max. 400 µs                                                                                                                |
| Cross-talk attenuation                           | > 60 dB                                                                                                                    |
| Refresh cycle time                               | 200 µs                                                                                                                     |
| Current inputs                                   |                                                                                                                            |
| Quantity                                         | Max. 8                                                                                                                     |
| Input current                                    | 0 .. 20 mA                                                                                                                 |
| Input impedance                                  | 243 Ω                                                                                                                      |
| Digital resolution                               | 14 bit                                                                                                                     |
| Max. input current                               | 35 mA (destruction limit)                                                                                                  |
| Basic accuracy at 25 °C                          | Max. ±0.1 % of input current range                                                                                         |
| Input cutoff frequency                           | 1.5 kHz (3 dB)                                                                                                             |
| Sample time                                      | 200 µs                                                                                                                     |
| Temperature inputs                               |                                                                                                                            |
| Temperature inputs                               | Pt100, Pt1000 selectable                                                                                                   |
| Quantity                                         | Max. 4                                                                                                                     |
| Connection type                                  | 2- or 4-wire, optional                                                                                                     |
| Temperature range                                | -100 .. +500 °C                                                                                                            |
| Input impedance                                  | > 100 kΩ                                                                                                                   |
| Basic accuracy at 25 °C                          | Max. ±0.1 % of input current range                                                                                         |
| Input cutoff frequency                           | 1.5 kHz (3 dB)                                                                                                             |
| Value of the LSB                                 | 0.1 K                                                                                                                      |
| Sample time                                      | 200 µs                                                                                                                     |
| Galvanic isolation from system                   | 500 V                                                                                                                      |
| Potentiometer power supply                       |                                                                                                                            |
| Quantity                                         | Max. 4                                                                                                                     |
| Voltage range                                    | ±10 V                                                                                                                      |
| Error at 25 °C                                   | Max. ±100 mV                                                                                                               |
| Load                                             | Max. 40 mA                                                                                                                 |
| External power supply                            | Voltage range 18 .. 34 V DC<br>Current consumption 230 mA at +5 V DC<br>Galvanic isolation from system 500 V (only AIO288) |

## Analog input / output modules

| AIO288/x                |                                                                                                                                             |          |                             |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------|
| Ambient conditions      |                                                                                                                                             | Standard | ColdClimate (❄)             |
| Operating temperature   | -30 .. +60 °C                                                                                                                               |          |                             |
| Rel. humidity operation | 5 .. 95 % without condensation                                                                                                              |          | 5 .. 95 % with condensation |
| Storage temperature     | -40 .. +85 °C                                                                                                                               |          |                             |
| Rel. humidity storage   | 5 .. 95 % with condensation                                                                                                                 |          |                             |
| Execution variants      |                                                                                                                                             |          |                             |
| AIO288                  | Analog input/output module; 8x In +-10V +-1V 20mA 4x Pt100/1000; 14bit; 0.1%; 200µs sample time; 8x Out +-10V; 4x Poti supply; isolated     |          |                             |
| AIO288❄                 | Like AIO288; ColdClimate (❄)                                                                                                                |          |                             |
| AIO288/1                | Analog input/output module; 8x In +-10V +-1V 20mA 4x Pt100/1000; 14bit; 0.1%; 200µs sample time; 8x Out +-10V; 4x Poti supply; NOT isolated |          |                             |

# Analog input / output modules



## Temperature input module PTAI216

The temperature recording module PTAI216 has four analog input channels and 12 inputs for Pt100/Pt1000 sensors.

- 4 analog inputs  $\pm 10\text{ V}$  /  $\pm 1\text{ V}$  /  $0 \dots 20\text{ mA}$
- 12 inputs for Pt100/Pt1000 sensors
- Single-ended or differential inputs for analog signals
- 2-wire inputs for Pt100/Pt1000 sensors
- Resolution 14 bit (AI) / 12 bit (Pt100/Pt1000)
- Sample time 2.5 ms (AI) / 480 ms (Pt100/Pt1000)
- Channels galvanically isolated from system
- wire break detection for the inputs
- Monitoring of the external power supply

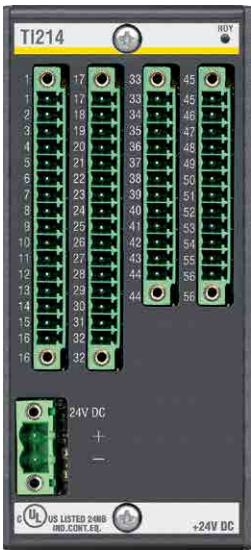
| Item     | Item no.    |
|----------|-------------|
| PTAI216  | 00010708-00 |
| PTAI216* | 00017456-00 |

## Analog input / output modules

| PTAI216                        |                                                                                        |                             |
|--------------------------------|----------------------------------------------------------------------------------------|-----------------------------|
| Voltage inputs                 |                                                                                        |                             |
| Quantity                       | Max. 4                                                                                 |                             |
| Input type                     | Single-ended or differential                                                           |                             |
| Input voltage                  | ±1 V or ±10 V                                                                          |                             |
| Input impedance                | > 33 kΩ                                                                                |                             |
| Input filter                   | 170 Hz (low pass 1st order)                                                            |                             |
| Digital resolution             | 14 bit                                                                                 |                             |
| Allowed common mode voltage    | Max. ±1 V                                                                              |                             |
| Cross-talk attenuation         | > 60 dB                                                                                |                             |
| Sample time                    | 2.5 ms                                                                                 |                             |
| Current inputs                 |                                                                                        |                             |
| Quantity                       | Max. 4                                                                                 |                             |
| Input current                  | 0 .. 20 mA                                                                             |                             |
| Input impedance                | 243 Ω                                                                                  |                             |
| Digital resolution             | 14 bit                                                                                 |                             |
| Max. input current             | 35 mA (destruction limit)                                                              |                             |
| Error at operating temperature | -30 ... +60°C -> ±0.3%*                                                                |                             |
| Sample time                    | 2.5 ms                                                                                 |                             |
| Pt100/Pt1000* inputs           |                                                                                        |                             |
| Quantity                       | 12                                                                                     |                             |
| Input type                     | 2-wire technology                                                                      |                             |
| Temperature range              | -100 .. +300 °C                                                                        |                             |
| Constant current via sensor    | Pt100: 3 mA<br>Pt1000: 0.3 mA                                                          |                             |
| Digital resolution             | 12 bit                                                                                 |                             |
| Value of the LSB               | 0.1 K                                                                                  |                             |
| Averaging                      | Over 16 values per 480 ms                                                              |                             |
| External power supply          |                                                                                        |                             |
| Galvanic isolation from system | 500 V                                                                                  |                             |
| Voltage range                  | 18 .. 34 V DC                                                                          |                             |
| Current consumption internal   | Normally 70 mA at 24 V DC                                                              |                             |
| Ambient conditions             |                                                                                        |                             |
|                                | Standard                                                                               | ColdClimate (❄)             |
| Operating temperature          | -30 .. +60 °C                                                                          |                             |
| Rel. humidity operation        | 5 .. 95 % without condensation                                                         | 5 .. 95 % with condensation |
| Storage temperature            | -40 .. +85 °C                                                                          |                             |
| Rel. humidity storage          | 5 .. 95 % with condensation                                                            |                             |
| Execution variants             |                                                                                        |                             |
| PTAI216                        | Temp.-recording module; 12x Pt100/1000; 4x In +-10V +-1V 20mA; 14bit; 0.25 %; isolated |                             |
| PTAI216❄                       | Like PTAI216; ColdClimate (❄)                                                          |                             |

\* only applies for DC in the input current range 20 mA

# Analog input / output modules



## Temperature input modules TI214/x

The temperature recording modules TI214/x provide 14 temperature measuring channels in a single module width. With the TI214 either Pt100/Pt1000 sensors in 2 and 3 wire technology or type J or K thermocouples can be connected to each measuring channel. The TI214/2 module allows for the connection of type N or S thermocouples. The sensor type can be individually selected for each channel. In this way, the most effective and cost-efficient solution can be implemented for the application. The average determination of the measured value can be set between 16 fold and 64 fold for easy an reliable interference suppression.

With the module version TI214 the temperature of the switching cabinet can be measured on the same module with an inexpensive Pt100 sensor, while for example the temperature control systems are fitted with thermocouples. The new 3-wire measuring evaluation of the Pt100/Pt1000 sensor compensates the voltage error of both symmetrical cable runs and enables the precision of complex 4-wire measuring technology to be implemented in inexpensive 3-wire technology. The Pt sensors can also be connected in simple 2-wire technology and this is sufficient for many applications with short measuring lines.

### TI214/x

- Resolution 14 bit (16 bit measured value averaging)
- Averaging of measured values for interference suppression
- Wire break detection the inputs
- Channels isolated against the system
- Monitoring of the external power supply
- Cold junction temperature compensated

### TI214

- 14 inputs for Pt100 / Pt1000 sensors as well as type J or K thermocouples
- 2-wire or 3-wire input for Pt100 / Pt1000 sensors

### TI214/2

- 14 inputs for thermocouplers type N or S

| Item    | Item no.    |
|---------|-------------|
| TI214   | 00014008-00 |
| TI214/2 | 00014008-20 |
| TI214✱  | 00018808-00 |



## Analog input / output modules

| TI214 / TI214✱                  |                                                                                                                                   | TI214/2                                                                                                                             |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Temperature measuring inputs    |                                                                                                                                   |                                                                                                                                     |
| Quantity                        | 14                                                                                                                                | 14                                                                                                                                  |
| Connection type Pt100/Pt1000    | 3-wire or 2-wire technology                                                                                                       | -                                                                                                                                   |
| Input filter                    | Low pass filter 1st order<br>cutoff frequency (3 dB) 17 kHz                                                                       | Low pass filter 1st order<br>cutoff frequency (3 dB) 8Hz                                                                            |
| Sensor types thermocouples      | J or K in insulated or uninsulated<br>design in accordance with<br>DIN IEC584 each input can be<br>programmed for different types | N or S in insulated or uninsulated<br>design in accordance with<br>DIN IEC584 each input can be pro-<br>grammed for different types |
| Temperature range Pt100/Pt1000  | -100 .. +800 °C                                                                                                                   | -                                                                                                                                   |
| Temperature range thermocouples | J/K: -30 .. +1000 °C                                                                                                              | N: -30 .. +1300 °C<br>S: -30 .. +1600 °C                                                                                            |
| Constant current Pt sensor      | 2 mA (Pt100), 200 µA (Pt1000)                                                                                                     | -                                                                                                                                   |
| Digital resolution              | 14 bits (16 bits representation with measured value averaging)                                                                    |                                                                                                                                     |
| Value of the LSB                | 0.055 K (Pt100 / Pt1000)<br>0.062 K<br>(thermocouple -30 .. +1000 °C)                                                             | 0.08 K<br>(thermocouple N -30 .. +1300 °C)<br>0.098 K<br>(thermocouple S -30 .. +1600 °C)                                           |
| Base accuracy                   | 0.1 % of measuring range at<br>25 °C (Pt100 / Pt1000)*<br>0.15 % of measuring range at<br>+25 °C (thermocouples J / K)**          | 0.15 % for type N and<br>0.25 % for type S of measuring<br>range at +25 °C (thermocouples<br>N / S)**                               |
| Conversion time                 | 80 ms at 16 fold averaging<br>320 ms at 64 fold averaging                                                                         | 1 ms without averaging<br>80 ms at 16 fold averaging<br>320 ms at 64 fold averaging                                                 |
| Thermocouples linearization     | Polynomial to IEC60584 part 1,<br>for sensor types J or K                                                                         | Polynomial to IEC60584 part 1,<br>for sensor types N or S                                                                           |
| Error detection                 | Wire break                                                                                                                        |                                                                                                                                     |
| Interference voltage strength   | -36 V .. +36 V                                                                                                                    |                                                                                                                                     |
| External power supply           |                                                                                                                                   |                                                                                                                                     |
| Galvanic isolation from system  | 500 V                                                                                                                             |                                                                                                                                     |
| Voltage range                   | 18 .. 34 V DC                                                                                                                     |                                                                                                                                     |
| Current consumption internal    | normally 160 mA at + 24 V DC                                                                                                      |                                                                                                                                     |
| Reverse polarity protection     | Yes                                                                                                                               |                                                                                                                                     |
| Ambient conditions              |                                                                                                                                   |                                                                                                                                     |
|                                 | Standard                                                                                                                          | ColdClimate (✱)                                                                                                                     |
| Operating temperature           | -30 .. +60 °C                                                                                                                     |                                                                                                                                     |
| Rel. humidity operation         | 5 .. 95 % without condensation                                                                                                    | 5 .. 95 % with condensation                                                                                                         |
| Storage temperature             | -40 .. +85 °C                                                                                                                     |                                                                                                                                     |
| Rel. humidity storage           | 5 .. 95 % with condensation                                                                                                       |                                                                                                                                     |
| Models                          |                                                                                                                                   |                                                                                                                                     |
| TI214                           | Temperature recording module; 14x thermocouple type J,K (FeCo/<br>NiCrNi); Pt100/1000; 14bit; 0.15%; isolated                     |                                                                                                                                     |
| TI214/2                         | Temp.-recording module; 14x thermocouple type N,S; 14 bit;<br>0.15%; isolated                                                     |                                                                                                                                     |
| TI214✱                          | Like TI214; ColdClimate (✱)                                                                                                       |                                                                                                                                     |

\* only applies for 3-conductor technology

\*\* without consideration of cold point compensation

# Analog input / output modules



## Strain gauge input module DMS202

The strain gauge module DMS202 is a two-channel, micro controller operated measuring module to read quickly changing DMS signals up approx. 1 kHz with a sample time of only 12.5  $\mu$ s.

- 2 DMS measurement inputs
- High-quality plug-in connector
- 2 analog measurement outputs
- Automatic measuring range selection (input)
- Wire break detection on the measurement inputs
- Monitoring of the external supply voltage

| Item   | Item no.    |
|--------|-------------|
| DMS202 | 00009884-00 |

## Analog input / output modules

| <b>DMS202</b>                            |                                                                                                                                  |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Bridge supply</b>                     |                                                                                                                                  |
| Carrier frequency                        | 5 kHz $\pm$ 2 %                                                                                                                  |
| Amplitude                                | 4 V <sub>eff</sub> $\pm$ 2 %                                                                                                     |
| Synchronization of the carrier frequency | Optional                                                                                                                         |
| Synchronization range                    | 5 kHz $\pm$ 2 %                                                                                                                  |
| <b>DMS amplifier input</b>               |                                                                                                                                  |
| Input resistance                         | > 5 M $\Omega$                                                                                                                   |
| Desired signal bandwidth                 | 1 kHz                                                                                                                            |
| Resolution                               | 12 bit                                                                                                                           |
| max. input common mode voltage           | 10 V (no overdrive)                                                                                                              |
| CMRR (0 .. 5 kHz)                        | > 80 dB                                                                                                                          |
| Wire break monitoring                    | Yes, error message                                                                                                               |
| Galvanic isolation from system           | 500 V                                                                                                                            |
| Monitoring of the ext. voltage           | Yes, power-fail signal                                                                                                           |
| Conversion time                          | 12.5 $\mu$ s for one channel, 25 $\mu$ s for two-channel operation                                                               |
| Measurement range selection              | 2.0 / 4.0 / 8.0 / 16.0 mV or Auto Range                                                                                          |
| Measurement range switchover             | Automatic or via software                                                                                                        |
| <b>Measurement outputs</b>               |                                                                                                                                  |
| Output voltage                           | 0 .. 10 V                                                                                                                        |
| Internal resistance                      | < 2 $\Omega$                                                                                                                     |
| Load resistor                            | > 2.5 k $\Omega$                                                                                                                 |
| Special functions                        | Peak value capture<br>Electronic capacity comparison<br>Carrier frequency synchronization                                        |
| <b>External power supply</b>             |                                                                                                                                  |
| Voltage range                            | 18 .. 34 V DC                                                                                                                    |
| Current consumption external             | 100 mA at 24 V DC                                                                                                                |
| Reverse polarity protection              | Yes                                                                                                                              |
| Galvanic isolation from system           | 500 V                                                                                                                            |
| <b>Ambient conditions</b>                |                                                                                                                                  |
| Operating temperature                    | 0 .. +60 °C                                                                                                                      |
| Rel. humidity operation                  | 5 .. 95 % without condensation                                                                                                   |
| Storage temperature                      | -40 .. +85 °C                                                                                                                    |
| Rel. humidity storage                    | 5 .. 95 % without condensation                                                                                                   |
| <b>Execution variants</b>                |                                                                                                                                  |
| DMS202                                   | Strain gauge measuremet, 2x full bridge; $\pm$ 2/4/8/16mV;<br>25 $\mu$ s sampling time; 5 kHz carrier frequency, 12bit; isolated |

# Function modules

## Flexibility and precision in soft motion control.

As the leading provider in the field of soft motion control, Bachmann electronic offers a flexible line of modules for directly wired motion control.

Bachmann modules cover all types of data acquisition, from fast pulse and incremental encoder cards with bandwidths up to 8 MHz to SSI (Serial Synchronous Inter-

face). The possibility of controlling the drives with analog signals (voltage), step motor outputs or PWM output channels allows flexible configuration.

All encoder interface modules of the M1 system offer precise synchronizability as well as comprehensive functional support for the programmer.



### Counter modules CNT204 / x

| Features                                                                                      |
|-----------------------------------------------------------------------------------------------|
| Number of counter inputs: 4<br>(for single-channel pulse encoders, zero initiators, triggers) |
| Number of incremental encoders: 2 input channels<br>(HTL and /or RS422)                       |
| Encoder power supply direct from the module via the connectors                                |
| Inputs can be synchronized                                                                    |



### Encoder interface modules ISI222 / x

| Features                                                         |
|------------------------------------------------------------------|
| Input channels for incremental or SSI encoder: 2                 |
| Output channels analog: 2 ( $\pm 10$ V DC)                       |
| Input channels digital: 4 (reference, trigger)                   |
| Encoder power supply directly from the module via the connectors |
| Monitoring of all external supply voltages                       |
| Max. input frequency: 1 MHz/8 MHz                                |



## Pulse width modulation module PWM202

### Features

- Pulse width modulated output channels: 2
- 18 .. 48 V DC external supply TTL
- Integrated current control
- Output current: to 2 A
- Resolution: 10/16 bit
- Monitoring of the load current
- Monitoring of all external supply voltages



## Axis controller module ACR222 / 2

### Features

- Interfaces for stepping motor output stages up to 150 kHz: 2
- Interfaces for incremental encoders to 1 MHz: 2
- Encoder power supply direct from the module via the connectors
- Monitoring of all external supply voltages
- Linear or sine shaped acceleration profiles
- External set or integrated profiles



Counter modules CNT204/x

The counter module CNT204/x contains four counters for single line pulse generators. Two of the channels can optionally be used as inputs for incremental encoders.

- 4 counter inputs for single line pulse generators
- Status indication: LED (green) per counter/initiator input
- 2 input channels for incremental encoders
- Encoder power supply directly from the module via the connectors
- Inputs can be synchronized
- Monitoring of all supply voltages
- Period measurement with 42 ns resolution
- Differential measurement (phase shift between C1 and C3 or C2 and C4) with 42 ns resolution

| Item      | Item no.    |
|-----------|-------------|
| CNT204/H  | 00010709-10 |
| CNT204/H❄ | 00016407-10 |
| CNT204/R  | 00010709-20 |

| CNT204/x                     |                                                                                                                                                                        |                             |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Incremental encoder inputs   |                                                                                                                                                                        |                             |
| Quantity                     | 2                                                                                                                                                                      |                             |
| Counter resolution           | 32 bit                                                                                                                                                                 |                             |
| Input signals                | A-, A+ / B-, B+ / N-, N+                                                                                                                                               |                             |
| Signal evaluation            | 1-/2-/4-edge evaluation or pulse direction mode                                                                                                                        |                             |
| Max. input frequency         | 1 MHz (RS422)/300 kHz (HTL)                                                                                                                                            |                             |
| Input filter                 | 185 kHz .. 6 MHz adjustable, default 6 MHz                                                                                                                             |                             |
| Counter inputs               |                                                                                                                                                                        |                             |
| Quantity                     | 4 (2 if INC inputs are used)                                                                                                                                           |                             |
| Counter resolution           | 32 bit                                                                                                                                                                 |                             |
| max. input frequency         | 20 kHz                                                                                                                                                                 |                             |
| min. pulse length            | 25 µs                                                                                                                                                                  |                             |
| Input filter                 | 183 Hz .. 46.88 kHz adjustable, default off (fg=100 kHz)                                                                                                               |                             |
| Encoder power supply         |                                                                                                                                                                        |                             |
|                              | +5 V                                                                                                                                                                   | +24 V                       |
| voltage                      | +5 V                                                                                                                                                                   | U <sub>ext</sub> -1 V       |
| Tolerance                    | ±5 %                                                                                                                                                                   | like U <sub>ext</sub>       |
| max. current/encoder         | 200 mA                                                                                                                                                                 | 300 mA                      |
| Ripple                       | < 150 mV <sub>ss</sub>                                                                                                                                                 | like U <sub>ext</sub>       |
| Short circuit proof          | Yes, permanent                                                                                                                                                         | Yes, permanent              |
| External power supply        |                                                                                                                                                                        |                             |
| Power supply                 | 18 .. 34 V DC                                                                                                                                                          |                             |
| Current consumption internal | 40 mA at 24 V + 1.2x current consumption of the encoders                                                                                                               |                             |
| Reverse polarity protection  | Yes                                                                                                                                                                    |                             |
| Ambient conditions           |                                                                                                                                                                        |                             |
|                              | Standard                                                                                                                                                               | ColdClimate (❄)             |
| Operating temperature        | -30 .. +60 °C                                                                                                                                                          |                             |
| Rel. humidity operation      | 5 .. 95 % without condensation                                                                                                                                         | 5 .. 95 % with condensation |
| Storage temperature          | -40 .. +85 °C                                                                                                                                                          |                             |
| Rel. humidity storage        | 5 .. 95 % with condensation                                                                                                                                            |                             |
| Execution variants           |                                                                                                                                                                        |                             |
| CNT204/H                     | Counter module; 2x INC HTL 300kHz + 2x counter HTL 20kHz oder 4x counter HTL 20kHz; HTL=24V; 32bit; INC A,A/B/N; position; phase difference; period; trigger; isolated |                             |
| CNT204/H❄                    | Like CNT204/H; ColdClimate (❄)                                                                                                                                         |                             |
| CNT204/R                     | Counter module; 2x INC RS422 1MHz + 2x counter HTL 20kHz oder 4x counter HTL 20kHz; HTL=24V; 32bit; INC A,A/B/N; position; phase difference; period; trigger; isolated |                             |

# Function modules



## Positioning modules ISI222/x

Especially designed for sophisticated motion control applications the ISI222 module offers compact equipment and optimum precision. Equipped for the total control of two motion axes, the module features a number of encoder interfaces for position acquisition, analog outputs for the application of manipulated variables, as well as digital inputs for the initiator or trigger. Furthermore, due to the central communication concept, all I/Os of the remaining M1 system can also be incorporated into the motion control (limit switches, etc.). Input frequencies up to 8 MHz and the integrated synchronization (IO-Bus-Sync) with the total system allow highly dynamic and precise movements.

Beside the full compatibility to the well proven controller modules M-SMC, M-CNC and M-SHAFT, also the user own programs and individually designed control tasks can utilize the extensive integrated functions of the module simply via the known standard interfaces (SVI, MIO). The extensive integrated error monitoring with ongoing checking of the encoder resolution identifies hard-to-see wiring or ESD problems and allows the application especially under difficult environmental conditions.

- 2 input channels for incremental and SSI encoders
- Full 32 bit counter
- 2 analog outputs (14 bit)
- 4 fast digital input channels for initiator and trigger
- Position measurement/ position storage can be initiated via triggers
- Virtual for use in applications: zero pulse, speed, etc.
- Synchronization via SYNC/PreSYNC
- Encoder supply via module
- Monitoring of the encoder voltage
- Wire break monitoring (encoder)

| Item     | Item no.    |
|----------|-------------|
| ISI222   | 00013737-00 |
| ISI222*  | 00016421-00 |
| ISI222/8 | 00014127-00 |



| ISI222 / x                                     |                                                                                                                                     |                |                       |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------|
| Encoder interface module                       |                                                                                                                                     |                |                       |
| Quantity                                       | 2                                                                                                                                   |                |                       |
| Counter resolution                             | 32 bit                                                                                                                              |                |                       |
| Input signals                                  | A-, A+ / B-, B+ / N-, N+                                                                                                            |                |                       |
| Signal evaluation                              | 1-/2-/4-edge evaluation or pulse direction mode                                                                                     |                |                       |
| Input frequency                                | Max. 1 MHz (ISI222), max. 8 MHz (ISI222/8)                                                                                          |                |                       |
| Synchronization                                | By means of SYNC signal                                                                                                             |                |                       |
| Modes                                          | Reference value monitoring<br>Conditional storage of counter value<br>Conditional load / rest of counter value<br>Speed measurement |                |                       |
| Error detection                                | Wire break, encoder resolution monitoring                                                                                           |                |                       |
| Galvanic isolation of channels*                | 500 V                                                                                                                               |                |                       |
| SSI encoder interface*                         |                                                                                                                                     |                |                       |
| Quantity                                       | 2                                                                                                                                   |                |                       |
| Data word length                               | programmable up to 32 bits                                                                                                          |                |                       |
| Input signals                                  | D-, D+                                                                                                                              |                |                       |
| Output signals                                 | T-, T+                                                                                                                              |                |                       |
| Data format                                    | Graycode and binary format, others can be evaluated by SW                                                                           |                |                       |
| Transfer clock rate                            | 100 kHz .. 2 MHz                                                                                                                    |                |                       |
| Synchronization                                | Via preSYNC function                                                                                                                |                |                       |
| Encoder power supply                           |                                                                                                                                     |                |                       |
| Output voltage ranges                          | +5 V and +15 V selectable with jumper, 24 V looped through                                                                          |                |                       |
| Output voltage                                 | +5 V                                                                                                                                | +15 V          | -1 V                  |
| Tolerance                                      | ±5 %                                                                                                                                | ±3 %           | like U <sub>ext</sub> |
| max. current/encoder                           | 250 mA                                                                                                                              | 100 mA         | 300 mA                |
| Short circuit proof                            | Yes, permanent                                                                                                                      | Yes, permanent | Yes, permanent (PTC)  |
| Ripple                                         | < 150 mV <sub>ss</sub> at +5 V and +15 V                                                                                            |                |                       |
| Galvanic isolation of channels                 | 500 V                                                                                                                               |                |                       |
| Analog outputs                                 |                                                                                                                                     |                |                       |
| Quantity                                       | 2                                                                                                                                   |                |                       |
| Output voltage                                 | ±10 V                                                                                                                               |                |                       |
| Resolution                                     | 14 bit                                                                                                                              |                |                       |
| Output current                                 | Max. ±2 mA                                                                                                                          |                |                       |
| Conversion time                                | <40 µs                                                                                                                              |                |                       |
| Basic accuracy at 25 °C                        | 0.025 %                                                                                                                             |                |                       |
| Error at the entire Temperature range          | ±0.1%                                                                                                                               |                |                       |
| Setting time of 1% of the output current range | Max. 500 µs                                                                                                                         |                |                       |
| Error detection                                | Wire break                                                                                                                          |                |                       |
| Short circuit proof                            | Yes, permanent                                                                                                                      |                |                       |
| Synchronization                                | By means of SYNC signal                                                                                                             |                |                       |

\* only for ISI222



## Function modules

| ISI222 / x                            |                                                                                                                                                                                                                                                               |                                                                 |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Digital inputs                        |                                                                                                                                                                                                                                                               |                                                                 |
| Quantity                              | 4 (2 INIT, 2 TRIG)                                                                                                                                                                                                                                            |                                                                 |
| voltage                               | 18 .. 34 V DC                                                                                                                                                                                                                                                 |                                                                 |
| Input delay                           | 30 µs default, filter adjustable                                                                                                                                                                                                                              |                                                                 |
| Acc. to IEC 61131                     | Type 1                                                                                                                                                                                                                                                        |                                                                 |
| Function                              | INIT: initiator, trigger for strobe register, digital input<br>TRIG: trigger for strobe register, digital input                                                                                                                                               |                                                                 |
| Connection type                       |                                                                                                                                                                                                                                                               |                                                                 |
| Connection for analog and digital I/O | Phoenix Contact MINICOMBICON connector RM 3.5 with flange                                                                                                                                                                                                     |                                                                 |
| Connection type                       | Screw clamp, spring tension clamp<br>plug codable, labeling by channels                                                                                                                                                                                       |                                                                 |
| Operating conditions                  |                                                                                                                                                                                                                                                               |                                                                 |
| Supply voltage                        | 18 .. 34 V DC                                                                                                                                                                                                                                                 |                                                                 |
| Mounting                              | Mountable on backplane BS2xx                                                                                                                                                                                                                                  |                                                                 |
| Mounting position                     | Horizontal (vertical at -20 .. +55 °C<br>operating temperature)                                                                                                                                                                                               | Horizontal (vertical at -30 .. +55 °C<br>operating temperature) |
| Ambient conditions                    |                                                                                                                                                                                                                                                               |                                                                 |
|                                       | Standard                                                                                                                                                                                                                                                      | ColdClimate (❄)                                                 |
| Operating temperature                 | -30 .. +60 °C                                                                                                                                                                                                                                                 |                                                                 |
| Rel. humidity operation               | 5 .. 95 % without condensation                                                                                                                                                                                                                                | 5 .. 95 % with condensation                                     |
| Storage temperature                   | -40 .. +85 °C                                                                                                                                                                                                                                                 |                                                                 |
| Rel. humidity storage                 | 5 .. 95 % with condensation                                                                                                                                                                                                                                   |                                                                 |
| Execution variants                    |                                                                                                                                                                                                                                                               |                                                                 |
| ISI222                                | Positioning module; 2x In INC/SSI; 1MHz; 32bit; RS422 level; INC A, A/B/N; position; gate time; period; velocity; encoder supply 5V / 15V / 24V; 2x Out +-10V; 14bit; 0.025 %; 40µs; synchronized; PreSYNC; 4x DI 24V; trigger; homing                        |                                                                 |
| ISI222❄                               | Like ISI222; ColdClimate (❄)                                                                                                                                                                                                                                  |                                                                 |
| ISI222/8                              | Positioning module; 2x In INC; 8MHz; 32bit; RS422 level; INC A, A/B/N; position; gate time; period; velocity; encoder supply 5V / 15V / 24V; 2x Out +-10V; 14bit; 0.025 %; 40µs; synchronized; PreSYNC; 4x DI 24V; trigger; homing; SSI-Encoder not supported |                                                                 |



### Pulse Width Modulation Module PWM202

The pulse width modulation module PWM202 has two power outputs for direct activation of inductive or ohmic loads, such as DC motors, immersion coils, etc. with pulse width modulated signals.

- 2 pulse-width modulated output channels
- 2 shielded DSub connectors for output channels
- Status indication: LED (green) per output
- Choice of high-power or TTL output level
- Monitoring of the load current
- Monitoring of the external supply voltage
- Monitoring of the internal temperature

| Item   | Item no.    |
|--------|-------------|
| PWM202 | 00011056-00 |

| PWM202                         |                                                                                                                   |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Outputs                        |                                                                                                                   |
| Quantity                       | 2                                                                                                                 |
| State indicating LEDs          | RDY yellow, OUT-1 / OUT-2 green                                                                                   |
| Output voltage                 | 18 .. 48 V (= $U_{\text{external}}$ ) or TTL level                                                                |
| Output current                 | 0 .. 2 A at $f \leq 40 \text{ kHz}$ and $U_{\text{out}} \leq 48 \text{ V}$ ( $T_A = +60 \text{ }^\circ\text{C}$ ) |
| Frequency                      | Channel 1: 3 Hz .. 40 kHz adjustable<br>Channel 2: 155 Hz .. 40 kHz adjustable                                    |
| Duty cycle                     | 0 .. 100 % individually adjustable for each channel                                                               |
| Resolution channel 1           | 16 bit, edge aligned or center aligned                                                                            |
| Resolution channel 2           | 10 bit, edge aligned                                                                                              |
| Galvanic isolation from system | 500 V                                                                                                             |
| Load resistor                  | Normally 20 $\Omega$                                                                                              |
| External power supply          |                                                                                                                   |
| Voltage range                  | 18 .. 48 V DC                                                                                                     |
| Power consumption              | Max. 10 W + load                                                                                                  |
| Reverse polarity protection    | Yes                                                                                                               |
| Monitoring                     |                                                                                                                   |
| External power supply          | Yes, power-fail signal + interrupt                                                                                |
| Overvoltage                    | Yes                                                                                                               |
| Undervoltage                   | Yes                                                                                                               |
| Overcurrent (channel)          | Yes                                                                                                               |
| Ambient conditions             |                                                                                                                   |
| Operating temperature          | -30 .. +60 $^\circ\text{C}$                                                                                       |
| Rel. humidity operation        | 5 .. 95 % without condensation                                                                                    |
| Storage temperature            | -40 .. +85 $^\circ\text{C}$                                                                                       |
| Rel. humidity storage          | 5 .. 95 % with condensation                                                                                       |
| Execution variants             |                                                                                                                   |
| PWM202                         | Pulse width modulation module; 2 channels each 2A/48V or TTL; actuator or current regulation; isolated            |

# Function modules



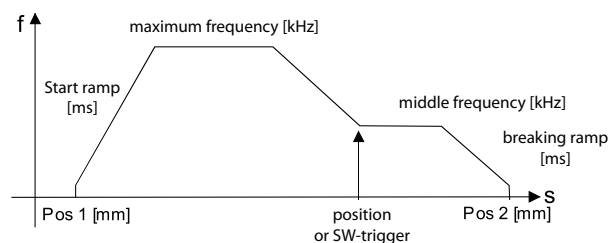
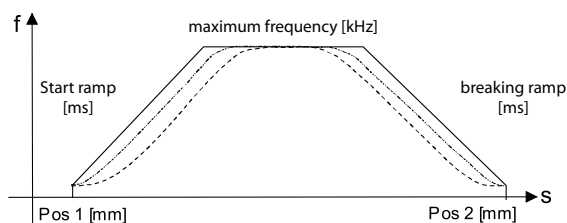
## Axis controller module ACR222/2

The axis controller module ACR222/2 is an encoder interface module to operate one/two (micro) stepping motor output stages with stepper frequencies of up to 150 kHz.

- 2 interfaces for stepping motor output stages to 150 kHz
- 2 interfaces for incremental encoders up to 1 MHz
- Encoder power supply directly from the module via the connectors
- Inputs for home, abort and 2 limit switches per channel
- Monitoring of the external supply voltage
- Linear, sine<sup>2</sup> or parabolic acceleration
- Two-step linear speed profiles

| Item     | Item no.    |
|----------|-------------|
| ACR222/2 | 00009928-10 |

| ACR222/2                       |                                                                                                                                                                             |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Encoder interface              |                                                                                                                                                                             |
| Counter resolution             | 24 bit                                                                                                                                                                      |
| Counter modes                  | 1-/2-/4-edge evaluation                                                                                                                                                     |
| Encoder frequency              | Max. 1 MHz                                                                                                                                                                  |
| Inputs                         | HEDL (HP/AVAGO interface)/RS422                                                                                                                                             |
| Galvanic isolation from system | 500 V                                                                                                                                                                       |
| Encoder power supply           | +5 V or +15 V selectable with jumper                                                                                                                                        |
| Motor controller interface     |                                                                                                                                                                             |
| Stepper frequency              | Max. 150 kHz                                                                                                                                                                |
| Number of steps (range)        | 1 .. 16 777 215                                                                                                                                                             |
| Acceleration type              | Linear, sin <sup>2</sup> - or parabolic                                                                                                                                     |
| Acceleration time/braking time | 8 ms .. 131 s                                                                                                                                                               |
| Output voltage                 | Low: 0 .. 2 V, high: 3 .. 34 V, I <sub>max</sub> = 10 mA                                                                                                                    |
| Input voltage                  | Low: 0 .. 3 V, high: 4 .. 30 V                                                                                                                                              |
| Voltage range                  | 18 .. 34 V DC                                                                                                                                                               |
| Current consumption internal   | Normally 400 mA at 24 VDC + $\Sigma$ current consumption of the encoders and sensors                                                                                        |
| Galvanic isolation from system | 500 V                                                                                                                                                                       |
| Reverse polarity protection    | Yes                                                                                                                                                                         |
| Ambient conditions             |                                                                                                                                                                             |
| Operating temperature          | 0 .. +60 °C                                                                                                                                                                 |
| Rel. humidity operation        | 5 .. 95 % without condensation                                                                                                                                              |
| Storage temperature            | -40 .. +85 °C                                                                                                                                                               |
| Rel. humidity storage          | 5 .. 95 % without condensation                                                                                                                                              |
| Execution variants             |                                                                                                                                                                             |
| ACR222/2                       | Stepper motor module; 2x Out 150kHz; 2x In INC; 1MHz; RS422; 8x DI 24V; acceleration modes linear/sine <sup>2</sup> /parable; without power amplifier; encoder supply 5/15V |

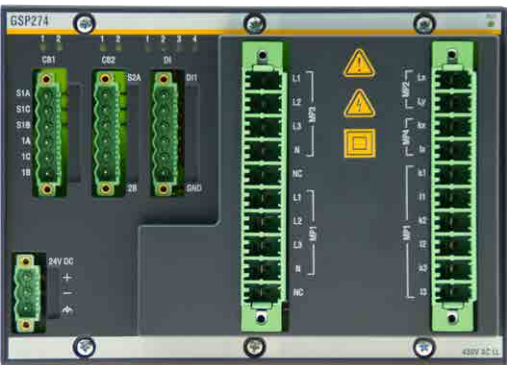


# Grid measurement module

## Safety and efficiency of the electrical energy supply.

The safety and efficiency of the electrical energy supply are placing increasing demands on the generator units, transmission systems and consumers. A new generation of systems for measuring, monitoring and protection provides an essential technical basis. Our grid modules supply the latest state-of-the-art technology as a fully integrated solution in the automation units of the M200 system. This provides modular expansion capability, data storage and communication over several

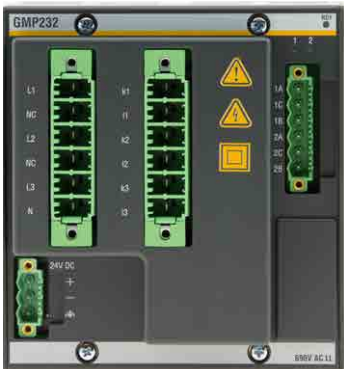
fieldbus and telecontrol interfaces that are simple and affordable. High resolution and fast acquisition of all grid variables forms the indispensable basis of all grid modules. The integrated energy metering simplifies handling in engineering and operation. In order to ensure network stability, generator units must be able to guarantee a defined response according to the relevant grid codes. Faults in the grid or in the plant must lead to defined responses such as the provision of control power or grid



### Grid measurement, protection and synchronization module GSP274

#### Features

- Measures current, voltage, frequency, power and power quality
- Synchronism-check relay
- Monitoring functions to ensure safe generator operations
- Controls two circuit breakers
- Integrated fault recorder
- Provides grid measurement simulation
- Integrated sequence of events recorder
- 4Q energy counter



### Grid measurement and protection module GMP232

#### Features

- Measures current, voltage, frequency, power and power quality
- Input voltage up to 690 VL-L, RMS
- Numerous monitoring functions
- Integrated fault recorder
- Sequence of events recorder with real time stamp
- Two integrated relays
- Grid measurement simulation
- Monitoring functions are independent of PLC status

disconnection. The GSP274 and GMP232 module series offer for this configurable protection and monitoring functions in accordance with the latest standards. The integrated harmonics analysis function deals with the problems of power quality caused by increasingly larger power electronic components. Precise, time-stamped event logging and integrated real-time data recorders provide a convenient basis for commissioning or fault analysis. Furthermore, the GSP274 modules also provide a synchronization unit for the automatic grid

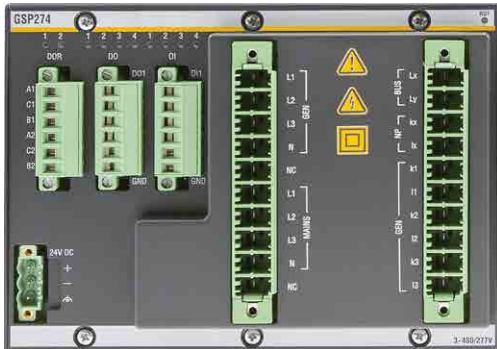
coupling of generators. GM260 modules impress with their particularly compact design and simple handling for consumption optimization and energy monitoring.



### Grid measurement module GM260

| Features                                         |
|--------------------------------------------------|
| Current, voltage, frequency and grid measurement |
| Remanent four-quadrant power counter             |
| Rated voltage up to 480 VL-L, RMS                |
| Robust and reliable hardware                     |

## Grid measurement module



| Item   | Item No.    |
|--------|-------------|
| GSP274 | 00019756-00 |

### Grid measurement, protection and synchronization module GSP274

The GSP274 enables the safe, reliable and automatic synchronization of generator units to the power supply grid. It also provides a number of monitoring functions for generator and grid protection. The circuit-breakers are tripped by the module directly via digital outputs and relays. Additional digital inputs enable the monitoring of the relevant switching state. The continuous monitoring of grid harmonics up to the 50th harmonic can be used for direct responses as well as for evaluating the power quality.

The module is provided with an integrated real-time data recorder for the high-precision recording of up to 16 measuring channels during protective tripping or synchronization. Error events are recorded continuously and stored permanently with a high resolution time entry. The internal time base of the module can be synchronized to an external time source (e.g. IEEE 1588 Precision Time Protocol), which supports the analysis of the data from spatially separated measurement and protection devices.

The GSP274 is fully integrated in the Bachmann SolutionCenter. Configurations can be created simply and stored for later reuse. Both the measured channel values and also the derived values are made available directly in the user interface. Commissioning and fault analysis are simplified with tabular, phasor and time sequence displays. Event logs and recorded time sequences can be exported in CSV respectively COMTRADE format. The integrated simulation function simplifies the configuration of protection and monitoring functions.



- Measurement of current, voltage, frequency, power, power factor, phase angle
- Measurement of grid harmonics up to the 50th (power quality)
- Synchronization monitoring /Synchro-check
- Monitoring/Protection functions for grid and generator protection
- Controls two circuit-breakers
- Integrated real-time data recorder
- Integrated event logging
- 4Q energy counter
- Measured value simulation



## Grid measurement module

| GSP274 - Grid measurement                               |                                                                |
|---------------------------------------------------------|----------------------------------------------------------------|
| Current/voltage measurement                             |                                                                |
| Measuring method                                        | True RMS (incl. harmonics)                                     |
| Sampling rate                                           | 50 $\mu$ s (20 kHz)                                            |
| Measurement interval                                    | 50 Hz: 10 ms<br>60 Hz: 8.33 ms                                 |
| Voltage measurement                                     |                                                                |
| Number                                                  | 7 (generator: L1,L2,L3,N / grid: L1,L2,L3,N / busbar Lx,Ly)    |
| Maximum rated voltage                                   | $U_{L-L, RMS}$ : 480 VAC $U_{L-N, RMS}$ : 277 VAC              |
| Voltage measuring range                                 | $U_{L-L, RMS}$ : 17.3 – 728 VAC, $U_{L-N, RMS}$ : 10 – 420 VAC |
| Accuracy*                                               | $\pm 0.1$ %                                                    |
| Continuous overload                                     | $U_{L-L, RMS}$ : 675 VAC, $U_{L-N, RMS}$ : 390 VAC             |
| Short-term overload (10x10 s, Interval 10 s)            | $U_{L-L, RMS}$ : 1143 VAC, $U_{L-N, RMS}$ : 660 VAC            |
| Input impedance                                         | >2 M $\Omega$                                                  |
| Current measurement                                     |                                                                |
| Number                                                  | 4 (generator: 3x, Generator star/neutral-point: X 1)           |
| Accuracy*                                               | $\pm 0.1$ %                                                    |
| Current transformer rated current                       | 5 A                                                            |
| Current measuring range                                 | 0 – 10 AAC                                                     |
| Continuous overload                                     | 10 AAC                                                         |
| Short-term overload<br>(5x1 s, interval 300 s)          | 100 AAC                                                        |
| Frequency measurement                                   |                                                                |
| Rated frequency                                         | 50 / 60 Hz                                                     |
| Reference range                                         | 50 Hz: 35 to 65 Hz<br>60 Hz: 45 to 75 Hz                       |
| Accuracy*                                               | $\pm 0.01$ Hz                                                  |
| Measurement interval                                    | Between two zero crossings<br>50 Hz: 10 ms<br>60 Hz: 8.33 ms   |
| Frequency change measurement                            | Yes                                                            |
| Maximum frequency change                                | $\pm 1$ Hz/s                                                   |
| Power measurement – active, reactive and apparent power |                                                                |
| Measured values                                         | P, Q, S per phase and as total                                 |
| Accuracy*                                               | $\pm 0.2$ %                                                    |
| Calculation method                                      | DIN 40110-2, IEC61400-21                                       |
| Measurement interval                                    | Calculation over one period<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms |

\* Accuracy values as a percentage of the nominal value at 25 °C

## Grid measurement module

| GSP274 - Grid measurement                          |                                                                                                                                                        |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy                                             |                                                                                                                                                        |
| Accuracy*                                          | ±0.2 %                                                                                                                                                 |
| Resolution                                         | 1 Ws                                                                                                                                                   |
| Active energy                                      | Supplied (positive), drawn (negative)                                                                                                                  |
| Reactive energy                                    | Supplied (positive), drawn (negative)                                                                                                                  |
| Type of memory                                     | Nonvolatile (on the module)                                                                                                                            |
| Measurement interval                               | Calculation over one period<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms                                                                                         |
| Power quality                                      |                                                                                                                                                        |
| Voltage                                            | Total harmonic distortion (THD) per phase                                                                                                              |
| Current                                            | Total demand distortion (TDD) per phase                                                                                                                |
| Voltage harmonics                                  | Amplitudes of harmonics up to 50th harmonic per phase                                                                                                  |
| Current harmonics                                  | Amplitudes of harmonics up to 50th harmonic per phase                                                                                                  |
| Calculation method                                 | EN 61000-4-7                                                                                                                                           |
| Measurement interval                               | 50 Hz: Calculation over 10 periods<br>60 Hz: Calculation over 12 periods                                                                               |
| Digital inputs – Switch position indication        |                                                                                                                                                        |
| Number                                             | 4                                                                                                                                                      |
| Signal rated voltages                              | 24 V DC (type 1 acc. to DIN EN 61131-2)                                                                                                                |
| Input voltage range (H)                            | 15 to 34 V DC                                                                                                                                          |
| Input voltage range (L)                            | -34 to 5 V DC                                                                                                                                          |
| Internal resistance                                | 6.8 kOhm                                                                                                                                               |
| Input delay (typically)                            | 1 ms                                                                                                                                                   |
| Status display (LED)                               | Green                                                                                                                                                  |
| Digital outputs – Synchronization and alarming     |                                                                                                                                                        |
| Number                                             | 4                                                                                                                                                      |
| Signal rated voltages                              | 24 V DC (type 1 acc. to DIN EN 61131-2)                                                                                                                |
| Output voltage range (H)                           | 18 to 34 V DC                                                                                                                                          |
| Output current max.                                | 0.5 A                                                                                                                                                  |
| Status display (LED)                               | Green                                                                                                                                                  |
| Digital relay outputs – Grid and system protection |                                                                                                                                                        |
| Number/type                                        | 2 changeover contacts                                                                                                                                  |
| Signal rated voltages                              | 230 V AC, 48 V DC, 24 V DC (not mixed)                                                                                                                 |
| Output current max.                                | Nominal 0.5 A at +24 VDC, DC-13<br>Nominal 0.5 A at +24 VDC, resistive load<br>Nominal 1 A at 230 VAC, AC-15<br>Nominal 2 A at 230 VAC, resistive load |
| Output current overload                            | 4 A                                                                                                                                                    |
| Status display (LED)                               | Green                                                                                                                                                  |

## GSP274 limit value monitoring

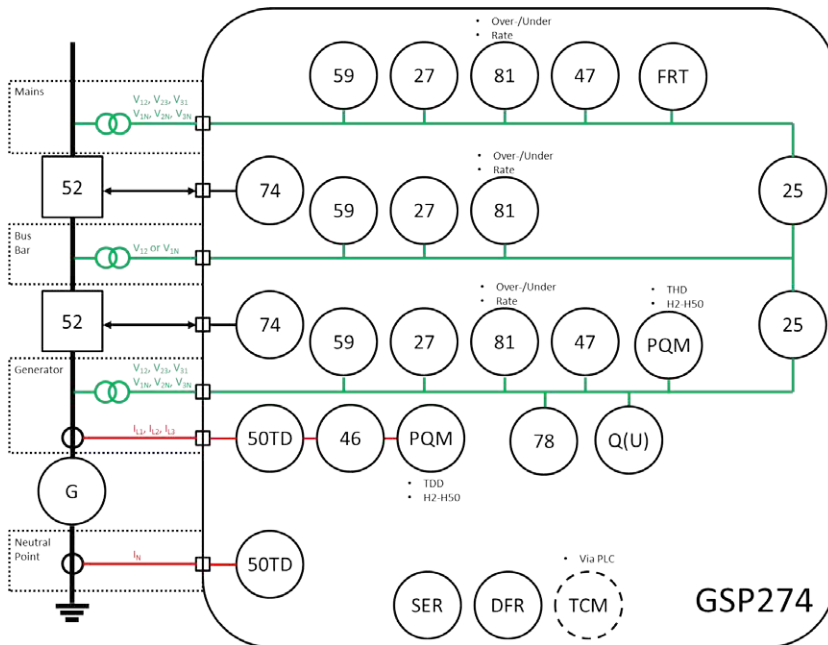


Figure 1: Available protection elements acc. to ANSI IEEE Std C37.2 – 2008 – overview

| GSP274 - Limit value monitoring            |                                        |                                                                                                                                                                           |
|--------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Undervoltage/overvoltage (ANSI 27/59)      |                                        |                                                                                                                                                                           |
| Accuracy*                                  | ±0.1 % full scale                      |                                                                                                                                                                           |
| Resolution                                 | 0.1 % $U_{Rated}$                      |                                                                                                                                                                           |
| Delay                                      | 0 to 65535 ms                          |                                                                                                                                                                           |
| Evaluated potentials                       | Phase-to-phase or phase-to-neutral     |                                                                                                                                                                           |
| Protection elements                        | U<<br>U<<<br>U><br>U>>                 | Undervoltage warning<br>Undervoltage error<br>Overvoltage warning<br>Overvoltage error                                                                                    |
| Underfrequency/overfrequency (ANSI 81 U/O) |                                        |                                                                                                                                                                           |
| Accuracy*                                  | ±0.01 Hz                               |                                                                                                                                                                           |
| Delay                                      | 0 to 65535 ms                          |                                                                                                                                                                           |
| Protection elements                        | f<<br>f<<<br>f<<<<br>f><br>f>><br>f>>> | Underfrequency inner band<br>Underfrequency middle band<br>Underfrequency outer band<br>Overfrequency inner band<br>Overfrequency middle band<br>Overfrequency outer band |

## Grid measurement module

### GSP274 - Limit value monitoring

#### Q(U)

|             |                                                                                                                                                                                                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | Voltage dependent directional reactive power protection. Used to support the voltage during grid faults. Trips if all three evaluated voltages are below a certain limit (e.g. $0.85 U_{Rated}$ ) and inductive reactive power is drawn from the power supply grid. |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Rate of change of frequency – ROCOF (ANSI 81 R)

|             |                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------|
| Description | To calculate the frequency change over time the last 10 (50 Hz) or 12 (60 Hz) frequency samples are linearly interpolated. |
|-------------|----------------------------------------------------------------------------------------------------------------------------|

#### Vector jump (ANSI 78)

|             |                                                                                      |
|-------------|--------------------------------------------------------------------------------------|
| Description | Monitoring of sudden phase shifts for detection of sudden load changes or islanding. |
|-------------|--------------------------------------------------------------------------------------|

#### Overcurrent (ANSI 50TD)

|                     |                        |                                          |
|---------------------|------------------------|------------------------------------------|
| Accuracy*           | $\pm 0.1$ % full scale |                                          |
| Resolution          | 0.1 % of $I_{Rated}$   |                                          |
| Delay               | 0 to 65535 ms          |                                          |
| Protection elements | I><br>I>>              | Overcurrent warning<br>Overcurrent error |

#### Time-dependent undervoltage monitoring – FRT (Fault Ride Through)

|             |                                                                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | Time-dependent undervoltage monitoring is triggered if one of the three evaluated voltages falls below a curve $U(t)$ configured via interpolation points. Up to 10 time/voltage pairs are available to calculate a grid-code dependent limit curve. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Voltage asymmetry (ANSI 47)

|             |                                                                                                                                                                              |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Current asymmetry (ANSI 46)

|             |                                                                                                                                                                              |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Power quality monitoring – PQM

|                     |                                                                                                                                            |                                                                                                                                                  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Description         | Monitors voltage and current harmonics up to the 50th harmonic. Trips if one of the pre-defined limits is exceeded (evaluation per phase). |                                                                                                                                                  |
| Protection elements | THD<br>TDD<br>$H_2$ to $H_{50}$<br>$H_2$ to $H_{50}$                                                                                       | Total harmonic distortion<br>Total demand distortion<br>Individual amplitudes of voltage harmonics<br>Individual amplitudes of current harmonics |

## Grid measurement module

### GSP274 - Limit value monitoring

#### Alarm relays (ANSI 74)

|             |                                                                                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | Two relays for actuating the circuit-breakers are provided for single fault tolerant grid and system protection acc. to VDE-AR-4105. See Digital relay outputs |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Synchronization test relays (ANSI 25)

|             |                                                                                                                                                                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | Digital outputs control up to two circuit-breakers (2 DO per circuit-breaker). They are activated by the GSP module if the synchronization criteria are fulfilled. Pulse or continuous signal can be configured for the actuation. See Digital outputs |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Trip circuit monitoring – TCM

|             |                                                                                                               |
|-------------|---------------------------------------------------------------------------------------------------------------|
| Description | Digital inputs are provided to monitor the actual switching state of the circuit-breakers. See Digital inputs |
|-------------|---------------------------------------------------------------------------------------------------------------|

#### Time synchronization

|                 |                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Basic principle | GSP module is synchronized automatically with the real-time clock of the PLC-CPU. This can be synchronized via the network. |
| Physical medium | Ethernet (CPU)                                                                                                              |
| Protocols       | IEEE 1588 PTP (Precision Time Protocol)<br>SNTP (Simple Network Time Protocol)                                              |

#### Event logging with real-time stamp – SER (sequence of events recorder)

|                |                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------|
| Description    | Monitoring events (configured alarm/protection functions) are stored with a precise time reference when they occur. |
| Type of memory | nonvolatile (on the module)                                                                                         |
| Size           | 1000 entries                                                                                                        |

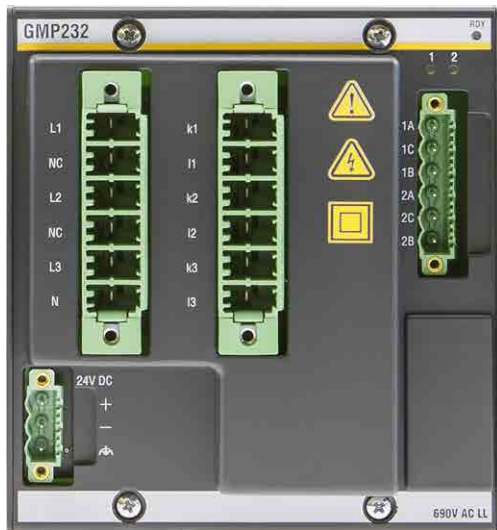
#### Real-time data recorder / digital fault recorder – DFR

|                          |                                                                                                                                                                                                                                                                                                       |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description              | The GSP module is provided with 3 integrated real-time data recorders. One data recorder can be used for recording the synchronization sequence between the generator and busbar and one for busbar and grid. Another data recorder can carry out recordings when triggered by a monitoring function. |
| Number of channels       | 16 channels (measured values, digital I/O, calculated values)                                                                                                                                                                                                                                         |
| Memory depth per channel | 40,960 sampling values (4 s at 100 µs sampling rate)                                                                                                                                                                                                                                                  |
| Sampling rate            | 100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms                                                                                                                                                                                                                                                                |
| Pre-trigger              | Yes                                                                                                                                                                                                                                                                                                   |

## Grid measurement module

| GSP274 - Module properties   |                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrical safety            |                                                                                                                                                                                                                                                                                                                                                               |
| Product standard             | IEC/EN61131-2                                                                                                                                                                                                                                                                                                                                                 |
| Generic standard             | IEC/EN60664-1                                                                                                                                                                                                                                                                                                                                                 |
| Pollution degree             | 2                                                                                                                                                                                                                                                                                                                                                             |
| Overvoltage category         | 3                                                                                                                                                                                                                                                                                                                                                             |
| Test surge voltage           | 4 kV                                                                                                                                                                                                                                                                                                                                                          |
| Protection class             | 2                                                                                                                                                                                                                                                                                                                                                             |
| Approvals / certificates     |                                                                                                                                                                                                                                                                                                                                                               |
| General                      | CE, UL/cUL, CCC                                                                                                                                                                                                                                                                                                                                               |
| Medium voltage directive     | BDEW:2008, FGW TR3:2011 (Rev. 22), FGW TR8:2011 (Rev. 5)                                                                                                                                                                                                                                                                                                      |
| Low-voltage directive        | VDE AR-N-4105:2011                                                                                                                                                                                                                                                                                                                                            |
| Marine                       | GL, DNV, LR, ABS, BV                                                                                                                                                                                                                                                                                                                                          |
| Others                       | In preparation: G59/2:2010, IEEE 37.90:2006                                                                                                                                                                                                                                                                                                                   |
| Ambient conditions           |                                                                                                                                                                                                                                                                                                                                                               |
| Operating temperature        | -30 to +60 °C                                                                                                                                                                                                                                                                                                                                                 |
| Rel. air humidity, operation | 5 to 95 % no condensation                                                                                                                                                                                                                                                                                                                                     |
| Storage temperature          | -40 to +85 °C                                                                                                                                                                                                                                                                                                                                                 |
| Rel. air humidity, storage   | 5 to 95 % no condensation                                                                                                                                                                                                                                                                                                                                     |
| Maximum operating height     | 2,000 m above sea level (operation up to 4,500 m on request)                                                                                                                                                                                                                                                                                                  |
| Power supply                 |                                                                                                                                                                                                                                                                                                                                                               |
| Via backplane                | +5 V   ≤ 316 mA, +15 V   ≤ 21 mA, -15 V   ≤ 23 mA                                                                                                                                                                                                                                                                                                             |
| External on the module       | 24 V   110 mA                                                                                                                                                                                                                                                                                                                                                 |
| System requirements          |                                                                                                                                                                                                                                                                                                                                                               |
| Hardware                     | All M1 CPU families apart from ME203, SK1 backplane not required                                                                                                                                                                                                                                                                                              |
| Software                     | M-Base 3.90 / SolutionCenter 1.90 or higher                                                                                                                                                                                                                                                                                                                   |
| Models                       |                                                                                                                                                                                                                                                                                                                                                               |
| GSP274                       | Grid measurement, protection and synchronization module; 7x In 480V, 4x In 5A; 4x In 5A; 4x In 24V; 4x Out 24V; 2x Out Relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated realtime data recorder (16 channels); sequence of event log with realtime stamp |

## Grid measurement module



| Item    | Item No.    |
|---------|-------------|
| GMP232  | 00017829-00 |
| GMP232* | 00019063-00 |

### Grid measurement and protection module GMP232

The GMP232 module enables the safe, reliable and fast measuring of all relevant values for three-phase electrical networks. It also provides a number of monitoring functions for generator and grid protection. Up to two circuit-breakers/trip circuits are triggered by the module directly via relay outputs. The continuous monitoring of grid harmonics up to the 50th harmonic can be used for direct responses as well as for evaluating the power quality.

The module is provided with an integrated real-time data recorder for the high-precision recording of up to 16 measuring channels during alarm/protection events. Error events are recorded continuously and stored permanently with a high resolution time entry. The internal time base of the module can be synchronized to an external time source (e.g. IEEE 1588 Precision Time Protocol), which supports the analysis of the data from spatially separated measurement and protection devices.

The GMP232 is fully integrated in the Bachmann SolutionCenter. Configurations can be created simply and stored for later reuse. Both the measured channel values and also the derived values are made available directly in the user interface. Commissioning and fault analysis are simplified with tabular, phasor and time sequence displays. Event logs and recorded time sequences can be exported in CSV respectively COMTRADE format. The integrated simulation function simplifies the configuration of protection and monitoring functions.

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Direct connection to input voltages up to 690 V<sub>L-L, RMS</sub>
- Measurement of grid harmonics up to the 50th (power quality)
- Monitoring/Protection functions for grid and generator protection
- Direct relay outputs for circuit-breaker/trip circuits
- Integrated real-time data recorder
- Integrated event logging
- 4Q energy counter
- Measured value simulation



## Grid measurement module

| GMP232 – Grid measurement                               |                                                                                                                                       |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Current/voltage measurement                             |                                                                                                                                       |
| Measuring method                                        | True RMS (incl. harmonics)                                                                                                            |
| Sampling rate                                           | 50 µs (20 kHz)                                                                                                                        |
| Measurement interval (RMS values)                       | 50 Hz: 20 ms<br>60 Hz: 16.67 ms                                                                                                       |
| Individual sampling values                              | Intervals that can be called via function calls in the user application:<br>100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms (via block access) |
| Voltage measurement                                     |                                                                                                                                       |
| Number                                                  | 3                                                                                                                                     |
| Maximum rated voltage                                   | $U_{L-L, RMS}$ : 690 VAC $U_{L-N, RMS}$ : 400 VAC                                                                                     |
| Voltage measuring range                                 | $U_{L-L, RMS}$ : 17.3 – 1195 VAC, $U_{L-N, RMS}$ : 10 – 690 VAC                                                                       |
| Accuracy*                                               | ±0.1 %                                                                                                                                |
| Continuous overload                                     | $U_{L-L, RMS}$ : 1437 VAC, $U_{L-N, RMS}$ : 830 VAC                                                                                   |
| Short-term overload(10x1 s, interval 10 s)              | $U_{L-L, RMS}$ : 2390 VAC, $U_{L-N, RMS}$ : 1380 VAC                                                                                  |
| Input impedance                                         | >2 MΩ                                                                                                                                 |
| Current measurement                                     |                                                                                                                                       |
| Number                                                  | 3                                                                                                                                     |
| Accuracy*                                               | ±0.1 %                                                                                                                                |
| Current transformer rated current                       | 5 A                                                                                                                                   |
| Current measuring range                                 | 0 – 10 AAC                                                                                                                            |
| Continuous overload                                     | 10 AAC                                                                                                                                |
| Short-term overload (5x1 s, interval 300 s)             | 100 AAC                                                                                                                               |
| Frequency measurement                                   |                                                                                                                                       |
| Rated frequency                                         | 50 / 60 Hz                                                                                                                            |
| Reference range                                         | 50 Hz: 35 to 65 Hz<br>60 Hz: 45 to 75 Hz                                                                                              |
| Accuracy*                                               | ±0.01 Hz                                                                                                                              |
| Measurement interval                                    | Between two zero crossings<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms                                                                         |
| Frequency change measurement                            | Yes                                                                                                                                   |
| Maximum frequency change                                | ±1 Hz/s                                                                                                                               |
| Power measurement – active, reactive and apparent power |                                                                                                                                       |
| Measured values                                         | P, Q, S per phase and as total                                                                                                        |
| Accuracy*                                               | ±0.2 %                                                                                                                                |
| Calculation method                                      | DIN 40110-2, IEC61400-21                                                                                                              |
| Measurement interval                                    | Calculation over one period<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms                                                                        |

\* Accuracy values as a percentage of the nominal value at 25 °C



## Grid measurement module

| GMP232 – Grid measurement |                                                                                                                                                        |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy                    |                                                                                                                                                        |
| Accuracy*                 | ±0.2 %                                                                                                                                                 |
| Resolution                | 1 Ws                                                                                                                                                   |
| Active energy             | Supplied (positive), drawn (negative)                                                                                                                  |
| Reactive energy           | Supplied (positive), drawn (negative)                                                                                                                  |
| Type of memory            | Nonvolatile (on the module)                                                                                                                            |
| Measurement interval      | Calculation over one period<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms                                                                                         |
| Power quality             |                                                                                                                                                        |
| Voltage                   | Total harmonic distortion (THD) per phase                                                                                                              |
| Current                   | Total demand distortion (TDD) per phase                                                                                                                |
| Voltage harmonics         | Amplitudes of harmonics up to 50th harmonic per phase                                                                                                  |
| Current harmonics         | Amplitudes of harmonics up to 50th harmonic per phase                                                                                                  |
| Calculation method        | EN 61000-4-7                                                                                                                                           |
| Measurement interval      | 50 Hz: Calculation over 10 periods<br>60 Hz: Calculation over 12 periods                                                                               |
| Digital relay outputs     |                                                                                                                                                        |
| Number/type               | 2 changeover contacts                                                                                                                                  |
| Signal rated voltages     | 230 V AC, 48 V DC, 24 V DC (not mixed)                                                                                                                 |
| Output current max.       | Nominal 0.5 A at +24 VDC, DC-13<br>Nominal 0.5 A at +24 VDC, resistive load<br>Nominal 1 A at 230 VAC, AC-15<br>Nominal 2 A at 230 VAC, resistive load |
| Output current overload   | 4 A                                                                                                                                                    |
| Status display (LED)      | Green                                                                                                                                                  |

## Grid measurement module

### GMP232 – Limit value monitoring

#### Undervoltage/overvoltage (ANSI 27/59)

|                      |                                    |                                                                                        |
|----------------------|------------------------------------|----------------------------------------------------------------------------------------|
| Accuracy*            | $\pm 0.1$ % full scale             |                                                                                        |
| Resolution           | 0.1 % $U_{\text{Rated}}$           |                                                                                        |
| Delay                | 0 to 65535 ms                      |                                                                                        |
| Evaluated potentials | Phase-to-phase or phase-to-neutral |                                                                                        |
| Protection elements  | U<<br>U<<<br>U><br>U>>             | Undervoltage warning<br>Undervoltage error<br>Overvoltage warning<br>Overvoltage error |

#### Underfrequency/overfrequency (ANSI 81 U/O)

|                     |                                        |                                                                                                                                                                           |
|---------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accuracy*           | $\pm 0.01$ Hz                          |                                                                                                                                                                           |
| Delay               | 0 to 65535 ms                          |                                                                                                                                                                           |
| Protection elements | f<<br>f<<<br>f<<<<br>f><br>f>><br>f>>> | Underfrequency inner band<br>Underfrequency middle band<br>Underfrequency outer band<br>Overfrequency inner band<br>Overfrequency middle band<br>Overfrequency outer band |

#### Q(U)

|             |                                                                                                                                                                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | Voltage dependent directional reactive power protection. Used to support the voltage during grid faults. Trips if all three evaluated voltages are below a certain limit (e.g. $0.85 U_{\text{Rated}}$ ) and inductive reactive power is drawn from the power supply grid. |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Rate of change of frequency – ROCOF (ANSI 81 R)

|             |                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------|
| Description | To calculate the frequency change over time the last 10 (50 Hz) or 12 (60 Hz) frequency samples are linearly interpolated. |
|-------------|----------------------------------------------------------------------------------------------------------------------------|

#### Vector jump (ANSI 78)

|             |                                                                                      |
|-------------|--------------------------------------------------------------------------------------|
| Description | Monitoring of sudden phase shifts for detection of sudden load changes or islanding. |
|-------------|--------------------------------------------------------------------------------------|

#### Overcurrent (ANSI 50TD)

|                     |                             |                                          |
|---------------------|-----------------------------|------------------------------------------|
| Accuracy*           | $\pm 0.1$ % full scale      |                                          |
| Resolution          | 0.1 % of $I_{\text{Rated}}$ |                                          |
| Delay               | 0 to 65535 ms               |                                          |
| Protection elements | I><br>I>>                   | Overcurrent warning<br>Overcurrent error |

#### Time-dependent undervoltage monitoring – FRT (Fault Ride Through)

|             |                                                                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | Time-dependent undervoltage monitoring is triggered if one of the three evaluated voltages falls below a curve $U(t)$ configured via interpolation points. Up to 10 time/voltage pairs are available to calculate a grid-code dependent limit curve. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Voltage asymmetry (ANSI 47)

|             |                                                                                                                                                                              |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Grid measurement module

### GMP232 – Limit value monitoring

#### Current asymmetry (ANSI 46)

|             |                                                                                                                                                                              |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description | EN 50160: Asymmetry is defined as the ratio of negative sequence components to positive sequence components. The reference value is the current basic oscillation component. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Power quality monitoring – PQM

|                     |                                                                                                                                            |                                            |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Description         | Monitors voltage and current harmonics up to the 50th harmonic. Trips if one of the pre-defined limits is exceeded (evaluation per phase). |                                            |
| Protection elements | THD                                                                                                                                        | Total harmonic distortion                  |
|                     | TDD                                                                                                                                        | Total demand distortion                    |
|                     | H <sub>2</sub> to H <sub>50</sub>                                                                                                          | Individual amplitudes of voltage harmonics |
|                     | H <sub>2</sub> to H <sub>50</sub>                                                                                                          | Individual amplitudes of current harmonics |

#### Time synchronization

|                 |                                                                                                                                 |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Basic principle | The GMP module is synchronized automatically with the real-time clock of the PLC-CPU. This can be synchronized via the network. |
| Physical medium | Ethernet (CPU)                                                                                                                  |
| Protocols       | IEEE 1588 PTP (Precision Time Protocol)<br>SNTP (Simple Network Time Protocol)                                                  |

#### Event logging with real-time stamp – SER (sequence of events recorder)

|                |                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------|
| Description    | Monitoring events (configured alarm/protection functions) are stored with a precise time reference when they occur. |
| Type of memory | Nonvolatile (on the module)                                                                                         |
| Size           | 1000 entries                                                                                                        |

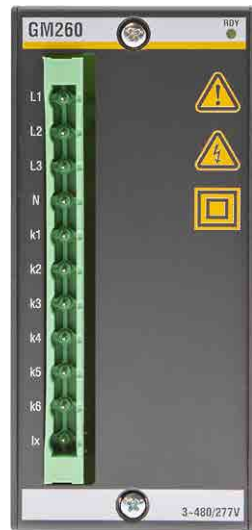
#### Real-time data recorder / digital fault recorder – DFR

|                          |                                                                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------|
| Description              | A high resolution time sequence recording can be started automatically when a monitoring function is triggered. |
| Number of channels       | 16 channels (measured values, digital I/O, calculated values)                                                   |
| Memory depth per channel | 40,960 sampling values (4 s at 100 µs sampling rate)                                                            |
| Sampling rate            | 100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms                                                                          |
| Pre-trigger              | Yes                                                                                                             |

## Grid measurement module

| GMP232 – Module properties   |                                                                                                                                                                                                                                                                                                             |                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Electrical safety            |                                                                                                                                                                                                                                                                                                             |                             |
| Product standard             | IEC/EN61131-2                                                                                                                                                                                                                                                                                               |                             |
| Generic standard             | IEC/EN60664-1                                                                                                                                                                                                                                                                                               |                             |
| Pollution degree             | 2                                                                                                                                                                                                                                                                                                           |                             |
| Overvoltage category         | 3                                                                                                                                                                                                                                                                                                           |                             |
| Test surge voltage           | 6 kV                                                                                                                                                                                                                                                                                                        |                             |
| Protection class             | 2                                                                                                                                                                                                                                                                                                           |                             |
| Approvals / certificates     |                                                                                                                                                                                                                                                                                                             |                             |
| General                      | CE, UL/cUL, CCC                                                                                                                                                                                                                                                                                             |                             |
| Medium voltage directive     | BDEW:2008, FGW TR3:2011 (Rev. 22), FGW TR8:2011 (Rev. 5)                                                                                                                                                                                                                                                    |                             |
| Marine                       | GL, DNV, LR, ABS, BV                                                                                                                                                                                                                                                                                        |                             |
| Others                       | In preparation: G59/2:2010, IEEE 37.90:2006                                                                                                                                                                                                                                                                 |                             |
| Ambient conditions           |                                                                                                                                                                                                                                                                                                             | ColdClimate (✱)             |
| Operating temperature        | Standard<br>-30 to +60 °C                                                                                                                                                                                                                                                                                   |                             |
| Rel. air humidity, operation | 5 to 95 % no condensation                                                                                                                                                                                                                                                                                   | 5 to 95 % with condensation |
| Storage temperature          | -40 to +85 °C                                                                                                                                                                                                                                                                                               |                             |
| Rel. air humidity, storage   | 5 to 95 % no condensation                                                                                                                                                                                                                                                                                   | 5 to 95 % with condensation |
| Maximum operating height     | 2,000 m above sea level (operation up to 4,500 m on request)                                                                                                                                                                                                                                                |                             |
| Power supply                 |                                                                                                                                                                                                                                                                                                             |                             |
| Via backplane                | +5 V   ≤ 260 mA, +15 V   ≤ 20 mA, -15 V   ≤ 16 mA                                                                                                                                                                                                                                                           |                             |
| External on the module       | 24 V   ≤ 87 mA                                                                                                                                                                                                                                                                                              |                             |
| System requirements          |                                                                                                                                                                                                                                                                                                             |                             |
| Hardware                     | All M1 CPU families apart from ME203, SK1 backplane not required                                                                                                                                                                                                                                            |                             |
| Software                     | M-Base 3.85 / SolutionCenter 1.85 or higher                                                                                                                                                                                                                                                                 |                             |
| Models                       |                                                                                                                                                                                                                                                                                                             |                             |
| GMP232                       | Grid measurement and protection module; 3x In 690V, 3x In 5A; 2x Out Relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated realtime data recorder (16 channels); sequence of event log with realtime stamp |                             |
| GMP232 CC                    | Like GMP232; ColdClimate (✱)                                                                                                                                                                                                                                                                                |                             |

## Grid measurement module



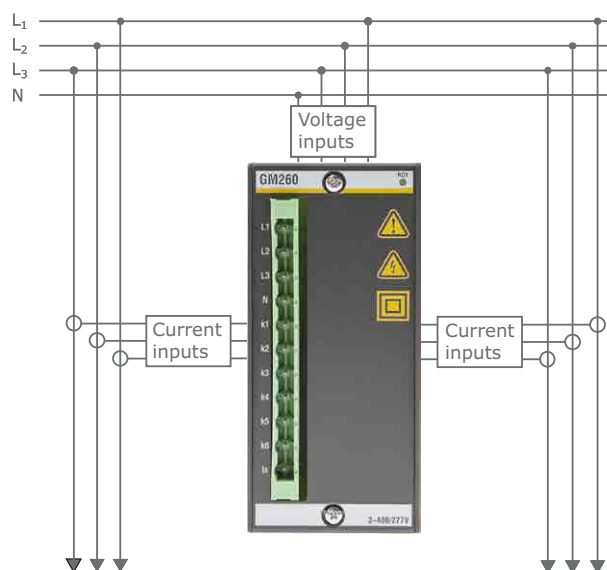
### Grid measurement module GM260

The GM260 module enables the safe, reliable and fast measuring of all relevant values for three-phase electrical networks. Two separate three-phase branches can be measured if there is a common voltage measuring point. The grid variables are calculated online in the module as TrueRMS values including harmonics up to the 40th harmonic. This is particularly useful for applications such as for operational measurement on machines or the energy monitoring in plants and buildings. As well as functions for determining the active, apparent and reactive power for each phase, two separate 4-quadrant energy counters are directly integrated in the module.

The GM260 module is fully integrated in the Bachmann SolutionCenter. Both the measured channel values and also the derived values are made available directly in the user interface.

| Item  | Item No.    |
|-------|-------------|
| GM260 | 00022162-00 |

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Direct connection to input voltages up to 480 V<sub>L-L, RMS</sub>
- TrueRMS calculation online
- 2 independent 4Q energy counters
- Compact design for 2 three-phase branches



Application example: Power measurement with common voltage input

## Grid measurement module

### GM260 – Grid measurement

#### Current/voltage measurement

|                      |                                 |
|----------------------|---------------------------------|
| Measuring method     | True RMS (incl. harmonics)      |
| Measurement interval | 50 Hz: 20 ms<br>60 Hz: 16.67 ms |

#### Voltage measurement

|                                            |                                                                |
|--------------------------------------------|----------------------------------------------------------------|
| Number                                     | 3                                                              |
| Maximum rated voltage                      | $U_{L-L, RMS}$ : 480 VAC, $U_{L-N, RMS}$ : 277 VAC             |
| Voltage measuring range                    | $U_{L-L, RMS}$ : 69.3 - 625 VAC, $U_{L-N, RMS}$ : 36 - 361 VAC |
| Accuracy*                                  | ±0.3 %                                                         |
| Continuous overload                        | $U_{L-L, RMS}$ : 675 VAC, $U_{L-N, RMS}$ : 390 VAC             |
| Short-term overload(10x1 s, interval 10 s) | $U_{L-L, RMS}$ : 1039 VAC, $U_{L-N, RMS}$ : 600 VAC            |
| Input impedance                            | >2 MΩ                                                          |

#### Current measurement

|                                             |                |
|---------------------------------------------|----------------|
| Number                                      | 6              |
| Accuracy*                                   | ±0.5 %         |
| Current transformer rated current           | 1 A            |
| Current measuring range                     | 0.01 - 1.2 AAC |
| Continuous overload                         | 1.2 AAC        |
| Short-term overload (5x1 s, interval 300 s) | 3 AAC          |

#### Frequency measurement

|                      |                                                               |
|----------------------|---------------------------------------------------------------|
| Rated frequency      | 50 / 60 Hz                                                    |
| Reference range      | 45 to 65 Hz                                                   |
| Accuracy*            | ±0.02 Hz                                                      |
| Measurement interval | Between two zero crossings<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms |

#### Power measurement – active, reactive and apparent power

|                      |                                                                |
|----------------------|----------------------------------------------------------------|
| Measured values      | P, Q, S per phase and as total                                 |
| Accuracy*            | ±0.8 %                                                         |
| Calculation method   | DIN 40110-2                                                    |
| Measurement interval | Calculation over one period<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms |

\* Accuracy values as a percentage of the nominal value at 25 °C

## Grid measurement module

| GM260 – Grid measurement     |                                                                                                                                                                               |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy                       |                                                                                                                                                                               |
| Number of energy counters    | 2                                                                                                                                                                             |
| Accuracy*                    | ±0.8 %                                                                                                                                                                        |
| Resolution                   | 1 Wh                                                                                                                                                                          |
| Active energy                | Supplied (positive), drawn (negative)                                                                                                                                         |
| Reactive energy              | Supplied (positive), drawn (negative)                                                                                                                                         |
| Measurement interval         | Calculation over one period<br>50 Hz: 20 ms<br>60 Hz: 16.67 ms                                                                                                                |
| Type of memory               | Nonvolatile (on the module)                                                                                                                                                   |
| Memory cycle                 | 1 sec                                                                                                                                                                         |
| Electrical safety            |                                                                                                                                                                               |
| Product standard             | IEC/EN 61131-2                                                                                                                                                                |
| Generic standard             | IEC/EN 60664-1                                                                                                                                                                |
| Pollution degree             | 2                                                                                                                                                                             |
| Overvoltage category         | 3                                                                                                                                                                             |
| Test surge voltage           | 4 kV                                                                                                                                                                          |
| Protection class             | 2                                                                                                                                                                             |
| Approvals / certificates     |                                                                                                                                                                               |
| General                      | CE, CCC (UL on request)                                                                                                                                                       |
| Ambient conditions           |                                                                                                                                                                               |
| Operating temperature        | -30 to +60 °C                                                                                                                                                                 |
| Rel. air humidity, operation | 5 to 95 % no condensation                                                                                                                                                     |
| Storage temperature          | -40 to +85 °C                                                                                                                                                                 |
| Rel. air humidity, storage   | 5 to 95 % no condensation                                                                                                                                                     |
| Maximum operating height     | 2,000 m above sea level (operation up to 4,500 m on request)                                                                                                                  |
| Power supply                 |                                                                                                                                                                               |
| Via backplane                | +5 V   ≤ 130 mA, +15 V   ≤ 45 mA                                                                                                                                              |
| System requirements          |                                                                                                                                                                               |
| Hardware                     | All M1 CPU families apart from ME203, SK1 backplane not required                                                                                                              |
| Software                     | M-Base 3.91 / SolutionCenter 1.91 or higher (recommended)<br>(if the release driver is installed manually, also executable from the system software of the CPU ≥ M-Base 3.90) |
| Models                       |                                                                                                                                                                               |
| GM260                        | Grid measurement module; 3x In 480V, 6x In 1A; U-, I-, P-, Q-, f-measurement; 4Q-energy metering                                                                              |

# System modules

## Systematic perfection.

The M1 automation system is based on an ingenious and field-tested modular concept. Precisely matched to the respective requirements, automation engineers can assemble the technically and economically optimized configuration from a broad selection of modules.

Extremely space-saving standardized module sizes, robust and absolutely maintenance-free mechanical design as well as immunity to external influences particularly characterize the M1 system concept from Bachmann electronics.



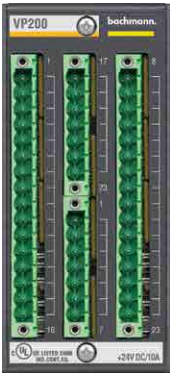
### Power supply module NT255

- | Features                               |
|----------------------------------------|
| Power supply of modules via backplane  |
| Supply voltage: 18 .. 34 V DC          |
| Monitoring of supply voltage           |
| Power-fail signal for processor module |
| Galvanic isolation                     |
| Output power: 45 W (55 W)              |
| Buffer time: 18 ms                     |



### Power supply module NT250/48

- | Features                               |
|----------------------------------------|
| Power supply of modules via backplane  |
| Supply voltage: 38 .. 58 V DC          |
| Monitoring of supply voltage           |
| Power-fail signal for processor module |
| Galvanic isolation                     |
| Output power: 45 W                     |
| Buffer time: 10 ms                     |



### Distribution modules VP200 / x

- | Features                                          |
|---------------------------------------------------|
| Distributor module for backplanes                 |
| 2 potentials up to 24 V or 48 V with 23 pins each |
| 12 A per pin                                      |



### Dummy module LM201

- | Features                                                          |
|-------------------------------------------------------------------|
| Placeholder for one module slot as a reserve for future extension |
| No electronics                                                    |
| Used to protect the backplane                                     |





## Backplanes BS2xx

## Features

|                                   |
|-----------------------------------|
| 1 .. 16 module slots              |
| Seamless connection possible      |
| Vibration proof fixing of modules |
| Snappable on backplane            |
| Stabile mechanical design         |

## Backplane BS2xx/❄️

## Features

|                                                               |
|---------------------------------------------------------------|
| 1 .. 16 module slots                                          |
| Seamless connection possible                                  |
| Vibration proof fixing of modules                             |
| Snappable on backplane                                        |
| Stabile mechanical design                                     |
| ColdClimate design (protected against temporary condensation) |

## Rail adapter S202

## Features

|                                     |
|-------------------------------------|
| 2 module slots                      |
| Can be snapped on EN 60715 DIN rail |
| Vibration proof fixing of modules   |

## Backplanes BS2xx/S

## Features

|                                                   |
|---------------------------------------------------|
| 1 .. 16 module slots                              |
| Seamless connection possible                      |
| Vibration proof fixing of modules                 |
| Snappable on backplane                            |
| Stabile mechanical design                         |
| For protection class 1                            |
| Grounding tab for protective conductor connection |

## Bus bar Adapters BS200/ET

## Features

|                                    |
|------------------------------------|
| 2 .. 8 module slots                |
| Optimized thermal connection       |
| Stabile mechanics / compact design |
| Vibration proof fixing of modules  |



Power supply module NT255

With the NT255 Bachmann electronic sets new standards for the power supplies of CPUs and backplane-supplied modules. As a result of intensive development work and in consideration of field experiences with several thousand supply modules, the NT255 combines long term knowledge with the latest technologies.

Best possible, selected components and lifetime optimized design form the reliable base for the module. Recent planar transformer technologies ensure a significantly increased efficiency, the integrated heat dissipation in the circuit board (>coolPCB technology<) prevents even minimal local warming and thus the early ageing of components. Moreover, because of the extremely reduced weight of the parts, the module is even more robust against shock and vibrations.

In spite of the primary design focus on a long service life and robust design, the NT255 also offers outstanding technical features: up to 80 % longer buffer time at short voltage drops and generous power reserves (55 W peak power) for temporary overload ensure safety and reliability in every respect.

- Input voltage range 18 .. 34 V DC
- Provides all the necessary CPU voltages as well as supply for modules on backplanes
- 45 W output power (55 W peak power)
- Galvanic isolation input/ground
- Galvanic isolation input/system
- Electronic reverse polarity protection
- 2 state indicators allow differentiation between supply failures and internal errors
- Monitored supply voltage
- Monitored output voltages
- Power-fail signal and state information for CPU module (processable from application)

| Item   | Item no.    |
|--------|-------------|
| NT255  | 00013251-00 |
| NT255* | 00016158-00 |

| NT255                           |                                                        |                             |
|---------------------------------|--------------------------------------------------------|-----------------------------|
| Input                           |                                                        |                             |
| Voltage range                   | 18 .. 34 V DC                                          |                             |
| Input voltage, peak value       | +40 V at t < 1 s/min                                   |                             |
| Power consumption               | Max. 68 W                                              |                             |
| Reverse polarity protection     | Electronic                                             |                             |
| Starting current limitation     | Max. 8 A after 5 ms                                    |                             |
| Fuse                            | SMD wire fuse 7 A at device defect                     |                             |
| Input voltage monitoring        | Yes, for power fail message                            |                             |
| Output                          |                                                        |                             |
| Output power                    | 45 W (55 W)                                            |                             |
| Output voltage / output current | +5 V/ 6 A (8 A peak)<br>+15 V / 0.5 A<br>-15 V / 0.5 A |                             |
| Power-fail bypass               | 18 ms, power-fail message after 3 ms                   |                             |
| Monitoring                      |                                                        |                             |
| State indication                | Power-fail on processor                                |                             |
| State display                   | LEDs (Power, Error, Ready)                             |                             |
| Galvanic isolation              | 500 V (input/system), 100 V (input/ground)             |                             |
| Ambient conditions              |                                                        |                             |
|                                 | Standard                                               | ColdClimate (❄)             |
| Operating temperature           | -30 .. +60 °C                                          |                             |
| Rel. humidity operation         | 5 .. 95 % without condensation                         | 5 .. 95 % with condensation |
| Storage temperature             | -40 .. +85 °C                                          |                             |
| Rel. humidity storage           | 5 .. 95 % without condensation                         | 5 .. 95 % with condensation |
| Execution variants              |                                                        |                             |
| NT255                           | Power supply 45W (55W); 24V; 5V 6A; +-15V 0.5A         |                             |
| NT255❄                          | Like NT255; ColdClimate (❄)                            |                             |

# System modules



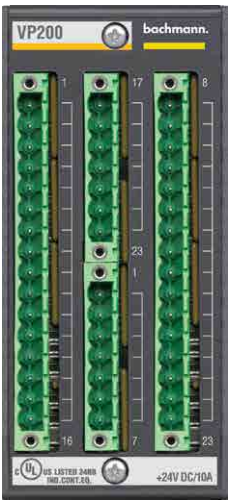
## Power supply module NT250/48

The power supply module NT250/48 is suitable for operation on 48 V DC input voltage. It supplies all M1 modules with all voltages required.

- Power supply for M1 controller systems
- State indicating LED
- Supply voltage 38 .. 58 V DC
- Monitoring of supply voltage
- Power fail signal for processor module
- Galvanic isolation input/bus
- Galvanic isolation input/ground

| Item     | Item no.    |
|----------|-------------|
| NT250/48 | 00012754-00 |

| NT250 / 48                    |                                                |
|-------------------------------|------------------------------------------------|
| Power supply unit             |                                                |
| Voltage range                 | 38 .. 58 V DC                                  |
| Input voltage, peak value     | +60 V at t < 1 s/min                           |
| Inrush current                | Max. 7 A after < 0.5 s                         |
| Output voltage/output current | +5 V/6.0 A<br>+15 V/0.5 A<br>-15 V/0.5 A       |
| Output power                  | 42 W                                           |
| Galvanic isolation            | 500 V (input/bus), 100 V (input/ground)        |
| Ambient conditions            |                                                |
| Operating temperature         | 0 .. +60 °C                                    |
| Rel. humidity operation       | 5 .. 95 % without condensation                 |
| Storage temperature           | -40 .. +85 °C                                  |
| Rel. humidity storage         | 5 .. 95 % without condensation                 |
| Execution variants            |                                                |
| NT250/48                      | Power supply 42W (55W); 48V; 5V 6A; +-15V 0.5A |



Distribution module VP200 / x

The distribution module VP200/x is used as backplane to distribute the supply voltage to sensors, switches etc.

- Distributor module for backplanes
- 2 potentials up to 24 V with 23 pins each
- 12 A per pin
- Can be snapped on backplanes as stand-alone module or can be integrated on an M1 backplane

| Item    | Item no.    |
|---------|-------------|
| VP200   | 00009496-00 |
| VP200/S | 00009498-00 |

| VP200 / x               |                                                                          |
|-------------------------|--------------------------------------------------------------------------|
| Distribution modules    |                                                                          |
| Quantity of potentials  | 2                                                                        |
| Quantity of pins        | 23 per common potential                                                  |
| Current                 | Max. 12 A per pin                                                        |
| voltage                 | 18 .. 34 V DC                                                            |
| Ambient conditions      |                                                                          |
| Operating temperature   | -30 .. +60 °C                                                            |
| Rel. humidity operation | 5 .. 95 % without condensation                                           |
| Storage temperature     | -40 .. +85 °C                                                            |
| Rel. humidity storage   | 5 .. 95 % without condensation                                           |
| Execution variants      |                                                                          |
| VP200                   | Supply voltage distribution module                                       |
| VP200/S                 | Supply voltage distribution module (potential rails) with mounting plate |

# System modules



## Dummy module LM201

The dummy module LM201 is used as fill-in for later extensions and does not contain any electronic components. Used to protect the backplane.

- Placeholder for one module slot
- No electronics
- Used to protect the backplane

| Item  | Item no.    |
|-------|-------------|
| LM201 | 00009494-00 |

### LM201

#### Execution variants

|       |                      |
|-------|----------------------|
| LM201 | Dummy module (cover) |
|-------|----------------------|



Rail adapter S202

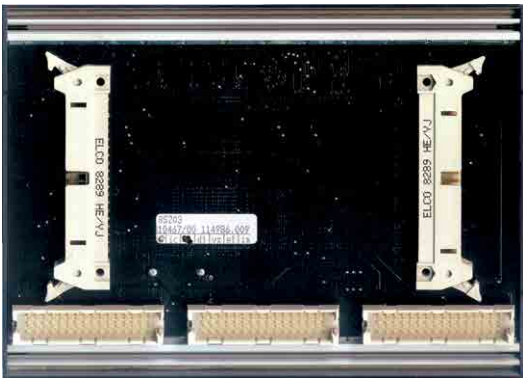
The DIN rail adapter S202 serves as a mounting element for individual modules on a top-hat rail per DIN 60715.

- 2 module slots
- Can be snapped on EN 60715 DIN rail
- Vibration proof fixing of modules

| Item | Item no.    |
|------|-------------|
| S202 | 00021588-00 |

| S202                    |                                                     |
|-------------------------|-----------------------------------------------------|
| Dimensions              |                                                     |
| Number of module slots  | 2                                                   |
| Width                   | 110 mm                                              |
| Depth                   | 15 mm                                               |
| Height                  | 119 mm                                              |
| Ambient conditions      |                                                     |
| Operating temperature   | Corresponding to the combined M200-module           |
| Rel. humidity operation | Corresponding to the combined M200-module           |
| Storage temperature     | Corresponding to the combined M200-module           |
| Rel. humidity storage   | Corresponding to the combined M200-module           |
| Design variants         |                                                     |
| S202                    | Backplane with 2 module slot, without circuit board |

# System modules



## Backplanes BS200 series

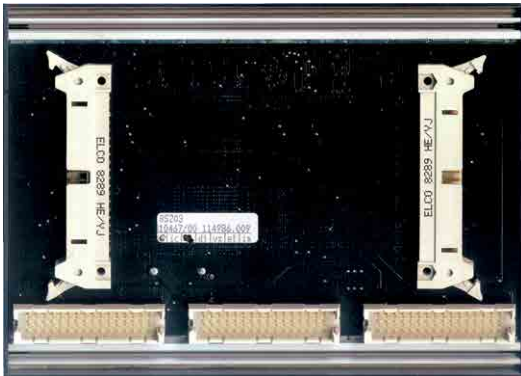
The backplanes BS201 to BS216 interconnect the M1 controller hardware modules, such as power supplies, CPU modules and input/output modules, mechanically and electrically. They are the backbone of the controller.

- 1 .. 16 module slots
- Seamless connection/possible
- Stable mechanics/compact design
- Vibration proof fixing of modules
- Can be snapped on EN 60715 DIN rail

| Item  | Item no.    |
|-------|-------------|
| S201  | 00009542-00 |
| BS201 | 00010507-00 |
| BS202 | 00009802-00 |
| BS203 | 00009313-00 |
| BS204 | 00009752-00 |
| BS205 | 00009206-00 |
| BS206 | 00009792-00 |
| BS207 | 00009207-00 |
| BS208 | 00009793-00 |
| BS209 | 00009634-00 |
| BS210 | 00009794-00 |
| BS211 | 00009795-00 |
| BS212 | 00009796-00 |
| BS213 | 00009797-00 |
| BS214 | 00009798-00 |
| BS215 | 00009799-00 |
| BS216 | 00009800-00 |

| BS200 series            |                                                     |
|-------------------------|-----------------------------------------------------|
| Dimensions              |                                                     |
| Number of module slots  | 1 .. 16                                             |
| Width                   | 55 mm x number of module slots                      |
| Depth                   | 23 mm incl. connector                               |
| Height                  | 119 mm                                              |
| Ambient conditions      |                                                     |
| Operating temperature   | -30 .. +60 °C (vertical: -30 .. +55 °C)             |
| Rel. humidity operation | 5 .. 95 % without condensation                      |
| Storage temperature     | -40 .. +85 °C                                       |
| Rel. humidity storage   | 5 .. 95 % without condensation                      |
| Execution variants      |                                                     |
| BS201                   | Backplane with 1 module slot                        |
| BS202                   | Backplane with 2 module slots                       |
| ..                      | ..                                                  |
| BS216                   | Backplane with 16 module slots                      |
| S201                    | Backplane with 1 module slot, without circuit board |





### Backplanes BS200❄ series

The backplanes for BS200/W❄ for cold weather and protection class 1 interconnect the M1 controller hardware modules, such as power supplies, CPU modules and I/O modules, mechanically and electrically. They are the backbone of the controller.

- 1 .. 16 module slots
- Seamless connection/possible
- Stable mechanics/compact design
- Vibration proof fixing of modules
- Can be snapped on EN 60715 DIN rail
- ColdClimate design (protected against temporary condensation)

| Item   | Item no.    |
|--------|-------------|
| BS203❄ | 00015947-00 |
| BS204❄ | 00015948-00 |
| BS205❄ | 00015949-00 |
| BS206❄ | 00015950-00 |
| BS207❄ | 00015951-00 |
| BS208❄ | 00015952-00 |
| BS209❄ | 00015953-00 |
| BS210❄ | 00015954-00 |
| BS211❄ | 00015955-00 |
| BS212❄ | 00015956-00 |
| BS213❄ | 00015957-00 |
| BS214❄ | 00015958-00 |
| BS215❄ | 00018623-00 |
| BS216❄ | 00018624-00 |

### BS200❄ series

#### Dimensions

|                        |                                |
|------------------------|--------------------------------|
| Number of module slots | 3 .. 16                        |
| Width                  | 55 mm x number of module slots |
| Depth                  | 23 mm incl. connector          |
| Height                 | 119 mm                         |

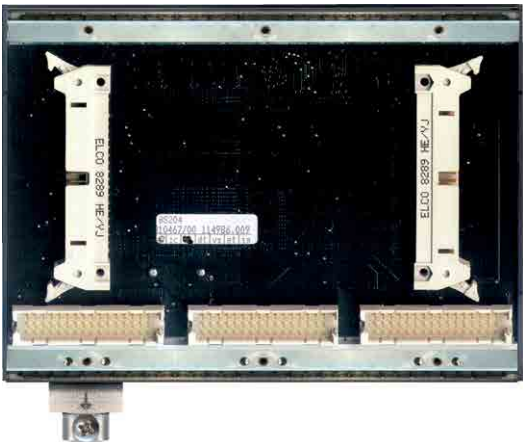
#### Ambient conditions

|                         |                                         |
|-------------------------|-----------------------------------------|
| Operating temperature   | -30 .. +60 °C (vertical: -30 .. +55 °C) |
| Rel. humidity operation | 5 .. 95 % with condensation             |
| Storage temperature     | -40 .. +85 °C                           |
| Rel. humidity storage   | 5 .. 95 % with condensation             |

#### Execution variants

|        |                                                 |
|--------|-------------------------------------------------|
| BS203❄ | Backplane with 3 module slots; ColdClimate (❄)  |
| BS204❄ | Backplane with 4 module slots; ColdClimate (❄)  |
| ..     | ..                                              |
| BS216❄ | Backplane with 16 module slots; ColdClimate (❄) |

# System modules



## Backplanes BS200/S series

The backplanes of the series BS200/S for protection class 1 interconnect the M1 controller hardware modules, such as power supplies, CPU modules and input/output modules, mechanically and electrically. They are the backbone of the controller.

- 3 .. 16 module slots
- Seamless connection/possible
- Stable mechanics/compact design
- Vibration proof fixing of modules
- Can be snapped on EN 60715 DIN rail
- For protection class 1
- Grounding tab (item no. 00016115-00) for protective conductor connection, necessary for use of voltages other than SELV

| Item                                | Item no.    |
|-------------------------------------|-------------|
| BS203/S                             | 00016785-00 |
| BS204/S                             | 00016786-00 |
| BS205/S                             | 00016787-00 |
| BS206/S                             | 00016788-00 |
| BS207/S                             | 00016789-00 |
| BS208/S                             | 00016790-00 |
| BS209/S                             | 00016791-00 |
| BS210/S                             | 00016792-00 |
| BS211/S                             | 00016793-00 |
| BS212/S                             | 00016794-00 |
| BS213/S                             | 00016795-00 |
| BS214/S                             | 00016796-00 |
| BS215/S                             | 00016797-00 |
| BS216/S                             | 00016798-00 |
| Protective conductor connection set | 00016115-00 |

| BS200/S                 |                                                                                               |
|-------------------------|-----------------------------------------------------------------------------------------------|
| Dimensions              |                                                                                               |
| Number of module slots  | 3 .. 16                                                                                       |
| Width                   | 55 mm x number of module slots                                                                |
| Depth                   | 23 mm incl. connector                                                                         |
| Height                  | 119 mm without protective conductor connection<br>137 mm with protective conductor connection |
| Ambient conditions      |                                                                                               |
| Operating temperature   | -30 .. +60 °C (vertical: -30 .. +55 °C)                                                       |
| Rel. humidity operation | 5 .. 95 % without condensation                                                                |
| Storage temperature     | -40 .. +85 °C                                                                                 |
| Rel. humidity storage   | 5 .. 95 % without condensation                                                                |
| Execution variants      |                                                                                               |
| BS203/S                 | Backplane with 3 module slots, Protection Class 1                                             |
| BS204/S                 | Backplane with 4 module slots, Protection Class 1                                             |
| ..                      | ..                                                                                            |
| BS216/S                 | Backplane with 16 module slots, Protection Class 1                                            |



Bus bar adapter with fitted M1 controller

Bus bar Adapters BS200/ET

The busbar adapters of the BS200/ET family are used to optimize thermal and robust Controller connection to e.g. the cabinet back panel. Through this application-specific coupling, the heat can be specifically removed through the rear wall of the cabinet housing, in which the cooling of the interior becomes much easier. Frequently, a maintenance-intensive active cooling of the components in the interior can therefore be avoided.

This adapter also allows for direct mounting without a top-hat rail, if this is beneficial for structural reasons, like in the case of a vertical mount or increased mechanical loads.

These accessories can be used for the bus bar-series BS200.

- 2 .. 8 module slots
- Optimized thermal connection
- Stable mechanics / compact design
- Vibration proof fixing of modules

| Item     | Item no.    |
|----------|-------------|
| BS202/ET | on request  |
| BS203/ET | on request  |
| BS204/ET | 00021791-00 |
| BS205/ET | 00021558-00 |
| BS206/ET | 00021792-00 |
| BS207/ET | 00021793-00 |
| BS208/ET | 00021794-00 |

| BS200/ET                |                                                                               |
|-------------------------|-------------------------------------------------------------------------------|
| Dimensions              |                                                                               |
| Number of module slots  | 2 .. 8                                                                        |
| Width                   | 55 mm x number of module slots                                                |
| Depth                   | 10 mm                                                                         |
| Height                  | 150 mm                                                                        |
| Ambient conditions      |                                                                               |
| Operating temperature   | Corresponding to the installed bus bar family                                 |
| Rel. humidity operation | Corresponding to the installed bus bar family                                 |
| Storage temperature     | Corresponding to the installed bus bar family                                 |
| Rel. humidity storage   | Corresponding to the installed bus bar family                                 |
| Design variants         |                                                                               |
| BS202/ET                | Backplane adapter with 2 module slots; for heat dissipation to the rear panel |
| BS203/ET                | Backplane adapter with 3 module slots; for heat dissipation to the rear panel |
| ..                      | ..                                                                            |
| BS208/ET                | Backplane adapter with 8 module slots; for heat dissipation to the rear panel |

# Storage media

## Robust in every detail.

To safely satisfy the high availability requirements imposed on the entire automation system, program memory and data memory should also be selected with the utmost care. The PCC201, CF200, as well as the latest CFA200 families are specially selected industrial types that meet the special requirements imposed by the harsh everyday conditions.

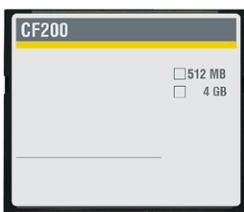
Due to the extended ambient conditions, the high number of supported write cycles and the exchange of experience with suppliers these memory cards are strongly recommended for use both in the controller system as well as in the operating and monitoring devices, and in industrial PCs.



### PC cards PCC201/xx

#### Features

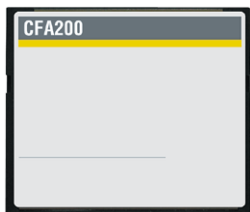
- Memory capacity 32 / 64 MB
- Access width 16 bits
- Designed as 5 V card
- Program voltage of 12 Vpp
- Write protection via operating software



### Compact Flash Memory CF200/xx

#### Features

- Compact Flash type I according to Compact Flash specification
- Memory capacity 512 MB, 4 GB, 8 GB
- Fast data transfer with ATA
- Write protection via operating software
- Extended temperature range
- Long service life / MTTF



### CFast Memory CFA200/xx

#### Features

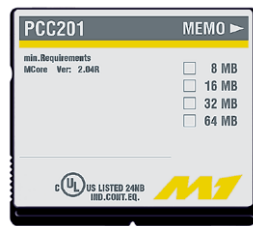
- CFast type I
- Memory capacity 4/8 GB
- Fast data transfer with SATA
- Write protection via operating software
- Extended temperature range
- Long service life / MTTF



### Bachmann System Maintenance Stick

#### Features

- USB stick with backup and restore program
- For operator terminals and industrial PCs with Linux and Windows
- Memory capacity 8 GB



### PC cards PCC201/xx

The PCC201/xx PC cards serve as a storage medium of the M1 controller. Depending on the memory extension, the PC cards may contain source codes and pieces of documentation in addition to the operating system, the drivers and the application software.

The PCC201 cards can directly be written to and formatted in all processor modules of the M1 controller. With an A-PCC200 adapter it is possible to use the PC cards in the PCMCIA slots of PCs and notebooks.

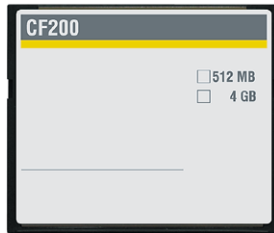
The PCC201 series is produced entirely in-house and therefore long-term supply is guaranteed.

- Memory capacity 32 / 64 MB
- Access width 16 bits
- Designed as 5 V card
- Program voltage of 12 V<sub>SS</sub>
- Write protection via operating software

| Item      | Item no.    |
|-----------|-------------|
| PCC201/32 | 00012081-30 |
| PCC201/64 | 00012081-40 |
| A-PCC200  | 00009540-00 |

| PCC201/xx               |                                                               |
|-------------------------|---------------------------------------------------------------|
| Basic data              |                                                               |
| Register                | No CMR (Component Management Register)                        |
| Powerdown mode          | Not possible                                                  |
| Information             | All information is stored in CIS (Card Information Structure) |
| Operating voltages      |                                                               |
| Operating voltage       | 5 V (min. 3 V for FLASH memory)                               |
| Program voltage         | 12 V                                                          |
| Ambient conditions      |                                                               |
| Operating temperature   | 0 .. +60 °C                                                   |
| Rel. humidity operation | 5 .. 95 % without condensation                                |
| Storage temperature     | -40 .. +85 °C                                                 |
| Rel. humidity storage   | 5 .. 95 % without condensation                                |
| Execution variants      |                                                               |
| PCC201/32               | PC Card 32MB                                                  |
| PCC201/64               | PC Card 64MB                                                  |
| A-PCC200                | Adapter for PCC-Card                                          |

## Storage media



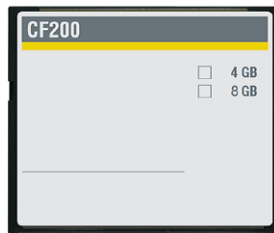
### Compact Flash memory CF200/xx

Given the high availability demands placed on automation systems, program and data memory must be selected with particular care. The Compact Flash memory cards CF200/xx are therefore especially selected industrial types that can cope with the requirements of harsh daily working routines. Use of the CF200/xx both in CPUs of the M1 family and in CT and WT devices is strongly recommended due to the extreme environmental conditions, the large number of supported write cycles and the many years of lasting experience with suppliers.

| Item      | Item no.    |
|-----------|-------------|
| CF200/512 | 00012759-00 |
| CF200/4GB | 00013556-00 |
| CF200/8GB | 00014321-00 |

- Compact Flash type I  
according to Compact Flash specification
- Memory capacity 512 MB, 2/4 GB
- Fast data transfer
- Write protection via operating software
- Extended temperature range
- Long service life / MTTF

| CF200/xx                |                                                                 |
|-------------------------|-----------------------------------------------------------------|
| Technical data          |                                                                 |
| Memory type             | Compact Flash type I                                            |
| Memory capacity         | 512 MB, 4 GB, 8 GB                                              |
| Data transfer rate      | Up to 8 MB/s                                                    |
| Operating voltage       | 3.3 V / 5 V (automatic adaptation)                              |
| Read / write cycles     | 2,000,000                                                       |
| MTBF at 25 °C           | > 4,000,000 h (depending on free memory)                        |
| Data retention          | 10 years                                                        |
| Data reliability        | < 1 unrecoverable errors in 10 <sup>14</sup> bits read accesses |
| Vibration               | 2 G 10 Hz .. 2 kHz                                              |
| Shock                   | 2000 G half cycle 0.5 ms                                        |
| Ambient conditions      |                                                                 |
| Operating temperature   | -40 .. +85 °C                                                   |
| Rel. humidity operation | 5 .. 95 % without condensation                                  |
| Storage temperature     | -40 .. +85 °C                                                   |
| Rel. humidity storage   | 5 .. 95 % without condensation                                  |
| Execution variants      |                                                                 |
| CF200/512               | Compact Flash Card 512MB                                        |
| CF200/4GB               | Compact Flash Card 4GB                                          |
| CF200/8GB               | Compact Flash Card 8GB                                          |



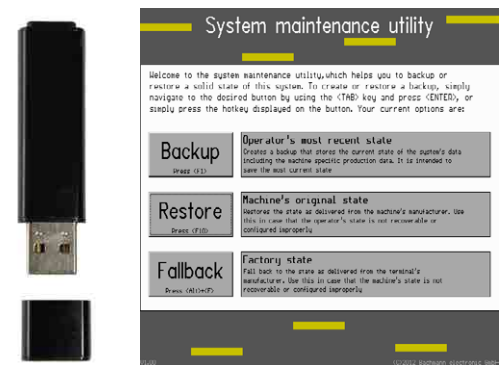
### CFast memory CFA200/xx

The full speed of the SATA interface is available with the CFAST Flash memory card for powerful controllers. Up to 30x the transmission rates of the CF cards can be reached. Given the high availability demands placed on automation systems, program and data memory must be selected with particular care. The CFast memory cards CFA200 / xx are therefore especially selected industrial types that can cope with the requirements of harsh daily working routines. Use of the CFA200/xx both in CPUs of the M1 family as well as in our visualization devices is strongly recommended due to the extreme environmental conditions, the large number of supported write cycles and the many years of lasting experience with suppliers. The robustness was significantly increased in comparison with a CF card via a stable edge connector.

| Item        | Item no.    |
|-------------|-------------|
| CFA200/4GB  | 00017355-00 |
| CFA200/8GB  | on request  |
| CFA200/16GB | 00019082-00 |

- CFast type I
- Memory capacity 4/8/16 GB
- Fast data transfer
- Write protection via software
- Extended temperature range
- Long service life / MTTF

| CFA200/xx               |                                          |
|-------------------------|------------------------------------------|
| Technical data          |                                          |
| Memory type             | CFast type I                             |
| Memory capacity         | 4 / 8 / 16 GB                            |
| Data transfer rate      | up to 100 MB / s                         |
| Operating voltage       | 3.3                                      |
| Read / write cycles     | > 3,000,000                              |
| MTBF at 25 °C           | > 2,500,000 h (depending on free memory) |
| Data retention          | 10 years                                 |
| Vibration               | 20 G    10 Hz .. 2 kHz                   |
| Shock                   | 1500 G    half cycle 0.5 ms              |
| Ambient conditions      |                                          |
| Operating temperature   | -40 .. +85 °C                            |
| Rel. humidity operation | 5 .. 95 % without condensation           |
| Storage temperature     | -40 .. +85 °C                            |
| Rel. humidity storage   | 5 .. 95 % without condensation           |
| Execution variants      |                                          |
| CFA200/4GB              | CFast Card 4GB                           |
| CFA200/16GB             | CFast Card 16GB                          |



**Bachmann System Maintenance Stick**  
for Linux and Windows devices

The Bachmann System Maintenance Stick (BSM Stick) is a combination of an 8 GB USB stick and an easy-to-operate, graphic backup and restore program for operator terminals and industrial PCs with Linux and Windows. Using the BSM Stick you can conveniently create complete backups of the operating system on a USB stick, or restore a complete backup from the stick.

The operating philosophy of the Bachmann System Maintenance Utility is based on the easiest possible operation via a standard PC keyboard, so that a corrupt operating system of an operator terminal or IPC can be quickly restored in the field, even by unexperienced operating personnel (one-click recovery). With the aid of the BSM Stick the end customer can keep machine downtimes to a minimum; this makes "repairs" of the visualization hardware, due to an operating system defect, unnecessary. Also the end customer can save the high expenses associated with keeping a pool of replacement devices on hand for these kinds of service cases. Thus the BSM Stick directly helps to reduce costs and optimizes availability of the terminal or of the IPC, and thus it helps to optimize availability of the system or machine, and contributes to increased acceptance of a machine on the part of the end customer.

The Bachmann System Maintenance Stick supports all series OT200, and series OT1300 operator terminals, as well as the series IPC1400 and IPC300 IPCs.

**System prerequisites**

- Free USB port
- System BIOS that supports booting from the USB port
- External standard PC keyboard

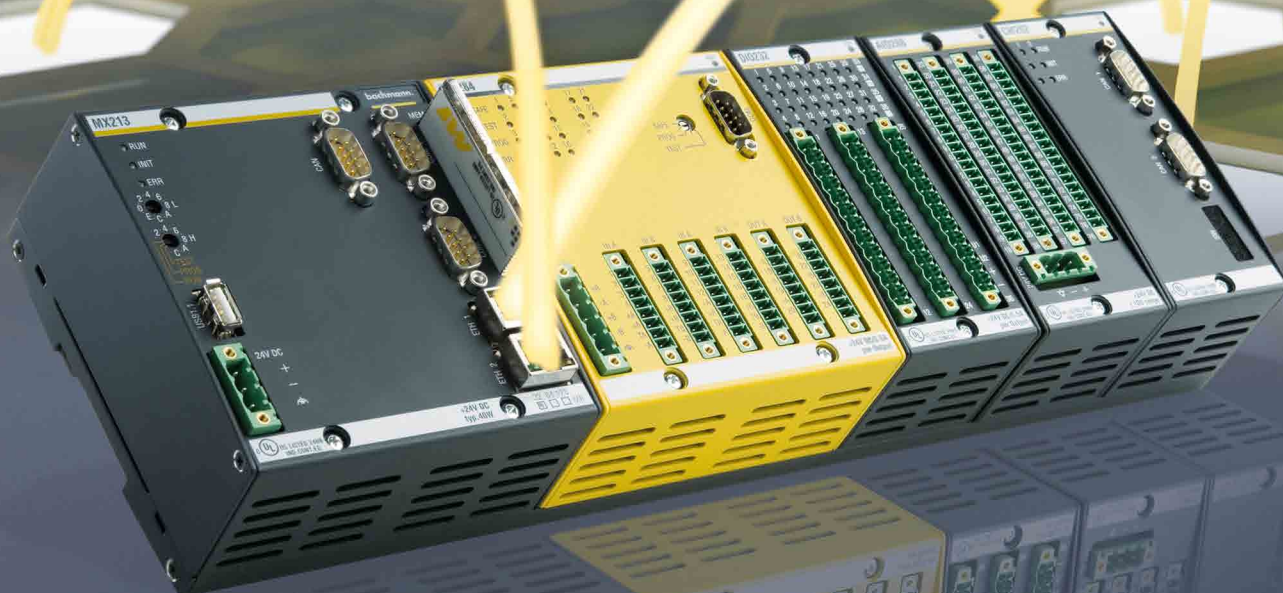
**Scope of delivery**

- 8 GB USB with pre-installed Bachmann System Maintenance Utility

| Item      | Item no.   |
|-----------|------------|
| BSM Stick | on request |







## **Networking – the backbone of the automation solution**

As an automation specialist in the area of distributed energy generation plants, we know the significance of a powerful, scalable, and absolutely reliable networking solution. Networking as the backbone of every automation solution has the task of connecting different sub-components according to their requirements in terms of signaling. In this regard rigorous requirements are imposed on real-time capability, manipulation security, as well as availability.

To meet these high requirements, Bachmann electronic provides an extensive offering of different networking components. For example, our offering enables a central control room connection adapted to the particular customer requirements via Ethernet, or a machine-internal, flexible connection of the individual machine components on the controller via real-time capable fieldbuses. You decide which of the networking possibilities established on the market best fits your automation task. Bachmann electronic is guaranteed to have a suitable solution in its product line.

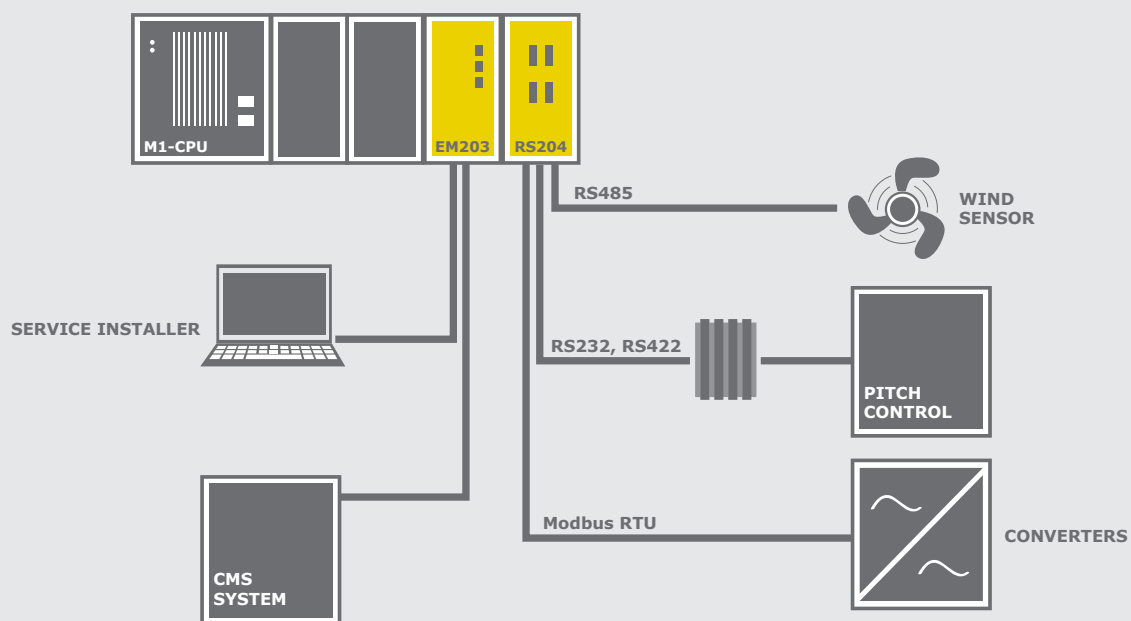
## System networking – Interfaces

### Numerous upgrade possibilities.

The M1-CPU already offers hardware interfaces for Ethernet and serial connections. If needed the number of these interfaces can be increased by placement of appropriate hardware modules on the backplane. The RS204 module offers additional serial ports with

9-pin D-Sub connectors. In addition the EM203 module extends the system by additional network adapters with three RJ45 ports. This means that the interface extensions can also be used on Fastbus substations.

### Topology: Interface





## Industrie Ethernet master EM203, EM213, EM213\*

### Features

Additional Ethernet port (separate IP address)

Cable length to 100 m per line

RJ45 connections: 3

Status display via LED

Integrated switch

Transfer rate to M1 CPU:  
max. 2.4 Mbit/s user data

Transfer rate as switch: max. 100 Mbit/s



## Interface modules RS204 \*

### Features

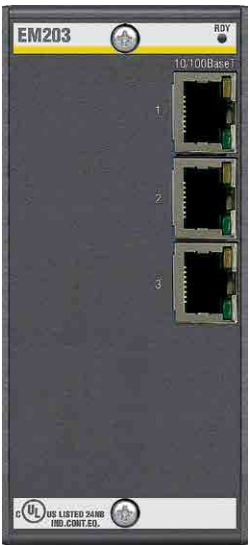
4 interfaces on one module

Several interface modules per controller possible

RS232/RS422/RS485 can be combined

High-speed interfaces up to 1.5 Mbit/s

Switchable terminating resistors

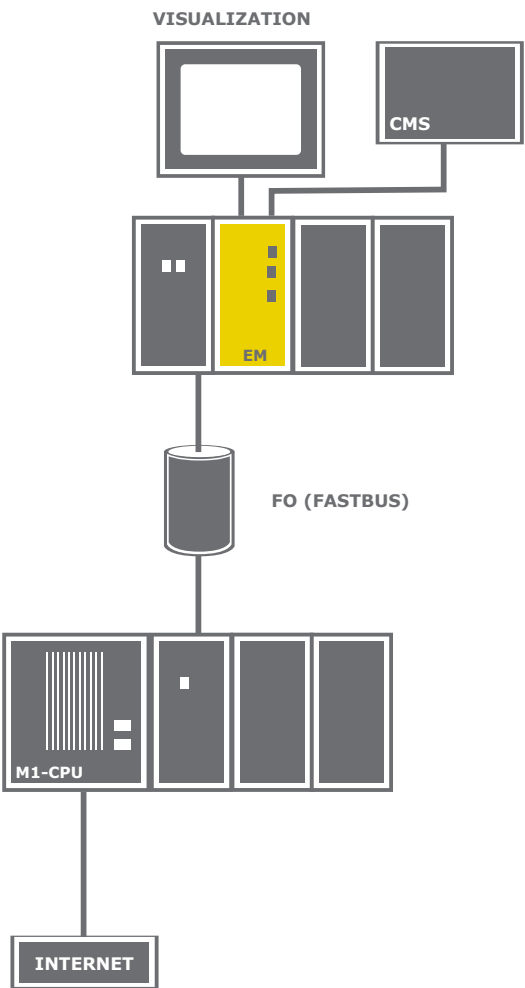


Industrie Ethernet master EM2x3

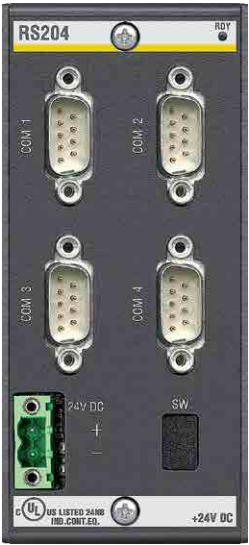
The module EM2x3 extends the control system with an additional Ethernet adapter with 3 ports for 10/100 MBit. Thus Ethernet ports for connection of a service laptop or for other Ethernet-based networking are also available on FASTBUS substations.

- Cable length to 100 m per line
- Status display via LED
- 3xRJ45 connections
- Integrated switch

| Item   | Item no.    |
|--------|-------------|
| EM203  | 00012671-00 |
| EM213  | 00017321-00 |
| EM213* | 00017470-00 |



| EM2x3                   |                                                                        |                                |                                |
|-------------------------|------------------------------------------------------------------------|--------------------------------|--------------------------------|
| Ethernet master         |                                                                        |                                |                                |
| Number of transceivers  | 3x 10/100BaseT                                                         |                                |                                |
| Connectors              | 3x RJ45/crossed and uncrossed cables can be used (autocross detection) |                                |                                |
| Line length             | max. 100 m/line                                                        |                                |                                |
| Transfer rate to M1 CPU | max. 2.4 Mbit/s user data                                              |                                |                                |
| Transfer rate as switch | max. 100 Mbit/s                                                        |                                |                                |
| Line impedance          | 100 Ω                                                                  |                                |                                |
| Status display          | LEDs for power, collision + 4x LinkPuls, 3x speed (10/100 Mbit/s)      |                                |                                |
| Ambient conditions      | Standard EM203                                                         | Standard EM213                 | ColdClimate (✱)                |
| Operating temperature   | 0 .. +60 °C                                                            | -30 .. +60 °C                  | -30 .. +60 °C                  |
| Rel. humidity operation | 5 .. 95 % without condensation                                         |                                | 5 .. 95 %<br>with condensation |
| Storage temperature     | -40 .. +85 °C                                                          |                                |                                |
| Rel. humidity storage   | 5 .. 95 %<br>without condensation                                      | 5 .. 95 %<br>with condensation | 5 .. 95 %<br>with condensation |
| Model variants          |                                                                        |                                |                                |
| EM203                   | Ethernet interface module; RJ45; 3 Ports; Eth100                       |                                |                                |
| EM213                   | Ethernet interface module; RJ45; 3 Ports; Eth100                       |                                |                                |
| EM213✱                  | like EM213; ColdClimate (✱)                                            |                                |                                |



## Interface modules RS204/x

The interface module RS204 is used to connect four asynchronous serial interfaces to the M1 controller.

- 4 interfaces on one module
- Any number of interfaces possible per controller
- RS232/RS422/RS485 and TTY can be combined
- High speed interfaces with up to 1.5 Mbaud
- Auto-flow control for automatic handshake
- Integrated terminating resistors (connect/disconnect)
- Interfaces galvanically isolated from the system

| Item    | Item no.    |
|---------|-------------|
| RS204   | 00009918-00 |
| RS204✳  | 00016169-00 |
| RS204/R | 00009918-01 |
| RS204/T | 00009918-20 |



| RS204/x                        |                                                                            |                                |                             |                                                                                              |
|--------------------------------|----------------------------------------------------------------------------|--------------------------------|-----------------------------|----------------------------------------------------------------------------------------------|
| Description                    | RS232                                                                      | RS422                          | RS485                       | TTY                                                                                          |
| Transfer rate* (max.)          | 115,2 Kbaud                                                                | 921,6 Kbaud                    | 921,6 Kbaud                 | 9,6 Kbaud                                                                                    |
| Signal level                   | RS232                                                                      | RS422                          | RS485                       |                                                                                              |
| Terminating resistance         | -                                                                          | Yes, adjustable via DIP switch |                             | -                                                                                            |
| Operating mode                 | Full duplex                                                                | Full duplex                    | Half duplex                 | TX active/RX active<br>TX active/RX passive<br>TX passive/RX active<br>TX passive/RX passive |
| External power supply          |                                                                            |                                |                             |                                                                                              |
| Voltage range                  | 18 .. 34 V DC                                                              |                                |                             |                                                                                              |
| Current consumption            | 125 mA bei 24 V DC                                                         |                                |                             |                                                                                              |
| Galvanic isolation from system | 500 V                                                                      |                                |                             |                                                                                              |
| Ambient conditions             | Standard                                                                   |                                | ColdClimate (❄)             |                                                                                              |
| Operating temperature          | -30 .. +60 °C                                                              |                                |                             |                                                                                              |
| Rel. humidity operation        | 5 .. 95 % without condensation                                             |                                | 5 .. 95 % with condensation |                                                                                              |
| Storage temperature            | -40 .. +85 °C                                                              |                                |                             |                                                                                              |
| Rel. humidity storage          | 5 .. 95 % with condensation                                                |                                |                             |                                                                                              |
| Model variants                 |                                                                            |                                |                             |                                                                                              |
| RS204                          | Serial interface, 4x RS232 / 422 / 485, 128 byte FIFO, isolated            |                                |                             |                                                                                              |
| RS204❄                         | like RS204, ColdClimate (❄)                                                |                                |                             |                                                                                              |
| RS204/T                        | Serial interface, 3x RS232 / 422 / 485, 1x TTY, 128 byte FIFO, insulated   |                                |                             |                                                                                              |
| RS204/R                        | Serial interface, 3x RS232 / 422 / 485, 1x RS232, 128 byte FIFO, insulated |                                |                             |                                                                                              |

\* The following transfer rates [bit / s] can be set via software: 110, 300, 1.2 k, 2.4 k, 4.8 k, 9.6 k, 19.2 k, 38.4 k, 57.6 k, 115.2 k, 230.4 k, 460.8 k, 921.6 k

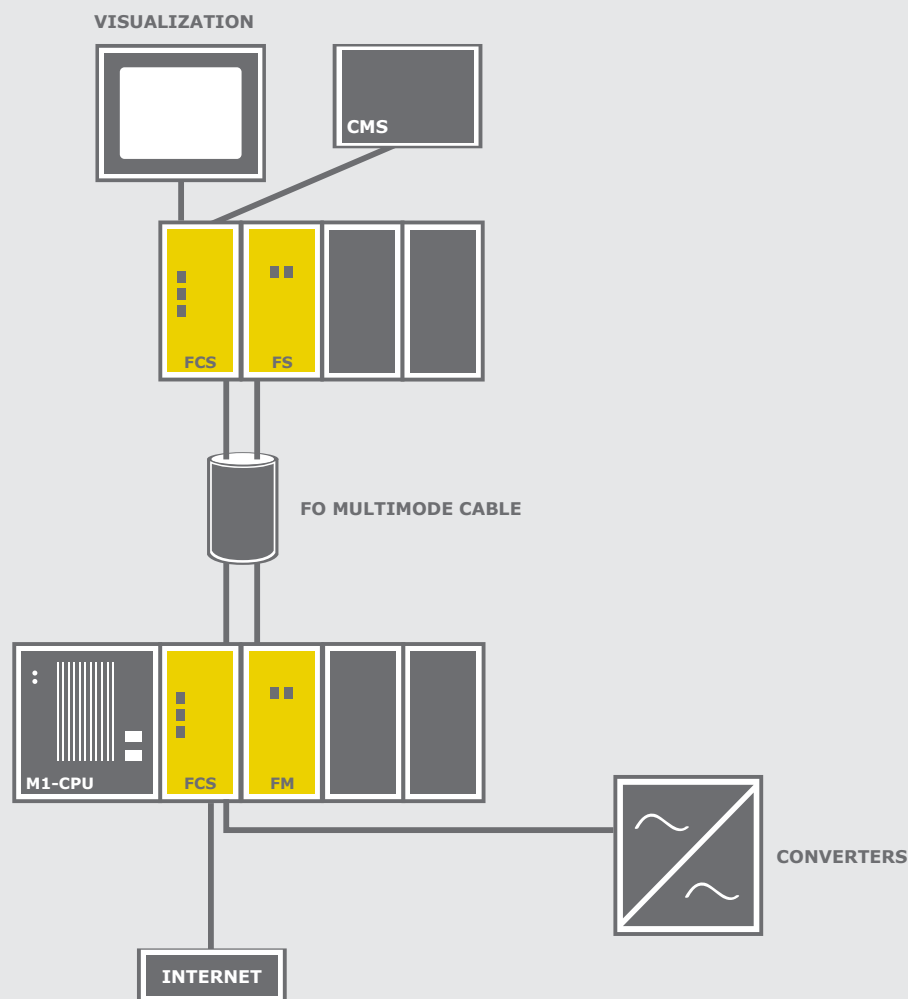
# System networking – Ethernet

## For the safest connections.

A secure, powerful and robust Ethernet connection is gaining ever greater significance. Whether as a simple switch like the SWI205, or as a media converter with switch functionality, like the FCS214, Bachmann electronic offers Ethernet networking components in recognized and proven quality. In addition, with the FCS additional diagnostic functions are

available. This means that the states of the optical components and of the fiber optic cable can be constantly monitored in diagnostic tools, as well as in the controller-side software. Thus deficient connection quality due to installation errors or due to aging of the components can be detected and corrected in a timely manner – even before a failure occurs.

## Topology: Ethernet

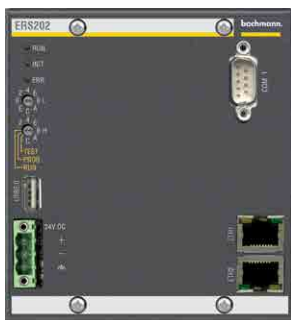




## Industrial Ethernet switch SWI205

### Features

- Cable length to 100 m per line
- RJ45 connections: 5
- Status display via LED
- Transfer rate: max. 100 Mbit/s
- Line impedance: 100  $\Omega$
- QoS (IEEE 802.1Q,p)



## Ethernet Remote Station ERS202

### Features

- 1 serial interface
- 2 Ethernet-interfaces 10 / 100 Mbit / s with status displays
- 1 USB interface
- RAM 256 MB DRAM
- Data memory 512 kB NVRAM
- Integrated power supply



## Media converter unmanaged switch FCS214

### Features

- Implementation copper – FO
- Up to 1 Gbit/s throughput
- Unmanaged – easy commissioning
- Reliable hardware
- Detailed, integrated diagnostic possibilities



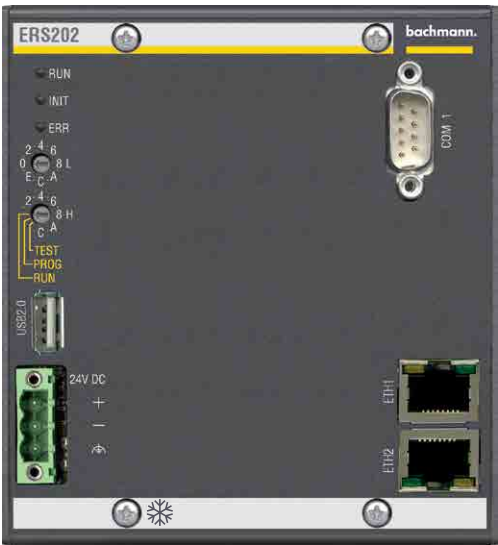
Industrial Ethernet switch SWI205

The module SWI205 is a powerful and industry compliant Ethernet switch and is used to connect M1 control systems, laptops and networks with the Ethernet 10//100BaseT technology.

- Cable length to 100 m per line
- Status display via LED
- 5xRJ45 connections

| Item     | Item no.    |
|----------|-------------|
| SWI205/S | 00012672-00 |

| SWI205                      |                                                                                        |
|-----------------------------|----------------------------------------------------------------------------------------|
| Ethernet switch             |                                                                                        |
| Number of transceivers      | 5x 10/100BaseT                                                                         |
| Connectors                  | 5x RJ45/crossed and uncrossed cables can be used (autocross detection)                 |
| Line length                 | max. 100 m/line                                                                        |
| Transfer rate               | max. 100 Mbit/s                                                                        |
| Line impedance              | 100 $\Omega$                                                                           |
| Status display              | LEDs for power, collision + 5x LinkPuls, 5x speed (10/100 Mbit/s)                      |
| External power supply       |                                                                                        |
| Supply voltage              | 18 .. 34 V DC                                                                          |
| Current consumption         | normally 100 mA at 24 V DC                                                             |
| Reverse polarity protection | yes                                                                                    |
| Ambient conditions          |                                                                                        |
| Operating temperature       | -30 .. +60 °C                                                                          |
| Rel. humidity operation     | 5 .. 95 % without condensation                                                         |
| Storage temperature         | -40 .. +85 °C                                                                          |
| Rel. humidity storage       | 5 .. 95 % without condensation                                                         |
| Model variants              |                                                                                        |
| SWI205/S                    | Ethernet switch; RJ45; 5 Ports; Eth100; integrated power supply 24V; DIN rail mounting |



Ethernet Remote Station ERS202

The module ERS202 serves as a remote slave module for sub-stations (e.g. redundant networks). It manages the local data and the exchange of two Ethernet ports to the for example redundant master controllers. Easy configuration and efficient data exchange allows for safe operation with the fastest possible switchover. The robust design as a cold climate version provides protection even under hard environmental conditions. An integrated power supply simplifies the construction. The module offers the following features:

- 1 Serial interface
- 2 Ethernet-interfaces 10/ 100 Mbit/ s with status displays
- 1 USB interface
- Status indicating LEDs for RUN, INIT and ERROR
- RAM 256 MB DRAM
- Data memory 512 Kb NVRAM
- Program memory of 16 MB and internal FLASH (4 MB for system software, 12 MB for redundancy configuration)
- Integrated power supply

| Item    | Item no.    |
|---------|-------------|
| ERS202❄ | 00021244-00 |

| ERS202                                                                     |                                                                                                       |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Processor + memory                                                         |                                                                                                       |
| CPU                                                                        | x86                                                                                                   |
| NVRAM (data memory)                                                        | 512 kB                                                                                                |
| DRAM (working memory)                                                      | 256 MB                                                                                                |
| FLASH (program memory)*                                                    | 16 MB internal                                                                                        |
| Interfaces                                                                 |                                                                                                       |
| Serial                                                                     | 1x RS232                                                                                              |
| Ethernet                                                                   | 2x 10 / 100 base-Tx                                                                                   |
| USB                                                                        | 1x USB 2.0                                                                                            |
| Power supply                                                               |                                                                                                       |
| Voltage range                                                              | 18 .. 34 V DC                                                                                         |
| Nominal power                                                              | 17 W                                                                                                  |
| Current consumption at + 5 V                                               | 2000 mA                                                                                               |
| Current consumption at + 15 V                                              | 250 mA                                                                                                |
| Current consumption at - 15 V                                              | 200 mA                                                                                                |
| Additional features                                                        |                                                                                                       |
| Watchdog                                                                   |                                                                                                       |
| Synchronization pulse for Ethernet                                         |                                                                                                       |
| Real-time clock with battery                                               |                                                                                                       |
| Status indication via 3 LEDs                                               |                                                                                                       |
| CPU ID selectable with rotary hexadecimal switches                         |                                                                                                       |
| Operating system VxWorks with Bachmann system extensions on internal FLASH |                                                                                                       |
| Ambient conditions                                                         | ColdClimate (❄)                                                                                       |
| Operating temperature                                                      | -30 .. +60 °C, fan-free                                                                               |
| Rel. humidity operation                                                    | 5 .. 95% with condensation                                                                            |
| Storage temperature                                                        | -40 .. +85 °C                                                                                         |
| Rel. humidity storage                                                      | 5 .. 95% with condensation                                                                            |
| Model variants                                                             |                                                                                                       |
| ERS202❄                                                                    | Ethernet Remote Station; 2x Eth100; 1x RS232; 1x USB2.0; integrated power supply 17W; ColdClimate (❄) |

\* depending on the configuration, a part of the program memory is reserved for the system software



**Media convertor – unmanaged switch FCS214 series**

The FCS214/x combines media convertor and gigabit switch in a single module. With a fiber optic connection and four RJ45 ports, it is optimally suited for data transmission over long distances. Selected diagnostic capabilities for the fiber optic link and the Ethernet data traffic can be directly integrated into existing PLC applications. The flexible connector concept allows easy connection via a patch cable or an industrial grade push-pull plug connection via an adapter.

- 4x RJ45, 1x FO-connection
- Up to 1 Gbit/s throughput
- Unmanaged – easy commissioning
- Reliable hardware
- Connection via Harting PushPull® connector or LC patch cable
- Integrated FO and Ethernet diagnostics

| Item      | Item no.    |
|-----------|-------------|
| FCS214/F  | 00017192-10 |
| FCS214/G  | 00017192-00 |
| FCS214/F* | 00019104-10 |
| FCS214/G* | 00019104-00 |

Screwable adapter for using PushPull connector

| Item    | Item no.    |
|---------|-------------|
| Adapter | 00016682-00 |



| FCS214                                    | FCS214/F                                                                                                                                 | FCS214/G                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Ports                                     |                                                                                                                                          |                             |
| RJ45                                      | 4x 10/100/1000 MBit/s                                                                                                                    | 4x 10/100/1000 MBit/s       |
| Fiber optic cable                         | 1x 100 MBit/s                                                                                                                            | 1x 1000 MBit/s              |
|                                           | FOC transmission medium Multimode Fibre (50/125 µm and 62,5/125 µm) max. 2000 m<br>FOC connector type LC<br>FOC guide wavelength 1310 nm |                             |
| Diagnostic possibilities                  |                                                                                                                                          |                             |
| Fiber optic cable – received light output | HW: three-color status LED<br>SW: 0 – 100 %                                                                                              |                             |
| Ethernet – throughput                     | number of data packets                                                                                                                   |                             |
| Ethernet – quality of communication       | good/bad frames, bad size, CRC error,...                                                                                                 |                             |
| Ethernet – mirror port                    | configurable                                                                                                                             |                             |
| Ambient conditions                        | Standard                                                                                                                                 | ColdClimate (❄)             |
| Operating temperature                     | -30 .. +60 °C                                                                                                                            |                             |
| Rel. humidity operation                   | 5 .. 95 %<br>without condensation                                                                                                        | 5 .. 95 % with condensation |
| Storage temperature                       | -40 .. +85 °C                                                                                                                            |                             |
| Rel. humidity storage                     | 5 .. 95 % with condensation                                                                                                              |                             |
| Model variants                            |                                                                                                                                          |                             |
| FCS214/F                                  | Ethernet fibre optic converter and switch; 100Mbit/s; 5 ports; 1x LC Connector; 4x RJ45; pluggable on back-planes                        |                             |
| FCS214/G                                  | Ethernet fibre optic converter and switch; 100/1000Mbit/s; 5 ports; 1x LC Connector; 4x RJ45; pluggable on backplanes                    |                             |
| FCS214/F❄                                 | like FCS214/F; ColdClimate (❄)                                                                                                           |                             |
| FCS214/G❄                                 | like FCS214/G; ColdClimate (❄)                                                                                                           |                             |

## Accessories\*

| Item               | Order designation  | Manufacturer | Description                                                                            |
|--------------------|--------------------|--------------|----------------------------------------------------------------------------------------|
| LC connector       | SXLC-DK0-56-0010   | LEONI        | LC connector duplex uniboot multimode type 2 for multimode fibers with 125 µm cladding |
| Harting connectors | 09 57 402 0500 020 | HARTING      | HARTING PushPull LC duplex plastic Multi Mode SFP                                      |
| Harting connectors | 09 57 409 0500 020 | HARTING      | HARTING PushPull LC duplex metal Multi Mode SFP                                        |

\*Information without guarantee, order directly from the manufacturer

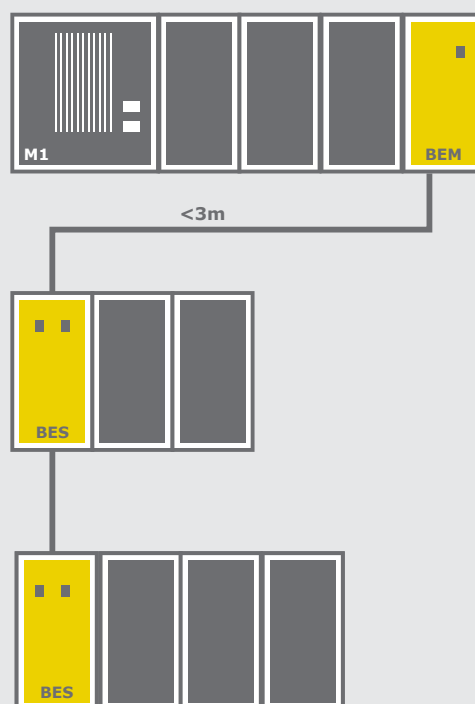
## System networking – Bus expansion

### Standardized performance.

With the bus expansion modules from Bachmann electronic for the CPU station, additional backplanes with I/O modules can be added. A configuration is not required to do this; at system start all stations and modules will be automatically detected and initialized. All I/O modules can be reached transparently; the physical structure of the control system does not need to be considered. Organization of

the controller in multiple stations permits both spatial adaptation to the control cabinet, as well as wide-area distribution of I/O modules for extended machines and plants. There is no restriction for the user in terms of performance and convenience. The interconnected backplanes behave as if they were connected on a single, large backplane.

### Topology: bus expansion





## Bus extension modules BEx200 series

### Features

Bus expansion master module:

1 interface

Bus expansion slave module:

2 interfaces (cascadable)

Up to 6 or 15 substations

Minimal signal delay

Distances of up to 3 m between stations

Integrated watchdog on slave modules

# Bus expansion



## Bus expansion modules BEx200 series

With the bus extension modules BEM21x and BES21x a »high speed« connection up to 3 m away is possible with less than 1.5 µs access time to distributed I/O units. Up to six distributed substations can be directly interconnected in a daisy chain topology. Each substation can in turn handle up to 15 M1 standard modules. The wiring using RJ45 connectors is one advantage of this new technology. Thus wiring is significantly facilitated. A special protocol is not required to use the I/Os with the bus expansion. The user can access these modules directly: As if they were local. The bus expansion module BES21x/N with integrated 24 V power supply provides power for the substation. If more than six substations are required, BES222/x can be used, which enables a special signal conditioning for up to 15 substations.

- Bus expansion master module with 1 interface
- Bus expansion slave module with 2 interfaces
- Bus expansion slave module optionally with integrated power supply
- Up to 6 or 15 local substations
- Minimal signal delay
- Distances of up to 3 m between 2 stations
- Integrated watchdog on slave modules

| Item     | Item no.    |
|----------|-------------|
| BEM211   | 00012846-00 |
| BES212   | 00012847-00 |
| BES212/N | 00012848-00 |
| BES222   | 00013502-00 |
| BES222/N | 00013503-00 |

## Bus expansion

| BEx200 series                      |                                                                                                 |
|------------------------------------|-------------------------------------------------------------------------------------------------|
| Bus expansion interface            |                                                                                                 |
| Line length                        | 3 m                                                                                             |
| Transmission medium                | CAT7 special cable                                                                              |
| Max. number of stations            | 6 (BES212/x) or<br>15 (BES222/x)                                                                |
| Integrated power supply (optional) |                                                                                                 |
| Voltage range                      | 18 .. 34 V DC                                                                                   |
| Current consumption                | max. 1.2 A at 24 V                                                                              |
| Nominal power                      | 17 W                                                                                            |
| Output current at +5 V             | 2 A                                                                                             |
| Output current at +15 V            | 250 mA                                                                                          |
| Output current at -15 V            | 200 mA                                                                                          |
| Reverse polarity protection        | yes                                                                                             |
| Ambient conditions                 |                                                                                                 |
| Operating temperature              | -30 .. +60 °C                                                                                   |
| Rel. humidity operation            | 5 .. 95% without condensation                                                                   |
| Storage temperature                | -40 .. +85 °C                                                                                   |
| Rel. humidity storage              | 5 .. 95% without condensation                                                                   |
| Model variants                     |                                                                                                 |
| BEM211                             | Bus extension master module with 1 interface                                                    |
| BES212                             | Bus extension slave module with 2 interfaces (up to 6 stations)                                 |
| BES212/N                           | Bus extension slave module with 2 interfaces and integrated power supply 17W (up to 6 stations) |
| BES222                             | Bus extension slave module with 2 interfaces (up to 15 stations)                                |
| BES222/N                           | Bus extension slave module with 2 interfaces; integrated power supply 17W (up to 15 stations)"  |

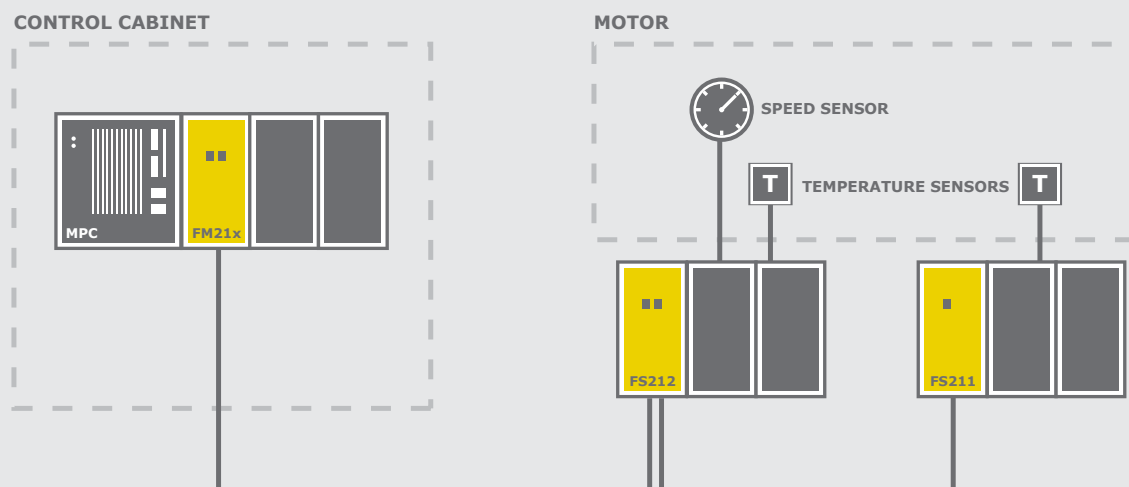
## System networking – FASTBUS

### Extensive networking possibilities.

With the aid of FO-based FASTBUS solutions numerous distributed tasks can be executed easily and reliably. FASTBUS permits a mixed topology of star and linear networking. In order to design distributed stations even more compact, FASTBUS slaves with integrated power supplies are available. These stations are capable of supplying the I/O modules on

the substations. Between the individual stations distances of up to 2000 m can be bridged with no problems, in this regard the galvanic separation is ensured by the fiber optic connection. Use of the FASTBUS does not require a configuration, or other special handling in the software, but rather functions in accordance with the »plug and play« principle.

### Topology: FASTBUS





**FASTBUS**

## FASTBUS modules Fx210 series

### Features

Fast, fail-safe distribution via fibre optic cables  
(up to 200 m)

Master modules with 1 or 2 FO interfaces

Slave modules with 1 or 2 FO interfaces

Up to 15 remote substations, cascable

Group isolation: 500 V



**FASTBUS**

## FASTBUS modules Fx220 series

### Features

Distances to 2000 m via multimode cable

Master modules with 1 or 2 FO interfaces

Slave modules with integrated power supply

Up to 15 remote substations, cascable

Connection technology via robust Harting PushPull®  
connector or LC patch cable



**FASTBUS modules Fx210 series**

The FASTBUS modules, FM211, FM212, FS211, and FS212 are designed to enable distribution of substations over long distances with a very low signal delay. The power supply integrated in the FASTBUS slave modules, FS211/N and FS212/N can supply the I/O modules of a substation.

- FASTBUS master modules with 1 or 2 FO interfaces
- FASTBUS slave modules with 1 or 2 FO interfaces
- FASTBUS slave modules with integrated power supply
- Up to 15 distributed substations
- Distances to 50 m for POF cable, 150 m for HCS cables or 200 m for special HCS cables between 2 stations
- Minimal signal delay

| Item    | Item no.    |
|---------|-------------|
| FM211   | 00010495-00 |
| FM212   | 00010496-00 |
| FS211/N | 00010498-00 |
| FS212/N | 00010500-00 |



| <b>Fx210 series</b>                |                                                                                                                                                                           |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FASTBUS interface                  |                                                                                                                                                                           |
| Line length                        | 50/150/200 m between the stations,<br>Total length max: 1000 m                                                                                                            |
| Transmission medium                | Plastic Optical Fiber (POF) max. 50 m<br>Hard Cladded Silica (HCS) max. 150 m<br>HCS sometimes also referred to as Plastic Silica Fiber (PCF),<br>Special HCS cable 200 m |
| Number of stations                 | max. 16                                                                                                                                                                   |
| Integrated power supply            |                                                                                                                                                                           |
| Input voltage                      | 24 V DC (18 .. 34 V)                                                                                                                                                      |
| Current consumption                | max. 1.2 A at 24 V                                                                                                                                                        |
| Nominal power                      | 17 W                                                                                                                                                                      |
| Output current at +5 V             | 2 A                                                                                                                                                                       |
| Output current at +15 V            | 250 mA                                                                                                                                                                    |
| Output current at -15 V            | 200 mA                                                                                                                                                                    |
| Galvanic isolation from the system | 500 V                                                                                                                                                                     |
| Reverse polarity protection        | yes                                                                                                                                                                       |
| Ambient conditions                 |                                                                                                                                                                           |
| Operating temperature              | 0 .. +60 °C                                                                                                                                                               |
| Rel. humidity operation            | 5 .. 95 % without condensation                                                                                                                                            |
| Storage temperature                | -40 .. +85 °C                                                                                                                                                             |
| Rel. humidity storage              | 5 .. 95 % without condensation                                                                                                                                            |
| Model variants                     |                                                                                                                                                                           |
| FM211                              | FASTBUS master module with 1 FO interface; HCS/PCF 150m or PMMA 50m                                                                                                       |
| FM212                              | FASTBUS master module with 2 FO interfaces; HCS/PCF 150m or PMMA 50m                                                                                                      |
| FS211/N                            | FASTBUS slave module with 1 FO interface; HCS/PCF 150m or PMMA 50m; integrated power supply 17W                                                                           |
| FS212/N                            | FASTBUS slave module with 2 FO interfaces; HCS/PCF 150m or PMMA 50m; integrated power supply 17W                                                                          |



FASTBUS modules Fx220 series

The FASTBUS modules FM221, FM222, FS221 and FS222 are designed to enable distribution of substations over long distances with a very low signal delay. The power supply integrated in the FASTBUS slave modules FS221/N and FS222/N can supply the I/O modules of a substation. The flexible connector concept allows easy connection via a patch cable or an industrial grade push-pull plug connection via an adapter.

- FASTBUS master modules with 1 or 2 FO interfaces
- FASTBUS slave modules with integrated power supply
- Up to 15 distributed substations
- Connection technology via robust Harting PushPull® connector or LC patch cable
- Distances to 2000 m via multimode cable
- Minimal signal delay
- ColdClimate models (❄)

| Item     | Item no.    |
|----------|-------------|
| FM221    | 00016747-10 |
| FM221❄   | 00018091-10 |
| FM222    | 00016747-00 |
| FS221/N  | 00016749-10 |
| FS221/N❄ | 00018092-10 |
| FS222/N  | 00016749-00 |

Screwable adapter for using PushPull connector

| Item    | Item no.    |
|---------|-------------|
| Adapter | 00016682-00 |

| Fx220 series                              |                                                                                                                  |                             |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------|
| FASTBUS interface                         |                                                                                                                  |                             |
| Line length                               | 2000 m between the stations,<br>Total length max: 2300 m                                                         |                             |
| Transmission medium                       | Multimode fiber (50/125 µm and 62.5/125 µm) max. 2000 m<br>FOC connector type LC<br>FOC guide wavelength 1310 nm |                             |
| Number of stations                        | max. 16 (max. 10 per line)                                                                                       |                             |
| Link budget                               | > 8 dB (3 dB Reserve)                                                                                            |                             |
| Diagnostic possibilities                  |                                                                                                                  |                             |
| Fiber optic cable – received light output | HW: three-color status LED<br>SW: 0 – 100 %                                                                      |                             |
| Integrated power supply                   |                                                                                                                  |                             |
| Input voltage                             | 24 V DC (18 .. 34 V)                                                                                             |                             |
| Nominal power                             | 17 W                                                                                                             |                             |
| Output current at +5 V                    | 2 A                                                                                                              |                             |
| Output current at +15 V                   | 250 mA                                                                                                           |                             |
| Output current at -15 V                   | 200 mA                                                                                                           |                             |
| Ambient conditions                        | Standard                                                                                                         | ColdClimate ☼               |
| Operating temperature                     | -30 .. +60°C                                                                                                     | -30 .. +60°C                |
| Rel. humidity operation                   | 5 .. 95 % without condensation                                                                                   | 5 .. 95 % with condensation |
| Storage temperature                       | -40 .. +85°C                                                                                                     | -40 .. +85°C                |
| Rel. humidity storage                     | 5 .. 95 % with condensation                                                                                      | 5 .. 95 % with condensation |
| Model variants                            |                                                                                                                  |                             |
| FM221                                     | FASTBUS master module with 1 FO-port; 50/62.5µm multi mode fiber; up to 2000m; LC connector                      |                             |
| FM221☼                                    | like FM221; ColdClimate (☼)                                                                                      |                             |
| FM222                                     | FASTBUS master with 2 FO-ports; 50/62.5µm multi mode fiber; up to 2000m; LC connector                            |                             |
| FS221/N                                   | FASTBUS slave 1 FO-port; 50/62.5µm multi mode fiber; up to 2000m; LC connector; integrated power supply 17W      |                             |
| FS221/N☼                                  | like FS221/N; ColdClimate (☼)                                                                                    |                             |
| FS222/N                                   | FASTBUS slave 2 FO-ports; 50/62.5µm multi mode fiber; up to 2000m; LC connector; integrated power supply 17W     |                             |

| Accessories*                    |                    |              |                                                                                                                  |
|---------------------------------|--------------------|--------------|------------------------------------------------------------------------------------------------------------------|
| Item                            | Order designation  | Manufacturer | Description                                                                                                      |
| LC connector                    | SXLC-DK0-56-0010   | LEONI        | LC connector duplex uniboot multimode type2 for multimode fibers with 125 µm outer diameter (Minibreakout-cable) |
| Harting connectors              | 09 57 402 0500 020 | HARTING      | HARTING PushPull LC duplex plastic Multi Mode SFP (Breakout-cable)                                               |
| Harting connectors              | 09 57 409 0500 020 | HARTING      | HARTING PushPull LC duplex metal Multi Mode SFP (Breakout-cable)                                                 |
| Fiber optic cable** (multimode) | 8421801LG000       | LEONI        | AT-V(ZN)Y(ZN)Y 2G50/125 TB900L 2,2 (Breakout-cable)                                                              |
| Fiber optic cable** (multimode) | 84950785G222       | LEONI        | I-V(ZN)Y 2G50/125 TB900L 2,8 (Minibreakout-cable)                                                                |

\*Information without guarantee, order directly from the manufacturer

\*\*When using the cables of other manufacturers observe any changes to the specifications such as attenuation or minimum bending radius. Fibers with a core diameter of 50 µm or 62.5 µm can be used. The outer diameter of the FO cable depends on the connector used.

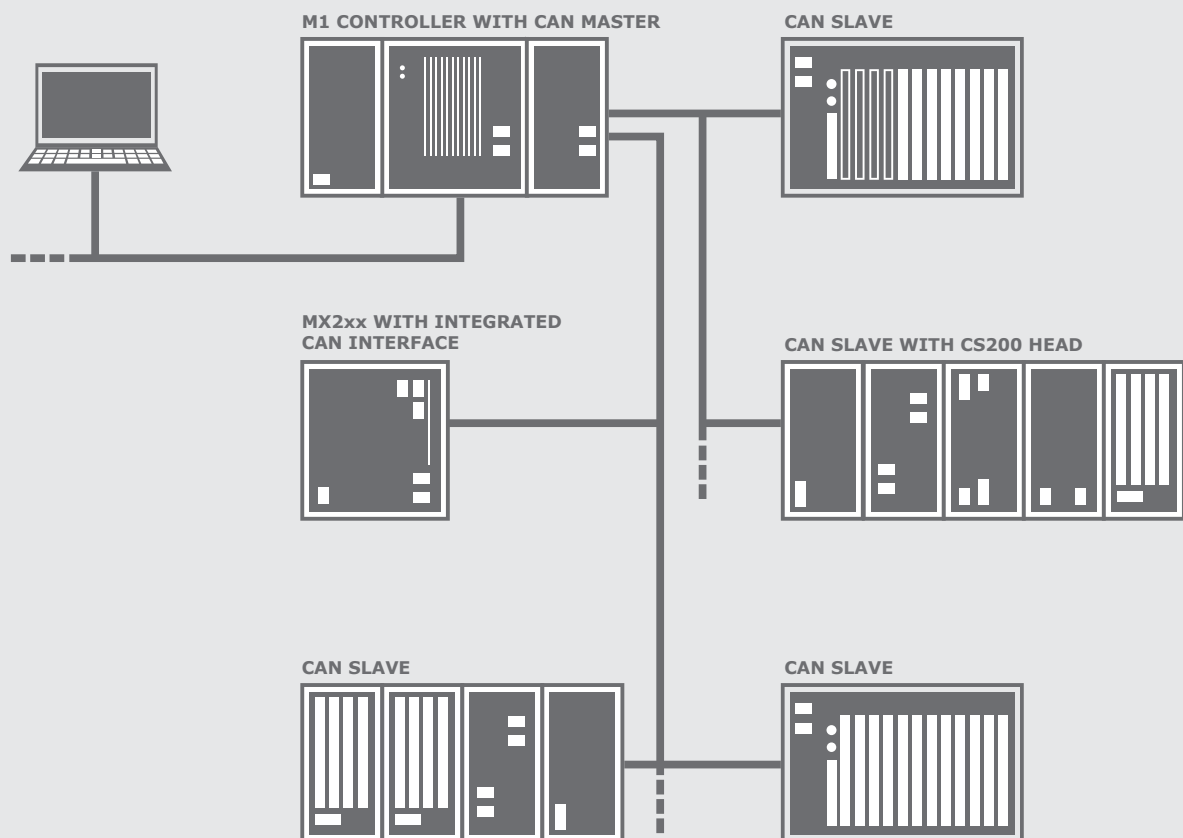
## Fieldbuses – CANopen

**Proven millions of times over.**

The Controller Area Network (CAN) in the CANopen specification has now developed to become the leading fieldbus system for industrial automation. Proven millions of times over and perfectly mature, it offers the ideal basis for safe, easy, and yet flexible networking tasks. By using only one fieldbus, the compact CAN I/O

modules from Bachmann electronic facilitate the homogeneous design of an automation system with high efficiency and packing density. Galvanic separation from the main station, the scalable range, and the extremely low-cost wiring make the modules particularly attractive for the users.

### Possible topology: CANopen





**CANopen**

## CAN master CM202

### Features

Up to 4 CM202 modules  
per M1 controller

2 independent CAN buses per  
CANopen master module

Can be used either as NMT  
master or NMT slave

Transfer rate:  
10 kbit/s to 1 Mbit/s



**CANopen**

## CAN slave CS200 / x

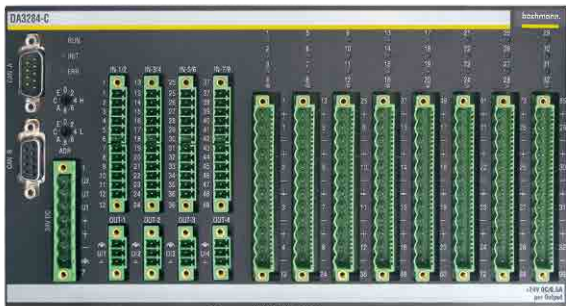
### Features

Head module for CANopen slave  
stations

Up to 30 I/O modules per slave  
station

Optional integrated power supply

Transfer rate:  
10 kbit/s to 1 Mbit/s



## Analog/digital I/O module DA3284-C

### Features

Compact CAN slave I/O module

8 analog inputs:

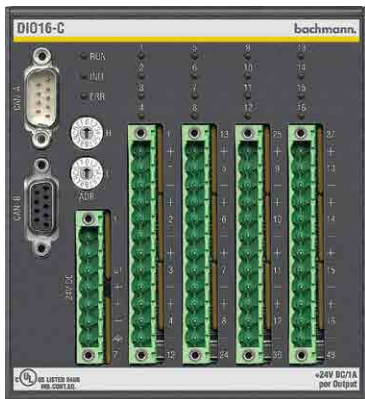
$\pm 10$  V,  $\pm 1$  V, Pt100, Pt1000, 0 (4) .. 20 mA

4 analog outputs  $\pm 10$  V,

either  $\pm 10$  V, 0 (4) .. 20 mA configurable

16 digital inputs

16 digital inputs or outputs (can be configured individually), 2 integrated counter inputs



## Digital I/O modules DIOxxx-C

### Features

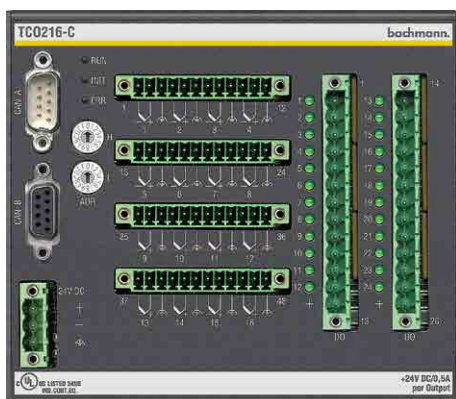
Stand-alone, compact CAN slave module

16/32/48 input channels, of which 16/32/32 free can be configured as output (DIO)

Digital outputs each with 1 A continuous current

Supply voltage: 18 .. 34 V DC

3-wire connection technology



**CANopen**

## Digital I/O modules TCO2xx-C

### Features

- Stand-alone, compact CAN slave module
- 8/16 temperature sensor inputs  
for temperature sensor types J and K
- Measuring range: 0 .. 500/800 °C
- 12/24 digital each with max. 1 A

## CANopen configurator

### Features

- Graphic configurator
- Easy integration of the DCF files
- Multiple networks  
(up to 8 CAN networks per CPU)
- CANSync for synchronization of drives\*
- CAN monitor for commissioning  
and diagnostics
- IP-based access to CAN nodes  
with »IP over CAN« in accordance with  
CiA Draft 301 / 405

\* CANSync synchronization also via  
the SYNC mechanism of the CPU



Note: There are processor modules  
with integrated CAN interface  
(see the processor modules section)



**CANopen master module CM202**

The CAN master module CM202 can operate either one or two separated networks. Both connections can be configured independently as NMT master or slave. In an M1 controller up to four CANopen master modules CM202 can be operated.

- Up to 4 CANopen master modules per M1 controller
- 2 independent CAN buses per CANopen master module
- Can be used as NMT master or slave
- Transfer rate 10 Kbaud to 1 Mbaud
- Bus length to 5000 m (signal repeater required)
- Galvanic isolation
- Short circuit proof

| Item   | Item no.    |
|--------|-------------|
| CM202  | 00009698-00 |
| CM202* | 00016404-00 |



| CM202                                                 |                                                                                                         |                             |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------|
| CANopen master                                        |                                                                                                         |                             |
| Max. number of masters                                | 4 per M1 controller                                                                                     |                             |
| Number of CAN buses                                   | 2 per module                                                                                            |                             |
| Max. number of nodes                                  | 64 per CAN bus                                                                                          |                             |
| Protocol                                              | CANopen to CiA DS 301                                                                                   |                             |
| Device profile                                        | in accordance with CiA DS 405                                                                           |                             |
| Firmware                                              | reloadable (FLASH technology)                                                                           |                             |
| Current consumption                                   | 320 mA/5 V DC                                                                                           |                             |
| CAN interface                                         |                                                                                                         |                             |
| Transfer rate                                         | 10 k .. 1 Mbaud                                                                                         |                             |
| Bus length                                            | max. 5000 m                                                                                             |                             |
| Connection                                            | 2x 9-pin D-Sub female connectors                                                                        |                             |
| Pin assignment                                        | in accordance with CiA DS 102/4                                                                         |                             |
| Signal level                                          | in accordance with CiA DS 102/4                                                                         |                             |
| Galvanic isolation, interfaces to the system          | 500 V                                                                                                   |                             |
| CANopen features in compliance with CiA Product Guide |                                                                                                         |                             |
| CANopen master                                        | yes                                                                                                     |                             |
| CANopen slave                                         | yes                                                                                                     |                             |
| Extended boot-up                                      | no                                                                                                      |                             |
| Minimum boot-up                                       | yes                                                                                                     |                             |
| COB ID distribution                                   | per SDO, no DBT                                                                                         |                             |
| Node ID distribution                                  | yes (no LMT)                                                                                            |                             |
| No. of TxPDOs                                         | 128                                                                                                     |                             |
| No. of RxPDOs                                         | 128                                                                                                     |                             |
| PDO modes                                             | sync, async, RTR, event                                                                                 |                             |
| Variable PDO mapping                                  | yes                                                                                                     |                             |
| Emergency message                                     | yes client (master), server (slave)                                                                     |                             |
| Life guarding                                         | yes (heartbeat and/or node guarding)                                                                    |                             |
| No. of SDOs                                           | 4 server, 64 client                                                                                     |                             |
| Device profile                                        | 301, 302, 405                                                                                           |                             |
| Ambient conditions                                    |                                                                                                         |                             |
|                                                       | Standard                                                                                                | ColdClimate (❄)             |
| Operating temperature                                 | -30 .. +60 °C                                                                                           |                             |
| Rel. humidity operation                               | 5 .. 95 % without condensation                                                                          | 5 .. 95 % with condensation |
| Storage temperature                                   | -40 .. +85 °C                                                                                           |                             |
| Rel. humidity storage                                 | 5 .. 95 % with condensation                                                                             |                             |
| Model variants                                        |                                                                                                         |                             |
| CM202                                                 | CAN fieldbus master module; 2x CAN/CANopen; up to 1Mbit/s; Master/Slave configurable; CANsync; isolated |                             |
| CM202❄                                                | like CM202; ColdClimate (❄)                                                                             |                             |

# CANopen



**CANopen**

## CANopen slave modules CS200 / x

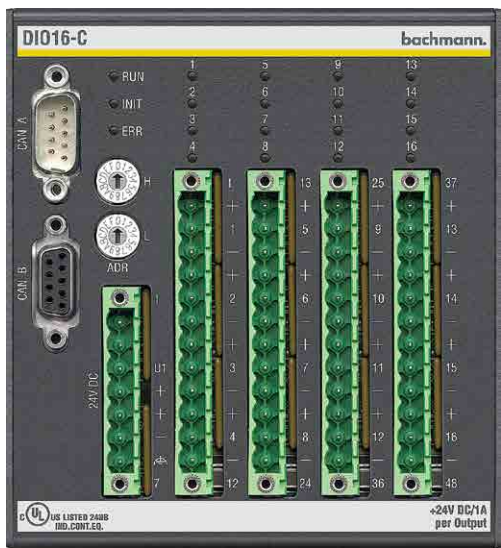
The CANopen slave module CS200/x is the head module for CANopen slave stations. The CANopen slave module CS200/x allows modular CANopen slave stations to be set up from the M1 modules. The same modules that are used for local stations can be used to design a slave station, which simplifies stock-keeping and consistently ensures the same technical data.

- Head module for CANopen slave stations
- Up to 30 I/O modules per slave station
- Optional integrated power supply
- Transfer rate 10 Kbaud to 1 Mbaud
- Bus length to 5000 m (signal repeater required)
- Two internally connected CAN interfaces for loop-through of the cable
- Galvanic isolation between CAN interfaces and control electronics
- Node address can be set via rotary switch
- 2 serial interfaces (COM 1/2)
- External 24 V power supply (CS200/N)

| Item    | Item no.    |
|---------|-------------|
| CS200   | 00013178-00 |
| CS200/N | 00013179-00 |

| CS200 / x             |                                                                              |
|-----------------------|------------------------------------------------------------------------------|
| CANopen slave         |                                                                              |
| Node ID               | 1 .. 254 selectable via rotary switch                                        |
| Protocol              | CANopen to CiA DS 301 V3.0                                                   |
| Device profile        | in accordance with CiA DS 401 for I/O, in accordance with CiA DS 402 for ACR |
| Firmware              | reloadable (FLASH technology)                                                |
| Number of I/O modules | 15 per station, 30 using bus extension modules BES/BEM or FASTBUS            |
| Current consumption   | 600 mA/5 V, 15 mA/+ 15 V, 40 mA/- 15 V                                       |
| Serial interfaces     | COM1: RS232, COM2: RS232/422/485                                             |

| CS200 / x                                             |                                                                                           |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------|
| CAN interface                                         |                                                                                           |
| Transfer rate                                         | 10 k .. 1 Mbaud                                                                           |
| Bus length                                            | max. 5000 m                                                                               |
| Connection                                            | 2x 9-pin D-Sub female connectors                                                          |
| Pin assignment                                        | in accordance with CiA DS 102/4                                                           |
| Signal level                                          | in accordance with CiA DS 102/4                                                           |
| Terminating resistance                                | 123 ohm, external                                                                         |
| Galvanic isolation,<br>Interfaces to the system       | 500 V                                                                                     |
| CANopen features in compliance with CiA Product Guide |                                                                                           |
| CANopen master                                        | N                                                                                         |
| CANopen slave                                         | Y                                                                                         |
| Extended boot-up                                      | N                                                                                         |
| Minimum boot-up                                       | Y                                                                                         |
| COB ID distribution                                   | per SDO, no DBT                                                                           |
| Node ID distribution                                  | N, (no LMT)                                                                               |
| No. of TxPDOs/RxPDOs                                  | 128/128                                                                                   |
| PDO modes                                             | sync, async, RTR, event                                                                   |
| Variable PDO mapping                                  | Y                                                                                         |
| Emergency message                                     | Y                                                                                         |
| Life guarding                                         | yes (heartbeat/node guarding)                                                             |
| No. of SDOs                                           | 4 servers                                                                                 |
| Device profile                                        | 301, 401, 402                                                                             |
| Optional integrated power supply (optional) CS200/N   |                                                                                           |
| Voltage range                                         | 18 .. 34 V DC                                                                             |
| Current consumption                                   | max. 1.2 A at 24 V                                                                        |
| Nominal power                                         | 17 W                                                                                      |
| Current consumption at + 5 V                          | 2000 mA                                                                                   |
| Current consumption at + 15 V                         | 250 mA                                                                                    |
| Current consumption at – 15 V                         | 200 mA                                                                                    |
| Ambient conditions                                    |                                                                                           |
| Operating temperature                                 | -30 .. +60 °C                                                                             |
| Rel. humidity operation                               | 5 .. 95% without condensation                                                             |
| Storage temperature                                   | -40 .. +85 °C                                                                             |
| Rel. humidity storage                                 | 5 .. 95% without condensation                                                             |
| Model variants                                        |                                                                                           |
| CS200                                                 | CAN bus master 1 line 1 Mbit/s, processor system, isolated                                |
| CS200/N                                               | CAN fieldbus slave module; 1x CAN/CANopen; 1Mbit/s; isolated; integrated power supply 17W |



**CAN**open

Digital input/output modules  
DIOxxx-C

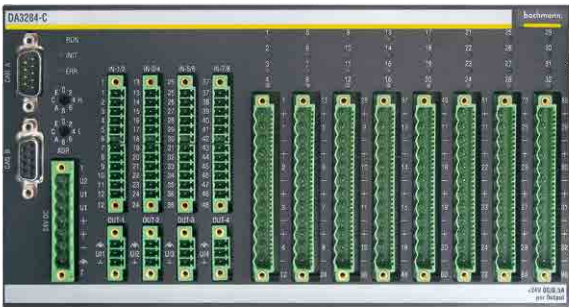
The digital I/O modules DIO16-C, DIO32-C, DIO48-C or DIO264-C are stand-alone CAN slave modules with 16, 32, 48 or 64 digital input/output channels.

- Stand-alone, compact CAN slave module
- 16/32 channels can be freely configured as input or output
- Digital outputs each with 1 A continuous current
- Two internally connected CAN interfaces for loop-through of the cable
- Galvanic isolation between CAN interfaces and control electronics
- Baud rate and node ID can be set via rotary switch
- Supply voltage 18 .. 34 V DC
- Operating range 0 .. +60 °C without additional cooling
- Full wiring without additional backplanes
- Snappable on EN 50022 backplanes

| Item     | Item no.    |
|----------|-------------|
| DIO16-C  | 00010285-00 |
| DIO16-C* | 00017453-00 |
| DIO32-C  | 00010129-00 |
| DIO48-C  | 00010526-00 |
| DIO264-C | 00009205-00 |

| DIOxxx-C                          | DIO16-C<br>DIO16-C*                                                                                                           | DIO32-C         | DIO48-C                    | DIO264-C        |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------|-----------------|
| Inputs                            |                                                                                                                               |                 |                            |                 |
| Quantity                          | max. 16                                                                                                                       | max. 32         | max. 48                    | max. 64         |
| Input delay                       | < 3.5 ms                                                                                                                      | < 3.5 ms        | < 3.5 ms                   | < 3.5 ms        |
| Internal resistance               | 6 kΩ                                                                                                                          | 6 kΩ            | 6 kΩ                       | 6 kΩ            |
| Status display                    | green LED                                                                                                                     | green LED       | green LED                  | green LED       |
| Outputs                           |                                                                                                                               |                 |                            |                 |
| Quantity                          | max. 16                                                                                                                       | max. 32         | max. 32                    | max. 32         |
| Supply voltage                    | 18 .. 34 V DC                                                                                                                 | 18 .. 34 V DC   | 18 .. 34 V DC              | 18 .. 34 V DC   |
| Isolated output blocks            | 1-16                                                                                                                          | 1-16, 17-32     | 1-16, 17-32                | 1-16, 17-32     |
| Nominal output current            | 1 A                                                                                                                           | 1 A             | 1 A                        | 1 A             |
| Output current (sum/block)        | max. 12 A                                                                                                                     | max. 12 A       | max. 12 A                  | max. 12 A       |
| Switching frequency               | max. 500 Hz                                                                                                                   | max. 500 Hz     | max. 500 Hz                | max. 500 Hz     |
| Short-circuit proof               | yes                                                                                                                           | yes             | yes                        | yes             |
| Status display                    | green LED                                                                                                                     | green LED       | green LED                  | green LED       |
| CAN interface                     |                                                                                                                               |                 |                            |                 |
| Transfer rate (Kbaud)             | 10 .. 1000                                                                                                                    | 10 .. 1000      | 10 .. 1000                 | 10 .. 1000      |
| Connection                        | 2x 9-pin D-Sub                                                                                                                | 2x 9-pin D-Sub  | 2x 9-pin D-Sub             | 2x 9-pin D-Sub  |
| Module ID                         | 1 .. 254                                                                                                                      | 1 .. 254        | 1 .. 254                   | 1 .. 254        |
| Galvanic isolation                | 500 V                                                                                                                         | 500 V           | 500 V                      | 500 V           |
| Terminating resistance            | 123 Ω, external                                                                                                               | 123 Ω, external | 123 Ω, external            | 123 Ω, external |
| External power supply             |                                                                                                                               |                 |                            |                 |
| Voltage range                     | 18 .. 34 V DC                                                                                                                 |                 |                            |                 |
| Current consumption (without I/O) | normally 100 mA at 24 V DC                                                                                                    |                 |                            |                 |
| Reverse polarity protection       | yes                                                                                                                           |                 |                            |                 |
| CAN protocols                     |                                                                                                                               |                 |                            |                 |
| CAL/CANopen                       | DS 301 communication profile, DS 401 device profile                                                                           |                 |                            |                 |
| Status LEDs                       | RUN (guarding), INIT, ERROR                                                                                                   |                 |                            |                 |
| Ambient conditions                |                                                                                                                               | Standard        | ColdClimate (❄)            |                 |
| Operating temperature             | -30 .. +60 °C                                                                                                                 |                 |                            |                 |
| Rel. humidity operation           | 5 .. 95% without condensation                                                                                                 |                 | 5 .. 95% with condensation |                 |
| Storage temperature               | -40 .. +85 °C                                                                                                                 |                 |                            |                 |
| Rel. humidity storage             | 5 .. 95% with condensation                                                                                                    |                 |                            |                 |
| Model variants                    |                                                                                                                               |                 |                            |                 |
| DIO16-C                           | CAN slave - digital input/output module; 16x DIO; 24V / 1A; 1 group; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated |                 |                            |                 |
| DIO16-C❄                          | like DIO16-C; ColdClimate (❄)                                                                                                 |                 |                            |                 |
| DIO32-C                           | CAN Slave - Digital IO module; 32x DIO, 24V / 1A; 2 groups; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated          |                 |                            |                 |
| DIO48-C                           | CAN Slave - Digital IO module; 16x DI; 32x DIO, 24V / 1A; 2 groups; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated  |                 |                            |                 |
| DIO264-C                          | CAN Slave - Digital IO module; 32x DI; 32x DIO, 24V / 1A; 2 groups; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated  |                 |                            |                 |

# CANopen



**CAN**open

## Analog and digital input/output module DA3284-C

Noteworthy compactness and a clever mix of possible signal types are offered by the CAN bus compact module DA3284-C. As a stand-alone fieldbus module (CANopen), the module offers the complete I/O spectrum already integrated for small applications or distributed signal connection points. It is the ideal addition to the familiar family of CAN digital modules and is an optimum »all-in-one« peripheral for small applications, e.g. such as those based on the control terminals CT300/CT200 from Bachmann electronic. The channel-specific programmable mode (on/off or applied standard signal) enables the unit to be adapted ideally to a wide range of applications without any interface converter. The robust design and processing quality, its outstanding technical specifications, seldom available from the usual fieldbus peripherals, are very impressive.

- Compact CAN slave I/O module
- 8 analog inputs  $\pm 10\text{ V}$ ,  $\pm 1\text{ V}$ , Pt100, Pt1000, 0 (4) .. 20 mA
- 4 analog outputs  $\pm 10\text{ V}$  or 0 (4) .. 20 mA configurable
- 16 digital inputs
- 16 digital inputs or outputs (individually configurable)
- 2 integrated counter inputs
- Digital outputs each with 0.5 A continuous current
- Error detection for digital and analog channels
- Full wiring without additional backplanes
- Powerful 32-bit processor for fast cycle times

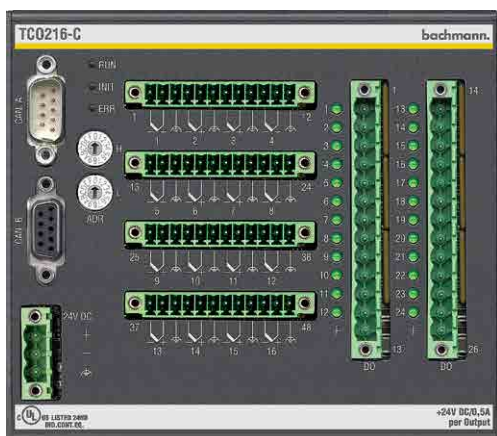
| Item      | Item no.    |
|-----------|-------------|
| DA3284-C  | 00013597-00 |
| DA3284-C* | 00017450-00 |

| DA3284-C                                |                                                                                                                |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Analog inputs                           |                                                                                                                |
| Quantity                                | 8                                                                                                              |
| Measuring ranges, selectable by channel | ±10 V, ±1V<br>Pt100, Pt1000: -100 °C .. +500 °C<br>0 (4) .. 20 mA                                              |
| Resolution                              | 14 bit                                                                                                         |
| Sampling rate                           | < 1 ms for all channels (500 µs)                                                                               |
| Input cutoff frequency                  | 750 Hz (3 dB)                                                                                                  |
| Basic accuracy at 25 °C                 | voltage 0.05 %<br>current/Pt100/Pt1000 0.1 %                                                                   |
| Error at the entire temperature range   | voltage 0.2 %<br>current/Pt100/Pt1000 0.2 %                                                                    |
| Error detection                         | cable break (at voltage), current or temperature error                                                         |
| Analog outputs                          |                                                                                                                |
| Quantity                                | 4                                                                                                              |
| Measuring ranges, selectable by channel | ±10 V, 0 (4) .. 20 mA configurable                                                                             |
| Resolution                              | 14 bit                                                                                                         |
| Conversion time                         | depends on CAN protocol                                                                                        |
| Basic accuracy at 25 °C                 | voltage 0.05 %<br>current 0.2 %                                                                                |
| Error at the entire temperature range   | voltage 0.1 %<br>current 0.4 %                                                                                 |
| Error detection                         | Load error                                                                                                     |
| Digital inputs                          |                                                                                                                |
| Quantity                                | 16 (max. 32)                                                                                                   |
| Input delay                             | 500 µs default value, filter adjustable                                                                        |
| Input current                           | normally 3 mA at +24 V DC                                                                                      |
| Input type                              | current consumption, type 1 in accordance with IEC61131                                                        |
| Status display                          | green LED                                                                                                      |
| Connection technology                   | 3-wire (+/-/signal)                                                                                            |
| Counter                                 |                                                                                                                |
| Counting channels                       | 2 (digital input channels 1 and 2)                                                                             |
| Counter frequency                       | max. 5 kHz                                                                                                     |
| Counter functions                       | counting, speed measurement (period duration, gate time)<br>measurement)                                       |
| Counting modes                          | - infinite up/down<br>- one-time up/down to/from reference value<br>- periodic up/down to/from reference value |
| Digital outputs                         |                                                                                                                |
| Quantity                                | 16                                                                                                             |
| Supply voltage                          | 18 .. 34 V DC                                                                                                  |
| Isolated output blocks                  | 1 .. 12, 13 .. 24                                                                                              |
| Nominal output voltage                  | 0.5 A                                                                                                          |
| Output current sum/block                | max. 8 A/4 A per block                                                                                         |
| Switching frequency                     | 500 Hz (with purely resistive load)                                                                            |
| Short-circuit proof                     | yes                                                                                                            |

## CANopen

| DA3284-C                                                    |                                                                                                                                                                        |  |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Digital outputs                                             |                                                                                                                                                                        |  |
| Error detection                                             | short circuit/ excess temperature by block<br>power supply per block ≤ 16.5 V                                                                                          |  |
| Status display                                              | green LED                                                                                                                                                              |  |
| Connection technology                                       | 3-wire (+ / - / signal)                                                                                                                                                |  |
| CAN interface                                               |                                                                                                                                                                        |  |
| CANopen                                                     | DS 301 communication profile, DS 401 device profile                                                                                                                    |  |
| Status LEDs                                                 | RUN (guarding), INIT, ERROR                                                                                                                                            |  |
| Transfer rate (Kbaud)                                       | 10 .. 1000 (adjustable via rotary switch)                                                                                                                              |  |
| Connection                                                  | 2x 9-pin D-Sub                                                                                                                                                         |  |
| Module ID                                                   | 1 .. 127 (configurable via rotary switch or SW)                                                                                                                        |  |
| Galvanic isolation                                          | 500                                                                                                                                                                    |  |
| Terminating resistance                                      | 123 ohm, external                                                                                                                                                      |  |
| Input/output connection technology                          |                                                                                                                                                                        |  |
| Connection for digital inputs/outputs and supply            | Phoenix Contact MINICOMBICON connector RM 5.8 with flange                                                                                                              |  |
| Connection technology for digital inputs/outputs and supply | screw clamp, spring tension clamp, crimp                                                                                                                               |  |
| Connection for analog inputs/outputs                        | Phoenix Contact MINI COMBICON RM 3.5 connector with flange                                                                                                             |  |
| Connection technology for analog inputs/outputs             | screw clamp, spring tension clamp                                                                                                                                      |  |
| Connection general                                          | plug codable, labeling by channels                                                                                                                                     |  |
| Operating conditions                                        |                                                                                                                                                                        |  |
| Voltage range                                               | 18 .. 34 V DC                                                                                                                                                          |  |
| Current consumption                                         | ≤ 270 mA at +24 VDC for module supply + load                                                                                                                           |  |
| Reverse polarity protection                                 | yes                                                                                                                                                                    |  |
| Galvanic isolation CAN bus module                           | 500 V <sub>RMS</sub>                                                                                                                                                   |  |
| Galvanic isolation I/O channels                             | none                                                                                                                                                                   |  |
| Ambient conditions                                          |                                                                                                                                                                        |  |
| Operating temperature                                       | Standard<br>ColdClimate (❄)                                                                                                                                            |  |
| Rel. humidity operation                                     | -30 .. +60 °C                                                                                                                                                          |  |
| Storage temperature                                         | 5 .. 95 % without condensation   5 .. 95 % with condensation                                                                                                           |  |
| Rel. humidity storage                                       | -40 .. +85 °C                                                                                                                                                          |  |
|                                                             | 5 .. 95 % with condensation                                                                                                                                            |  |
| Model variants                                              |                                                                                                                                                                        |  |
| DA3284-C                                                    | CAN slave universal input/output module; 16x DI; 16x DIO; 24V/0.5A; 4x AO +-10V 20mA; 8x AI +-10V +-1V 20mA Pt100/1000; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s |  |
| DA3284-C❄                                                   | like DA3284-C; ColdClimate (❄)                                                                                                                                         |  |





**CANopen**

## Temperature I/O modules TCO2xx-C

The temperature I/O modules, TCO204-C, TCO208-C and TCO216-C are stand-alone CAN slave modules with 8 or 16 thermocouple inputs and 12 or 24 digital outputs.

- Stand-alone, compact CAN slave module
- Thermocouple inputs for thermocouple types J and K
- Measuring range 0 .. +500 °C/ +800 °C configurable
- Sensor break detection
- Digital outputs each with 1 A
- Supply voltage 18 .. 34 V DC
- Operating range 0 .. +60 °C
- Snappable on EN 50022 backplanes
- CAN node ID can be set (hex switch)
- Baud rate is adjustable (hex switch)

| Item     | Item no.    |
|----------|-------------|
| TCO208-C | 00010850-00 |
| TCO216-C | 00008673-00 |

### TCO2xx-C

#### Temperature sensor inputs

|                            |                                           |
|----------------------------|-------------------------------------------|
| Quantity                   | 8/16                                      |
| Sensor types               | J or K, selectable per input              |
| Measuring range            | 0 .. +500 °C/ +800 °C configurable        |
| Resolution                 | 12 bit                                    |
| Linearization              | Polynomial in accordance with DIN IEC 584 |
| Cold junction compensation | 0 .. +133 °C (K)                          |
| Sampling period            | 16 ms                                     |
| Sensor break detection     | yes                                       |

#### Digital outputs

|                            |                                  |
|----------------------------|----------------------------------|
| Quantity                   | 12/24                            |
| Supply voltage             | 18 .. 34 V DC                    |
| Output current per channel | 0.5 A (max. 1 A)                 |
| Output current (sum)       | max. 12 A                        |
| Switching frequency        | max. 500 Hz at 1 kOhm ohmic load |
| Short-circuit proof        | yes                              |
| Status display             | green LEDs                       |

## CANopen

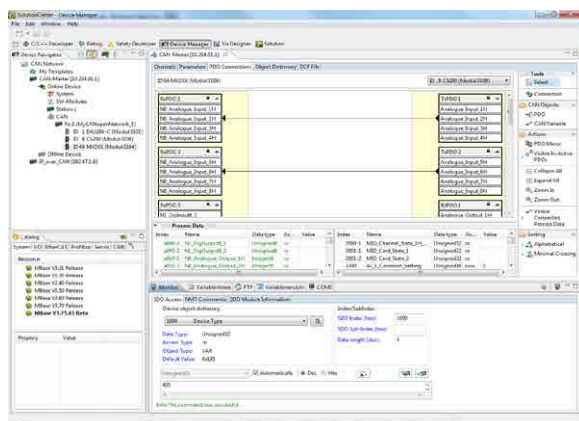
| TCO2xx-C                          |                                                                                                                                                                     |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CAN interface                     |                                                                                                                                                                     |
| Transfer rate                     | 10 k .. 1 Mbaud                                                                                                                                                     |
| Connection                        | 2x 9-pin D-Sub female connectors                                                                                                                                    |
| Module ID                         | 1 .. 254                                                                                                                                                            |
| Galvanic isolation via interfaces | 500 V                                                                                                                                                               |
| Terminating resistance            | 123 ohm, external                                                                                                                                                   |
| Status LEDs                       | RUN (guarding), INIT, ERROR                                                                                                                                         |
| Communication profile             | CiA DS 301                                                                                                                                                          |
| Device profile                    | CiA DS 401                                                                                                                                                          |
| External power supply             |                                                                                                                                                                     |
| Supply voltage                    | 18 .. 34 V DC                                                                                                                                                       |
| Current consumption (without I/O) | normally 105/110/120 mA at 24 V DC                                                                                                                                  |
| Ambient conditions                |                                                                                                                                                                     |
| Operating temperature             | 0 .. +60 °C                                                                                                                                                         |
| Rel. humidity operation           | 5 .. 95 % without condensation                                                                                                                                      |
| Storage temperature               | -40 .. +85 °C                                                                                                                                                       |
| Rel. humidity storage             | 5 .. 95 % without condensation                                                                                                                                      |
| Model variants                    |                                                                                                                                                                     |
| TCO208-C                          | CAN slave temperature input/digital output module; 8x thermocouple type J, K; 12x digital Out 24V / 0,5A; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated  |
| TCO216-C                          | CAN slave temperature input/digital output module; 16x thermocouple type J, K; 24x digital Out 24V / 0,5A; CAN/CANopen; 2x DSUB 9 (In/Out); up to 1Mbit/s; isolated |



## CANopen configurator

The Bachmann SolutionCenter supports the commissioning and diagnostics of CAN and CANopen networks with integrated tools. With a few mouse clicks a network can be configured from standard EDS files and transferred to the controller. Thanks to the easy interface to the application and to the commissioning tools a signal test can be executed immediately.

- Managing EDS files in the device catalog
- Online and offline configuration of networks
- Bus scan of online networks for convenient creation of a configuration
- Graphic network presentation
- Graphic presentation of the PDO mapping
- Tabular editor for network parameters
- Editors for specific device parameters
- Tabular editor for the object directory enables adding, changing, and deleting of network variables
- Fast workflow for the creation of standard configurations



The CAN monitor in the SolutionCenter enables more extensive diagnostics. It offers dialogs for:

- Direct SDO access
- NMT and LSS commands
- PDO triggering
- Access to emergency lists

# Fieldbuses – DeviceNet

## Proven basis, new view.

DeviceNet is based on the same physical layer as CAN, however it has an object-oriented view of the process data and uses monitored point-to-point connections. The bus system is standardized through the ODVA (Open DeviceNet Vendor Association).

The DeviceNet master module and its software equipment enable operation of the M1 controller as DeviceNet master

and DeviceNet slave, as well as simultaneous operation in two networks in combined master/slave mode.

The cyclic data is available to the application program via the process image. Acyclic accesses and status commands are possible via libraries for M-PLC and C/C++. The configuration is executed via the Bachmann SolutionCenter.



**DeviceNet™**

| Item   | Item no.    |
|--------|-------------|
| DNM201 | 00012696-00 |

### DeviceNet master DNM201

The DNM201 fieldbus master module allows the M1 controller to be used as bus master in DeviceNet networks. The DNM201 module is used to connect drives and input/output interfaces. The system bus of an M1 supports up to 8 separate networks, each with a maximum of 64 nodes that can be operated with different cycle times. Thus the bus architecture allows up to 512 DeviceNet stations (nodes) to be controlled individually.

- 1 DeviceNet module for up to 64 nodes
- 8 separate networks with max. 512 nodes (requires 8 DNM201 modules in one M1 system)
- Support of »Multi-Master« mode
- 5-pin connector (in acc. with open DeviceNet standard)
- Isolation voltage from DNM201 to case 100 V
- Isolation voltage from DeviceNet bus to system voltages of the controller 500 V
- Baud rates 125/250/500 kbit/s
- Extensive status LEDs
- Modes: Master (multi-master capable), slave, master/slave
- Module and network status LEDs (MS/NS)
- Error detection: Duplicate MAC-ID check, device heartbeat, device shutdown message
- Automatic resumption of communication after failure

| DNM201                                |                                                                                                                                                                                                                           |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technical data                        |                                                                                                                                                                                                                           |
| Maximum number of stations            | 64 nodes                                                                                                                                                                                                                  |
| Number of independent DeviceNet lines | up to 8 DNM201 modules per M1 system (equals 512 nodes)                                                                                                                                                                   |
| Bus connection                        | 5-pin DeviceNet connector                                                                                                                                                                                                 |
| Galvanic isolation via interfaces     | 500 V                                                                                                                                                                                                                     |
| Baud rates                            | 125/250/500 kbit/s                                                                                                                                                                                                        |
| DPRAM size                            | 4 or 8 kByte                                                                                                                                                                                                              |
| Protocol conformity                   | ODVA specification release 2.0                                                                                                                                                                                            |
| Access libraries                      | for C or IEC 61131                                                                                                                                                                                                        |
| Modes                                 | master (multi-master ability – multiple masters on the same CAN bus possible), slave, master/slave                                                                                                                        |
| Supported communication services      | I/O communication bit-strobe, polling, change of state, cyclic to 448 byte connection size, support of »Group2Server« as slaves, no multicast polling, explicit message, fragmentation protocol, UCMM, message forwarding |
| LEDs                                  |                                                                                                                                                                                                                           |
| RDY                                   | yellow off: Controller cannot initialize the DNM module<br>yellow on: Controller has successfully initialized the module                                                                                                  |
| MS RUN (MS=Module State)              | green on: DNM ready<br>green flashing: DNM is being configured                                                                                                                                                            |
| MS ERR (MS=Module State)              | red on: DNM not ready                                                                                                                                                                                                     |
| NS RUN (NS=Net State)                 | green on: DNM online and connected<br>green flashing: DNM online, but not connected/ not completely configured                                                                                                            |
| NS ERR (NS=Net State)                 | red on: no network connection possible<br>green flashing: Connection in timeout                                                                                                                                           |
| Ambient conditions                    |                                                                                                                                                                                                                           |
| Operating temperature                 | -30 .. +60 °C                                                                                                                                                                                                             |
| Rel. humidity operation               | 5 .. 95% without condensation                                                                                                                                                                                             |
| Storage temperature                   | -40 .. +85 °C                                                                                                                                                                                                             |
| Rel. humidity storage                 | 5 .. 95% with condensation                                                                                                                                                                                                |
| Model variants                        |                                                                                                                                                                                                                           |
| DNM201                                | Device Net master module; 1x device net interface; 500 kbit/s; isolated                                                                                                                                                   |

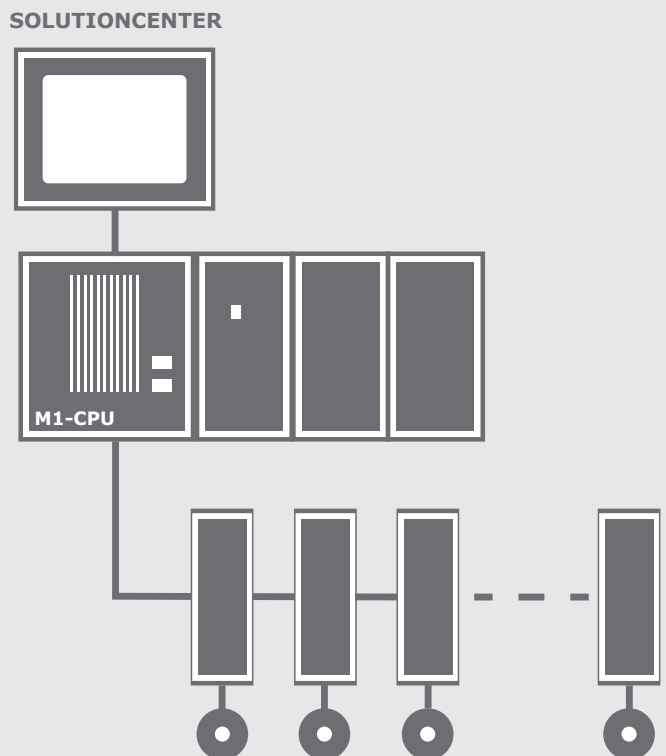
## Fieldbuses – EtherCAT

### The fast communication path.

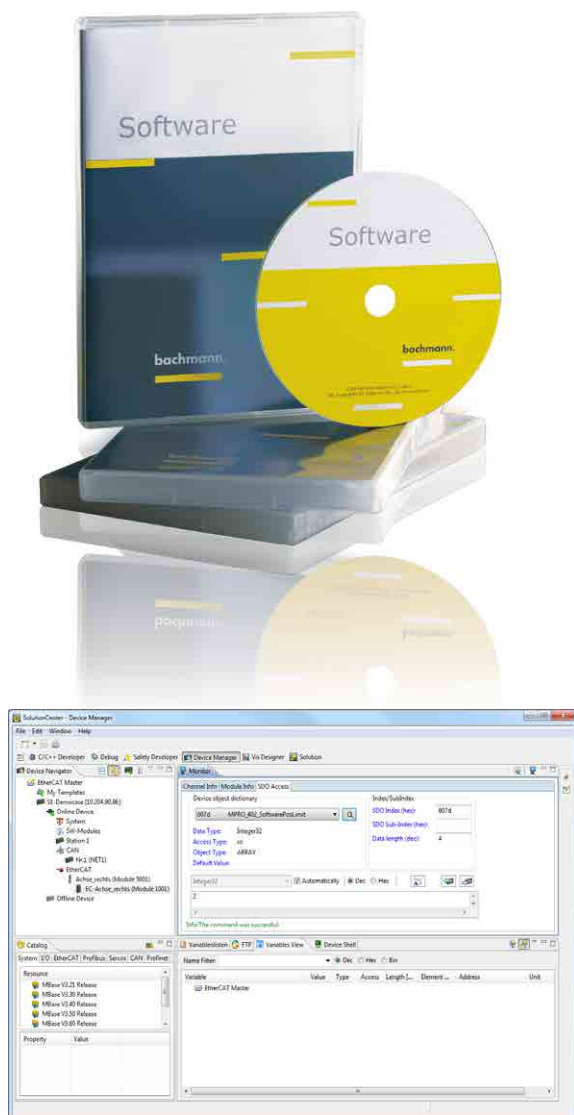
The EtherCAT bus system is outstandingly suited for the activation of servo-electric drives. As a pure software solution, the EtherCAT master from Bachmann electronic uses the available Ethernet ports on the controller CPU.

The configurator for EtherCAT networks is integrated in the SolutionCenter and generates an operable configuration on the controller based on the XML description files of the various slave manufacturers.

### Possible topology: EtherCAT



EtherCAT<sup>®</sup>



## EtherCAT master

The EtherCAT master is a pure software solution and uses an Ethernet port on the controller CPU. The motion software packages from Bachmann electronic and any other application programs can be synchronized precisely to the timing of the EtherCAT bus to ensure the synchronization of setpoint calculation and transmission. The SolutionCenter supports commissioning and diagnostics through a configurator and monitor.

The Drive Middleware as the connecting link between motion software and EtherCAT drive directly operates the functions and the status model of the drive so that the user no longer needs to program out the specific sequences in the application software.

- Software solution for operation on standard controller CPUs
- Addressing the slaves via autoincrement or alias address
- Allocating and checking alias addresses
- Supports optional nodes
- Supports slaves with distributed clock
- Synchronization of application programs and fieldbus is possible
- Cyclic data exchange via PDO mapping
- Display of process values as logical I/O modules and in the PLC process image
- Acyclic data exchange for application via SDO function interface is available
- Function interface for network and slave status
- Extensive diagnostics via system variables
- Quality is ensured through regular participation in ETG Plug Fests



ECS200 EtherCAT Slave Module

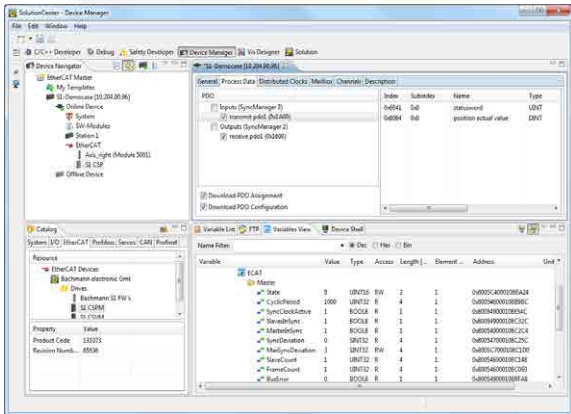
The EtherCAT slave module ECS200 allows connecting a M1 controller system as slave device to an external EtherCAT network. The goal is to use the M1 to control an autonomous intelligent subsystem within a complex system or machine. The application programs (PLC, C/ C++) have full access to the incoming and outgoing cyclic process data via the MIO and SVI interfaces and via the process image. The slave state and the connection state can be recognized by the user programs. Thus, emergency situations like network problems or failures of the external EtherCAT Master can be handled individually in dedicated emergency routines. The application programs at the slave station can be accurately synchronized to the external EtherCAT bus for closed-loop control operations. The execution cycle of the user programs can be maintained also in emergency situations. Distributed Clocks are supported. Amount and size of the incoming and outgoing cyclic data are configured on the slave station, and then a dedicated ESI file is generated to configure the master system. The PDO mapping can be defined statically or can be created by the EC Master dynamically. As EtherCAT slave, the M1 is a module device with a static object dictionary that does not need to be further configured by the master. Diagnostic is supported by several LED indications on the module, by log messages and by a monitor in the Bachmann SolutionCenter.

- 2 EtherCAT Ports IN, OUT
- Max. 700 Bytes cyclic data for Rx und Tx each
- Bus interval 125 µs to 10 ms
- Distributed Clock
- User programs can be synchronised to EtherCAT
- Connection- and network state visible for user programs
- Behavior in case of network problems configurable
- LED for display of slave state
- Error-LEDs for In- and Out-Port
- Galvanic isolation from the system
- Condensation-proof ColdClimate design on request

| Item    | Item no.    |
|---------|-------------|
| ECS200  | 00018548-00 |
| ECS200* | 00019206-00 |



| ECS200                                  |                                                                             |                             |
|-----------------------------------------|-----------------------------------------------------------------------------|-----------------------------|
| EtherCAT data                           |                                                                             |                             |
| EtherCAT Device Type                    | Module device                                                               |                             |
| Object dictionary                       | statical (depends on configuration of the slave station)                    |                             |
| PDO Mapping                             | statical or dynamical                                                       |                             |
| Distributed Clock                       | available                                                                   |                             |
| EtherCAT data types                     | BOOL, BIT, USINT, SINT, UINT, INT, UDINT, DINT, REAL, ULINT, LINT, LREAL    |                             |
| Number of cyclic data                   | max. 700 Byte respectively in Tx and Rx                                     |                             |
| Cycle time                              | ≥ 125 µs, depend on CPU and data volume, max. 10 ms                         |                             |
| Interface to user program               |                                                                             |                             |
| Access of cyclic data                   | process image, UFB channel view, SVI view                                   |                             |
| Slave Status                            | readable, settable through functional interface                             |                             |
| Connection quality to network           | view as module and channel state of UFB, request by user software           |                             |
| Time-base synchronization               | adapted to synchronization by user software of EC network                   |                             |
| Behaviour in the event of network break | further completion of the user software by intervall possible               |                             |
| Mailbox data                            | on request                                                                  |                             |
| Diagnostic                              |                                                                             |                             |
| LED Run                                 | Run (permanent light for operational, blinking codes for other slave state) |                             |
| LEDs Parity Error 1, 2                  | failure in the physical receive layer of in or out ports                    |                             |
| LEDs EtherCAT Ports                     | standard LED's for activity (green) and data rate (orange)                  |                             |
| Monitor in SolutionCenter               | value view of state information                                             |                             |
| Logbook entries                         | Information host via debug level selectable                                 |                             |
| Configuration                           |                                                                             |                             |
| SolutionCenter                          | setting of object directories via UFB channel configurator                  |                             |
| System requirements                     |                                                                             |                             |
| M-Base                                  | V3.80 or higher                                                             |                             |
| Processor module                        | recommended MX207 or higher                                                 |                             |
| Electrical data                         |                                                                             |                             |
| Number EtherCAT Ports                   | 2 (In/out)                                                                  |                             |
| Supply                                  | internal via bus rail BS2xx                                                 |                             |
| Current consumption                     | internal 270 mA                                                             |                             |
| Galvanic isolation from the system      | 500 V                                                                       |                             |
| Ambient conditions                      |                                                                             |                             |
|                                         | Standard                                                                    | ColdClimate (❄)             |
| Operating temperature                   | -30 .. +60 °C                                                               |                             |
| Rel. humidity operation                 | 5 .. 95 % without condensation                                              | 5 .. 95 % with condensation |
| Storage temperature                     | -40 .. +85 °C                                                               |                             |
| Rel. humidity storage                   | 5 .. 95 % without condensation                                              | 5 .. 95 % with condensation |
| Model variants                          |                                                                             |                             |
| ECS200                                  | EtherCAT slave module; 2x Eth100 (In/Out); operation only with CPU module   |                             |
| ECS200❄                                 | like ECS200; ColdClimate (❄)                                                |                             |



The Device Manager includes an integrated EtherCAT configurator that creates a complete network configuration (ENI – EtherCAT Network Information) from the standardized slave description files (ESI - EtherCAT Slave Information) and transfers it to the controller. For access to the process data, in addition, logical I/O modules are generated on the master that enable an immediate diagnosis and signal test in the Device Manager.

- Managing the slaves in the catalog
- Online and offline creation of network configurations
- Busscan of the online controller also in the case of configuration errors with display of the discrepancies for quick error detection
- Direct transfer of pre-configured PDOs
- Browser for object directory of the slave (if supported by the slave)
- Automatic generation of logical I/O modules for access to cyclic process data
- Immediate wiring test without user software is possible
- Monitor for SDO read and write access for the running network
- Monitor for setting and checking the alias address



# Fieldbuses – PROFIBUS

Widely used, esteemed everywhere.

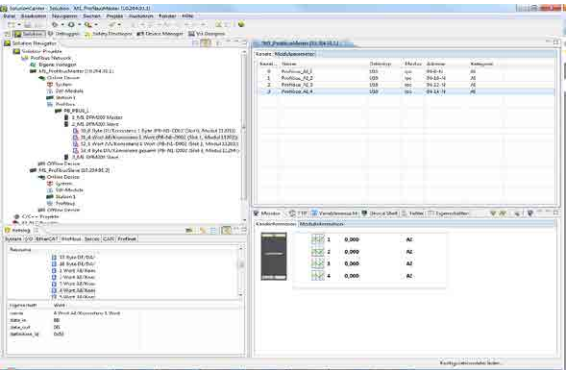
PROFIBUS is a field bus that is widely used, particularly in the area of mechanical engineering and plant engineering and even today – in spite of all Ethernet-based fieldbuses – it continues to show increasing quantities. A broad palette of peripheral components and an active user organization will also ensure long-term availability of

PROFIBUS components in the future. Bachmann electronic offers a fieldbus interface module for the backplane that can be used both as master, as well as slave. The SolutionCenter contains a complete configurator that enables interfaces to the engineering tools of other manufacturers through the consistent application of standards.



## PROFIBUS DP master DPM200

| Features                                   |
|--------------------------------------------|
| Fast ASIC technology                       |
| Transfer rate:<br>9.6 kbit/s .. 12 Mbit/s  |
| Up to 3 masters per M1 controller          |
| Maximum 125 slave stations (with repeater) |



| Features                                                                  |
|---------------------------------------------------------------------------|
| Multiple networks (multiple networks per CPU)                             |
| Convenient integration of the GSD files                                   |
| PROFIBUS DP class 1 master                                                |
| Support of all baud rates (9.6 Kbaud to 12 Mbaud) defined in the standard |
| Transparent access to IO and process variables                            |



**PROFIBUS DP master module  
DPM200**

The interface module for Profibus DP (Distributed Peripherals) can be operated as DP master, DP slave or as combined master/slave, which in a multi-master network offers variables for another master. The process data is available to the application program as logical I/O module and thus can be reached via the process image or via the function interface.

- Up to 3 DPM200 modules per M1 controller
- Transfer rate 9.6 Kbaud to 12 Mbaud
- 8 kByte shared memory for process data image
- Consistency lock for data blocks is configurable
- Two internal bridged connections for loop-through of the cable
- Galvanic isolation between fieldbus and controller

| Item    | Item no.    |
|---------|-------------|
| DPM200  | 00010555-00 |
| DPM200* | 00018032-00 |

# PROFIBUS

| DPM200                                          |                                                               |                            |
|-------------------------------------------------|---------------------------------------------------------------|----------------------------|
| PROFIBUS DP master                              |                                                               |                            |
| Large process image                             | 8 Kb x 16 DPM                                                 |                            |
| Firmware                                        | update via SolutionCenter is possible                         |                            |
| Max. number of masters                          | 3 per M1 controller                                           |                            |
| Max. number of slaves                           | 32 without repeater, 125 with repeater                        |                            |
| PROFIBUS Standard                               | V0                                                            |                            |
| Data length in the DPM                          | 732 bytes per slave                                           |                            |
| Current consumption                             | 400 mA/ 5 V DC                                                |                            |
| Interface                                       |                                                               |                            |
| Transfer rate                                   | 9.6 k .. 12 Mbaud                                             |                            |
| Connection                                      | 2x 9-pin D-Sub female connectors                              |                            |
| Pin assignment                                  | in accordance with EN 50170                                   |                            |
| Signal level                                    | in accordance with RS485 standard                             |                            |
| Galvanic isolation,<br>Interfaces to the system | 500 V                                                         |                            |
| Ambient conditions                              | Standard                                                      | ColdClimate ❄              |
| Operating temperature                           | -30 .. +60 °C                                                 | -30 .. +60 °C              |
| Rel. humidity operation                         | 5 .. 95% without condensation                                 | 5 .. 95% with condensation |
| Storage temperature                             | -40 .. +85 °C                                                 | -40 .. +85 °C              |
| Rel. humidity storage                           | 5 .. 95% with condensation                                    | 5 .. 95% with condensation |
| Model variants                                  |                                                               |                            |
| DPM200                                          | Profibus master/slave module; 12Mbit/s; Profibus V0; isolated |                            |
| DPM200❄                                         | like DPM200; ColdClimate (❄)                                  |                            |

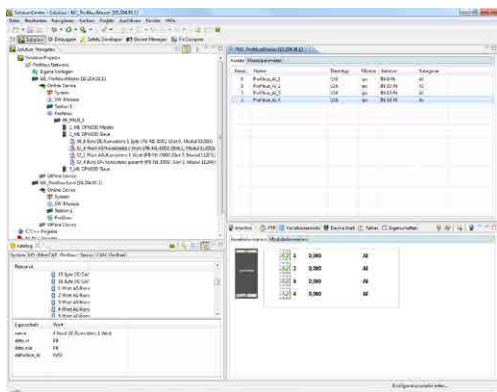


## PROFIBUS configurator

The Device Manager contains a complete configuration tool for creation of PROFIBUS configurations for master and slave applications of the M1 system. Devices from any manufacturer can be added to the catalog via their standardized device description file in GSD format, and integrated in the configuration.

The PROFIBUS configurator enables creation of networks with an M1 controller as master station and multiple slave stations. Likewise, M1 DP slave stations can either be configured together with an M1 master, or a pure slave configuration can be created for an M1.

In this regard the slaves can be additional M1 controllers or also standard-conformant slave devices from other manufacturers. For an M1 controller a pure slave configuration can also be created. For this station a GSD file can be exported that facilitates integration in a different configuration tool.



On the master and slave station the configurator automatically generates logical I/O modules for access to the process data that permit an immediate diagnosis and signal test via the Device Manager and enable easy integration into the process image. Bit-coded values can in this manner be conveniently split into the individual DI or DO signals and given symbolic channel names, without the necessity of masking out the bits in the application program.

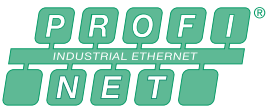
- Graphic network configuration
- Catalog for managing device descriptions files in GSD format
- Generates complete network configurations for applications with M1 as master
- Generates reduced configuration for applications with M1 as slave, if a master from a different manufacturer is used
- Exports GSD files for configured M1 slaves for use in other tools
- Flexible creation of access channels that organize the byte stream of the PROFIBUS in handy process values

# Fieldbuses – PROFINET

## More flexibility, a more efficient network.

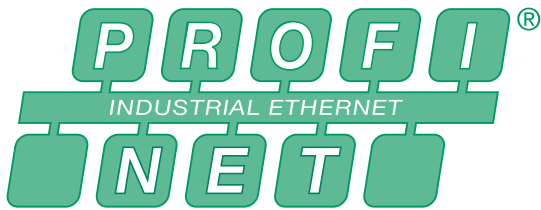
The Ethernet-based fieldbus system, PROFINET IO RT, is the technical successor of PROFIBUS DP. The advantage of Ethernet as a media is the flexibility of the network topology, as standard Ethernet switches can be used. Moreover, the network infrastructure can be used

in parallel for other traffic. Thanks to the prioritized transmission of PROFINET, other protocols, such as FTP, HTML, visualization, etc. can be operated on the same physical network.



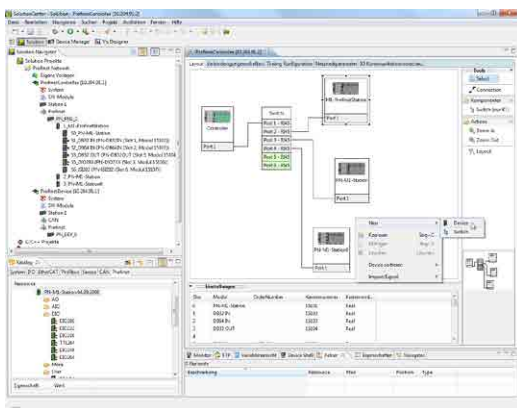
| Features                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode controller (master) and device (slave)                                                                                                                                   |
| Transmission of I/O channel values of the device to and from the controller                                                                                                   |
| Transmission of process values (SVI) of the device to and from the controller via data blocks                                                                                 |
| Configuration data for I/O channels on the device (measuring range, signal direction, etc.) are stored on the controller and transmitted to the devices when the system boots |
| Standardized GSDML file available for configuration in other configuration tools                                                                                              |
| Minimum bus cycle 1 ms                                                                                                                                                        |
| Data rate 10/100 Mbit                                                                                                                                                         |
| Other TCP/IP data traffic on the same network is possible                                                                                                                     |





## PROFINET IO (RT)

At Bachmann electronic PROFINET RT is a pure software solution that can be started on the available Ethernet ports of the controller. The control system can be operated as PROFINET controller (master) and as PROFINET device (slave). The PROFINET device offers access to its I/O channels to the PROFINET controller. Each module on the device can be assigned to another controller, or input values can be read by several controllers (Shared Device). Moreover, the PROFINET device offers also access to process variables of its local application programs. Thus it is not only possible to create I/O-Slaves but also devices with local intelligence (I-Device). An I-Device works directly on its I/O-Signals and synchronizes itself with a superior controller.



- Transmission of I/O channel values from and to the controller
- I-Device: Transmission of process variables (SVI) for coupling between CPUs (intelligent device)
- Shared Device: Modules of a device can be assigned to several controllers
- Automatic handling of transmission errors, different switch-on sequences, and network failures
- Extensive diagnostics
- Parallel operation with other Ethernet traffic in the same network
- Cycle times  $\geq 1$  ms
- Adjustable reduction ratio for individual process values that should be transmitted less frequently, e.g. for analog inputs



## PROFINET configurator

The graphical configurator for PROFINET networks is part of the Device Manager in the SolutionCenter. It enables the design of the network topology, including all switches and cables. The devices are managed via the standardized GSDML files in the PROFINET catalog.

On the devices, modules can be assigned to slots according to the information in the GSDML files. For configuration of I-Devices, the communication of process variables between M1 PROFINET devices and the PROFINET controller is organized with data blocks. SVI variables of the application software are assigned to the data blocks and can then be exchanged with a PROFINET controller.

On the M1 PROFINET controller, the I/O and process values of its devices are represented as logical I/O modules which enable convenient access to the process data for application software and diagnostic tools. Network parameters such as timeout limits, optional stations, assignment of process values to communication relations, and further settings are available in parameter tables.

The controller- and device-configurations are automatically distributed to all participating M1 systems. Additionally, the configuration project is stored on the controllers, so the configuration can be directly opened for verification or change. This grants that the maintenance engineer always works on the current network configuration.

- Complete network configurations for the PROFINET controller
- Partial network configurations for M1 PROFINET devices
- Device catalog for managing GSDML description files
- Free arrangement of the devices in the graphical network layout editor
- Assignment of the modules to the slots on the device
- Convenient processing of network and device parameters in tables
- Generation of logical I/O modules on the controller
- Direct opening of the existing configuration from the controller



\_\_\_\_\_



- max. 4 MBUS201 masters per M1 controller
- M-Bus protocol implemented as fieldbus
- max. 5 meters (slaves) per master
- Adapter can be inserted directly on the DSUB connector
- Integrated M-Bus power supply
- Interfaces M-Bus and RS232 are galvanic isolated
- LED display for collision detection and power supply
- Data transmission at 300 to 9600 bps

| Item    | Item no.    |
|---------|-------------|
| MBUS201 | 00019766-00 |

| MBUS201                     |                 |                                                                                                                               |
|-----------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------|
| Interfaces                  |                 |                                                                                                                               |
| M-Bus                       |                 | In accordance with DIN EN 13757-2                                                                                             |
|                             | Connection      | Spring-force terminal in housing, shield support                                                                              |
|                             | Number of nodes | max. 5 counters (slaves) per master                                                                                           |
|                             | Data rate       | 300 to 9600 bps                                                                                                               |
| RS232                       |                 | In accordance with EIA-232, D-Sub 9-pin, socket, no hardware handshake                                                        |
| Power supply                |                 | 24 V ( 20 .. 30 V DC)                                                                                                         |
| Current consumption         |                 | max. 0.25 A                                                                                                                   |
| Reverse polarity protection |                 | yes                                                                                                                           |
| Status displays             |                 |                                                                                                                               |
| Power supply                |                 | LED green                                                                                                                     |
| Collision detection- M-Bus  |                 | LED yellow                                                                                                                    |
| Housing                     |                 |                                                                                                                               |
| Dimensions (W x H x D)      |                 | 32 x 60 x 15 mm                                                                                                               |
| Nickel-plated zinc die-cast |                 |                                                                                                                               |
| Mounting                    |                 | Hex socket (size 2.5) with ball head                                                                                          |
|                             |                 |                                                                                                                               |
| Operating temperature       |                 | -30 .. +60 °C                                                                                                                 |
| Rel. humidity, operation    |                 | 5 .. 95 % without condensation                                                                                                |
| Storage temperature         |                 | -40 .. +85 °C                                                                                                                 |
| Rel. Humidity, storage      |                 | 5 .. 95 % without condensation                                                                                                |
| Model variants              |                 |                                                                                                                               |
| MBUS201                     |                 | M-Bus master adapter; energy measurement fieldbus EN13757; M-Bus interface to RS232 DSUB 9; 24V power supply; up to 9,6kbit/s |

# Fieldbuses – MODBUS TCP/UDP/RTU

## Modbus

**Simply proven, proven simple.**

Modbus is a very simple, but proven fieldbus system. In principle it only knows the two data types, bool and integer, and a set of queries that are always posed by the master and answered by the slaves. Modbus RTU was originally developed for serial interfaces, later the principles were then extended to Ethernet with Modbus TCP and Modbus UDP.

Thanks to its simplicity and its interoperability, Modbus is widely used in older, as well as in new applications. Bachmann electronic offers Modbus master and slave as a pure software solution. Special hardware is not required. Both the Ethernet ports and COM ports of all controller CPUs, as well as the ports of the corresponding bus modules EM203 and RS204 can be used.

## Modbus master / Modbus slave

| Features                                                                     |
|------------------------------------------------------------------------------|
| Modbus master and slave available                                            |
| Supported protocols: Modbus TCP, Modbus UDP and Modbus RTU                   |
| Multiple protocols can be used simultaneously                                |
| Uses existing interfaces of the controller, special hardware is not required |
| Interfaces can be spatially distributed on FASTBUS or BES substations.       |
| Configuration via Device Manager                                             |

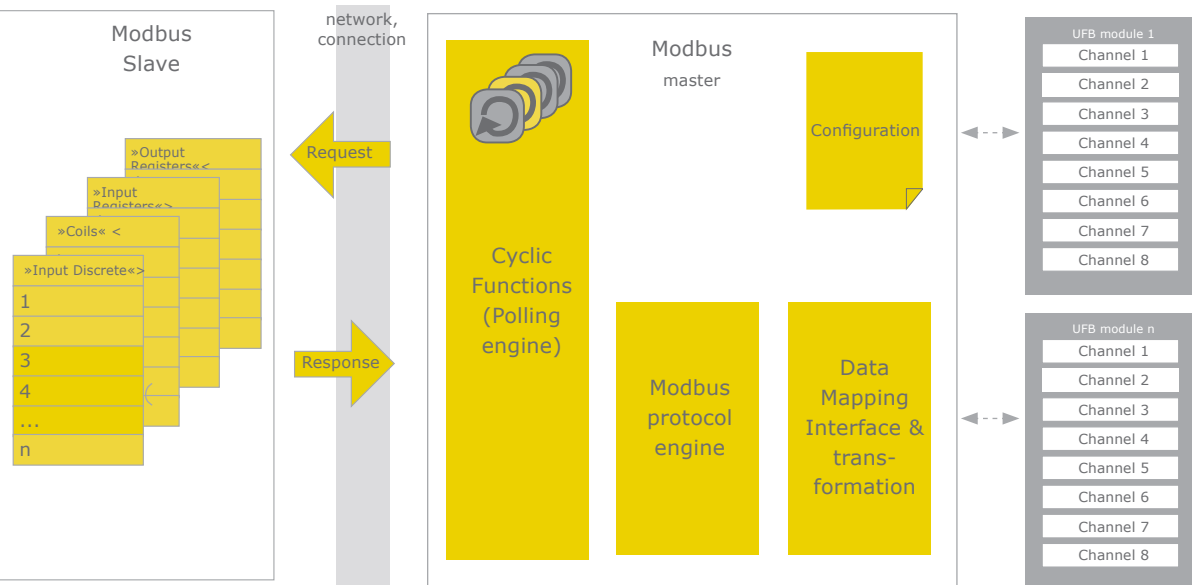


### Modbus master

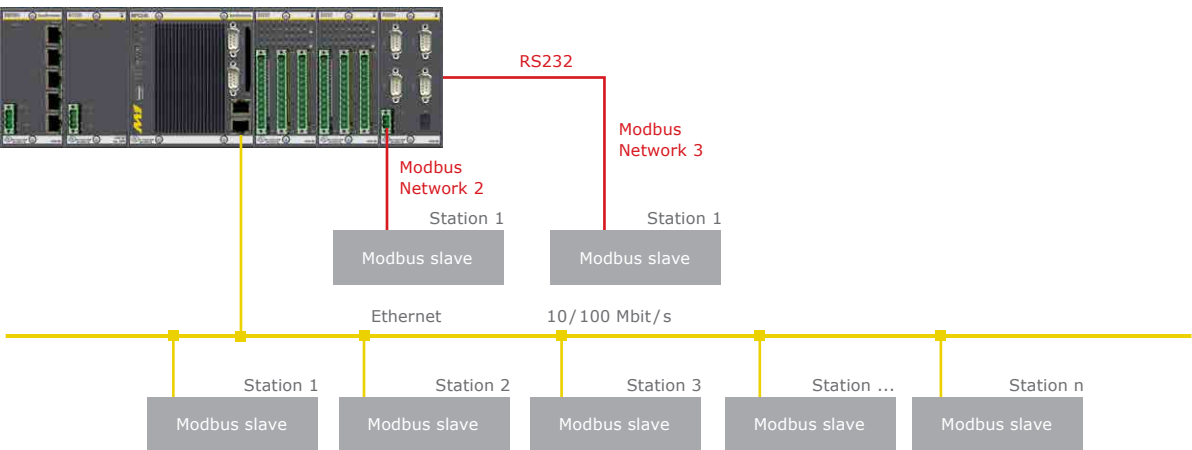
With the Bachmann M1 Modbus master read/write access to the data from any external standard-conformant Modbus slave device is possible. The registers, coils and discrete inputs of the external device are mapped to logical hardware modules of the control system per hardware modules. The cyclic update is executed automatically, the values remain available in the process image. Queries to the slaves are summarized automatically in this process to reduce the load. In addition, the Modbus master offers a function interface via which any Modbus requests can be sent to the slaves. The error messages of the Modbus system (Modbus exceptions) are passed through to the application software. All Ethernet ports for Modbus TCP and UDP, as well as all serial interfaces for Modbus TCP, are available. These can also be distributed spatially to substations of the control system.

- Supported protocols:  
Modbus TCP, Modbus UDP and Modbus RTU
- Use of the onboard interfaces of the CPUs
- Possibility of spatial distribution of the interfaces via FAST substations and EM203 or RS204 module
- Mapping of the contents of the »Modbus Primary Tables« to virtual channel values
- Multiple networks parallel  
(also for different modes)
- Gateway functionality  
(also to other bus systems)
- Investment protection thanks to extremely wide distribution
- Compatibility and openness
- Easy handling

# MODBUS TCP/UDP/RTU



Modbus TCP master





## MODBUS TCP/UDP/RTU

| Protocol                                |                                                                                                                                                                            |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Protocols                               | Modbus RTU<br>Modbus TCP, Modbus UDP                                                                                                                                       |
| Protocol version                        | Modbus Application Protocol Specification V1.1a                                                                                                                            |
| Supported function codes                | 1, 2, 3, 4, 15, 16 (are used automatically purely through configuration). Via a function interface any function codes can be called directly from the application program. |
| Interfaces                              |                                                                                                                                                                            |
| Physical layer – Modbus RTU             | RS232, RS422, RS485                                                                                                                                                        |
| Interfaces – Modbus RTU                 | serial interfaces to M1-CPU, CT300 series, CT200 series                                                                                                                    |
| Distributability – Modbus RTU           | yes (FASTBUS or BEM / BES substation with RS204 module)*                                                                                                                   |
| Physical layer – Modbus TCP             | Ethernet 10 / 100 MBit in accordance with IEEE 802.3                                                                                                                       |
| Interfaces – Modbus TCP                 | ETH0 and ETH1 to M1-CPU, CT200 series                                                                                                                                      |
| Distributability – Modbus TCP           | yes (FASTBUS or BEM / BES substation with EM203 module)*                                                                                                                   |
| Performance data                        |                                                                                                                                                                            |
| Multiple Modbus networks simultaneously | yes (up to 8 networks per CPU)                                                                                                                                             |
| Nominal transfer rates serial (RTU)     | 38400, 19200, 9600, 4800 bits/s (gross)                                                                                                                                    |
| Nominal transfer rates Ethernet (TCP)   | 10 / 100 Mbit / s (gross)                                                                                                                                                  |
| Parallel traffic to Modbus TCP          | yes (normal IP traffic via the same interface)                                                                                                                             |
| Word order                              | configurable                                                                                                                                                               |
| Optimization                            | automatic summary of requests                                                                                                                                              |
| Diagnostics and safety                  |                                                                                                                                                                            |
| Log book support                        | yes (with adjustable debug level)                                                                                                                                          |
| Online diagnostics                      | yes                                                                                                                                                                        |
| Implementation                          |                                                                                                                                                                            |
| Form of delivery                        | IO driver (modbus.m)                                                                                                                                                       |
| Interface to the application            | virtual modules in accordance with the »Unified Fieldbus Model« for access via MIO or process image                                                                        |
| Configuration data format               | mconfig.ini (ASCII)                                                                                                                                                        |
| System prerequisites                    |                                                                                                                                                                            |
| Supported devices                       | all controller CPUs                                                                                                                                                        |

\* Substation operation via RS204 at reduced data rate/overall performance depends on overall application

# MODBUS TCP/UDP/RTU

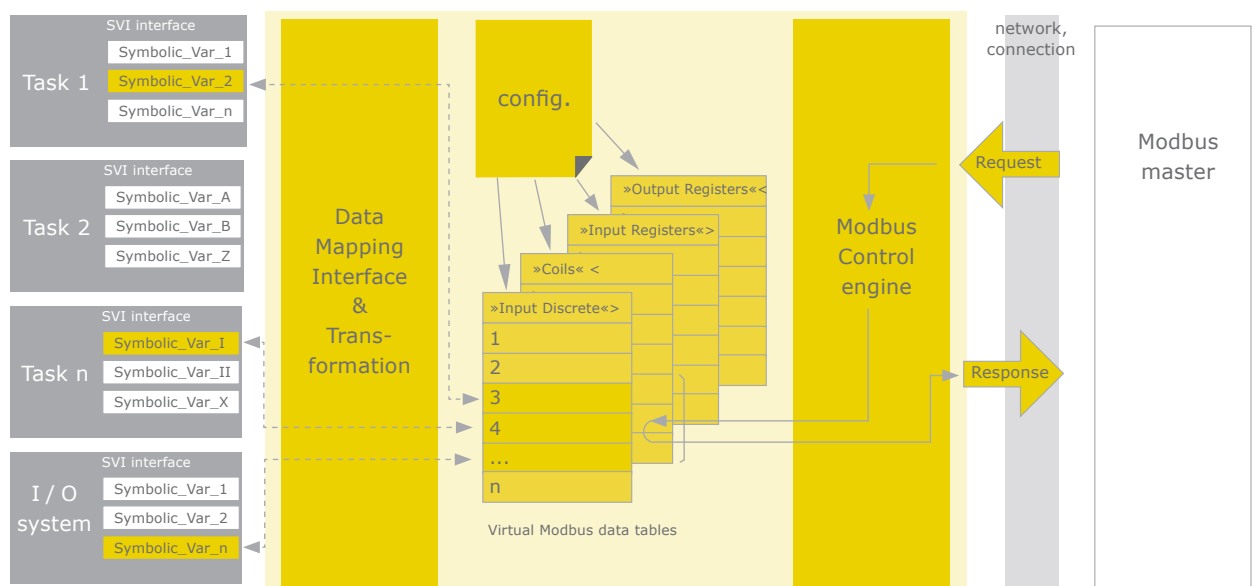


## Modbus slave

The Modbus slave can be installed as a software module on every controller CPU. Controlled through a mapping table, it reads variables of the system and makes them available on Modbus registers, where they can be read by every standard-conformant Modbus master. Write accesses of the master are appropriately forwarded by the Modbus slave to the mapped variables. In this manner process variables of the user software, direct I/O signals, as well as system variables, such as time of the controller, can be transparently presented for the external Modbus master.

All Ethernet ports for Modbus TCP and UDP, as well as all serial interfaces for Modbus TCP, are available. These can also be distributed spatially to substations of the control system.

- Supported protocols: Modbus TCP/UDP/RTU
- Use of the onboard interfaces of the CPUs
- Possibility of spatial distribution of the interfaces via FASTBUS substations and EM203 or RS204 module
- Mapping of any SVI variables in the Modbus Primary Tables
- Mapping of any I / O channels in the Modbus Primary Tables
- Easy data access through applications (bidirectional)



## MODBUS TCP/UDP/RTU

| Protocol                                   |                                                                                                                  |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Protocols                                  | Modbus RTU, Modbus UDP, Modbus TCP                                                                               |
| Protocol version                           | Modbus Application Protocol Specification V1.1a                                                                  |
| Data direction                             | bidirectional                                                                                                    |
| Supported function codes                   | 1, 2, 3, 4, 5, 6, 15, 16                                                                                         |
| Interfaces                                 |                                                                                                                  |
| Physical layer – Modbus RTU                | RS232, RS422, RS485                                                                                              |
| Interfaces – Modbus RTU                    | serial interfaces on controller CPUs                                                                             |
| Distributability – Modbus RTU              | yes (FASTBUS or BEM / BES substation with RS204 module)*                                                         |
| Physical layer – Modbus UDP                | Ethernet 10 / 100 MBit in accordance with IEEE 802.b                                                             |
| Interfaces – Modbus TCP                    | all Ethernet interfaces of the controller CPUs                                                                   |
| Distributability – Modbus TCP              | yes (FASTBUS or BEM / BES substation with EM203 module)*                                                         |
| TCP/IP Port                                | adjustable, preset: 502                                                                                          |
| Performance data                           |                                                                                                                  |
| Multiple slave instances simultaneously    | yes up to 4 instances per CPU for concurrent operation in multiple Modbus networks.                              |
| Nominal transfer rates serial (RTU)        | 38400, 19200, 9600, 4800 bits / s (gross)                                                                        |
| Nominal transfer rates Ethernet (TCP)      | 10/100 Mbit /s (gross)                                                                                           |
| Multiple master connections simultaneously | yes, for Modbus TCP configurable, number of simultaneous master connections (default 10). For UDP no limitation. |
| Parallel traffic to Modbus TCP             | yes (normal IP traffic via the same interface)                                                                   |
| Diagnostics and safety                     |                                                                                                                  |
| Log book support                           | yes (with adjustable debug level)                                                                                |
| Online diagnostics                         | yes                                                                                                              |
| Online connection statistics               | yes                                                                                                              |
| Access limitation                          | yes (configurable list of allowed IP addresses)                                                                  |
| Implementation                             |                                                                                                                  |
| Form of delivery                           | Software module (modus.m)                                                                                        |
| Connection to process data                 | SVI variables, flags and I/O signals                                                                             |
| Configuration data format                  | mconfig.ini (ASCII)                                                                                              |
| System prerequisites                       |                                                                                                                  |
| Supported devices                          | all controller CPUs                                                                                              |

\* Substation operation via RS204 at reduced data rate/overall performance depends on overall application

# Telecontrol/field level

## Standard communication in energy plants/substation automation.

Facilities for energy generation, transmission and distribution require a particularly high level of availability and are therefore critical infrastructures. Communication systems for control facilities and substation automation have therefore become established that are specially adapted to the additional requirements involved. A high level of standardization as well as a particularly robust design are essential for worldwide use in networks covering several regions.

Time stamps and other meta data in addition to the actual values and special transmission types are often provided. The M1 automation system offers telecontrol/substation protocols as ready-to-use, installable software packages that can be combined as required. A key benefit is the fact that available application logic that has already been tested does not have to be modified selectively for each protocol. It is only necessary to configure the variables (SVI) to be exchanged.

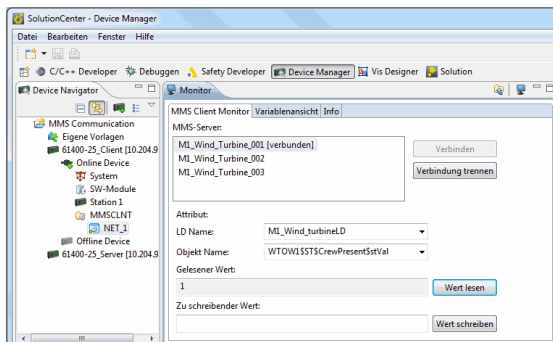
### MMS client (IEC61850 / IEC61400-25)

| Features                                                             |
|----------------------------------------------------------------------|
| Communication in accordance with standards IEC61400-25 or IEC61850   |
| Pure software solution, special additional hardware is unnecessary   |
| Shared operation with other protocols on the same Ethernet interface |
| Enables access from outside to variables of the controller           |



### **MMS client (IEC61850 / IEC61400-25) Manufacturing Message Specification client**

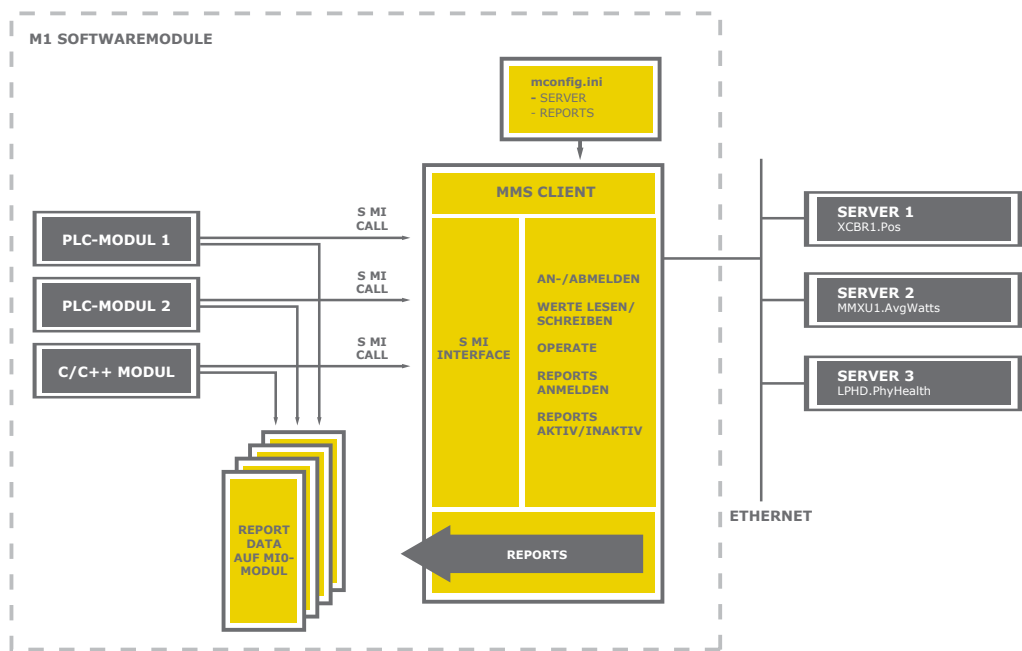
Numerous switching, protective, and measurement devices in the energy technology area are equipped with an Ethernet interface and offer communication in accordance with the IEC61850 standard. Via this interface parameters can be assigned for the devices, and the devices can be diagnosed, and actual values can be picked up through polling or received per report. Previously this interface has been primarily served by SCADA and control room systems. Through the Bachmann MMS client the control system is capable of directly using the IEC61850 interface of such peripheral devices. The MMS client behaves on the controller in a manner similar to a fieldbus driver: It supplies actual values and reports of the peripheral devices directly into the application software. Inversely, switch commands, setpoints and parameters for the peripheral device can be set directly from the application program.



- Pure software solution, special additional hardware is unnecessary
- It is started as a stand-alone service directly from the application software
- Common operation with other protocols on the same Ethernet port and in the same network
- Configuration via SolutionCenter, no external tools are required
- Operates devices in accordance with IEC61850 and/or IEC61400-25 in the same network
- Operating interface for sequential programs (IEC61131-3, C/C++) via SMI for temporal decoupling
- Library for PLC programming in accordance with IEC61131-3
- Header file for C/C++ programming
- Disclosed interface for tools and visualizations
- Report data is available via logical I/O modules for application programs and tools
- Commissioning and diagnostics monitor in the SolutionCenter

# Telecontrol/field level

| MMS client (IEC61850 / IEC61400-25)                                     |                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Usability                                                               |                                                                                                                                                                                                                      |
| Implementation areas                                                    | wind power in accordance with IEC61400-25<br>distributed energy resources: CHP, photovoltaic, Heat accumulators in accordance with IEC61850-7-420<br>switchgear and protective devices in accordance with IEC61850-7 |
| Scope of delivery                                                       | software components for the controller<br>PLC library and C-defines for operation of the API<br>test and diagnostics monitor in the SolutionCenter<br>user manual<br>sample configuration<br>PCS sample project      |
| User interface                                                          | Individual read and write commands via non-blocking PLC modules (PLC) or non-blocking calls (C/C++).<br>Incoming report data on logical IO modules and in the process image.                                         |
| Capabilities in accordance with IEC 61400-25/IEC 61850                  |                                                                                                                                                                                                                      |
| Login/logout on the external server with or without password            | Associate, Abort, Release                                                                                                                                                                                            |
| Check connection status                                                 | MMS status request                                                                                                                                                                                                   |
| Read value from data attributes                                         | GetDataValues                                                                                                                                                                                                        |
| Write value from data attributes                                        | GetDataValues                                                                                                                                                                                                        |
| Write value from data attributes                                        | SetDataValues                                                                                                                                                                                                        |
| Activation and configuration – buffered and unbuffered reports (BR, UR) | Get/SetBRCBValues, Get/SetURCBValues, BRCB...buffered report control block                                                                                                                                           |
| Generating, deleting and reading of datasets                            | CreateDataSet, DeleteDataSet, GetDataSetDirectory                                                                                                                                                                    |
| Issuing of switch commands (operates)                                   | Select, Select with value, Operate, Cancel, TimeActivatedOperate                                                                                                                                                     |
| Receipt of information reports as reaction to operates                  |                                                                                                                                                                                                                      |





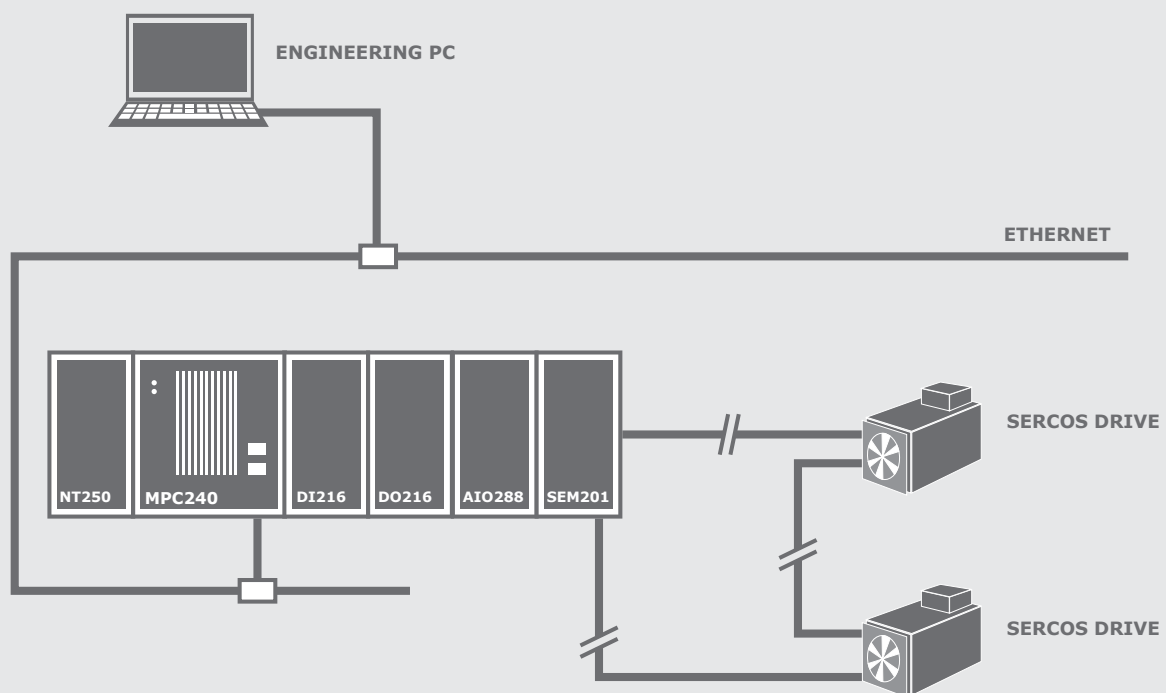
## Fieldbuses – SERCOS

**Specialized for rigorous requirements.**

SERCOS (SErial Realtime COmmunication System) is a dedicated bus system for activation of high-quality electric drives and servo amplifiers. Communication is configured on the controller and distributed to the drives when the system boots. The process data of the drive is available in standardized form and makes not only the numeric values available

via appropriate services, but it also makes meta information, such as symbolic names, input limits and units, available. Via service channel accesses, in addition to the cyclic process data, acyclic parameters at runtime from the application program can also be changed or transferred from a list of initial parameters at system start.

### Possible topology: SERCOS







**sercos**  
the automation bus

**SERCOS master module SEM201**

The SERCOS (Serial Real-time Communication System) master module SEM201 is capable of controlling up to 32 drives. The bus has a ring structure and offers a high level of interference immunity thanks to the fibre optic technology.

- SERCOS 2 Standard IEC 61491
- Fiber optic technology
- Bus with ring structure
- 2 Kb x 32 DPRAM
- Transfer rates: 2/4/8/16 Mbaud
- Cycle times: 62.5 µs .. 65 ms
- Multiple masters can be synchronized

| Item   | Item no.    |
|--------|-------------|
| SEM201 | 00011756-00 |

| SEM201                         |                                                                               |
|--------------------------------|-------------------------------------------------------------------------------|
| Description                    |                                                                               |
| Channels/drives                | fiber optic ring with max. 32 drives, 2 kB x 32 DPRAM                         |
| Modules per controller         | max. 12                                                                       |
| Transfer rate                  | 2/4/8/16 Mbaud                                                                |
| Cycle times                    | 62.5 µs .. 65 ms                                                              |
| Synchronization                | multiple masters can be synchronized                                          |
| Certified by                   | SI – Sercos International (formerly IGS)                                      |
| Galvanic isolation from system | yes, via fiber optic cable                                                    |
| Ambient conditions             |                                                                               |
| Operating temperature          | 0 .. +60 °C                                                                   |
| Rel. humidity operation        | 5 .. 95 % without condensation                                                |
| Storage temperature            | -40 .. +85 °C                                                                 |
| Rel. humidity storage          | 5 .. 95 % without condensation                                                |
| Model variants                 |                                                                               |
| SEM201                         | Sercos master module; 2/4/8/16MBaud; SERCOS II; FO interface 2x FSMA (In/Out) |

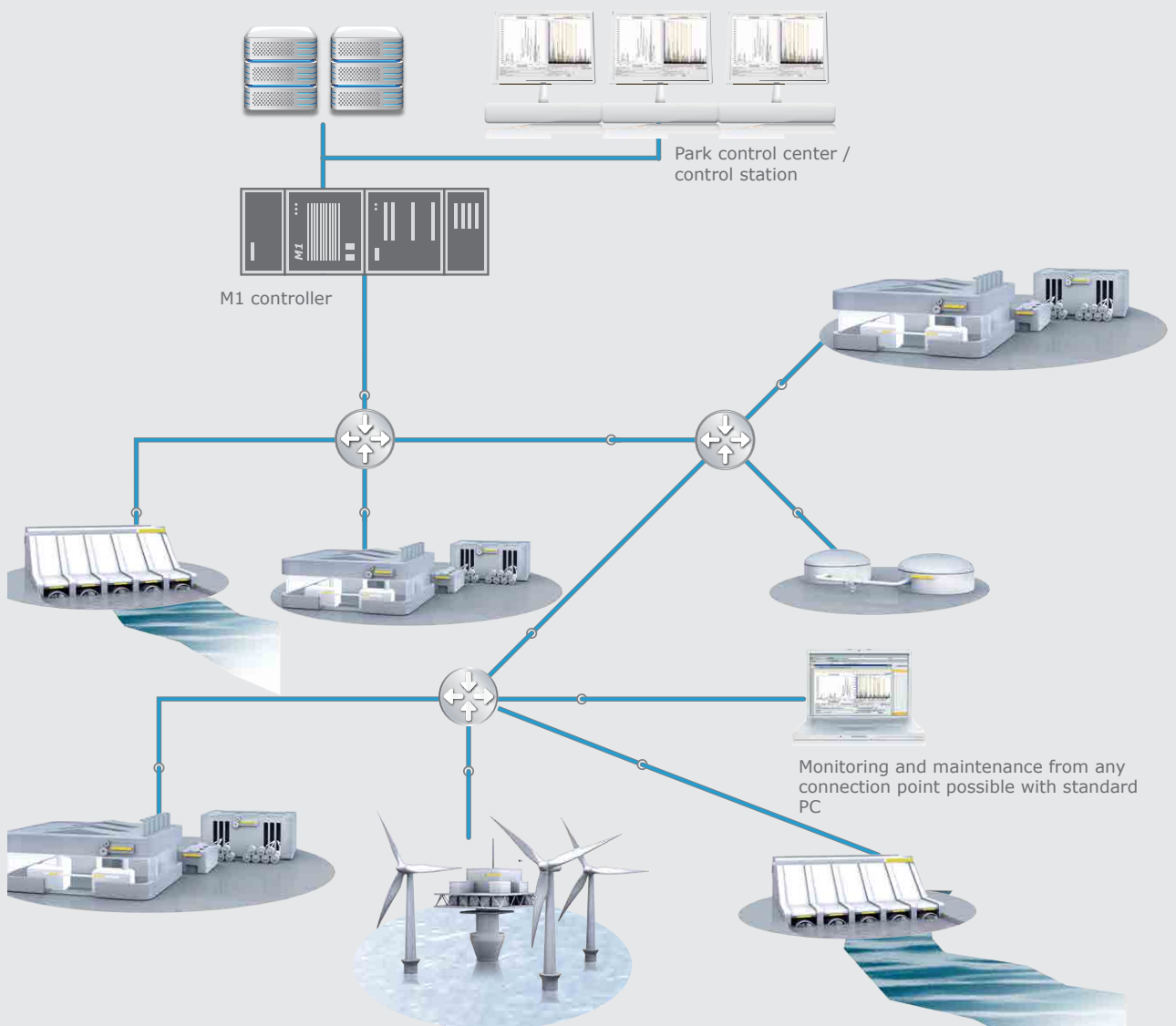
## The real-time communication solution for large projects

Renewable energy sources like solar and wind power stations exist in ranges and dimensions that vary considerably. Beginning with separate installations at a distance of a few hundred meters up to hundreds of participants spread across several square kilometers, the installations have to maintain contact among themselves and with a monitoring and control center. Operators are placing ever higher demands on the controllability of such virtual power stations. In order to be able to react positively to errors like LVRT and FRT, there has to be a swift and reliable real-

time connection to every separate power station. Diagnostic and remote maintenance tasks, e.g. state-of-the-art condition monitoring analyses, should be possible parallel to time-sensitive communications.

bluecom provides reliable real-time communication technology for the highest performance requirements, specifically optimized for renewable energy systems' rapid exchange of information. Top reliability, easy maintenance and diagnosability, as well as adaptability to existing networks, have been achieved. As a software-only solution absent with special

### bluecom - energy park/virtual power station networking model



requirements for CPU and compatible to a broad spectrum of network hardware, applications in user-defined topologies can be put into effect, having up to 500 participants and saves resources. Library functions for cyclic and acyclic communication in IEC 61131-3, C and C++ make for the greatest easy development. The configuration, monitoring and diagnostic analysis are executed via the SolutionCenter.

Thanks to its compatibility with Ethernet standard IEEE 802.3, bluecom provides a sustainable solution for the networking tasks of modern power stations. bluecom at once predefines the optimization of performance with lower CPU and network load for master-master communication at the machine and plant level too.



## bluecom

### Features

Networking of more than 500 subscribers in a free network topology with bidirectional transmission of at least 250 bytes in a real-time cycle of 20 ms.

Continuous additions of stations and entire network segments during real-time operation

Optimization of speed and bandwidth utilization ensure high data throughput with low CPU and network load

Monitoring and analysis of the state of the network and the fastest location of errors possible with no extra effort via integrated diagnostic and monitoring interfaces

Standards-compliant implementation is the basis for the influence-free coexistence of real-time communication parallel to other Ethernet-based protocols and services



## bluecom

bluecom defines an open real-time transmission protocol optimized for the requirements of diverse Ethernet based network structures that have grown over time. Structures such as these can be found in the networking of alternative energy plants, for instance, the so-called virtual power stations.

bluecom connects hundreds of network devices deterministically and is not assigned to proprietary extensions of Ethernet standard IEEE 802.3. The user is free to choose the topology, the transmission medium and the transmission rate. As a result, bluecom render the most cost-efficient real-time networking of new and pre-existing systems possible.

- Real-time networking of more than 500 sub-stations with cycle time of less than 20 ms at 250 bytes of bidirectional data transmission
- Compatible with every MX, MPC, MH and MC series processor module
- Ethernet-based real-time protocol without specific requirements for networking topology
- Optimized for speed and bandwidth utilization
- Efficiency by design (low CPU and networking utilization)
- Hot-plug functionality when removing and adding network stations

| Item           |                                                                                                                                                                                                                                                                 | Item no.    |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| bluecom CL     | License to operate the bluecom communication software on any number of Bachmann controller CPUs (Redistribution exclusively together with CPU modules).                                                                                                         | 00019331-61 |
| bluecom CL AMT | One year extension of product support and update delivery for the bluecom Company License.                                                                                                                                                                      | 00019331-71 |
| bluecom RT     | Runtime License to operate the bluecom communication software on one controller CPU. Enables the communication with one or several bluecom compliant devices. Extension of product support and update delivery is covered by a valid M-Base Annual Maintenance. | 00019331-63 |
| bluecom DL     | License to develop bluecom compatible products on third party devices by any number of employees in one location (Porting License).                                                                                                                             | 00020721-64 |
| bluecom DL AMT | One year extension of product support and update delivery for the bluecom Porting License.                                                                                                                                                                      | 00020721-74 |

- Parallel communication via the same interfaces and media, without impact on real-time capabilities (HTTP, FTP, video, VoIP, ...)
- Priorization of Ethernet traffic acc. to IEEE 802.3q
- Configurable bandwidth limit
- Subnet formation and cascading
- Multi-master functionality
- Integrated error detection and diagnostics functionality
- Configurable I/O mapping of network variables
- Programming and diagnostic interface in IEC 61131-3 and C/C++

| bluecom                          |                                                                                                                                                               |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rationale / Type / Compatibility |                                                                                                                                                               |
| Protocol type                    | Ethernet-based real-time protocol                                                                                                                             |
| Ethernet compatibility           | yes, as per IEEE 802.3q (ISO/OSI layer 1+2)                                                                                                                   |
| Registered IEEE Ethertype        | 0x892D                                                                                                                                                        |
| Transmission medium              | independent of transmission medium<br>wireless communication (802.11) permissible once the jitter requirements have been taken care of                        |
| Gateway functionality            | Interface of different network types on the application level                                                                                                 |
| Fieldbus                         | CAN, Profibus DP, Profinet, Modbus UDP + TCP, EtherCAT                                                                                                        |
| Control station level            | Standard protocols:<br>IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP<br>Application development:<br>communication library M1Com and M1Com.NET |
| Topology / Networking            |                                                                                                                                                               |
| Topologies                       | Star, bus, ring*, mesh network                                                                                                                                |
| Dimension                        | in compliance with IEEE 802.3 - max. 2000 m per network section via fiber optic connection (FCS214)                                                           |
| Transfer rates supported         | 100 Mbit/s, 1 Gbit/s                                                                                                                                          |
| Time synchronization             | via PTP (IEEE 1588) **                                                                                                                                        |
| Switches / infrastructure        | Standard Ethernet IEEE 802.3q                                                                                                                                 |
| Parallel data traffic            | yes, possible<br>Ethernet-based protocols and services, e.g. HTTP(S), FTP(S), SMTP, SMTP, video stream, Modbus, OPC, MMS, ...                                 |

\* employing appropriate network hardware

\*\* accuracy achievable subject to CPU type used and master clock used

| bluecom                                |                                                                                                                                                          |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration / Programming            |                                                                                                                                                          |
| Configuration                          | SolutionCenter (support via wizards)                                                                                                                     |
| Remote configuration                   | yes (Ethernet LAN, Internet)                                                                                                                             |
| Network configuration                  | SolutionCenter (support via wizards)                                                                                                                     |
| Programming                            | IEC 61131-3, C/C++ user interfaces integrated, Library functions                                                                                         |
| Software interfaces                    | API for sending and receiving and for monitoring and checking the full and proper delivery of packets, as well as the management of I/O stations         |
| Network variables                      | yes (configuration of variables at the endpoints automatically generates bluecom communication channel)                                                  |
| Adding/removing slaves                 | yes, possible (hot plug)                                                                                                                                 |
| Diagnostics / Monitoring               |                                                                                                                                                          |
| I/O live display                       | yes (SolutionCenter, IEC 61131-3, C, C++)                                                                                                                |
| I/O network variables                  | yes, for every I/O channel (status, value)                                                                                                               |
| Channel status                         | yes, for every bluecom channel                                                                                                                           |
| Error status                           | yes (SolutionCenter, IEC 61131-3, C, C++)                                                                                                                |
| Diagnostics                            | yes (SolutionCenter, IEC 61131-3, C, C++)                                                                                                                |
| Statistics                             | yes (SolutionCenter, IEC 61131-3, C, C++)                                                                                                                |
| Network monitor                        | SolutionCenter                                                                                                                                           |
| Network analysis                       | yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)                                                                 |
| Bandwidth limitation                   | Monitoring and limitation of real-time communication bandwidth use included (adjustable, pre-configured: 35 Mbit/s)                                      |
| Jitter monitoring                      | yes                                                                                                                                                      |
| QoS                                    | yes (IEEE 802.3q)                                                                                                                                        |
| Performance data                       |                                                                                                                                                          |
| Number of I/O stations                 | max. 500 *** (restricted by software)                                                                                                                    |
| Cycle time                             | 200 µs .. 1 s *** (any intermediate values configurable)                                                                                                 |
| Transmission frame cyclic              | 0 .. 1400 bytes per payload unit                                                                                                                         |
| Transmission frame acyclic             | 32000 bytes per payload unit                                                                                                                             |
| Capacity under test conditions         | Master CPU: MPC293, slave CPU: MX213, 10 ms cycle, 96 slaves, 50-byte cyclic data exchange bidirectional to each I/O station, transmission medium copper |
| CPU load only Protocol                 | Master: 17%, slave: 1,7%                                                                                                                                 |
| CPU load (Protocol, GetData + SetData) | Master: 27%, slave: 3%                                                                                                                                   |
| Network load                           | Master: 9 Mbit/s, slave: 0.082 Mbit/s                                                                                                                    |

\*\*\* Limit value is subject to the power of the controller and the network, as well as the controller capacity utilization and the network topology/load

| <b>bluecom</b>              |                                                                                                                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Installation</b>         |                                                                                                                                                              |
| Installation medium         | CD ROM or network                                                                                                                                            |
| Installation tool           | SolutionCenter                                                                                                                                               |
| Upgrading existing systems  | by software possible / licence required                                                                                                                      |
| <b>System prerequisites</b> |                                                                                                                                                              |
| Automation equipment        | M1 CPUs of the MX200 series or better (application licence)<br>Porting information is available for implementation on external equipment (developer licence) |
| Software                    | MSys / MxCCore / M-BASE V3.80 or higher                                                                                                                      |
| Network                     | industrial standard managed switch (unmanaged switch with appropriate configuration)                                                                         |

## Communication – Control room networking

### A suitable system for every industry.

Machines and plants usually work as a composite and are coupled to a central data acquisition system, a control room, or a PDA/MES system. Regardless of whether this involves aggregates of a wind park, or production machines of a manufacturing shop – Bachmann

electronic has a suitable communication system for every industry in its product line. A powerful, laboratory-certified OPC server is available in two variants, as well as an MMS server tailored to the energy industry for communication in accordance with IEC61850 and IEC61400-25.



### OPC UA Server

#### Features

- Operation on the controller without additional Windows PC
- OPC UA data access (DA) for accessing process variables
- Read and write access to process variables can be controlled via user groups
- Login can be requested by configuration
- Signing by TLS certificate can be requested by configuration
- Communication encryption can be requested by TLS up to 256 bits



### M1 OPC standard server

#### Features

- OPC Data Access 1.0, 2.04, 2.05, 3.0
- Connection to M1 or CT via Ethernet
- Secure SSL connection to the controllers
- Up to 5 automation devices per server
- Up to 10,000 information points
- Operation under Microsoft Windows 7, Vista, XP

### M1 OPC enterprise server

#### Features

- OPC Data Access 1.0, 2.04, 2.05, 3.0
- Connection to M1 or CT via Ethernet
- Secure SSL connection to the controllers
- No limitation of connected M1 systems
- No restriction of data quantity
- Simulation of clients
- Operation under Microsoft Windows 7, Vista, XP, Server 2003, Server 2008



The telecontrol protocol, according to IEC60870-5-104, is widely used in power generation, power distribution and infrastructure areas. It allows the control and monitoring of intelligent sub-components and sub-stations through a superordinate control center. The palette

of these sub-components ranges from circuit breakers, converters, and energy meters to cogeneration units up to complete power plants.



## MMS Server (IEC61850 / IEC61400-25)

### Features

- Communication in accordance with standards IEC 61400-25 or IEC 61850
- Pure software solution, special additional hardware is unnecessary
- Shared operation with other protocols on the same Ethernet interface
- Enables access from outside to variables of the controller



## IEC60870-5 Server (Slave)

### Features

- Standard compliant implementation of IEC60870-5-101, -103, -104 Server
- Service/software solution that can be subsequently installed
- No changes to the application logic required
- Fully configurable/no application-specific processing via PLC libraries required
- Configurator for commissioning and diagnostic monitor in the SolutionCenter
- Import/export in CSV format for exchange with other manufacturers
- Reducing the amount of data via configurable threshold filters



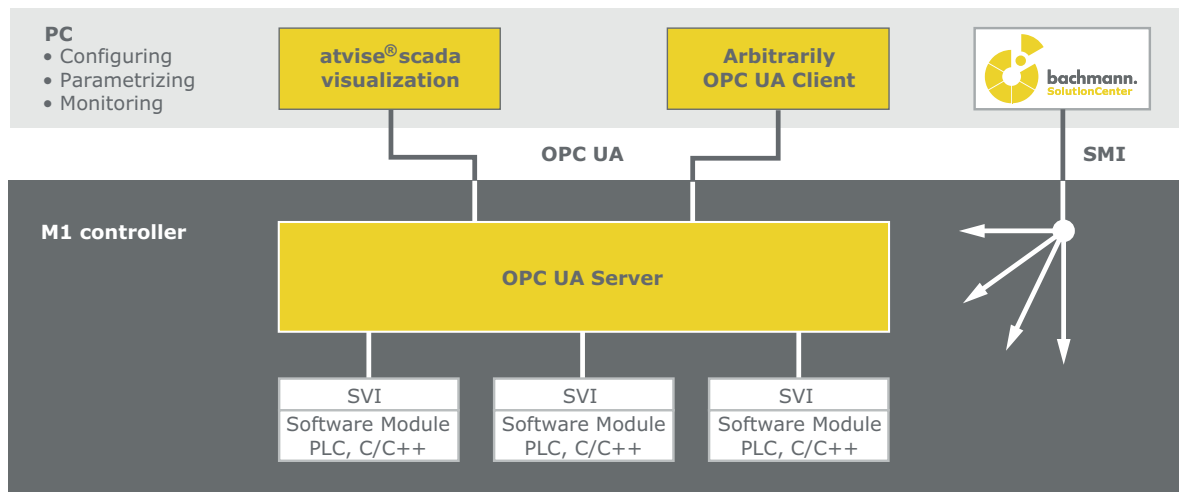
**OPC UA Server  
(Openness, Productivity and  
Connectivity)**

The OPC UA Server is a pure software solution and can be executed directly on the controller CPU without additional hardware. It offers full and transparent access to the process values of the control application. Systems for visualization, Scada or data logging can use OPC UA as manufacturer independent interface. An additional Windows® PC for execution of the OPC server software is no longer required. More benefits from the direct execution on the controller are the automatic recognition of process data without the need to create a configuration, and the accurate source time stamps. If requested, the communication is encrypted, and the communication partners can be identified unambiguously by TLS certificates. Plain communication without login data and the certification check are of course still possible.

- Data Access according to OPC UA specification
- Is installed as additional service on the controller
- Displays the process values of the controller in its address space without additional configuration steps
- Considers access permissions on variables at reading and writing
- Write access can be logged
- Quality is granted by participation at Interop workshops and conformance tests

| Item                             | Item no.    |
|----------------------------------|-------------|
| OPC UA Server (installation DVD) | 00022170-00 |
| OPC UA Server (Licence)          | 00022170-63 |

## Communication – Control room networking



Functionality of OPC UA server

## Communication – Control room networking

| OPC UA Server                       |                                               |
|-------------------------------------|-----------------------------------------------|
| Supported OPC UA Profiles           |                                               |
| Security Profile                    | Security Policy - None                        |
|                                     | Security Policy - Basic128Rsa15               |
|                                     | Security Policy - Basic 256                   |
| Transport Profile                   | UA-TCP UA-SC UA Binary                        |
| Server Profiles                     | Base Server Behaviour Facet                   |
|                                     | Basic DataChange Subscription Server Facet    |
|                                     | Core Server Facet                             |
|                                     | Embedded UA Server                            |
|                                     | Enhanced DataChange Subscription Server Facet |
|                                     | Low End Embedded Device Driver Facet          |
| Supported OPC UA Information Models |                                               |
| Information models                  | Data Access (DA)                              |
| Supported OPC UA Service Sets       |                                               |
| Discovery Service Set               | FindServers                                   |
|                                     | GetEndpoints                                  |
| SecureChannel Service Set           | OpenSecureChannel                             |
|                                     | CloseSecureChannel                            |
| Session Service Set                 | CreateSession                                 |
|                                     | ActivateSession                               |
|                                     | CloseSession                                  |
|                                     | Cancel                                        |
| View Service Set                    | Browse                                        |
|                                     | BrowseNext                                    |
|                                     | TranslateBrowsePathToNodeIds                  |
|                                     | RegisterNodes                                 |
|                                     | UnregisterNodes                               |
| Attribute Service Set               | Read                                          |
|                                     | Write                                         |
| MonitoredItem Service Set           | CreateMonitoredItems                          |
|                                     | ModifyMonitoredItems                          |
|                                     | SetMonitoringMode                             |
|                                     | SetTriggering                                 |
|                                     | DeleteMonitoredItems                          |
| Subscription Service Set            | CreateSubscription                            |
|                                     | ModifySubscription                            |
|                                     | SetPublishingMode                             |
|                                     | Publish                                       |
|                                     | Republish                                     |
|                                     | DeleteSubscriptions                           |

## Communication – Control room networking

| OPC UA Server                     |                                                                                                                             |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Security features                 |                                                                                                                             |
| Encryption                        | see Security Profile                                                                                                        |
| Protection against overload (DoS) | CPU overload caused by clients can be avoided by limiting the minimum sample rate                                           |
| Public Key Infrastructure         | file based on the controller                                                                                                |
| Access logging                    | connections and write operations are stored in the security log of the controller                                           |
| Diagnose                          |                                                                                                                             |
| State variables                   | number of active sessions                                                                                                   |
|                                   | number of active subscriptions                                                                                              |
|                                   | number of items monitored by subscription                                                                                   |
| Show functions                    | list of sessions                                                                                                            |
|                                   | list of all software modules in the address space                                                                           |
|                                   | list of all items in subscriptions                                                                                          |
| Logbook messages                  | amount and type of messages can be selected by debug levels                                                                 |
| Installation                      |                                                                                                                             |
| Shipping                          | as DVD oder by download                                                                                                     |
| Installation                      | via SolutionCenter; Can be installed separately as service on the controller                                                |
| License                           | needs a runtime license for each controller CPU, independant of number of items or clients                                  |
| License protection                | license file depending on hardware                                                                                          |
| System requirements               |                                                                                                                             |
| CPU Hardware                      | all M1 CPU types except ME203 (MH2xx, MC2xx, MPC2xx, MX2xx)                                                                 |
| Memory                            | minimum 64 MB, recommended 128 MB                                                                                           |
| System software version           | M-Base 3.85 or better                                                                                                       |
| Order information                 |                                                                                                                             |
| OPC UA Server (DVD)               | OPC UA Server installation DVD. Contains executable software for installation on the controller and the user documentation. |
| OPC UA Server (Licence)           | licence for operating one installation of the OPC UA Server on one M1 controller system                                     |

## Communication – Control room networking



### **M1 OPC standard server (Openness, Productivity and Connectivity)**

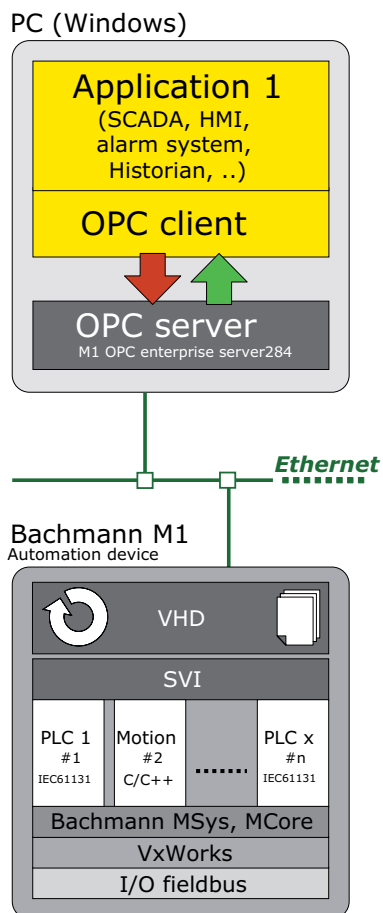
OPC defines a number of manufacturer-neutral software interfaces for automation ([www.opcfoundation.org](http://www.opcfoundation.org)). With OPC data access actual states and values (online data) can be exchanged between controllers and software applications, such as visualizations, control systems or production data acquisition. As a pure software interface OPC runs on a PC or IPC under Windows and communicates with the M1 automation systems via Ethernet. Any standard-conformant OPC clients will then either be operated on the PC of the server, or in the network and permit data exchange in both directions.

The integrated configuration tool supports the selective disclosure of any variables from the control system under a freely selectable item name for the clients. Configurations can either be created directly in the graphic interface, or transferred from other tools via the import/export function. Inversely a test client that is also integrated in the »OPC Configurator« configuration tool allows checking of the data exchange with underlying controllers without a completely set-up OPC client application.



- OPC conformant data server – manufacturer-neutral interface
- Specifications – OPC Data Access 1.0, 2.04, 2.05 and 3.0
- Connection to M1 or CT via Ethernet
- Secure SSL connection to the controllers
- Up to 5 automation devices per server
- Up to 10,000 information points (items/field elements)
- Multi-processor support (depending on operating system)
- Graphic configuration tool
- Flat and hierarchical browsing
- Integrated test client (configuration tool)
- Operation under Microsoft Windows Vista, XP, 2000

## Communication – Control room networking



| OPC standard server               |                                                                                                                                 |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Server                            |                                                                                                                                 |
| Protocol for client application   | OPC data access                                                                                                                 |
| Supported specifications          | V1.0, 2.04, 2.05a, 3.0                                                                                                          |
| Data exchange direction           | bidirectional                                                                                                                   |
| Supported data types              | basis types    UINT1, UINT8, SINT8, UINT16, SINT16, UINT32, SINT32, REAL32, BOOL8, CHAR8, CHAR16, MIXED, REAL64, UINT64, SINT64 |
|                                   | block types    all basis types; basis type BLK (e.g. CHAR8 + BLK = STRING)                                                      |
| Data type mapping                 | SVI on OPC (automatic)                                                                                                          |
| Number of variables (items)       | 10,000 (individual variables or field elements)                                                                                 |
| Time stamp on the server          | yes                                                                                                                             |
| Time stamp from controller        | yes (per group one time item possible)                                                                                          |
| Quality attribute on the server   | yes                                                                                                                             |
| Quality attribute from controller | yes (per group one quality item possible)                                                                                       |

## Communication – Control room networking

| M1 OPC standard server                 |                                                 |
|----------------------------------------|-------------------------------------------------|
| Server                                 |                                                 |
| Display of connection loss             | yes (affected items show quality=BAD)           |
| Server type                            | OUT_PROCESS                                     |
| Operation without GUI                  | yes                                             |
| Flat browsing                          | yes                                             |
| Hierarchical browsing                  | yes                                             |
| Refresh rates                          | dynamically adjustable per group (from 50 ms)*  |
| Multi-processor support                | yes                                             |
| Interfaces to the controller           |                                                 |
| Physical interface to the M1           | Ethernet IEEE 802.3 (10/100 Mbit/s full-duplex) |
| Basis protocols                        | TCP/IP<br>UDP/IP<br>QSOAP                       |
| Protocol                               | SMI/VHD                                         |
| Multiple connections per controller    | yes                                             |
| Simultaneous queries                   | yes                                             |
| Number of connected controllers        | 5 (maximum)                                     |
| Access protection                      | yes, configurable                               |
| Supported security levels              | 0 to 4                                          |
| Encryption                             | SSL (configurable)                              |
| Configuration                          |                                                 |
| Graphic interface                      | yes (OPC configurator)                          |
| Browsing of controllers                | yes                                             |
| Browsing of controller variables (SVI) | yes                                             |
| Import/export                          | yes (CSV)                                       |
| Templates                              | yes                                             |
| Clones (with enumeration)              | yes                                             |
| Restricted access                      | yes (only on configured items)                  |
| Item names                             | OPC-side can be freely configured («renaming»)  |
| Item access rights                     | OPC side can be freely restricted               |
| Integrated test client                 | yes                                             |
| Configurations can be saved            | yes                                             |
| Access protection on configuration     | yes (different user levels)                     |
| Diagnostics                            |                                                 |
| Error logging                          | yes (log file)                                  |
| Debug mode                             | yes (several can be set)                        |
| Diagnosis on items                     | yes (static items)                              |
| Statistics on items                    | yes (static items)                              |

\* Refresh rates depend on the data volume and the computer performance,  
(Free) controller performance and network topology/network load.



## Communication – Control room networking

| <b>M1 OPC standard server</b>            |                                                                                                                     |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Installation</b>                      |                                                                                                                     |
| Installation medium                      | CD ROM or network<br>(See standard package M-Base and M-COM)                                                        |
| Installation can be automated (»silent«) | yes                                                                                                                 |
| <b>System prerequisites – server</b>     |                                                                                                                     |
| Computer                                 | IBM-compatible PC (Intel x86 architecture)                                                                          |
| Processor                                | minimum: Intel Pentium 500 MHz or comparable (Windows 2000)<br>recommended: Intel Core2Duo or Core2Quad with >2 GHz |
| RAM                                      | minimum: 256 MB RAM (Windows 2000)<br>recommended: >1 GB RAM                                                        |
| Network card                             | at least 1x Ethernet 802.3                                                                                          |
| Hard disk                                | >300 MB free                                                                                                        |
| Graphic                                  | 1024 x 768 or better (only for configuration)                                                                       |
| Input devices                            | keyboard, 2-button mouse (only for configuration)                                                                   |
| Operating system (OPC Server)            | Windows Vista<br>Windows XP<br>Windows 2000                                                                         |
| Other software                           | Text editor or MS Excel recommended for external configuration                                                      |
| <b>System prerequisites M1</b>           |                                                                                                                     |
| M1 automation devices                    | families ME, MX, MPC, MPE, as well as CT/WT200 , CT/WT300<br>(achievable performance is type-dependent)             |
| System software                          | MSys V2.11 or higher (for full function scope)                                                                      |



## M1 OPC enterprise server (Openness, Productivity and Connectivity)

OPC defines a number of manufacturer-neutral software interfaces for automation ([www.opcfoundation.org](http://www.opcfoundation.org)). With OPC data access, actual states and values (online data) can be exchanged between controllers and software applications, such as visualizations, control systems or production data acquisition. As a pure software interface OPC runs on a PC or IPC under Windows and communicates with the M1 automation systems via Ethernet. Any standard-conformant OPC clients will then either be operated on the PC of the server, or in the network and permit data exchange in both directions.

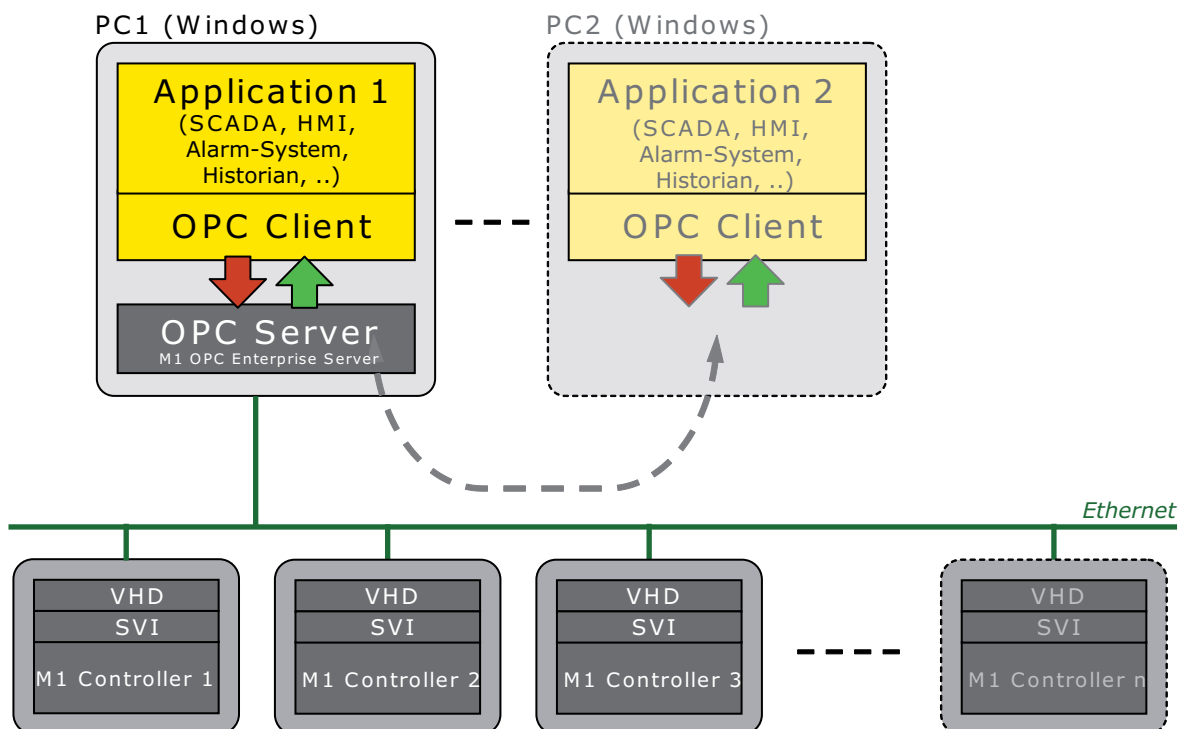
The integrated configuration tool supports the selective disclosure of any variables from the control system under a freely selectable item name for the clients. Configurations can either be created directly in the graphic interface, or transferred from other tools via the import/export function. Convenient copy functions accelerate the configuration or management even for large installations with many connected controllers.

The integrated simulation enables communication tests with client applications even without connected M1 systems. Inversely a test client that is likewise integrated in the »OPC Configurator« configuration tool allows checking of the data exchange with underlying controllers without a completely set-up OPC client application. The Bachmann M1 OPC enterprise server has been specially developed for large installations with a variety of automation devices, i.e. for large data volumes. In addition to the possibility of handling multiple network connections simultaneously, here the parallelization of queries and the multi-processor support have a particular effect.

| Item                                     | Item no.    |
|------------------------------------------|-------------|
| OPC Enterprise Server (Installation-DVD) | 00015632-xx |
| OPC Enterprise Server (Runtime license)  | 00015632-63 |

## Communication – Control room networking

- OPC-conformant data server – manufacturer-neutral interface
- Specifications: OPC Data Access 1.0, 2.04, 2.05 and 3.0
- Connection to M1 or CT via Ethernet
- Secure SSL connection to the controllers
- No restriction of the connected M1 systems\*
- No restriction of data quantity (items)\*
- Multi-processor support (depending on operating system)
- Powerful configuration tool
- Flat and hierarchical browsing
- Simulation for clients (configuration tool)
- Integrated test client (configuration tool)
- Operation under Microsoft Windows 7, Vista, XP, 2000, Server 2003 and Server 2008



\* However there is restriction due to computer performance, network capacity and communication load on the M1 system. The actual achievable throughput depends on the application case.

## Communication – Control room networking

| M1 OPC enterprise server               |                                                                                                                                  |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Server                                 |                                                                                                                                  |
| Protocol for client application        | OPC data access                                                                                                                  |
| Supported specifications               | V1.0, 2.04, 2.05a, 3.0                                                                                                           |
| Data exchange direction                | bidirectional                                                                                                                    |
| Supported data types                   | basis types     UINT1, UINT8, SINT8, UINT16, SINT16, UINT32, SINT32, REAL32, BOOL8, CHAR8, CHAR16, MIXED, REAL64, UINT64, SINT64 |
|                                        | block types     all basis types; basis type + BLK (e.g. CHAR8 + BLK = STRING)                                                    |
| Data type mapping                      | SVI on OPC (automatic)                                                                                                           |
| Number of variables (items)            | user-defined**                                                                                                                   |
| Time stamp on the server               | yes                                                                                                                              |
| Time stamp from controller             | yes (per group one time item possible)                                                                                           |
| Quality attribute on the server        | yes                                                                                                                              |
| Quality attribute from controller      | yes (per group one quality item possible)                                                                                        |
| Display of connection loss             | yes (affected items show quality=BAD)                                                                                            |
| Server type                            | OUT_PROCESS or SERVICE (configurable)                                                                                            |
| Operation without GUI                  | yes                                                                                                                              |
| Flat browsing                          | yes                                                                                                                              |
| Hierarchical browsing                  | yes                                                                                                                              |
| Refresh rates                          | dynamically adjustable per group (from 50 ms)**                                                                                  |
| Multi-processor support                | yes                                                                                                                              |
| Simulation mode                        | yes                                                                                                                              |
| Interfaces to the controller           |                                                                                                                                  |
| Physical interface to the M1           | Ethernet IEEE 802.3 (10/100 Mbit/s full-duplex)                                                                                  |
| Basis protocols                        | TCP/IP<br>UDP/IP<br>QSOAP                                                                                                        |
| Protocol                               | SMI/VHD                                                                                                                          |
| Multiple connections per controller    | yes                                                                                                                              |
| Simultaneous queries                   | yes                                                                                                                              |
| Number of connected controllers        | user-defined**                                                                                                                   |
| Access protection                      | yes, configurable                                                                                                                |
| Supported security levels              | 0 to 4                                                                                                                           |
| Encryption                             | SSL (configurable)                                                                                                               |
| Configuration                          |                                                                                                                                  |
| Graphic interface                      | yes (OPC configurator)                                                                                                           |
| Browsing of controllers                | yes                                                                                                                              |
| Browsing of controller variables (SVI) | yes                                                                                                                              |

\*\* Refresh rates depend on the data volume and the computer performance, (Free) controller performance and network topology/network load.

\*\*\* No program-technical restriction. Limit value depends on performance of the computer, the network and the capacity utilization of the controllers.

## Communication – Control room networking

| M1 OPC enterprise server                 |                                                                                                                     |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Configuration                            |                                                                                                                     |
| Import/export                            | yes (CSV)                                                                                                           |
| Templates                                | yes                                                                                                                 |
| Clones (with enumeration)                | yes                                                                                                                 |
| Restricted access                        | yes (only on configured items)                                                                                      |
| Item names                               | OPC-side can be freely configured («renaming»)                                                                      |
| Item access rights                       | OPC side can be freely restricted                                                                                   |
| Integrated test client                   | yes                                                                                                                 |
| Configurations can be saved              | yes                                                                                                                 |
| Access protection on configuration       | yes (different user levels)                                                                                         |
| Diagnostics                              |                                                                                                                     |
| Error logging                            | yes (log file)                                                                                                      |
| Debug mode                               | yes (several can be set)                                                                                            |
| Diagnosis on items                       | yes (static items)                                                                                                  |
| Statistics on items                      | yes (static items)                                                                                                  |
| Installation                             |                                                                                                                     |
| Installation medium                      | CD ROM or network                                                                                                   |
| Installation can be automated («silent») | yes                                                                                                                 |
| License basis                            | per installation (single-license obligation)                                                                        |
| License protection                       | hardware-dependent software key                                                                                     |
| Configured installation                  | yes (items/controller configuration, as well as configuration users can be preset)                                  |
| System prerequisites – server            |                                                                                                                     |
| Computer                                 | IBM-compatible PC (Intel x86 architecture)                                                                          |
| Processor                                | minimum: Intel Pentium 500 MHz or comparable (Windows 2000)<br>recommended: Intel Core2Duo or Core2Quad with >2 GHz |
| RAM                                      | minimum: 256 MB RAM (Windows 2000)<br>recommended: >1 GB RAM                                                        |
| Network card                             | at least 1x Ethernet 802.3                                                                                          |
| Hard disk                                | >300 MB free                                                                                                        |
| Graphic                                  | 1024 x 768 or better (only for configuration)                                                                       |
| Input devices                            | keyboard, 2-button mouse (only for configuration)                                                                   |
| Operating system (OPC Server)            | Windows 7<br>Windows Vista<br>Windows XP<br>Windows 2000<br>Windows Server 2003<br>Windows Server 2008              |
| Other software                           | Text editor or MS Excel recommended for external configuration                                                      |
| System prerequisites M1                  |                                                                                                                     |
| M1 automation devices                    | families ME, MX, MPC, MPE, as well as CT/WT200 , CT/WT300<br>(achievable performance is type-dependent)             |
| System software                          | MSys V2.11 or higher (for full function scope)                                                                      |



**MMS server**  
**Manufacturing Message Specification Server**

The MMS server equips the M1 controller with the capability of communicating in accordance with the standards IEC 61400-25 or IEC 61850. These are two communication standards that have been created to correspond to the needs of the energy industry and the grid operators. The standardization makes it possible to seamlessly integrate an ever-increasing number of heterogeneous plants, such as wind turbines or CHPs, in a control room or in a mixed network.

The standards, IEC61400-25 and IEC61850, extend far beyond pure data communication. They also define the data modeling and thus offer an object-oriented view of the system. Objects, such as generator, circuit breaker, transformer, rotor, etc. are defined. For each of these objects the additional characteristics, their designations, the data types and the associated services are specified. The MMS server from Bachmann electronic depicts the variables that are available from the plant control programs (e. g. PLC) in the SVI (**S**tandard **V**ariable **I**nterface) on an IEC conformant communication. The user of the MMS server determines the standardized ICD file (ICD = **I**ntelligent Electronic Device **C**apability **D**escription), what information of the plant is represented, and is therefore visible to the client (e. g. the control station). This enables individual adaptation to different plants or modular expansion stages.

| Item           |                                                                                                                                                                                                                                                 | Item no.    |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| MMS server RT  | License to operate the MMS Server on one controller CPU. Allows communication over the ethernet interface with standards-compliant client software using the IEC61850 or IEC61400-25 protocol in accordance with the documentation.             | 00014547-63 |
| MMS server DVD | Software and documentation for the MMS Server. Provides communication over the ethernet interface according to the standards IEC61850 or IEC61400-25. Without a valid Runtime License the MMS Server runs only temporarily for 2h in demo mode. | 00014547-xx |

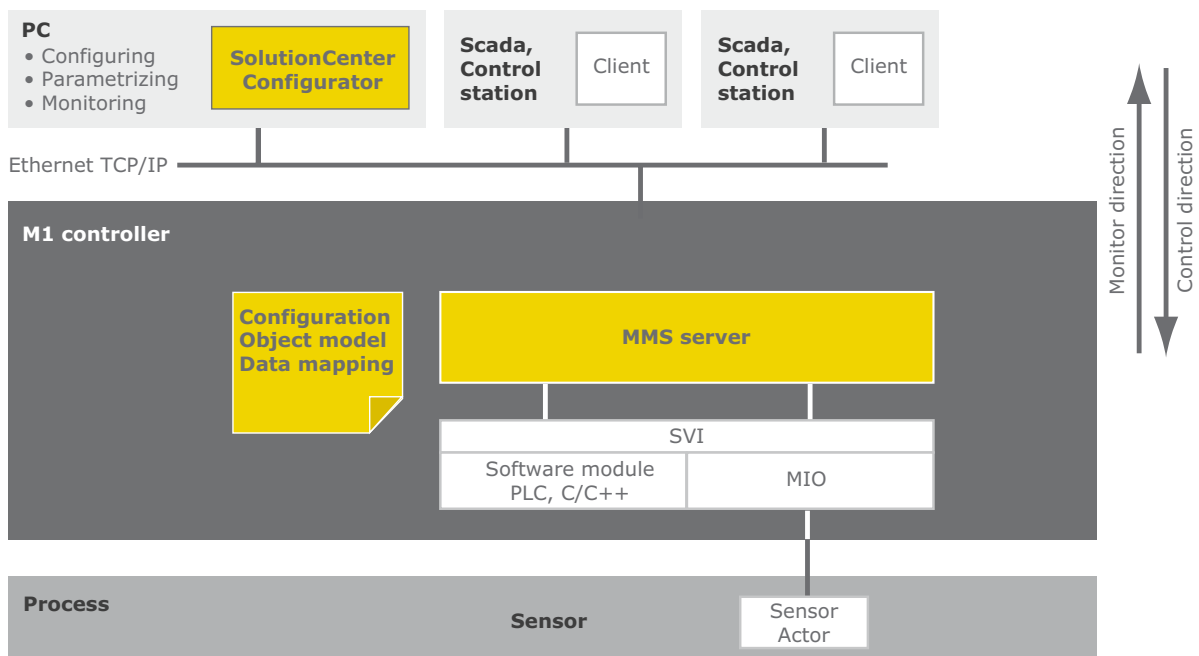
# Communication – Control room networking

## Features

- It is started as a stand-alone software module
- No special hardware required, pure software solution for all M1 CPU types except ME203
- Configuration of the variable set via standardized ICD file (XML format)
- Mapping of the SVI variables to IEC variables in a readable ASCII file, that can be automatically generated
- Automatic deadband calculation (db, zeroDb) for analog values (MV, CMV)
- Integrated into the access control features of the controller system
- Optional entry points for additional preprocessing and post-processing of values, e. g. logging of write accesses
- Can be operated together with other protocols (OPC, QSOAP, Telnet, etc.) on the same Ethernet interface of the M1
- Number of clients, reports, etc. can be limited
- Automatic limitation of CPU load

## Capabilities in accordance with IEC61400-25 / IEC61850

- Unterstützt Ed. 1 und Ed. 2 der IEC61850
- The object definition decides between IEC61850 or IEC61400-25
- Transport layer MMS (Manufacturing Message Specification) in accordance with ISO 9506
- Browsing of variables / objects with presentation of structures and elements in plain text (self-describing system)
- Reading and writing of values (Get / Set Data Values)
- Summarizing of data (datasets)
- Generation of reports, e. g. if there is a value change
- Command issue with command preselect (Select – Operate)
- File transfer



## Communication – Control room networking

| MMS server – Available services |                                                                                                                                                                                                                                                                                                               |                            |           |              |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------|--------------|
| Functional group                | Description                                                                                                                                                                                                                                                                                                   | Services                   | IEC 61850 | IEC 61400-25 |
| Server                          | Represents the visible outwards appearance of a device. All other functional groups are part of the server.                                                                                                                                                                                                   | ServerDirectory            | M         | O            |
| Application association         | Service for connection with a client. Allows restricted access to information and functions of the server.                                                                                                                                                                                                    | Associate                  | M         | M            |
|                                 |                                                                                                                                                                                                                                                                                                               | Abort                      | M         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | Release                    | M         | O            |
| Logical device                  | Represents a group of functions with each function defined as logical node.                                                                                                                                                                                                                                   | GetLogical-DeviceDirectory | M         | O            |
| Logical node                    | Represents a certain function, e.g. the overvoltage protection.                                                                                                                                                                                                                                               | LogicalNode-Directory      | M         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | GetAllDataValues           | M         | X            |
| Data                            | Allows specification of typified information, such as the position of a switch with quality information and timestamp.                                                                                                                                                                                        | GetDataValues              | M         | M            |
|                                 |                                                                                                                                                                                                                                                                                                               | SetDataValues              | O         | M            |
|                                 |                                                                                                                                                                                                                                                                                                               | GetDataDefinition          | M         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | GetDataDirectory           | M         | O            |
| Data set                        | Allows grouping of different data.                                                                                                                                                                                                                                                                            | GetDataSetValues           | M         | M            |
|                                 |                                                                                                                                                                                                                                                                                                               | CreateDataSet              | O         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | DeleteDataSet              | O         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | GetDataSet-Directory       | O         | O            |
| Reporting                       | Describes the conditions for reporting based on client-defined parameters. Reporting can be triggered by change of process data (e.g. data change) or by quality changes. The reports can be sent immediately or delayed. The reports contain information on status changes and events, data update excepted. | Report (BRCB)              | C         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | GetBRCBValues              |           |              |
|                                 |                                                                                                                                                                                                                                                                                                               | SetBRCBValues              |           |              |
|                                 |                                                                                                                                                                                                                                                                                                               | Report (URCB)              |           |              |
|                                 |                                                                                                                                                                                                                                                                                                               | GetURCBValues              |           |              |
|                                 |                                                                                                                                                                                                                                                                                                               | SetURCBValues              |           |              |
| Control                         | Describes the service for the control of devices or groups for parameter specification, for instance.                                                                                                                                                                                                         | Select                     | O         | O            |
|                                 |                                                                                                                                                                                                                                                                                                               | SelectWithValue            |           |              |
|                                 |                                                                                                                                                                                                                                                                                                               | Cancel                     |           |              |
|                                 |                                                                                                                                                                                                                                                                                                               | Operate                    | M         | M            |
|                                 |                                                                                                                                                                                                                                                                                                               | Command-Termination        | O         | O            |



## Communication – Control room networking

| MMS server – Available services |                                |                         |           |              |
|---------------------------------|--------------------------------|-------------------------|-----------|--------------|
| Functional group                | Description                    | Services                | IEC 61850 | IEC 61400-25 |
| File                            | Defines the exchange of files. | GetFile                 | O         | O            |
|                                 |                                | SetFile                 | M         | X            |
|                                 |                                | DeleteFile              | O         |              |
|                                 |                                | GetFileAttribute-Values | M         |              |

M = mandatory

O = optional

C = conditional, at least one of them should be supported (BRCB or URCB)

X = not part of the standard

# Communication – Control room networking



## IEC60870-5 Server (Slave)

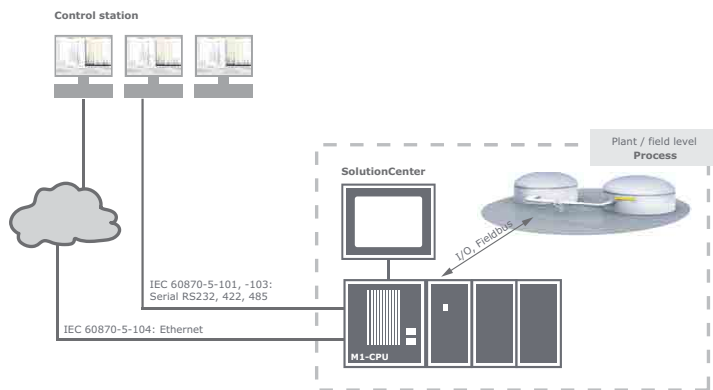
For communication in accordance with IEC60870-5-101, -103 and -104

### Application areas

The telecontrol protocol, according to standards IEC60870-5-101 IEC60870-5-104, is widely used in power generation, power distribution and infrastructure areas. They enable the control and monitoring of intelligent sub-components and sub-stations through a superordinate control center. The palette of these sub-components ranges from circuit breakers, converters, and energy meters to cogeneration units up to complete power plants. The IEC60870-5-103 standard was defined especially for communication with protective devices.

### Product features

The IEC60870-5 Server is installed purely as a software component on the controller and requires no special hardware. It uses the serial interfaces (-101, 103) or the Ethernet ports (-104) available on the controller. Through configuration of multiple instances, simultaneous operation of -101, -103, and/or -104 is possible; multiple masters can communicate simultaneously with the controller. The information objects that the server offers in the control and monitoring direction, are created and linked to the controller's existing process variables via the configuration. Different data models can be created for different masters. The login of masters can be restricted by specifying a permitted IP address, and the number of simultaneous connections can also be limited. Write accesses can be captured in the security log of the controller.



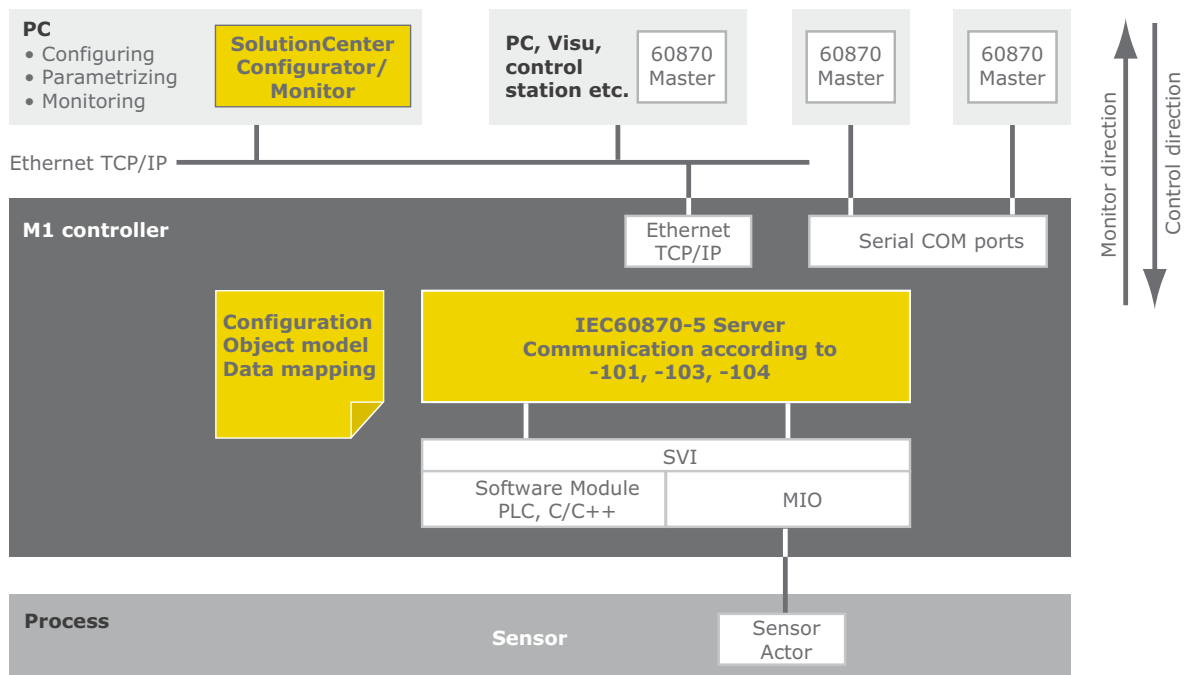
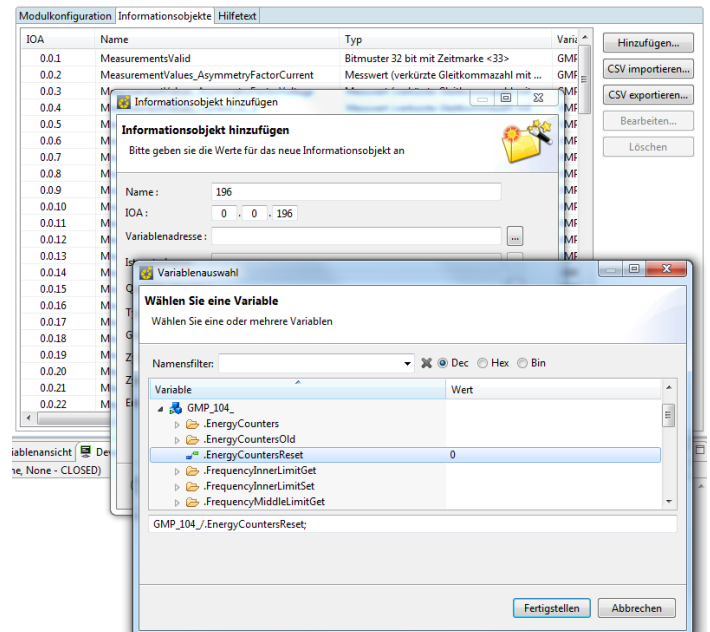
| Item                  |                                                                                                                                                                                                                                                                      | Item no.    |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| IEC60870-5-Server RT  | License to operate the IEC 60870-5 server on one controller CPU. Provides communication over the ethernet or serial interfaces with standards-compliant clients using the IEC60875-5-101, -103 and -104 protocol in accordance with the compatibility documentation. | 00022127-63 |
| IEC60870-5-Server DVD | Software and documentation for the IEC60870-5 server. Provides access to process data according to the standards IEC 60870-5-101 and 103 - 104. Without a valid Runtime License the IEC60870-5 server runs only temporarily for 2h in demo mode.                     | 00022127-xx |

## Communication – Control room networking

To save bandwidth, a threshold filter can be enabled. Values that are outside of defined Min/Max limits are marked as invalid and will only be transferred again when they return to the valid range. No implementation by the user is necessary for this.

### Engineering

For the generation of externally visible information objects, a convenient tool is available in the SolutionCenter that supports the user with dialogs and wizards, and validates the entries immediately. Thus, inconsistent or incorrect configurations can be avoided. The link to the process data takes place by selecting the corresponding SVI variables from a variable browser. To exchange the configuration with other manufacturers, import and export in a generic CSV format is available. A monitor in the Solution-Center shows the current configuration of information objects used in the server, and the value most recently transmitted to the client.



## Communication – Control room networking



### Advantage

Existing software for sequence control and regulation does not need to be changed and will not be affected in its run time. This therefore enables a more flexible response to end customer requirements without having to change the existing tested software for controlling and regulating of the substation. Through realization as a finished server with integrated update- and threshold logic, tedious replication of the protocol functions via limiting PLC-libraries, and the associated training efforts in the standard, is eliminated. Thus engineering and testing time can be reduced. The integrated diagnostics shorten troubleshooting if there are malfunctions in running operation. The diverse communication possibilities via field busses and real-time Ethernet, the broad range of signal interfaces to grid measurement, as well as powerful mass storage, predestine the M1 system in conjunction with the telecontrol protocols according to IEC60870-5 for use as a control device, central control, data concentrator, datalogger, and gateway.

### Technical data

- Standard compliant implementation of IEC60870-5-101, -103, -104 Server
- Service/software solution that can be subsequently installed
- No changes to the application logic required
- Fully configurable/no application-specific processing via PLC libraries required
- Configurator for commissioning and diagnostic monitor in the SolutionCenter
- Import/export in CSV format for exchange with other manufacturers
- Reducing the amount of data via configurable threshold filters
- Number and IP addresses of authorized clients can be limited
- Logging of write accesses in the security log of the controller

## Communication – Control room networking

| IEC60870-5 server                           |                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General product features                    |                                                                                                                                                                                                                                                                                                                                                           |
| Supported protocols                         | IEC60870-5-101, IEC60870-5-103, IEC60870-5-104 as slave (server)                                                                                                                                                                                                                                                                                          |
| Type                                        | Licensable service for Bachmann M1 controls (software-only solution, subsequently installable) with configuration interface.<br>Requires a valid license file for operation.                                                                                                                                                                              |
| Parallel operation                          | Multiple independent server instances on one controller                                                                                                                                                                                                                                                                                                   |
| Message types (ASDUs)                       | Comprehensive implementation of the essential application data service units, for example: single point information; single command; double-point information; double command; step position information; regulating step command; measured value, normalized; time synchronization; reset and many more.<br>(See interoperability documents for details) |
| Data mapping                                | Per configuration each server instance is separately defined.<br>Access to:<br>- SVI variables of application programs (software modules) implementation-independent (IEC61131-3, C, C++)<br>- Physical inputs/outputs direct (MIO)<br>- Data from fieldbus/Ethernet protocols via UFB                                                                    |
| Data type mapping                           | Implicit in the server (mapping SVI data types on IEC data types)                                                                                                                                                                                                                                                                                         |
| Query groups                                | Yes, information can be assigned to query groups 1 to 16 per configuration                                                                                                                                                                                                                                                                                |
| Source time stamping                        | Implicitly possible through server, explicitly possible via application.<br>Resolution in ms                                                                                                                                                                                                                                                              |
| Quality labeling                            | Implicitly possible through server, explicitly possible via application.<br>Values outside of the configured Min/Max range are automatically marked as invalid.                                                                                                                                                                                           |
| Designation of the transmission cause (COT) | Implicitly through server                                                                                                                                                                                                                                                                                                                                 |
| Cyclic transmission                         | Can be configured with individual cycle time per information object                                                                                                                                                                                                                                                                                       |
| Background scan                             | Can be configured with individual cycle time per server instance                                                                                                                                                                                                                                                                                          |
| Update rates                                | Configurable monitoring cycle for detection of spontaneous value changes. Additional triggering possible through software. Automatic protection against system overload. Minimum cycle limited through free capacity of the CPU                                                                                                                           |
| Threshold filters                           | With -101 and -104 one threshold value can be configured per information object, filtration is either absolute or integrating                                                                                                                                                                                                                             |
| Connection monitoring                       | Connection status can be detected via diagnostics variables for customer software                                                                                                                                                                                                                                                                         |
| Access control and logging                  | Limiting of the number of clients, IP address specification for client, integration with M1 Access Control: Logging of connections and write accesses                                                                                                                                                                                                     |

## Communication – Control room networking

| IEC60870-5 server                    |                                                                                                                                                                                                                            |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration                        |                                                                                                                                                                                                                            |
| Configuration interface              | Integrated in Bachmann SolutionCenter                                                                                                                                                                                      |
| Data configuration/mapping           | Via configuration interface (with variable browser and consistency check)<br>- open configuration format (ASCII) for automated creation                                                                                    |
| Exchange with other manufacturers    | Import and export of CSV format                                                                                                                                                                                            |
| Diagnostics                          |                                                                                                                                                                                                                            |
| Monitor for information objects      | Bachmann SolutionCenter shows all information objects with the last transmitted value and time stamp                                                                                                                       |
| Connection statistics                | Visible in the monitor and diagnostics variables                                                                                                                                                                           |
| Status variables                     | Yes (server publishes essential operating characteristics and diagnostic information also as SVI variables – visible for all applications and via module "Scope" loggable over time)                                       |
| Debugging                            | Yes (runtime shiftable levels of information output)                                                                                                                                                                       |
| Logbook                              | Yes (essential operational information is displayed in the central logbook)                                                                                                                                                |
| Write accesses                       | Yes (logging in the M1 security log)                                                                                                                                                                                       |
| Installation                         |                                                                                                                                                                                                                            |
| Delivery form                        | Separately installable product (service); delivery on CD-ROM or as download                                                                                                                                                |
| Installation                         | Via SolutionCenter                                                                                                                                                                                                         |
| Licensing                            | Subject to individual license per CPU (regardless of number of servers, client connections or points of information)                                                                                                       |
| License protection                   | Hardware-dependent license file                                                                                                                                                                                            |
| System prerequisites – controller    |                                                                                                                                                                                                                            |
| Device                               | All M1 CPU families (MH200, MC200, MPC200, MX200) except ME203                                                                                                                                                             |
| System version                       | Msys from version 3.85, Mcore from version 3.80                                                                                                                                                                            |
| System prerequisites – configuration |                                                                                                                                                                                                                            |
| SolutionCenter                       | SolutionCenter from version 1.85 (M-Base 3.85) – see SolutionCenter product data sheets                                                                                                                                    |
| IEC60870-5-101                       |                                                                                                                                                                                                                            |
| Physical interface                   | Serial ports of the M1 CPU or of RS204 modules in operating modes RS232, RS422 and RS485. Parallel operation of multiple protocols on the same port is not possible                                                        |
| Operating mode of the Link Layer     | Either symmetric or asymmetric                                                                                                                                                                                             |
| Addressing                           | Device via address of the connection layer (Link Layer) and station address (Common Address). Information object address (IOA) either structured (28.7.16) or flat (1836816), can be freely assigned in the configuration. |
| Baud rates                           | No restriction through the IEC server                                                                                                                                                                                      |

## Communication – Control room networking

| IEC60870-5 server     |                                                                                                                                                                                                                                                                      |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC60870-5-103        |                                                                                                                                                                                                                                                                      |
| Physical interface    | Same as for -101                                                                                                                                                                                                                                                     |
| Addressing            | Device: Common station address. Information object:<br>Via FUN, INF or via GIN                                                                                                                                                                                       |
| IEC60870-5-104        |                                                                                                                                                                                                                                                                      |
| Physical interface    | Ethernet IEEE 802.3 (interfaces of the M1 CPUs and EM2131) Parallel operation with other TCP/IP based communication on the same interface is possible.                                                                                                               |
| Addressing            | Device: Via selection of the Ethernet interface, as well as assignment of the IP port (default 2404). IOA same as for -101                                                                                                                                           |
| Variants              |                                                                                                                                                                                                                                                                      |
| IEC60870-5-Server RT  | License to operate the IEC 60870-5 server on one controller CPU. Provides communication over the ethernet or serial interfaces with standards-compliant clients using the IEC60875-5-101, -103 and -104 protocol in accordance with the compatibility documentation. |
| IEC60870-5-Server DVD | Software and documentation for the IEC60870-5 server. Provides access to process data according to the standards IEC 60870-5-101 and 103 - 104. Without a valid Runtime License the IEC60870-5 server runs only temporarily for 2h in demo mode.                     |





## **Know-how protection**

Manipulation protection

Cryptographic functions

## **Security log**

Monitoring of variables

## **Access control**

Communication security

SSL/TLS





## Security

Modern machines and production plants are deeply integrated in IT environments, whether this is in corporate networks or in public communication networks, for example for remote maintenance. This results in information security requirements that often present plant builders and operators with new challenges.

Faced with the constantly increasing pressure from international competition, machine and plant builders are increasingly concentrating their unique selling points in the software. The build quality of different vendors is similar, and thus also the resulting production speed. Experience and knowledge about the process are what makes the difference between vendors. Knowledge is increasingly being integrated in applications and data, for example, in the form of algorithms, closed-loop control parameters and recipes. New chances arising from the offering of new services such as online monitoring and maintenance require secure communication routes, separated access areas and manipulation-proof logging. Ultimately, the operator must protect his intellectual property from unauthorized modifications or misuse by third parties if he wants to ensure the responsible use of his own plant.

For some time now, the requirements of regulations and standards have forced application sectors, such as the energy and water supply and functional safety sectors, into taking concrete measures. Particularly in these critical areas, the devices and software from Bachmann electronic are the preferred solution. Different protective measures such as secured network connections, user and access control and security logging have been integral elements of every Bachmann controller for several years. The existing security concept is constantly being examined according to the latest standards and regulations and further developed jointly with our customers, not just since Stuxnet or Duqu.

# Security

## With Bachmann one decisive step ahead.

Machines and production plants are connected with private and public communication networks in many cases today. Applications in the energy and water supply sector belong to the so-called critical infrastructures and place particular demands on information security stipulated by law.

Bachmann controllers are used world-wide especially in cases where maximum availability, robustness and communication skills are called for. Many years of experience in critical applications offer each user the assuredness that he is working with proven functions that are being developed constantly.

With an extensive security package for machines and plants, Bachmann protects its units from unauthorized access and logs every write access up to variable level if necessary. Quite incidentally, the security measures increase the robustness against communication problems that are caused, for example, by faulty network devices.



### Security

| Features                                                                                            |
|-----------------------------------------------------------------------------------------------------|
| Layer-based protection concept                                                                      |
| Ethernet load limitation                                                                            |
| Securing of network services and logging by means of authentication and end-to-end encryption (SSL) |
| Access control and logging                                                                          |
| Protection functions at system level                                                                |
| Open interfaces for access control and cryptographic functions in user applications                 |
| Continuous, independent security log                                                                |
| Predefined security levels for basic protection                                                     |
| Integrated component of the M-Base                                                                  |



## Security

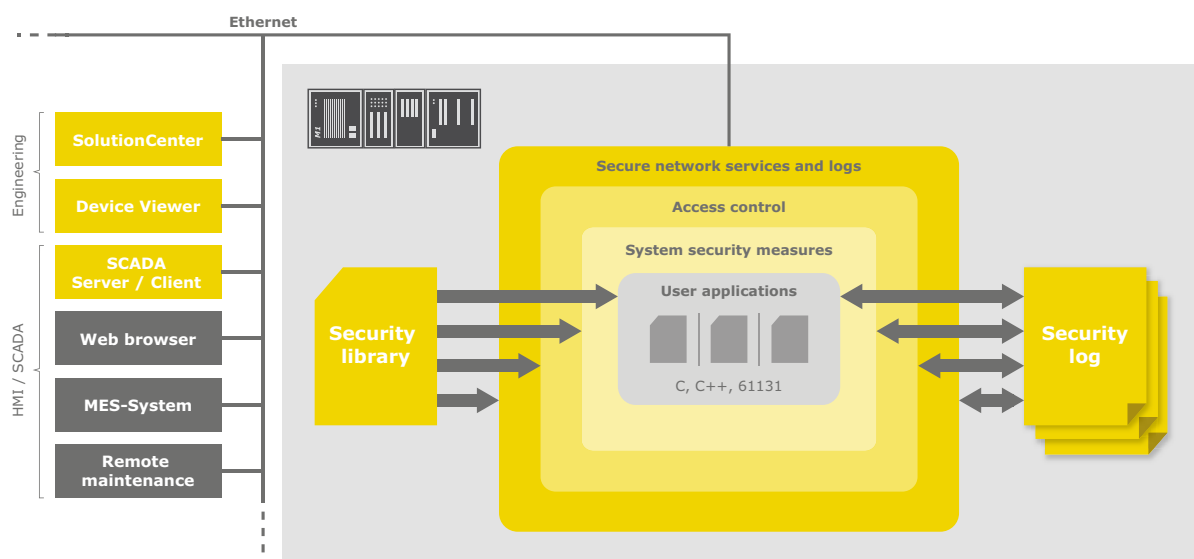
### Communication and information security

The direct consequences of targeted, destructive access to a machine controller or an unintentional operating error are the same: standstill or even destruction of a machine or plant and thus production stoppage, loss of reputation and money. Therefore, the main objective is to ensure robustness against disturbances. Protection of data and communication as well as the logging of access are preventive measures which make unauthorized access more difficult and bring irregularities to light.

#### Targeted access

Exposed machines and plants are not subject to the same perimeter protection as enclosed industrial plants. Hence, wind power plants or biogas plants are relatively easy to access and the response times in the event of a detected break-in are high. High risk in production plants mainly emanates from legitimized persons. Service staff from the external service provider or a dismissed employee who in frustration succumbs to the temptation of a targeted act of damage to property are two classical examples.

The targets here are switches, routers and controllers with free ports. These can be used for inconspicuous disruption or for targeted interception of communications.



The layer-based security architecture forms multiple security walls around user applications. Each level includes specific security measures that can also be used in user-specific applications.

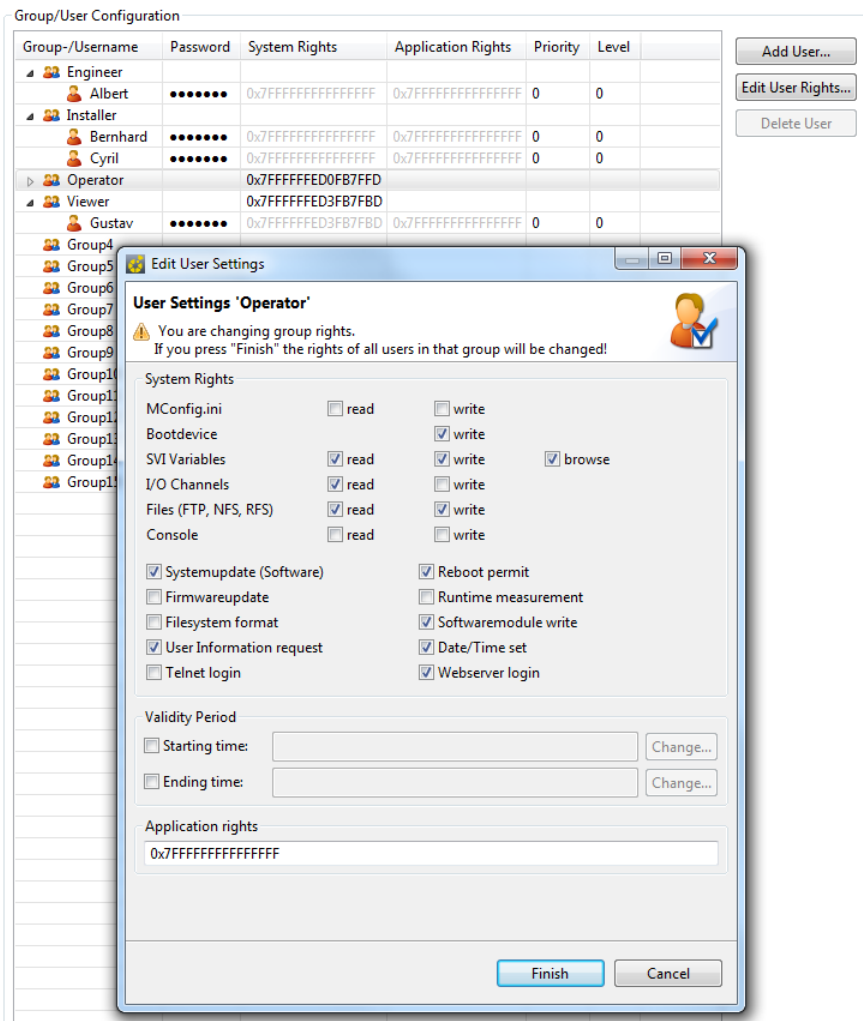
# Security

Control components of Bachmann have various measures for counteracting targeted access. Effective mechanisms are in place for protecting against network overload which ensure stability of the application in the event of denial of service attacks. Vigorous implementation of end-to-end encryption of the communication by SSL renders eavesdropping ineffective. User programs use interfaces to current cryptographic procedures to encrypt data.

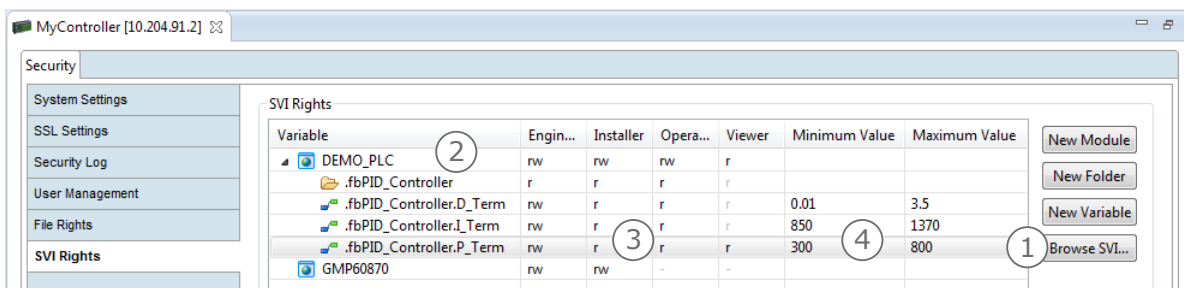
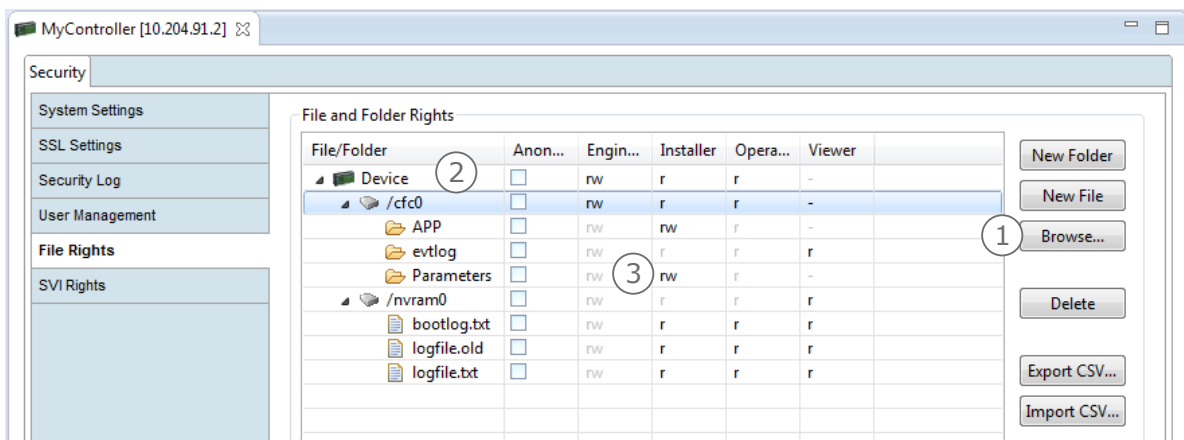
## Critical infrastructures

Guided by national and international regulations, public utility companies are particularly sensitized in

matters of security and are obligated to protect their plants accordingly. Comprehensive measures embedded in detailed security concepts at all organizational levels have long been established. Protective fencing, own surveillance staff and continuous access controls have been found in critical parts of these plants. Control networks and operating panels were strictly sealed off previously. In the meantime, modern business and service models require targeted access of other organizational components via Intranet and even externally via Internet.



Access Control includes a powerful module for user and access control. Users and groups can be created by simple Copy&Paste as well as by integrated inheritance logic thus saving a great deal of time. The clear assignment of system rights allows the specific assignment of rights for each user.



Management of file and variable rights:

- (1) Individual files and variables or entire folders are selectable for the rights management using a browser.
- (2) These are presented in a clear tree structure.
- (3) Finely grained read and write permissions can be assigned user-related directly in the list using the Inline-Editing function.
- (4) Additionally variables can be limited in the value range.

## Defects and operating errors

Targeted security management only helps in the case of undesirable and potentially destructive access. Inadvertent changes to machine parameters, failures of network components or misconfigurations of the machine network are far more frequent, particularly in the protected environment of production plants, but pose the same security threats in terms of symptoms and effects. For example, a broadcast storm as a result of a faulty network switch, overloads connected network clients in the same way as a targeted denial of service attack.

Unlike other security measures, the added value of revealing defects can only be achieved if appropriate protective measures directly affect the controller.

Bachmann provides its controllers with functions for limiting the bandwidth of the ethernet ports in order to increase the robustness against intentional and unintentional network disturbances. Real-time processes are not disturbed by overloading of the network interface.

It is advisable to set up a user and access management system for each user via Access Control. This limits any possibilities of manipulation centrally according to the least privilege principle, and independent security logging allows changes to be allocated to individual users. Operating errors can thus be detected and warranty cases processed speedily.

# Security

## Safety and Security

Functional safety requires a high degree of security measures to prevent operating errors. Unnoticed changes to the safety programming as well as dangerous interferences during safe operation must be prevented and logged. Safety Control of Bachmann already warns about any malicious, manipulated code on the configuration computer and protects against inadvertent changes by means of functions for pinning software versions. A separate login system on each safety controller allows individually restrictable access. The continual logging is tamper-proof and implemented redundantly, so that even in the case of partial destruction of the module, it will be possible to reproduce the chain of events up to the failure with a high degree of probability.

## Simply secure

Security measures are only effective if they are also applied. Bachmann sees it as its task to promote the total application and dissemination of security functions even when no comprehensive security concepts exist and the staff are still not security experts. Simple activation and operation of the extensive protective measures ensures that the dangers of careless operation and simple attacks are already minimized even at this early stage.

The central part is composed of four predefined security levels that can be selected in the security configurator. Behind this are templates which set the settings within the controller so that certain logs and functions are activated or even forbidden depending on the level.

Basic protection is gainable in three steps:

1

### *Safeguarding the system and network*

- setting the **security level**
- deactivating unnecessary services
- activating **logging**

2

### *Limiting access*

- **defining group rights**
- **creating users**
- **setting file rights**

3

### *Securing user programs*

- Implementing **applications** while taking general security aspects into account

Recommended procedure for safeguarding the control

Monitor

FTP

Variablenansicht

Device Shell

Fehler

Eigenschaften

Registered Users

1

Log

| Num... | User Name | Access Right | Tool     | Login time          | Uptime access     | Last access         | Last SVI access     | Group | Level | Priority | Client      |
|--------|-----------|--------------|----------|---------------------|-------------------|---------------------|---------------------|-------|-------|----------|-------------|
| 1      | Albert    | false        | SC       | 2013-07-12 10:30:56 | 0 Day(s) 00:00:04 | 2013-07-12 10:31:00 | -                   | 0     | 0     | 0        | 10.204.0.32 |
| 2      | Dora      | false        | OPCUASRV | 2013-07-12 10:17:07 | 0 Day(s) 00:13:50 | 2013-07-12 10:30:58 | -                   | 2     | 0     | 0        | 10.204.0.32 |
| 3      | Emily     | false        | LoadPlcV | 2013-07-12 10:27:52 | 0 Day(s) 00:03:08 | 2013-07-12 10:31:00 | 2013-07-12 10:28:02 | 2     | 0     | 0        | 10.204.0.32 |

Monitor

MyController [10.204.91.2]

Registered Users

Security Log

2

| ID    | Type | Date/Time               | User Name | Event        | Resource                                    | Value Old | Value New |
|-------|------|-------------------------|-----------|--------------|---------------------------------------------|-----------|-----------|
| 14524 | I    | 2013-07-12 16:47:42,377 | Albert    | Logout       |                                             |           |           |
| 14523 | I    | 2013-07-12 16:47:42,167 | Albert    | Copy syst... | /cfc0/mconfig.ini                           |           |           |
| 14522 | I    | 2013-07-12 16:47:42,166 | Albert    | Set syste... | /cfc0/mconfig.ini: [SYSTEM]](SerialDrivers) |           |           |
| 14521 | I    | 2013-07-12 16:47:41,848 | Albert    | Login        |                                             |           |           |
| 14520 | I    | 2013-07-12 16:46:45,540 | Dora      | Login        |                                             |           |           |
| 14519 | I    | 2013-07-12 16:46:06,582 | Dora      | Logout       |                                             |           |           |
| 14518 | I    | 2013-07-12 16:45:59,673 | Dora      | Set value    | LOAD_PLC/.iCMD[1]                           | 25        | 32        |
| 14517 | I    | 2013-07-12 16:45:46,990 | Dora      | Login        |                                             |           |           |
| 14516 | I    | 2013-07-12 16:45:38,545 | Emily     | Set value    | LOAD_PLC/.bCMD_bSTATES_On                   | 0         | 1         |
| 14515 | I    | 2013-07-12 16:42:01,851 | Dora      | Logout       |                                             |           |           |

The online security monitor gives comfortable overview:

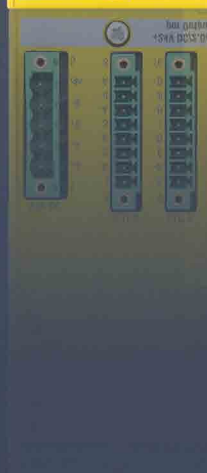
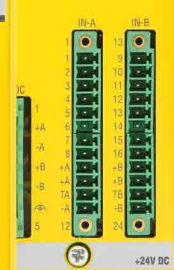
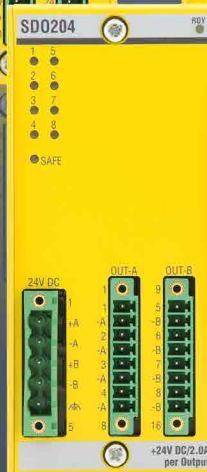
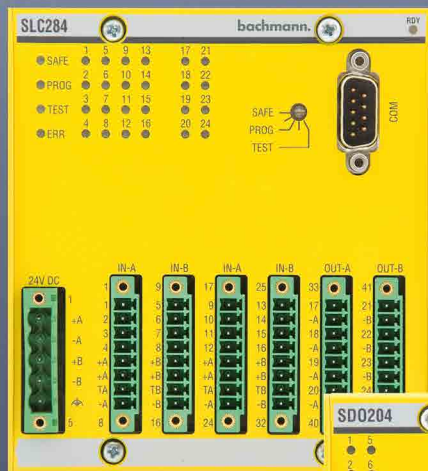
- (1) Details according to logged in users and the token status
- (2) Security log entries show details to connections and communication status, e.g. login/logout (3) or assignment of new values to variables (4)

# Security

| Security                                                                       |                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ethernet                                                                       |                                                                                                                                                                                                                                                                                                 |
| Load limitation                                                                | Separately adjustable limitation of the read and write workload for each Ethernet interface;<br>Protect the machine application against DDoS attacks (Distributed Denial of Service), Broadcast Storms and defects in the network infrastructure.                                               |
| Network services and logs                                                      |                                                                                                                                                                                                                                                                                                 |
| SSL/TLS based network communication                                            | Security standard for the establishment of a secured communication channel at IP-level.<br>Support (selection):<br><i>Bachmann products:</i> Configuration and programming tool SolutionCenter, WebMI Pro, M1COM, MJCOM<br><i>Manufacturer neutral:</i> OPC UA, webserver, file transfer        |
| Server and client authentication                                               | The M1 controller can be an SSL server as well as a client.<br>The client authentication is also supported in server mode. This is used for certificate-based authentication of computers, services and users on the M1.                                                                        |
| Secured and deactivatable services (webserver, OPC-server, FTP, NTP, SMTP ...) | Unnecessary protocols can be deactivated by configuration. This ensures that only used ports are accessible thus reducing the area for attack.                                                                                                                                                  |
| Access Control                                                                 |                                                                                                                                                                                                                                                                                                 |
| User Administration                                                            | Password protected restrictions are configured on a group and user basis for system access and application rights. Time-restricted access is provided.                                                                                                                                          |
| Token-based write access protection                                            | The special mechanism guarantees that the token owner is granted exclusive write permission. Additionally, prioritization can be assigned based on the user role. Various degrees of priority can be assigned at user and group level.                                                          |
| File access                                                                    | File access, i.e. authorization for the read or write operation as well as the visibility for browse requests can be set at group level. The configuration allows individual assignment of rights at directory and file level and facilitates this by means of the available inheritance logic. |
| Variable protection                                                            | The visibility, read and write access of online available process variables can be allocated to access rights of the individual user. Mechanism and configuration as with file permissions.                                                                                                     |
| User specific extensions provided                                              | User and access management system as well as the token mechanism can be replaced by user-specific applications. Thus, special policies and functions can be implemented and the controls can be integrated smoothly into existing systems.                                                      |



| Security                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                            |
| Enable/disable application development                                                      | Protection against installation of unauthorized programs.                                                                                                                                                                                                                                                                                                                                  |
| Memory protection                                                                           | Application programs are protected at memory level against write access from other applications.<br>Protection against malware that want to eavesdrop and manipulate data at operating system level. Protection against buffer overflows.                                                                                                                                                  |
| Null pointer protection                                                                     | Special protection to prevent manipulations via null pointer exception handling.                                                                                                                                                                                                                                                                                                           |
| Security log with archiving function                                                        | Login and logout of users as well as each write access are logged at variable level, security-relevant modifications are noted. Timestamp, user, group, old and new value as well as further details are stored in continuously generated file archives.<br>Access is offline, e.g. via a central archiving system, but online is also possible via application programs or SCADA systems. |
| Predefined security levels                                                                  | Four templates for simplifying and shortening the security configuration.                                                                                                                                                                                                                                                                                                                  |
| User Application                                                                            |                                                                                                                                                                                                                                                                                                                                                                                            |
| Access Control                                                                              | The information for logged in users, their session status and security protocols can be accessed from user programs.                                                                                                                                                                                                                                                                       |
| Security Library                                                                            | Symmetric, asymmetric encryption procedures, signature and authentication procedures, block and stream ciphers, SSL/TLS are available to the application programs by means of openssl library.<br>These functions can be used in PLC in the form of library functions.                                                                                                                     |
| Examples of important cryptographic procedures and secure methods for network communication | Symmetric encryption: AES, 3DES<br>Asymmetric encryption: RSA<br>hash functions: SHA, RIPEMD, MD5<br>MAC functions: CBC-MAC, HMAC<br>Signature algorithms: RSA-PSS, ECDSA<br>Key transfer process: SSL/TLS (TLS 1.2, TLS 1.1, TLS 1.0, SSL 3.0)<br>Certificate variants, data encoding: PKS7, PKS12, x509                                                                                  |
| Standards, regulations and recommendations                                                  |                                                                                                                                                                                                                                                                                                                                                                                            |
| Security in Control Systems                                                                 | The security measures were implemented while taking the following standards, regulations and recommendations into account:<br>IEC 62351, IEC 62443, ISA 99, VDI/VDE 2182, FIPS 140, NIST 800 series                                                                                                                                                                                        |
| Publisher                                                                                   | BSI, BDEW, NERC                                                                                                                                                                                                                                                                                                                                                                            |
| System prerequisites                                                                        |                                                                                                                                                                                                                                                                                                                                                                                            |
| Automation equipment                                                                        | M1 CPUs of the MX200 series or better                                                                                                                                                                                                                                                                                                                                                      |
| Engineering PC                                                                              | For system prerequisites see SolutionCenter                                                                                                                                                                                                                                                                                                                                                |
| Runtime software                                                                            | M-Sys / MxCCore ≥ V3.80                                                                                                                                                                                                                                                                                                                                                                    |
| Engineering software                                                                        | M-Base ≥ 3.80                                                                                                                                                                                                                                                                                                                                                                              |
| Installation medium                                                                         | Included in M-Base (runtime and engineering components)                                                                                                                                                                                                                                                                                                                                    |



## **Safety technology**

Safety – for man as well as machine – plays an increasingly important role in the world of automation: Machines and plants are becoming ever more complex and the requirements imposed on functional safety continuously increase.

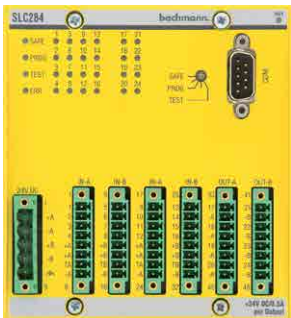
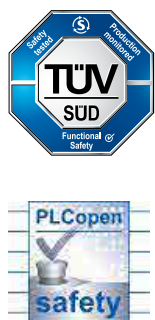
Bachmann electronic offers a safety package that is consistently integrated in the M1 automation system that is designed for the most rigorous safety requirements. It consists of the programmable SLC284 safety module, digital I/O modules, and the Safety Developer, and it can be extended to meet individual needs in accordance with the latest safety standards (PL e, SIL3, Cat 4). And best of all: In addition to safety, efficiency is also increased; the intelligent safety technology helps to significantly lower engineering costs. Through specific diagnostic possibilities and the fastest possible intervention, availability of the machine/system is increased and downtimes are reduced.

# Safety module & Safety Developer

## Integrated safety.

With the safety modules for realization of functional safety, Bachmann electronic is setting a clear signal for a holistic and integrated automation solution. The systems presented here not only offer the best-possible safety, they also guarantee continuity and investment protection.

The new programmable safety module, SLC284, and the digital I/O safety modules, SDI208 or SDO204, make it possible to set up a solution that is integrated in the M1 Automation System. This solution can be adapted to the individual requirements and satisfies the latest safety standards.



### Safety processor module SLC284

#### Features

- 16 digital inputs/8 digital outputs – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Programmable in function block language in accordance with IEC 61131-3
- Programming, configuration, monitoring and debugging per SolutionCenter
- Manipulation protection thanks to configurable user schemes with access and function restrictions
- 1x RS232 for on-site maintenance access without developer tools



### Digital input module SDI208

#### Features

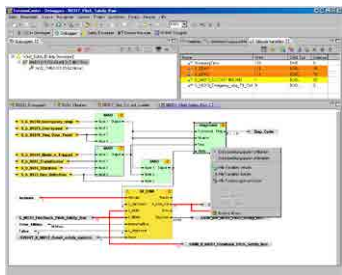
- Digital input module with two galvanically separated input groups
- 16 digital input channels – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Each channel can be optionally tested per test clocking
- Cross-circuit detection
- Autonomously safe – robust against network breakdowns

For the subsequent safety-relevant safety engineering steps the SolutionCenter contains the Safety Developer, which includes all the required tools for safety-oriented programming in accordance with FBD acc. to IEC61131-3 and PLCopen, and has been developed and certified in close cooperation with TÜV.



### Digital output signal SDO204

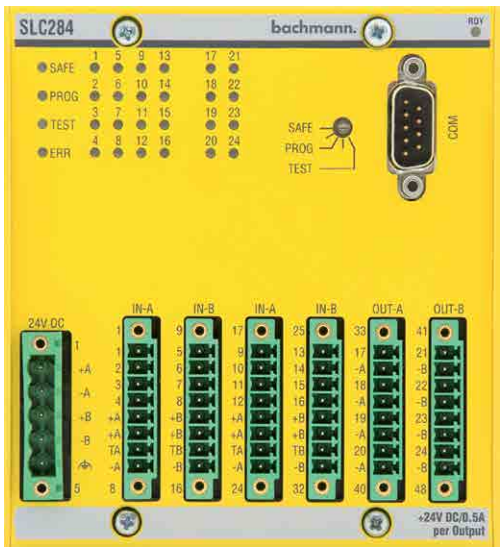
| Features                                                                       |
|--------------------------------------------------------------------------------|
| Digital output module with two galvanically separated output groups            |
| 8 digital output channels – can be used redundantly in pairs (PL e/SIL3/Cat 4) |
| Autonomously safe – robust against network breakdowns                          |
| Output voltage range +18 .. 34 V DC                                            |
| 2 A per channel                                                                |



### Safety Developer Engineering tool

| Features                                                                                          |
|---------------------------------------------------------------------------------------------------|
| Integrated in the SolutionCenter all-in-one engineering tool                                      |
| Full-graphic function plan editor with autorouting                                                |
| Certified safety modules in accordance with PLCopen Safety                                        |
| Standard modules for logical links, timers and arithmetic operations in accordance with EN61131-3 |
| Integrated debugger and monitor - online monitoring in safe operation                             |

# Safety modules



## Safety processor module SLC284

The programmable safety controller SCL284 – ideally integrated in the M1 controller – is presented as an independent, safe, and modern safety controller. The Safety Logic Controller is approved in accordance with the latest safety norm, IEC61508.

No additional cabling is needed for communication between the Safety Logic Controller SLC284 and the safety I/O modules SDI208 and SDO204. The modules can be separated by several hundred meters and operated in a distributed manner via the bus expansion or a FASTBUS.

- 16 digital inputs / 8 digital outputs – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Each output with emergency delay is configurable in the event of communication lost
- Safety Controller with two independent 32-bit microcontrollers
- Fastest program cycle 5 ms
- Decentralized I/O via FASTBUS or bus expansion with SDI208 or SDO204
- All safety I/O states can be used by the M1 controller
- Safety programming via SolutionCenter
- Galvanic isolation between the groups
- Galvanic isolation from the system bus
- Operating mode selector switch
- Operating status display »SAFE«, »PROG«, »TEST«, »ERROR«
- Status display for each channel via LED
- Programming via independent serial interface or via controller

| Item    | Item no.    |
|---------|-------------|
| SLC284  | 00014273-00 |
| SLC284* | 00017465-00 |

| SLC284                                                    |                                                                                                                                                                                                   |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Processor                                                 |                                                                                                                                                                                                   |
| CPU                                                       | 2x LPC2468, 72 MHz, 32 bit                                                                                                                                                                        |
| Controller                                                |                                                                                                                                                                                                   |
| Programming                                               | via controller (I/O bus) or serial interface (COM)                                                                                                                                                |
| Number of independent safety programs per SLC             | 1                                                                                                                                                                                                 |
| Program cycle                                             | minimal 5 ms                                                                                                                                                                                      |
| I/O expansion                                             | via SDI208 or SDO204 modules                                                                                                                                                                      |
| Digital inputs                                            |                                                                                                                                                                                                   |
| Quantity                                                  | 16 digital inputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)                                                                                                                            |
| Input voltage range (H)                                   | 15 .. 34 V DC                                                                                                                                                                                     |
| Input voltage range (L)                                   | -34 .. +5 V DC                                                                                                                                                                                    |
| Input delay (normally) HW                                 | 300 µs                                                                                                                                                                                            |
| Input delay (normally) SW                                 | 1 ms with deactivated test clocking                                                                                                                                                               |
| Input type according to IEC61131-2 input current at least | type 1<br>3.5 mA at 24 V DC                                                                                                                                                                       |
| Status display (LED)                                      | green                                                                                                                                                                                             |
| Error monitoring                                          | internal function monitoring<br>external test clocking optional                                                                                                                                   |
| Digital outputs                                           |                                                                                                                                                                                                   |
| Quantity                                                  | 8 digital outputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)                                                                                                                            |
| Output voltage range                                      | 18 .. 34 V DC                                                                                                                                                                                     |
| Output current per channel (max.)                         | 0.5 A nominal                                                                                                                                                                                     |
| Total current per group (max.)                            | 2 A                                                                                                                                                                                               |
| Delay 0 to 1                                              | max. 35 µs at full load                                                                                                                                                                           |
| Delay 1 to 0                                              | max. 155 µs at full load                                                                                                                                                                          |
| Output groups                                             | 2, electronic fuse                                                                                                                                                                                |
| Status display (LED)                                      | green                                                                                                                                                                                             |
| Switching frequency (max., ohmic load)                    | 500 Hz                                                                                                                                                                                            |
| Error monitoring                                          | short circuit, overload, inadequate or excess voltage of the power supply                                                                                                                         |
| Time-delayed emergency shut-off                           | each output individual from 0 .. 1800 s configurable (resolution 100 ms);<br>Emergency shut-off is activated in the event of communication lost e.g. cable break or failure in the supply voltage |

## Safety modules

### SLC284

#### Internal power supply

|                                    |                            |
|------------------------------------|----------------------------|
| Galvanic isolation from the system | 500 V                      |
| Galvanic isolation between groups  | 500 V                      |
| Internal power supply              | Backplanes BS2xx           |
| Current consumption internal       | 5 V / 600 mA via backplane |

#### External power supply

|                             |                                                                                      |
|-----------------------------|--------------------------------------------------------------------------------------|
| Reverse polarity protection | yes                                                                                  |
| Input voltage               | 24 V DC (18 .. 34 V)                                                                 |
| Current consumption         | normally 95 mA at +24 VDC + $\Sigma$ current consumption of the encoders and sensors |

#### Connection technology

|                       |                                                     |
|-----------------------|-----------------------------------------------------|
| Connection technology | screw or spring terminal, writable and codable plug |
|-----------------------|-----------------------------------------------------|

#### Standards

|                  |                                                                                                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Machine safety   | IEC61508: Functional safety – draft of complex E/E/PE safety components                                                                                            |
| Approved for     | ISO13849: Safety of Machinery<br>IEC62061: Functional safety machine-related E/E/PE systems<br>IEC61511: Functional safety equipment and process industry<br>EN954 |
| Product standard | IEC61131-2<br>UL508                                                                                                                                                |

#### Additional features

Status display via LEDs

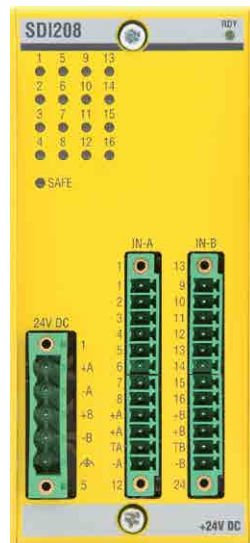
Operating mode adjustable via hex switch

| Ambient conditions          | Standard                      | ColdClimate (✱)            |
|-----------------------------|-------------------------------|----------------------------|
| Operating temperature       | -20 .. +60 °C fanless         | -30 .. +60 °C fanless      |
| Relative humidity operation | 5 .. 95% without condensation | 5 .. 95% with condensation |
| Storage temperature         | -40 .. +85 °C                 | -40 .. +85 °C              |
| Relative humidity storage   | 5 .. 95% without condensation | 5 .. 95% with condensation |

#### Model variants

|         |                                                                                                                                                                                     |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SLC284  | Safety CPU module; integrated digital input/output; SIL3/PLe: 8x DI 24V; 4x DO 24V / 0.5A; (SIL2/PLd: 16x DI, 8x DO); 6ms cycle time; RS232; operating standalone or with CPU modul |
| SLC284✱ | like SLC284; ColdClimate (✱)                                                                                                                                                        |





**Safety Control**

### Safety input modules SDI208

The safety input module SDI208 adds an additional 8 input channels to the safety logic controller SLC284. A homogeneous total system is created through independent and safe integration in the M1 controller. Through the free choice of the slot – either directly beside the safety controller, through bus expansion, or several hundred meters away through the FASTBUS – the safety system can be optimally adapted to the distributed requirements and existing infrastructure of the system.

The input module, SDI208, is approved under the latest safety standard IEC61508. The input module can be easily integrated in the safety application, comparable with a standard I/O module – as the proven »SolutionCenter« development platform offers the easiest configuration, most flexible type of programming, and a safe simulation via easily combinable PLC-Open function modules. All variables, and states of the SDI208 safety input module are accessible in all other machine program languages (PLC, C/C++, Java); visualization is also available and makes cumbersome parallel wiring unnecessary.

- 16 digital inputs – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Safe monitoring of the inputs with redundant 32-bit microcontrollers
- Several SDI208 modules per controller possible
- All safety I/O states can be used by M1 controller
- Safety programming via SolutionCenter
- Galvanic isolation between the groups
- Galvanic isolation from the system
- Operating state display »SAFE«
- Status display for each channel via LED

| Item    | Item no.    |
|---------|-------------|
| SDI208  | 00014544-00 |
| SDI208* | 00017459-00 |

## Safety modules

### SDI208

#### Digital inputs

|                                    |                                                                        |
|------------------------------------|------------------------------------------------------------------------|
| Quantity                           | 16 digital inputs - can be used redundantly in pairs (PL e/SIL3/Cat 4) |
| Input voltage range (H)            | 15 .. 34 V DC                                                          |
| Input voltage range (L)            | -34 .. +5 V DC                                                         |
| Input delay (normally) HW          | 300 µs                                                                 |
| Input delay (normally) SW          | 1 ms with deactivated test clocking                                    |
| Input type according to IEC61131-2 | type 1                                                                 |
| Input current at least             | 3.5 mA at 24 V DC                                                      |
| Status display (LED)               | green                                                                  |
| Error monitoring                   | internal function monitoring<br>external test clocking optional        |

#### Internal power supply

|                                    |                            |
|------------------------------------|----------------------------|
| Galvanic isolation from the system | 500 V                      |
| Galvanic isolation between groups  | 500 V                      |
| Internal power supply              | Backplanes BS2xx           |
| Current consumption internal       | 5 V / 600 mA via backplane |

#### External power supply

|                             |                                                                                     |
|-----------------------------|-------------------------------------------------------------------------------------|
| Reverse polarity protection | yes                                                                                 |
| Input voltage               | 24 V DC (18 .. 34 V)                                                                |
| Current consumption         | normally 65 mA at 24 VDC + $\Sigma$ current consumption of the encoders and sensors |

#### Connection technology

|                       |                                                       |
|-----------------------|-------------------------------------------------------|
| Connection technology | screw or spring terminal<br>writable and codable plug |
|-----------------------|-------------------------------------------------------|

#### Standards

|                  |                                                                                                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Machine safety   | IEC61508 Functional safety draft of complex E/E/PE safety components                                                                                               |
| Approved for     | ISO13849: Safety of Machinery<br>IEC62061: Functional safety machine-related E/E/PE systems<br>IEC61511: Functional safety equipment and process industry<br>EN954 |
| Product standard | IEC 61131-2 ... UL508                                                                                                                                              |

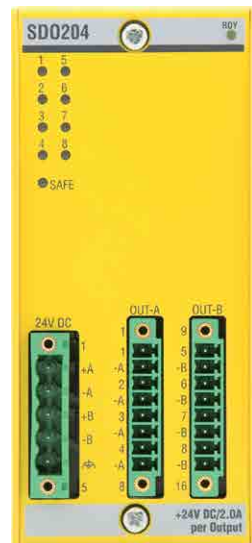
#### Additional features

Status display via LEDs

| Ambient conditions          | Standard                       | ColdClimate (✱)             |
|-----------------------------|--------------------------------|-----------------------------|
| Operating temperature       | -20 .. +60 °C fanless          | -30 .. +60 °C fanless       |
| Relative humidity operation | 5 .. 95 % without condensation | 5 .. 95 % with condensation |
| Storage temperature         | -40 .. +85 °C                  | -40 .. +85 °C               |
| Relative humidity storage   | 5 .. 95 % without condensation | 5 .. 95 % with condensation |

#### Model variants

|         |                                                                      |
|---------|----------------------------------------------------------------------|
| SDI208  | Safety digital input module; SIL3/PLe: 8x DI 24V; (SIL2/PLd: 16x DI) |
| SDI208✱ | like SDI208; ColdClimate (✱)                                         |



**Safety Control**

### Safety output modules SDO204

The safety output module, SDO204, adds an additional 4 output channels to the safety logic controller, SLC284, and a homogeneous overall system is created through the independent and safe inclusion in the M1 controller. Through the free choice of the slot – either directly beside the safety controller, through bus expansion, or several hundred meters away through the FASTBUS – the safety system can be optimally adapted to the distributed requirements and existing infrastructure of the system.

The input module, SDO204, is approved under the latest safety standard IEC61508. The input module can be easily integrated in the overall safety application, comparable with a standard I/O module – as the proven »SolutionCenter« development platform offers the easiest configuration, most flexible type of programming, and a safe simulation via easily combinable PLC-Open function modules. All variables and states of the SDO204 safety output module are accessible in other machine program languages (PLC, C/C++, Java), however the visualization is also available and makes bothersome parallel wiring unnecessary.

- 8 digital outputs – can be used redundantly in pairs (PL e/SIL3/Cat 4)
- Each output with emergency delay is configurable in the event of communication lost
- Safe monitoring of the inputs with redundant 32-bit microcontrollers
- Several SDO208 units per controller possible
- All safety I/O states can be used by M1 controller
- Safety programming via SolutionCenter
- Galvanic isolation between the groups
- Galvanic isolation from the system
- Operating state display »SAFE«
- Status display for each channel via LED

| Item    | Item no.    |
|---------|-------------|
| SDO204  | 00014545-00 |
| SDO204* | 00017462-00 |

## Safety modules

### SDO204

#### Digital outputs

|                                        |                                                                                                                                                                                                   |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quantity                               | 8 digital outputs - can be used redundantly in pairs (PL e/SIL3/Cat 4)                                                                                                                            |
| Output voltage range                   | 18 .. 34 V DC                                                                                                                                                                                     |
| Output current per channel             | 2 A nominal                                                                                                                                                                                       |
| Total current per group (max.)         | 8 A (derating from 40 °C ambient temperature)                                                                                                                                                     |
| Delay 0 to 1                           | max. 35 µs at full load                                                                                                                                                                           |
| Delay 1 to 0                           | max. 155 µs at full load                                                                                                                                                                          |
| Output groups                          | 2, electronic fuse                                                                                                                                                                                |
| Status display (LED)                   | green                                                                                                                                                                                             |
| Switching frequency (max., ohmic load) | 500 Hz                                                                                                                                                                                            |
| Error monitoring                       | short circuit, overload, inadequate or excess voltage of the power supply                                                                                                                         |
| Time-delayed emergency shut-off        | each output individual from 0 .. 1800 s configurable (resolution 100 ms);<br>Emergency shut-off is activated in the event of communication lost e.g. cable break or failure in the supply voltage |

#### Internal power supply

|                                    |                            |
|------------------------------------|----------------------------|
| Galvanic isolation from the system | 500 V                      |
| Galvanic isolation between groups  | 500 V                      |
| Internal power supply              | Backplanes BS2xx           |
| Current consumption internal       | 5 V / 250 mA via backplane |

#### External power supply

|                             |                                                                          |
|-----------------------------|--------------------------------------------------------------------------|
| Reverse polarity protection | yes                                                                      |
| Input voltage               | 24 V DC (18 .. 34 V)                                                     |
| Voltage range               | 18 .. 34 V DC                                                            |
| Current consumption         | normally 70 mA at +24 VDC + $\Sigma$ current consumption of the encoders |

#### Connection technology

|                       |                                                       |
|-----------------------|-------------------------------------------------------|
| Connection technology | screw or spring terminal<br>writable and codable plug |
|-----------------------|-------------------------------------------------------|

#### Standards

|                  |                                                                                                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Machine safety   | IEC61508 Functional safety draft of complex E/E/PE safety components                                                                                               |
| Approved for     | ISO13849: Safety of Machinery<br>IEC62061: Functional safety machine-related E/E/PE systems<br>IEC61511: Functional safety equipment and process industry<br>EN954 |
| Product standard | IEC 61131-2<br>UL508                                                                                                                                               |

### SDO204

#### Additional features

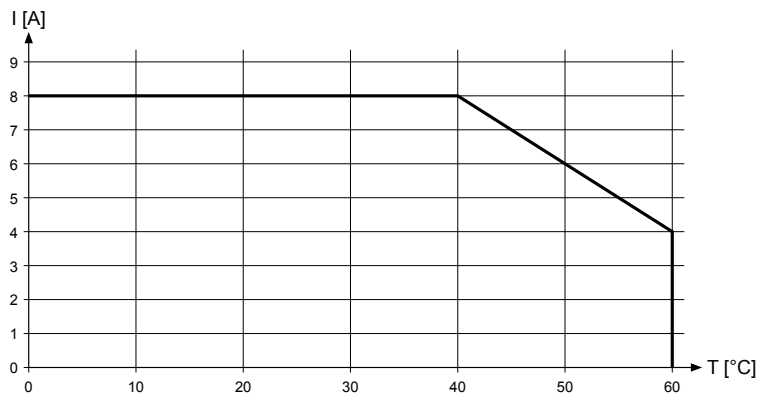
Status display via LEDs

| Ambient conditions          | Standard                                                                   | ColdClimate (✱)             |
|-----------------------------|----------------------------------------------------------------------------|-----------------------------|
| Operating temperature       | -20 .. +60 °C fanless                                                      | -30 .. +60 °C fanless       |
| Relative humidity operation | 5 .. 95 % without condensation                                             | 5 .. 95 % with condensation |
| Storage temperature         | -40 .. +85 °C                                                              | -40 .. +85 °C               |
| Relative humidity storage   | 5 .. 95 % without condensation                                             | 5 .. 95 % with condensation |
| Elevation limit             | 2000 m above sea level (use), 3000 m above sea level (storage & transport) |                             |

#### Model variants

|         |                                                                           |
|---------|---------------------------------------------------------------------------|
| SDO204  | Safety digital output module; SIL3/PLe: 4x DO 24V / 2A; (SIL2/PLd: 8x DO) |
| SDO204✱ | like SDO204; ColdClimate (✱)                                              |

\* Derating of 40°C ambient temperature

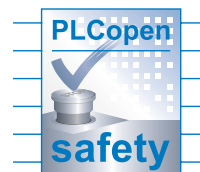


## Safety Developer

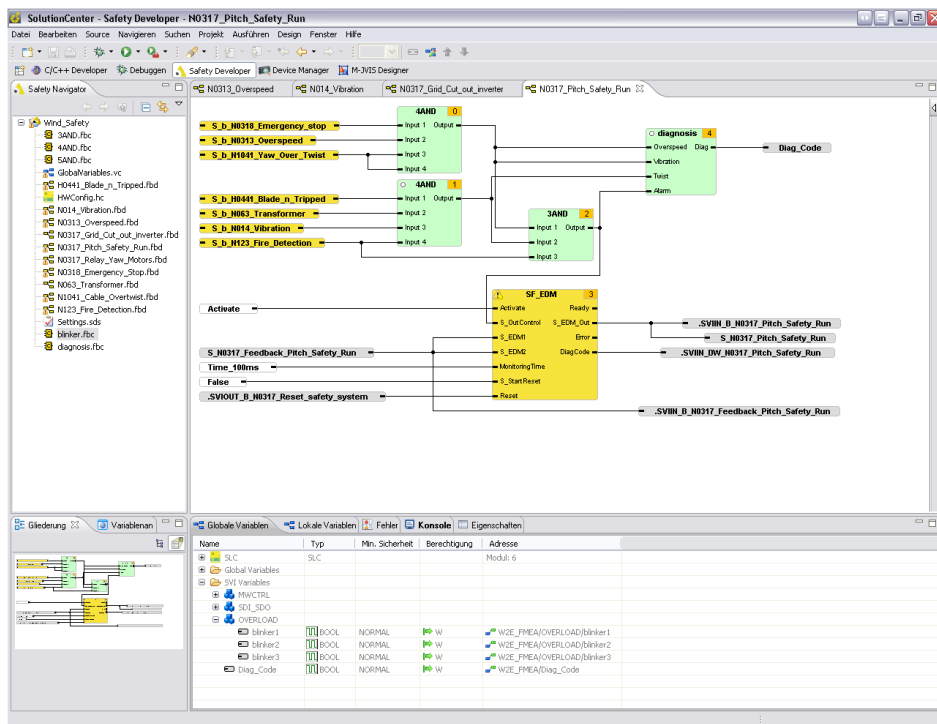


### Safety Developer Engineering tool

For the more safety-relevant, engineering steps the SolutionCenter contains the Safety Developer that includes all tools required for safety-conformant programming in accordance with EN61508 andb PLCopen. Safety Developer has been developed and certified in close collaboration with TÜV. All methods required for logging and the verification obligation of the machine manufacturer are integral components: password management, fail-safe program transmission, tamper-proof logging on the target device, documentation of the safety program, and all software components used, unique identification of the safety modules, and the programming itself.



- Integrated in the SolutionCenter all-in-one engineering tool
- Full-graphic function plan editor with autorouting
- Certified safety modules in accordance with PLCopen Safety
- Standard modules for logical links, timers and arithmetic operations in accordance with EN61131-3
- Color coding of secure and unsecure signal flow
- Grouping of circuitry parts for repeat use (compound)
- Adjustable test depth for the project translation
- Variable monitoring, value simulation and break points
- Open programming interfaces (PLC, C, C++) for e.g. online monitoring
- Bidirectional exchange of values between secure and non-secure controller
- Unique identification of the safe hardware
- Configuration of the clocked self-monitoring of inputs/outputs
- Communication to safe hardware via Ethernet (M1) or serial
- Certified redundant program download
- Logging of the acceptance state in PDF format
- Direct connection to version management
- Online monitoring of all I/Os also in safe operating mode



## Programming in accordance with PLCopen Safety

The safety application is programmed in a free-graphic function plan editor (Safety Editor) in accordance with EN61131-3. The module set includes a library of safety modules that have been strictly implemented, tested, and certified in accordance with the PLCopen safety standard. For the logic, additionally required standard modules, such as timers, arithmetic, and logical operations are available. The application can be organized in multiple separated functional units and sub programs in order to structure the program. Unsafe input and output signals from the control system can be added to the safety

project via a browser. The execution sequence of the modules is presented graphically and can be corrected by the user. Redundant hardware inputs are summarized via equivalence or antivalence blocks and subsequently presented as a safe signal in the program. The data types, bool, integer, and time, are supported.

# Safety Developer

## Visibility in the standard program

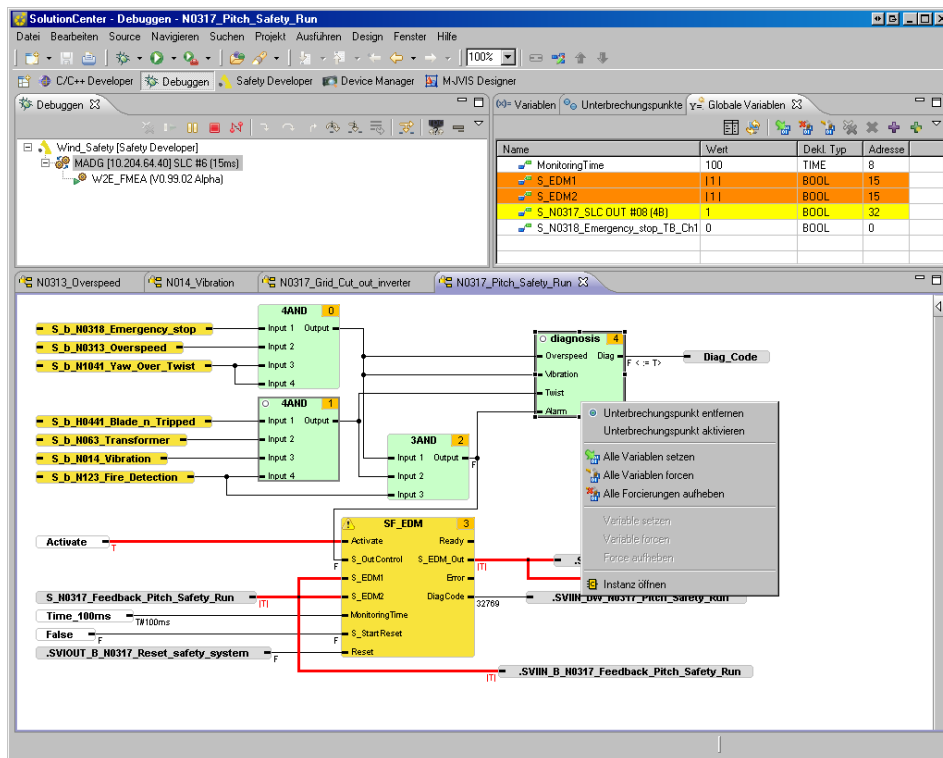
The transparent exchange of signals functions in both directions. In the Safety Developer you configure which values – irrespective of the states of the safe I/Os – should also be visible in the unsafe world. Thus intermediate results in networks and the status of modules can be presented in a visualization, recorded with the Scope, or evaluated in a PLC program. Thus there are extensive diagnostic possibilities and a high level of operating convenience.

## Safe and unsafe paths

Signals from the standard sequential program and from the I/O modules of the control system can be used in the safety program as unsafe input and output signals. The classification of a signal as safe or unsafe is presented with color coding.

## User-specific templates

A logical circuit that is structured from a group of basic modules can be put together and given an interface in the project for a function group. Thus separate user-specific function blocks (templates) can be created and used in the project multiple times. These groups or even complete networks can also be transferred from one project into the next project.





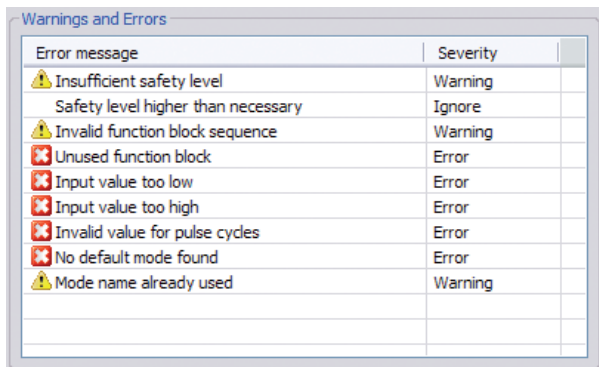
## Tracking changes

In the Safety Developer version management is an integral component – regardless of the logging and verification obligation. The version management database is operated directly from the project navigator. A local history is always kept automatically, which enables reversal of changes even without a genuine version management system. Naturally Undo/Redo functions are also available.

## Program verification

The program for execution on the target system is not compiled, but rather is translated into a script that is checked and executed redundantly by the firmware of the target system. Nevertheless the Safety Developer can detect and display possible error sources in the code when the script is generated.

## Modularity



| Error message                        | Severity |
|--------------------------------------|----------|
| ⚠ Insufficient safety level          | Warning  |
| ⚠ Safety level higher than necessary | Ignore   |
| ⚠ Invalid function block sequence    | Warning  |
| ✖ Unused function block              | Error    |
| ✖ Input value too low                | Error    |
| ✖ Input value too high               | Error    |
| ✖ Invalid value for pulse cycles     | Error    |
| ✖ No default mode found              | Error    |
| ⚠ Mode name already used             | Warning  |

The Safety Developer takes the flexible requirements in today's industry into account through its modular project management. FBD networks, and also additional safe I/O modules of the project, can be activated depending on the expansion stage, signals can be connected to different sources and potentially susceptible equipment, thus a project for maximum machine expansion can be created and tested. Adaptation to the real degree of expansion is achieved through the bringing together of the desired parts. Commissioning of individual machine parts is also possible in this manner.

## Logging

The verification obligation is supported in different ways. For logging of acceptance, a project report can be generated that also presents the entire program code graphically. The tamper-proof log book of the safety controller logs each safety-relevant change in the system, such as the download of a changed program. Thus any manipulation can be traced with user name, date, and time.

Optionally the safety program can be stored on the safety controller and can be opened and further processed from the controller. Additional user-specific information, such as author, version history, and additional comments can be stored for each network.

## Hardware configuration

In addition to the tools for variable selection, programming, and logging, the safe hardware can also be directly configured in the Safety Developer. This includes not only assignment of unique channel names, but particularly also allocation of the controller to the project, the adding of additional safe I/O modules, and specification of test intervals for clocked lines, which then are tested automatically by the hardware for short circuit, cross-connection, and interference voltage.

Safety-relevant, required unique module identification that excludes the possibility of swapping modules after a service deployment is also executed directly in the Safety Developer. Communication between Safety Developer and the control system for program download, diagnosis and configuration is executed conveniently and in broadband via the Ethernet Interface of the M1 control system. Alternatively, communication can also be executed directly with the Safety Controller via a serial RS232 interface, which also enables use of the Safety Controller as a stand-alone solution without a surrounding control system.





## **Redundancy – maximum availability ensures productivity**

Automation devices from plant, transport and mechanical engineering are no longer unthinkable. They control and regulate mission critical systems - often entirely stand-alone or with requirements that manual operation can no longer perform. Maximum reliability and ranges of solutions for high-availability applications call for increasingly higher demands on productivity right up to 27/7 availability.

Proven ruggedness and exceptional service life data are often insufficient here. Effective measures against network, sensor and wiring outages, as well as statistically rare component part failure, are required.

Bachmann electronic with its scalable redundancy products for the proven M1 automation system always provides the right solution. The redundancy product series upgrades the significant ruggedness and availability of the hardware modules universal fault tolerance. The software-only implementation based on redundant Ethernet real-time networking guarantees compatibility without special and expensive redundancy hardware and makes upgrading of existing applications possible.

# Redundancy

## The right solution for each application

### Hot-standby redundancy

Maximum reliability thanks to fully automatic variable exchange and bumpless application switchover. Ideal where outages are economically unacceptable and for technical challenges like in rapid control applications.

### Warm-standby redundancy

Values interchange is supported by network redundancy. Adjusts to redundant data recording and for simple and less critical redundancy applications.

### Network redundancy

Using the basic redundancy version, critical transmission links are protected against interruptions due to mechanical damage and network equipment outages.

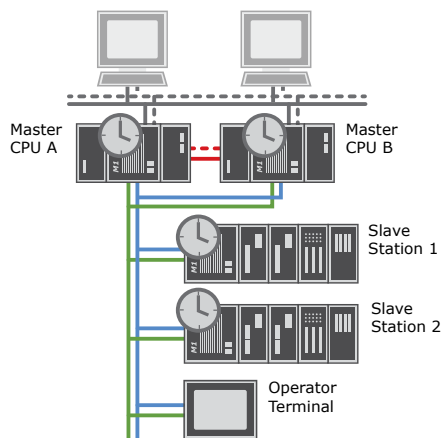


#### Common features

|                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Redundancy cycles up to 1 ms possible*                                                                                                                      |
| Automatic switchover between variables and process value sources within one PLC cycle                                                                       |
| Support of fully autonomous, dual communication guarantees maximum reliability with freely selectable transmission medium (copper/optical fiber)            |
| Integration of configuration, monitoring and programming in the engineering tool SolutionCenter                                                             |
| Redundancy networking on Ethernet basis, full support of TCP/IP-based parallel communication                                                                |
| Networking topology freely selectable: star, bus, ring and combinations → easily adaptable to existing network                                              |
| Master CPUs: all processor modules from the MPC, MC, MH series                                                                                              |
| Retrofittable and upgradable without CPU exchange, application of standard components                                                                       |
| Support of standard applications in addition to redundancy applications, even with diverse cycle times                                                      |
| Standard operating range of -30°C ... +60°C, with short-term Temperature peaks of -40°C ... +70°C with condensation present when using cold climate modules |

\* tested with CPUs of the MPC series; limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available, network and CPU load via non-redundant applications

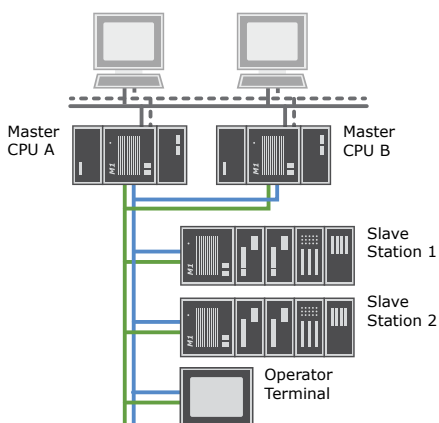
# Redundancy



## Hot-standby redundancy

### Features

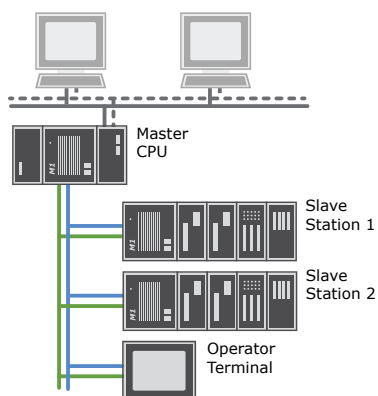
- Two master CPUs
- Automatic matching of the master CPUs
- Bumpless switchover
- Chronological synchronization of all stations
- Configuration and monitoring in the SolutionCenter
- Expanded diagnostic and programming interfaces for monitoring and analysis of redundancy status
- Network redundancy included
- Freely adjustable switchover time, automatic switchover in case of error



## Warm-standby redundancy

### Features

- Two master CPUs
- Diagnostic interface for monitoring and analyzing the redundancy status
- Slaves decide from which CPU the data packet is applied (voter)
- Switching time configurable
- Matching of the master CPUs not integrated

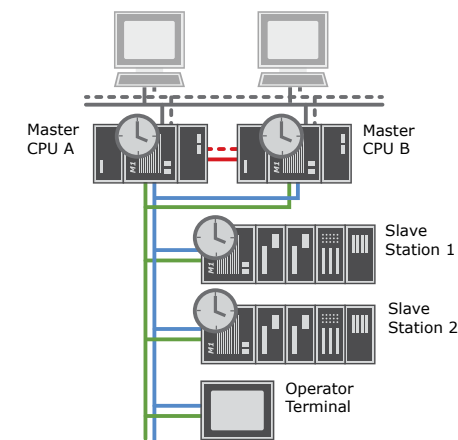


## Network redundancy

### Features

- One master CPU
- Redundant communication (cyclic and non-cyclic communication)
- Easy configuration in development environment, integrated diagnostics (status, quality)
- Programming interface, libraries and system variables for easy creation of applications
- Slaves work as smart substations
- Network switchover in the same PLC cycle

# Redundancy



## Hot-standby redundancy

Mission-critical systems, applications in harsh environments and facilities where even short outages, e.g. owing to cost restraints, are not tolerated are hot-standby redundancy's main fields of activity. In addition, control engineering applications with their requirement of smooth switchover, i.e. no deviation between values when switching the master CPU, are executable in this redundancy version too.

With redundancy on all system levels (i.e. hardware, system software, application programming and maintenance, monitoring interfaces) hot-standby redundancy provides maximum reliability with outstanding convenience at the same time.

The full integration of configuration, programming and monitoring in Bachmann tools shortens application creation and minimizes deviations with respect to everyday standard operating sequences. At the same time, risks in the course of maintenance operations, error corrections and application updates decrease during the process in operation.

Hot-standby redundancy combines the highest redundancy technology and the best performance possible with the customary ruggedness of every Bachmann module.

Hot-standby redundancy enhances network redundancy by the following attributes, among others:

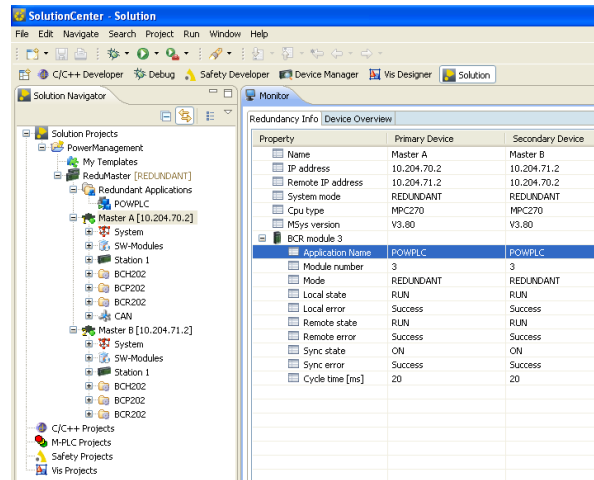
- Fully automatic matching of process variables
- Automatic failover upon detecting internal errors
- Integrated self-tests for checking system status
- Automatic system matching (system software, configuration, applications)
- Automatic application synchronization (variance < 200 µs)

| Item         |                                                                                                                                                                                                                                                  | Item no.    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| M-HS-REDU RT | License to operate a hot-standby redundancy on two controller CPUs as redundant main controllers (includes 2 licenses). Allows any number of IO stations (slaves) to connect redundantly to both main controllers (includes network redundancy). | 00019829-63 |

- Millisecond-precise synchronization of all stations
- Network switching time freely configurable (0 ... 10 PLC cycles)
- Blumpless switchover
- Redundancy programming support in M-PLC (IEC 61131-3)
- Debugging and forcing of variables in redundant applications (M-PLC)
- Resistant to single-fault events, additionally many multi-fault scenarios are overridden on a continuous basis

## Integration in the SolutionCenter

- Applying, monitoring and deleting redundancy devices
- Extra support in Solution Navigator and Device Manager for configuring, monitoring and logging redundant applications
- Textual and graphical redundancy status displays
- Virtual redundancy devices with the option of applying and manipulating redundancy configurations and applications
- Redundancy master status information
  - Device designation
  - Current redundancy status of the entire system
  - CPU information
  - System software information
  - Network information
- Redundancy application status information
  - Current redundancy status (REDUNDANT/SINGLE/ERROR)
  - Runtime state (RUN/STOP/ERROR)
  - Error status codes
  - Synchronization status
  - Cycle time
- Maintenance interface for redundancy systems integrated (execution of commands on both master CPUs at the same time)
- All commands and monitoring mechanisms are available to the operator as open user interfaces and/or as system variables.



# Redundancy

| Hot-standby redundancy            |                                                                                                                                                                  |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rationale/Characteristic          |                                                                                                                                                                  |
| High availability system type     | Hot-standby redundancy with local I/O stations (1oo2 voting integrated)                                                                                          |
| CPU redundancy                    | yes (synchronization and self-monitoring automatic)                                                                                                              |
| Network redundancy                | included                                                                                                                                                         |
| I/O redundancy                    | possible                                                                                                                                                         |
| Sensor redundancy                 | possible                                                                                                                                                         |
| Switchover                        | bumpless                                                                                                                                                         |
| Continuous dual-channel ability   | yes                                                                                                                                                              |
| Communication redundancy          | yes                                                                                                                                                              |
| Processing units (recommendation) | Master: M1 standard CPUs of the MPC, MC, MH families or better<br>Slave: M1 standard CPUs of the MX, MPC, MC, MH families or better                              |
| I/O peripheral                    | via MX CPU all from M1 standard module portfolio                                                                                                                 |
| Use of special hardware           | no (straight software solution and standard Ethernet)                                                                                                            |
| Topology/Networking               |                                                                                                                                                                  |
| Protocol basis                    | Ethernet IEEE 802.3q, Ethertype 0x892D                                                                                                                           |
| Communication protocol            | bluecom with redundancy enhancement (100% IEEE 802.3q compatible)                                                                                                |
| Media redundancy                  | yes (2-channel, galvanically separated Ethernet networks)                                                                                                        |
| Switches                          | industrial standard managed switch (or unmanaged switch with appropriate configuration)                                                                          |
| Topologies                        | Star, bus, ring, mesh                                                                                                                                            |
| Ring redundancy                   | possible via parallel application of MRP, STP and RSTP                                                                                                           |
| Dimension                         | in compliance with IEEE 802.3 - max. 2000 m per network section with fiber optic connection via FCS214 module                                                    |
| CPUs spatially separable          | yes (see Dimension)                                                                                                                                              |
| Time synchronization              | integrated in network protocol                                                                                                                                   |
| Number of I/O stations            | more than 100                                                                                                                                                    |
| Smart substations                 | yes, for example, I/O stations can execute local applications for: emergency operation, load separation or local logging                                         |
| Parallel data traffic             | yes, possible (Ethernet-based protocols and services, e.g. HTTP, FTP, video stream, Modbus, OPC, MMS, ...)                                                       |
| Interfaces                        |                                                                                                                                                                  |
| I/O peripheral                    | M1 standard module portfolio                                                                                                                                     |
| Redundancy network                | bluecom network variables                                                                                                                                        |
| Field buses                       | Gateway function for CAN, Profibus DP, Profinet, Modbus, EtherCAT via application possible                                                                       |
| SCADA / control station & PDA     | Standard protocols:<br>IEC61850, IEC61400-25, IEC60870-5-104, OPC DA,<br>Modbus TCP/UDP<br>Application development:<br>communication library M1Com and M1Com.NET |
| IT protocols                      | see M1 software (FTP, HTTP, SNMP, SMTP, ... and security versions)                                                                                               |
| Configuration/Programming         |                                                                                                                                                                  |
| Configuration                     | SolutionCenter (support via wizards)                                                                                                                             |
| Remote configuration              | yes (Ethernet LAN, Internet)                                                                                                                                     |
| Network configuration             | SolutionCenter (support via wizards)                                                                                                                             |
| Programming                       | M-PLC: IEC 61131-3 (IL, LD, FBD, ST, AS, SFC)                                                                                                                    |

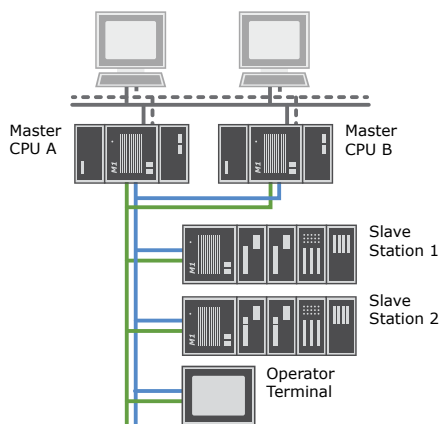


| Hot-standby redundancy          |                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration/Programming       |                                                                                                                                          |
| Editor                          | CoDeSys                                                                                                                                  |
| Redundancy download             | Automatic                                                                                                                                |
| Redundancy debugging            | yes                                                                                                                                      |
| Redundancy synchronization      | automatic (process variables, system software)                                                                                           |
| Manual switchover               | yes<br>Switchover: triggering by user<br>Failover: automatic via software                                                                |
| Multitasking                    | yes (one redundant task permissible per PLC application, total up to three independent redundancy tasks)                                 |
| Mixed operation                 | yes (non-redundant, non-synchronized applications can run parallel to redundancy applications)                                           |
| Diagnostics/Monitoring          |                                                                                                                                          |
| I/O live display                | SolutionCenter                                                                                                                           |
| Redundancy status               | yes                                                                                                                                      |
| Error status                    | yes                                                                                                                                      |
| Diagnostic user interface (API) | yes, integrated                                                                                                                          |
| Statistic user interface (API)  | yes, integrated                                                                                                                          |
| Network monitor                 | SolutionCenter                                                                                                                           |
| Network analysis                | yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)                                                 |
| Distributed logging             | yes (synchronized, granularity 1 ms)                                                                                                     |
| Performance data                |                                                                                                                                          |
| Master cycle time               | 1 ... 1000 ms*                                                                                                                           |
| I/O cycle time                  | Minimum 200 µs for non-redundant applications<br>1 ms... 1000 ms for redundant applications*                                             |
| I/O frame works                 | more than 100 stations*<br>Number of channels unrestricted (*, **) - typically 400 .. 600 channels per station (1/3 analog, 2/3 digital) |
| Synchronization volume          | max 120*1400 byte                                                                                                                        |
| Switching time                  | adjustable from 0 .. 10 cycles                                                                                                           |
| Time precision                  | < 1ms *                                                                                                                                  |
| Installation                    |                                                                                                                                          |
| Installation medium             | CD ROM or network                                                                                                                        |
| Installation tool               | SolutionCenter                                                                                                                           |
| Upgrading existing systems      | possible via software / new CF card required                                                                                             |
| License protection              | Data CF of the master CPUs is integrated dongle                                                                                          |
| System prerequisites            |                                                                                                                                          |
| Controller equipment            | M1 CPUs of the MX200 family or better (minimum 2 Ethernet interfaces onboard)                                                            |
| Network                         | 2x Ethernet 100 MBit/s or Gbit/s, managed switch                                                                                         |
| Software                        | MSys / MxCCore / M-BASE V3.80 or higher                                                                                                  |

\* Limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available and network and CPU load via non-redundant applications

\*\* No program-technical restriction.

# Redundancy



**Redundancy  
Control**

## Warm-standby redundancy

For applications where reliable recording of critical data has priority, warm-standby redundancy is the preferred solution. Good support when configuring and monitoring the actual CPU redundancies helps during the rapid development of applications for which bumpless switchover is not required. Continuous operation during maintenance, system updating and application changes is also possible in this version.

If a master CPU for maintenance work is disconnected from the network, real-time processing is only affected to a minimum. The data transmission continues seamlessly and from the perspective of the receiving stations no packets are lost. The matching of process variables in the master CPU has to be resolved on the application level, which means extra effort and expense and increased complexity vis-à-vis hot-standby redundancy (see Fig. 1).

Warm-standby redundancy provides the qualities of network redundancy and the following advantages as well:

- CPU redundancy
- Switching time freely configurable (0 ... 10 PLC cycles)
- Selection of the data master integrated in end points (voter), the fastest switching times possible as a result
- Diagnostic interface for monitoring and analyzing the redundancy status in the SolutionCenter
- Automatic matching of the master CPUs not integrated → switchover not bumpless

| Item         |                                                                                                                                                                                                                                                                                    | Item no.    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| M-NW-REDU RT | License to operate a network redundancy communication master on one controller CPU. Allows any number of IO stations (slaves) to connect redundantly over the network. Two network redundancy licenses are necessary for warm-standby operation (for each master-cpu one license). | 00019828-63 |

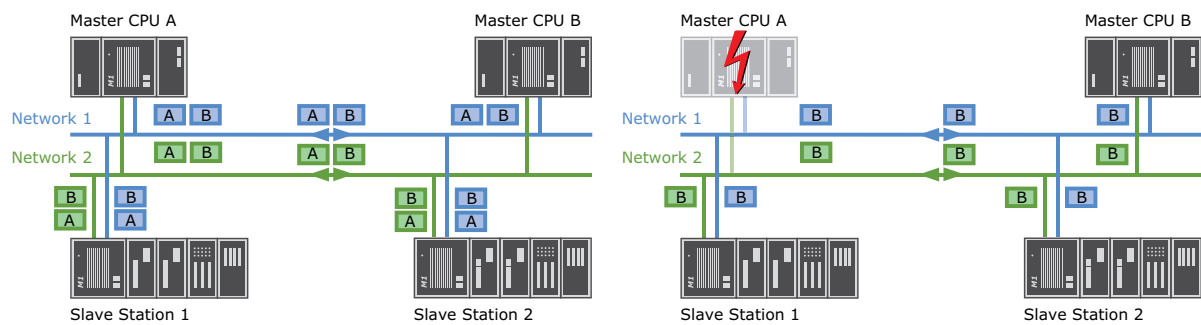


Fig.1 Switchover of the active CPU within a PLC cycle, e.g. cycle time 1 ms – switchover  $\leq$  1 ms

## Warm-standby redundancy

### Rationale/Characteristic

|                                   |                                                                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| High availability system type     | Warm-standby redundancy with decentral I/O (1oo2 voting integrated)                                                                 |
| CPU redundancy                    | yes (no automatic synchronization and self-monitoring)                                                                              |
| Network redundancy                | included                                                                                                                            |
| I/O redundancy                    | possible                                                                                                                            |
| Sensor redundancy                 | possible                                                                                                                            |
| Switchover                        | not bumpless                                                                                                                        |
| Continuous dual-channel ability   | yes                                                                                                                                 |
| Communication redundancy          | yes                                                                                                                                 |
| Processing units (recommendation) | Master: M1 standard CPUs of the MPC, MC, MH families or better<br>Slave: M1 standard CPUs of the MX, MPC, MC, MH families or better |
| I/O peripheral                    | via MX CPU all from M1 standard module portfolio                                                                                    |
| Use of special hardware           | no (straight software solution and standard Ethernet)                                                                               |

### Topology/Networking

|                          |                                                                                                                           |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Protocol basis           | Ethernet IEEE 802.3q, Ethertype 0x892D                                                                                    |
| Communication protocol   | bluecom with redundancy enhancement (100% IEEE 802.3q compatible)                                                         |
| Media redundancy         | yes (2-channel, galvanically separated Ethernet networks)                                                                 |
| Switches                 | industrial standard managed switch (or unmanaged switch with appropriate configuration)                                   |
| Topologies               | Star, bus, ring, mesh                                                                                                     |
| Ring redundancy          | possible via parallel application of MRP, STP and RSTP                                                                    |
| Dimension                | in compliance with IEEE 802.3 - max. 2000 m per network section with fiber optic connection via FCS214 module             |
| CPUs spatially separable | yes (see Dimension)                                                                                                       |
| Time synchronization     | integrated in network protocol                                                                                            |
| Number of I/O stations   | more than 100                                                                                                             |
| Smart substations        | yes, for example I/O stations can execute local applications for: emergency operation or load separation or local logging |
| Parallel data traffic    | yes, possible (Ethernet-based protocols and services, e.g. HTTP, FTP, video stream, Modbus, OPC, MMS, ...)                |

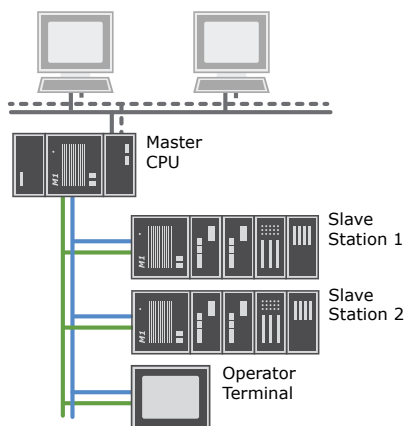
# Redundancy

| Warm-standby redundancy         |                                                                                                                                                               |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interfaces                      |                                                                                                                                                               |
| I/O peripheral                  | M1 standard module portfolio                                                                                                                                  |
| Redundancy network              | bluecom network variables                                                                                                                                     |
| Field buses                     | Gateway function for CAN, Profibus DP, Profinet, Modbus, EtherCAT via application possible                                                                    |
| SCADA / control station & PDA   | Standard protocols:<br>IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP<br>Application development:<br>communication library M1Com and M1Com.NET |
| IT protocols                    | see M1 software (FTP, HTTP, SNMP, SMTP, ... and security versions)                                                                                            |
| Configuration/Programming       |                                                                                                                                                               |
| Configuration                   | SolutionCenter (support via wizards)                                                                                                                          |
| Remote configuration            | yes (Ethernet LAN, Internet)                                                                                                                                  |
| Network configuration           | SolutionCenter (support via wizards)                                                                                                                          |
| Programming                     | M-PLC: IEC 61131-3 (IL, LD, FBD, ST, AS, SFC)                                                                                                                 |
| Editor                          | CoDeSys                                                                                                                                                       |
| Redundancy download             | Automatic                                                                                                                                                     |
| Redundancy debugging            | yes                                                                                                                                                           |
| Redundancy synchronization      | manual                                                                                                                                                        |
| Manual switchover               | to integrate by user                                                                                                                                          |
| Multitasking                    | to integrate by user                                                                                                                                          |
| Mixed operation                 | yes (non-redundant, non-synchronized applications can run parallel to redundancy applications)                                                                |
| Diagnostics/Monitoring          |                                                                                                                                                               |
| I/O live display                | SolutionCenter                                                                                                                                                |
| Redundancy status               | yes (restricted to network redundancy)                                                                                                                        |
| Error status                    | yes                                                                                                                                                           |
| Diagnostic user interface (API) | yes, integrated                                                                                                                                               |
| Statistic user interface (API)  | yes, integrated                                                                                                                                               |
| Network monitor                 | SolutionCenter                                                                                                                                                |
| Network analysis                | yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)                                                                      |
| Performance data                |                                                                                                                                                               |
| Master cycle time               | 1...1000 ms*                                                                                                                                                  |
| I/O cycle time                  | Minimum 200 µs for non-redundant applications<br>1 ms... 1000 ms for redundant applications*                                                                  |
| I/O frame works                 | more than 100 stations*<br>Number of channels unrestricted (*, **) - typically 400 .. 600 channels per station (1/3 analog, 2/3 digital)                      |
| Switching time                  | adjustable from 0 .. 10 cycles                                                                                                                                |

- \* Limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available and network and CPU load via non-redundant applications
- \*\* No program-technical restriction.

| Warm-standby redundancy    |                                                                            |
|----------------------------|----------------------------------------------------------------------------|
| Installation               |                                                                            |
| Installation medium        | CD ROM or network                                                          |
| Installation tool          | SolutionCenter                                                             |
| Upgrading existing systems | possible via software / new CF card required                               |
| License protection         | Data CF of the master CPUs is integrated dongle                            |
| System prerequisites       |                                                                            |
| Controller equipment       | M1 CPUs of the MX200 series or better (min. 2 Ethernet interfaces onboard) |
| Network                    | 2x Ethernet 100 MBit/s or Gbit/s, managed switch                           |
| Software                   | MSys / MxCCore / M-BASE V3.80 or higher                                    |

# Redundancy



## Network redundancy

Cable break and outage or misconfiguration of network equipment are frequent causes of failure in the daily automation routine. Searching for errors in the process often proves to be expensive and difficult. In doing so, however, little carelessness hides the risk of longer production stoppages and economically relevant outages. The introduction of redundant real-time networking makes separate cable routes possible. In conjunction with the simultaneous transmission of all data packets on both network lines, single failures on the transmission line no longer have the effect of disrupting communication and therefore automation.

The product „network redundancy“ fulfills these qualities precisely by means of a combination of media and communication redundancies. Even in the case of an error, no data packets to the receiving stations (master or slave) are lost in the process (see Fig. 1). Integrated self-monitoring and diagnostic interfaces draw attention to transmission errors and make finding their location easier.

The network redundancy is optimized for real-time capabilities, compatibility, ruggedness and performance. Conformity with Ethernet standard IEEE 802.3 guarantees the cost-effective networking of more than one hundred redundancy stations\*.

- Switch-over time ≤ 1 PLC cycle
- Real-time network fully Ethernet compatible (IEEE 802.3q)
- Monitoring and diagnostics of errors via SolutionCenter

| Item         |                                                                                                                                                                        | Item no.    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| M-NW-REDU RT | License to operate a network redundancy communication master on one controller CPU. Allows any number of IO stations (slaves) to connect redundantly over the network. | 00019828-63 |

- Programming interfaces, libraries and system variables for data transmission and communication monitoring in IEC 61131-3
- Prioritized redundancy data transmission makes parallel communication via IP-based protocols possible
- Bandwidth limit integrated
- Connection of terminals via TCP/IP

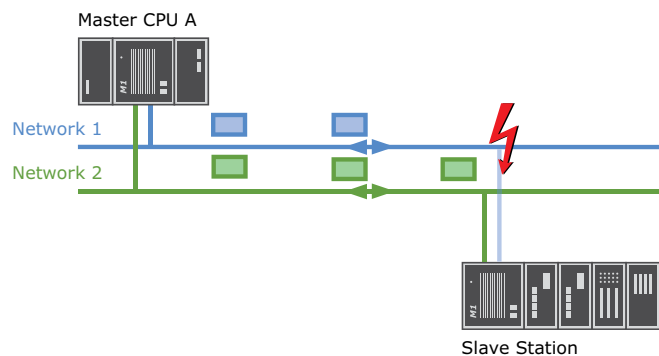


Fig. 1 In case of an error, no data packets to the receiving stations are lost.

| Network redundancy                |                                                                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Rationale/Characteristics         |                                                                                                                                     |
| High availability system type     | Communication and media redundancy (1002 voting integrated)                                                                         |
| CPU redundancy                    | no                                                                                                                                  |
| Network redundancy                | yes                                                                                                                                 |
| Switchover                        | 0 ms                                                                                                                                |
| Continuous dual-channel ability   | yes                                                                                                                                 |
| Communication redundancy          | yes                                                                                                                                 |
| Processing units (recommendation) | Master: M1 standard CPUs of the MPC, MC, MH families or better<br>Slave: M1 standard CPUs of the MX, MPC, MC, MH families or better |
| I/O peripheral                    | via MX CPU all from M1 standard module portfolio                                                                                    |
| Use of special hardware           | no (straight software solution and standard Ethernet)                                                                               |
| Topology/Networking               |                                                                                                                                     |
| Protocol basis                    | Ethernet IEEE 802.3q, Ethertype 0x892D                                                                                              |
| Communication protocol            | bluecom with redundancy enhancement (100% IEEE 802.3q compatible)                                                                   |
| Media redundancy                  | yes (2-channel, galvanically separated Ethernet networks)                                                                           |
| Switches                          | industrial standard managed switch (or unmanaged switch with appropriate configuration)                                             |
| Topologies                        | Star, bus, ring, mesh                                                                                                               |
| Ring redundancy                   | possible via parallel application of MRP, STP and RSTP                                                                              |
| Dimension                         | in compliance with IEEE 802.3 - max. 2000 m per network section with fiber optic connection via FCS214 module                       |
| CPUs spatially separable          | yes (see Dimension)                                                                                                                 |
| Time synchronization              | integrated in network protocol                                                                                                      |
| Number of I/O stations            | more than 100                                                                                                                       |
| Smart substations                 | yes, I/O stations can execute local applications for:<br>emergency operation, load separation or local logging                      |
| Parallel data traffic             | yes, possible (Ethernet-based protocols and services, e.g. HTTP, FTP, video stream, Modbus, OPC, MMS, ...)                          |

# Redundancy

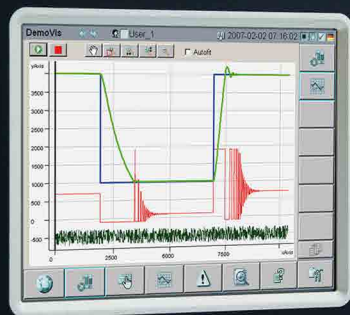
| Network redundancy              |                                                                                                                                                               |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interfaces                      |                                                                                                                                                               |
| I/O peripheral                  | M1 standard module portfolio                                                                                                                                  |
| Redundancy network              | bluecom network variables                                                                                                                                     |
| Field buses                     | Gateway function for CAN, Profibus DP, Profinet, Modbus, EtherCAT via application possible                                                                    |
| SCADA / control station & PDA   | Standard protocols:<br>IEC61850, IEC61400-25, IEC60870-5-104, OPC DA, Modbus TCP/UDP<br>Application development:<br>communication library M1Com and M1Com.NET |
| IT protocols                    | see M1 software (FTP, HTTP, SNMP, SMTP, ... and security versions)                                                                                            |
| Configuration/Programming       |                                                                                                                                                               |
| Configuration                   | SolutionCenter (support via wizards)                                                                                                                          |
| Remote configuration            | yes (Ethernet LAN, Internet)                                                                                                                                  |
| Network configuration           | SolutionCenter (support via wizards)                                                                                                                          |
| Programming                     | M-PLC: IEC 61131-3 (IL, LD, FBD, ST, AS, SFC)                                                                                                                 |
| Editor                          | CoDeSys                                                                                                                                                       |
| Diagnostics/Monitoring          |                                                                                                                                                               |
| Redundancy status               | yes                                                                                                                                                           |
| Error status                    | yes                                                                                                                                                           |
| Diagnostic user interface (API) | yes, integrated                                                                                                                                               |
| Statistic user interface (API)  | yes, integrated                                                                                                                                               |
| Network monitor                 | SolutionCenter                                                                                                                                                |
| Network analysis                | yes (by Wireshark plug-in, Wireshark data are generated automatically on the controller)                                                                      |
| Performance data                |                                                                                                                                                               |
| Master cycle time               | 1...1000 ms*                                                                                                                                                  |
| I/O cycle time                  | Minimum 200 µs for non-redundant applications<br>1 ms... 1000 ms for redundant applications*                                                                  |
| I/O frame works                 | more than 100 stations*<br>Number of channels unrestricted (*, **) -<br>typically 400 .. 600 channels per station (1/3 analog, 2/3 digital)                   |
| Installation                    |                                                                                                                                                               |
| Installation medium             | CD ROM or network                                                                                                                                             |
| Installation tool               | SolutionCenter                                                                                                                                                |
| Upgrading existing systems      | possible via software / new CF card required                                                                                                                  |
| License protection              | Data CF of the master CPUs is integrated dongle                                                                                                               |
| System prerequisites            |                                                                                                                                                               |
| Automation equipment            | M1 CPUs of the MX200 family or better (minimum 2 Ethernet interfaces onboard)                                                                                 |
| Network                         | 2x Ethernet 100 MBit/s or Gbit/s, managed switch                                                                                                              |
| Software                        | MSys / MxCCore / M-BASE V3.80 or higher                                                                                                                       |

\* Limit value subject to CPU type, memory available, application size, number of exchangeable variables, network bandwidth available and network and CPU load via non-redundant applications

\*\* No program-technical restriction







## HMI devices

We have devoted 20 years of, what is now, our 40-year company history to the areas of »Human Machine Interfaces«, abbreviated as HMIs. Always oriented to the specific needs of our business partners and the target industries, Bachmann electronic offers a complete product line of visualization systems in different performance classes and for a wide variety of implementation areas.

All HMIs are developed and manufactured in our main facility in Feldkirch in Austria. In order to offer our customers the highest level of investment protection possible, all components are selected by our development team according to the premises of long-term availability and stability. To achieve this, the experienced engineers use industrial-grade components exclusively. In addition, every visualization device is subjected to a 48-hour run-in test in the climate chamber prior to delivery, and the specified operating temperature range is run through several times.

With M1 webMI pro Bachmann is offering a state-of-the-art visualization solution that supplements the HMIs. All compatible HMIs come as standard with the necessary interfaces and software components.

# Operator terminals

The optimal operator terminal for every application.

With the series OT100, OT200 and OT1300 operator terminals, Bachmann electronic offers operator terminals in different performance classes. The devices of the Essential class, OT100, are display devices that are primarily designed for simple text-based presentation in conjunction with a powerful M1 CPU. With the devices of the Intermediate class, OT200, the user

gets a »self-contained«, i.e. full-fledged 5.7" terminal based on PC technology with embedded Linux as the operating system. The brand new Advanced class OT1300 series with the Intel's latest processors and integrated solid state disk (SSD) or alternatively with AMD G-T40E Dualcore processor – is the ideal application for requirements where high performance capability paired with



## Operator terminal OT100 series

| Features                                   |
|--------------------------------------------|
| Display: 4.2" STN Bluemode                 |
| Processor: 72 MHz 32 bit                   |
| RAM: 64 kB internal                        |
| Interfaces: RS232/422                      |
| Project planning: Vis Designer, PLC blocks |



## Operator terminal OT200 series

| Features                                                   |
|------------------------------------------------------------|
| Display: 5.7" QVGA, 5.7" VGA, color TFT, opt. touch screen |
| Processor: AMD Geode LX800, 500 MHz                        |
| RAM: 512 MB                                                |
| Compact Flash: ≥ UDMA 2 GB                                 |
| Operating system: embedded Linux                           |
| Interfaces: Ethernet, USB, RS232                           |
| Project planning: Vis Designer, Java programming           |

shallow mounting depth and different screen diagonals are demanded. For visualization under extreme climatic conditions, condensation-proof »ColdClimate« devices are available in all performance classes. Devices for use in marine applications (indicated in the product designation with »M«) have a galvanically isolated supply voltage and, depending on the model, they have

typical marine features, such as internal signal encoders, a floating relay output, etc. In conjunction with Bachmann's own project planning tool, Vis Designer, visualizations can be quickly and easily implemented with all device series. Consistent application of industrial-grade components guarantees long-term availability and thus investment security.



## Operator terminal OT1300 series

### Features

Display: 10.4" VGA/12.1" SVGA/15" XGA/19"  
SXGA color TFT, opt. touch screen

Processor: Intel i7 2x 1.7 GHz  
Intel Celeron 847E 2x 1.1 GHz  
AMD G-T40E 2x 1.0 GHz

RAM: 2 GB DDR3 or 4 GB DDR3

Ultrafast CFast mass memory

Interfaces: 1x GBit Ethernet, 2x or 4x USB 2.0

Standard operating temperature: 0 ... 60 °C, fanless

Operating system: Linux embedded

Windows 7 embedded

Project management: M1 webMI pro, custom

# Operator terminals



## Operator terminal OT100 series

The devices are equipped with a full graphic 4.2" STN display. With use of UTF-8 character coding many lines of Asiatic and Cryillic characters can be displayed. The brightness of the LED backlighting can be controlled with the PLC program or via the input elements. With the ability to operate at temperatures from -30° to +60 °C, these terminals are predestined for use under extreme conditions where dependability is a must. Communication with the M1 controller occurs through an integrated interface that can be programmed to either the RS232 or RS422 standard. The arrangement and design of the control elements, including an alphanumeric multi-click keyboard are oriented to the familiar operating philosophy of mobile phones. For better tactile feel the keys are embossed and have integrated snap disks. The aluminum front panel with inlayed front foil underlines the sophisticated and robust character of the terminal.

- Full-graphic 4.2" STN Bluemode display with 240 x 64 pixels
- Model-dependent operating/display elements: 5x softkeys, alphanumeric multi-click keyboard, 1x Exit key, 1x Shift key, 1x keyboard entry lock/unlock key, 1x Backspace key, cursor directional pad with Enter key and 3 LEDs
- Convenient project planning via Vis Designer
- Character coding with UTF-8
- Operating temperature range from -30 .. +60 °C

| Item           | Item no.    |
|----------------|-------------|
| OT115/R/BE1    | 00014569-00 |
| OT115/R/BE2    | 00014570-00 |
| OT115/R/BE2/CC | 00017593-00 |

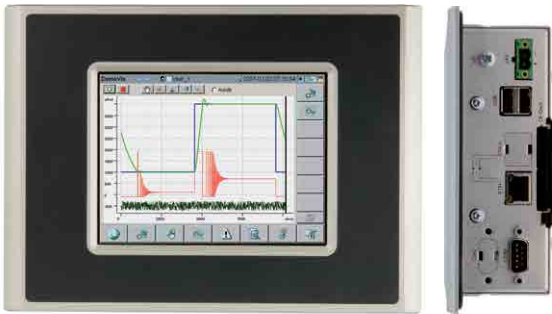
CC ... ColdClimate (❄) variant

## Operator terminals

| OT100 series                      |  | OT115/R/BE1                                                                                                                                                                                                     |  | OT115/R/BE2                  |  | OT115/R/BE2/CC                |  |
|-----------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------|--|-------------------------------|--|
| Display                           |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Diagonal/resolution               |  | 4.2" STN Bluemode (240 x 64 pixels)                                                                                                                                                                             |  |                              |  |                               |  |
| Display brightness                |  | 450 cd/m²                                                                                                                                                                                                       |  |                              |  |                               |  |
| Backlight                         |  | LED: dimmable via keyboard/PLC program                                                                                                                                                                          |  |                              |  |                               |  |
| Processor/RAM                     |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Processor                         |  | 72 MHz 32 bit                                                                                                                                                                                                   |  |                              |  |                               |  |
| RAM                               |  | 64 kB internal                                                                                                                                                                                                  |  |                              |  |                               |  |
| Control/display elements          |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Front keyboard                    |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Softkeys                          |  | 5x                                                                                                                                                                                                              |  | 5x                           |  |                               |  |
| Enter                             |  | 1x                                                                                                                                                                                                              |  | 1x                           |  |                               |  |
| Cursor keys                       |  | 4x                                                                                                                                                                                                              |  | 4x                           |  |                               |  |
| Multi-click keyboard              |  | -                                                                                                                                                                                                               |  | alphanumeric                 |  |                               |  |
| Exit                              |  | -                                                                                                                                                                                                               |  | 1x                           |  |                               |  |
| Shift                             |  | -                                                                                                                                                                                                               |  | 1x                           |  |                               |  |
| Keyboard entry                    |  | -                                                                                                                                                                                                               |  | 1x lock/unlock               |  |                               |  |
| Backspace                         |  | -                                                                                                                                                                                                               |  | 1x                           |  |                               |  |
| Display elements                  |  | -                                                                                                                                                                                                               |  | 1x red LED<br>2x yellow LEDs |  |                               |  |
| Interface                         |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| RS232/422 (switchable)            |  | 1x                                                                                                                                                                                                              |  |                              |  |                               |  |
|                                   |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Power supply*                     |  | 24 V DC (18 V .. 36 V), 10 ms buffering                                                                                                                                                                         |  |                              |  |                               |  |
| Certifications                    |  | CE, UL, GL; pending: ABS, BV, DNV, LR                                                                                                                                                                           |  |                              |  |                               |  |
| Ambient conditions                |  | Standard                                                                                                                                                                                                        |  |                              |  | ColdClimate (❄)               |  |
| Operating temperature             |  | -20 .. +60°C fanless                                                                                                                                                                                            |  |                              |  | -30 .. +60°C fanless          |  |
| Storage temperature               |  | -30 .. +80°C                                                                                                                                                                                                    |  |                              |  | -40 .. +85°C                  |  |
| Rel. humidity storage / operation |  | 5.. 95 %<br>without condensation                                                                                                                                                                                |  |                              |  | 5.. 95 %<br>with condensation |  |
| Certifications                    |  | CE, UL, GL; pending: ABS, BV, DNV, LR                                                                                                                                                                           |  |                              |  |                               |  |
| Degree of protection              |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Front / Rear                      |  | IP65 / IP20                                                                                                                                                                                                     |  |                              |  |                               |  |
| Software                          |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Visualization                     |  | project planning: Vis Designer / programming: Java, C, PLC environment                                                                                                                                          |  |                              |  |                               |  |
| Dimensions and weights            |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| Dimensions (W x H x D)            |  | 170 x 128 x 50 mm                                                                                                                                                                                               |  | 170 x 160 x 50 mm            |  | 170 x 160 x 50 mm             |  |
| Weight                            |  | approx. 1 kg                                                                                                                                                                                                    |  | approx. 1 kg                 |  | approx. 1 kg                  |  |
| Variants                          |  |                                                                                                                                                                                                                 |  |                              |  |                               |  |
| OT115/R/BE1                       |  | 4.2" STN-Bluemode display (240x64 Pixel), 1x RS232, front panel with cross elements, operating temp. -20°C .. +60°C, storage temperature -30°C .. +80°C, rel. humidity operation 5 .. 95 % without condensation |  |                              |  |                               |  |
| OT115/R/BE2                       |  | 4.2" STN-Bluemode display (240x64 Pixel), 1x RS232, front panel with AlphaNum key, operating temp. -20°C .. +60°C, storage temperature -30°C .. +80°C, rel. humidity operation 5 .. 95 % without condensation   |  |                              |  |                               |  |
| OT115/R/BE2/CC                    |  | 4.2" STN-Bluemode display (240x64 Pixel), 1x RS232, front panel with AlphaNum key, operating temp. -30°C .. +60°C, storage temperature -40°C .. +85°C, rel. humidity operation 5 .. 95 % with condensation      |  |                              |  |                               |  |

\* In the case of OTs for marine applications the supply voltage is galvanically isolated.

# Operator terminals



## Operator terminal OT200 series

The OT200 operator terminal series offers an inexpensive entry into the world of visualization devices. Smaller visualization applications in the renewable energies, industry, and marine areas are the ideal implementation area of the operator terminals. The system is connected to the automation via Ethernet, in addition the device has two USB2.0 interfaces. The system is ideally designed for Java visualizations.

The operator terminal comes with a color TFT display and dimmable LED backlight in various screen resolutions. The operator terminal is operated via a touch screen and/or a keyboard integrated in the front panel. In the marine version, OT205V/M, the device has an internal signal encoder, as well as a floating relay output.

- Extremely compact and powerful
- Fanless operation up to +60 °C
- Visualization with Bachmann Vis Designer
- 5.7" color TFT monitor with QVGA or VGA resolution
- Optionally with keyboard integrated in the front panel
- Marine approval and marine-typical special functions

| Item           | Item no.    |
|----------------|-------------|
| OT205/BE1      | 00018216-00 |
| OT205/V/BE1    | 00018218-00 |
| OT205/V/BE2    | 00018221-00 |
| OT205/M/BE1    | 00018217-00 |
| OT205/V/BE1/CC | 00018219-00 |

|    |                             |
|----|-----------------------------|
| V  | ... VGA resolution          |
| M  | ... maritime variant        |
| CC | ... ColdClimate (❄) variant |



## Operator terminals

| OT200 series                         | OT205/BE1                                   | OT205/V/<br>BE1         | OT205/M/<br>BE1         | OT205/V/<br>BE2   | OT205/V/<br>BE1/CC                |
|--------------------------------------|---------------------------------------------|-------------------------|-------------------------|-------------------|-----------------------------------|
| Display                              |                                             |                         |                         |                   |                                   |
| Diagonal/resolution                  | 5.7" QVGA<br>(320 x 240)                    | 5.7" VGA<br>(640 x 480) |                         |                   |                                   |
| Display type                         | Color TFT                                   |                         |                         |                   |                                   |
| Display brightness                   | 700 cd/m²                                   |                         |                         |                   |                                   |
| Half-brightness                      | min. 50,000 h                               |                         |                         |                   |                                   |
| Processor/RAM                        |                                             |                         |                         |                   |                                   |
| Processor                            | AMD Geode LX800, 500 MHz                    |                         |                         |                   |                                   |
| RAM                                  | 512 MB                                      |                         |                         |                   |                                   |
| Mass storage                         |                                             |                         |                         |                   |                                   |
| CF card                              | ≥ UDMA 2 GB                                 |                         |                         |                   |                                   |
| Control/display elements             |                                             |                         |                         |                   |                                   |
| Touch screen type                    | analog resistive                            |                         |                         |                   |                                   |
| Front keyboard                       |                                             |                         |                         |                   |                                   |
| Softkeys                             | -                                           |                         |                         | 11x               | -                                 |
| Enter                                | -                                           |                         |                         | 1x                | -                                 |
| Cursor keys                          | -                                           |                         |                         | 4x                | -                                 |
| Multi-click keyboard                 | -                                           |                         |                         | alpha-<br>numeric | -                                 |
| Exit                                 | -                                           |                         |                         | 1x                | -                                 |
| Shift                                | -                                           |                         |                         | 1x                | -                                 |
| System LED                           | optional 5x                                 |                         |                         | 2                 | -                                 |
| Status LED                           | Run, Init, Error                            |                         |                         |                   |                                   |
| Interfaces                           |                                             |                         |                         |                   |                                   |
| Ethernet 10/100                      | 1x                                          |                         |                         |                   |                                   |
| USB 2.0                              | 2x                                          |                         |                         |                   |                                   |
| RS232                                | 1x                                          |                         |                         |                   |                                   |
| Buzzer                               | -                                           | 1x                      |                         |                   |                                   |
| Floating relay output                | -                                           | 1x                      |                         |                   |                                   |
|                                      |                                             |                         |                         |                   |                                   |
| Power supply*                        | 24 V DC (18 V .. 36 V)                      |                         |                         |                   |                                   |
| Certifications                       | CE, UL, CSA, CUL, CCC, GL, ABS, BV, DNV, LR |                         |                         |                   |                                   |
| Ambient conditions                   | Standard                                    | Marine                  | Standard                | ColdClimate (❄️)  |                                   |
| Operating temperature                | 0 .. +60°C fanless**                        | -15 .. +50°C            | 0 .. +60°C<br>fanless** | -30 .. +60°C      |                                   |
| Storage temperature                  | -20 .. +85°C                                |                         |                         |                   | -40 .. +85°C                      |
| Rel. humidity storage /<br>operation | 5 .. 95 % without condensation              |                         |                         |                   | 5 .. 95 %<br>with<br>condensation |

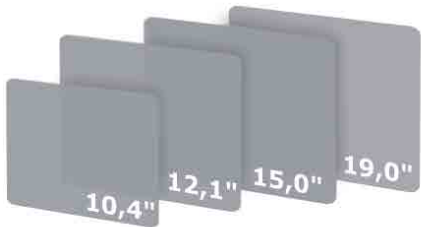


## Operator terminals

| OT200 series           | OT205/BE1                                                                                                                                                                                                                                                                                 | OT205/V/<br>BE1 | OT205/M/<br>BE1 | OT205/V/<br>BE2 | OT205/V/<br>BE1/CC |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|--------------------|
| Software               |                                                                                                                                                                                                                                                                                           |                 |                 |                 |                    |
| Operating system       | Linux embedded                                                                                                                                                                                                                                                                            |                 |                 |                 |                    |
| Visualization          | Vis Designer / Java                                                                                                                                                                                                                                                                       |                 |                 |                 |                    |
| Dimensions and weight  |                                                                                                                                                                                                                                                                                           |                 |                 |                 |                    |
| Dimensions (W x H x D) | 212 x 156 x 49 mm                                                                                                                                                                                                                                                                         |                 |                 |                 |                    |
| Weight                 | approx. 2 kg                                                                                                                                                                                                                                                                              |                 |                 |                 |                    |
| Variants               |                                                                                                                                                                                                                                                                                           |                 |                 |                 |                    |
| OT205/BE1              | Display: 5,7"; QVGA (320x240); Touch; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. 0°C.. +60 °C; storage temp. -20°C..+85°C, rel. humidity 5 .. 95 % without condensation                                                       |                 |                 |                 |                    |
| OT205/V/BE1            | Display: 5,7"; VGA (640x480); Touch; CPU: LX800@500 MHz; RAM:512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. 0°C.. +60 °C; storage temp. -20°C..+85°C, rel. humidity 5 .. 95 % without condensation                                                         |                 |                 |                 |                    |
| OT205/V/BE2            | Display: 5,7"; VGA (640x480); AlphaNumKB; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. 0°C.. +60°C; storage temp. -20°C..+85 °C, rel. humidity 5 .. 95 % without condensation                                                   |                 |                 |                 |                    |
| OT205/M/BE1            | Display: 5,7"; VGA (640x480); Touch; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1x Buzzer; 1x potential free relay output; 1xRS232; operating temp -15°C.. +50 °C; storage temp. -20°C..+85 °C, rel. humidity 5 .. 95 % without condensation           |                 |                 |                 |                    |
| OT205/V/BE1/CC         | Display: 5,7"; VGA (640x480); Touch; CPU: LX800@500 MHz; RAM: 512MB-DDR; CF-Card-Slot; 1xEth 10/100MBit; 2xUSB2.0; 1xRS232; operating temp. -30°C.. +60°C; rel. humidtdity operation 5 .. 95 % with condensation; storage temp. -40°C..+85°C, 5 .. 95 % short-term condensation (≤60 min) |                 |                 |                 |                    |

\* In the case of OTs for marine applications the supply voltage is galvanically isolated.

\*\* For details regarding the maximum permissible ambient temperatures for different install positions and install types, see section, »Device dimensions and ambient temperatures«



## Operator terminal OT1300 series

The new OT1300 series combines the latest technology, performance and durability with an attractive and slim-line design. The OT1300 series is the ideal choice for visualization applications in the renewable energy and industrial sectors. Condensation-proof ColdClimate modules guarantee maximum availability, even in very demanding environments. The consistent use of industry standard components moreover guarantees long-term availability and thus investment protection. The large range of available systems in the OT1300 series ensures an optimum price performance ratio.

- Processor/RAM:  
AMD G-T40E (2x 1 GHz) / 2 GB DDR3 RAM  
Intel Celeron 847E (2x 1,1 GHz) / 2 GB DDR3 RAM  
Intel Core i7 (2x 1,7 GHz) / 4 GB DDR3 RAM
- Ultrafast CFast mass memory
- SATA HDD or SSD options for large volume storage
- Interfaces (standard device): 1x or 2x GBit Ethernet, 4x USB2.0, 1x RS232
- Standard operating temperature: 0 ... +60 °C, fanless
- Enhanced temperature range (ColdClimate):  
-30 .. +60 °C
- Operating systems: Linux Embedded, Windows Embedded Standard 7

| Item                            | Item no.    |
|---------------------------------|-------------|
| OT1310/BE1/GT1G0/2G/4G0/LX      | 00022647-00 |
| OT1312/BE1/GT1G0/2G/4G0/LX      | 00022646-00 |
| OT1315/BE1/GT1G0/2G/4G0/LX      | 00022645-00 |
| OT1319/BE1/GT1G0/2G/4G0/LX      | 00022644-00 |
| OT1310/BE1/GT1G0/2G/4G0/WES7E   | 00023273-00 |
| OT1312/BE1/GT1G0/2G/4G0/WES7E   | 00022882-00 |
| OT1315/BE1/GT1G0/2G/4G0/WES7E   | 00023275-00 |
| OT1319/BE1/GT1G0/2G/4G0/WES7E   | 00023276-00 |
| OT1312/BE1/CE1G1/2G/SSD64/WES7P | 00023501-00 |
| OT1315/BE1/CE1G1/2G/SSD64/WES7P | 00023502-00 |
| OT1319/BE1/CE1G1/2G/SSD64/WES7P | 00024295-00 |
| OT1312/BE1/CO1G7/4G/SSD64/WES7P | 00024293-00 |
| OT1315/BE1/CO1G7/4G/SSD64/WES7P | 00024294-00 |
| OT1319/BE1/CO1G7/4G/SSD64/WES7P | 00023870-00 |

CC ... ColdClimate (❄)

other models on request

## Operator terminals

| OT1300 series                     | OT1310/BE1/<br>GT1G0                          | OT1312/BE1/<br>GT1G0    | OT1315/BE1/<br>GT1G0  | OT1319/BE1/<br>GT1G0    |
|-----------------------------------|-----------------------------------------------|-------------------------|-----------------------|-------------------------|
| Display                           |                                               |                         |                       |                         |
| Diagonal                          | 10.4" VGA<br>(640x480)                        | 12.1" SVGA<br>(800x600) | 15" XGA<br>(1024x768) | 19" SXGA<br>(1280x1024) |
| Display type                      | Color TFT                                     |                         |                       |                         |
| Display brightness                | 450 cd/m²                                     | 450 cd/m²               | 400 cd/m²             | 350 cd/m²               |
| Half-brightness                   | min. 50,000 h                                 |                         |                       |                         |
| Processor/RAM                     |                                               |                         |                       |                         |
| Processor                         | AMD G-T40E (2x 1 GHz)                         |                         |                       |                         |
| RAM                               | 2 GB                                          |                         |                       |                         |
| Mass storage                      |                                               |                         |                       |                         |
| SSD                               | -                                             |                         |                       |                         |
| CFast card                        | ≥ 4 GB                                        |                         |                       |                         |
| Control/display elements          |                                               |                         |                       |                         |
| Touch screen type*                | analog resistive, membrane front              |                         |                       |                         |
| System LEDs                       | Power, Diag, Act                              |                         |                       |                         |
| Interfaces                        |                                               |                         |                       |                         |
| Ethernet 10/100/1000 MBit         | 1x                                            |                         |                       |                         |
| USB 2.0                           | 4x                                            |                         |                       |                         |
|                                   |                                               |                         |                       |                         |
| Power supply                      | 24 V DC (18 V .. 36 V), galvanically isolated |                         |                       |                         |
| Certifications                    | CE, UL, CSA, CUL, CCC                         |                         |                       |                         |
| Software                          |                                               |                         |                       |                         |
| Operating systems**               | Linux Embedded<br>Windows Embedded Standard 7 |                         |                       |                         |
| Visualization***                  | atvise scada / M1 webMI pro                   |                         |                       |                         |
| Ambient conditions                |                                               |                         |                       |                         |
| Operating temperature             | 0 .. +60 °C fanless                           |                         |                       |                         |
| Storage temperature               | -20 .. +80 °C                                 |                         |                       |                         |
| Rel. humidity operation / storage | 5 .. 95 % without condensation                |                         |                       |                         |
| Dimensions and weight             |                                               |                         |                       |                         |
| Dimensions (W x H x D)            | 310 x 234 x 68 mm                             | 341 x 253 x 68 mm       | 406 x 308 x 75 mm     | 471 x 375 x 76 mm       |
| Weight                            | approx. 2.5 kg                                | approx. 3.0 kg          | approx. 4.5 kg        | approx. 6.0 kg          |

- \* Customer-specific front panel on request  
 \*\* Windows Embedded Standard 8 on request  
 \*\*\* not included

## Operator terminals

| OT1300 series                     | OT1310/BE1/CC<br>GT1G0                        | OT1312/BE1/CC<br>GT1G0 |
|-----------------------------------|-----------------------------------------------|------------------------|
| Display                           |                                               |                        |
| Diagonal                          | 10.4" VGA (640x480)                           | 12.1" SVGA (800x600)   |
| Display type                      | Color TFT                                     |                        |
| Display brightness                | 450 cd/m²                                     | 450 cd/m²              |
| Half-brightness                   | min. 50,000 h                                 |                        |
| Processor/RAM                     |                                               |                        |
| Processor                         | AMD G-T40E (2x 1 GHz)                         |                        |
| RAM                               | 2 GB                                          |                        |
| Mass storage                      |                                               |                        |
| SSD                               | -                                             |                        |
| CFast card                        | ≥ 4 GB                                        |                        |
| Control/display elements          |                                               |                        |
| Touch screen type*                | analog resistive, membrane front              |                        |
| System LEDs                       | Power, Diag, Act                              |                        |
| Interfaces                        |                                               |                        |
| Ethernet 10/100/1000 MBit         | 1x                                            |                        |
| USB 2.0                           | 4x                                            |                        |
|                                   |                                               |                        |
| Power supply                      | 24 V DC (18 V .. 36 V), galvanically isolated |                        |
| Certifications                    | CE, UL, CSA, CUL, CCC                         |                        |
| Software                          |                                               |                        |
| Operating systems**               | Linux Embedded<br>Windows Embedded Standard 7 |                        |
| Visualization***                  | atvise scada / M1 webMI pro                   |                        |
| Ambient conditions                |                                               |                        |
| Operating temperature             | -30 .. +60 °C fanless                         |                        |
| Storage temperature               | -30 .. +80 °C                                 |                        |
| Rel. humidity operation / storage | 5 .. 95 % without condensation                |                        |
| Dimensions and weight             |                                               |                        |
| Dimensions (W x H x D)            | 310 x 234 x 68 mm                             | 341 x 253 x 68 mm      |
| Weight                            | approx. 2.5 kg                                | approx. 3.0 kg         |

- \* Customer-specific front panel on request  
 \*\* Windows Embedded Standard 8 on request  
 \*\*\* not included

## Operator terminals

| OT1300 series                     | OT1312/BE1/<br>CE1G1<br>CO1G7                           | OT1315/BE1/<br>CE1G1<br>CO1G7 | OT1319/BE1/<br>CE1G1<br>CO1G7 |
|-----------------------------------|---------------------------------------------------------|-------------------------------|-------------------------------|
| Display                           |                                                         |                               |                               |
| Diagonal                          | 12.1" SVGA (800x600)                                    | 15" XGA (1024x768)            | 19" SXGA (1280x1024)          |
| Display type                      | Farb-TFT                                                |                               |                               |
| Display brightness                | 450 cd/m²                                               | 400 cd/m²                     | 350 cd/m²                     |
| Half-brightness                   | min. 50.000 h                                           |                               |                               |
| Processor/RAM                     |                                                         |                               |                               |
| Processor                         | Celeron 847E (2x 1,1 GHz) or Intel Core i7 (2x 1,7 GHz) |                               |                               |
| RAM                               | 2 GB                                                    | 4 GB                          |                               |
| Mass storage                      |                                                         |                               |                               |
| SSD                               | ≥ 64 GB                                                 |                               |                               |
| CFast card                        | ≥ 4 GB                                                  |                               |                               |
| ontrol/display elements           |                                                         |                               |                               |
| Touch screen type*                | analog resistiv, Folienfront                            |                               |                               |
| System LEDs                       | Power, Diag, Act                                        |                               |                               |
| Interfaces                        |                                                         |                               |                               |
| Ethernet 10 / 100 / 1000 MBit     | 2x                                                      |                               |                               |
| USB 2.0                           | 4x                                                      |                               |                               |
| RS232                             | 1x                                                      |                               |                               |
|                                   |                                                         |                               |                               |
| Power supply                      | 24 V DC (18 V .. 36 V), galvanically isolated           |                               |                               |
| Certifications                    | CE, UL, CSA, CUL, CCC                                   |                               |                               |
| Software                          |                                                         |                               |                               |
| Operating systems**               | Windows Embedded Standard 7                             |                               |                               |
| Visualization***                  | atvise scada / M1 webMI pro                             |                               |                               |
| Ambient conditions                |                                                         |                               |                               |
| Operating temperature             | 0 .. +60 °C fanless                                     |                               |                               |
| Storage temperature               | -20 .. +80 °C                                           |                               |                               |
| Rel. humidity operation / storage | 5 .. 95 % without condensation                          |                               |                               |
| Dimensions and weight             |                                                         |                               |                               |
| Dimensions (W x H x D)            | 341 x 253 x 74 mm                                       | 406 x 308 x 81 mm             | 471 x 375 x 82 mm             |
| Weight                            | approx. 3.5 kg                                          | approx. 5.0 kg                | approx. 6.5 kg                |

- \* Customer-specific front panel on request  
 \*\* Windows Embedded Standard 8 on request  
 \*\*\* not included

## Operator terminals

| OT1300 series       |                                                                                                                                                                                                                                                                                                    |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variants            |                                                                                                                                                                                                                                                                                                    |
| OT1310/BE1/GT1G0    | Operator Terminal: 10,4"; VGA (640x480); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation                                              |
| OT1312/BE1/GT1G0    | Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation                                             |
| OT1315/BE1/GT1G0    | Operator Terminal: 15"; XGA (1024x768); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation                                               |
| OT1319/BE1/GT1G0    | Operator Terminal: 19"; SXGA (1280x1024); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card 4 GB; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation                                             |
| OT1312/BE1/CE1G1    | Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; Intel Celeron 847E (2x 1,1 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5" SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation |
| OT1315/BE1/CE1G1    | Operator Terminal: 15"; XGA (1024x768); Resistive Touch; Intel Celeron 847E (2x 1,1 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5" SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation   |
| OT1319/BE1/CE1G1    | Operator Terminal: 19"; SXGA (1280x1024); Resistive Touch; Intel Celeron 847E (2x 1,1 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5" SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation |
| OT1312/BE1/CO1G7    | Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; Intel Core i7 (2x 1,7 GHz); 4 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5" SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation      |
| OT1315/BE1/CO1G7    | Operator Terminal: 15"; XGA (1024x768); Resistive Touch; Intel Core i7 (2x 1,7 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5" SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation        |
| OT1319/BE1/CO1G7    | Operator Terminal: 19"; SXGA (1280x1024); Resistive Touch; Intel Core i7 (2x 1,7 GHz); 2 GB DDR3 RAM; 2x Eth10/100/1000; 4x USB2.0; 1x RS232; SSD 60/64 GB 2,5" SATA; CFast-Card-Slot; operating temp. 0 .. +60 °C; storage temp. -20 .. +80 °C; rel. humidity 5 .. 95 % without condensation      |
| OT1310/BE1/CC/GT1G0 | Operator Terminal: 10,4"; VGA (640x480); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card-Slot; operating temp. -30 .. +60 °C; storage temp. -30 .. +80 °C; rel. humidity 5 .. 95 % with condensation                                               |
| OT1312/BE1/CC/GT1G0 | Operator Terminal: 12,1"; SVGA (800x600); Resistive Touch; AMD G-T40E (2x 1 GHz); 2 GB DDR3 RAM; 1x Eth10/100/1000; 4x USB2.0; CFast-Card-Slot; operating temp. -30 .. +60 °C; storage temp. -30 .. +80 °C; rel. humidity 5 .. 95 % with condensation                                              |





**Robust. Spacious. In conformance with standards.**



## Industrial PCs

Robust industrial PCs are used in the automation sector for controlling machines, networking plant components as well as for data acquisition and image processing. Bachmann electronic's passively cooled IPC1400 panel PCs offer the ideal industrial PC for every task. The remote displays of the Dx900 series allow visualization to be implemented up to 100 m away from the central computer unit IPM1400. The front panels of the operator units are made from aluminum and their function, color and design can be adapted to customer requirements. The operating elements required can be implemented as real machine pushbuttons, with a foil keyboard or as touch screens. Whether complete standard system or customer-specific solution Bachmann electronic always delivers 100 % quality: precisely like the HMI devices all Bachman industrial PCs are subjected to a 48-hour run-in test in the climate chamber, in which the specified operating temperatures are run through multiple times. Naturally compliance with the applicable industrial/ product standards, as well as the legally prescribed standards is ensured.

# Industrial PC

## Customized PC-based visualization devices – compact or modular.

The display diagonals, operating elements and design of the modular IPC1400 series devices can be adapted to the customer's needs and offers scalable processing performance. It can be factory fitted with a number of different interfaces or retrofitted quickly in the field.

Maximum flexibility for applications requiring a spatial separation between the controller and the display / operator unit is offered by the combination of IPM1400 with digital serial remote installation (DSA) and the remote display of the Dx900 series. The Dx900's display diagonals, operating elements and design can be adapted to individual requirements.

In order to ensure the lowest possible failure rate and maximum investment security, Bachmann electronic places considerable importance on the selection of the components used in terms of availability, mechanical resistance and suitability for industrial use.



## Industrial PC IPC1400 series

### Features

Display: 10.4" VGA / 12.1" SVGA / 15" XGA / 19" SXGA, color TFT, touch screen, customer-specific front panel\*

Processor: Celeron M processor ULV 423 1.06 GHz

Core Duo processor L2400 2x 1.66 GHz

RAM: 1 GB / 2GB

Compact Flash: 4GB / 8GB

Operating system: Windows XP Embedded, Windows 7

Slot system: PCI, HDD\*

Interfaces: Ethernet, USB, PS/2, RS232, CF slot

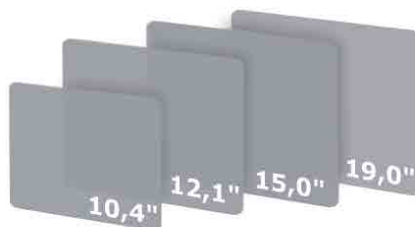
\* on request



## Industrial PC IPC1400 series

The highly modular and compact IPC1400-series is suitable for demanding visualizations. The family relies on modularity, Performance scalability and service friendly. The system with TFT screens is available with different diagonals to meet specific customer requirements. The modular slot system enables the implementation of a wide range of slots such as PCI and PICE, as well as the simultaneous use of different mass storage technologies.

- Scalable industrial PC based on a Celeron M or Core Duo processor
- Maximum reliability and maintenance friendly
- Modular slot system
- Customer-specific configuration and front panel design
- Compact unit or computer with remote display up to 100 m



| Item       | Item no.    |
|------------|-------------|
| IPC1410/CM | 00016898-00 |
| IPC1410/CD | 00016902-00 |
| IPC1412/CM | 00016899-00 |
| IPC1412/CD | 00016903-00 |
| IPC1415/CM | 00016900-00 |
| IPC1415/CD | 00016904-00 |
| IPC1419/CD | 00016905-00 |

CM      processor Celeron M ULV 423 1.06GHz  
 CD      processor Core Duo L2400, 2x 1.66 GHz

## Industrial PC

| IPC1400 series                                 | IPC1410                                                         | IPC1412                |
|------------------------------------------------|-----------------------------------------------------------------|------------------------|
| Display                                        |                                                                 |                        |
| Diagonal/resolution                            | 10.4" VGA (640x480)                                             | 12.1" SVGA (800x600)   |
| Display type                                   | color TFT                                                       |                        |
| Display brightness                             | 450 cd / m²                                                     | 350 cd / m²            |
| Half-brightness                                | min. 50,000 h                                                   |                        |
| Processor/RAM                                  |                                                                 |                        |
| Processor                                      | Celeron M ULV 423 1.06 GHz<br>Core Duo L2400, 2x 1.66 GHz       |                        |
| RAM                                            | 1 GB / 2 GB                                                     |                        |
| Mass storage                                   |                                                                 |                        |
| CF card type I+II                              | 4 GB / 8 GB                                                     |                        |
| Control/display elements                       |                                                                 |                        |
| Touch screen type                              | analog resistive                                                |                        |
| Front keyboard / Number of keys                | on request / max. 128, 2-fold programmable                      |                        |
| System LEDs                                    | Power, Diag, HDD                                                |                        |
| Interfaces                                     |                                                                 |                        |
| Network                                        | 2x Ethernet 10 / 100 MBit                                       |                        |
| USB                                            | 3x USB 2.0 + 1x powered USB 2.0                                 |                        |
| Serial                                         | 2x RS232 / 422 / (also configurable as full RS232)              |                        |
| Mouse / keyboard                               | 1x combined PS/2 connection                                     |                        |
| Audio                                          | AC97, 1x Line-In, 1x Line-Out, 1x MIC                           |                        |
| External monitor                               | 1x RGB, 1x DVI                                                  |                        |
| Expansion modules                              |                                                                 |                        |
| 2.5" hard disk (slot)                          | (optional) ≥ 160 GB or RAID1: 80 GB (24/7), other on request    |                        |
| Slots* (module)                                | max. 2x PCI, max. 2x PCIexpress (on request)                    |                        |
|                                                |                                                                 |                        |
| Power supply                                   | 24 V DC (18 V .. 36 V)                                          |                        |
| Certifications                                 | CE, UL, CSA, CUL, CCC                                           |                        |
| Software                                       |                                                                 |                        |
| Operating systems                              | Windows XP Embedded, Windows 7                                  |                        |
| Visualization                                  | Vis Designer / Java, other visualizations at customer's request |                        |
| Ambient conditions                             |                                                                 |                        |
| Operating temperature**<br>Fanless<br>with fan | 0 .. 50 °C,<br>0 .. 50 °C***                                    |                        |
| Storage temperature                            | -20 .. +60 °C                                                   |                        |
| Rel. humidity operation / storage              | 5 .. 95 % without condensation                                  |                        |
| Dimensions and weights                         |                                                                 |                        |
| Dimensions (W x H x D)                         | 314 x 237 x 110 mm****                                          | 337 x 256 x 110 mm**** |
| Weight                                         | approx. 5 kg                                                    | approx. 5 kg           |

\* in conjunction with RAID1 max. 1x PCI or 1x PCIe slot possible

\*\* other temperature ranges on request

\*\*\* for details regarding the maximum permissible ambient temperatures for different install positions and install types, see section, »Device dimensions and ambient temperatures«

\*\*\*\* without expansion / attachments (per expansion: +30 mm -> max. 2 expansions = +60 mm)

| IPC1400 series                    | IPC1415                                                         | IPC1419                               |
|-----------------------------------|-----------------------------------------------------------------|---------------------------------------|
| Diagonal/resolution               | 15" XGA (1024x768)                                              | 19" SXGA (1240x1024)                  |
| Display type                      | color TFT                                                       |                                       |
| Display brightness                | 250 cd / m <sup>2</sup>                                         | 300 cd/m <sup>3</sup>                 |
| Half-brightness                   | min. 50,000 h                                                   |                                       |
| Processor/RAM                     |                                                                 |                                       |
| Processor                         | Celeron M ULV 423 1.06 GHz<br>Core Duo L2400, 2x 1.66 GHz       | Core Duo L2400, 2x 1.66 GHz           |
| RAM                               | 1 GB / 2 GB                                                     |                                       |
| Mass storage                      |                                                                 |                                       |
| CF card type I+II                 | 4 GB / 8 GB                                                     |                                       |
| Control/display elements          |                                                                 |                                       |
| Touch screen type                 | analog resistive                                                |                                       |
| Front keyboard / Number of keys   | on request / max. 128, 2-fold programmable                      |                                       |
| System LEDs                       | Power, Diag, HDD                                                |                                       |
| Status LEDs                       | optional: max. 64                                               |                                       |
| Interfaces                        |                                                                 |                                       |
| Network                           | 2x Ethernet 10 / 100 MBit                                       |                                       |
| USB                               | 3x USB 2.0 + 1x powered USB 2.0                                 |                                       |
| Serial                            | 2x RS232 / 422 / 485 (also configurable as full RS232)          |                                       |
| Mouse / keyboard                  | 1x combined PS/2 connection                                     |                                       |
| Audio                             | AC97, 1x Line-In, 1x Line-Out, 1x MIC                           |                                       |
| External monitor                  | 1x RGB, 1x DVI                                                  |                                       |
| Expansion modules                 |                                                                 |                                       |
| 2.5" hard disk (slot)             | (optional) ≥ 40 GB or RAID1: 80 GB (24/7), on request           |                                       |
| Slots* (module)                   | max. 2x PCI, max. 2x PCIexpress (on request)                    |                                       |
|                                   |                                                                 |                                       |
| Power supply                      | 24 V DC (18 V .. 36 V)                                          |                                       |
| Certifications                    | CE, UL, CSA, CUL, CCC                                           |                                       |
| Software                          |                                                                 |                                       |
| Operating systems****             | Windows XP Embedded, Windows 7                                  |                                       |
| Visualization                     | Vis Designer / Java, other visualizations at customer's request |                                       |
| Ambient conditions                |                                                                 |                                       |
| Operating temperature**           |                                                                 |                                       |
| Fanless                           | 0 .. 40 °C                                                      |                                       |
| with fan                          | 0 .. 50 °C***                                                   |                                       |
| Storage temperature               | -20 .. +60 °C                                                   |                                       |
| Rel. humidity operation / storage | 5 .. 95 % without condensation                                  |                                       |
| Dimensions and weights            |                                                                 |                                       |
| Dimensions (W x H x D)            | 405 x 308 x 124 mm*****                                         | 470 (19") x 374.6 (9 U) x 121 mm***** |
| Weight                            | approx. 6 kg                                                    | approx. 12 kg                         |

- \* in conjunction with RAID1 max. 1x PCI or 1x PCIe slot possible
- \*\* other temperature ranges on request
- \*\*\* for details regarding the maximum permissible ambient temperatures for different install positions and install types, see section, »Device dimensions and ambient temperatures«
- \*\*\*\* other operating systems on request
- \*\*\*\*\* without expansion / attachments (per expansion: +30 mm -> max. 2 expansions = +60 mm)

## Industrial PC

### IPC1400 series

#### Variants

|                   |                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IPC1410/BE1/CM1G1 | Industrial PC: Display: 10,4"; VGA (640x480); Touch; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation                               |
| IPC1410/BE1/CD1G6 | Industrial PC: Display: 10,4"; VGA (640x480); Touch; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation  |
| IPC1412/BE1/CM1G1 | Industrial PC: Display: 12,1"; SVGA (800x600); Touch; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation           |
| IPC1412/BE1/CD1G6 | Industrial PC: Display: 12,1"; SVGA (800x600); Touch; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation |
| IPC1415/BE1/CM1G1 | Industrial PC: Display: 15,1"; XGA (1024x768); Touch; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1xPS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation            |
| IPC1415/BE1/CD1G6 | Industrial PC: Display: 15,1"; XGA (1024x768); Touch; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation |
| IPC1419/BE1/CD1G6 | Industrial PC: Display: 19"; SXGA (1240x1024); Touch; CPU: Core Duo Prozessor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; CF-Card: 8GB- WXPP-FES; 2x Eth 10/100MBit;3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation  |

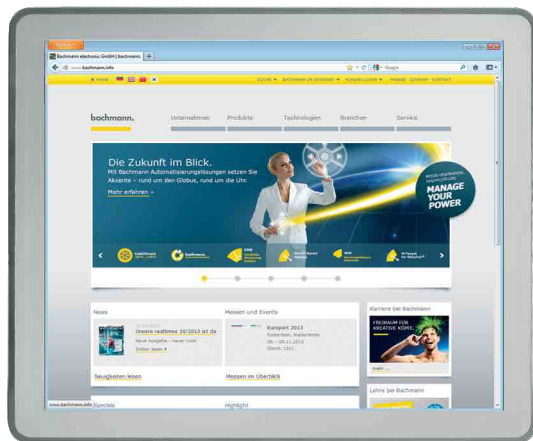


## Headless IPCs and remote displays

### Displays with USB and CAN connectivity.

The Dx900 display series from Bachmann electronic enables the spatial separation between the display and operator unit and the controller. The remote display and the IPM1400 are connected via a 100 meter cable using the serial remote installation (DSA). The DSA itself is implemented as a module of the IPM1400 cassette system and ensures the interference free transfer

of video, USB and CAN signals from the central unit to the Dx900 series display. USB terminals on the display enable a wide range of peripheral devices to be operated directly at the interface between the user and machine. CAN enables operating elements on the display to be connected directly with the controller hardware. A customized cable can be supplied on request.



### Remote displays DD900 series

#### Features

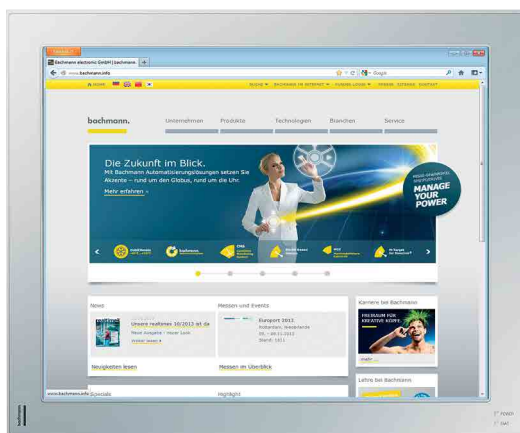
Display: 15" XGA / 19" SXGA, color TFT, touch screen, customer spec. front panel\*

Remote: 100 m, video, USB, CAN

Protection: front IP65 / rear IP54

Housing: stand-alone, aluminum housing, Support arm connection

\* on request



### Remote displays DF900 series

#### Features

Display: 15" XGA / 19" SXGA, color TFT, touch screen, customer specific front panel\*

Remote: 100 m, video, USB, CAN

Protection: front IP65 / rear IP20

Housing: control cabinet mounting

\* on request



The display diagonals, operating elements and design of the 900 series can also be adapted to individual requirements.

The control panels of the 900 series are available in two variants to meet different mounting requirements: the DD900 series comes with a modern aluminum housing with protection to IP65 at the front and

IP54 at the rear. The DF900 devices are designed with a mounting depth less than 60 millimeters for control cabinet mounting. Aluminum frontpanels with a decorative film and an all-round seal also ensure protection to IP65 (front).



## Cabinet PC IPM1400

### Features

Processor: Celeron M processor ULV 423 1.06 GHz  
Core Duo processor L2400 2x 1.66 GHz

RAM: 1 GB / 2GB

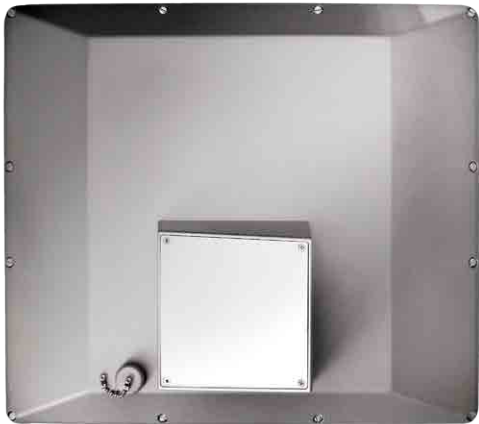
Operating system: Windows XP Embedded

Slot system: PCI, HDD\*

Interfaces: Ethernet, USB, PS/2, RS232,  
CF slot

\* on request

# Headless IPCs and remote displays

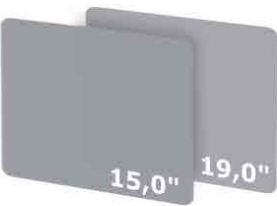


## Remote displays DD900 series

The DD900 remote display is an industrial control panel in a modern aluminum housing. The design and operating elements can be adapted to the customer's requirements.

The integrated USB interface enables a wide range of peripherals to be connected directly on the terminal. CAN enables operating elements on the remote display to be connected directly with the controller hardware without requiring any additional wiring.

- Remote installation between control panel and IPM up to 100 m
- Mounting on support arm
- Transfer of video, USB and CAN signals via one cable



| Item  | Item No.   |
|-------|------------|
| DD915 | on request |
| DD919 | on request |

## Headless IPCs and remote displays

| DD900 series                    |                                          | DD915 | DD919                |
|---------------------------------|------------------------------------------|-------|----------------------|
| Display                         |                                          |       |                      |
| Diagonal/resolution             | 15" XGA (1024x768)                       |       | 19" SXGA (1280x1024) |
| Display type                    | color TFT                                |       |                      |
| Display brightness              | 300 cd / m²                              |       |                      |
| Half-brightness                 | min. 50,000 h                            |       |                      |
| Control/display elements        |                                          |       |                      |
| Touch screen type               | analog resistive                         |       |                      |
| Front keyboard / Number of keys | optional / max. 128, 2-fold programmable |       |                      |
|                                 |                                          |       |                      |
| Interfaces                      | 1x USB (rear)<br>CAN (rear)              |       |                      |
|                                 |                                          |       |                      |
| Power supply                    | 24 V DC (18 V .. 36 V)                   |       |                      |
| Operating temperature           | 0 °C .. 40 °C, fan-free                  |       |                      |
| Certifications                  | CE, UL, CUL                              |       |                      |
|                                 |                                          |       |                      |
| Housing                         | aluminum                                 |       |                      |
| Degree of protection (front)    | IP65                                     |       |                      |
| Degree of protection (rear)     | IP54                                     |       |                      |

# Headless IPCs and remote displays

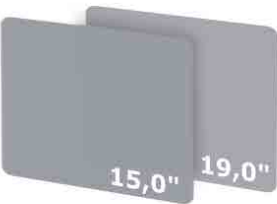


## Remote displays DF900 series

The remote display DF900 is an industrial terminal in flat design. Design and control elements of the front panel can be adapted to the customer's requirements.

The integrated USB interface enables a wide range of peripherals to be connected directly on the terminal. CAN enables operating elements on the remote display to be connected directly with the controller hardware without requiring any additional wiring.

- Remote installation between control panel and IPM up to 100 m
- Mounting in the cabinet
- Transfer of video, USB and CAN signals via one cable
- Slimline remote terminal



| Item  | Item No.   |
|-------|------------|
| DF915 | on request |
| DF919 | on request |

## Headless IPCs and remote displays

| DF900 series                    | DF915                                    | DF919                    |
|---------------------------------|------------------------------------------|--------------------------|
| Display                         |                                          |                          |
| Diagonal/resolution             | 15" XGA (1024x768)                       | 19" SXGA (1280x1024)     |
| Display type                    | color TFT                                |                          |
| Display brightness              | 300 cd / m²                              |                          |
| Half-brightness                 | min. 50,000 h                            |                          |
| Control/display elements        |                                          |                          |
| Touch screen type               | analog resistive                         |                          |
| Front keyboard / Number of keys | optional / max. 128, 2-fold programmable |                          |
| System LEDs                     | Power, DIAG                              |                          |
|                                 |                                          |                          |
| Interfaces                      | 2x USB (rear)<br>1x CAN (rear)           |                          |
|                                 |                                          |                          |
| Power supply                    | 24 V DC (18 V .. 36 V)                   |                          |
| Operating temperature           | 0 °C .. +50 °C, fan-free                 | 0 °C .. +45 °C, fan-free |
| Certifications                  | CE, UL, CUL                              |                          |
|                                 |                                          |                          |
| Housing                         | aluminum                                 |                          |
| Degree of protection (front)    | IP65                                     |                          |
| Degree of protection (rear)     | IP20                                     |                          |

# Headless IPCs and remote displays



## Cabinet PC IPM1400

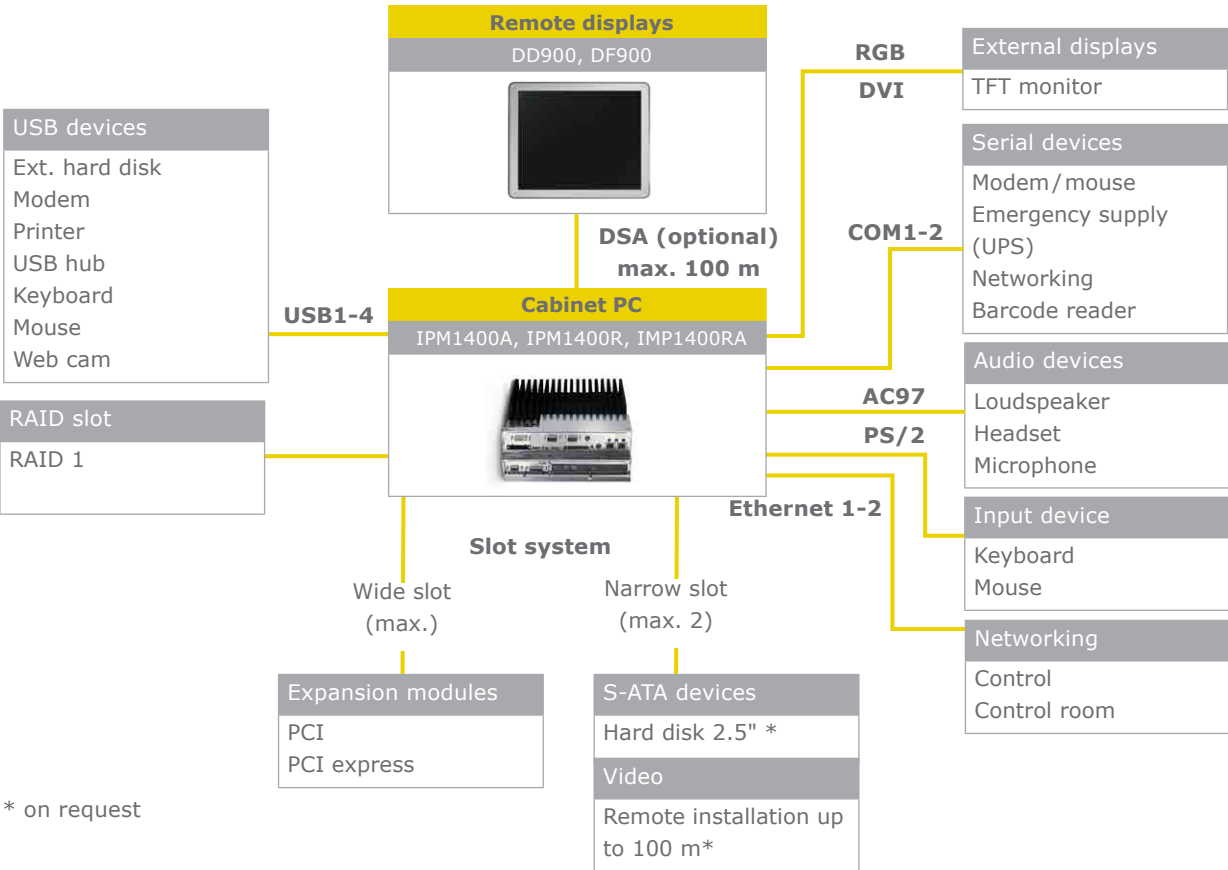
The IPM1400 cabinet PC while inconspicuous is the powerful and reliable brain of the well-designed Dx900 series terminals. The configuration varies depending on the application, and most I/Os as well as additional cards are individually arranged.

- Powerful and scalable cabinet PC based on Celeron M and Core Duo processors
- Individual configuration of the PC using expansion units

| Item             | Item No.   |
|------------------|------------|
| IPM1400/CM1G1/A  | on request |
| IPM1400/CD1G6/X  | on request |
| IPM1400/CD1G6/AX | on request |

|    |     |                                       |
|----|-----|---------------------------------------|
| CM | ... | processor Celeron M ULV 423 1.06GHz   |
| CD | ... | processor Core Duo L2400, 2x 1.66 GHz |

## Interfaces



\* on request

## Headless IPCs and remote displays

| IPM1400 series                    |  | IPM1400/CM1G1/A                                                         |  | IPM1400/CD1G6/X                                                    |  | IPM1400/CD1G6/AX       |  |
|-----------------------------------|--|-------------------------------------------------------------------------|--|--------------------------------------------------------------------|--|------------------------|--|
| Processor/RAM                     |  |                                                                         |  |                                                                    |  |                        |  |
| Processor system*                 |  | Celeron-M processor<br>ULV 423 1.06 GHz                                 |  | Core Duo processor L2400, 2x 1.66 GHz                              |  |                        |  |
| RAM                               |  | 1 GB                                                                    |  | 2 GB                                                               |  |                        |  |
| Mass storage                      |  |                                                                         |  |                                                                    |  |                        |  |
| 2.5" Flash disk                   |  | -                                                                       |  |                                                                    |  |                        |  |
| CF card type I+II                 |  | 4 GB                                                                    |  | -                                                                  |  |                        |  |
| Interfaces                        |  |                                                                         |  |                                                                    |  |                        |  |
| Network                           |  | 2x Ethernet 10/100                                                      |  |                                                                    |  |                        |  |
| USB                               |  | 3x USB 2.0 + 1x powered USB 2.0                                         |  |                                                                    |  |                        |  |
| Serial                            |  | 2x RS232 / 422 / (also configurable as full RS232)                      |  |                                                                    |  |                        |  |
| Mouse / keyboard                  |  | 1x combined PS/2 connection                                             |  |                                                                    |  |                        |  |
| Audio                             |  | AC97, 1x Line-In, 1x Line-Out, 1x MIC                                   |  |                                                                    |  |                        |  |
| System LEDs                       |  | Power, Diag, HDD                                                        |  |                                                                    |  |                        |  |
| External monitor                  |  | 1x VGA, 1x DVI, 1x DSA                                                  |  | 1x VGA, 1x DVI                                                     |  | 1x VGA, 1x DVI, 1x DSA |  |
| Expansion modules                 |  |                                                                         |  |                                                                    |  |                        |  |
| 2.5" hard disk                    |  | -                                                                       |  | ≥ 80 GB (24/7), RAID 1                                             |  |                        |  |
| Slots*****                        |  | max. 2x PCI or 2x PCIexpress                                            |  |                                                                    |  |                        |  |
|                                   |  |                                                                         |  |                                                                    |  |                        |  |
| Power supply                      |  | 24 V DC (18 V .. 36 V)                                                  |  |                                                                    |  |                        |  |
| Tested acc. to                    |  | CE, UL, CUL, CSA, CC                                                    |  |                                                                    |  |                        |  |
| Software                          |  |                                                                         |  |                                                                    |  |                        |  |
| Operating systems***              |  | Windows XP Professional (FES), Windows Embedded Standard 2009           |  |                                                                    |  |                        |  |
| Visualization                     |  | Vis Designer / Java, other visualizations at customer's request         |  |                                                                    |  |                        |  |
| Ambient conditions                |  |                                                                         |  |                                                                    |  |                        |  |
| Operating temperature**           |  | 0 °C .. 50 °C fan-free                                                  |  |                                                                    |  |                        |  |
| Storage temperature               |  | -20 .. +60 °C                                                           |  |                                                                    |  |                        |  |
| Rel. humidity operation / storage |  | 5 .. 95% without condensation                                           |  |                                                                    |  |                        |  |
| Dimensions and devices            |  |                                                                         |  |                                                                    |  |                        |  |
| Dimensions (W x H x D)            |  | 256 x 288 x 126 mm<br>(incl. mounting plate,<br>without expansion unit) |  | 256 x 288 x 156 mm<br>(incl. mounting plate<br>and expansion unit) |  |                        |  |

\* other processors on request

\*\* other temperature ranges on request

\*\*\* other operating systems on request

\*\*\*\* optional, IPM1400R / IPM1400RA, max. 1x PCI or 1x PCIe slot possible

## Headless IPCs and remote displays

| IPM1400 series   |                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variants         |                                                                                                                                                                                                                                                                                                                                                                                     |
| IPM1400/CM1G1/A  | Industrial PC: Headless; CPU: Celeron M ULV 423 (1M Cache, 1.06 GHz, 533 MHz FSB); RAM:1GB-DDR2; CF-Card: 4GB - WXP; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; 1x DSA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation                    |
| IPM1400/CD1G6/X  | Industrial PC: Headless; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; HDD: RAID1-2x160GB WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; operating temp. 0 °C.. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation          |
| IPM1400/CD1G6/AX | Industrial PC: Headless; CPU: Core Duo Processor L2400 (2M Cache, 2x 1.66 GHz, 667 MHz FSB); RAM:2GB-DDR2; HDD: RAID1-2x160GB WXPP-FES; 2x Eth 10/100MBit; 3x USB2.0; 1x powered USB2.0; 2x RS232/422; 1x PS2; 1x Line-in, 1x Line-Out, 1x Mic; 1x DVI; 1x VGA; 1x DSA; operating temp. 0 °C .. +50 °C; storage temp. -20 °C .. +60 °C; rel. humidity 5 .. 95% without condensation |



## Headless IPCs and remote displays



**Intuitive. Intelligent. Platform-independent.**



## Engineering software

In the automation of plants and machines software has become an essential component. As an innovative provider Bachmann electronic also establishes the state of the technology in this area as well and enables groundbreaking future solutions, such as the Bachmann SolutionCenter. With a series of the latest software engineering and diagnostic tools we support rapid and convenient realization of programs for machine sequence, process control, visualization, and not least, communication with the outside world.

»Time-to-market« is no longer just a buzz word,  
rather it is a principle that is lived.

With engineering software from Bachmann electronic you rely on complete solutions that have been thought-through in the details; solutions that increase the productivity and sovereignty of your applications, that free-up resources for your core business, and that can also be used reliably in the distant future.

## Project engineering made easy: SolutionCenter

### A milestone in the reduction of engineering costs.

As part of a unique, complete software solution, the Bachmann SolutionCenter covers all aspects of the engineering process – configuration, programming, controlling/regulation, communication, Motion, visualization, as well as test and commissioning. Thanks to the highly modular Eclipse plug-in concept, the tool can be easily expanded, even for integrated user-specific requirements.

Matched in the best manner possible to the devices and systems of the manufacturer, it provides time savings, brings synergies, and increases usability. Users benefit from the cohesive operating concept and avoid redundant entry or unnecessary manual entry. A close linking to the automation systems of Bachmann electronic enables simplifications in virtually all processes.



## Configuring

- Controller design offline
- Configuration of the hardware modules
- Management and use of predefined hardware and software modules
- Assignment of signal designations
- Archiving, export and import of subsystems or complete controller systems
- Configuration of the fieldbuses, telecontrol:
  - CANopen, DeviceNet
  - PROFIBUS DP
  - PROFINET IO RT/IRT
  - EtherCAT, SERCOS
  - Modbus TCP, UDP, RTU
  - IEC61850/IEC61400-25 (MMS)
  - IEC60870-5-101, -103, -104
  - OPC UA/DA

## Programming

- IEC61131-3 (CoDeSys, PLCopen Safety)
- C/C++
- MATLAB® / Simulink®
- Extensive libraries
- Repository with SVN

## Visualizing

- Configurations for M1 webMI pro web visualizations
- VisDesigner project designs
- Communication libraries for developing user-defined visualizations (Java, C, .NET)
- OPC server

## Controlling & regulation

- Motion Control:
  - Softmotion (M-SMC)
  - Shaft (M-SHAFT)
  - Three-dimensional motion (M-CNC)
- Temperature controller (M-TEMP)
- M-Target for Simulink®
- Libraries for IEC61131-3 and C

## Testing and diagnostics

- Software oscilloscope
- Variable browser / Watch view
- Logbooks
- Task lists with runtime measurement
- Error lists in the Error Handler
- Printout of PLC report
- Direct access to I/O signals
- Remote monitoring
- Internet-enabled communication

## Tools/Add-Ons

- Access control
- Time synchronization (SNTP, IEEE1588)
- SVN repository (source code & configuration management)
- Configuration history/ comparison
- Eclipse plugins



## M-Base

The complete product range of the engineering software from Bachmann electronic is delivered in a software package. For different applications, derivatives are made available which are tailored to the needs of individual users.

- Device configuration & system settings
- Fieldbus configuration
- Right of accesses
- Programming in C/C++, IEC61131
- Safe programming
- Visualization project
- Comprehensive system diagnostics
- Many monitoring functions
- Project and diagnostic reports

| Items                                   | Item Nr.    |
|-----------------------------------------|-------------|
| M-Base One-time License                 | 00015629-60 |
| M-Base Annual Maintenance               | 00015629-70 |
| M-Base COM One-time License             | 00015778-60 |
| M-Base COM Annual Maintenance           | 00015778-70 |
| M-Base SC One-time License              | 00018914-60 |
| M-Base SC Annual Maintenance            | 00018914-70 |
| M-Base SC Light One-time License        | 00018888-60 |
| M-Base SC Light Annual Maintenance      | 00018888-70 |
| M-Base Device Viewer One-time License   | 00015845-60 |
| M-Base Device Viewer Annual Maintenance | 00015845-70 |

| Delivery variants                       |                                                                                                                                                                                              |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M-Base                                  |                                                                                                                                                                                              |
| M-Base One-time License                 | Complete engineering package for configuration, programming and modeling for the Bachmann M1. The product support and the updates of one year are included in the license.                   |
| M-Base Annual Maintenance               | extension of the product support and updates for one year longer                                                                                                                             |
| M-Base SC One-time License              | SolutionCenter for configuration and diagnostic, programming in C/C++, visualization tool and Safety Developer. The product support and updates within one year are included in the license. |
| M-Base SC Annual Maintenance            | extension of the product support and updates for one year longer.                                                                                                                            |
| M-Base SC Light One-time License        | SolutionCenter with Device Manager for pure configuration and diagnostic for the M1 controller system. The product support and the updates of one year are included in the license.          |
| M-Base SC Light Annual Maintenance      | extension of the product support and updates for one year longer                                                                                                                             |
| M-Base Device Viewer One-time License   | Device Viewer for pure monitoring of the M1 controller system. The product support and the updates of one year are included in the license.                                                  |
| M-Base Device Viewer Annual Maintenance | extension of the product support and updates for one year longer                                                                                                                             |
| M-Base COM One-time License             | communication library for MVIS visualizations. The product support and the updates of one year are included in the license.                                                                  |
| M-Base COM Annual Maintenance           | extension of the product support and updates for one year longer                                                                                                                             |

## Configuration

### Merging hardware, fieldbuses, and software into a unit.

The expenses for design, wiring, and commissioning of a machine represent a considerable share of the engineering costs. Bachmann electronic supports the user on all levels with convenient and innovative tools. From the planning of the control topology and the configuration of fieldbuses to the wiring test

and to installation of software modules, one tool can be used that permits flexible adaptation to a wide variety of tasks with its consistent operating concept. The Device Manager as part of the SolutionCenter is the central point for all configuration and diagnostics tasks.



### Device Manager

The Device Manager is the integrated tool for configuration and commissioning of all automation devices from Bachmann electronic. The entire M1 controller family, the panel PLCs from the CT series, the terminals of the WT series, but also standard-conformant fieldbus nodes from third-party suppliers are supported by this tool. Through the capability for complete offline engineering work can start before the hardware is available. The flowing alternation between offline and online configuration in both directions is not only possible for the complete controller, it is also possible for the exchange and archiving of individual hardware and software modules, as well as for complex fieldbus configurations.

The work area is consistently organized for all topics in a configurator window and a monitor window. The Configurator shows the saved target status that will be valid after the next system startup, the monitor shows the actual status and allows manual change of values and settings. The hardware structure is presented in the real topology. The type of networking via proprietary and standardized bus systems is presented through the organization of a tree structure; the I/O modules can be uniquely detected and directly operated through the graphic presentation. Thus the wiring test can be executed immediately after switching on the system. The software for the controller is also managed in the Device Manager. The system packages from Bachmann electronic are summarized in a catalog. All the software is updated conveniently

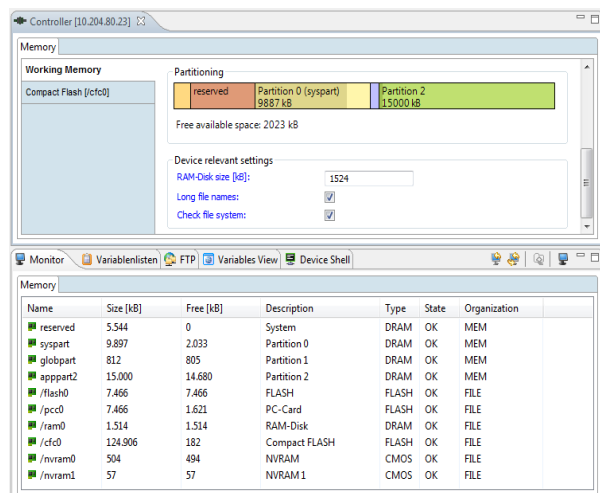
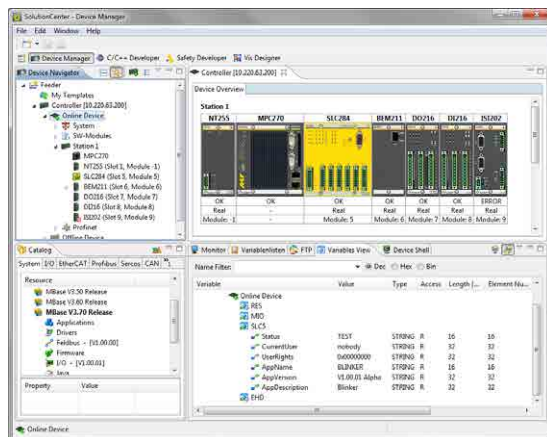


# Configuration

via a wizard that guides the user through the procedure. In addition to the provided system packages, the user can also put together and manage his own, machine-specific packages and transfer them to other PCs. Thus unique software states can be assured on all systems and on all service PCs.

The variable set of all participating controllers is presented in a structured manner in a separate view. Searching for values is facilitated through an automatic full-text search; a selection of relevant values can be summarized, saved, and reloaded in an additional window. Through a trend display the temporal progression of values can be graphically presented.

- One interface for all Bachmann devices
- Managing devices
- Backup of existing devices
- Offline configuration of entire control systems or individual HW/SW modules
- Offline and online configuration of fieldbuses (CAN, PROFINET RT and IRT, PROFIBUS DP, EtherCAT)
- The same mode of operation for online and offline devices
- Consistent concept: Monitor (actual status) and configurator (target status)
- Graphic presentation of the I/O modules
- Configuration and diagnostics in one tool
- Software is managed in catalogs, user-specific catalogs
- Flexible compilation of functional window areas (perspectives)



# Testing and diagnostics

## Monitoring and debugging for every field of application.

Bachmann M1 automation systems are designed for a broad user spectrum. More extensive than is the case with the conventional solutions for industrial automation, the support for experts was considered right from the start. Monitoring and debugging tools for

every field of application, from the signal test of the control cabinet builder to section identification of the control system engineer, shorten commissioning times and increase the transparency of the overall system.



### Scope 3 – Overview in real-time

Signal analytics and diagnostics directly with the controller

In the initial project design and also for commissioning or troubleshooting, transparent information concerning states and sequences of an automatic system is essential for success. For many dynamic processes seeing a physical variable as only a numeric value is insufficient. The software oscilloscope »Scope 3« makes the temporal progression of processes visible and places this progression in relation to other process variables. »Scope 3« is an indispensable tool for optimization of a controller setting, for troubleshooting in a sequential program, or for ongoing verification of the manufacturing process on the machine. It permits specific and stand-alone recording, archiving of the relevant data in a database and subsequent

| Item           |                                                                                                                                                                                                                                                                                                                                                                                                                                        | Item no.    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| SCOPE 3 Pro RT | Software package to install on Windows PCs and M1 controllers for the diagnostics of signal waveforms (IO- and process variables). Stand-alone task for recording and archiving of records on the controller, trigger and pretrigger, multiple recordings. Comprehensive graphical representation (chart) and evaluation functions, data export on the PC, SolutionCenter integration. License bound to target device.                 | 00024212-63 |
| SCOPE 3 DVD    | Installation medium for Scope 3 (DVD). Software module for the M1 controller and Scope 3 tool for displaying recordings and data analysis. A Scope software module without a valid runtime license can be used for up to two hours for recordings. After that, the recording is stopped, but it is possible to restart after a period of 10 minutes. Without a runtime license, archiving functions on the M1 controller are disabled. | 00024212-00 |

## Testing and diagnostics

measurement or evaluation of a great number of values in parallel. Different trigger conditions as well as pre-trigger and post-trigger functionalities enable acquisition of all relevant data, such as in the case of sporadically occurring errors.

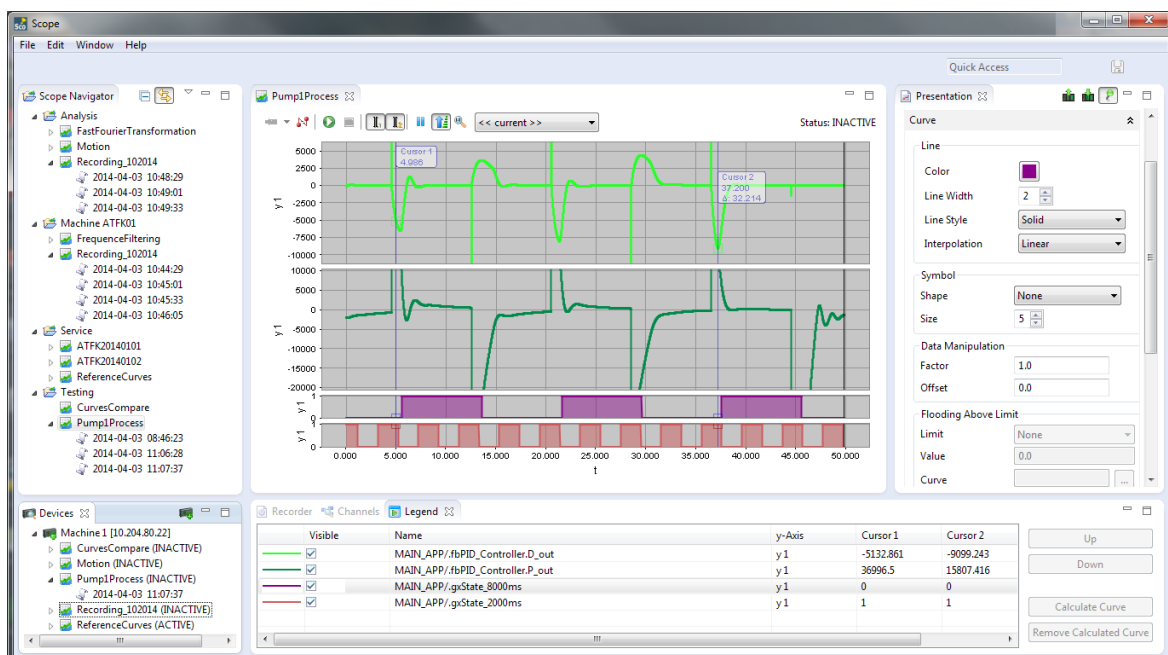
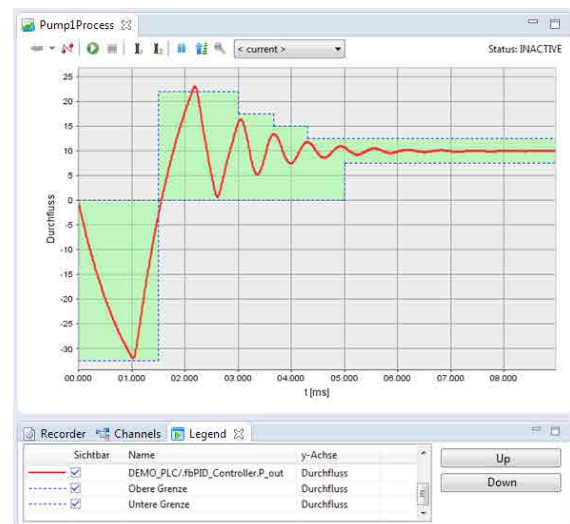
Calculation of additional curves from the recording values facilitates retrospective analysis. A special exchange format enables saving and sending of the recording configuration and entered values in one and the same file. Thus, for example, Scope recordings can be forwarded by email and further processed by the recipient to their full extent (zoom, measurement with cursors, calculated curves, etc.).

»Scope 3« is also the right tool for the long-term archiving of measured values directly on the controller. The maximum storage space available is configured and the recording started by means of archiving limits.

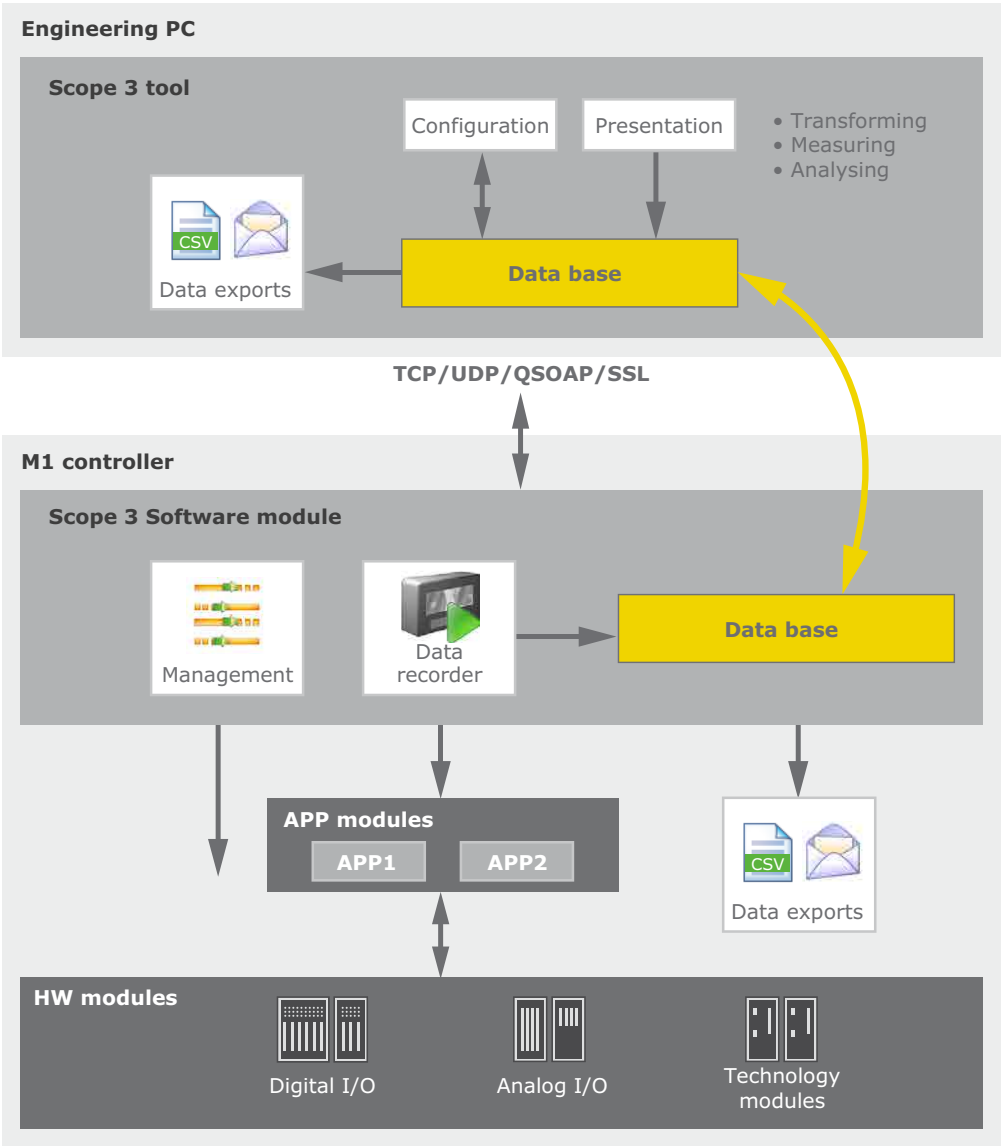
Thus, millions of data points can also be archived directly on the controller. Backup and export functions then allow further processing of the collected data.

- Recording of analog and digital values
- Real-time acquisition directly on the controller
- Long-term recordings per database
- Large number of signals (multiple acquisition tasks possible)

- High resolution / variable sampling priority
- Versatile trigger possibilities / pre-triggers and post-triggers
- Graphic evaluation / curve display on the PC
- Measurement of curves
- Scaling / shifting of curves and calculated curves
- Overlay of reference curves
- Archiving / export on the PC



# Testing and diagnostics



The central aspect of Scope 3 is the portable database on the Engineering PC and M1 controller. This enables very simple data exchange and collaboration – also using copies of a single file, if necessary.

| Scope 3                       |                                                                                                                                                                                                                                                                                                               |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General                       |                                                                                                                                                                                                                                                                                                               |
| Recording module              | Stand-alone real-time recorder on the controller                                                                                                                                                                                                                                                              |
| Configuration                 | Graphic configuration interface in the SolutionCenter or standalone-tool                                                                                                                                                                                                                                      |
| Presentation interface        | Diagram display with dynamic legend in the SolutionCenter or standalone tool                                                                                                                                                                                                                                  |
| Recording module              |                                                                                                                                                                                                                                                                                                               |
| Recordable data sources       | Channel values direct (MIO), SVI variables                                                                                                                                                                                                                                                                    |
| Data Types                    | All analog and digital formats up to 64-bit                                                                                                                                                                                                                                                                   |
| Recordable tasks              | SVI variables of any number of software modules simultaneously                                                                                                                                                                                                                                                |
| Sampling modes                | <ul style="list-style-type: none"> <li>• Continuous</li> <li>• Triggered once</li> <li>• Triggered cyclically</li> </ul>                                                                                                                                                                                      |
| Sampling rate                 | <ul style="list-style-type: none"> <li>• Cyclical, min. 100 microseconds, max. 60 minutes</li> <li>• Coupled with hardware interrupts</li> </ul>                                                                                                                                                              |
| Time base                     | <ul style="list-style-type: none"> <li>• System-tick</li> <li>• Hardware-sync-signal</li> <li>• Auxiliary clock</li> <li>• Real-time clock</li> </ul>                                                                                                                                                         |
| Trigger                       | <ul style="list-style-type: none"> <li>• Any combination of start- and stop-triggers</li> <li>• Recording conditions as additional limitation of the recorded data</li> <li>• Edge, level and distance triggering</li> <li>• Pre-trigger and post-trigger of any length (max. length of recording)</li> </ul> |
| Data quantities               | No technical limitation, dependent on the free resources on the M1 controller                                                                                                                                                                                                                                 |
| Interface                     | C-library for using the data recorder in an application: <ul style="list-style-type: none"> <li>• Executing commands (Start, Stop, etc.)</li> <li>• Changing the recording configuration</li> </ul>                                                                                                           |
| Scaling                       | Several recordings executable in parallel with different sampling rates and different priorities                                                                                                                                                                                                              |
| Auto-run                      | Yes, automatic start after reboot possible                                                                                                                                                                                                                                                                    |
| Write protection              | Yes, definable warning text on changes                                                                                                                                                                                                                                                                        |
| Data buffer                   | Configurable ring buffer for loss-free transfer of data from the controller to the PC                                                                                                                                                                                                                         |
| Data archiving on controller* |                                                                                                                                                                                                                                                                                                               |
| System                        | Embedded database, optionally activatable, database file can be copied freely to different controllers or PCs and used                                                                                                                                                                                        |
| Archiving interval            | Freely configurable in seconds, fast recorded data is buffered and stored in the database in the archiving interval                                                                                                                                                                                           |
| Configurable limits           | <ul style="list-style-type: none"> <li>• Length in seconds</li> <li>• Number of recorded points</li> <li>• Number of recordings</li> </ul>                                                                                                                                                                    |
| Caching of the data-base      | Cache size in the working memory freely configurable                                                                                                                                                                                                                                                          |
| Interface                     | C-library for using the database in an application: <ul style="list-style-type: none"> <li>• Addition of reference channels or entire recordings</li> <li>• Export of data or hot backup</li> </ul>                                                                                                           |

\* Functions are only available in the Professional Version

## Testing and diagnostics

### Scope 3

#### Management / Configuration

|                             |                                                                                                             |
|-----------------------------|-------------------------------------------------------------------------------------------------------------|
| Project Management          | Configurations can be created flexibly in workspace and managed there in projects                           |
| Management of recordings    | Recordings installed on the M1 can be managed directly via their own view                                   |
| Configuration of recordings | All configuration methods can be selected via masks. Errors in the configuration are validated immediately. |
| Delivery of configuration   | A recording configuration can be delivered to a controller via a single action.                             |
| Backup of data              | Data on an M1 can be saved on the PC by drag and drop.                                                      |

#### Presentation/analysis system

|                                      |                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Presentation forms                   | Value-over-time $[x(t)]$ , value-over-value $[x(y)]$                                                                                                                                                                                                                                                                        |
| Time formats                         | Milliseconds [ms] or date/time formats (freely configurable)                                                                                                                                                                                                                                                                |
| Number of value axes                 | User-defined                                                                                                                                                                                                                                                                                                                |
| Number of curves                     | User-defined, selective showing/hiding for maintaining clarity                                                                                                                                                                                                                                                              |
| Axis reference                       | Each curve can be allocated to any axis                                                                                                                                                                                                                                                                                     |
| Auto-scaling                         | Yes, linear or logarithmic scaling possible                                                                                                                                                                                                                                                                                 |
| Fixed scaling                        | Yes, adjustable                                                                                                                                                                                                                                                                                                             |
| Scale arrangement                    | Yes, adjustable                                                                                                                                                                                                                                                                                                             |
| Measurement cursors                  | 2 (can be offset separately and together)                                                                                                                                                                                                                                                                                   |
| Measurement cursor functions         | Value display in legend, time display, differential display                                                                                                                                                                                                                                                                 |
| Stacked Plot                         | Yes, a separate diagram per signal, selective full-screen mode per curve                                                                                                                                                                                                                                                    |
| Array of curves                      | Up to 10 older recordings can additionally be displayed faded into the background for comparison                                                                                                                                                                                                                            |
| Grid                                 | Yes, configurable                                                                                                                                                                                                                                                                                                           |
| Presentation options                 | Curve, axis, grid colors, all line thicknesses, orientation, axis label, axis arrangement (left/right), flooded curves on reference value or other curves                                                                                                                                                                   |
| Raw value transformation             | Factor and offset per signal                                                                                                                                                                                                                                                                                                |
| Reference curves                     | Yes, can be imported from CSV or integrated via application                                                                                                                                                                                                                                                                 |
| Highlighting ranges                  | Curves can be flooded against a configurable reference value or against another curve, configurable via color and transparency value                                                                                                                                                                                        |
| Curve calculation                    | <ul style="list-style-type: none"> <li>Measured curve values or calculated curve values are the basis</li> <li>The calculation methods are addition, subtraction, multiplication, division, integration, differentiation, Fast Fourier Transformation (FFT)</li> <li>Users can add their own calculation methods</li> </ul> |
| Possibilities for making comparisons | Yes, comparison of recordings from different time ranges as well as different recordings                                                                                                                                                                                                                                    |
| Interfaces                           | Extendible with regard to specific calculation operations for curves and export functions for individual formats                                                                                                                                                                                                            |

| Scope 3                 |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data retention          |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Recording configuration | Can be exported/imported as a file                                                                                                                                                                                                                                                                                                                                                                                                     |
| Value storage           | On the controller or PC                                                                                                                                                                                                                                                                                                                                                                                                                |
| Exchange formats        | A database for configuration and data can be exported/imported                                                                                                                                                                                                                                                                                                                                                                         |
| Excel interface         | CSV export                                                                                                                                                                                                                                                                                                                                                                                                                             |
| System requirements     |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| PC software (minimum)   | Processor 2 GHz, working memory 1024 MB RAM, hard disk drive with 250 MB of free storage space, screen resolution 1024x768 pixels, Microsoft Windows XP or higher                                                                                                                                                                                                                                                                      |
| M1 software module      | M1 controller system (except for ME2xx) with M-Base 3.75 or higher                                                                                                                                                                                                                                                                                                                                                                     |
| Design variants         |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| SCOPE 3 Pro RT          | Software package to install on Windows PCs and M1 controllers for the diagnostics of signal waveforms (IO- and process variables). Stand-alone task for recording and archiving of records on the controller, trigger and pre-trigger, multiple recordings. Comprehensive graphical representation (chart) and evaluation functions, data export on the PC, SolutionCenter integration. License bound to target device.                |
| SCOPE 3 DVD             | Installation medium for Scope 3 (DVD). Software module for the M1 controller and Scope 3 tool for displaying recordings and data analysis. A Scope software module without a valid runtime license can be used for up to two hours for recordings. After that, the recording is stopped, but it is possible to restart after a period of 10 minutes. Without a runtime license, archiving functions on the M1 controller are disabled. |

# Programming

## Maximum performance for maximum stability.

Any automation platform is only as good as the software that is available for it. The stability, real-time capability and performance of the runtime system have the highest priorities. The M1 automation system can be programmed in the respective familiar environment of the automation engineer: All five languages of IEC 61131-3 are supported, as are C, C++ or Java.

Also the model-based development via UML-Design/ coding or integration in the function block editors of MATLAB® / Simulink® are unique in the industrial environment. Comprehensive, complete provided libraries simplify the use even of complex units from automation, motion control, and information technology/web.



### M-PLC programming interface

| Features                                                                      |
|-------------------------------------------------------------------------------|
| Easy entry into IEC 61131-3                                                   |
| IT, ST, LD, FDB, CFC, QFB                                                     |
| Convenient debugging on the target system with single-step, breakpoints, etc. |
| Provided libraries with pre-finished and tested functions                     |



### C / C++ Developer

| Features                                                        |
|-----------------------------------------------------------------|
| Languages: ANSI C and C++                                       |
| Gnu compiler gcc                                                |
| Automatic adaptation and management of the computer environment |
| Editor and debugger based on Eclipse CDT                        |
| Intellisense: Automatic supplementation of structure elements   |
| Syntax highlighting                                             |
| Folding code ranges, e.g. for complete while loops              |



## M-PLC Programming interface

### PLC programming interface according to IEC 61131-3

M-PLC is a complete development environment for programming the M1 controller in accordance with IEC 61131-3. The M-PLC puts a simple approach to the powerful IEC language at the disposal of the PLC programmer. Use of the edit and debugging functions is based on the proven development program environments of advanced programming languages.

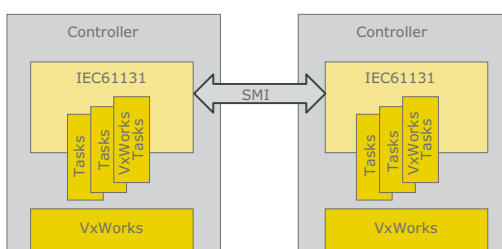
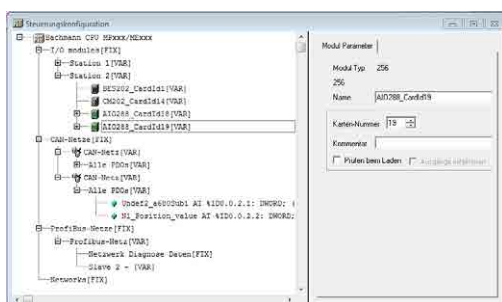
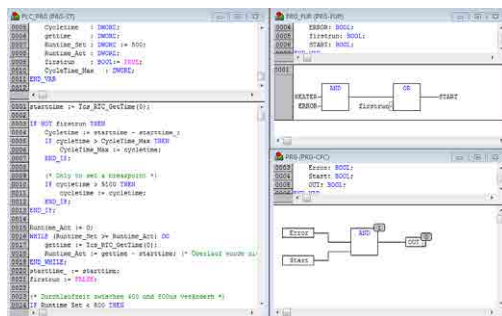
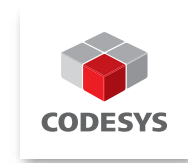
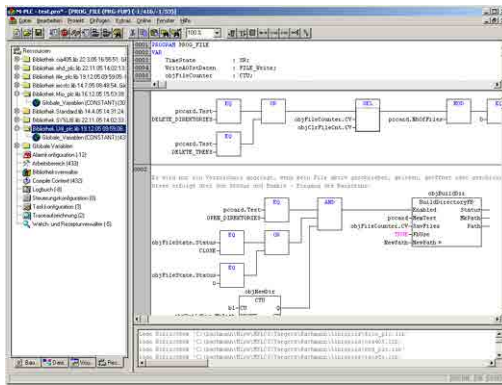
- Easy entry into IEC 61131-3
- All languages defined in IEC standard 61131-3 are supported (instruction list, structured text, ladder diagram, function block diagram, continuous function chart, sequential function chart).
- Editor and debugging functions
- Provided libraries with pre-finished and tested functions

### Programming

- Editors for programming in all IEC 61131-3 languages

|     |                           |
|-----|---------------------------|
| IL  | Instruction List          |
| ST  | Structured Text           |
| LD  | Ladder Diagram            |
| FBD | Function Block Diagram    |
| SFC | Sequential Function Chart |
| CFC | Continuous Function Chart |

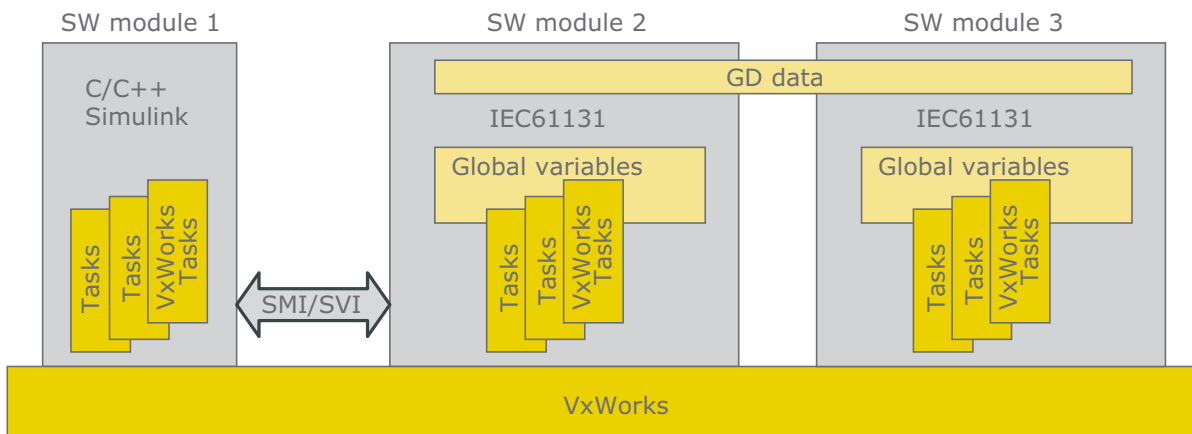
- Syntax highlighting for key words defined in IEC 61131-3
- Graphic project navigation bar (based on Windows Explorer)
- Support of all elementary IEC 61131-3 data types to 64 bit
- Support of fields, structures and pointers
- Graphic controller and task configuration
- CAN objects from \*.dcf files in M-PLC can be applied as symbols
- PB objects from \*.2bf files in M-PLC can be applied as symbols
- Library management for creation and management of libraries
- Watch manager and recipe manager (freely definable variable monitoring)
- M-PLC can be started several times (multiple projects open and online in parallel)
- Automatic project backup and creation of backup
- Project archiving on the controller
- Password protection for projects
- Offline simulation
- Online help
- Data exchange system-wide via SVI/SMI interface programming



# Programming

## Runtime system

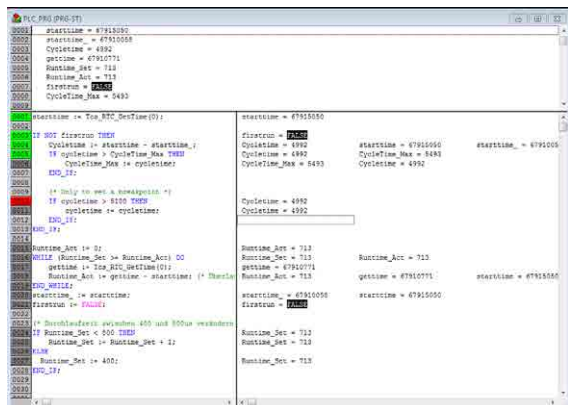
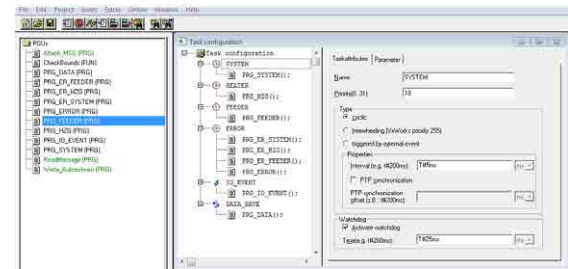
- Any number of running M-PLC projects on one processor
- Every PLC project supports up to 16 separate tasks
- Each task can be configured independently of the others in terms of (priority, task call-up mode [event, timetrigger, free running, sync], watchdog)
- Actual multitasking via operating system tasks (VxWorks)



## Online functions

- Online change (exchange of blocks in running operation) also for multitasking projects
- Monitoring of all project variables
- Writing and forcing of variables
- Single cycle, single step and break points
- Sequence control (program lines that have been run through will be displayed)
- Recording and graphic presentation of project variables – trace

- Communication between software modules (pre-compiled units)
- Between different tasks of an IEC61131 module: global variables or SMI/SVI
- Between IEC61131 modules: GD flag range or SMI/SVI
- Between IEC61131 modules and other modules (C/C++, Simulink): SMI/SVI
- Between any modules on different controllers: SMI
- Interface to visualization/SCADA/BDE
- Standard protocols: OPC DA, IEC 61850/IEC61400, Modbus, ...
- Libraries for integration into separate software (for C/C++, C#.NET, Java)
- Support of battery-buffered data (RETAIN flag)



## Manufacturer libraries

- **STANDARD** IEC 61131-3 Standard functions and function blocks
- **CONT\_PLC** 7 standard PID controllers
- **MIO\_PLC** Functions for direct access to hardware I/Os
- **SMI\_PLC** Functions for fast communication between modules and controllers (SMI/SVI)
- **EHD\_PLC** Functions for inputting and managing errors in the EHD
- **UTIL\_PLC** Functions for access to RTC, runtime system info, special conversions
- **FILE\_PLC** Functions for access to files, directories and serial interfaces
- **CIA405** Functions for access to CAN
- **DN\_PLC** Functions for access to device net
- **PB\_PLC** Functions for access to Profibus
- **USS\_PLC** Functions for communication with "Micromaster" frequency converters

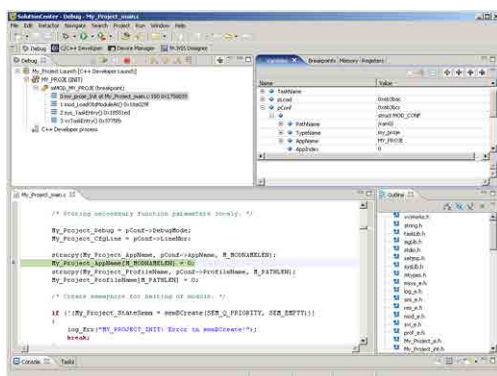
## Extensions relative to CoDeSys

- Grouping possibility for I/O modules in the process image (controller configuration)
- runtime-optimized process image (only channels being used are processed)
- CAN objects with symbolic names in the process image
- Addressing for inputs/outputs: undelayed access that bypasses the process image
- Adjustment of the interval time and watchdog time in the controller configuration
- Multiple, concurrently running PLC projects on one CPU with different priorities/interval times
- Actual operating system tasks within the PLC projects
- GD flag range for shared data from multiple projects on one CPU
- RD flag range for remnant (battery-buffered) data
- Optionally, the normal flag range (MX .. MR) can also be placed in the battery-buffered memory area.
- Interface in the runtime system for libraries
- Initialization (C), deinitialization, version check, memory management, management of background tasks, provision for online change

- Support for exception handling in the runtime system
- Display of the status "in error handling" (ERROR) in the interface
- Implementation of the I/O modules of the process image in the runtime system
- Optimized for performance, flexibility and combinability, shared use of an I/O module by multiple projects/SW modules possible
- Saving/loading of the entire project including sources to/from the controller
- Transparency of the global variables (flags, symbolic variables, structures) controller- and visualization-wide

## Integration in the SolutionCenter (projects are SW modules)

- Generation of an executable \*.m file with configuration information
- Task interval time measurement, can be queried in the project itself and in Device Manager
- Watchdog integration
- Execution possible in an application layer (memory protection)
- Install, start, stop, reset and delete of PLC projects in Device Manager
- The state machine of a PLC project in the runtime system always corresponds to the model defined for SW modules.
- Integration via M1 system debug mode and M1 system logbook
- Start of a project when booting through entry in MConfig.ini



## C / C++ Developer

High-level language programming in C and C++ is also gaining increased significance in automation technology. These languages are not only widely used, they also offer the possibility of extremely efficient programming and of encapsulating frequently-used sequences in classes. The ability to structure a software module into any number of tasks, and in the process being able to use all the resources of a powerful operating system, VxWorks®, without restriction is an incredible expansion of the possibilities. C / C++ Developer enables programming in ANSI C, as well as in C++.

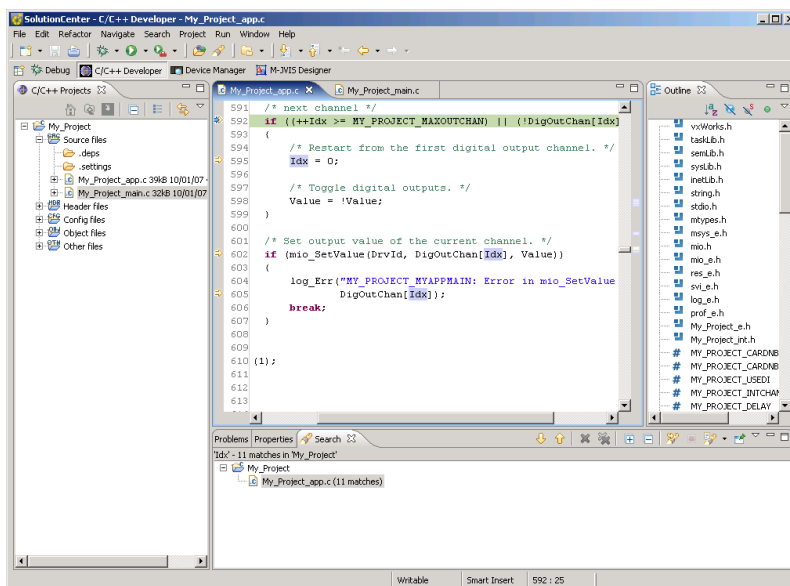
Thanks to the mature interface and the restriction to the required setting possibilities, getting started with C and C++ programming remains easy. For the start of a new project multiple selectable project templates available that already contain all calls for the start of the software module and its interaction with the operating system. Consequently the programmer can immediately devote himself to the logic of his application. Projects can be compiled immediately after they are created. The result is a finished, executable program file for the M1 controller family. The »make« environment and all configuration files are managed and set up by C / C++ Developer automatically. For transfer of existing projects from a different development environment there is also the possibility of continuing to use the existing configuration files for the compile process, without having them managed by the C / C++ Developer (»unmanaged make«). Integration of existing libraries (\*.a) in projects is also possible, as is generation of your own libraries. The generated executable program file can be directly transferred, configured, installed and started from the C / C++ Developer on the control system.

Troubleshooting is supported by a mature debugger that can not only be active after download of the project, but also enables integration of a software module that is already running. Set break points can be deactivated and will be saved automatically in the project, in addition they can also be saved in lists. In addition to the break points, watch points, also referred to as »hardware breakpoints« are also available. These do not stop a task when it executes a defined code, but rather they stop a task when a specific memory address is read and/or written to.

The contents of the stack variables and the global variables are readable and writable, complex data types and structures are resolved appropriately and mapped in the form a tree. In addition, any number of memory contents can be listed in numeric format.

All tasks that belong to the software module are presented. For each function that is in the debugger the call-up hierarchy is displayed (stack trace).

- Languages ANSI C and C++
- Gnu compiler gcc
- Automatic adaptation and management of the compiler environment
- Editor and debugger based on Eclipse CDT
- Intellisense: Automatic supplementation of structure elements
- Syntax highlighting
- Folding code ranges, e.g. for complete while loops
- Jump to the declaration of variables and functions from the code
- Debug agent integrated in the M1 operating system (MSys), no additional settings are necessary
- Installation and start of the created software module from the development environment
- Coupling of the debugger to the running software modules
- Generation and integration of libraries
- All important compiler settings are accessible via dialogs



## Model-based design/Simulation

### Proven security for the future.

M-Target for Simulink® enables rapid implementation of algorithms developed in MATLAB®/Simulink® on the M1 automation system. Processes are presented in the simulation environment of MATLAB® and suitable control and regulation strategies are developed for this. The overall system can be varied as often as desired in the computer

simulation, before trials are executed on real prototypes of machines and plants. Automatic code generation enables transfer of the developed algorithms to the controller and automatically establishes the connection to the input/output modules used.

# Model-based design/Simulation



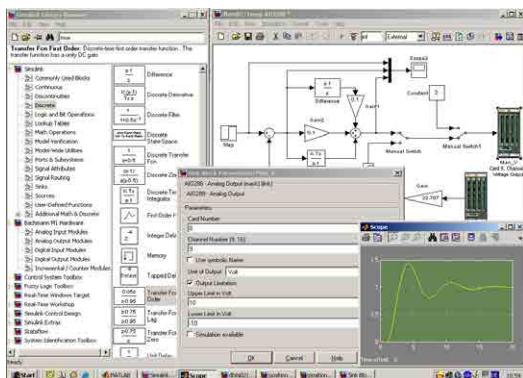
## M-Target for Simulink®

### Fast development of controllers and sequence controllers

The MATLAB® program package and the associated toolbox, Simulink® from Mathworks Inc. are considered to be the worldwide standard in the area of modeling dynamic systems in technologically demanding processes.

With the complete integration of the M1 controller as target system, a convenient and efficient implementation of the MATLAB® functions is enabled on an M1 control system. The user can concentrate exclusively on working in the familiar, graphic Simulink® programming environment, where he can model the system in its entirety and simulate the effect of changes even before transfer to an M1 control system. The code for the M1 target system is generated automatically in the background and requires no knowledge of a programming language. This complete integration enables efficient programming and commissioning of the M1 control system.

- Faster implementation of controllers through shorter controller design phases
- Shorter commissioning processes through reliable automatic code generation
- Higher level of agreement between machine model and controller model



| Item                                        | Item no.    |
|---------------------------------------------|-------------|
| M-Target for Simulink<br>One-time License   | 00015577-60 |
| M-Target for Simulink<br>Annual Maintenance | 00015577-70 |

Existing MATLAB® / Simulink® subsystems can be reused in new simulations of the controller programs. The integration of Bachmann »ready-to-use« software modules facilitates development of complex, customer-specific software. The unique and direct interplay between process model, controller model and support a more stable modeling of the overall process. Transfer to the M1 controller is executed automatically from the MATLAB® / Simulink® environment, parameter variations in the model are implemented online in the M1 target system (target). Sequential programs can be implemented through the optional Stateflow and Coder toolboxes.

# Model-based design/Simulation

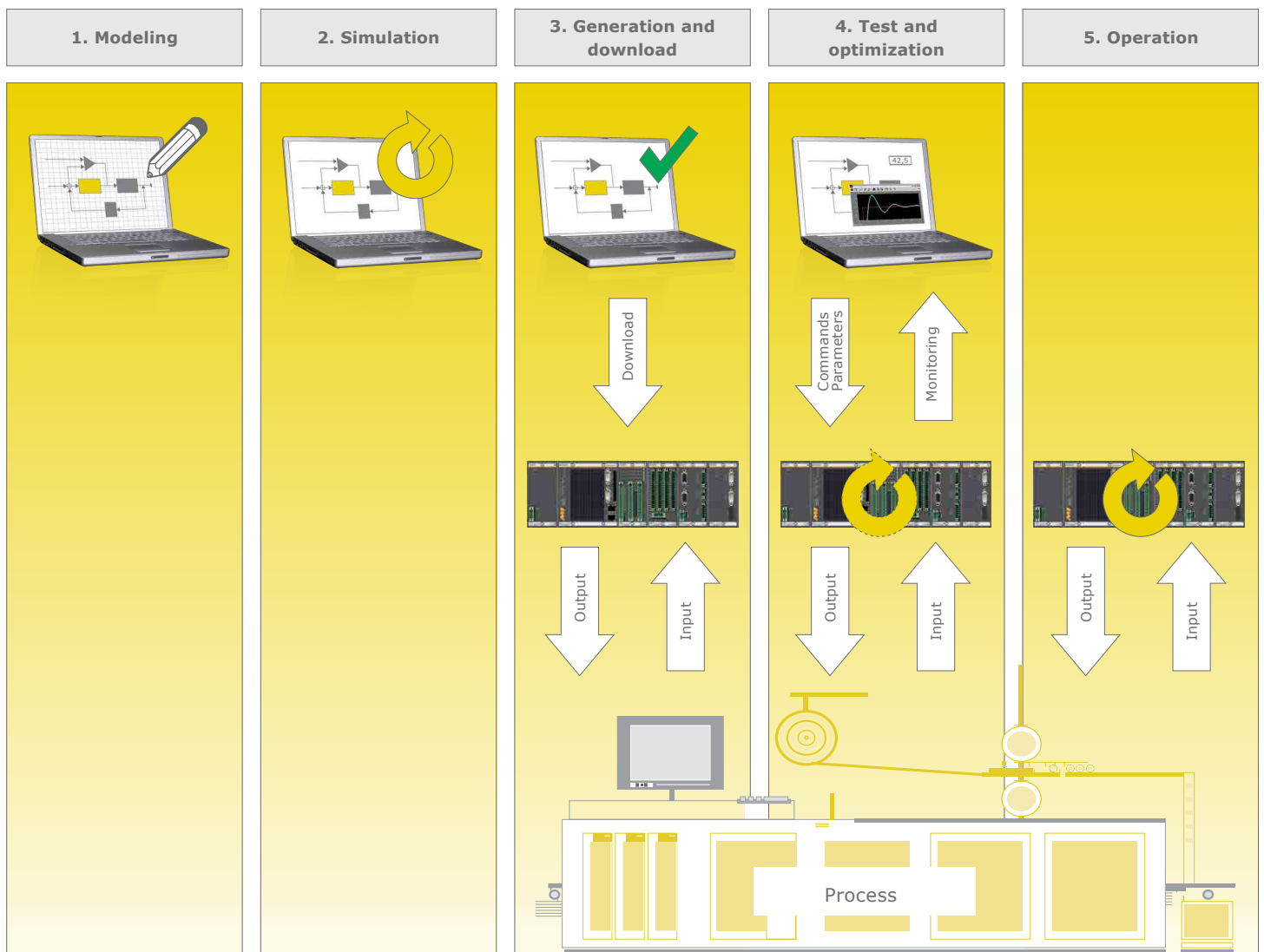
## Development Process

### 1. Modeling

Both plant (physical system) and control systems are modeled in Simulink®. Using application specific tools reduces the time spent developing the system. This is achieved by enabling the developer to use modeling languages native to the domain of interest. Domain-specific products for physical modeling, such as SimElectronics, SimHydraulics, SimMechanics, make it easier to create intuitive, reusable models of the multidomain physical system. For mathematical modeling, MATLAB® and Simulink® also offer a range of capabilities. Established service companies offer additional expertise in all domains.

### 2. Simulation

The resulting complete model is now simulated offline on the computer. Comprehensive test series of all possible operating conditions or error situations are played through. Iterative model adjustments and new simulations follow seamlessly. The high-quality process/solver for numeric calculation of differential equations also prove themselves outside of simple analytical systems. Outstanding graphic depiction possibilities, such as curves and surface plots and even animated 3D-CAD models, optimize the work sequence.





## Model-based design/Simulation

### 3. Generation and download

In this step, the process model is first separated from the actual control or regulation part. Then a mouse click triggers automatic code generation and preparation of the application for the real-time system. This can be loaded directly from the Simulink® interface into the controller.

## 4. Test and optimization

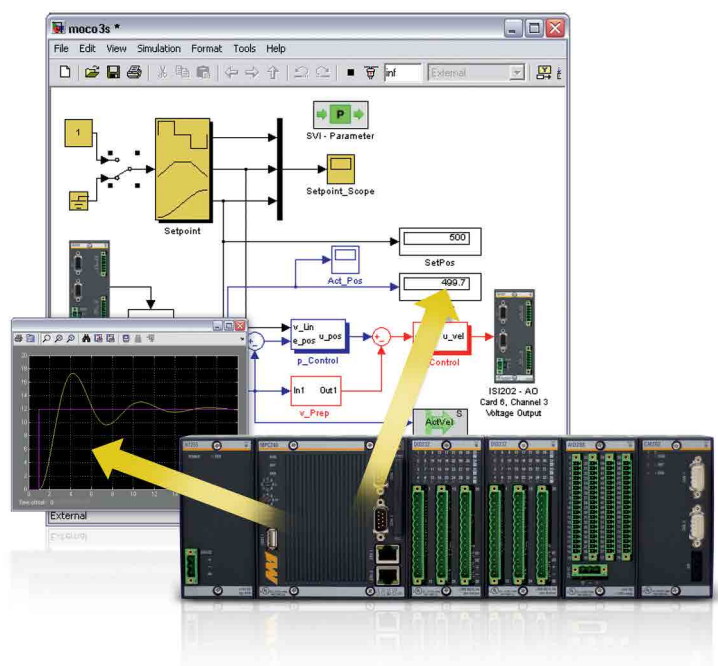
The generated real-time program now runs in the controller. But it can exchange data directly with the Simulink® interface on the PC through the communication interfaces integrated during code generation. Then, in the so-called “external mode”, the actual process values (variables, channel values) are available directly online in Simulink®. At the same time, variable values or internal parameters of the Simulink® blocks can also be changed from there in the real-time program. In this mode, the Simulink® model created by the developer is only the graphic front end for visualization of process values and stipulation of parameters. Using the real process environment, the discovered solution can be verified and further optimized. If necessary, users can switch to a prior process step and make changes there (iterative improvement).

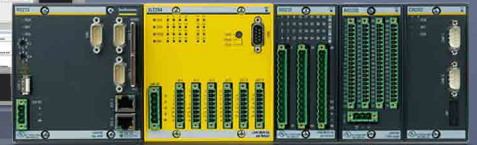
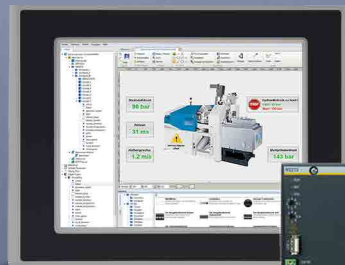
## 5. Operation

As soon as a satisfactory result is achieved, the project management PC can be separated from the controller – which continues to run autonomously in real time. All interfaces to parallel-running applications on the same (or other) controllers remain in place. The published process variables can be depicted through the general engineering tool SolutionCenter or in visualizations.

## External Mode

Display and change online data directly  
from real-time systems in Simulink®.





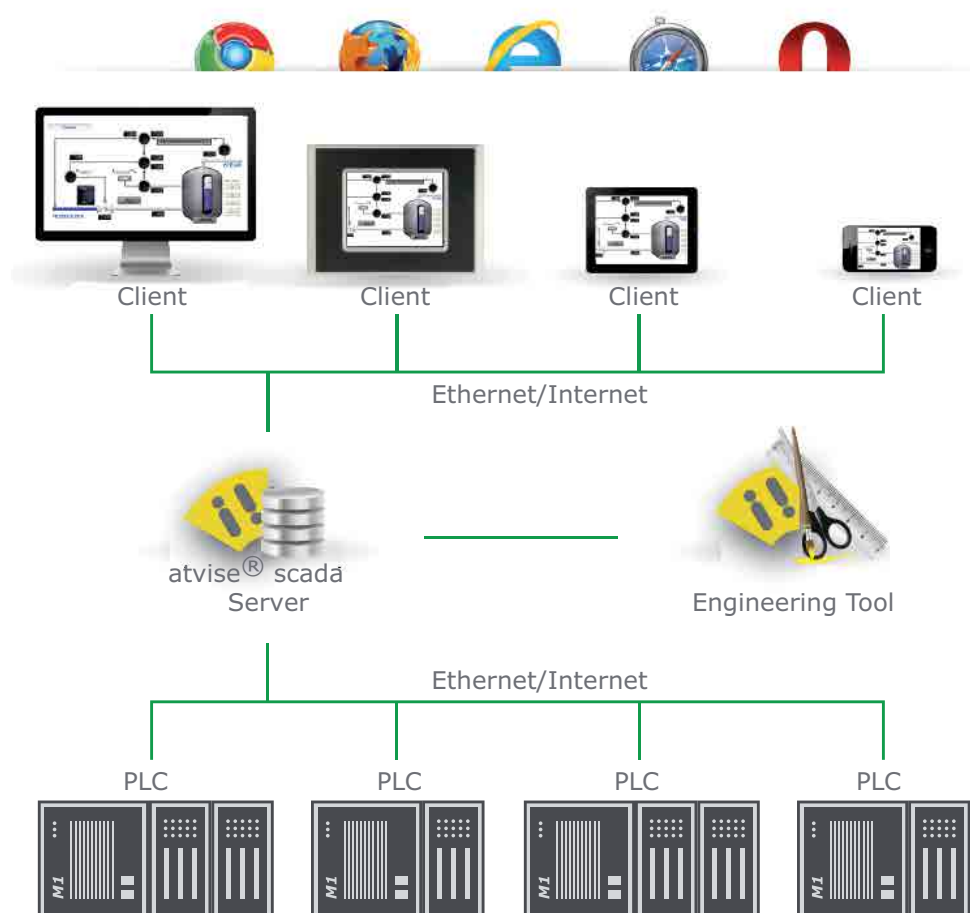
## **HMI and SCADA Solutions through web technology**

Increasing complexity and the constantly escalating level of automation in a wide variety of systems demand future-oriented technologies to monitor and control processes effectively. HMI and SCADA systems contribute significantly in this regard and guarantee a highest possible degree of security. Moreover, future applications have to be able to demonstrate a high degree of flexibility; even connecting to fixed operator control stations in the age of mobile terminals is a thing of the past.

Due to its generic structure, the specially designed HMI and SCADA solutions from Bachmann electronic for professional and control center technology can be used in all areas of application and industries like energy, plant construction and mechanical engineering, maritime applications, building control systems in the infrastructure sector or logistics. The modern and efficient structure makes for scaling from extremely small applications with scarcely a dozen information points up to industrial-scale systems with several hundred thousand process values. Top-quality user interfaces are produced by using web technologies alone, while installations on the HMI equipment fall by the wayside. Visualization is available on all equipment with a standard browser and is not constrained by screen sizes and resolutions.

The new "Supervisory Control and Data Acquisition" solution puts the Internet in the service of the automation world thanks to pure Web technology. With the continuous use of industrial and communication standards (e.g. OPC UA), the engineering effort is reduced to a minimum.

- Latest-generation SCADA/HMI system
- Client-server architecture (multi-client)
- History database
- User administration & access security
- Java Script server- and client side, open for customer-specific adaptation of the Java Script
- OPC UA Data Access and Alarms & Conditions interface to superior systems





## atvise® scada

### Pure web Supervisory Control and Data Acquisition Solution

The provision of information independent of location and daytime has become the paradigm of all areas of our life in our Internet age. This requirement expands within the industrial automation in terms of role- and person-selective operation and process manipulation. Conventional control and operating systems emerged along with other requirements and were based on older, restrictive technologies, making their suitability clearly limited for today's challenges.

### State-of-the-Art Technology

By using the latest technologies for the development atvise® scada, classical limitations have been overcome: the Internet now serves the automation world - the visualization is based on pure web technology. The implementation of valid industrial and communication standards (e.g. OPC UA) allows for example customers to reduce the efforts in project and maintenance to a minimum.

### Open Standards

By focusing on international standards (such as HTML5, SVG - vector graphics, TCP / IP) the generated user interface is displayed and executed on all popular Web browsers without special additives, such as individual plug-ins, ActiveX, Java or Silverlight. This means added value in various ways: Web browsers are everywhere device independently available - whether on the particular facility level or in the case of remote services. Eliminating cumbersome client installations and updates means less effort for operation and maintenance. Maximum possibilities in graphic design along with maximum access security are the values of benefit that the latest

| Item                                 | Item No.      |
|--------------------------------------|---------------|
| atvise scada 50 CCD* - micro         | 00021504-00   |
| atvise scada 150 CCD* - small        | 00021504-10   |
| atvise scada 1500 CCD* - standard    | 00021504-20** |
| atvise scada 10000 CCD* - large      | 00021504-30** |
| atvise scada Unlimited CCD* - xxi    | 00021504-40   |
| atvise Server-sided Scripting Option | 00021679-00   |
| atvise Fixed Client Option           | 00021680-00   |
| atvise Elements Option               | 00021681-00   |

\* CCD = Concurrent Connected Data points (via http). e.g.: 50CCD = an opened

Web browser displays 50 data points or two opened Web browsers display 25 data points apiece, etc.

\*\* Starting with the standard, a fixed workstation is included

stage of expansion of the Internet (web 2.0) and the smartphone era offer. atvise scada is completely based on standards rather than the makeshift „to connect to the outside,“ therefor securing highest performance, scalability and simplicity.

## Powerful Engineering Tool

The project and configuration is done with the engineering tool atvise builder from any PC. Via LAN or Internet the tool accesses the server and allows online, during ongoing operation of the plant, e.g. the creation of data objects, the configuration of alarms or the drawing of process images.

A variety of preconfigured standard objects and panel layouts are available. Their graphics have been created with the onboard-tools of the atvise builders editor and therefore are completely customizable by the user. The user can also create own objects and apply the pre-configured dynamizations to these elements. The designed user interfaces are immediately and without any modification applicable on all target systems - regardless of screen resolution, operating system or Web browser. Refresh rates and response surpass all previous experience with Web applications and even conventional supervisory control systems.

## SCADA Functions

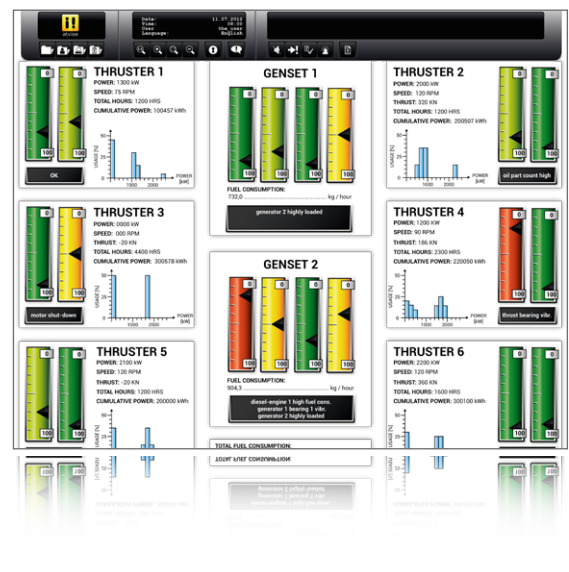
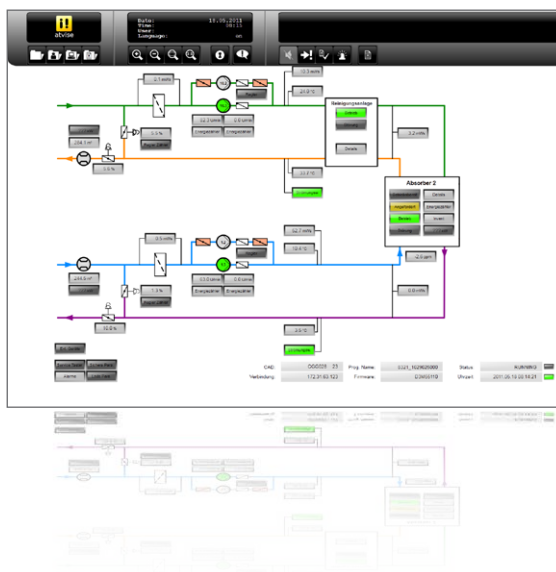
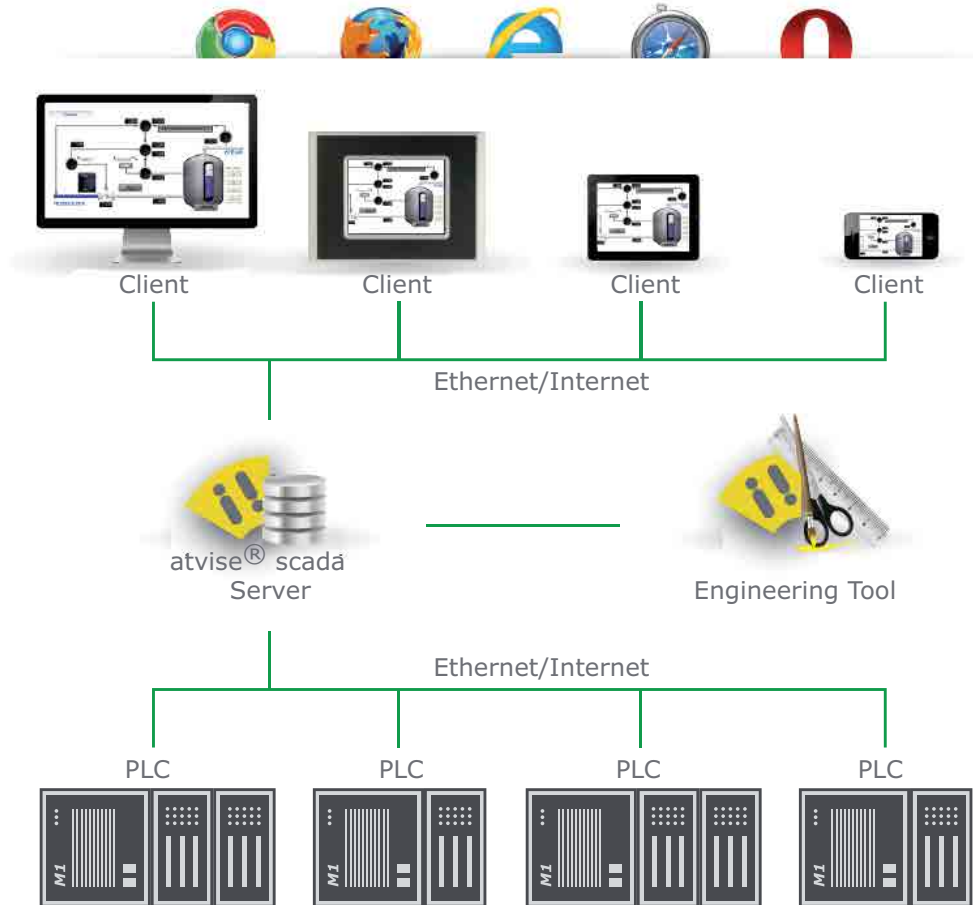
atvise scada in general supports all typical SCADA functionalities in regards to alarming, historisation, trending, user management and multi-language. For specific requirements an additional high performance client-and server-side Java Script option is available within a built-in script editor. This system has been specifically designed for professional automation and control systems and due

to its generic structure can be utilized in all fields and industries. The modern and efficient design allows scaling from small applications with only a few dozens data-points to world-scale plants with more than 100,000 process variables

- Latest generation SCADA / HMI system
- Client-Server architecture (Multi-client)
- User interfaces in pure web technology
- Device and operating system independent (HTML5, SVG) PC / Mac / Unix, Tablet, Smartphone, iPad ...\*
- Process connection OPC UA
- Online Engineering / multi-user
- Built-in alarm system
- History database
- Online-/offline trending
- Online language/font switching
- User management and access security
- Java script, server- and client-sided
- OPC UA Data Access and Alarm Conditions interface to superior level systems



\* Current browser compatibility list can be called up at [www.atvise.com](http://www.atvise.com).



| atvise®                   |                                                                                                                                                      |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Process interface         |                                                                                                                                                      |
| Protocols                 | OPC Unified Architecture (UA) Data Access<br>OPC Data Access V2.05, V3.0<br>webMI Data Interface                                                     |
| Physical interface        | Ethernet (physical type dependent on target system)                                                                                                  |
| Parallel operation        | yes (multiple protocols, multiple data sources)                                                                                                      |
| Data types                | all OPC UA compliant elementary types, arrays and structures                                                                                         |
| Data mapping              | integrated (to digital, analog and string as elements of arbitrary structures)                                                                       |
| Data model mapping        | yes (automatically)                                                                                                                                  |
| Data naming               | arbitrary names (use source name possible)                                                                                                           |
| Source time stamping      | yes (from PLC/controller, OPC compliant)                                                                                                             |
| Quality tagging           | yes (from PLC/controller, OPC compliant)                                                                                                             |
| Transmission mode         | event-driven, cyclically (configurable)                                                                                                              |
| Update rate               | dependent on project and configuration (starting from 100 ms)*<br>sampling and publish intervals configurable                                        |
| Update inhibition         | time / threshold dependent                                                                                                                           |
| Connection monitoring     | yes                                                                                                                                                  |
| Access control / security | yes (OPC UA compliant, including SSL encryption)                                                                                                     |
| Namespace browsing        | yes (hierarchical browsing interface at design and runtime)                                                                                          |
| Simulation mode           | yes                                                                                                                                                  |
| Logging                   | yes (diagnostics user interface per item element)                                                                                                    |
| Server                    |                                                                                                                                                      |
| Core technology           | C++ platform independent                                                                                                                             |
| Process data model        | fully structured, object oriented (hierarchy, derived types)                                                                                         |
| Engineering model         | type (class) / instantiated objects, inherited properties                                                                                            |
| Data volume               | scalable and dependent on hardware platform<br>(with Windows 7 32-Bit up to approx. 700 000 process items)*                                          |
| Multi processing          | multithreaded computation / benefits from multi-core / multi-CPU systems                                                                             |
| Server time stamping      | yes (additionally to source time stamp)                                                                                                              |
| Database                  | embedded, powerfail-safe                                                                                                                             |
| Configuration storage     | engineering database                                                                                                                                 |
| Alarm system              | OPC UA Alarms & Conditions compliant (arbitrary alarm categories)                                                                                    |
| Historian                 | process value database with incremental archiving<br>archive groups with configurable sampling interval and offset<br>alarm database (alarm history) |
| Longtime archiving        | yes (data aggregation, derived long term archives)                                                                                                   |
| Trending                  | online trending (without archiving)<br>historical trending (offline)<br>combined online/offline trending                                             |

\* Performance data depends on data volume, computation power, (available) controller performance / device and network topology/-load. Performance depends generally on application.



| atvise®                                        |                                                                                                                                          |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Server                                         |                                                                                                                                          |
| Trend configuration                            | fixed configuration at design time<br>user configurable trend displays at runtime (persistable)                                          |
| User administration                            | yes (privileges/rights, groups, users)                                                                                                   |
| Functional Extensions                          | Java Script (server sided)<br>full access to all item related functions and external databases (via ODBC)<br>specific extensions via DLL |
| Module interface                               | C++ API                                                                                                                                  |
| Virtualization                                 | possible                                                                                                                                 |
| Client Interface                               | HTTP / HTTPS (integrated webserver)                                                                                                      |
| Supervisory Interface<br>(supervisory systems) | OPC UA Data Access (also atvise® <-> atvise® connectivity)<br>OPC UA Alarms & Conditions                                                 |
| Client                                         |                                                                                                                                          |
| Technology client                              | up to date, standard-compliant web browser*                                                                                              |
| Technology process images                      | HTML, SVG, Java Script                                                                                                                   |
| Number of clients                              | technically almost any number of clients (>>20)<br>dependent on license, see also Installation/CCDs                                      |
| Zooming                                        | yes, continuously                                                                                                                        |
| Deluttering                                    | yes (zoom level dependent visibility/content)                                                                                            |
| Scaling                                        | yes (automatic resize/adaption to client device)                                                                                         |
| Vector graphics                                | yes (lossless scaling/zooming)                                                                                                           |
| Base objects                                   | see "Configuration/Engineering"                                                                                                          |
| Process objects                                | see "Configuration/Engineering"                                                                                                          |
| Alarm screen                                   | yes                                                                                                                                      |
| Trend / multitrend                             | yes                                                                                                                                      |
| Operator input protocol                        | yes                                                                                                                                      |
| Operation                                      | mouse or other pointer devices<br>keyboard (hotkeys configurable)<br>touchscreen, multitouch**                                           |
| Multi language                                 | yes (online language change)                                                                                                             |
| Font type switching                            | yes (online)                                                                                                                             |
| Character sets                                 | any (inclusive asian sign languages, cyrillic etc.)                                                                                      |
| Maps / GIS                                     | yes                                                                                                                                      |
| Parallel content                               | yes (anything running in a web browser: HTML, Video, Audio, VRML/3D, Chat, ...)                                                          |
| Functional extensions                          | Java Script (client sided)                                                                                                               |

\* Latest browser compatibility list can be accessed at [www.atvise.com](http://www.atvise.com)

\*\* Multitouch support depends on specific device functionality, operating system and web browser

| atvise®                                |                                                                                                                                                                                                   |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration/engineering              |                                                                                                                                                                                                   |
| Data model editor                      | yes (integrated in atvise® builder)                                                                                                                                                               |
| Prozess image editor (fully graphical) | yes (integrated in atvise® builder)                                                                                                                                                               |
| Programming editor                     | yes (integrated Java Script Editor in atvise® builder)                                                                                                                                            |
| Page editor                            | yes (integrated HTML Source Editor in atvise® builder, not required for engineering)                                                                                                              |
| Engineering model                      | type (Class) / instantiated objects, inheritance of properties, graphical objects (face plates) may be a property of a data object                                                                |
| Graphical objects                      | primitives: line, polygon, shape (any), rectangle, ellipse, etc.<br>widgets: label, text field, table, trend etc.                                                                                 |
| Object library                         | yes , comprehensive catalogue of predefined standard objects in pure vector graphics (adjustable, extensible), contains beyond others bar graphs, gauges, tanks, engines, etc.                    |
| Picture library                        | yes (optional)                                                                                                                                                                                    |
| Graphic format support                 | SVG (and others compliant to W3C)                                                                                                                                                                 |
| Animations                             | text, value, boundary color, background color, text color, visibility, operability, size x/y, position x/y, rotation, flashing, ...                                                               |
| Advanced graphics                      | arbitrary shapes and clippings, bevel, simple and complex gradient shading, transparency, semi transparency (alpha blending), rotation, shading, transformation/adaption of existing SVG graphics |
| Server interface                       | OPC UA (Ethernet/Internet)                                                                                                                                                                        |
| Online engineering                     | yes (project changes during runtime/operation)                                                                                                                                                    |
| Remote engineering                     | yes (remote access possible)                                                                                                                                                                      |
| Multi engineering                      | yes (several engineering users work on one project)                                                                                                                                               |
| Variations                             | Engineering system atvise builder can offer a configured feature set to users (different groups / qualification levels in engineering)                                                            |
| Import/export                          | XML and CSV                                                                                                                                                                                       |
| Installation                           |                                                                                                                                                                                                   |
| Clients                                | no installation required (pure web technology)                                                                                                                                                    |
| Server                                 | installation by Internet/network (or CD-ROM)                                                                                                                                                      |
| Configured installation                | yes (project specific adjustments via XML)                                                                                                                                                        |
| Licensing                              | CCD (Concurrent Data Points) - simultaneously displayed data items on all connected clients                                                                                                       |
| License protection                     | hardware dependent software key (server sided)                                                                                                                                                    |

| <b>atvise®</b>                         |                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Diagnosis</b>                       |                                                                                                                                                                                                                                                                                                                                                          |
| Process data monitor                   | yes                                                                                                                                                                                                                                                                                                                                                      |
| Process data statistics                | yes                                                                                                                                                                                                                                                                                                                                                      |
| Systemlog                              | yes                                                                                                                                                                                                                                                                                                                                                      |
| Online help system                     | yes                                                                                                                                                                                                                                                                                                                                                      |
| <b>System requirements server</b>      |                                                                                                                                                                                                                                                                                                                                                          |
| Device                                 | minimum: PC or server with at least 500 MHz Intel Pentium oder equivalent, 512 MB RAM (project dependent), network (LAN), input devices, 128 MB available disk space.<br>Recommended: PC or server with 1.6 GHz Intel Pentium or equivalent, 2 GB RAM (project dependent), network (LAN), input device, display 1280x1024, 512 MB available disk space** |
| Operating system                       | Windows XP SP3, Windows 7 (32), Windows 7 (64)***, Windows Server 2008                                                                                                                                                                                                                                                                                   |
| Operating elements                     | not required (headless server operation with remote administration possible)                                                                                                                                                                                                                                                                             |
| <b>System requirements engineering</b> |                                                                                                                                                                                                                                                                                                                                                          |
| Device                                 | PC with 1,6 GHz Intel Pentium equivalent or better, 2G B RAM (project dependent), network (LAN), display 1280x1024, 512 MB available disk space                                                                                                                                                                                                          |
| Operating system                       | Windows XP SP3, Windows 7 (32), Windows 7 (64)***, Windows Server 2008                                                                                                                                                                                                                                                                                   |
| Operating elements                     | keyboard, 2-button mouse                                                                                                                                                                                                                                                                                                                                 |
| <b>System requirements client</b>      |                                                                                                                                                                                                                                                                                                                                                          |
| Device                                 | PC, notebook, tablet, smartphone, iPad or similar.<br>Required CPU-performance und memory depends on device type/ technology and project size / parameters                                                                                                                                                                                               |
| Operating system                       | any (Web browser is relevant)                                                                                                                                                                                                                                                                                                                            |
| Web browser*                           | any up-to-date Web Browser (Java Script, HTML 5, SVG)<br>e.g. recent versions of Internet Explorer, Firefox, Chrome, Safari or similar                                                                                                                                                                                                                   |
| Operating elements                     | dependent from device technolgy and operating system                                                                                                                                                                                                                                                                                                     |

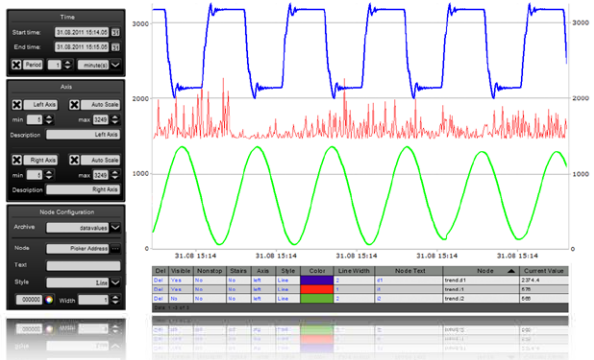
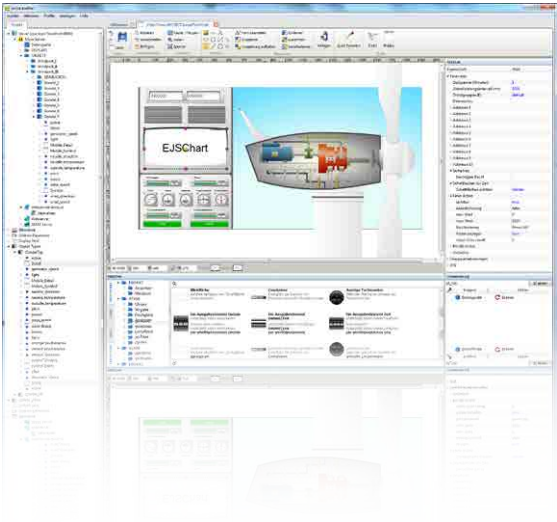
\* Latest browser compatibility list can be accessed at [www.atvise.com](http://www.atvise.com)

\*\* For large scale configurations state-of-the-art server hardware with up to date performance

\*\*\* Windows 7 64-Bit currently in 32-Bit compatibility mode, full 64-Bit support in preparation

| atvise®                             |                                                                                                                                                   |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Variants                            |                                                                                                                                                   |
| atvise scada 50 CCD* - micro        | atvise scada software package for one SCADA Server for Windows (web licencing), limited to a maximum of 50 concurrent visualised datapoints       |
| atvise scada 150 CCD* - small       | atvise scada software package for one SCADA Server for Windows (web licencing), limited to a maximum of 150 concurrent visualised datapoints      |
| atvise scada 1500 CCD* - standard   | atvise scada software package for one SCADA Server for Windows (web licencing), limited to a maximum of 1500 concurrent visualised datapoints **  |
| atvise scada 10000 CCD* - large     | atvise scada software package for one SCADA Server for Windows (web licencing), limited to a maximum of 10000 concurrent visualised datapoints ** |
| atvise scada unlimited CCD* - xxl   | atvise scada software package for one SCADA Server for Windows (web licencing), more then 10000 concurrent visualised datapoints                  |
| atvise serversided scripting option | offers serversided scripting in JavaScript on the atvise scada server (requires atvise scada)                                                     |
| atvise fixed client option          | grants access for an additional operating station, independent of the actual status of the CCD count (requires atvise scada "standard" or higher) |
| atvise elements option              | advanced symbol and objects library with more than 4,000 high quality vector graphic elements (per engineering workstation)                       |

\* CCD = Concurrent Connected Datapoints (over http). E.g.: 50 CCD = one opened webbrowser displaying 50 datapoints or two opened webbrowser displaying 25 datapoints each, etc.  
\*\* Licenses "standard" and higher include 1 fixed client

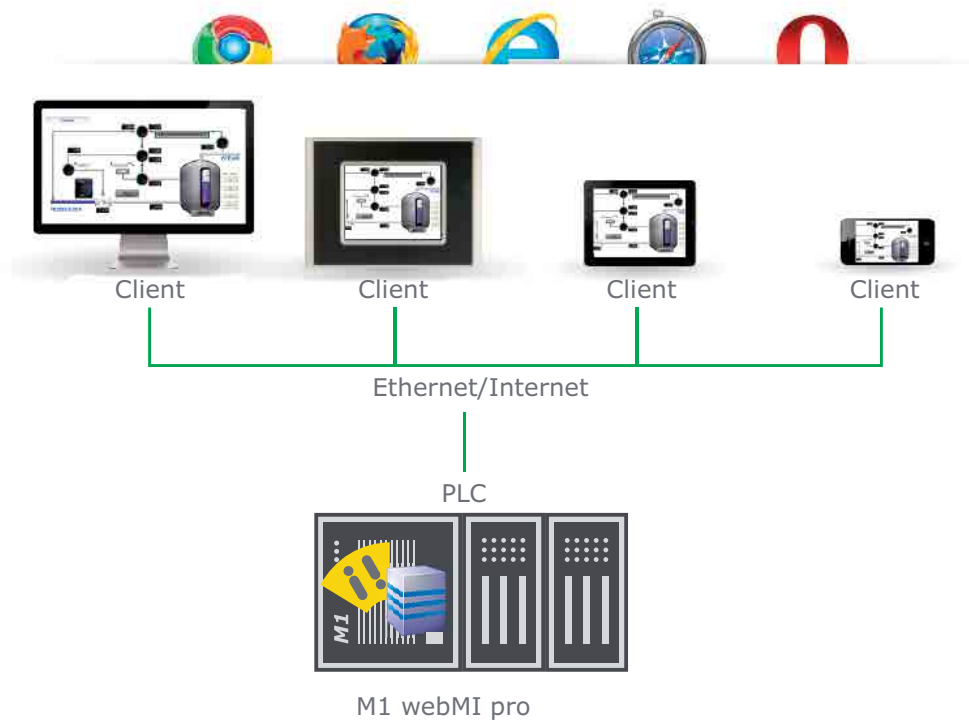




## M1 webMI pro

The M1 webMI pro server for Web visualization runs directly on the controller, slim and high-performing software that makes any device with a browser into a user interface for a machine anywhere at any time.

- directly integrated into the M1 controller system
- No dedicated HMI devices necessary
- Free scalability thanks to vector graphics (SVG)
- Device and operating system-independent for, e.g., operator terminals, iPad, ...
- Operate and monitor with standard browser
- Alarming and journaling of variables





### M1 webMI pro

#### Web visualization directly on the controller

For the operation and monitoring of machines and systems, usually dedicated MMI devices are required and the software for this purpose must be installed and allocated. Thanks to the M1 webMI pro, this is no longer necessary; here, the visualization is integrated directly on the controller. As a result, each authorized device using a current browser becomes the HMI - always and everywhere.

#### Pure Web standards

With the M1 webMI pro it is possible to exploit the advantages of the Web technologies entirely without limiting add-ons such as browser plug-ins and ActiveX. Any visualization devices from smartphones to a high-performance control panel can be connected directly to the M1 controller via a secure web server - operating and monitoring when- and wherever the process calls for it.

#### High-quality user interface

The integration into the powerful M1 controller system is evidence of the kind of performance that state-of-the-art web technologies provide: A flicker-free display is produced even at data update rates of well under 100 ms and with hundreds of animated graphic elements. The additional resources that are required here are minimal.

When viewing an M1 webMI pro visualization page, the singular advantages of HTML5 and SVG (Scalable Vector Graphics), the basis of all graphic objects, become immediately apparent. Perfect graphic results are achieved with zero loss of quality when scaling and zooming.

| Item                 | Item No.    |
|----------------------|-------------|
| M1 webMI pro RT      | 00022839-63 |
| M1 webMI pro YMT     | 00022839-70 |
| M1 webMI pro Starter | 00022846-00 |
| M1 webMI pro DVD     | 00022839-00 |

## M1 webMI pro

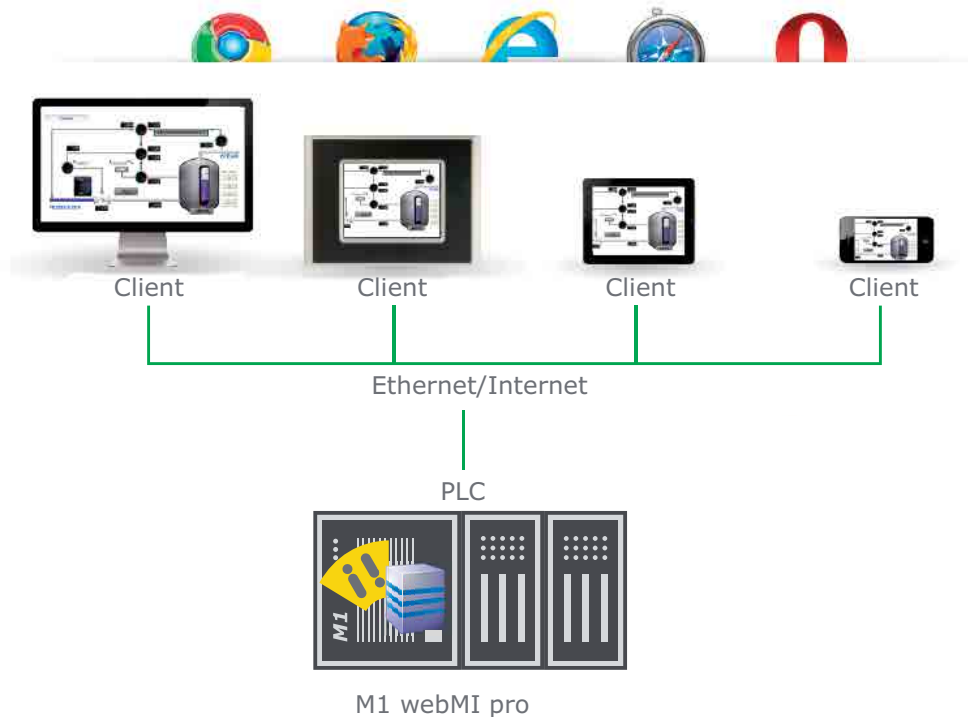


### All major HMI functions on board

Thanks to fully-graphic planning incl. dynamization of the objects depicted, the creation of visualizations is easy and possible without programming knowledge. Here all functions of a modern HMI solution such as alarming, journaling, trending, user administration, and multilinguality are supported. Special requirements of the HMI can be implemented via client-side Java scripts, there are practically no limits to the possibilities.

- Directly integrated in the controller
- Client-server architecture (multi-client)
- User interface in pure Web technology
- Device and operating system-independent (HTML5, SVG) PC/Mac/Unix, tablet, smartphone, iPad, ...\*
- Alarming and journaling of variables
- Graphic trend display
- Online language/font switchover
- User administration & access security
- Client-side Java Script

\* Current browser compatibility list can be called up at [www.atvise.com](http://www.atvise.com).





| M1 webMI pro                   |                                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Server                         |                                                                                                                                                                      |
| Installation                   | Web server as a software module directly on the M1 controller via SolutionCenter                                                                                     |
| Parallel Operation             | yes, multiple visualizations can be run on several TCP interfaces                                                                                                    |
| Sampling interval              | Server monitors the process variables in a cycle of 50 to 5000 ms                                                                                                    |
| Access security/Security       | yes (AccessControl of the M1, HTTPS with SSL encryption)                                                                                                             |
| Server time stamp              | yes                                                                                                                                                                  |
| Alarm system                   | Alarms on variables incl. persistence of the alarm status                                                                                                            |
| Archiving                      | Archiving of the process values on the controller, configuration of the sample intervals via archive groups, up to 100.000 data points can be stored in the database |
| User Administration            | yes (rights, groups, users)                                                                                                                                          |
| Functional expansions          | yes, M1 applications can provide data for processing in the HMI                                                                                                      |
| Client                         |                                                                                                                                                                      |
| Installation                   | No installation necessary                                                                                                                                            |
| Technology process images      | HTML, SVG, Java Script                                                                                                                                               |
| Number of clients              | Up to 16 clients at the same time                                                                                                                                    |
| Zooming                        | yes, continuously without quality loss                                                                                                                               |
| Scaling                        | yes (automatic adaptation of the resolution on the target device) without additional engineering effort                                                              |
| Vector graphics                | yes (all components of the HMI are SVGs)                                                                                                                             |
| Trend                          | yes (live trending and historical data views are possible)                                                                                                           |
| Operation                      | Mouse or other pointing device<br>Keyboard (hotkeys can be configured)<br>Touchscreen, Multitouch**                                                                  |
| Multilingual                   | yes (online)                                                                                                                                                         |
| Font switching                 | yes (online)                                                                                                                                                         |
| Fonts                          | any (including Asian-language characters, Cyrillic, etc.)                                                                                                            |
| Embedding of external contents | yes (everything that runs in the Web browser: HTML, video, audio, VRML/3D chat, etc.)*                                                                               |
| Functional expansions          | Total flexibility through Java Script (client-side)                                                                                                                  |

\* Current browser compatibility list can be called up at [www.atvise.com](http://www.atvise.com).

\*\* Multi-touch dependent on device functionality, operating system and browser version

# M1 webMI pro

| M1 webMI pro                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration/Engineering          |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Variable integration               | Variables can be read in directly from the M1 controller                                                                                                                                                                                                                                                                                                                                                                            |
| Fully-graphic process image editor | yes (integrated into atvise builder)                                                                                                                                                                                                                                                                                                                                                                                                |
| Program editor                     | yes (integrated Java Script editor in atvise builder)                                                                                                                                                                                                                                                                                                                                                                               |
| Page editor                        | yes (integrated HTML source editor in atvise builder)                                                                                                                                                                                                                                                                                                                                                                               |
| Graphic objects                    | Primitive: line, polygon, shape (any), rectangle, ellipse, bezier curve, etc.<br>Widgets: label, text field, table, trend, etc.                                                                                                                                                                                                                                                                                                     |
| Object library                     | yes, extensive catalog of pre-configured standard objects in pure vector graphic (adaptable, expandable) contains among other things bar graphs, tachograph, tanks, engines and much more                                                                                                                                                                                                                                           |
| Graphic incorporation              | SVG (and all other according to W3C) as well as pixel graphics (PNG, JPG, etc.)                                                                                                                                                                                                                                                                                                                                                     |
| Animation types                    | Text, value, frame color, background color, text color, visibility, operability, size x/y, position x/y, rotation, blinking, distortion, ...                                                                                                                                                                                                                                                                                        |
| Graphic options                    | Any shapes & sectors, roundings, simple and complex color processes, transparency, semi-transparency (alpha blending), rotation, shading, transformation/change of existing SVG graphics                                                                                                                                                                                                                                            |
| Interface to the server            | HTTP(S), FTP(S)                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Import/Export                      | XML (customer-specific expansions feasible)                                                                                                                                                                                                                                                                                                                                                                                         |
| System prerequisites               |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Clients                            | commercially available browser only*                                                                                                                                                                                                                                                                                                                                                                                                |
| Server                             | All M1 CPUs except ME203 (MH2xx, MC2xx, MPC2xx, MX2xx) with at least M-Base 3.85                                                                                                                                                                                                                                                                                                                                                    |
| Ausführungen                       |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| M1 webMI pro RT                    | Licenses to operate the M1 webMI pro on one controller CPU. Deployment of dynamized web pages (HTML, SVG) via the integrated web server to display on modern browser-enabled devices. Data coupling to SVI and IO channels locally, simple alarm handling and archiving value directly to the controller system. Engineering with atvise Builder and SolutionCenter.                                                                |
| M1 webMI pro AMT                   | Product support and updates delivery of webMI pro for one year.                                                                                                                                                                                                                                                                                                                                                                     |
| M1 webMI pro Starter               | Combination package of 10 Runtime Licenses M1 webMI pro, basic training M1 webMI pro for up to 8 people, advanced training M1 webMI pro for up to 4 people. One Year of product support and updates delivery are included in this package (Annual Maintenance). (Can only be ordered once per company, only one date per training, prices for training location Feldkirch/A or Bochum/D otherwise extra travel expenses are added). |
| M1 webMI pro DVD                   | Installation media for webMI (DVD). Graphical development tool atvise Builder and runtime component M1 webMI pro. Without valid Runtime License only limited operation possible. Requires M-Base SC.                                                                                                                                                                                                                                |

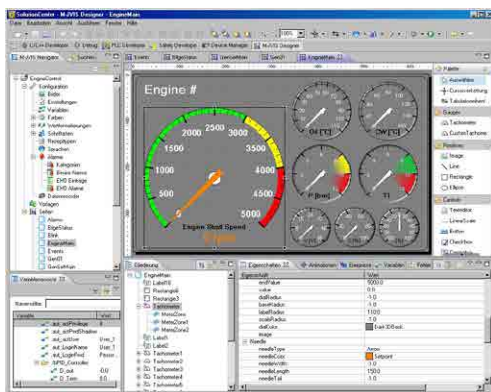
\* Current browser compatibility list can be called up at [www.atvise.com](http://www.atvise.com).



## Vis Designer

The Bachmann Vis Designer visualization package is a comprehensive software solution for all the requirements of fully-graphic machine and plant visualization.

- Full-graphic visualization software for HMI applications (operating / monitoring)
- Complete configuration tool with graphic user interface (Eclipse)
- Platform-neutral thanks to Java technology
- Online language switchover
- Recipes / dataset management



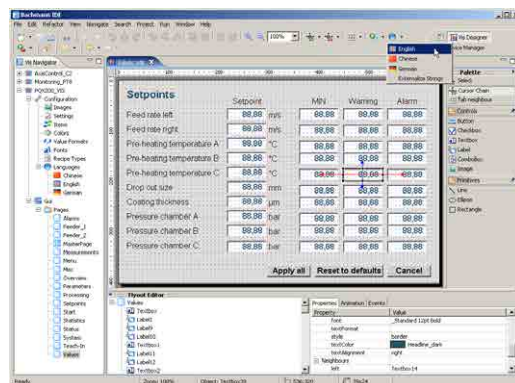
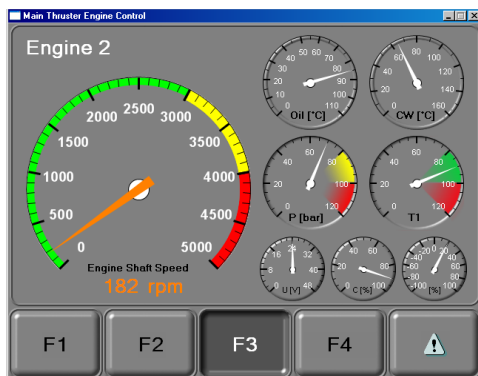
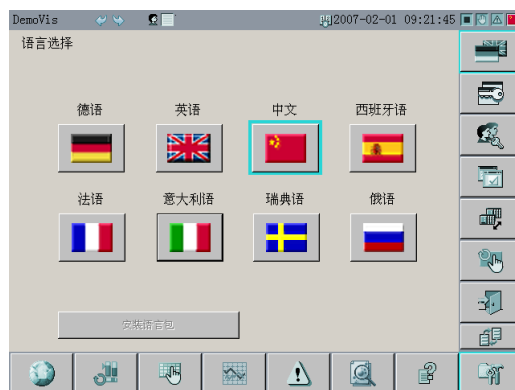
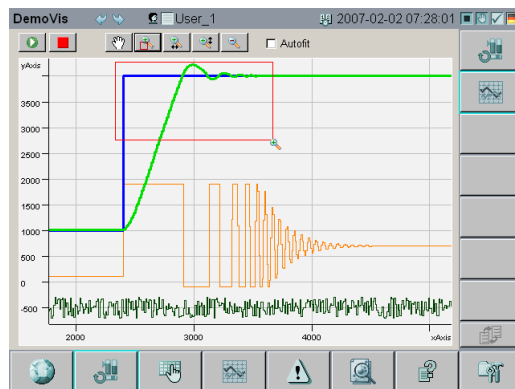
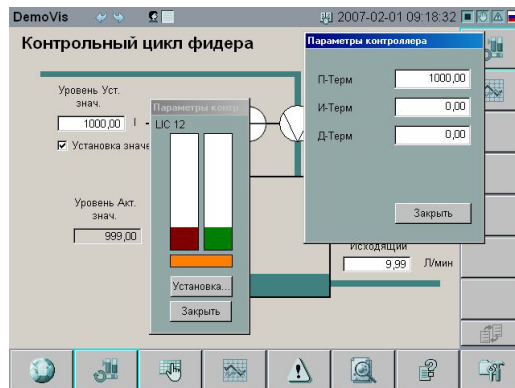
## Vis Designer

Based on the latest Java technology the Vis Designer enables creation and operation of graphic user interfaces, both in the form of conventional applications, as well as for web access (applets). Vis Designer is available as an intuitively operated, graphic editor for generation process images. From the supplied basic elements, such as buttons, input fields, or selection lists, the pages are built up and linked with process variables. Your own graphics and icons can be easily imported. Convenient dialogs guide the user through all important work steps so that no programming skills whatsoever are required for a simple visualization.

Finished created applications can be executed per mouse click, either as a complete application directly on the PC, or they can be installed as software modules on the visualization devices of the WT, CT, OT, or IPC series. Another possibility is that the application can also be stored as an applet on a web server (e.g. on an M1 controller). In this case the visualization application can be loaded and executed from any Java-capable visualization device (PC, IPC, OT, WT, CT). The running application is fully network capable and communicates autonomously with the SVI interfaces of all automation devices from Bachmann electronic.

- Full-graphic visualization software for HMI applications (operating/monitoring)
- Complete configuration tool with graphic user interface
- Platform-neutral thanks to Java technology
- Visualization can run on
  - PC/IPC
  - Operator terminals (OT, WT)
  - Control terminals
- Web-capable through applets and Java Webstart
- Extensive presentation possibilities
- Online language switchover
- Recipes/dataset management
- Alarm handling, message screen
- Trend presentation
- Mature window technology (frames, dialogs)
- Input aids: Cursor linking, tab order, soft keyboard, number pad
- Extensive cross-references/search function

The Vis Designer supports the most important control elements and image formats, it is fully-graphic and allows the use of different fonts. The user of the visualization application can switchover between any number of languages online. In addition, to numerous animation types, pre-finished and easy to configure commands can be stored for user inputs.



# Vis Designer

## Vis Designer

### Features – development environment

|                               |                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project management            | multiple projects / concurrently in access                                                                                                                                                                                                                                                                                                                                                                  |
| Project data storage          | configuration time: XML<br>runtime: compiled Java code                                                                                                                                                                                                                                                                                                                                                      |
| Image creation                | graphic editor and configurators: Vis Designer                                                                                                                                                                                                                                                                                                                                                              |
| Presentation                  | fully-graphic                                                                                                                                                                                                                                                                                                                                                                                               |
| Color depth designer          | trueColor                                                                                                                                                                                                                                                                                                                                                                                                   |
| Window technology             | yes (Eclipse dockable views and perspectives)                                                                                                                                                                                                                                                                                                                                                               |
| Page display                  | multi-document view (multiple pages open in parallel)                                                                                                                                                                                                                                                                                                                                                       |
| Navigation                    | project tree and tabs in the main view                                                                                                                                                                                                                                                                                                                                                                      |
| Zoom in the editor            | yes (infinite)                                                                                                                                                                                                                                                                                                                                                                                              |
| Project planning aids         | wizards, content assistance, problems view with quick-fix function, drag & drop                                                                                                                                                                                                                                                                                                                             |
| Undo/Redo                     | yes (user-defined depth)                                                                                                                                                                                                                                                                                                                                                                                    |
| Cross-reference function      | yes (with list output / search tree)                                                                                                                                                                                                                                                                                                                                                                        |
| Search function               | wild card search and filtering in tables                                                                                                                                                                                                                                                                                                                                                                    |
| Graphic objects               | line, circle/ellipse, rectangle, button, text (label), input field, text field, combo box, check box, radio box, image/icon, scale, pointer instrument, table, trend                                                                                                                                                                                                                                        |
| Animations                    | value presentation (formatted), number format, visibility, operability, presentation, image content, image sequence, color change, fill level, position, pointer position, transparency (operating-system dependent)                                                                                                                                                                                        |
| Reuse / object orientation    | templates (groups of animated graphic objects) with the possibility of reuse through referenced variables (placeholders). Changes to the template will be automatically effective in every instance.                                                                                                                                                                                                        |
| User interaction              | input, mouse click left (touch), mouse click right, selection, Hover, etc.                                                                                                                                                                                                                                                                                                                                  |
| Commands                      | <ul style="list-style-type: none"> <li>- Value: write constant / toggle value / copy from variable / increment (with step) / decrement (with step)</li> <li>- Recipe (dataset): load / save</li> <li>- Image change (with target area)</li> <li>- Language switchover</li> <li>- Data source: connect / disconnect / change (multiplex)</li> <li>- Start program, data operations, and much more</li> </ul> |
| Number formatting             | freely definable for variable configuration                                                                                                                                                                                                                                                                                                                                                                 |
| Value ranges                  | freely definable for variable configuration                                                                                                                                                                                                                                                                                                                                                                 |
| Variable definition           | manual in the table or import of online controllers                                                                                                                                                                                                                                                                                                                                                         |
| Local variables               | yes                                                                                                                                                                                                                                                                                                                                                                                                         |
| Colors visualization          | as many as desired (functional color names / referencing)                                                                                                                                                                                                                                                                                                                                                   |
| Fonts                         | TrueType fonts can be imported; functional font names with referencing                                                                                                                                                                                                                                                                                                                                      |
| Language switchover editor    | yes                                                                                                                                                                                                                                                                                                                                                                                                         |
| Number of languages / project | User defined (memory-dependent)                                                                                                                                                                                                                                                                                                                                                                             |

| Vis Designer                       |                                                                                                                                                                                                                                                                                                 |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Features – development environment |                                                                                                                                                                                                                                                                                                 |
| Transfer to target device          | Can run as: <ul style="list-style-type: none"> <li>• application on the PC/IPC (local or on the network)</li> <li>• application on Bachmann target device (OT, CT, WT)</li> <li>• Java applet on Bachmann M1 controller and execution in the browser</li> <li>• Webstart application</li> </ul> |
| Preview                            | yes <ul style="list-style-type: none"> <li>• Not dynamized in the editor or</li> <li>• local deployment dynamized (process data connection)</li> </ul>                                                                                                                                          |
| Recipe management                  | integrated (flat dataset handling)                                                                                                                                                                                                                                                              |
| Button navigation runtime          | cursor linking can be manually configured or generated automatically. Preview of the jump targets directly in the editor                                                                                                                                                                        |
| Tabulator navigation runtime       | tab order can be manually configured or generated automatically. Preview of the jump targets directly in the editor                                                                                                                                                                             |
| Features – runtime system          |                                                                                                                                                                                                                                                                                                 |
| Type                               | PC, IPC, WT or CT series                                                                                                                                                                                                                                                                        |
| Graphic                            | depending on the target device from QVGA (320x240) to XGA                                                                                                                                                                                                                                       |
| Presentation                       | fully-graphic                                                                                                                                                                                                                                                                                   |
| Colors                             | depends on the target device (to TrueColor)                                                                                                                                                                                                                                                     |
| Fonts                              | TrueType fonts can be used in the project planning (at runtime, then either converted embedded fonts, or use of the TrueType fonts installed on the target system)                                                                                                                              |
| Operation                          | 2-button mouse, keyboard, touch screen, or membrane keyboard                                                                                                                                                                                                                                    |
| Navigation in the image            | menus, cursor linking, (arrow keys), tab linking, mouse                                                                                                                                                                                                                                         |
| Menus                              | configurable                                                                                                                                                                                                                                                                                    |
| Number of process images (pages)   | user defined (memory-dependent)                                                                                                                                                                                                                                                                 |
| Number of objects / image          | user defined (performance-dependent)                                                                                                                                                                                                                                                            |
| Online language switchover         | yes, online                                                                                                                                                                                                                                                                                     |
| Language management/switchover     | yes, online (user-defined number of color schemes, e.g. for day/night or for error indication)                                                                                                                                                                                                  |
| Communication with the controller  | Bachmann M1 VHD / SVI with automatic communication groups                                                                                                                                                                                                                                       |
| Protocols                          | TCP / IP, UDP / IP, QSOAP                                                                                                                                                                                                                                                                       |
| Communication security             | SSL (Secure Socket Layer)                                                                                                                                                                                                                                                                       |
| Multiplexing of controllers        | yes (can be selected from the interface)                                                                                                                                                                                                                                                        |
| Number of data sources             | user-defined (data from multiple controllers can be presented in the same process image)                                                                                                                                                                                                        |

# Visualization

## Greater transparency and flexibility in process visualization.

The clear and understandable presentation of process and machine information, as well fully intuitive interaction are the center of the visualization software from Bachmann electronic.

In order to provide these characteristics, not only locally on the machine, but also in a distributed manner on the intranet/Internet, the latest generation

of the Bachmann software is based on Java and web technologies.

This offers independence from devices and operating systems and saves time, as well as maintenance costs. The provided »ready-to-use« functions, the available libraries and components, and the extraordinary suitability of Java for visualization tasks reduce engineering effort of the applications.



### M-JVIS, M-JSYS Tool library

| Features                                         |
|--------------------------------------------------|
| Tool library for Java visualizations             |
| Management of process variables and their values |
| Language management / switchover                 |
| Alarm handling                                   |
| Quality table                                    |
| Communication to the controller (RPC, FTP, Vis)  |
| Basis of M1 software modules                     |
| Monitoring the communication                     |





## M-JVIS, M-JSYS Tool library

M-JVIS and M-JSYS are libraries for creation of visualizations under Java that can be used platform-independently on Java-capable devices. The components are based on Java version 1.1.8. This version is supported by the VM (virtual machine) from Bachmann electronic.

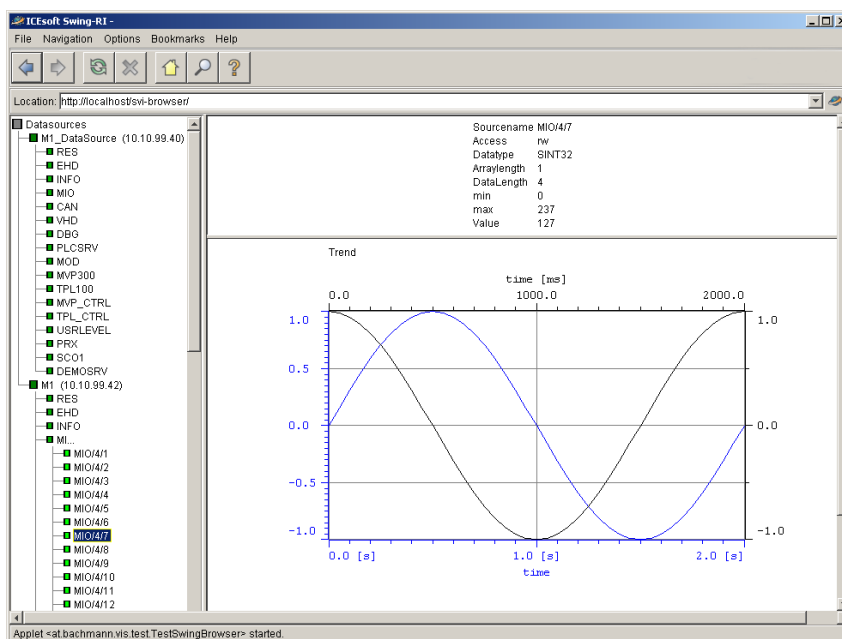
### M-JVIS consists of the following packages:

- M-JVIS / DACC
- M-JVIS / UTIL
- M-JVIS / GUI

### The packages are divided into two types of classes:

- Configuration classes that are implemented in the form of beans
- Runtime classes that allow a dynamic configuration and during runtime handle the management or presentation of the data

The configurations of all objects are stored in XML files.



# Visualization

## M-JVIS / DACC

The M-JVIS / DACC package manages process variables and their values (DACC = Data Access).

M-JVIS/DACC consists of the following components:

- Process variable management
- Recipe management
- Unit switchover
- Communication interface

## M-JVIS / UTIL

The M-JVIS / UTIL package consists of the following components:

- Language management / language switchover
- Protocols
- Alarm handling
- Quality table / statistical process control

## M-JVIS / GUI

The M-JVIS / GUI contains the graphic components  
The graphic components are based on AWT.

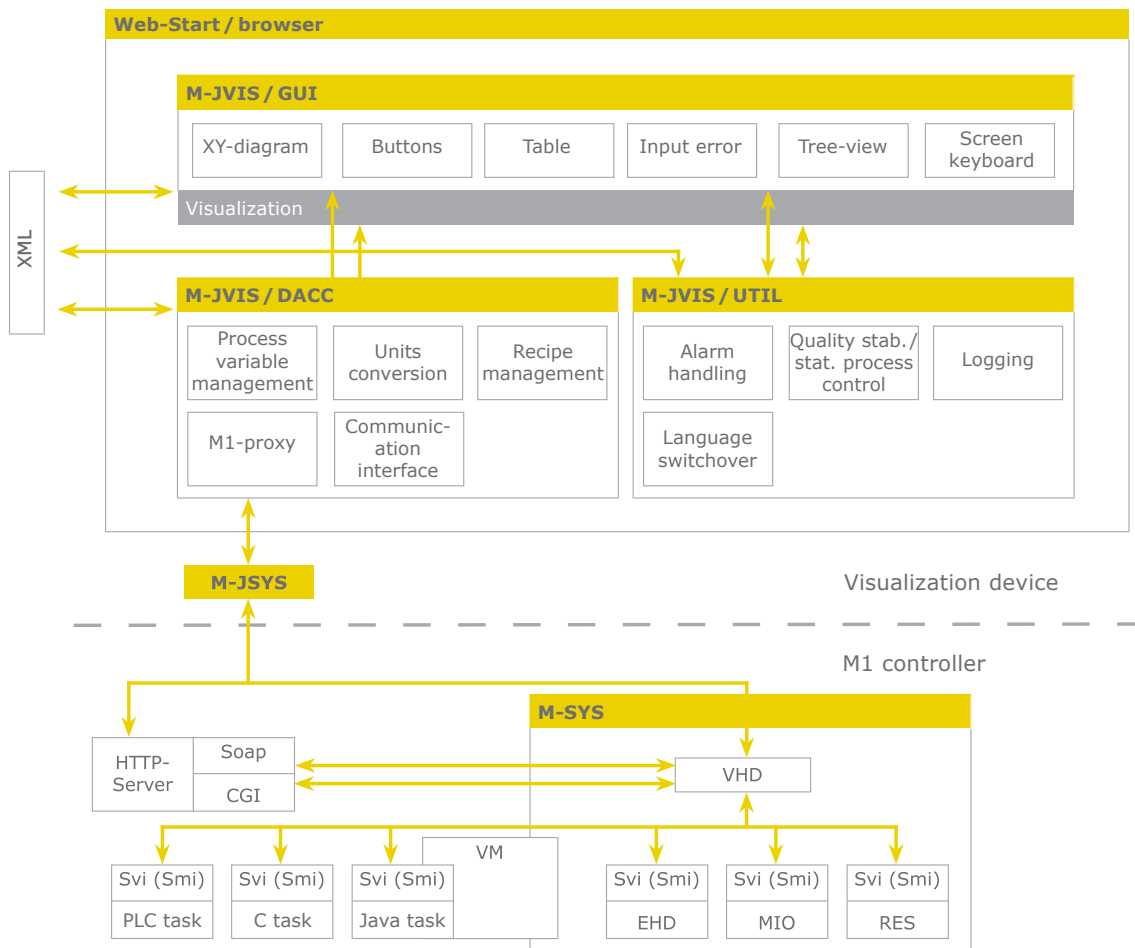
M-JVIS / GUI consists of the following components:

- XY diagram
- Table
- Tree view
- Screen keyboard
- Input fields
- Button

## M-JSYS

The M-JSYS package allows general access to the control system.

- Read-out and change of the controller configuration
- RPCs for control
- Access to system software modules









## **Motion Control – standardized drive control**

The requirements imposed on modern drive technology are becoming ever more specialized, and not rarely are mechanical engineers confronted with special requests or special regulations from the customer side. Even with the most modern machines, with the most innovative drives, individual drive solutions are still requested. No problem for Bachmann electronic: with the M1 automation system, drive controllers can be selected with complete independence from the drive type.

Building on the IEC 61800-7 standard, an open and universal interface to the drive technology is implemented in the M1 automation system, with the name »Drive Middleware«. Drive Middleware takes over the translation from the logical drive with a manufacturer-independent, standardized drive profile on the respective physical drive.

The Drive Middleware interface permits selection of a drive that is perfectly matched to the respective requirements. In this regard the fieldbus technology (CANopen, EtherCAT, SERCOS, PROFINET, etc.) or the product line of the drive manufacturer are irrelevant. Thanks to fieldbus-independence with concurrent standardization of the fieldbus profiles, the finished Motion Control applications can be implemented in the shortest time possible and the training/maintenance costs of the various drive worlds are significantly reduced. At Bachmann electronic, perfect solutions for every request are just part of the standard.

## Control

### Professional motion guidance for individual requirements.

With expert know-how gained through years of experience in the area of control and system technology, Bachmann electronic is indisputably one of the leading providers of special solutions in the industry. This knowledge and the associated technology does not necessarily have to be worked out by each company itself. Customers and partners of Bachmann electronic can rely on proven and highly-optimized software controllers for a wide variety of applications. Thus years of development work can be embedded as a finished, configurable module in your own application.

palette of freely usable components extends from simple motion control of multiple axes, to CNC and shaft controllers, to special modules for demanding temperature applications.

Extensive libraries for C or IEC61131-3 encapsulate the functionality and guarantee standardized access from the application program. Naturally all controller modules from Bachmann electronic support SVI communication (Standard Variable Interface), as well as the synchronizing function »Sync« of the M1 system family. Commissioning and diagnostic tools with graphic interface designed by experienced users additionally facilitate use. The



### M-SMC Software Motion Control

#### Features

- Software module for regulating the speed and/or position of motion axes
- Combined actuator / controller operation
- Master / slave operation for parallel guided motions
- Convenient commissioning via monitor
- Library for IEC 61131-3 PLC programs



### M-CNC Three-dimensional motions

#### Features

- Path motion for Cartesian 3-axis system
- Profile specification in accordance with DIN 66025 (program structure of numerically-controlled axes)
- Interfaces (analog, incremental, fieldbus, etc.)
- Configuration and diagnostics via Device Manager
- Commissioning interface (CNC monitor)
- Library for IEC 61131-3 PLC programs



### **M-SHAFT** Shaft controller

#### Features

Software module that simulates a virtual shaft from 0° to 360°

Cyclic and synchronous regulation of 32-axes

Speed of the shaft can be changed in running operation

Independent master operation or can be synchronized as slave

Convenient axis commissioning via monitor



### **Drive Middleware**

#### Features

Uniform, fieldbus-independent programming of motion applications in accordance with IEC 61800-7

Full integration in the Bachmann SolutionCenter

Easy addition of new, supplemental drives

Position control, speed control, and torque control are integrated

Easy management of the drive parameters



### **M-TEMP** Temperature controller

#### Features

Temperature control software for universal implementation

Modes: Actuator or controller (2-3 point)

Automatic parameter assignment (learn function)

Heating power monitoring

Sensor failure detection

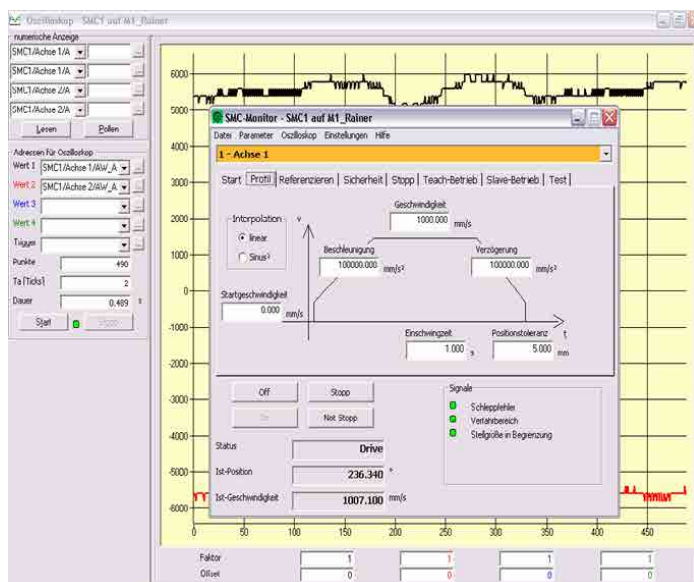
For heating sections, cooling sections, and combined sections



## M-SMC Software Motion Control

Software module for regulating the speed and / or position of motion axes Based on a simple configuration a wide variety of options or modes of regulation can be selected.

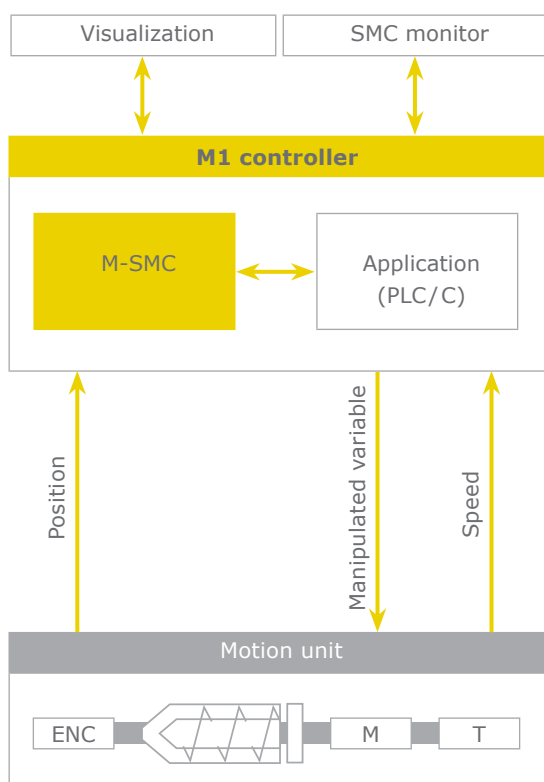
- Configuration as speed controller, position controller, or underlying speed controller (cascade control)
- Combined actuator / controller operation
- Master / slave operation for parallel guided motions
- Specification of speed, accelerations, delays and the target position to be approached
- Specification of position tolerance window and tolerance monitoring time (settling time)
- Sampling times: min. 200  $\mu$ s, in 100  $\mu$ s increments
- Easy application through FUB interface for PLC programs
- Commissioning interface





## Features

- Up to 16 freely configurable axes per SMC module can be defined
- Software module can be loaded multiple times
- Free configuration of the hardware input and output signals via Device Manager
- »Controller enable« signal (output), »controller ready« signal (input)
- Master slave relationship between axes
- Flying saw
- Online switchover from speed to position specification
- Online change of the controller parameters
- Change of target position or speed during travel
- Selection of different pre-defined referencing methods is possible
- Reversing operation with teach function for controller adjustment
- Integrated drag error monitor with various response methods and status output
- Monitoring of software limit switches
- Monitoring of hardware limit switches
- PLC function library
- Software module available for all M1 processor modules
- Easy integration of visualization systems through disclosure of the parameter interfaces and addressing via symbolic variables
- Different methods of interpolation for position, speed and acceleration
- Configurable PID controller structure with FeedForward
- Different methods for implementing master/slave applications
- Support of fieldbus systems (CAN, SERCOS, EtherCAT)
- Easy commissioning through the Windows interface SMC monitor
- Test function for determination of the section parameters



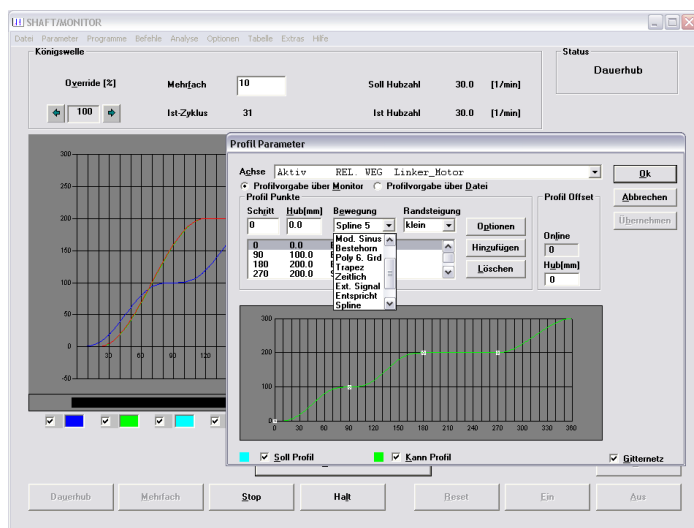
# Control



## M-SHAFT Shaft controller

M-SHAFT is a software module that simulates a virtual shaft that turns from 0° to 360°. Different axis types can be synchronized on this shaft. M-SHAFT is ideally suited for machines with a cyclically recurring sequence, such as packaging machines, processing machines, etc.

- Speed (rpm) of the shaft can be changed in running operation
- Independent master operation or can be synchronized as slave
- Up to 32 axes per software module can be synchronized to the shaft
- Step up / step down ratio for each axis can be freely selected
- Axes can be switched on and off in running operation
- End position monitor and dead time compensation for digital axes
- Offline collision monitoring of the axes
- Convenient commissioning tool M-SHAFT monitor



## Profile specification

- Offline or online profile specification for each axis is possible
- Profile specification via an external file is possible (up to 360 interpolation points)
- Profile calculation online in the production cycle without stop (online interpolation)
- Free selection of the type of interpolation between the interpolation points
- Interpolation types: Linear, sinoid,  $\sin^2$ , modified sinus, spline, trapeze, Bestehorn, polygon 6th degree, temporal, ext. signal

## Table interpreter

- Profile calculation for minimal cycle times via table interpreter
- Record by record position-oriented consideration of profiles (similar to CNC)
- CNC commands (F, W, X, E, T)
- Loop command for automatic repetitions of specific table columns
- Input of tables via M-SHAFT monitor

## Axis types

- Regulated, absolute  
(absolute coordinates, e. g. lift cylinder)
- Regulated, relative  
(relative coordinates, e.g. feed)
- Analog  
(analog manipulated variable, e.g. -10 .. +10 V)
- Digital (e.g. pneumatic ejector, press)
- Multi-cam (16 digital cams per axis)

## Summary – features

- Configurable and parameter-assignable software module
- All options can be configured via software (number of axes, axis type, I / Os, etc.)
- Fast commissioning via graphic presentation of all datasets
- High product quality through high repeatability
- Short set-up times through omission of mechanical switch cams
- Simplified mechanics through independent drives
- Software module can be instanced

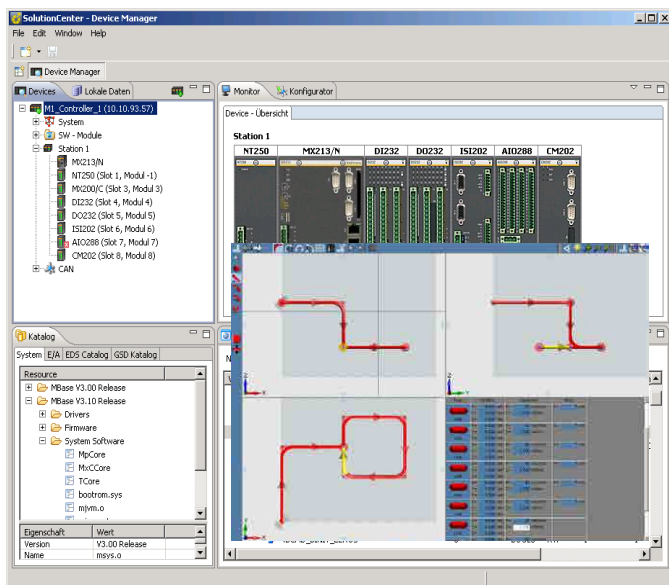
# Control



## M-CNC Three-dimensional motions

M-CNC is a software module for path control of three-dimensional motions with three axes in Cartesian arrangement. Motions are specified in accordance with DIN 66025.

- Path motion for Cartesian 3-axis system
- Profile specification in accordance with DIN 66025 (program structure of numerically-controlled axes)
- Configuration and diagnostics via Device Manager
- Commissioning interface (CNC monitor)
- Library for IEC 61131-3 PLC programs

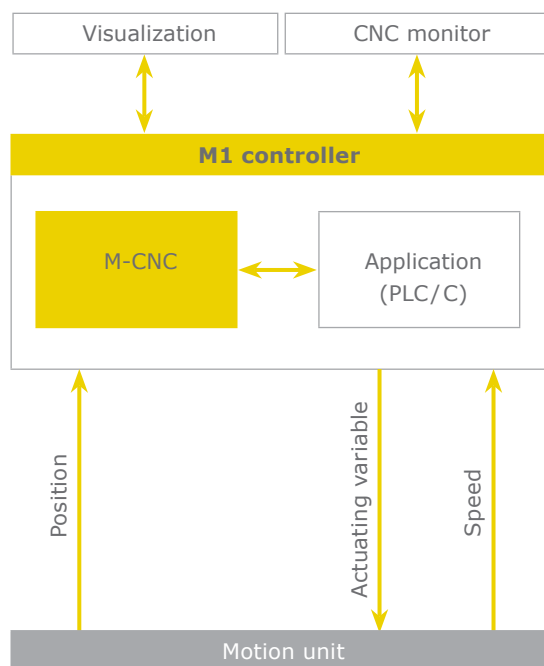


## Functions

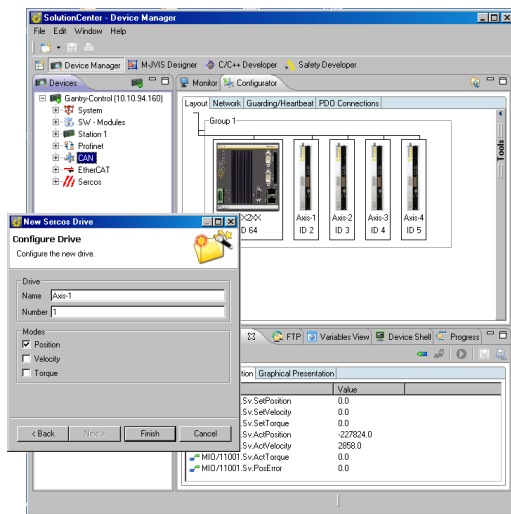
- Genuine 3-axis CNC controller
- Circle segments and straight lines user-defined in space
- Point control behavior (PTP travel)
- Straight line interpolation (path)
- Circle interpolation (clockwise/counterclockwise)
- Predefined dwell time
- Tool path corrections:
- Tool corrections:
- Reference point travel
- Referencing (various methods)
- Multiple instances of the module are possible
- Different methods for area monitoring at calculation and execution
- Several methods of interpolation for position, speed, acceleration of single axis

## Special functions

- Fast and direct setting of outputs from M-CNC
- Single-axle travel
- Teaching of axes / positions
- Cascading with speed controller (M-SMC)
- ActiveX element for Visual Basic, Visual C and Delphi
- Commissioning monitor for efficient graphic user guidance



# Control



## Drive Middleware

### Investment security

The investment in a motion application is not lost if there is a change in the drive supplier.

### Learning effort is reduced

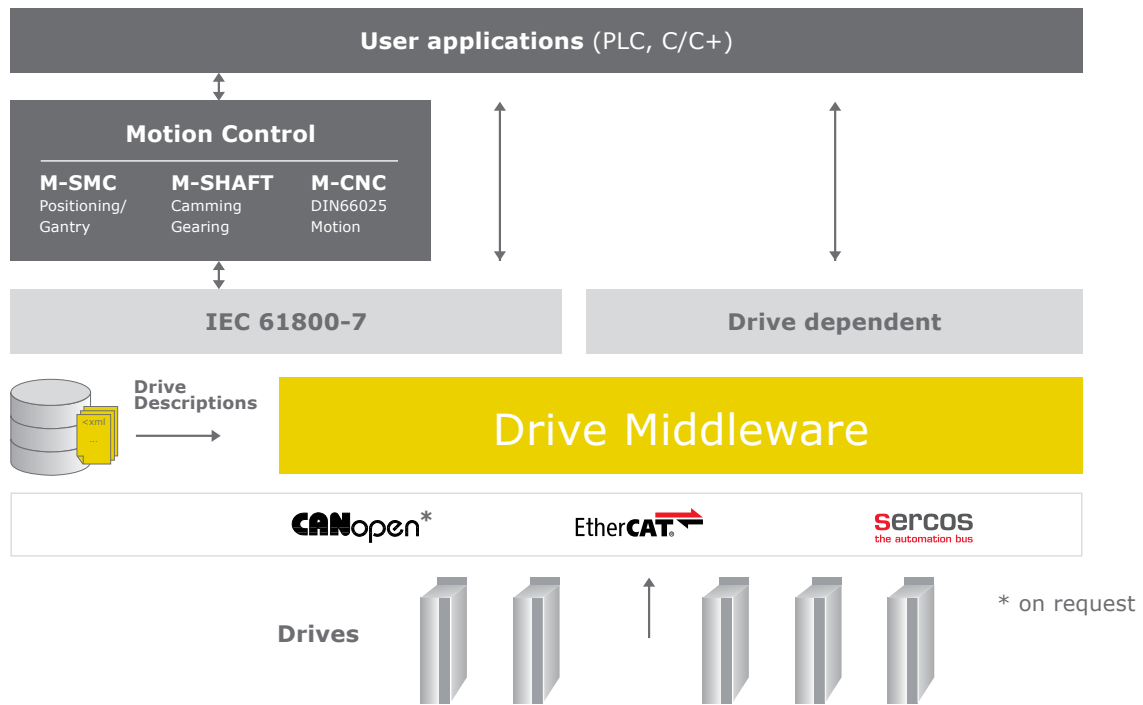
The different drive profiles, such as SERCOS, ProfiDRIVE, and DS402 have their own state machines, error routines, and parameter designations. Through standardization in accordance, the training effort and the complexity of drive solutions is reduced.

### Drive-independence for coordinated axis motions

Multi-axis applications, as they are realized with M-SMC, M-SHAFT, etc. can be implemented independently of the fieldbus profiles of the individual drives.

### Features

- Uniform, fieldbus-independent programming of motion applications in accordance
- Full integration in the Bachmann SolutionCenter
- Connection to motion applications for multi-axis applications is already integrated
- Easy addition of new, supplemental drives
- Cyclical and non-cyclical communication is possible
- Referencing methods in accordance with DS402 are integrated

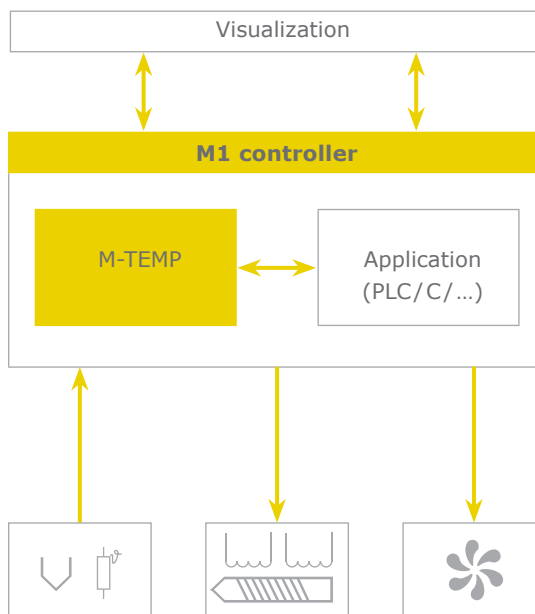




### M-TEMP Temperature controller

M-TEMP is a software module of the M1 controller for monitoring and regulating temperature-dependent processes. To achieve an optimal adaptation to the controlled system, all control parameters can also be changed during operation.

- Temperature control software for universal implementation
- Modes: Actuator or controller
- Automatic parameter assignment (learn function)
- Integrated adaptive setpoint filtering
- Temperature range  $-200^{\circ}\text{C}$  to  $+1400^{\circ}\text{C}$





## Features

- Fast commissioning via graphic user interface
- User-defined changing between actuator and controller operation
- Heating and cooling path control with one controller is possible
- Setpoint change during operation is possible (setpoint function)
- Suppression of vibrations in the event of major setpoint changes, through adaptive setpoint filtering
- Change of all control parameters is possible during operation
- Possibility of autonomous determination of the control parameters
- Precise determination of the target temperature and process monitoring functions
- Versatile possibilities for data input and output
- Automatic generation of a cleaning pulse for analog cooling controllers
- Conventional and user-defined temperature units are possible
- Detection of sensor break
- Detection of defective power switches
- Current measurement function
- PLC function library
- Maximum of 9 controller systems, each with up to 127 controllers
- Controller sample time 20 ms to 30 min
- Pulse width modulation periods from 20 ms to 30 min
- Temperature resolution 1/100 °C

## Possible functions

- Heating controller
- Cooling controller
- Three-state controllers (combined heating and cooling section)

## Process monitoring functions

- Tolerance band monitoring
- Increase monitoring
- Heating power monitoring
- Heating current monitoring

## Actual value acquisition via

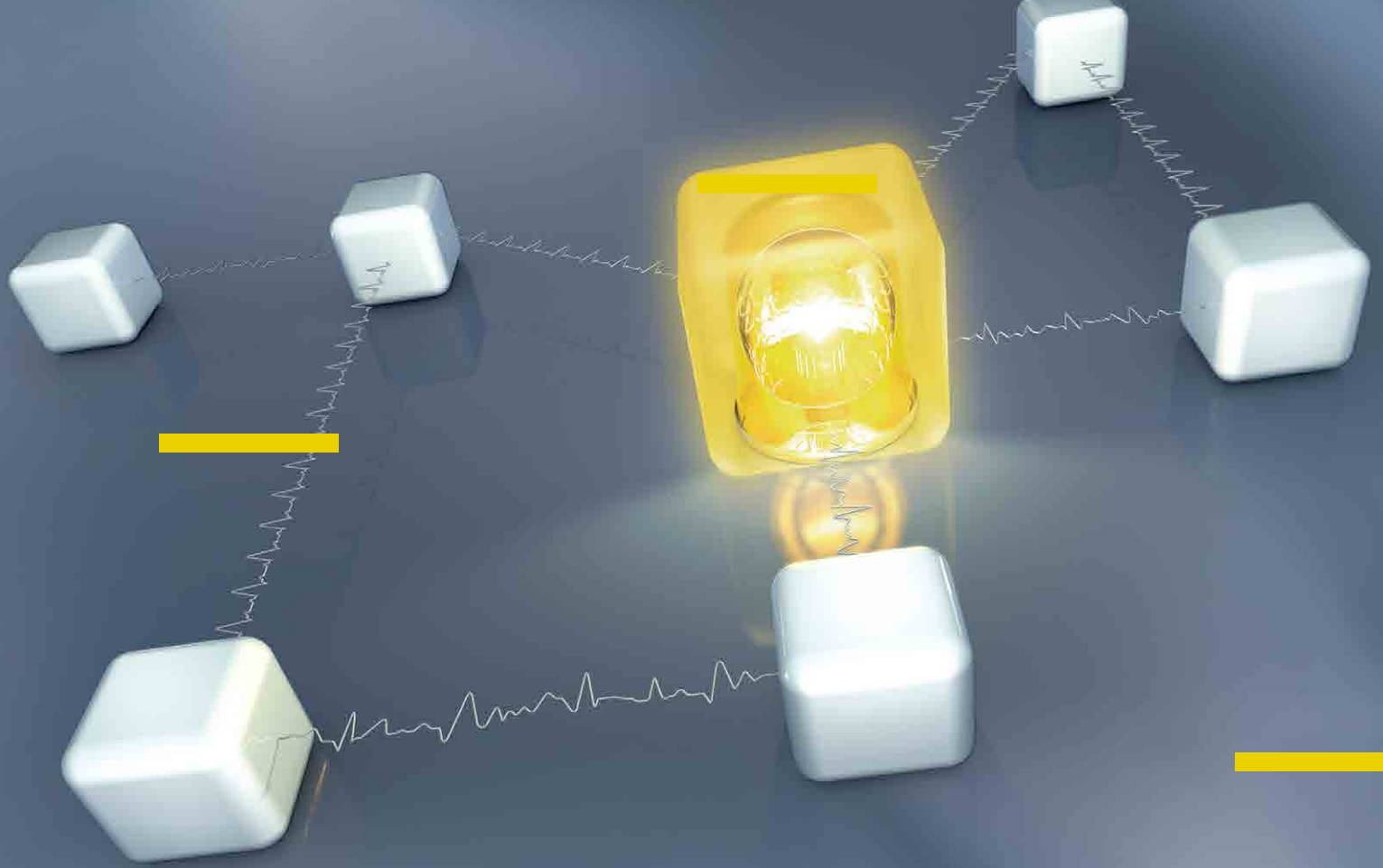
- AIO288 (Pt100 sensor)
- TCO2xx-C (thermal element)
- DA3284-C (Pt100, Pt1000)
- PTAI216 (Pt100 sensor)
- SVI interface (external)

## Manipulated variable to

- AIO288, AO204 (analog value 0 .. 10 V)
- TCO2xx-C, DO2xx, DIO2xx, DIO2xx-C, DA3284-C (digital output with pulse width modulation)

## SVI interface

- External, e. g. for a different task



**CMS**  
Condition  
Monitoring  
System



## Condition Monitoring

The annual revenue of a production plant is significantly determined by its reliability. Particularly for difficult to reach plants and plants that can only be reached under specific conditions, such as offshore wind power plants, focused planning of maintenance is necessary. A Condition Monitoring System (CMS) integrated in the automation system can provide all information, in order to detect failure hazards early on and plan maintenance tasks in good time. Thus the costs for spare parts and maintenance can be minimized and downtimes can be significantly reduced.

Condition Monitoring is based on the continuous or regular acquisition of the machine condition by measuring and analyzing meaningful physical variables (e.g. vibration, temperature, condition of lubricant, etc.).

A CMS that is built with the Bachmann M1 system benefits from its versatile communication and service interfaces and also reduces the training period of the operating and maintenance personnel. Secure web technologies also enable defined access to the full system or to individual parts of the plant from the outside. Thus data is accessible at all times for operators and maintenance personnel, so that optimal process control and power generation are ensured.

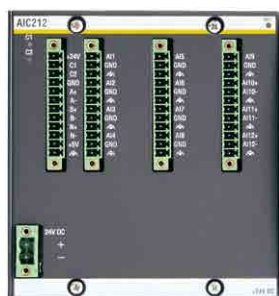


## Condition Monitoring

### More control, fewer outages.

The operational availability of modern machines and plants requires a comprehensive maintenance and service concept as well as a consistent design. Due to the high costs of failure, heavy mechanical elements for power transmission (power trains, gears, prime movers) and bearings in particular place considerable pressures on manufacturers and operators. A continuous and if possible automatic monitoring of the mechanical systems is the ideal solution.

The condition of the equipment (wear and damage) can be monitored and maintenance and service can be timely scheduled to ensure maximum operability. Within the framework of Condition Monitoring, in addition to numerous well-known indicators, such as temperature, current consumption or load selective operating hour acquisition, vibration analyses in the frequency range, in particular, has proven to be an effective output variable.



### Vibration sensor input module AIC212

#### Features

Number of inputs: 12 analog inputs  
(9 inputs with IEPE interface for Piezo vibration sensors and 3 inputs with  $\pm 10$  V)

Resolution:  $> 17$  bit

Dynamics:  $> 95$  dB

Sampling rate up to 50 kHz, adjustable

Galvanic isolation from system 500 V



### Omega-Guard® Stand-alone solution

#### Features

12 analog inputs

PLC-independent CMS

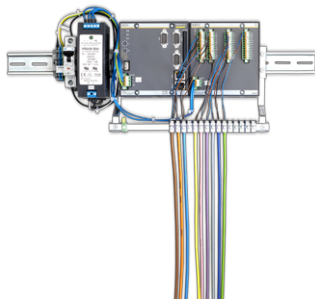
Fixing with mounting feet,  
direct mounting or magnets



### Remote service via WebLog Expert

#### Features

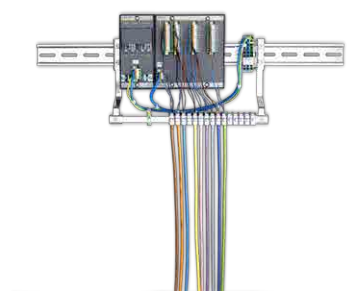
Client-based »WebLog  
Expert« software for  
remote diagnostics



### Ω-Guard® TopBox-integrated solution

#### Features

- 12 analog inputs
- PLC-independent CMS
- Installation in existing control cabinet



### Ω-Guard® Fully integrated solution

#### Features

- 12 analog inputs
- PLC-independent CMS
- Installation in existing control cabinet



### Acceleration sensors BAM100 / BAM500

#### Features

- Robust design
- Connection via ICP inputs of the AIC212
- Hermetically sealed
- Corrosion resistant
- Insulated housing



### μ-bridge Sensor

#### Features

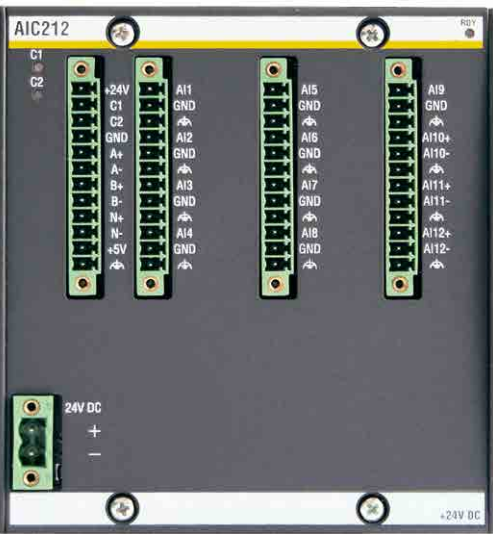
- IEPE standard
- Operating current: 4 .. 10 mA
- Surge protection:  $I_{max} = 16 \text{ mA}$
- Output voltage (offset)  
 $11 \pm 0.5 \text{ V}$
- Max. saturation degree 8V



### SVM300 series Structural Vibration Monitor

#### Features

- Measurement in 2 axes
- Measurement range  $\pm 2 \text{ g}$
- Resolution:  $\geq 0.305 \text{ mg}$
- Internal memory ( $\leq 150 \text{ days}$ )
- Protection class IP67

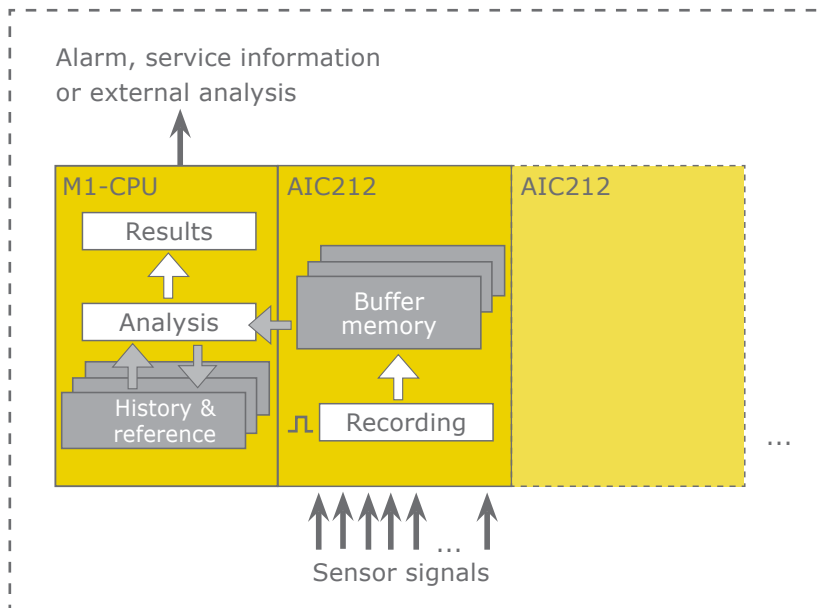


Vibration sensor input module AIC212

The M1 automation system's AIC212 module offers up to nine vibration measuring inputs for high resolution, signal correlated monitoring of different measuring points. Three signal inputs with a standard signal level of  $\pm 10\text{ V}$  and a position transducer input provide consistent acquisition of other relevant variables and the angle or position relation of the mechanics. Thanks to the embedding in the M1 system analyses can also directly consider any other signals or variables of the entire controller composite (e.g. current performance, operating condition), doubling the sensor system.

The AIC212 module has its own integrated working memory to record time series of signal profiles for up to 50 kilo samples/second – which is far below the controller cycle time. The evaluation is carried out in the well established M1 CPU modules in the form of CMS application programs that can operate as required with static processes, frequency or location analyses. The measuring data is also provided as channel values in the cycle of controller programs as directly recorded online variables.

| Item    | Item no.    |
|---------|-------------|
| AIC212  | 00014151-00 |
| AIC212* | 00017444-00 |



As an M1 standard module, the AIC212 allows implementation of »stand-alone« condition monitoring as well as use in the various remote or distributed configurations of the Bachmann automation system. The use of M1 CPUs for evaluation, logging and alarming allows such a CMS to benefit from the wide range of communication and service interfaces and also reduces the training requirements for start-up and maintenance personnel.

Instead restricting evaluations through a strictly prescribed frame, the AIC212 system concept allows a free design of the Condition Monitoring software for the particular requirements of the respective application. Regardless of the implementation (C/C++, IEC 61131 or MATLAB®/Simulink®) the recording time sequences of the CPU are available in memory and enable consistent access via the location and time specific software. (change to ... consistent location-specific and time-specific access through the software. Existing evaluation packages can be ported to the M1 CPU system (VxWorks®/Intel x86 compatible processor) since no special solutions (DSPs, special operating systems) are required.

- 12 analog inputs (9 inputs with ICP® interface for Piezo vibration sensors and 3 inputs with  $\pm 10$  V)
- Position detection (incremental encoder input 24 V and A/B/N track or 2 counter inputs with 24 V for initiators)

- All channels, including position measurement (Rotary encoder signal) sampled synchronously
- Analog filter and digital filtering with adjustable cut-off frequency
- Resolution > 17 bits
- Dynamics > 95 dB
- Sampling rate 50 kHz, adjustable
- Different trigger modes for the recording start (position/location, IO bus sync, etc.)
- High-speed buffer memory directly on the module
- Access to channel values also synchronous with application (direct access and process image for PLC programs)
- Embedding in M1 plant management system or as autonomous CMS
- Use of any signals of other modules or calculated variables for evaluation
- Signal base suitable for frequency analysis with/ without location reference
- Several AIC212 modules in one system simultaneously
- Evaluations can be designed to individual requirements
- Broad spectrum of usable implementation technologies (C, C++, MATLAB®/Simulink®) on the real-time operating system VxWorks®
- Synergy by using fieldbus and service communication
- Local memory in evaluation CPU: CF card, PC card

## Condition Monitoring

### AIC212

| Analog inputs                              |                                                                                                                                                                                                                       |                                             |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Quantity                                   | 9                                                                                                                                                                                                                     | 3                                           |
| Measuring range                            | AC-coupled ±6 V, ICP® interface                                                                                                                                                                                       | ±10 V                                       |
| Resolution                                 | > 17 bits                                                                                                                                                                                                             |                                             |
| Dynamic                                    | > 95 dB                                                                                                                                                                                                               |                                             |
| Scan rate*                                 | up to 50 kHz per channel adjustable                                                                                                                                                                                   |                                             |
| Frequency range general                    | 0.1 Hz .. 20 kHz                                                                                                                                                                                                      |                                             |
| Error (full scale) at +25 °C               | ±0.1 %                                                                                                                                                                                                                |                                             |
| Digital filter                             | adjustable depending on sampling frequency                                                                                                                                                                            |                                             |
| Distortion attenuation / distortion factor | THD+N (f <sub>SIN_in</sub> =1kHz, fSample=50kHz)<br>Level <sub>IN_from_FullScale</sub> = 0dB < -78 dB<br>Level <sub>IN_from_FullScale</sub> = -20 dB < -68 dB<br>Level <sub>IN_from_FullScale</sub> = -40 dB < -48 dB |                                             |
|                                            |                                                                                                                                                                                                                       |                                             |
|                                            |                                                                                                                                                                                                                       |                                             |
|                                            |                                                                                                                                                                                                                       |                                             |
| Input impedance                            | 200 kOhm                                                                                                                                                                                                              | >1 MOhm                                     |
| Current source for ICP interface           | 5 mA/channel                                                                                                                                                                                                          |                                             |
| Cross-talk control range                   | +8 .. +12 V                                                                                                                                                                                                           | ±2 V                                        |
| Error detection                            | wire break                                                                                                                                                                                                            |                                             |
| Interference voltage strength              | -15 .. +36 V                                                                                                                                                                                                          |                                             |
| Incremental and counter inputs             |                                                                                                                                                                                                                       |                                             |
| Interface                                  | 24 V initiators/proximity switch with 10mA sink                                                                                                                                                                       | incremental                                 |
|                                            | either one incremental interface or two counter inputs can be used for proximity switches                                                                                                                             |                                             |
| Number of channels                         | 2                                                                                                                                                                                                                     | 1                                           |
| Display                                    | yes, via green LED                                                                                                                                                                                                    | no                                          |
| Counter frequency                          | 5 kHz                                                                                                                                                                                                                 | 36 kHz                                      |
| Measured value/resolution                  | 32 bit                                                                                                                                                                                                                | 32 bit                                      |
| Input signals                              | A                                                                                                                                                                                                                     | A-, A+ / B-, B+ / N-, N+                    |
| Filter frequency                           | programmable                                                                                                                                                                                                          | ---                                         |
| Error detection                            | error pulse                                                                                                                                                                                                           | phase error                                 |
| Evaluation                                 | -                                                                                                                                                                                                                     | 1, 2, 4 edge signals & pulse direction mode |
| Supply                                     | for external sensors: 24 V/5 V short circuit proof                                                                                                                                                                    |                                             |
| Galvanic isolation from system             | 500 V                                                                                                                                                                                                                 |                                             |

\* Frequency bands/ $f_{\text{sample}}$ : 20 kHz/48 kHz; 10 kHz/24 kHz; 5 kHz/12 kHz; 2.5 kHz/6 kHz



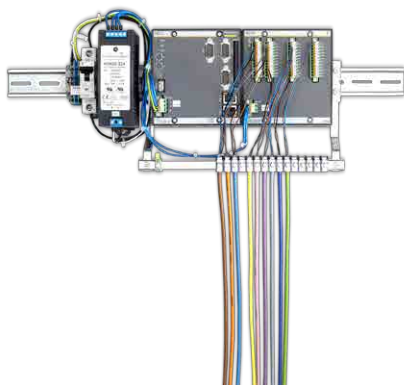
## Condition Monitoring

| AIC212                   |                                                                                                                                                                                             |                             |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Operating conditions     |                                                                                                                                                                                             |                             |
| Power supply             | 24 V (18 V .. 34 V) with reverse polarity protection                                                                                                                                        |                             |
| Power consumption module | approx. 9.5 W without encoder supply                                                                                                                                                        |                             |
| Ambient conditions       | Standard                                                                                                                                                                                    | ColdClimate (✱)             |
| Operating temperature    | -30 .. +60 °C                                                                                                                                                                               |                             |
| Rel. humidity operation  | 5 .. 95 % without condensation                                                                                                                                                              | 5 .. 95 % with condensation |
| Storage temperature      | -40 .. +85 °C                                                                                                                                                                               |                             |
| Rel. humidity storage    | 5 .. 95 % with condensation                                                                                                                                                                 | 5 .. 95 % with condensation |
| Model variants           |                                                                                                                                                                                             |                             |
| AIC212                   | Analog measuring module for Condition Monitoring; 9x Input ICP; 3x Input +-10V; 18bit; 0.1%; >95dB dynamic range; 20µs sample time; 1x INC HTL; 36kHz; A,A/B/N; 128MB measured data storage |                             |
| AIC212✱                  | like AIC212; ColdClimate (✱)                                                                                                                                                                |                             |

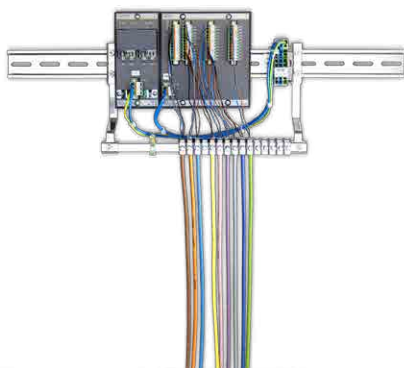
# Condition Monitoring



Stand-alone solution



TopBox-integrated solution



Fully integrated solution

## Ω-Guard® System variants

With the GL-tested and certified machine diagnostic system (Condition Monitoring System: CMS) Ω-Guard® an intelligent monitoring solution without mechanical moving components (hard disks, fans) is available for use under harsh ambient conditions.

The hardware and software architecture has been based on a modular concept. Thus analog and digital inputs and outputs can be flexibly configured. Ω-Guard® in particular has extensive self-test possibilities that enable a detailed function check of the CMS. Script-oriented software enables easy adaptation to different monitoring tasks with due consideration of the special requirements imposed on technical plant management.

The following characteristics of this CMS must be particularly highlighted:

- Modularity
- Future compatibility (inclusion many additional measured values is possible)
- Extensive temperature range
- Robust relative to environmental influences
- Watchdog monitoring
- Client-based »WebLog Expert« software for remote diagnostics

| Item                                   | Item no.    |
|----------------------------------------|-------------|
| Ω-Guard®<br>Stand-alone solution       | 00022367-00 |
| Ω-Guard®<br>TopBox-integrated solution | 00022370-00 |
| Ω-Guard®<br>Fully integrated solution  | 00022373-10 |

| <b>Ω-Guard®</b>                  |                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------|
| Analog measurement channels      |                                                                                                 |
| Number of channels               | 12 analog inputs (9 inputs with IEPE interface for piezo vibration sensors and 3x ±10 V inputs) |
| Sampling rate                    | up to 50 kHz, all channels including position detection (encoder signal) scanned synchronously  |
| Measuring range                  | IEPE standard, current (4-20mA), voltage (±10V)                                                 |
| Error detection                  | Cable break, interference pulse, phase error                                                    |
| Sensor supply                    |                                                                                                 |
| IEPE                             | 4 mA                                                                                            |
| External operating voltage       | For external sensors: 24 V / 5 V short-circuit-proof                                            |
| Power supply                     |                                                                                                 |
| Multi-voltage power supply       | 100 .. 240 V / 50 .. 60 Hz / 50 W                                                               |
| Interference immunity            |                                                                                                 |
| ESD                              | EN 61000-4-2                                                                                    |
| Electromagnetic field            | EN 61000-4-3                                                                                    |
| Burst                            | EN 61000-4-4                                                                                    |
| Surge                            | EN 61000-4-5                                                                                    |
| Conducted HF                     | EN 61000-4-6                                                                                    |
| DIPS (line voltage fluctuations) | EN 61000-4-11<br>Operation with multi-voltage power supply                                      |
| CPU unit                         |                                                                                                 |
| Interfaces                       | Ethernet, FASTBUS                                                                               |
| Communication                    | LAN, GRPS, Modem                                                                                |
| Housing / power supply           |                                                                                                 |
| Type                             | Wall mounting, fixing feet mounting, mounting with magnets                                      |
| Degree of protection             | IP65                                                                                            |
| Dimensions                       | 380 mm x 380 mm x 210 mm (Stand-alone solution)                                                 |
| Operating parameters             |                                                                                                 |
| Operating temperature            | -25 .. +60 °C                                                                                   |
| Storage temperature              | -40 .. +85 °C                                                                                   |

# Condition Monitoring

## Remote service via WebLog Expert

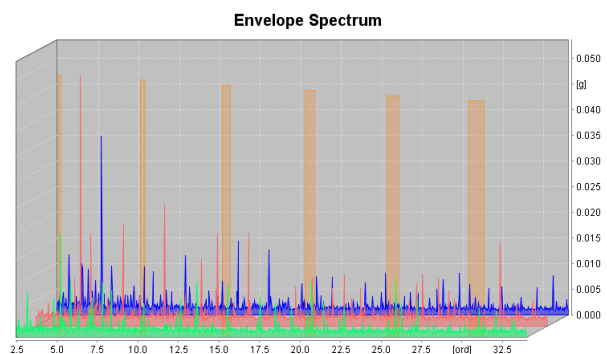
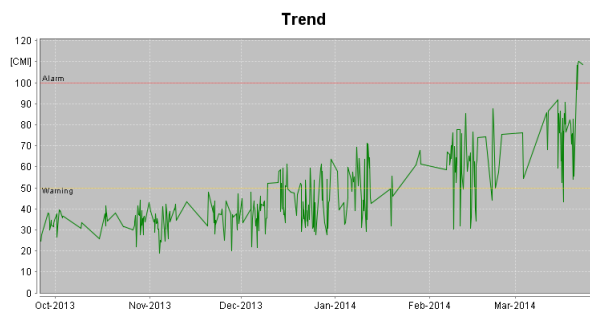
### Client-based »WebLog Expert« software for remote diagnostics

The success of a condition monitoring system is closely linked to correct installation, parameterization and commissioning, as well as rapid and correct reaction to reported changes of status. Our experts accordingly handle all concerns on-site, even training and orientation of customer personnel. Our modern teleservice for distributed applications includes online monitoring over a secure Internet connection and thus is available worldwide. Currently we monitor far more than 2.000 Condition Monitoring systems via Internet. In this regard the power range of the systems extends from 250 kW to 5 MW. We developed the »WebLog Expert« portal new for this. It serves as an interface to the diagnostic system and enables worldwide access to the status data of the monitored plants. Alarm messages are signaled to the users via a status window. Simultaneously a trend analysis of the state of the machine can be executed via the integrated database. The »WebLog Expert« software solution that can be implemented universally is the foundation for the worldwide tediagnosics and early error detection for distributed machines and plants.



Communication and analyses are based on progressive web-based and database-based technologies. Through its scalability and modularity »WebLog Expert« permits secure adaptation and fast configuration for solving all tasks, extending to demanding tasks in the condition monitoring area in various industries (particularly wind energy, biogas, shipping industry, etc.) Thus »WebLog Expert« is the basis for use of many Condition Monitoring systems that can be installed immediately in the original equipment with the »M1« controller by the OEM on the same bus system, or that are available for retrofitting of machines and plants.

- Password protected access
- On the start page all current error messages are displayed
- Visualization of the detailed diagnostic results for each measurement point
- Expert tools for fault diagnosis





### Acceleration sensors BAM100 / BAM500

The tried and tested acceleration sensors are provided with an extremely robust housing, a hermetic sealing and an insulated housing and are thus proven even for demanding ambient conditions. Their minimally invasive mounting on the object as well compact dimensions make them suitable for difficult to access measuring points.

The piezo vibration sensors offer a sensitive response to the smallest accelerations and are connected via the IPC inputs of the AIC212. The BAM100 sensor is suitable for fast rotating machine areas. The more sensitive BAM500 sensor is used for slow rotating areas.

| Item   | Item no.    |
|--------|-------------|
| BAM100 | 00020455-00 |
| BAM500 | 00020456-00 |

| Acceleration sensor    | BAM100                     | BAM500                     |
|------------------------|----------------------------|----------------------------|
| Technical data         |                            |                            |
| Sensitivity            | 100 mV/g                   | 500 mV/g                   |
| Output                 | ICP®-compatible            |                            |
| Sensor connection      | M12                        |                            |
| Measuring range        | 0.5/0.2 Hz .. 14 kHz       |                            |
| Acceleration range     | VDC >25 V<br>80 g maximum  | VDC >22 V<br>10 g maximum  |
| Amplitude nonlinearity | 1 %                        |                            |
| Frequency response     | ± 3 dB<br>0.5 Hz .. 14 kHz | ± 3 dB<br>0.2 Hz .. 14 kHz |
| Resonance frequency    | 30 kHz                     |                            |
| Operating voltage      | 18 .. 30 VDC               |                            |
| Operating current      | 2 .. 10 mA                 |                            |



µ-bridge sensor

We developed the »µ-bridge« sensor to capture sound waves and flexural vibrations in machines and plants (e.g. on components, solid bodies, etc.). The structure-borne sound waves emitted by machine parts are characteristic for the wear status of a part.

For the µ-bridge sensor the force of the sound wave is converted to a measurement voltage without a detour through a spring mass damper system. This even makes it possible to detect structure-borne sound waves and flexural vibrations at frequencies from 10 kHz to under 1 Hz with high resolution and bandwidth; this means that the sensor is particularly well suited for measurements on slowly rotating or vibrating parts.

| Item     | Item no.    |
|----------|-------------|
| µ-bridge | 00019918-00 |

| µ-bridge                      |                                     |
|-------------------------------|-------------------------------------|
| Technical data                |                                     |
| Operating mode                | IEPE standard                       |
| Operating current             | 4 .. 10 mA                          |
| Output voltage (offset)       | 11 ±0.5 V                           |
| Max. saturation degree        | 8 V                                 |
| Sensitivity                   | 0.7 V/N                             |
| Signal-to-noise ratio         | -83 dB                              |
| Carrier-to-interference ratio | -79 dB                              |
| Low limit frequency           | high pass 1st order, $f_g = 1.6$ Hz |
| High limit frequency          | $f_g > 10$ kHz                      |



### Structural Vibration Monitor SVM300 series

The SVM300 structural vibration monitor series is used for analyzing oscillations, shocks and vibrations. It has an internal memory that enables grid-independent autonomous analysis for up to 150 days and is implemented in protection class IP67.

- Measurement in 2 axes
- Measurement range  $\pm 2$  g
- Resolution:  $\geq 0.305$  mg
- Internal memory ( $\leq 150$  days)
- Protection class IP67

| Item     | Item no.    |
|----------|-------------|
| SVM300/E | 00020930-00 |

| SVM300 Series               |                                                                                 |
|-----------------------------|---------------------------------------------------------------------------------|
| Acceleration sensors        |                                                                                 |
| Acceleration axes           | x, y                                                                            |
| Measuring range             | max. $\pm 2$ g                                                                  |
| Resolution                  | $\geq 0.305$ mg                                                                 |
| Signal bandwidth (low-pass) | $\leq 5$ Hz                                                                     |
| Sample rate                 | min. 25 samples/s                                                               |
| Memory                      |                                                                                 |
| Internal memory             | 2 GB                                                                            |
| Recording period            | 150 days (at 25 samples/s)                                                      |
| Real-time clock (RTC)       |                                                                                 |
| Deviation/year              | $\leq 15$ minutes/year (battery buffered)                                       |
| Diagnostics                 |                                                                                 |
| 2 status LEDs               | Operation/fault and communication                                               |
| Connections/interfaces      |                                                                                 |
| Ethernet (ETH)              | 10/100 Mbit/s RJ45 socket, push pull (variant 4)                                |
| Power supply (PWR)          | +12 V (10 .. 34 V) with reverse polarity protection, push-pull (variant 4)      |
| Housing/power supply        |                                                                                 |
| Degree of protection        | IP 67                                                                           |
| Dimensions                  | 150 mm x 150 mm x 40 mm                                                         |
| Environmental condition     |                                                                                 |
| Operating temperature       | -40 .. +60 °C                                                                   |
| Rel. humidity operation     | 5 .. 95 % with condensation                                                     |
| Storage temperature         | -40 .. +85 °C                                                                   |
| Rel. humidity storage       | 5 .. 95 % with condensation                                                     |
| Model                       |                                                                                 |
| SVM300/E                    | Structural vibration monitor with Ethernet connection and two acceleration axes |







## **Sector-specific solutions**

Bachmann offers sophisticated automation solutions to its customers world-wide in a wide range of application areas. Setting new standards, thinking ahead, as well as responding quickly and flexibly to new challenges – these are the tasks to which we are committed in securing the critical competitive edge for our customers. All our activities are focused on the benefit to the customer: We deliver tailored solutions and set ourselves the highest standards. The independence we have in development and production enables us to tackle specific market and customer requirements with passion and commitment every day.

Our broad and modular product range meets really every customer requirement. We provide you with a homogeneous and holistic system solution that also ensures a high level of availability and is future proof. We offer you everything from a single source and at the highest quality. Our automation systems stand out on account of their extraordinary robustness, high performance and open interfaces. The latest and most innovative platform for your sector specific requirements.

## Sector-specific solutions



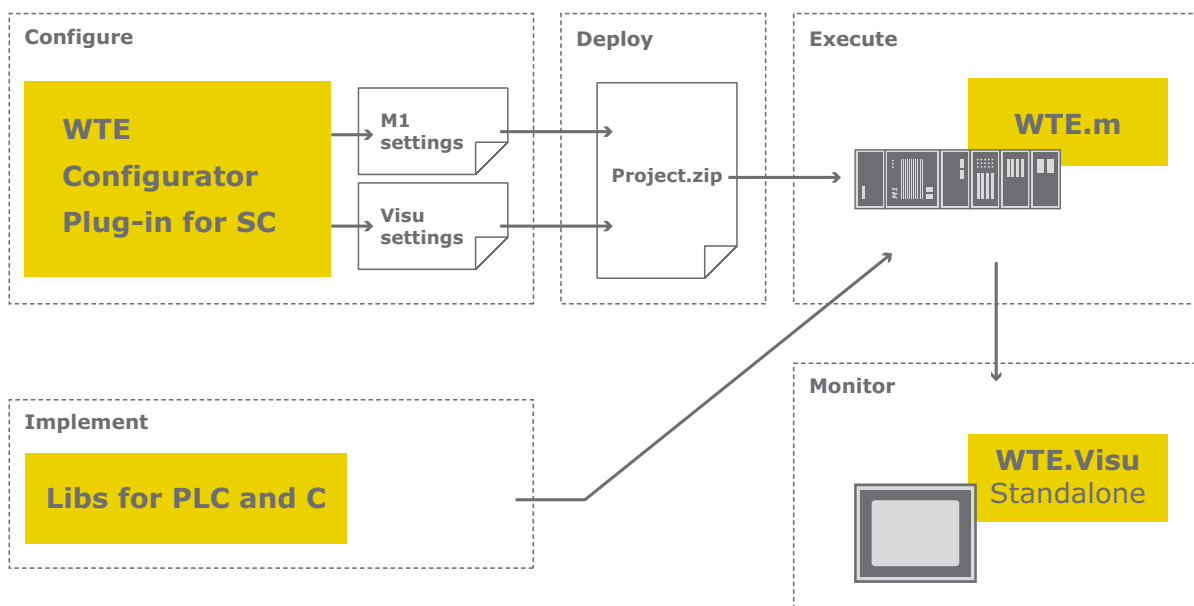
### Wind Turbine Essentials WTE

The WTE software package is tailored to the requirements of manufacturers and control system developers of wind turbines, and helps to considerably reduce the time required for developing and commissioning the controller software and the visualization. Bachmann's Wind Turbine Essentials cover many standard tasks required for the automation of wind turbines. The configurator of the WTE toolset is integrated into the Engineering Suite SolutionCenter and enables the structured configuration of the event system, user roles and access rights, data sampling with long-term recording and statistical processing. A visualization for developers and customers is created in parallel with the data configuration. The runtime components execute the event system, sample data values, send alarm messages and check passwords of users. The complete logging of all events and user operations is secured by the M1 system features. A visualization is offered both for a PC with mouse operation and for a panel with touch screen (OT) in optimal resolution. The visualization offers access to process data which can be arranged in arbitrary groups with freely selectable physical units and description texts in any language or character set. The PC visu contains additionally graphical components for snapshots and long-term trends as well as power curve and wind rose diagrams. The software developer can additionally use the WTE features in his own code because most features are also delivered in program libraries for IEC61131-3 (M-PLC) und C/C++. For user management and access control, WTE contains also a dedicated login-checker and a tool to generate passwords.

| Item                                     | Item no.    |
|------------------------------------------|-------------|
| WTE SDK<br>(DVD for installation)        | 00022097-00 |
| WTE Admin Tool<br>(DVD for installation) | 00022098-00 |
| WTE Company Licence                      | 00022097-60 |
| WTE Runtime Licence                      | 00022097-63 |

## Sector-specific solutions

- Configuring instead of programming
- Readable, comparable, extensible project format
- High performance in execution of vast event configurations
- Setting and resetting events automatically from variable value or from user program
- Individual configurable time delay for setting and resetting events and for power-up
- Freely configurable reactions to events
- Complete logging with high-resolution time stamps
- Standardized power curve created with a few mouse clicks
- Numerous statistical functions with automatic data sampling and graphical display in visualization
- Flexible assignment of user access rights depending on login name and password
- Ready-to-use visualization is created by configuration
- Arbitrary grouping of monitor- and parameter values
- Arbitrary language and character sets for description texts
- Extensive program libraries for customer specific extensions



▲ Software package overview: Wind Turbine Essentials (WTE)

## Sector-specific solutions

| Wind Turbine Essentials WTE         |                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configurator                        |                                                                                                                                                                                                                                                                                                                                                  |
| Environment                         | The configurator is installed as extension to the Bachmann SolutionCenter.                                                                                                                                                                                                                                                                       |
| Project handling                    | Turbine projects are stored without any external dependencies and thus can be transferred easily from one PC to another.                                                                                                                                                                                                                         |
| Workflow                            | For all parts of the configuration, comfortable table editors with input assistants are available.                                                                                                                                                                                                                                               |
| Validation                          | Immediate check for plausible and complete configuration parameters                                                                                                                                                                                                                                                                              |
| User management                     | Configuration of user roles, assignment of required role to each value. Required role for reading and writing can differ                                                                                                                                                                                                                         |
| Storage format                      | Project files in readable format enable comparison between versions and parallel work of different team members                                                                                                                                                                                                                                  |
| Version control                     | Tools for version control (SVN, CVS, etc.) can be operated directly from the project navigator. This assures that always complete projects are stored on the server.                                                                                                                                                                             |
| Import of external models           | Project contents like event configuration can also be imported from different sources as CSV format. Projects of the predecessor product M-WAB can be imported directly into the WTE configurator                                                                                                                                                |
| Software modules for the controller |                                                                                                                                                                                                                                                                                                                                                  |
| WTE software module                 | Executable program for the controller, behavior is defined by configuration project. Executes event system, logging, sampling of production data, statistical processing, trend- and snapshot-recordings. Supports fail-safe software update.                                                                                                    |
| WTE alarm handler                   | Executable program for the controller. Is called in case of an error by the WTE module for automatic dispatch of E-mail and/or SMS messages. Triggering is also possible by other application programs. WTE event logs are included as attachment.                                                                                               |
| WTE login checker                   | Executable program for the controller. See <i>User management and access rights</i> for details                                                                                                                                                                                                                                                  |
| Visualization                       |                                                                                                                                                                                                                                                                                                                                                  |
| WTE Visualization                   | ready-to-use visualization for a Desktop PC with mouse operation, graphical display of trends, power curve, wind rose. Buttons for turbine commands, arbitrary grouping of values in tables for numerical display of monitor values, parameters, event logs and access logs.                                                                     |
| Displayed values                    | Variable values are selected and grouped, then descriptive texts, formats and physical units are assigned. The visualization displays the values according to the selected language and the access right of the current user. Both values of the WTE software module and values of any other process variable on the controller can be selected. |
| WTE eVis                            | visualization optimized for HMI panels with touch screen under Windows or Linux                                                                                                                                                                                                                                                                  |
| Internationalization                | Definition of descriptive texts for events, parameters and monitor values directly in the WTE configurator. Export and import of languages to CSV format for external translation. Filter for missing translations is available.                                                                                                                 |

| Wind Turbine Essentials WTE             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Visualization                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Character set                           | all international character sets are supported, e. g. for Asian, Cyrillic or Arabic languages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Text representation of numerical values | status information is commonly stored as numerical values. For these values it is possible to configure descriptive texts for different languages.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Brand labeling                          | icons and images can be replaced by manufacturer-specific images                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Event system                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Event parameters                        | <p>Events are operational states which are derived from sensor data, from programmed reactions and from operator input. The complete list of all events that might occur is the central part of the turbine control program. Necessary reactions to events, like stopping the turbine, yawing operations etc. are assigned to events. For each event, a set of the following additional parameters can be configured:</p> <ul style="list-style-type: none"> <li>arbitrary number and type of user-defined event reactions. Typical are brake, yaw and alarm level.</li> <li>Creation of follow-up-events on repeated occurrence of another event within a defined period, e. g. frequent exceeding of a temperature limit</li> <li>Descriptive name of event in different languages for display in the visualization</li> <li>classification in Info, Warning, Error</li> <li>Possibility to deactivate an event, e. g. during service procedures. Required user access right for deactivating.</li> <li>time delay after power up, e. g. to wait for the completion of an average calculation.</li> <li>time delay between setting an event and calling the reaction</li> <li>required user right for resetting events (error acknowledgement)</li> </ul> |
| Setting and resetting events            | <ul style="list-style-type: none"> <li>automatically by variable value</li> <li>automatically via handler block with hysteresis</li> <li>via set- and reset-functions of WTE libraries</li> <li>via reset command of the visu (depends on access right)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Max. number of events                   | only limited by memory and CPU load                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Trends and snapshots                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Trends                                  | continuous long-term recording of values for archiving reasons, e. g. for recording of the turbine's production data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Snapshots                               | continuous short-term recording of some selected variable values until a trigger condition occurs. Then the last few minutes are stored, otherwise the values are discarded. Typically used for error-analysis with a pre-trigger condition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Sector-specific solutions

### Wind Turbine Essentials WTE

#### Trends und Snapshots

|         |                                                                                                                                                                                                                                  |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Storage | File based on the storage media of the controller. Each recording is stored in one file, the filename contains time and date of the recording. File format is documented and thus can be parsed also by customer specific tools. |
| Storage | Selection of available recordings by type and by date and time. The trend display offers several Y-axes, show/hide curves and measurement cursors with numerical value display. Trend values can also be shown as table.         |

#### Statistical functions

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Average calculation | Average calculation of linear and polar values, selectable sample time and averaging time, with or without calculation of minimum/maximum values and standard deviation.                                                                                                                                                                                                                                           |
| State counter       | Counts rising edges and duration of on-state, separated output as day-, year- and total count/duration. Values are shown as variables and are stored automatically in files. Maximum values for edge count and duration can be configured, then exceeding the limit can raise a maintenance warning. Typically used for counting operating hours of aggregates.                                                    |
| Energy counter      | Adds up the current power to energy and keeps produced and consumed energy separated, both are displayed as day-, year- and total values. Results are displayed in variables and are automatically logged to files.                                                                                                                                                                                                |
| Power curve         | Creates a power curve according to IEC61400-12, selectable with or without internal average calculation. One type can directly process raw data, the other expects input data which are already averaged. The WTE Visualization displays the power curve together with an optional reference curve. It is possible to keep several power curves on the controller, e. g. to verify the result of parameter changes |
| Wind rose           | Shows the distribution of wind speed depending on the wind direction. The WTE visualization has a graphical display of the wind rose.                                                                                                                                                                                                                                                                              |

#### User management and access rights

|                           |                                                                                                                                                                                 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition of user rights | Creation of a list of user roles in the configurator, then assignment of required role to a variable.                                                                           |
|                           | Required role can be different for Read- and write-access. E. g. reading of operating hours is possible for everybody, resetting the counter is only allowed for certain users. |
| Password generator        | Separated stand-alone tool to create passwords which are valid for a limited period between one day and one year.                                                               |
| Login Checker             | Executable program for the controller. Derives user rights from login name, password and date and can limit the access of the user                                              |
| Access log                | Complete logging of all logins and write operations to the controller. Log is stored on the controller                                                                          |

| Wind Turbine Essentials WTE |                                                                                                                                                                                                                                                                  |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Programming libraries       |                                                                                                                                                                                                                                                                  |
| Supported languages         | The libraries are available with an identical feature set for IEC61131-3 (M-PLC) as *.lib and for C/C++ as *.a                                                                                                                                                   |
| WTE Interface Library       | Comfortable interface for communication between user program and WTE software module, especially for setting/resetting events, retrieving current state of events, resetting counters, triggering snapshots and start/stop wind rose and power curve recordings. |
| WTE Library                 | Functions and function blocks for statistical data processing, energy- and state-counters, creation and administration of specific log files                                                                                                                     |
| File functions              |                                                                                                                                                                                                                                                                  |
| General features            | Fast and resource-saving access to storage media                                                                                                                                                                                                                 |
|                             | Automatic creation of a series of files with a configurable maximum size for each file                                                                                                                                                                           |
|                             | Filename contains date and time of last entry which makes sorting in chronological order easy                                                                                                                                                                    |
|                             | Each file contains an optional header with selectable information, e. g. turbine name, software version etc.                                                                                                                                                     |
|                             | The oldest file can optionally be deleted automatically                                                                                                                                                                                                          |
|                             | Files can optionally be zipped automatically on closing                                                                                                                                                                                                          |
| Supported file formats      | CSV with header information and column captions                                                                                                                                                                                                                  |
|                             | Binary with header information                                                                                                                                                                                                                                   |
|                             | Ring file for temporary storage of values                                                                                                                                                                                                                        |
| System requirements         |                                                                                                                                                                                                                                                                  |
| Engineering PC              | Bachmann SolutionCenter needs to be installed, required version M-Base 3.80 or better                                                                                                                                                                            |
| Controller software         | M-Base 3.80 or better                                                                                                                                                                                                                                            |
| Controller hardware         | controller CPU of series MX200, MPC200, MC200 and MH200                                                                                                                                                                                                          |
| Delivery variants           |                                                                                                                                                                                                                                                                  |
| WTE SDK                     | DVD for installation<br>Software development Kit contains configurator, runtime components, libraries and visualization                                                                                                                                          |
| WTE Admin Tool              | DVD for installation<br>Tool to create manufacturer specific passwords with limited validity period. Matches the login checker included in WTE                                                                                                                   |
| WTE Company Licence         | License to use the WTE development tools in the whole company                                                                                                                                                                                                    |
| WTE Runtime Licence         | License to use the WTE software module on controller                                                                                                                                                                                                             |

## Sector-specific solutions



### Wind Power Scada WPS

Based on atvise® scada, Bachmann's Wind Power Scada software (WPS) provides a SCADA system specifically designed for the wind power sector. WPS makes it possible to obtain both a comprehensive and a detailed view of the entire wind farm and any individual turbine at the same time.

#### State-of-the-art technologies

Just like atvise® scada, WPS uses pure web technology to provide the user with a completely seamless system on all levels. Thanks to this technology, the visualization can be operated on any PC, tablet or smartphone. The use of scalable vector graphics (SVG) enables the creation of a highly ergonomic solution for any device level (control center/wind farm/individual plant).

#### Communication standards

WPS implements communication standards such as OPC UA (Unified Architecture) and IEC61400-25. The OPC UA interface ergonomically integrates live process data and alarms and can be used for historization. Process variables are standardized thanks to the use of data structures compliant with IEC 61400-25.



## Sector-specific solutions

### Scalability

WPS makes it possible to represent all relevant plant levels: From the global view of the region, to the wind farm, right down to the individual turbine. Specific information providing the user with an overview at any time is displayed for each level. If detailed information is required, the corresponding level can be accessed quickly and conveniently.

### SCADA functions

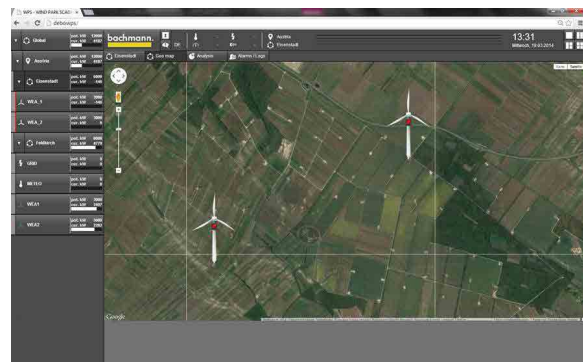
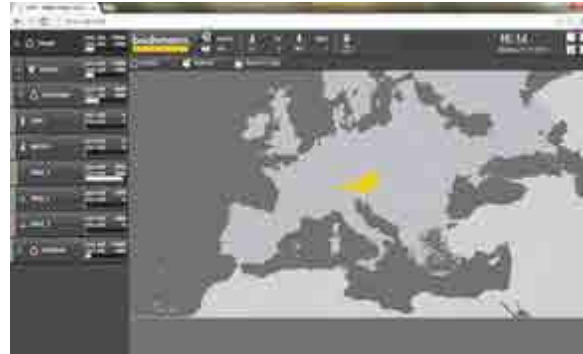
WPS provides the functions familiar to users of atvise® scada, such as alarm handling, historization, trending and multi-lingual functionality. User management is implemented transparently and ergonomically for the user. A login procedure on the WPS is all that is needed to allow access right through to individual turbines. The well-known security standards of the Bachmann M1 controller are used here for transmission (SSL) and user management (groups/level) in order to prevent unauthorized access. Data history, alarms/events and trending are logged by the M1 and seamlessly redirected to the WPS to allow extensive analysis (power curve/wind rose/filter).

### Project design

The WPS is designed using the atvise® Builder tool. The IEC61400-25 compliant object structure enables the user to design the required elements simply. As with atvise® scada, the data points are linked in the Builder by browsing an OPC UA data source. The scripting functionality as well as all the other benefits of the atvise® Builder can likewise be used for designing a WPS project. A comprehensive library offers a wide range of ready-to-use components specifically designed for the wind sector. The fully object-oriented implementation of these components allows an efficient operation (reproduction / adaptation).

### Connection to external systems

The standard OPC UA interface makes it possible to integrate external controller systems based on the IEC61400-25 data model directly into the WPS system.



## Sector-specific solutions

Third party systems that do not support these standards can be integrated using a (gateway) Bachmann controller that provides the basis for the WPS functions.

The standard communication protocols of the M1 (Profinet/Profibus/CANBus...) are available to provide a basis for taking the process data from the wind turbine. Customized, proprietary solutions can also be implemented on the gateway controller in order to fully utilize WPS.

- Sector-specific SCADA system
- Use of standard OPC UA and IEC61400-25 communication protocols
- High scalability

- Live process data on all visualization levels
- Automatic adaption of the graphic solution for PC, tablet or smartphone
- All visualizations are available on a wide range of state-of-the-art hardware such as smartphone, tablet or PC
- Standard user management for SCADA and turbine
- Online/offline trending
- Online language selection
- Alarm and data history

### WPS – Wind Power Scada

#### Process connection / Communication

|                    |                                                                           |
|--------------------|---------------------------------------------------------------------------|
| Protocols          | OPC Unified Architecture (UA) Data Access<br>IEC61400-25                  |
| Physical interface | Ethernet                                                                  |
| Parallel operation | Yes, several clients with different technologies (PC, tablet, cell phone) |
| Scalability        | Cascadable server with WPS instances                                      |

#### Project design

|                         |                |
|-------------------------|----------------|
| Development environment | atvise builder |
|-------------------------|----------------|

#### Functionalities

|                          |                            |
|--------------------------|----------------------------|
| Language switchover      | Yes                        |
| Data history             | Yes, logged by the M1      |
| Alarm/Event Logging      | Yes, logged by the M1      |
| Trending (Event trigger) | Yes, logged by the M1      |
| Wind rose                | Yes                        |
| User management          | Yes                        |
| Access security          | Yes, with SSL transmission |

#### Visualization

|         |                                                                                                                  |
|---------|------------------------------------------------------------------------------------------------------------------|
| Browser | HTML5 visualization (Chrome / Firefox / Internet Explorer / Safari) with SVG graphics (Scalable Vector Graphics) |
|---------|------------------------------------------------------------------------------------------------------------------|





## Directives and certificates – for worldwide implementation

Product certifications and approvals are essential prerequisites for global acceptance of industrial products.

Whether national standards, climatic conditions, degrees of protection, set-up, installation, operation or maintenance possibilities – in international implementation the course must be set in the project coordination phase. And it is precisely at this point that our strengths are brought to bear.

### Approvals

|              |                                |
|--------------|--------------------------------|
| GL           | Germanischer Lloyd             |
| CE           | Declaration of Conformity      |
| UL           | Underwriters Laboratories      |
| CSA          | Canadian Standards Association |
| HALT         | Highly Accelerated Life Test   |
| ISO9001/2000 | Quality management             |
| CCC          | China Compulsory Certification |
| DNV          | Det Norske Veritas             |
| LR           | Lloyds Register                |
| BV           | Bureau Veritas                 |
| ABS          | American Bureau of Shipping    |





## Standards and approvals

### M1 controller hardware

| Item no.    | Module    | CE | CCC | UL | cUL | GL | DNV | LR | ABS | BV | RoHS* |
|-------------|-----------|----|-----|----|-----|----|-----|----|-----|----|-------|
| 00009928-10 | ACR222/2  | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00012245-10 | AI202/SI  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010693-20 | AI204/1   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010693-10 | AI204/2   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010693-00 | AI204/4   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017447-00 | AI204/4✱  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012245-00 | AI204/SI  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017772-00 | AI208/SI  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018843-00 | AI208/SI✱ | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014151-00 | AIC212    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017444-00 | AIC212✱   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00020627-00 | AIO208    | ** | **  |    |     |    |     |    |     |    | **    |
| 00020628-00 | AIO208✱   | ** | **  |    |     |    |     |    |     |    | **    |
| 00020631-00 | AIO216    | ** | **  |    |     |    |     |    |     |    | **    |
| 00020632-00 | AIO216✱   | ** | **  |    |     |    |     |    |     |    | **    |
| 00014470-00 | AIO288    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016157-00 | AIO288✱   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014470-10 | AIO288/1  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010692-00 | AO202     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012246-10 | AO202/SI  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012246-00 | AO204/SI  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00011244-00 | AO208/I   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017441-00 | AO208/I✱  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009540-00 | A-PCC200  | •  | •   |    |     |    |     |    |     |    | •     |
| 00009754-00 | BEM201    | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00012846-00 | BEM211    | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00009755-10 | BES202    | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00009755-00 | BES202/N  | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00012847-00 | BES212    | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00012848-00 | BES212/N  | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00013502-00 | BES222    | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00013503-00 | BES222/N  | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00010507-00 | BS201     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009802-00 | BS202     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009313-00 | BS203     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015947-00 | BS203✱    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016785-00 | BS203/S   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009752-00 | BS204     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015948-00 | BS204✱    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |

\* RoHS China (no RoHS Europe)

\*\* Certification in process

## Standards and approvals

| M1 controller hardware |         |    |     |    |     |    |     |    |     |    |       |
|------------------------|---------|----|-----|----|-----|----|-----|----|-----|----|-------|
| Item no.               | Module  | CE | CCC | UL | cUL | GL | DNV | LR | ABS | BV | RoHS* |
| 00016786-00            | BS204/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009206-00            | BS205   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015949-00            | BS205*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016787-00            | BS205/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009792-00            | BS206   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015950-00            | BS206*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016788-00            | BS206/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009207-00            | BS207   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015951-00            | BS207*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016789-00            | BS207/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009793-00            | BS208   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015952-00            | BS208*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016790-00            | BS208/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009634-00            | BS209   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015953-00            | BS209*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016791-00            | BS209/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009794-00            | BS210   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015954-00            | BS210*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016792-00            | BS210/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009795-00            | BS211   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015955-00            | BS211*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016793-00            | BS211/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009796-00            | BS212   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015956-00            | BS212*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016794-00            | BS212/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009797-00            | BS213   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015957-00            | BS213*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016795-00            | BS213/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009798-00            | BS214   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015958-00            | BS214*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016796-00            | BS214/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009799-00            | BS215   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018623-00            | BS215*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016797-00            | BS215/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009800-00            | BS216   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018624-00            | BS216*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016798-00            | BS216/S | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009698-00            | CM202   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016404-00            | CM202*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |

\* RoHS China (no RoHS Europe)

\*\*\* on request

## Standards and approvals

| M1 controller hardware |            |    |     |    |     |    |     |    |     |    |       |
|------------------------|------------|----|-----|----|-----|----|-----|----|-----|----|-------|
| Item no.               | Module     | CE | CCC | UL | cUL | GL | DNV | LR | ABS | BV | RoHS* |
| 00010709-10            | CNT204/H   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016407-10            | CNT204/H*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010709-20            | CNT204/R   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013178-00            | CS200      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013179-00            | CS200/N    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013597-00            | DA3284-C   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017450-00            | DA3284-C*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010281-00            | DI212      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009002-00            | DI216      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00008997-00            | DI232      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016411-00            | DI232*     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012162-00            | DI232/48   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00011516-00            | DI232/np1  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010285-00            | DIO16-C    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017453-00            | DIO16-C*   | •  | •   | •  | •   | •  | •   | •  | •   | •  |       |
| 00010615-00            | DIO216     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010892-00            | DIO216/4   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016141-00            | DIO216/4*  | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013034-00            | DIO232     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019116-00            | DIO248     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019115-00            | DIO264     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009205-00            | DIO264-C   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019114-00            | DIO280     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019119-00            | DIO280*    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010129-00            | DIO32-C    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010526-00            | DIO48-C    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009884-00            | DMS202     | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00012696-00            | DNM201     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009004-00            | DO216      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009003-00            | DO232      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016414-00            | DO232*     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012176-00            | DO232/48   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014497-10            | DOR206/230 | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010555-00            | DPM200     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018032-00            | DPM200*    | •  | •   | •  | •   |    |     |    |     |    | •     |
| 00012671-00            | EM203      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017321-00            | EM213      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |

\* RoHS China (no RoHS Europe)

\*\* Certification in process



## Standards and approvals

| M1 controller hardware |              |    |     |    |     |    |     |    |     |    |       |
|------------------------|--------------|----|-----|----|-----|----|-----|----|-----|----|-------|
| Item no.               | Module       | CE | CCC | UL | cUL | GL | DNV | LR | ABS | BV | RoHS* |
| 00017470-00            | EM213✱       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017192-00            | FCS214/G     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017192-10            | FCS214/F     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010495-00            | FM211        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010496-00            | FM212        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016747-10            | FM221        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018091-10            | FM221✱       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016747-00            | FM222        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018091-00            | FM222✱       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010497-00            | FS211        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010498-00            | FS211/N      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010499-00            | FS212        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00010500-00            | FS212/N      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016749-10            | FS221/N      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018092-10            | FS221/N✱     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016749-00            | FS222/N      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018092-00            | FS222/N✱     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00020620-00            | GIO212       | ** | **  |    |     |    |     |    |     |    | **    |
| 00020623-00            | GIO212✱      | ** | **  |    |     |    |     |    |     |    | **    |
| 00022162-00            | GM260        | ** | **  |    |     | ** | **  | ** | **  | ** | **    |
| 00017829-00            | GMP232       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019063-00            | GMP232✱      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019756-00            | GSP274       | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00021759-00            | GSP274✱      | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00013737-00            | ISI222       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016421-00            | ISI222✱      | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014127-00            | ISI222/8     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014477-00            | LM20         | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00009494-00            | LM201        | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018805-10            | MC205        | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00018805-12            | MC205-CFA4GB | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00020513-1x            | MC205✱       | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00018806-1x            | MC210        | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00020514-1x            | MC210✱       | •  | •   | •  | •   | ** | **  | ** | **  | ** | •     |
| 00013176-00            | ME203/CN     | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016336-00            | ME203/CN✱    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013191-00            | ME203/CNW    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |

\* RoHS China (no RoHS Europe)

## Standards and approvals

| M1 controller hardware |                      |    |     |    |     |    |     |    |     |    |       |
|------------------------|----------------------|----|-----|----|-----|----|-----|----|-----|----|-------|
| Item no.               | Module               | CE | CCC | UL | cUL | GL | DNV | LR | ABS | BV | RoHS* |
| 00013177-00            | ME203/EN             | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00015985-00            | ME203/EN*            | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016370-0x            | MH212/S              | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018652-0x            | MH212/S*             | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012711-40            | MPC240               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018591-x0            | MPC240               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016338-40            | MPC240*              | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00020547-x0            | MPC240*              | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013127-40            | MPC240/W             | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00021018-00            | MPC240/W-<br>CF512MB | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018372-00            | MPC240/W-<br>CF4GB   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012708-40            | MPC265               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018587-x0            | MPC265               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012710-40            | MPC270               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018589-x0            | MPC270               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016180-40            | MPC270*              | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00020413-x0            | MPC270*              | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00013129-40            | MPC270/W             | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00023264-00            | MPC270/W-<br>CF512MB | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014274-40            | MPC293               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017629-00            | MPC293-<br>CF512MB   | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017332-40            | MPC293/W             | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00020575-00            | MPC293/W-<br>CF512MB | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014445-00            | MX207                | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018594-x0            | MX213                | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018597-x0            | MX213*               | •  | •   | •  | •   | •  | •   | •  | •   | •  |       |
| 00018593-x0            | MX220                | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00019210-00            | MX220*               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017689-x0            | MX220*               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012754-00            | NT250/48             | •  | •   |    |     | •  | •   | •  | •   | •  | •     |
| 00013251-00            | NT255                | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016158-00            | NT255*               | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00012081-10            | PCC201/ 8            | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |

\* RoHS China (no RoHS Europe)

\*\* Certification in process

## Standards and approvals

| M1 controller hardware |           |    |     |    |     |     |     |     |     |     |       |
|------------------------|-----------|----|-----|----|-----|-----|-----|-----|-----|-----|-------|
| Item no.               | Module    | CE | CCC | UL | cUL | GL  | DNV | LR  | ABS | BV  | RoHS* |
| 00012081-20            | PCC201/16 | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00012081-30            | PCC201/32 | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00012081-40            | PCC201/64 | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00010708-00            | PTAI216   | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00017456-00            | PTAI216✱  | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00011056-00            | PWM202    | •  | •   | •  | •   |     |     |     |     |     | •     |
| 00021235-00            | RS204     | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00021674-00            | RS204✱    | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00009542-00            | S201      | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00014544-00            | SDI208    | •  | •   | •  | •   |     |     |     |     |     | •     |
| 00017459-00            | SDI208✱   | •  | •   | •  | •   | **  | **  | **  | **  | **  | •     |
| 00014545-00            | SDO204    | •  | •   | •  | •   |     |     |     |     |     | •     |
| 00017462-00            | SDO204✱   | •  | •   | •  | •   | **  | **  | **  | **  | **  | •     |
| 00011756-00            | SEM201    | •  | •   | •  | •   |     |     |     |     |     | •     |
| 00014273-00            | SLC284    | •  | •   | •  | •   |     |     |     |     |     | •     |
| 00017465-00            | SLC284✱   | •  | •   | •  | •   | **  | **  | **  | **  | **  | •     |
| 00012672-00            | SWI205/S  | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00010851-00            | TCO204-C  | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00010850-00            | TCO208-C  | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00008673-00            | TCO216-C  | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00014008-00            | TI214     | •  | •   | •  | •   | •   | •   | •   | •   | •   | •     |
| 00014008-20            | TI214/2   | •  | •   | •  | •   | *** | *** | *** | *** | *** | •     |
| 00009496-00            | VP200     | •  | •   | •  | •   |     |     |     |     |     | •     |
| 00009498-00            | VP200/S   | •  | •   | •  | •   |     |     |     |     |     | •     |

\* RoHS China (no RoHS Europe)

\*\*\* on request

## Standards and approvals

### HMI devices

| Item no.    | Module            | CE | CCC | UL | cUL | GL | DNV | LR | ABS | BV | RoHS* |
|-------------|-------------------|----|-----|----|-----|----|-----|----|-----|----|-------|
| 00014221-00 | CT205/BE1         | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014336-00 | CT205/V/BE1       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00016898-00 | IPC1410/BE1/CM1G1 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00016902-00 | IPC1410/BE1/CD1G6 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00016899-00 | IPC1412/BE1/CM1G1 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00016903-00 | IPC1412/BE1/CD1G6 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00016900-00 | IPC1415/BE1/CM1G1 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00016904-00 | IPC1415/BE1/CD1G6 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00016905-00 | IPC1419/BE1/CD1G6 | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00017609-00 | IPC312/BE1        | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00017227-10 | IPC315/BE1        | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00014569-00 | OT115/R/BE1       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00014570-00 | OT115/R/BE2       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00017593-00 | OT115/R/BE2/CC    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018216-00 | OT205/BE1         | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018217-00 | OT205/M/BE1       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018218-00 | OT205/V/BE1       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018219-00 | OT205/V/BE1/CC    | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00018221-00 | OT205/V/BE2       | •  | •   | •  | •   | •  | •   | •  | •   | •  | •     |
| 00022298-00 | OT1310/BE1/GT1G0  | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00021833-00 | OT1312/BE1/GT1G0  | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00022299-00 | OT1315/BE1/GT1G0  | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00021831-00 | OT1319/BE1/GT1G0  | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00014314-00 | WT310/BE1         | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00014329-00 | WT312/BE1         | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |
| 00014399-00 | WT315/BE1         | •  | •   | •  | •   | -  | -   | -  | -   | -  | •     |

### M1 controller hardware

| Item no.    | Module  | BDEW | VDE4105 | TR3 | TR8 |
|-------------|---------|------|---------|-----|-----|
| 00017829-00 | GMP232  | •    | -       | •   | •   |
| 00019063-00 | GMP232* | •    | -       | •   | •   |
| 00019756-00 | GSP274  | •    | •       | •   | •   |
| 00021759-00 | GSP274* | •    | •       | •   | •   |

\* RoHS China (keine RoHS Europa)

\*\* Zertifizierung läuft



## ColdClimate

| ColdClimate modules                   |                  |             |
|---------------------------------------|------------------|-------------|
| Processor modules                     | Item designation | Item number |
| Processor module                      | ME203/EN*        | 00015985-00 |
| Processor module                      | ME203/CN*        | 00016336-00 |
| Processor module                      | MX213/*-CF512MB  | 00018597-00 |
| Processor module                      | MX213/*-CF4GB    | 00018597-10 |
| Processor module                      | MX220/*          | 00019210-00 |
| Processor module                      | MX220/*-CF512MB  | 00017689-00 |
| Processor module                      | MX220/*-CF4GB    | 00017689-10 |
| Processor module                      | MPC240*          | 00016338-40 |
| Processor module                      | MPC240*-CF512MB  | 00020547-00 |
| Processor module                      | MPC240*-CF4GB    | 00020547-10 |
| Processor module                      | MPC270*          | 00016180-40 |
| Processor module                      | MPC270*-CF512MB  | 00020413-00 |
| Processor module                      | MPC270*-CF4GB    | 00020413-10 |
| Processor module                      | MC205*           | 00020513-10 |
| Processor module                      | MC205*-CFA4GB    | 00020513-12 |
| Processor module                      | MC210*           | 00020514-10 |
| Processor module                      | MC210*-CFA4GB    | 00020514-12 |
| Processor module                      | MH212/S*         | 00018652-00 |
| Processor module                      | MH212/S*-CFA4GB  | 00018652-02 |
| Digital input/output modules          | Item designation | Item number |
| Digital input module                  | DI232*           | 00016411-00 |
| Digital output module                 | DO232*           | 00016414-00 |
| Digital input/output module           | DIO216/4*        | 00016141-00 |
| Digital input/output module           | DIO232*          | 00019502-00 |
| Digital input/output module           | DIO280*          | 00019119-00 |
| Safety modules                        | Item designation | Item number |
| Safety Logic Controller               | SLC284*          | 00017465-00 |
| Safety digital input module           | SDI208*          | 00017459-00 |
| Safety digital output module          | SDO204*          | 00017462-00 |
| Analog input/output module            | Item designation | Item number |
| Universal input/output module         | GIO212*          | 00020623-00 |
| Universal input/output module         | AIO208*          | 00020628-00 |
| Universal input/output module         | AIO216*          | 00020632-00 |
| Analog input module                   | AI208/SI*        | 00018843-00 |
| Analog input module                   | AI204/4*         | 00017447-00 |
| Analog output module                  | AO208/I*         | 00017441-00 |
| Analog input/output module            | AIO288*          | 00016157-00 |
| Temperature recording module          | PTAI216*         | 00017456-00 |
| Temperature input module              | TI214*           | 00018808-00 |
| Measurement module for Condition Mon. | AIC212*          | 00017444-00 |
| Functional module                     | Item designation | Item number |
| Counter module                        | CNT204/H*        | 00016407-10 |
| Positioning module                    | ISI222*          | 00016421-00 |
| Grid measurement module               | Item designation | Item number |
| Grid measurement module               | GMP232*          | 00019063-00 |
| Interface module                      | Item designation | Item number |
| Industrie-Ethernet-Master             | EM213*           | 00017470-00 |
| Interface module                      | RS204*           | 00021674-00 |

| ColdClimate modules                 |                  |             |
|-------------------------------------|------------------|-------------|
| System networking                   | Item designation | Item number |
| Ethernet Remote Station             | ERS202*          | 00021244-00 |
| Media converter                     | FCS214/F*        | 00019104-10 |
| Media converter                     | FCS214/G*        | 00019104-00 |
| FASTBUS module                      | FM221*           | 00018091-10 |
| FASTBUS module                      | FM222*           | 00018091-00 |
| FASTBUS module                      | FM221/N*         | 00018092-10 |
| FASTBUS module                      | FM222/N*         | 00018092-00 |
| CANopen Master module               | CM202*           | 00016404-00 |
| PROFIBUS DP-Master module           | DPM200*          | 00018302-00 |
| Decentralized CAN modules           | Item designation | Item number |
| Digital input/output module         | DIO16-C*         | 00017453-00 |
| Analog and digital in/output module | DA3284-C*        | 00017450-00 |
| Fieldbusses                         | Item designation | Item number |
| EtherCAT slave module               | ECS200*          | 00019206-00 |
| PROFIBUS-DP-Master module           | DPM200*          | 00018032-00 |
| Digital input/output module         | DIO16-C*         | 00017453-00 |

| ColdClimate modules |                  |             |
|---------------------|------------------|-------------|
| System modules      | Item designation | Item number |
| Power supply        | NT255*           | 00016158-00 |
| Backplane           | BS203*           | 00015947-00 |
| Backplane           | BS204*           | 00015948-00 |
| Backplane           | BS205*           | 00015949-00 |
| Backplane           | BS206*           | 00015950-00 |
| Backplane           | BS207*           | 00015951-00 |
| Backplane           | BS208*           | 00015952-00 |
| Backplane           | BS209*           | 00015953-00 |
| Backplane           | BS210*           | 00015954-00 |
| Backplane           | BS211*           | 00015955-00 |
| Backplane           | BS212*           | 00015956-00 |
| Backplane           | BS213*           | 00015957-00 |
| Backplane           | BS214*           | 00015958-00 |
| Backplane           | BS215*           | 00018623-00 |
| Backplane           | BS216*           | 00018624-00 |

| ColdClimate Terminals |                     |             |
|-----------------------|---------------------|-------------|
| OT100 series          | Item designation    | Item number |
| Operator Terminal     | OT115/R/BE2/CC      | 00017593-00 |
| OT200 series          | Item designation    | Item number |
| Operator Terminal     | OT205/V/BE1/CC      | 00018219-00 |
| OT1300 series         | Item designation    | Item number |
| Operator Terminal     | OT1310/BE1/CC/GT1G0 | on request  |
| Operator Terminal     | OT1312/BE1/CC/GT1G0 | on request  |

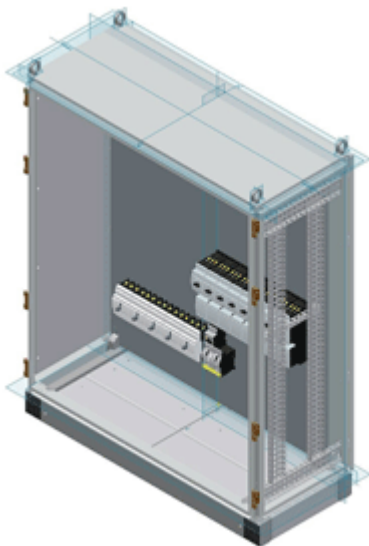
## CAE/CAD data

---

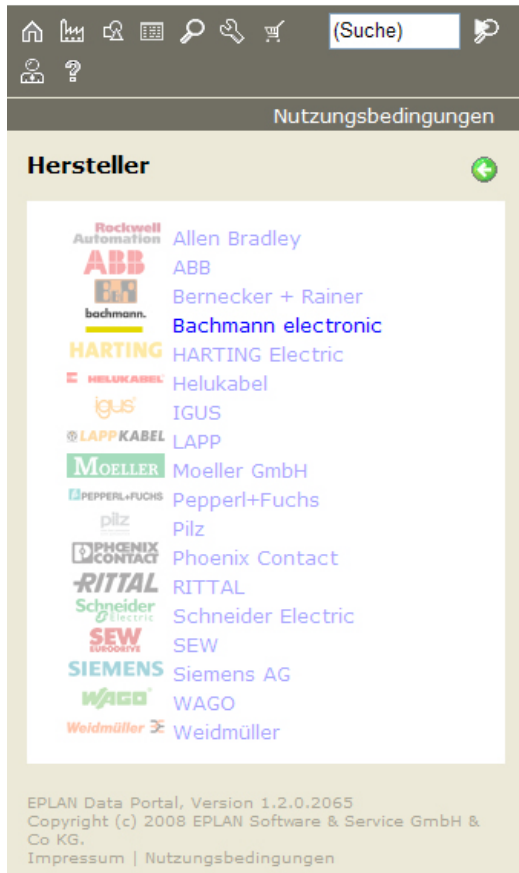
### CAE/CAD data – the convenient solution.

High-quality automation components are good and important, however they no longer suffice for successful machine building and process plant engineering projects. Development and project planning also play a crucial role for automation. Consequently the electrical and mechanical design of control cabinets is increasingly executed with 3D-supported programs that can ensure optimal placement of components and cable routing.

The same applies at Bachmann electronic: With eCAD import functionality in the SolutionCenter the turnaround time of automation projects can be significantly reduced. We satisfy the new market requirements and support our customers with additional components in the integrated engineering process.







## ePLAN library for control cabinet construction

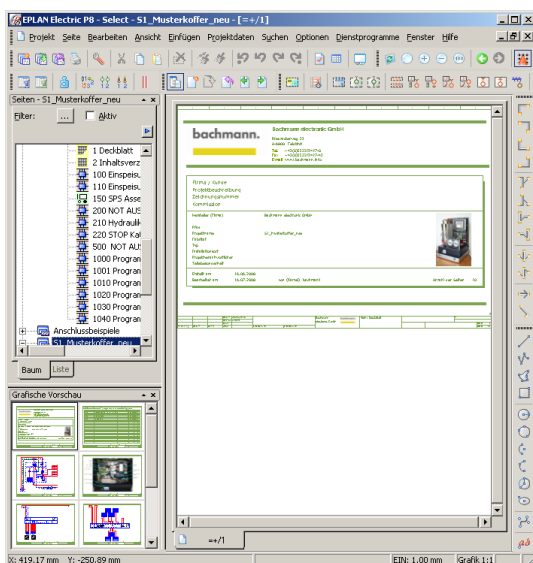


Good automation components no longer suffice for successful machine building and plant engineering projects. Efficient development and project planning is becoming ever more important. Bachmann electronic meets the requirements and supports its customers with two additional components in the integrated engineering process.

The device data necessary for electrical design of the Bachmann automation components is provided as a library in the ePLAN data portal. Macros for circuit diagram and control cabinet layout, function templates for intelligent configuration of controllers, item data for the spare parts catalog; The data that is created and certified with ePLAN can be loaded directly into the ECAD project and immediately used for the design – a significant contribution in time savings, as well as for uniform structuring of the project.

With the new eCAD import functionality in the SolutionCenter the time of automation projects can be significantly reduced. While one team plans parts lists, circuit diagrams and control cabinet layouts, another team can create the required software in parallel. Through the use of symbolic variables in the software, to this point in the project knowledge of the structure of the hardware is not required. Only through automatic import of the ECAD data into the SolutionCenter will a link be established between symbolic variables and the hardware used, and an operable software module be generated.

Variants, extensions or corrections in ECAD project planning are no problem – the software module will simply be re-generated with the changed and newly-imported ECAD data.



## CAE/CAD data

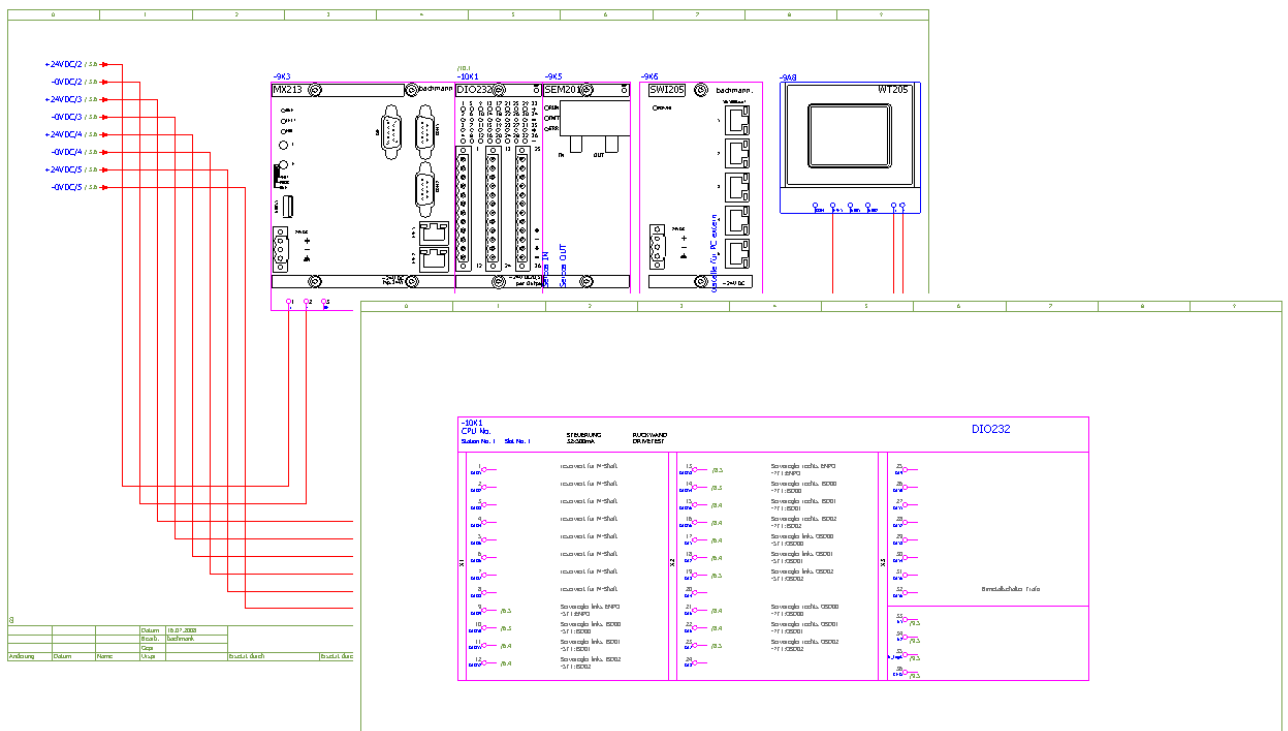
### ePLAN library

The ePLAN library contains device data, macros and technical documentation of all automation components: M1 hardware, visualization hardware and S1 servo system.

- Direct transfer from the portal into the electrical project planning
- Tested and assured quality through Certification
- Ongoing update and extension
- Support for the entire electrical project planning
  - circuit diagrams, control cabinet layouts, Overview drawings, PLC configurations and spare part documentation
- Support for implementation of the library
- Use of design software ePLAN P8 and higher

### ECAD import in the SolutionCenter

- Software is created with symbolic variables
- Linking of the symbolic variables with the hardware used through import of the ECAD data into the SolutionCenter
- An operable software module is generated
- Variants, extensions, or corrections in the ECAD project planning can be easily integrated at any time through subsequent import



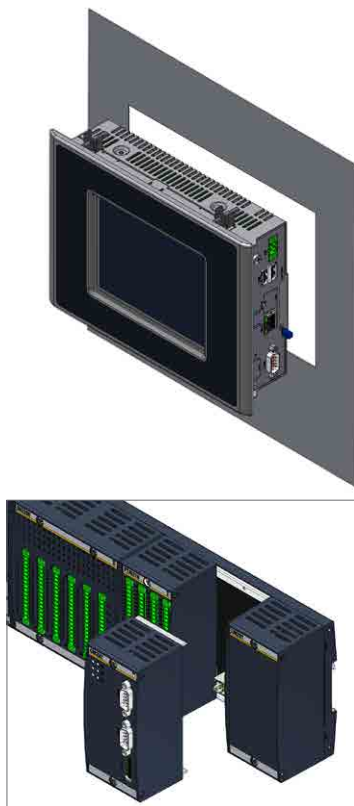


### 3D-CAD model library for control cabinet design

Control cabinets are increasingly being designed with 3D-assisted programs in order to guarantee an optimal placement of the components and the wiring. Bachmann electronic supports its customers in this engineering process and makes a library available for this purpose.

The 3D-CAD model library contains the versioned 3D models of the controller and terminal products. The 3D models are created on a 1:1 scale. The STEP format was chosen so that it can be further processed by all major 3D drawing programs. The models show the external details of the products at full resolution so that a realistic appearance for the 3D design is facilitated. Internal details are largely masked out, which achieves a considerable reduction of the data size.

Bachmann electronic provides this library without charge to its customers for standard products. Libraries can be created for customer-specific products if needed.



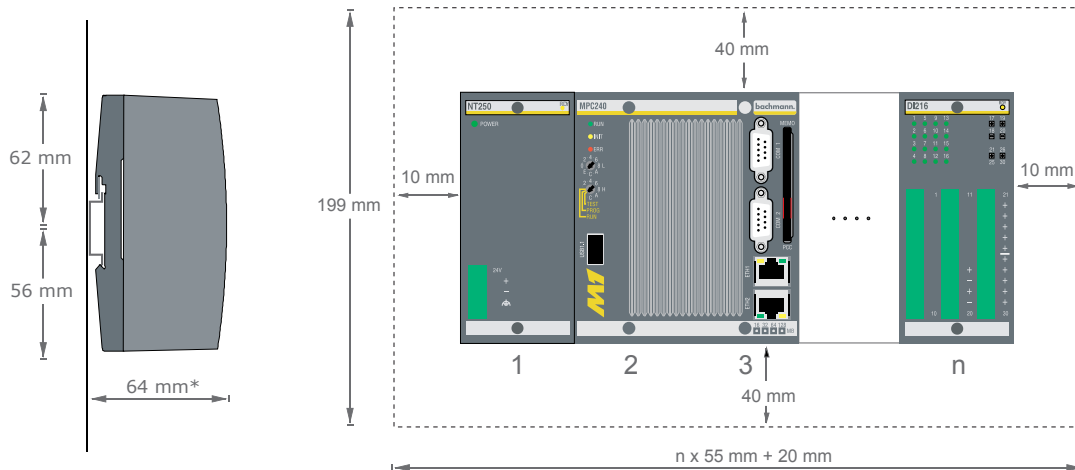
#### 3D-CAD model library

- Detailed display of the products in the STEP 3D exchange format
- Data reduced to the required Data volume
- Labeling of the 3D models with the product version number

# Installation in the control cabinet / housing

## M1 controller hardware

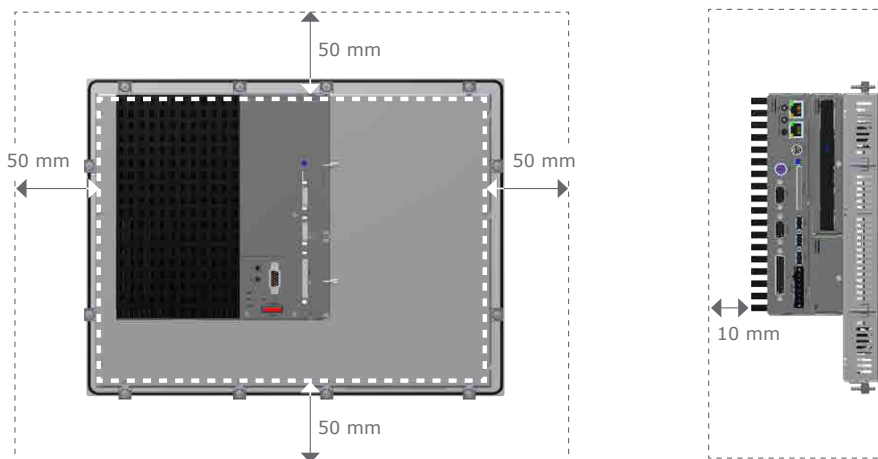
UL/CSA regulations and those of the EU Directive 73/23 EC (Low-voltage Directive) specify that controllers be mounted in a cabinet, an enclosure or a closed operating area in order to meet the requirements for electrical safety. When determining the spatial requirements of an M1 controller, certain minimum distances between the mounting rack and the adjacent fixtures must be considered



\*for cables an additional movement space of at least 30 mm must be provided. When using high covers for the D-SUB connectors more space can also be required.

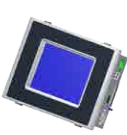
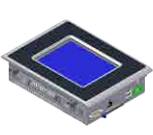
## HMI systems

In order to protect against the potential danger of overheating, the visualization equipment should be mounted in a cabinet or housing, with the minimum distances specified below.

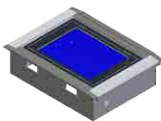


Note: Every device series can have lower minimum distances upon request, depending on the specific conditions.

**Installation in the control cabinet\***

|                  | Vertical                                                                          | Interfaces<br>Bottom/top                                                          | 45° angle                                                                          | Horizontal                                                                          |
|------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                  |  |  |  |  |
| CT200 series     | 50 °C                                                                             | 50 °C                                                                             | 50 °C                                                                              | 45 °C                                                                               |
| OT100 series     | 60 °C                                                                             | 60 °C                                                                             | 60 °C                                                                              | 55 °C                                                                               |
| OT200 series**   | 50 °C                                                                             | 50 °C                                                                             | 50 °C                                                                              | 45 °C                                                                               |
| OT1300 series    | 60 °C                                                                             | 60 °C                                                                             | 60 °C                                                                              | 55 °C                                                                               |
| WT300 series     | 50 °C                                                                             | 45 °C                                                                             | 45 °C                                                                              | 45 °C                                                                               |
| IPC300 series**  | 50 °C                                                                             | 45 °C                                                                             | 45 °C                                                                              | 45 °C                                                                               |
| IPC1400 series** | 50 °C                                                                             | 45 °C                                                                             | 45 °C                                                                              | 45 °C                                                                               |

**Installation in the control housing**

|                  | Vertical                                                                            | Horizontal                                                                            |
|------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|                  |  |  |
| CT200 series     | 45 °C                                                                               | 40 °C                                                                                 |
| OT100 series     | 55 °C                                                                               | 50 °C                                                                                 |
| OT200 series**   | 45 °C                                                                               | 40 °C                                                                                 |
| OT1300 series    | 55 °C                                                                               | 50 °C                                                                                 |
| WT300 series     | 45 °C                                                                               | 40 °C                                                                                 |
| IPC300 series**  | 45 °C                                                                               | 40 °C                                                                                 |
| IPC1400 series** | 45 °C                                                                               | 40 °C                                                                                 |

\* Subject to observation of the defined minimum clearances and surrounding volume in the control cabinet.

\*\* Maximum ambient temperature, individual device variants may vary (see user manual for detailed information).

## Dimensions – HMI devices

| Dimensions          |                  |
|---------------------|------------------|
| Device              | W x H x D (mm)   |
| CT series           |                  |
| CT205               | 212 x 156 x 49   |
| CT205M              | 212 x 156 x 49   |
| CT205V              | 212 x 156 x 49   |
| OT series           |                  |
| OT115/R/BE1         | 170 x 128 x 50   |
| OT115/R/BE2         | 170 x 160 x 50   |
| OT205/BE1           | 212 x 156 x 49   |
| OT205/V/BE1         | 270,5 x 175 x 49 |
| OT205/M/BE1         | 212 x 156 x 49   |
| OT1310/BE1/GT1G0    | 310 x 234 x 68   |
| OT1310/BE1/CC/GT1G0 | 310 x 234 x 68   |
| OT1312/BE1/GT1G0    | 341 x 253 x 68   |
| OT1312/BE1/CC/GT1G0 | 341 x 253 x 68   |
| OT1315/BE1/GT1G0    | 406 x 308 x 75   |
| OT1319/BE1/GT1G0    | 471 x 375 x 76   |
| OT1312/BE1/CE1G1    | 341 x 253 x 74   |
| WT series           |                  |
| WT310/BE1           | 307 x 233 x 94   |
| WT312/BE1           | 307 x 256 x 97   |
| WT315/BE1           | 405 x 308 x 97   |

## Dimensions – industrial PCs

| Dimensions  |                                                    |
|-------------|----------------------------------------------------|
| Device      | W x H x D (mm)                                     |
| IPC series  |                                                    |
| IPC310/BE1  | 307 x 233 x 94                                     |
| IPC312/BE1  | 337 x 256 x 97                                     |
| IPC315/BE1  | 405 x 308 x 97                                     |
| IPC1410/BE1 | 314 x 240 x 110                                    |
| IPC1412/BE1 | 337 x 256 110 <sup>2)</sup> /159 <sup>3)</sup>     |
| IPC1415/BE1 | 405 x 308 x 124 <sup>2)</sup> /171 <sup>3)</sup>   |
| IPC1419/BE1 | 470 x 374,6 x 121 <sup>2)</sup> /170 <sup>3)</sup> |

<sup>1)</sup> for 19" installation

<sup>2)</sup> without attachment/expansion units

<sup>3)</sup> with 2 attachments (1 attachment = 25 mm)

## Dimensions – control system

| Dimensions                  |                |            |
|-----------------------------|----------------|------------|
| Module                      | W x H x D (mm) | Weight (g) |
| Processor modules           |                |            |
| MPC2xx                      | 110 x 119 x 61 | 650        |
| ME203/x                     | 55 x 119 x 61  | 230        |
| ME203/xN                    | 55 x 119 x 61  | 310        |
| MX213                       | 110 x 119 x 61 | 670        |
| MH212/x                     | 220 x 119 x 96 | 1870       |
| Safety modules              |                |            |
| SLC284                      | 110 x 119 x 61 | 360        |
| SDI208                      | 55 x 119 x 61  | 210        |
| SDO204                      | 55 x 119 x 61  | 230        |
| Digital input/output module |                |            |
| DI2xx/xx                    | 55 x 119 x 61  | 200        |
| DO2xx/xx                    | 55 x 119 x 61  | 240        |
| DOR206/xx                   | 55 x 119 x 61  | 220        |
| DIO216/xx                   | 55 x 119 x 61  | 210        |
| DIO232                      | 55 x 119 x 61  | 210        |
| DIO248                      | 110 x 119 x 61 | 370        |
| DIO264                      | 110 x 119 x 61 | 390        |
| DIO280/x                    | 110 x 119 x 61 | 385        |
| Analog input/output module  |                |            |
| GIO212                      | 55 x 119 x 61  | 200        |
| AIO208                      | 55 x 119 x 61  | 200        |
| AIO216                      | 55 x 119 x 61  | 200        |
| AI204/x                     | 55 x 119 x 61  | 210        |
| AI20x/SI                    | 55 x 119 x 61  | 210        |
| AO202                       | 55 x 119 x 61  | 200        |
| AO208/Ix                    | 55 x 119 x 61  | 230        |
| AO202/SI                    | 55 x 119 x 61  | 200        |
| AO204/SI                    | 55 x 119 x 61  | 210        |
| AIO288/x                    | 55 x 119 x 61  | 240        |
| PTAI216x                    | 55 x 119 x 61  | 220        |
| TI214/x                     | 55 x 119 x 61  | 210        |
| DMS202                      | 55 x 119 x 61  | 235        |
| AIC212x                     | 110 x 119 x 61 | 360        |
| Technology module           |                |            |
| CNT204/Hx                   | 55 x 119 x 61  | 200        |
| CNT204/R                    | 55 x 119 x 61  | 225        |
| ISI222/x                    | 55 x 119 x 61  | 235        |
| ACR222/2                    | 55 x 119 x 61  | 265        |
| PWM202                      | 55 x 119 x 61  | 220        |
| Interface module            |                |            |
| RS204/x                     | 55 x 119 x 61  | 200        |
| EM213x                      | 55 x 119 x 61  | 340        |
| SWI205/S                    | 55 x 119 x 61  | 240        |
| Bus module                  |                |            |
| BEM211                      | 55 x 119 x 61  | 195        |
| BES212                      | 55 x 119 x 61  | 205        |
| BES222                      | 55 x 119 x 61  | 205        |
| BES202/N                    | 55 x 119 x 61  | 290        |
| BES2x2/N                    | 55 x 119 x 61  | 290        |
| FCS214/x                    | 55 x 119 x 61  | 290        |
| Grid measurement module     |                |            |
| GSP274                      | 165 x 119 x 75 | 640        |
| GMP232                      | 110 x 119 x 61 | 600        |
| GM260                       | 55 x 119 x 61  | 190        |

## Dimensions – control system

| Dimensions                                     |                |            |
|------------------------------------------------|----------------|------------|
| Module                                         | W x H x D (mm) | Weight (g) |
| Bus modules                                    |                |            |
| FM211                                          | 55 x 119 x 70  | 320        |
| FM222                                          | 55 x 119 x 70  | 400        |
| FS221/N                                        | 55 x 119 x 70  | 350        |
| FS222/N                                        | 55 x 119 x 70  | 425        |
| CM202x                                         | 55 x 119 x 61  | 200        |
| CS200/x                                        | 55 x 119 x 61  | 300        |
| DPM200                                         | 55 x 119 x 61  | 200        |
| DNM201                                         | 55 x 119 x 61  | 205        |
| SEM201                                         | 55 x 119 x 72  | 200        |
| Dezentralized CAN modules                      |                |            |
| DIO16-Cx                                       | 110 x 119 x 61 | 485        |
| DIO32-C                                        | 164 x 119 x 61 | 695        |
| DIO48-C                                        | 228 x 119 x 61 | 750        |
| DIO264-C                                       | 137 x 119 x 61 | 250        |
| DA3284-Cx                                      | 228 x 119 x 61 | 850        |
| TCO2xx-C                                       | 137 x 119 x 61 | 250        |
| Power supply modules / bus rails / accessories |                |            |
| NT250/48                                       | 55 x 119 x 61  | 300        |
| NT255x                                         | 55 x 119 x 61  | 300        |
| VP200/x                                        | 55 x 119 x 61  | 260        |
| LM201                                          | 55 x 119 x 61  | 115        |
| BS201                                          | 55 x 119 x 14  | 260        |
| BS202                                          | 110 x 119 x 22 | 150        |
| BS203x                                         | 165 x 119 x 22 | 260        |
| BS204x                                         | 220 x 119 x 22 | 365        |
| BS205x                                         | 275 x 119 x 22 | 440        |
| BS206x                                         | 330 x 119 x 22 | 515        |
| BS207x                                         | 385 x 119 x 22 | 620        |
| BS208x                                         | 440 x 119 x 22 | 690        |
| BS209x                                         | 495 x 119 x 22 | 740        |
| BS210x                                         | 550 x 119 x 22 | 880        |
| BS211x                                         | 605 x 119 x 22 | 960        |
| BS212x                                         | 660 x 119 x 22 | 1000       |
| BS213x                                         | 715 x 119 x 22 | 1100       |
| BS214x                                         | 770 x 119 x 14 | 1200       |
| BS215x                                         | 825 x 119 x 22 | 1310       |
| BS216x                                         | 880 x 119 x 22 | 1420       |
| BS203/S                                        | 165 x 137 x 22 | 280        |
| BS204/S                                        | 220 x 137 x 22 | 385        |
| BS205/S                                        | 275 x 137 x 22 | 460        |
| BS206/S                                        | 330 x 137 x 22 | 535        |
| BS207/S                                        | 385 x 137 x 22 | 640        |
| BS208/S                                        | 440 x 137 x 22 | 710        |
| BS209/S                                        | 495 x 119 x 22 | 760        |
| BS210/S                                        | 550 x 137 x 22 | 900        |
| BS211/S                                        | 605 x 137 x 22 | 980        |
| BS212/S                                        | 660 x 137 x 22 | 1020       |
| BS213/S                                        | 715 x 137 x 22 | 1120       |
| BS214/S                                        | 770 x 137 x 14 | 1220       |
| BS215/S                                        | 825 x 137 x 22 | 1330       |
| BS216/S                                        | 880 x 137 x 22 | 1440       |



## Bachmann training: profit from our knowledge.

Availability of qualified personnel is a crucial factor for assurance of product quality. Consequently employees at all levels of an enterprise must be offered advanced training on a regular basis. We are pleased to support you in this regard: with our extensive Bachmann training offering.

### **Our offering**

Our training offering extends from proven standard training courses to training courses that are individually tailored to your requirements.

### **Our procedure**

Our modularly structured training concept makes it possible to put together a training program that meets the needs of your company.

### **Your result**

Qualified employees and documentation that meets the requirements of your training program.

We would be pleased to create a training program for your company!  
Contact us: [training@bachmann.info](mailto:training@bachmann.info)



Note: Additional information on this topic  
is provided in our training catalog  
»bachmann.training«.



# Imprint

---

## **Copyright © 2014 by Bachmann electronic GmbH**

---

Bachmann electronic GmbH  
Kreuzäckerweg 33  
6800 Feldkirch, Austria  
P +43 (0) 55 22/34 97-0  
info@bachmann.info  
www.bachmann.info

### **Publisher:**

Bachmann electronic GmbH, Feldkirch

Product overviews, operating manuals, manuals, and software are protected by copyright. Copying, duplication, translation or conversion to any electronic medium or machine readable form in whole or in part is prohibited. All other rights to the software are specified in the license provisions. Citation of products that do not come from Bachmann electronic GmbH, is for information purposes only and does not constitute misuse of trademarks. Bachmann electronic GmbH assumes no guarantee relative to the selection, performance or usability of these products. All rights reserved.

---



Specification subject to change – the product's characteristics are exclusively governed by the data of the respective user manual.

### Limitation of liability:

We have checked the content of the document for agreement with the described hardware / software. Nevertheless the possibility of deviations cannot be excluded; we cannot assume any liability for complete agreement. The information in this document is checked on a regular basis and necessary corrections will be included in subsequent editions.

---



