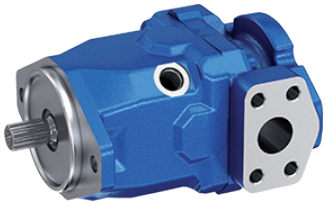
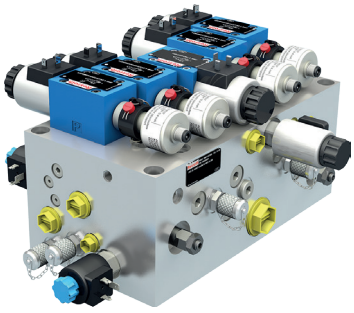
RE 08100-01
Edition: 2022-08
Replaces: 2014-12

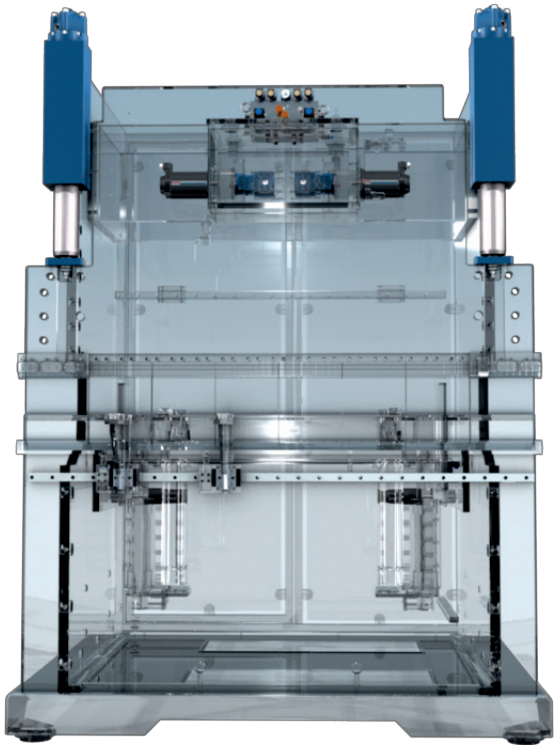
A Bosch Company

Pump-controlled, hydraulic Drives for Press Brakes

Technical Information





Content

Introduction

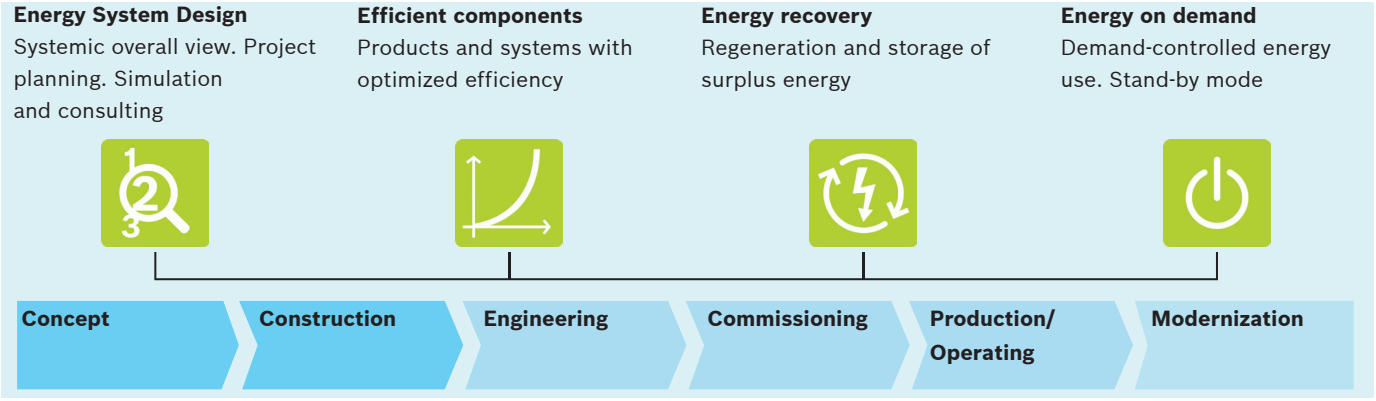
Hydraulic press brakes, which are used for precise forming of metal plate by means of defined bending, are increasingly being equipped with variable speed drives in order to save energy. The solution for this from Bosch Rexroth is called "Sytronix". With the use of intelligent drives and with optimal set-point values for torque and speed of rotation the motor-pump system provides performance tailored to the needs of each phase of the cycle.
The higher the proportion of partial-load operation, the greater the savings potential, as only the power for the movement of masses and deformation during the cycle is required.

This allows energy savings of up to 50%. In addition to the reduction of energy consumption, noise emissions are reduced by up to 10 dB(A) at the same time - the expense for secondary noise reducing measures is correspondingly reduced.
The components required for the Sytronix drive are configured for the specific requirements according to the modular design principle. Additionally there are various possibilities to extend the system with tool clamping and/or crowning. Sytronix systems are part of the Bosch Rexroth 4EE strategy for the energy reduction of machines and systems.

More & Less – The universal process for optimum energy efficiency

The energy efficiency of the machine life cycle can be optimized in all phases. Isolated individual measures, which are used in complex systems, normally lead only to limited success.
Bosch Rexroth understands the requirements and knows how to make full use of the potential of all technologies, whether electrical, hydraulic, individual components or integrated solutions.

Due to our decades of experience we are familiar with many complex dynamics. Our holistic system approach helps to identify all areas and make full use of potentials, where energy can be saved - from design to modernization.



Why variable Speed Drives, why Sytronix from Bosch Rexroth?

More

- Energy-saving subsidies/models from country - state - EU etc. (Rexroth is happy to provide support here)
- Increasing plant utilization through modernization measures with Sytronix
- Simple integration of Rexroth components into the safety control system enables status monitoring and, if desired, also diagnostics/monitoring
- End-to-end automation solution enables new approaches to maintenance concepts and a reduction in downtime
- Improvement of system efficiency by eliminating throttling losses in control valves
- Precise and highly dynamic oil quantity metering into the cylinder chambers with the 4Q principle due to the high dynamics of the servo motor-pump system

Less

- Energy savings of up to 50 % reduces operating costs "TCO" and lowers CO2 emissions
- Noise reduction of up to 10 dB(A) in hydraulic power units
- Reduction of investment costs in the
  - Cooling system (due to reduced heat input into the oil)
  - Electric drives and motors capable of multiple overloads
  - 4Q pumps, from 0.... well over 3000 RPM possible
  - Optimal fluid reservoirs
- Reduced space requirements due to continued highest hydraulic power density and related component savings in the hydraulic system

Standard Systems and Hydraulic Parameters

Press force (at approx. 280 bar)	Nominal size from block (up to approx. volume flow)	Nominal size of the pump A10FZG... (single/double/...)	Nominal size SFA... (ZSF...) Suction /pre-fill valve	Δp_{min} holding pressure X2 -> PB	Max. system pressure
up to 3000 kN	NG 6 up to 55 l/min	3 - 6 - 8 - 10 ccm 12 - 14 - 16 - 18 ccm 21 - 23 - 26 - 28 ccm	NG 32 (...200 l/min) NG 40 (... 300 l/min) NG50 (... 500 l/min)	min. 40 bar	... 315 bar
up to 12000 kN	NG 10 up to 120 l/min		NG 50 (...500 l/min) NG 63 (... 800 l/min) NG 80 (... 1200 l/min)		
up to 25000 kN	NG 16 up to 200 l/min		NG 80 (...1200 l/min) NG 100 (... 1900 l/min) NG 125 (... 3000 l/min)		

All information/characteristics are approximate values and serve for initial system design.
Furthermore, additional oil velocities with regard to the diameter and length of the oil lines must also be taken into account. See page 13.

Questionnaire for the Dimensioning of Sytronix Pump-controlled Solutions for Press Brakes

System parameters / details / design criteria

a) **Cylinder**

Piston diameter _____ in mm
Piston rod diameter _____ in mm
Stroke _____ in mm
Number (1 or 2 cylinders) _____
Distance between the cylinders _____ in mm

b) **Forces and pressures**

Max. required pressing force _____ in kN
Weight ram (incl. bending beam, without tool) _____ in kg

c) **Positioning accuracy**

Repeat accuracy _____ in mm

d) **Safety regulations and functions**

CE guideline EN 12622 ☐ Yes
Other regulations, standards ☐ Yes Country, name _____
No regulations specified ☐ Yes

e) **Selectable options for the offer**

e.1) **Hydraulic crowning** ☐ Yes ☐ No
Filling capacity _____ in Liter
Filling pressure _____ in bar
Filling time _____ in s

e.2 **Hydraulic upper tool clamping** ☐ Yes ☐ No

With accumulator ☐ Yes

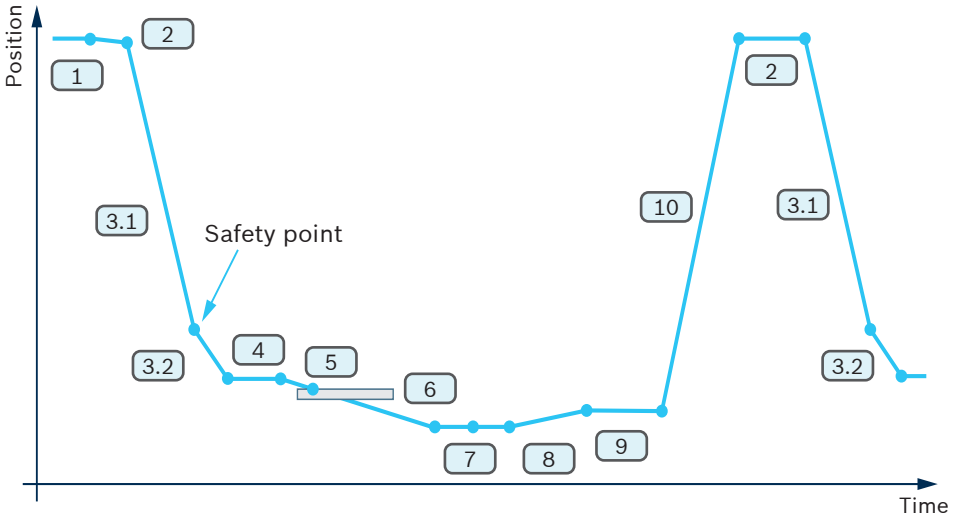
Filling capacity _____ in Liter
Filling pressure _____ in bar
Filling time — Clamping open _____ in s
— Clamping closed _____ in s

e.3 **Hydraulic lower tool clamping** ☐ Yes ☐ No

With accumulator ☐ Yes

Filling capacity _____ in Liter
Filling pressure _____ in bar
Filling time — Clamping open _____ in s
— Clamping closed _____ in s

Questionnaire for the Dimensioning of Sytronix Pump-controlled Solutions for Press Brakes



1 Standstill - Press "OFF"
2 Press "ON" - Wait at TDC
3.1 Rapid downward
3.2 Creep speed downwards
4 Waiting time mute position
5 Pressing
6 STOP at BDC
7 Decompression
8 Creep speed upwards
9 Waiting time before rapid upward
10 Rapid upward
... continue again at point 2 **OR**
... back to point 1

System parameters / details / design criteria

3.1 **Rapid downward**

Stroke length, distance _____ in mm
Speed _____ in mm/s
Acceleration, deceleration _____ in mm/s²

3.2 **Creep speed downwards**

Stroke length, distance – Standard 6 mm distance to workpiece _____ in mm
Speed – Standard 10 mm/s _____ in mm/s
Acceleration, deceleration _____ in mm/s²

4 **Waiting time mute position**

Holding period _____ in s

5 **Pressing**

Stroke length, distance _____ in mm
Speed _____ in mm/s
Acceleration, deceleration _____ in mm/s²

6 **STOP at BDC** _____ in s

7 **Decompression** _____ in s

8 **Creep speed upwards**

Stroke length, distance _____ in mm
Speed _____ in mm/s
Acceleration, deceleration _____ in mm/s²

9 **Waiting time before rapid upward**

Holding period _____ in s

10 **Rapid upward**

Stroke length, distance _____ in mm
Speed _____ in mm/s
Acceleration, deceleration _____ in mm/s²

2 **Typ. break at TDC after the cycle (manual operation)**

Manual operation – long _____ in s
Automatic mode – short _____ in s

Components and Structure of a Sytronix System

For press brake customers who wish to use variable speed pump systems in their presses, Rexroth offers pre-configured solution packages according to press force, cylinder dimensions and the required movement cycle (see page 3).
The basic schematic (independent of nominal size) configuration is shown in the following illustrations. The programmable logic controller (PLC) and the motion controller transmit the switching signals as well as the set-point signals for rotational speed and torque to the drive, which through the connection to the servo motor feeds electrical energy into the system. The axial piston pump, which is attached via a mechanical coupling, converts the electrical energy into hydraulic energy and pumps a volumetric flow via the hydraulic manifold block to the cylinder(s) of the press brake system. The manifold block with its parts list and the hydraulic circuit drawing conform to the currently valid standards for hydraulic press brakes. The axial piston pump works in 4-quadrant operation, i.e. extending and retracting of the cylinder is achieved directly via the pump, whereby throttling losses at the control edges of control valves are avoided.
By measuring the position of the cylinders the press brake is operated in closed-loop position control during the complete cycle.
The pre-fill valve is assembled on to the cylinder by the customer and achieves high volume flows during suction operation.

Additionally to the precise control and regulation of the machine additional sensor packages can achieve the functional extension of predictive maintenance and condition monitoring of the machine.

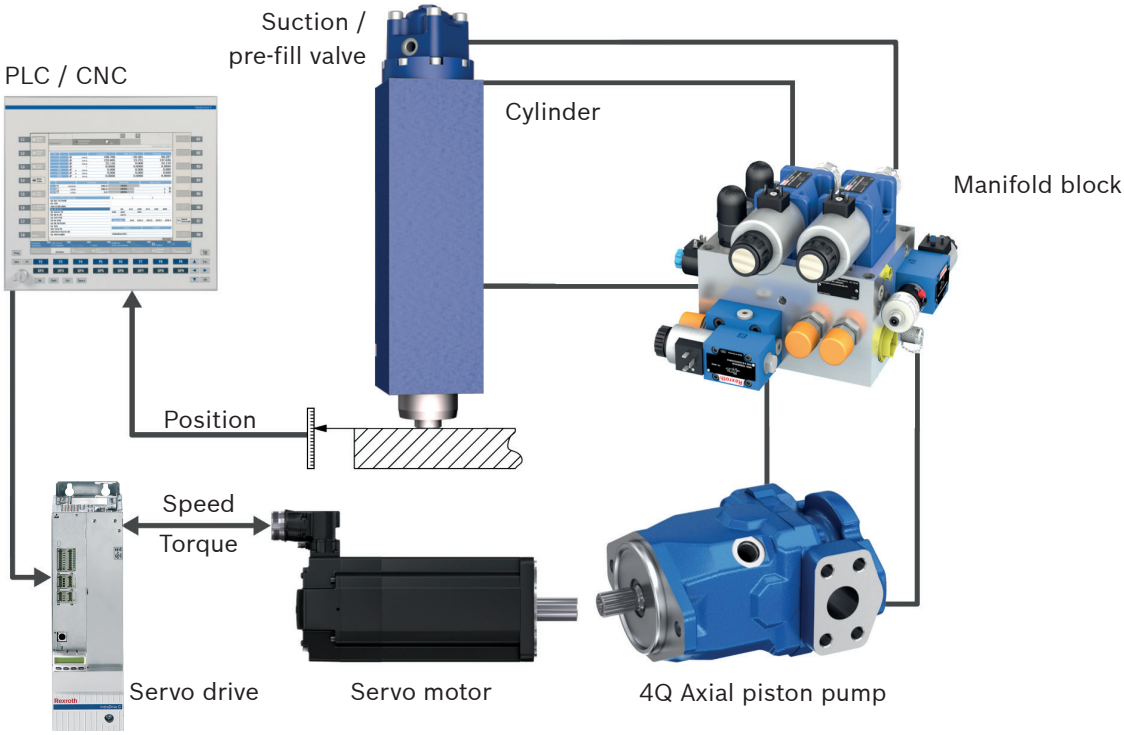
Efficiency improvement through:

- Elimination of throttling losses at control edges of a control valve
- Precise metering of the required oil quantity, optimized by the speed control of the dynamic servo motor
- No idle power: E-motor can be switched off if no volume flow or pressure is required for regulation

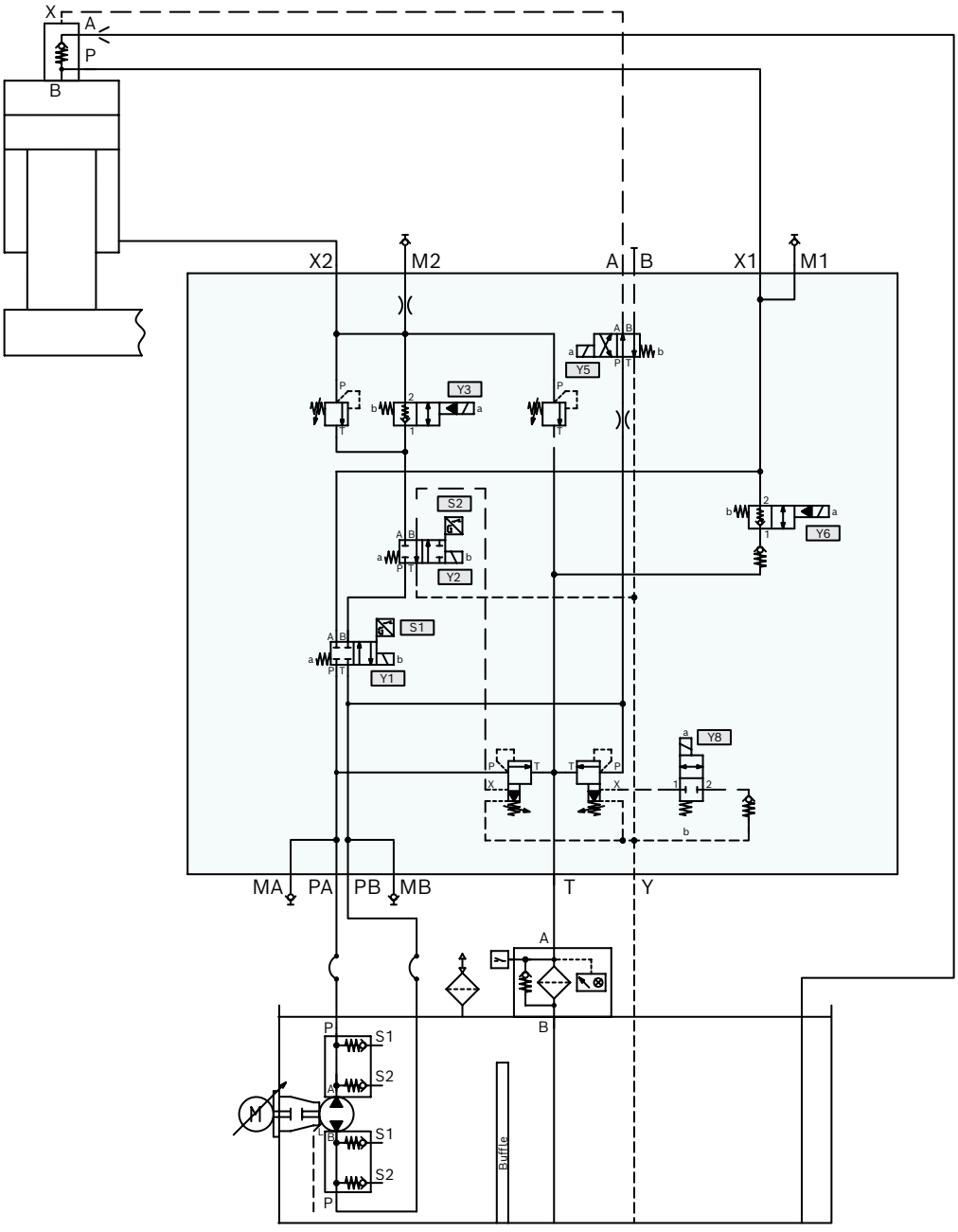
Positive impact on environmental aspects and operating costs:

- Energy consumption/costs and heat management/ CO2 reduction
- Reduction of the installed power (nominal size of the e-motor): it is possible to overload the servomotor significantly for a short time
- Reduced tank volume possible
- Reduction or elimination of media cooling
- Noise reduction: the rotational speed has a significant influence on the generation of noise

Sytronix system: Structure of a press brake cylinder axis



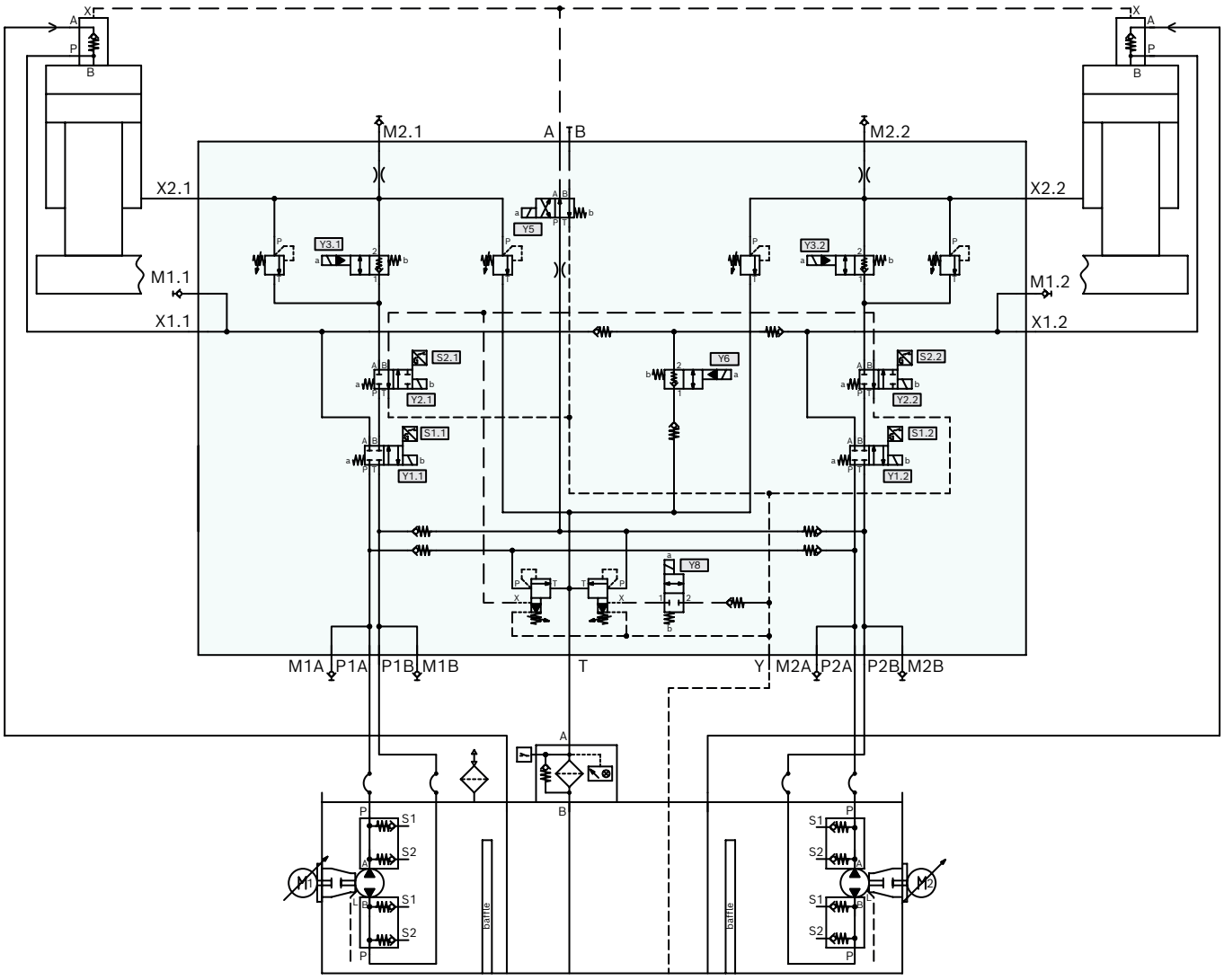
Sytronix System – Hydraulic Circuit Diagram with Single Block



Single block in size NG6, 10, 16

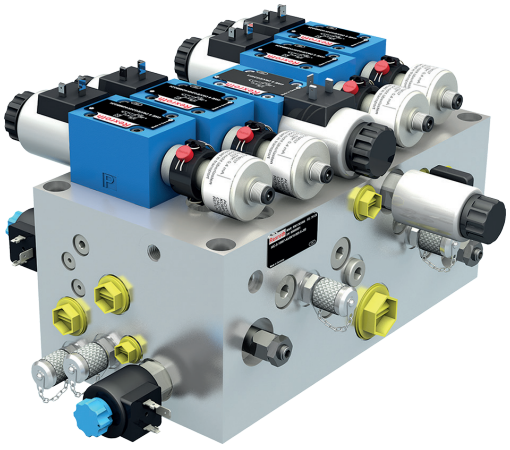
- With pre-fill valve SFA/ZSF...
- Suction line as short as possible, one nominal size larger than the pre-fill valve nominal size
  e.g. size NG50 ↔ suction line NW63
- Run the X2 line delta-p optimized
  (possibly a size bigger than the X1 line)

Sytronix System – Hydraulic Circuit Diagram with Central Block

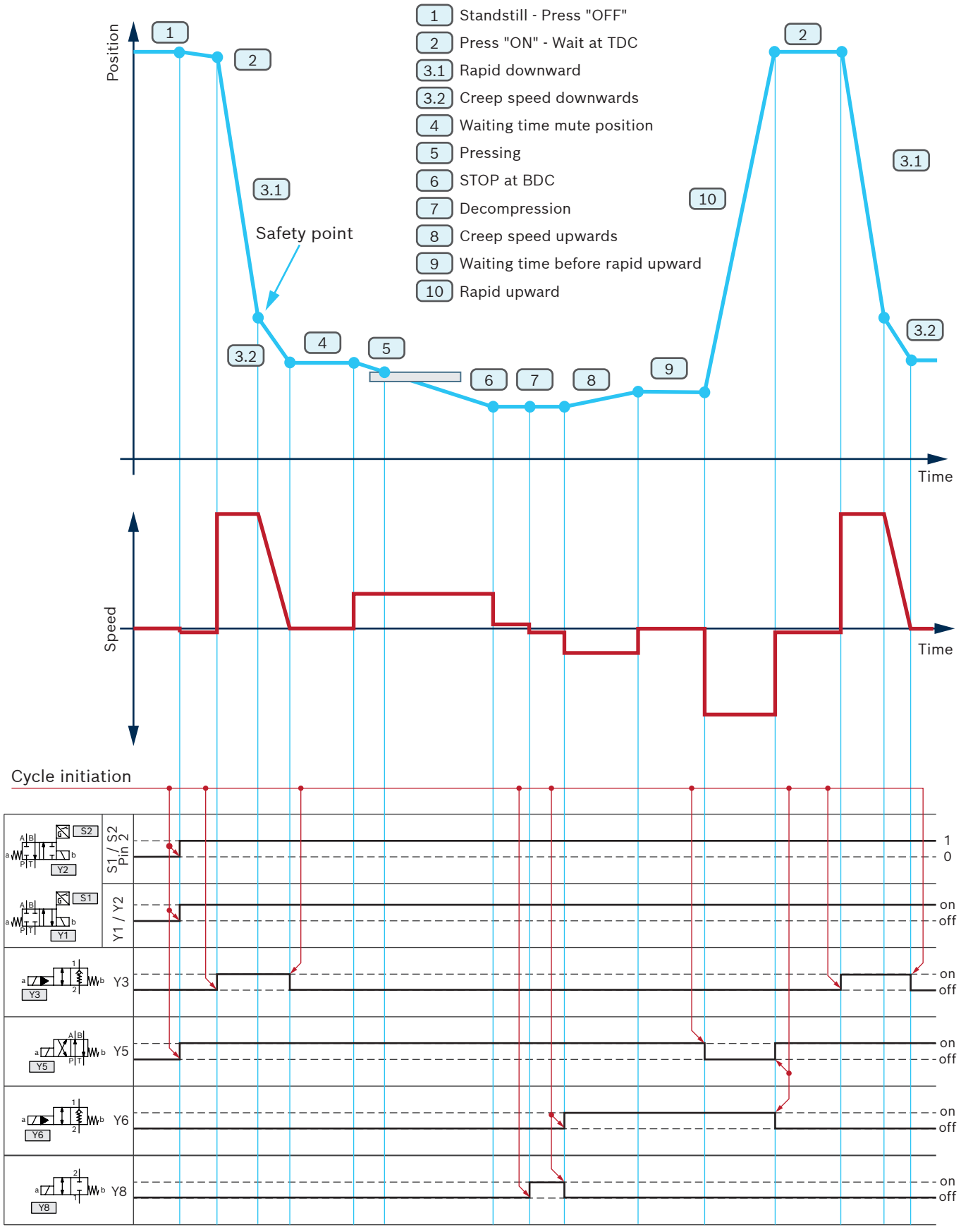


Central block in size NG6, 10, 16

- With pre-fill valve SFA/ZSF...
- Suction line as short as possible, one nominal size larger than the pre-fill valve nominal size
  e.g. size NG50 ↔ suction line NW63
- The central block and the motor-pump systems should be placed centrally between the cylinders.
  Equal line lengths between "motor pump to the control block to cylinder"
- Run the X2 line delta-p optimized
  (possibly a size bigger than the X1 line)
- Use of the central block with distance between both cylinders smaller < 3 m



Flow Diagram



Sytronix Solution for Press Brakes

"Dissolved" construction

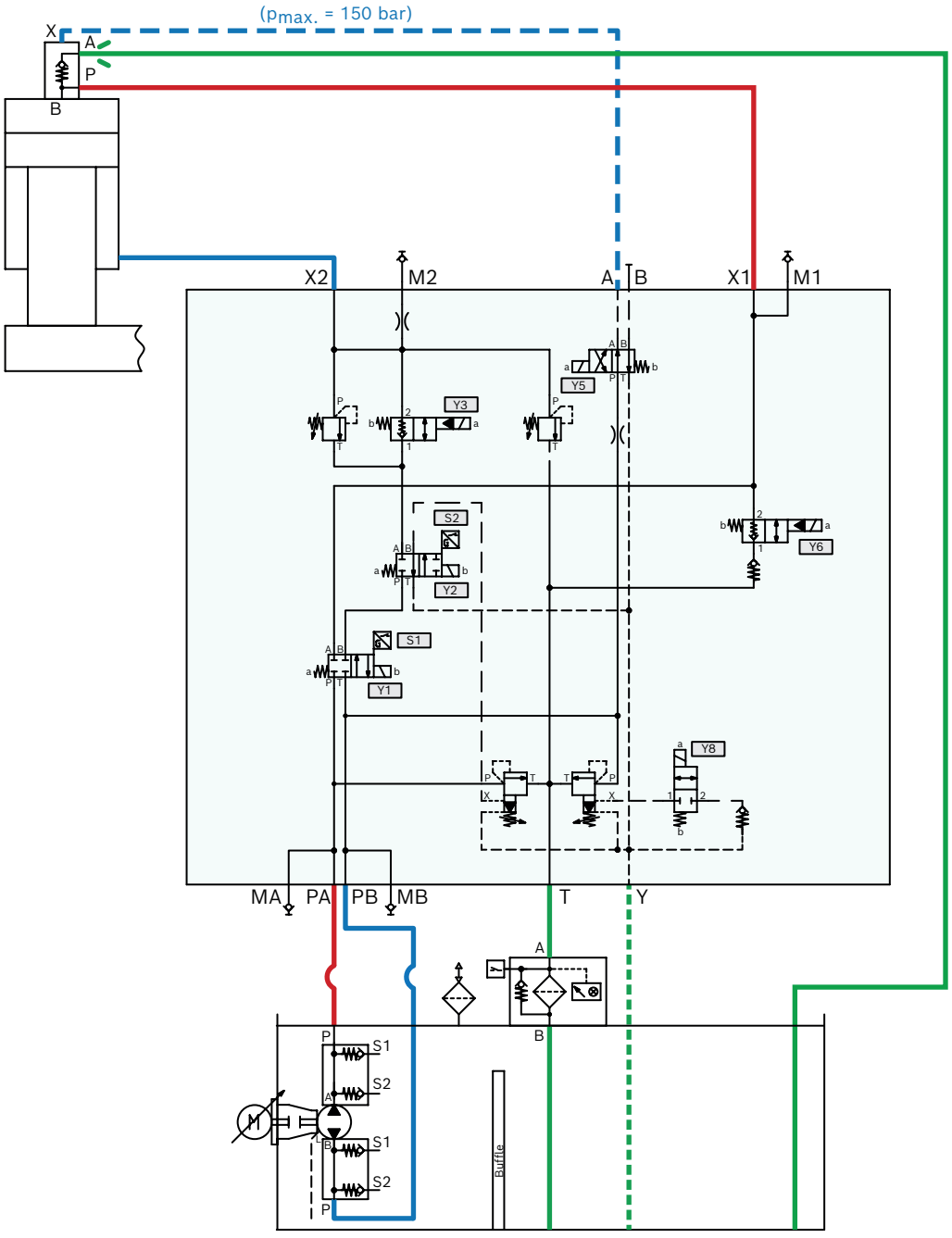
Bosch Rexroth enables you to make individual solutions by means of a dissolved construction. Rexroth carries out the system engineering of the complete system. You as the customer can then procure the components as individual parts, integrate them into your machine and build your system independently and individually.
Rexroth can help here with the system implementation. Here we exploit Rexroth's complete component portfolio from small to large. The following table shows a possible/typical overview of the included components.

Parts list of an exemplary Sytronix solution in "dissolved" construction

Designation	Type
Main manifold block	AGEV2-...
Fixed displacement pump	A10FZG...
Suction block	HIC-S-...
Pump carrier	PSG...
Damping ring	DT...
Clamp hub pump	ROTEX...
Gear ring	ROTEX...
Clamp hub motor	ROTEX...
Return filter	10TEN...PWR10...
Filter element	1...PWR10...
Inline filter	110LEN...PWR10...
Filter element	2...PWR10...
Filter display	WE...; WO...
Cable socket, plug, cable sets	3PZ4...; 4PZ24...; usw.
Tank ventilation filter	TLF...; BF...;
Pre-fill valve	SFA...; ZSF...;
Servo motor	MS2N...; MAD...; (MSK...)
Servo drive (incl. control section)	HCS... (CSB...)
Mains choke	HNL...
Mains filter	NFD...
Motor power cable	RL...; RKL...
Motor encoder cable	RG...; RKG...
etc.	

Sytronix Solution for Press Brakes

Hydraulic circuit diagram – "dissolved" construction



Recommended oil speeds

Suction lines	**approx. p = 0 ... 1 bar***	**approx. 0,5 ... 1 m/s**	**Line drawn in green**
Low pressure lines	**approx. p = 2 ... 100 bar***	**approx. 2 ... 4 m/s**	**Line drawn in blue**
Pressure lines	**approx. p = 150 ... 350 bar***	**approx. 5 ... 12 m/s**	**Line drawn in red**

(*) absolute pressures !

Information on the design of hydraulic piping

- As few deflections as possible
- As few fittings as possible
- Optimum pipe diameter

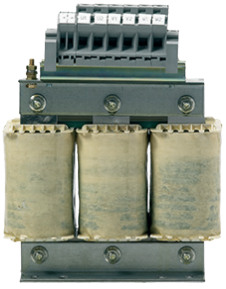
Sytronix Solution for Press Brakes

"Power unit" construction

Bosch Rexroth provides you with standardized power unit solutions.
System Engineering is carried out by Rexroth based upon information from the customer and a complete Sytronix power unit with all components is assembled as a ready to install unit.

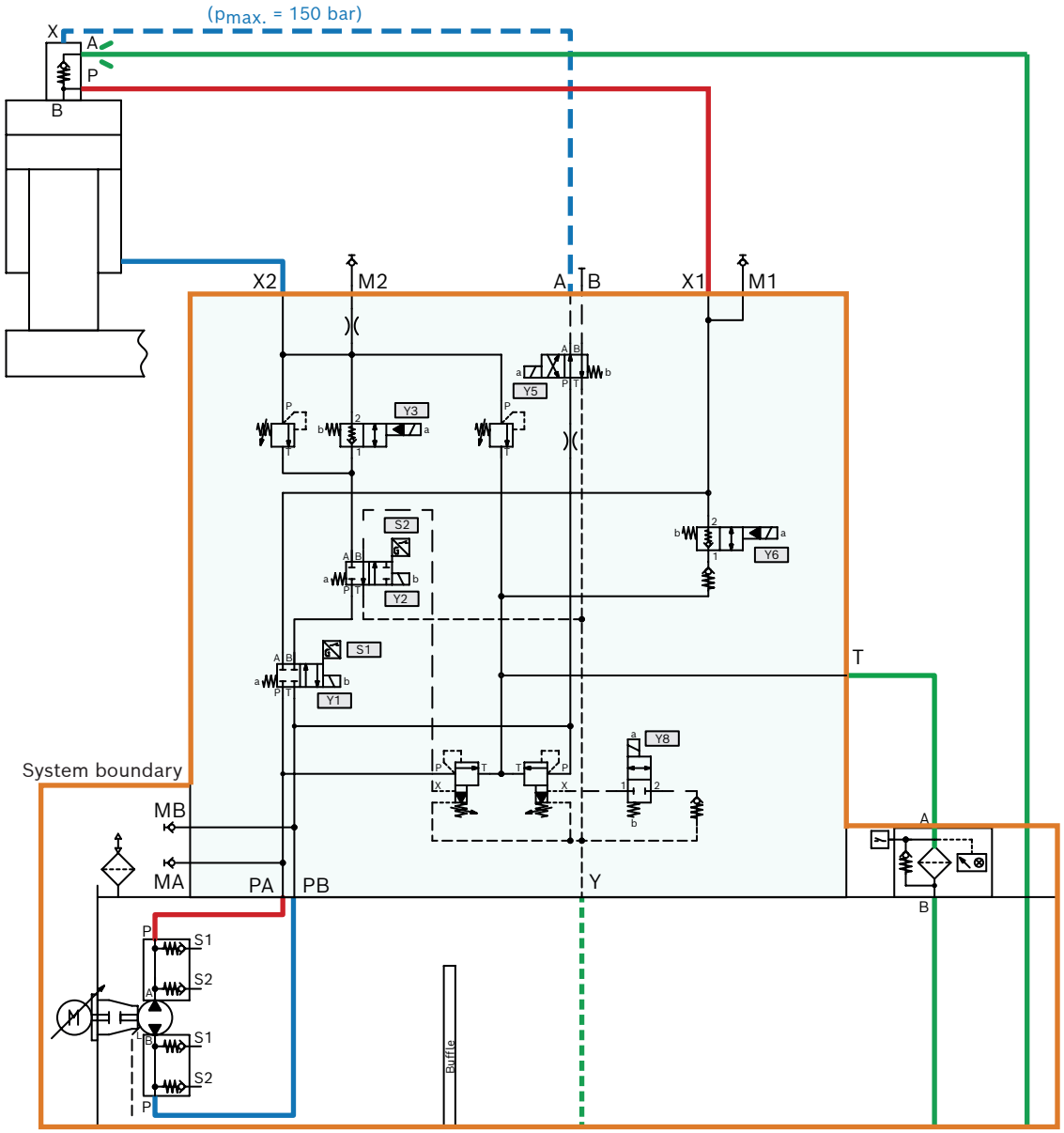
Parts list of an exemplary Sytronix solution in "power unit" construction

Designation	Type
Power unit	ABKAG...-...
Clamp hub motor	ROTEX...
Cable socket, plug, cable sets	3PZ4...; 4PZ24...; usw.
Pre-fill valve	SFA...; ZSF...;
Servo drive (incl. control section)	HCS... (CSB...)
Mains choke	HNL...
Mains filter	NFD...
Motor power cable	RL...; RKL...
Motor encoder cable	RG...; RKG...
etc.	



Sytronix Solution for Press Brakes

Hydraulic circuit diagram – "power unit" construction



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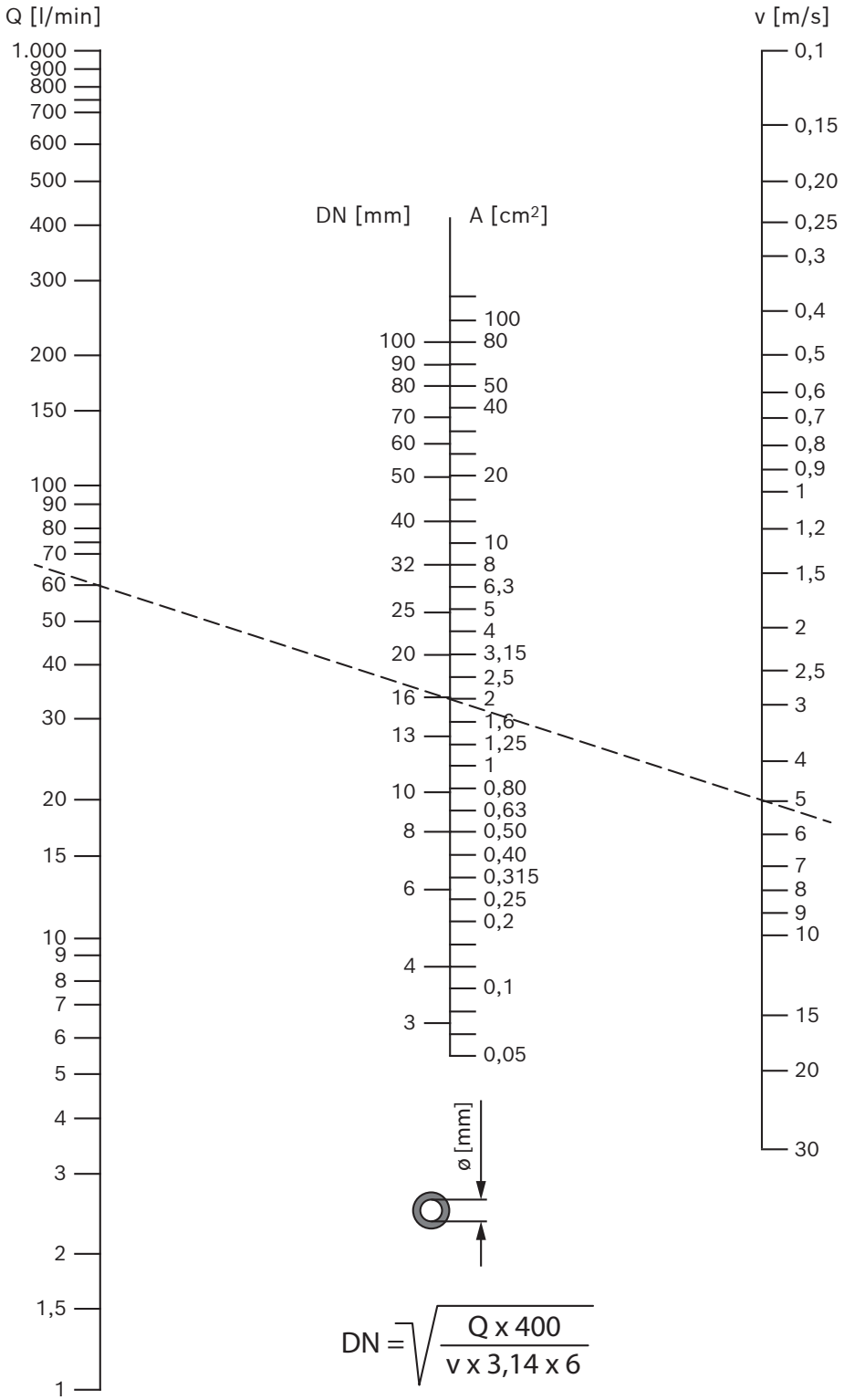
(*) absolute pressures !

Information on the design of hydraulic piping

- As few deflections as possible
- As few fittings as possible
- Optimum pipe diameter

Nomogram for Determining the Pipe Inside Diameter



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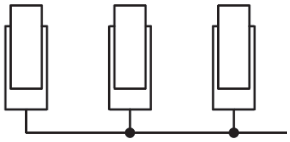
(*) absolute pressures !

Overview of Variants for Crowning and Tool Clamping

Crowning

Filling capacity			Liter	
Filling time			Seconds	
Mechanical pressure adjustment	or		bar	BOM1
Proportional pressure adjustment	or		bar	BOM2

(Info: Set point pressure characteristic, possibly valve amplifier)



Tool clamping – upper tool (Tool clamping always with electronic pressure switch!)

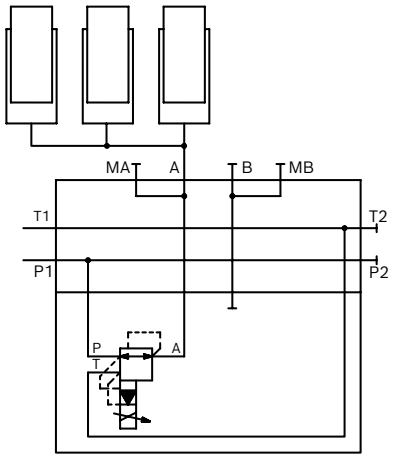
Filling capacity			Liter	
Filling time			Seconds	
De-energized clamping "OPEN"	or			
De-energized clamping "CLOSED"	or			
With accumulator	or			
Without accumulator	or			
Mechanical pressure adjustment	or		bar	WZKO1
Proportional pressure adjustment	or		bar	WZKO2

Tool clamping – lower tool (Tool clamping always with electronic pressure switch!)

Filling capacity			Liter	
Filling time			Seconds	
De-energized clamping "OPEN"	or			
De-energized clamping "CLOSED"	or			
With accumulator	or			
Without accumulator	or			
Mechanical pressure adjustment	or		bar	WZKU1
Proportional pressure adjustment	or		bar	WZKU2

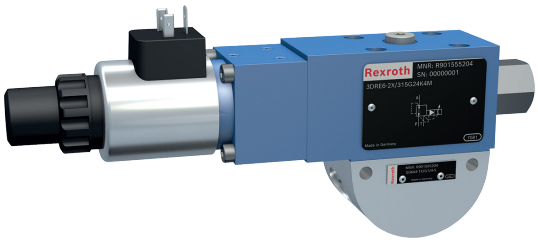
Overview of Variants for Crowning and Tool Clamping

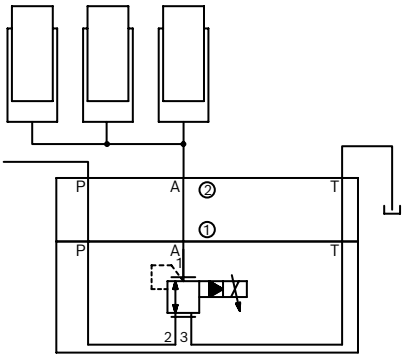
Example representations, combinations on HSR plates possible:



Crowning

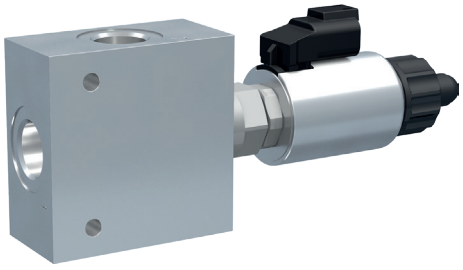
- with precise pressure control

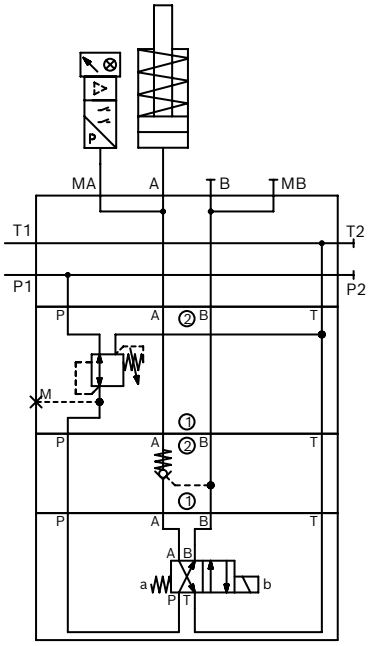




Crowning

- with standard pressure control



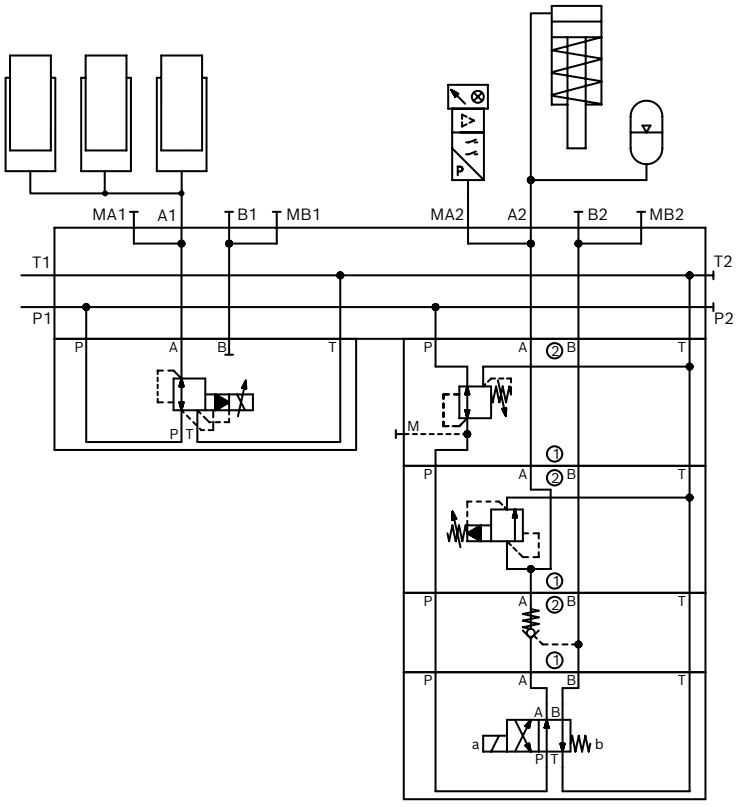


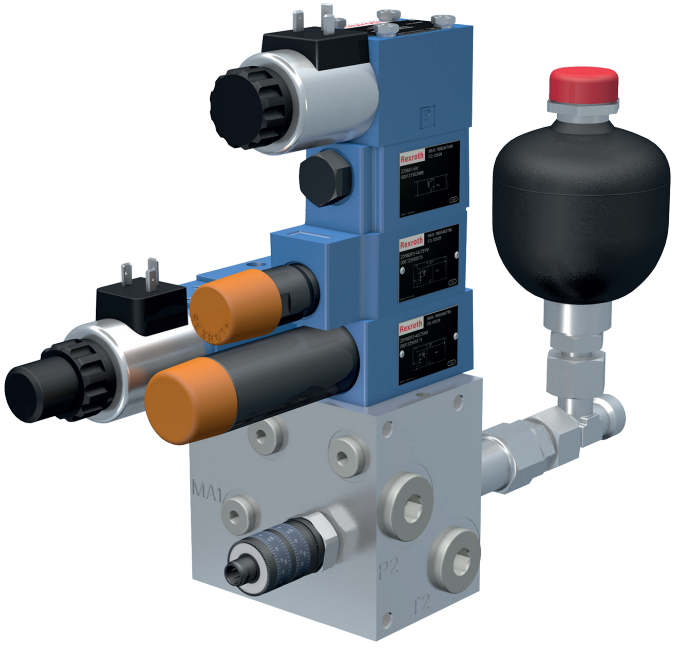
Tool clamping for lower tool

- with electrical pressure switch
- with mechanical pressure adjustment
- with tool clamping in basic position "open"

Overview of Variants for Crowning and Tool Clamping

Example representations, combinations on HSR plates possible:





Crowning and tool clamping for upper tool

Crowning

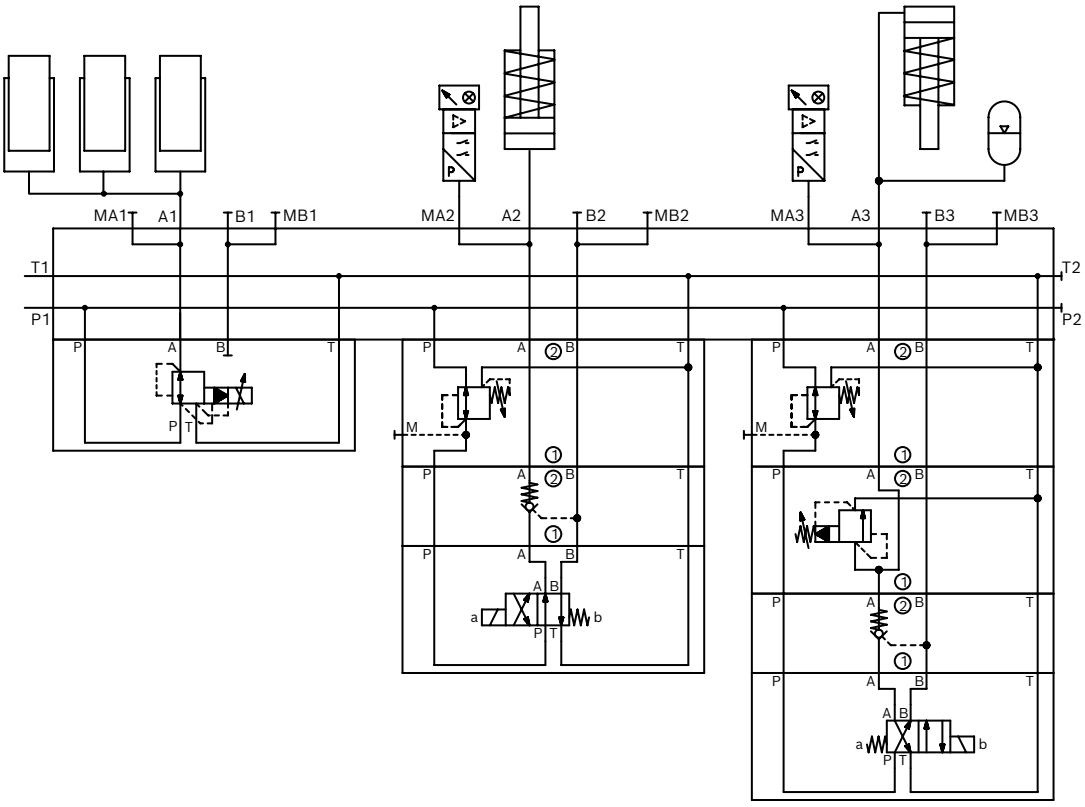
- with precise pressure control

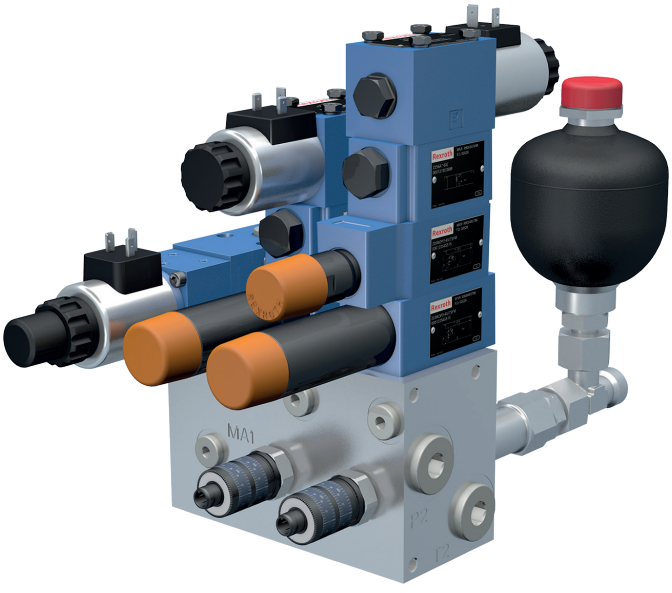
Tool clamping for upper tool

- with electrical pressure switch
- with mechanical pressure adjustment
- with accumulator
- with accumulator pressure protection
- with tool clamping in basic position "closed"

Overview of Variants for Crowning and Tool Clamping

Example representations, combinations on HSR plates possible:





<u>Crowning, tool clamping for lower tool and tool clamping for upper tool</u>

<u>Crowning</u>

- with precise pressure control

Tool clamping for lower tool

- with electrical pressure switch
- with mechanical pressure adjustment
- with tool clamping in basic position "closed"

Tool clamping for upper tool

- with electrical pressure switch
- with mechanical pressure adjustment
- with accumulator
- with accumulator pressure protection
- with tool clamping in basic position "closed"

Components and Accessories

Power units for additional functions

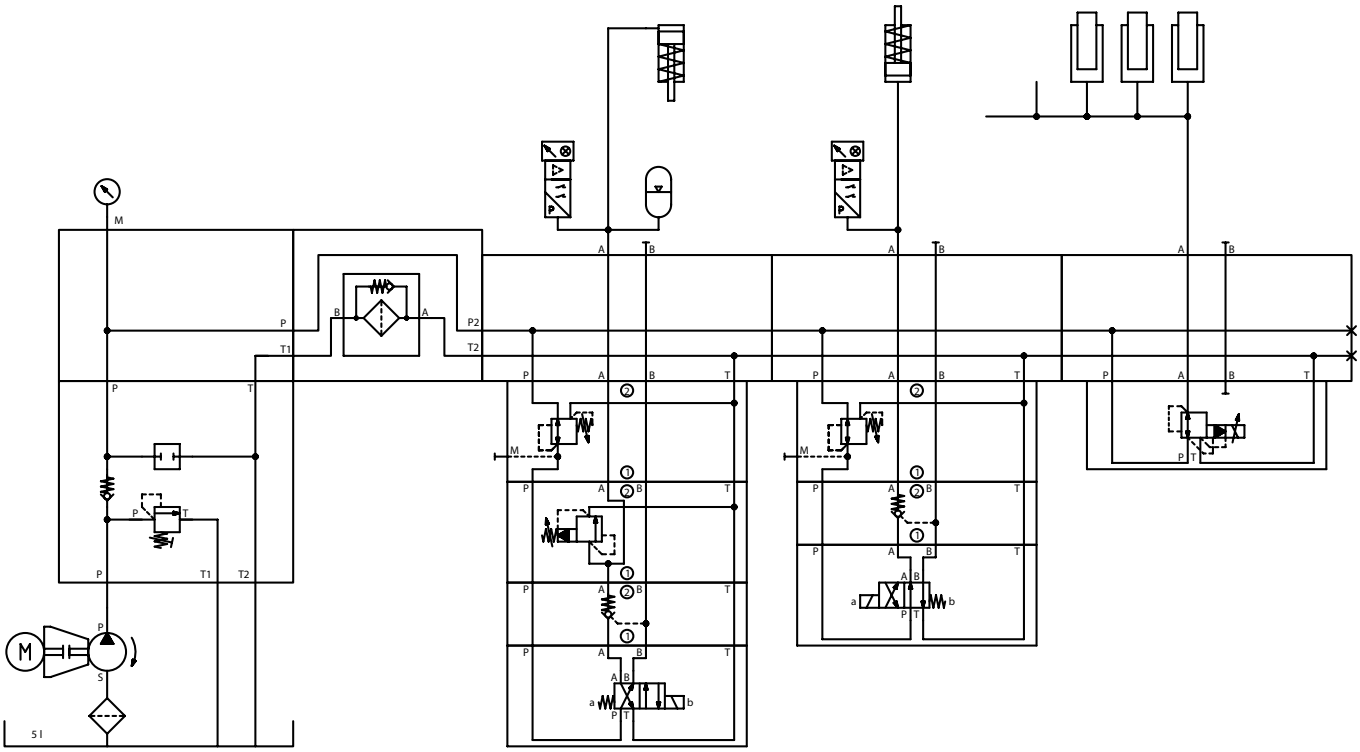
Example: CPM-MT as well as K; KE; KS – Compact Power Modules – compact hydraulic power units

Advantages:

- Max. flow rate Q up to 20 l/min
- Max. intermittent pressure p2 up to 250 bar
- Max. peak pressure p3 (for max. 2 seconds) up to 270 bar (with a reduced number of cycles depending of pump size)
- AC motors power range up to 5,5 kW
- AC motors protection class IP54
- Gear pumps displacement up to 7,4 cm^3
- Tank volume up to 20 l
- Average duty cycle S3 (intermittent operation) 60 % (except motor 2.2 kW)

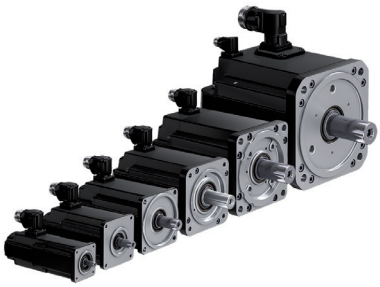
For more information see RE 18306-02 and RE 18306-04.

Example: Hydraulic circuit



Components and Accessories

E-Motors



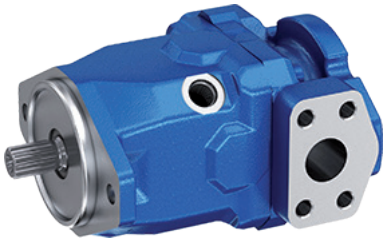
MS2N
Efficiency category IE1 - IE3
- Continuous torque from 0.8 up to 214 Nm
- Maximum torque from 3.8 up to 360 Nm

For more information see R911347583.

MSK
Efficiency category IE1 - IE3
- Maximum torque from 4 up to 631 Nm
- Maximum speed from 3200 up to 9000 min^{-1}

For more information see R911296289.

Pumps / Motors



Axial piston unit for variable speed operation with synchronous and asynchronous motors, closed circuit
Type: A10FZG
Series 10
Displacement volume 6 up to 63 ccm
Nominal pressure 315 bar
Maximum pressure 350 bar

- For use in four-quadrant operation
- Suitable for start/stop operation
- Suitable for long pressure holding operation
- Proven A10 rotary group technology
- Through-drive option

For more information see RE 91485.

Components and Accessories

Suction / pre-fill valves

Pilot operated pre-fill valve
Type SFA
- Sizes 25 up to 80
- Maximum pressure 350 bar

For more information see RE 20485.

Pilot operated pre-fill valve
Type ZSF and ZFSW
- Sizes 32 up to 200
- Maximum pressure 350 bar

For more information see RE 20478.

Pilot operated pre-fill valve
Type SFE
- Sizes 25 up to 100
- Maximum pressure 350 bar

For more information see RE 20745.

Pressure / line filters and filter elements

Pressure/line filters and filter elements
- Nominal pressure 400 bar
- Nominal size 40 - 400 according to DIN 24550
- With bypass and mechanical-optical or electrical maintenance indicators
- High dirt holding capacity of the elements
- Filter fineness 3, 6, 10 and 25 µm

Return filters and filter elements

Return filter and filter elements
- Nominal pressure 10 bar
- Nominal size 40 - 1000 according to DIN 24550
- With bypass and mechanical-optical or electrical maintenance indicators
- High dirt holding capacity of the elements
- Filter fineness 3, 6, 10 and 25 µm

Components and Accessories

Cable / Plug

Mating connectors and cable sets for valves and sensors in hydraulics for the electrical connection of:

- Valve solenoids
- Valves with integrated electronics
- Position and pressure sensors

For more information see RE 08006.

Pressure transducer

Pressure transducer for hydraulic applications
Type HM20

- Measurement ranges 10 bar up to 630 bar

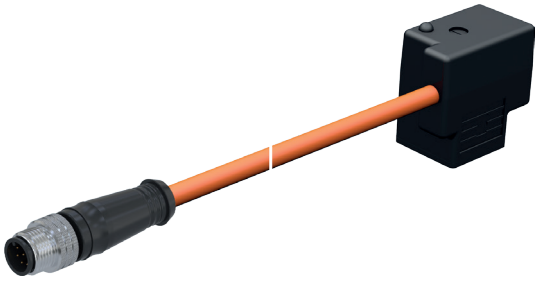
For more information see RE 30272.

Pressure switch
Type HEDE11

- 2x antivalent switching outputs up to 400 bar operating pressure
- Simple switching point adjustment via two optimally readable setting rings, mechanical locking device
- Compact design

For more information see RE 30279.

Amplifier



Connector switching amplifier with pulse width modulation (PWM)
Type VT-SSBA1-PWM-1X/V002/5, Mat.-Nr. R901290194

- Suitable for controlling type WE 6 and WE 10 switching valves with 12 V or 24 V DC solenoids with the control spools described in the data sheet
- Depending on the control spool, increase of the power limit possible
- For "G24" version (energy saving) reduction of coil temperature of at least ≥ 30 °C at 100 % duty cycle

For more information see RE 30362.

Components and Accessories

Components control cabinet

IndraDrive Cs
Compact converter HCS 01

- Power range from 0,15 kW ... 14 kW
- Maximum current from 3,3 A ... 54 A
- Direct power supply from 110 V ... 500 V
- High overload capacity

For more information see R911339012 / R911322210.

IndraDrive C
Compact converter HCS02

- Power range from 1,5 kW ... 11 kW
- Maximum current from 12 A ... 70 A
- Direct power supply from 200 V ... 500 V
- 2,5x overload capacity

For more information see R911309636 / R911318790.

IndraDrive C
Compact converter HCS03

- Power range from 22 kW ... 110 kW
- Maximum current from 70 A ... 350 A
- Direct power supply from 400 V ... 500 V
- 1,5x overload capacity

For more information see R911339024 / R911318790.

IndraDrive control sections CSB02...
for the compact converter HCS02 and HCS03

- Individual solutions for standard to high-end applications
- Open interfaces for international use
- Integrated safety technology
- Multi-Ethernet interface
  (Sercos, EtherCAT®, PROFINET IO, EtherNet/IP)
- Multi-encoder interface for evaluation of all common encoder types
- Integrated safety technology Safe Torque Off or Safe Motion as option
- Additional equipment option (PROFIBUS, CANopen, encoder emulation, second multi-encoder interface, I/O expansion)

For more information see R911338962.

Components and Accessories

Components control cabinet

IndraDrive mains filter HNF01

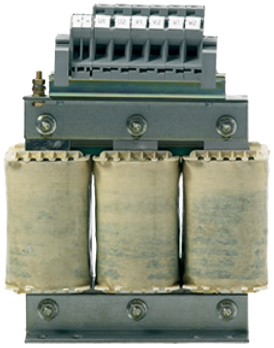
- Ensures compliance with EMC limits and suppresses leakage currents
- Suitable for IndraDrive C (HCS02 & HCS03)
- Mains voltage / rated current up to 480 V / 202 A
- EMV category C1-C3 according to DIN EN 61800-3
- Certification according to UL (Underwriters Laboratories Inc.®)
- Protection class IP20 according to IEC 60529

For more information see R911342564.

IndraDrive mains filter NFD03

- Ensures compliance with EMC limits and suppresses leakage currents
- Suitable for IndraDrive C (HCS02 & HCS03)
- Mains voltage / rated current up to 480V / 180A
- EMV category C2-C3 according to DIN EN 61800-3
- Certification according to UL (Underwriters Laboratories Inc.®)
- Protection class IP20 according to IEC 60529

For more information see R911322210.



IndraDrive mains choke HNL01

- Reduction of harmonics in mains supply
- Mains voltage / rated current up to 480 V / 220 A
- EMV category C2-C3 according to DIN EN 61800-3
- Certification according to UL (Underwriters Laboratories Inc.®)
- Protection class IP20 according to IEC 60529

For more information see R911342564.

Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

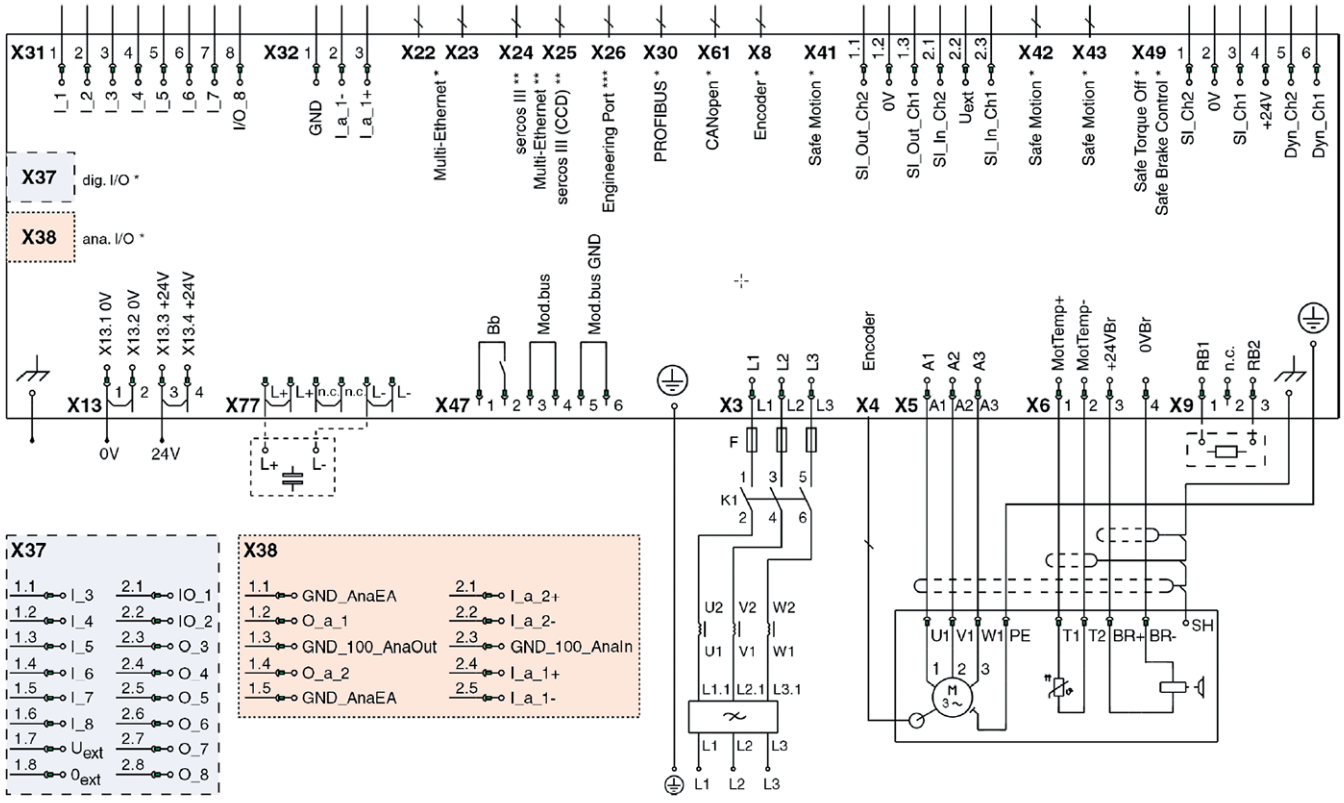
The basic parameterization shown in the following includes an extract and is not a complete user guide. For further information please see the corresponding operating and user instructions as well as the engineering descriptions. Press brakes often have a higher level controller, which provides an analog set-point signal (+/-10V) for rotary speed and torque to the drive controller (IndraDrive). This processes the input signals internally and controls the servo-motor with a corresponding output signal. For a correct continuous communication chain a clearly defined assignment of the corresponding channels is necessary.
Dependent upon the selected drive controller the control section is either already integrated (HCS01) or to be separately mounted to the power section (HCS02 and HCS03). Additionally, with the use of an HCS03 drive controller the braking resistor must be separately installed and cabled in the control cabinet.

The following description includes an excerpt of the basic parameterization of an HCS01 drive controller:

1. Install and wire the HCS01 drive controller in the control cabinet according to the specifications and the project planning description (R911322210)..
2. Connect the servomotor to the HCS01 drive controller according to the user instructions (R911325518):
   a. Plug X5: Power cable U1, V1 and W1
   b. Plug X6: Brake and temperature contact
   c. Plug X4: Encoder cable
3. To signal that the drive controller is ready for operation, the Bb relay contact (X47.1, X47.2) must also be wired and included in the emergency stop circuit and wired to the disconnection path of the mains contactors (see R911322210 Fig. 4 - 27).

Important: the power of the device may be switched on only when the Bb contact is closed.

Connection diagram

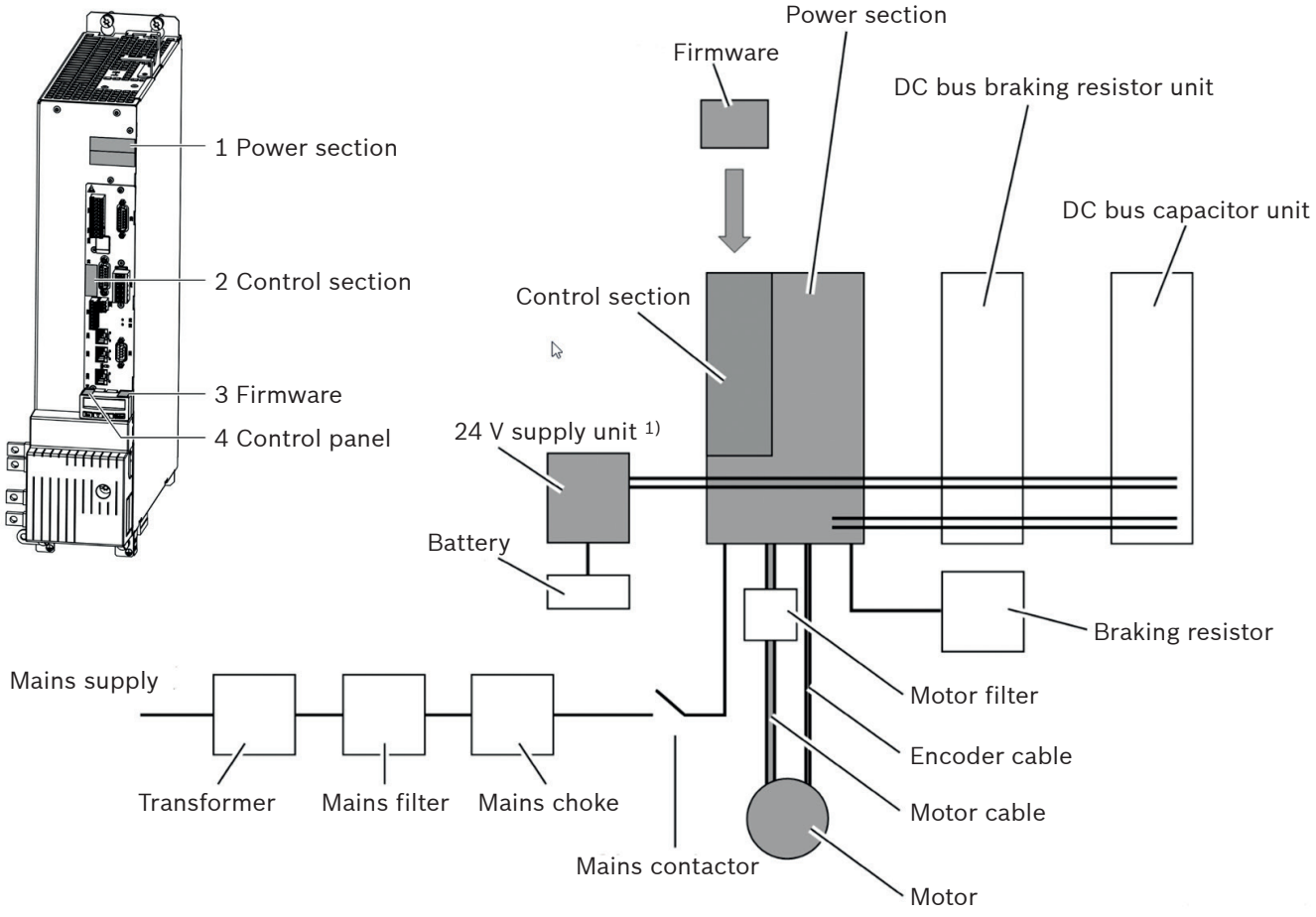


* optional
** ECONOMY = sercos III; BASIC = Multi-Ethernet; ADVANCED = sercos III cross communication (CCD)
*** Only available on devices HCS01.1E-W00**-A-0*-A-CC (ADVANCED)

Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

The following description includes an excerpt of the basic parameterization of an HCS02 drive controller and CSB02 control section.

Connection and wiring diagram



The components marked with gray background color are always required.

1) 24 V power supply unit can be omitted when using devices with integrated 24 V power supply (HCS02.1E- or HCS03.1E-...-NNNV with control section CSB01.1N-FU)

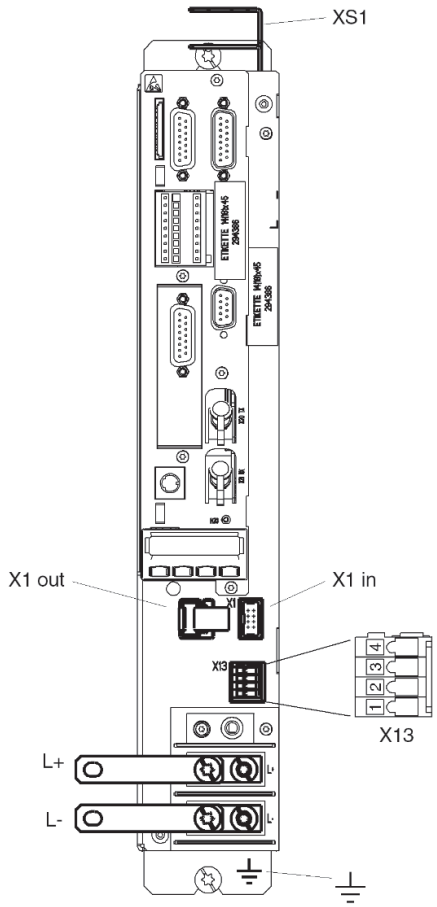
Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

Excerpt of the basic parameterization of a HCS02 drive controller and the CSB02 control section

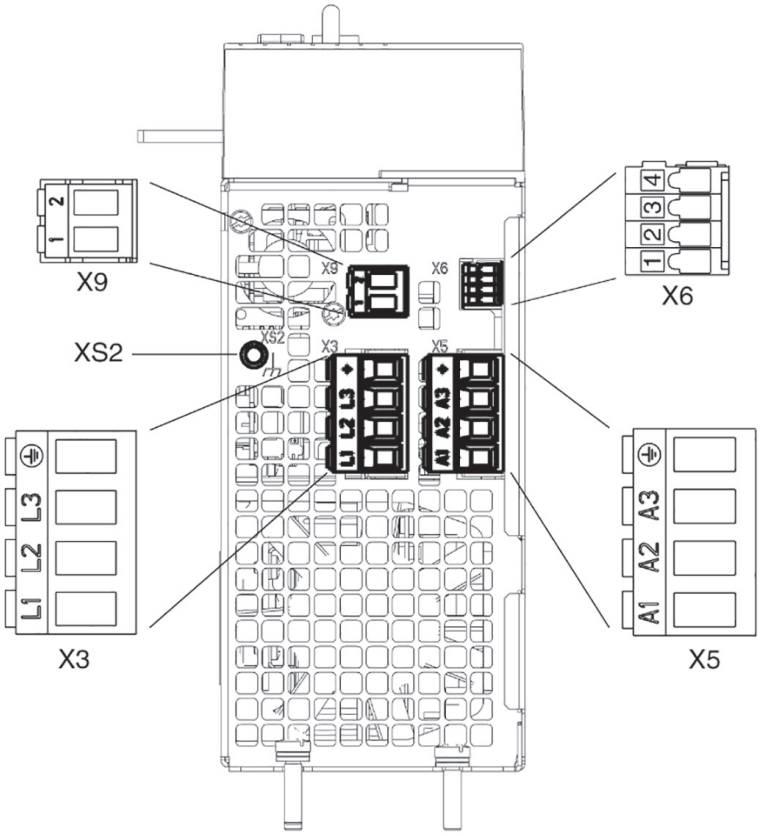
1. Install and wire the HCS02 drive controller in the control cabinet according to the specifications and the project planning description (R911318790), and also the integrated control section CSB02 (see R911338962), which is mounted in the HCS02 drive controller.

2. Connect the servomotor according to the instruction manual (R911339018) of the HCS02 drive controller and the project planning instructions (R911338962) of the control section CSB02:
   a. Plug X5: Power cable
   b. Plug X6: Brake and temperature contact
   ...is connected to the HCS drive controller

Example front side:
Power section connection points HCS02.1E-W0028, W0070



Example bottom side:
Power section connection points HCS02.1E-W0028, W0070



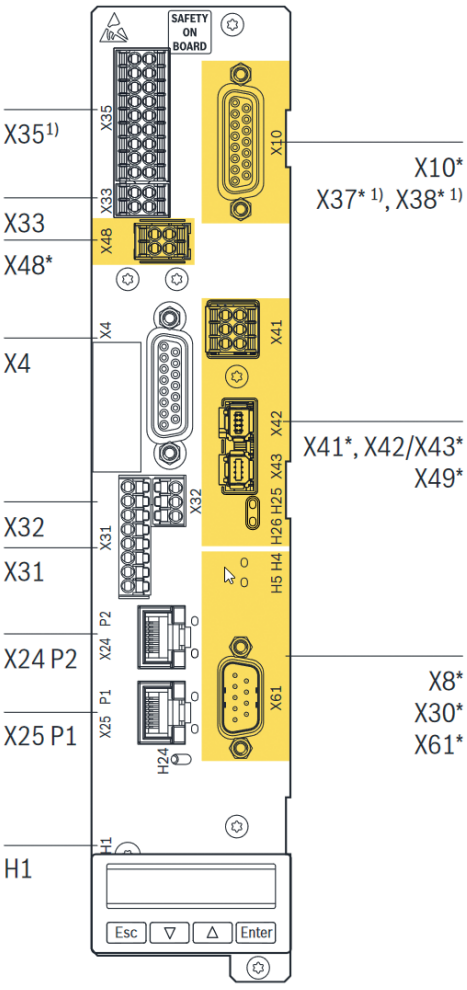
X1 Module bus
X13 Control voltage
XS1 Control cable shield connection
L+, L- DC bus

X3 Mains connection
X5 Motor connection
X6 Motor temperature monitoring, motor holding brake
X9 External braking resistor
XS2 Motor cable shield connection

Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

Excerpt of the basic parameterization of a HCS02 drive controller and the CSB02 control section

Example front side: Electrical connections



Connection point	Description
X4	Encoder evaluation EC
X8*	Encoder evaluation EC
	Encoder emulation EM
X10*	Encoder evaluation EC
	Encoder emulation EM
X24 P2 X25 P1	Communication Multi-Ethernet ET
X30*	Communication PROFIBUS PB
X31	Digital inputs/outputs
	Probe input
X32	Analog inputs
X33	Voltage input (24 V, 0 V)
	Bb relay
X35 1)	Digital inputs/outputs
	Analog inputs (current/voltage)
	Analog outputs (voltage)
X37* 1)	Digital inputs/outputs
X38* 1)	Analog inputs/outputs
X41* X42/X43*	S4, S5, SB safety technology (Not required for SB: X41, X42 and X43; LEDs included)
X48*	Safety technology (Only available with S4, S5 and SB safety technology)
X49*	L3 safety technology
X61*	CANopen communication CN
H1	Operating panel interface

* Optional connection point; optional connection points are highlighted in yellow in the figure.

1) CSB02.xB only

c. Plug X4: Encoder cable
... is connected to the CSB control section

3. To signal that the drive controller is ready for operation, the Bb relay contact (X33) must also be wired and included in the emergency stop circuit and wired to the disconnection path of the mains contactors.

Important: the power of the device may be switched on only when the Bb contact is closed.

Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

The communication between the higher level controller and the drive controller is achieved by exchanging signals. These inputs and outputs must be assigned to the corresponding parameters in the drive controller. Here it is distinguished between a status signal (drive controller output signal) and a control signal (drive controller input signal). The allocation for the analog interface is achieved according to the following specification:

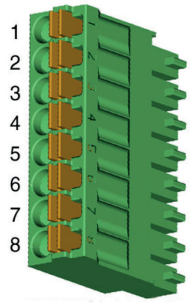
- Device status word: Parameter P-0-0115
- Device control word: Parameter P-0-4028

When the power is switched on and the DC bus voltage has built up, the drive can deliver power. This ready signal is reported via the status word parameter P-0-0115 and must be assigned to a digital output of the drive controller. With the X31 module, the drive controller already has on-board connection points for digital inputs and outputs, so that the ready signal can be sent to the higher level controller, for example via pin 8 (output) of the X31 module.

Important: The ready signal must be present and sent before the controller enable is switched on.

Excerpt from the basic parameterization of an HCS drive controller and CSB02 control section.

X31, Digital inputs, digital output

View	Connection	Signal name	Function	Default assignment
	1	I_1	Digital input	Probe 1 [1]
	2	I_2		Probe 2 [1]
	3	I_3		E-Stop input [2]
	4	I_4		Travel range limit switch input [2]
	5	I_5		Travel range limit switch input [2]
	6	I_6		Not assigned [2]
	7	I_7		Not assigned [2]
	8	I_8	Digital input/output	Not assigned

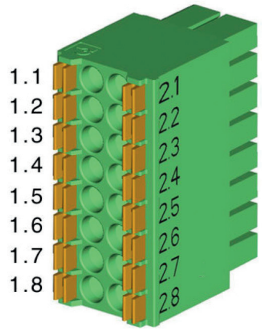
[1] Digital inputs type B (probe)
[2] Digital inputs type A (standard)

Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

Excerpt from the basic parameterization of an HCS drive controller and CSB02 control section.

X37, digital inputs/outputs (DA option)

In addition to the possibility of using integrated outputs, the optional I/O extension via the X37 module can also be used (if part of the scope of delivery) for the assignment of the ready signal and an output (e.g. port 2.3) can be defined.

View	Connection	Signal name	Function	Connection	Signal name	Function
	1.1	I_3	Digital input	2.1	IO_1	Digital input/output
	1.2	I_4		2.2	IO_2	
	1.3	I_5		2.3	IO_3	Digital output
	1.4	I_6		2.4	IO_4	
	1.5	I_7		2.5	IO_5	
	1.6	I_8		2.6	IO_6	
	1.7	24V_Ext	Power supply (U_{ext})	2.7	IO_7	
	1.8	0V_Ext		2.8	IO_8	

Now the drive is actively switched and the "controller enable" (bit 15) and "drive stop" (bit 13) can be communicated by the higher-level controller via the control word P-0-4028. For this purpose, the corresponding bits of the device control word must be assigned to digital inputs. As with the previously defined outputs, the integrated X31 module (e.g. connectors 3 and 4) or the optional X37 module can be used to define the input signals.
The motor is now supplied with power via the drive controller and can follow the set points from the higher level controller.

Important: The release valves may only be opened when the status of the system has been acknowledged via P-0-0115 (bits 14 and 15).

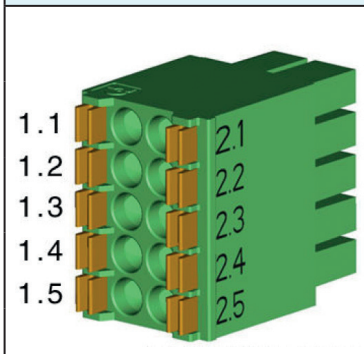
In addition, it can be checked during operation if the drive signals a warning or an error. A warning is available, for example, if the drive has reached its torque/speed limit and can no longer follow the set point.
Finally, the drive controller must be parameterized so that it can follow the analog set points. To do this, the analog inputs of the optional DA module on the X38 module must be assigned accordingly:

- Speed set point: Parameter S-0-0036
- Torque limit value: Parameter S-0-0092

Basic Parameterization of the IndraDrive Drive Controller for HCS01, HCS02 and HCS03

Excerpt from the basic parameterization of an HCS drive controller and CSB02 control section.

X38, analog inputs/outputs (DA option)

View	Connection	Signal name	Function	Connection	Signal name	Function
	1.1	GND_AnaEA	GND reference	2.1	IA_2+	Analog differential input
	1.2	OA_1	Analog output	2.2	IO_2	
	1.3	GND_100_AnaOut	Connection for inner cable shield	2.3	GND_100_AnaIn	Connection for inner cable shield
	1.4	OA_2	Analog output	2.4	IO_4	Analog differential input
	1.5	GND_AnaEA	GND reference	2.5	IO_5	

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