User Manual
GL-9086 Network Adapter Module

EtherCAT network adapter, light version, max. 16 slices

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1. About This Manual

This manual contains information on the software and hardware features of the Beijer Electronics GL-9086 Network Adapter Module. It provides in-depth specifications, guidance on installation, setup, and usage of the product.

1.1. Symbols Used in This Manual

This publication includes Warning, Caution, Note and Important icons where appropriate, to point out safety-related, or other important information. The corresponding symbols should be interpreted as follows:

WARNING
The Warning icon indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury, and major damage to the product.

CAUTION
The Caution icon indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, and moderate damage to the product.

NOTE
The Note icon alerts the reader to relevant facts and conditions.

IMPORTANT
The Important icon highlights important information.

2. Safety

Before using this product, please read this manual and other relevant manuals carefully. Pay full attention to safety instructions!

In no event will Beijer Electronics be responsible or liable for damages resulting from the use of this product.

The images, examples and diagrams in this manual are included for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Beijer Electronics cannot take responsibility or liability for actual use based on the examples and diagrams.

2.1. Product Certifications

The product has the following product certifications.

2.2. General Safety Requirements

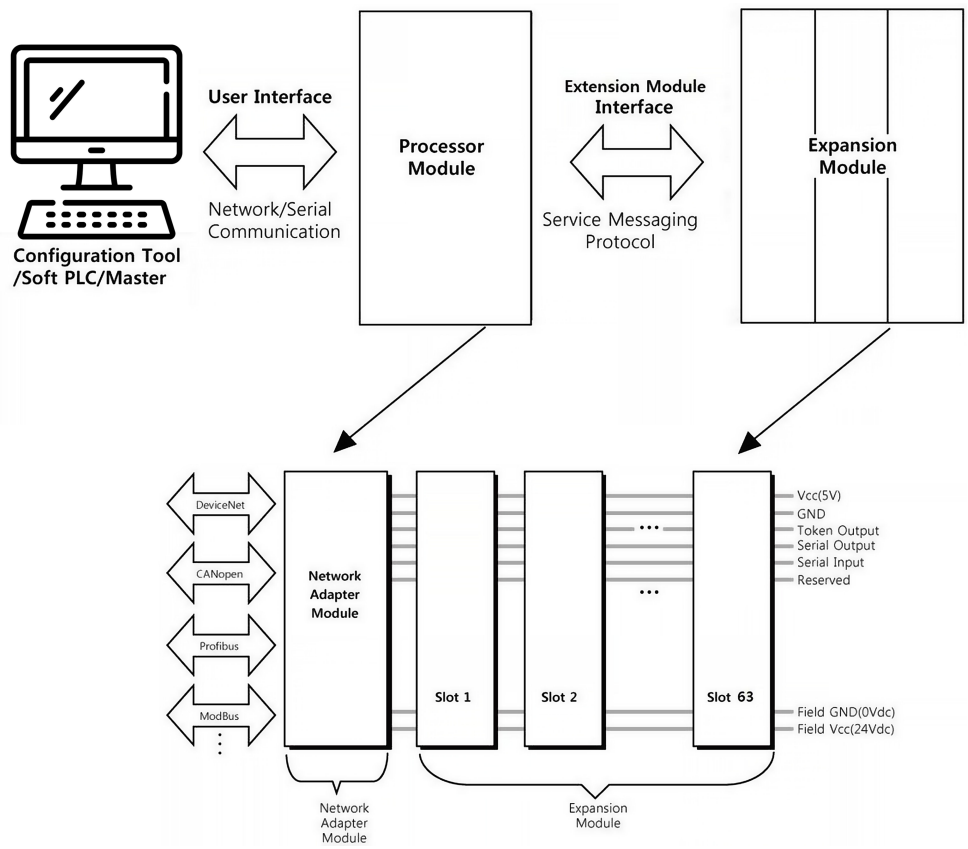
WARNING

- Do not assemble the products and wires with power connected to the system. Doing so cause an "arc flash", which can result in unexpected dangerous events (burns, fire, flying objects, blast pressure, sound blast, heat).
- Do not touch terminal blocks or IO modules when the system is running. Doing so may cause electric shock, short circuit or malfunction of the device.
- Never let external metallic objects touch the product when the system is running. Doing so may cause electric shock, short circuit or malfunction of the device.
- Do not place the product near inflammable material. Doing so may cause a fire.
- All wiring work should be performed by an electrical engineer.
- When handling the modules, ensure that all persons, the workplace and the packing are well grounded. Avoid touching conductive components, the modules contain electronic components that may be destroyed by electrostatic discharge.

CAUTION

- Never use the product in environments with temperature over 60°C. Avoid placing the product in direct sunlight.
- Never use the product in environments with over 90% humidity.
- Always use the product in environments with pollution degree 1 or 2.
- Use standard cables for wiring.

3. About the G-series System

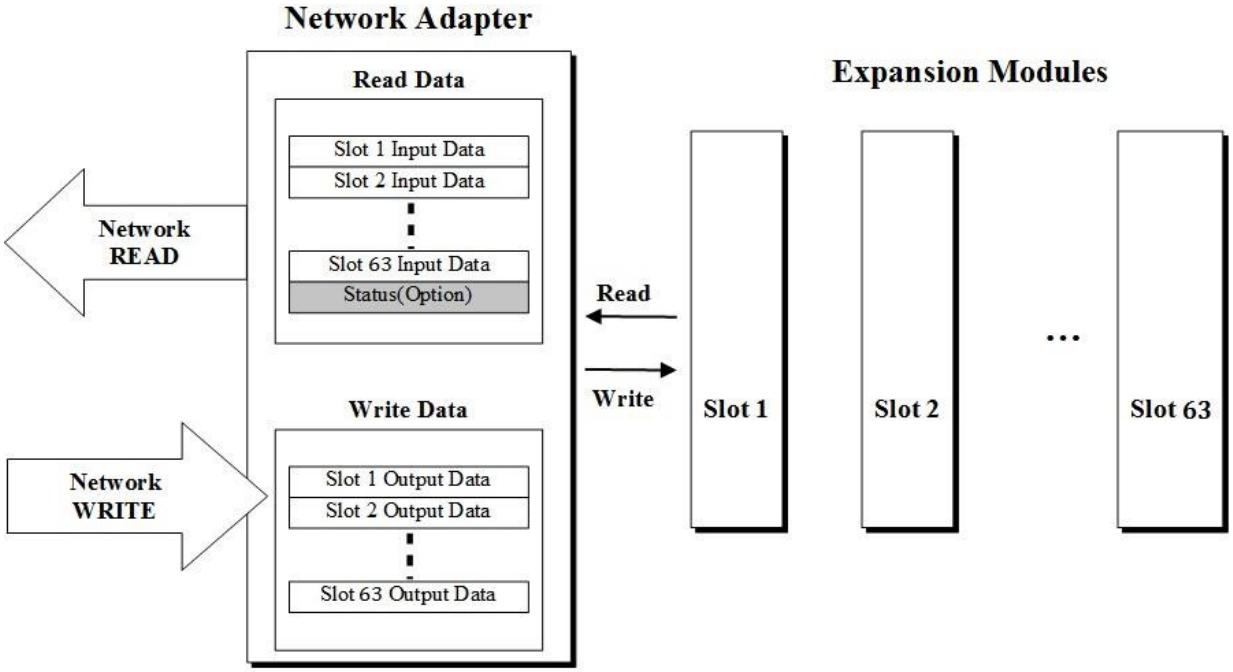


System overview

- **Network Adapter Module** - The network adapter module forms the link between the field bus and the field devices with the expansion modules. The connection to different field bus systems can be established by each of the corresponding network adapter module, e.g., for MODBUS TCP, Ethernet IP, EtherCAT, PROFINET, CC-Link IE Field, PROFIBUS, CANopen, DeviceNet, CC-Link, MODBUS/Serial etc.
- **Expansion Module** - Expansion module types: Digital IO, Analog IO, and Special modules.
- **Messaging** - The system uses two types of messaging: Service messaging and IO messaging.

3.1. IO Process Data Mapping

An expansion module has three types of data: IO data, configuration parameter, and memory register. The data exchange between the network adapter and the expansion modules is made via IO process image data by internal protocol.



Data flow between network adapter (63 slots) and expansion modules

The input and output image data depend on the slot position and the data type of the expansion slot. The ordering of input and output process image data is based on the expansion slot position. Calculations for this arrangement are included in the manuals for network adapter and programmable IO modules.

Valid parameter data depends on the modules in use. For example, analog modules have settings of either 0-20 mA or 4-20 mA, and temperature modules have settings such as PT100, PT200, and PT500. The documentation for each module provides a description of the parameter data.

4. Specifications

4.1. Environmental Specifications

Operating temperature	-20°C - 60°C
UL temperature	-20°C - 60°C
Storage temperature	-40°C - 85°C
Relative humidity	5% - 90% non-condensing
Mounting	DIN rail
Shock operating	IEC 60068-2-27 (15G)
Vibration resistance	IEC 60068-2-6 (4 g)
Industrial emissions	EN 61000-6-4: 2019
Industrial immunity	EN 61000-6-2: 2019
Installation position	Vertical and horizontal
Product certifications	CE, FCC, UL, cUL

4.2. General Specifications

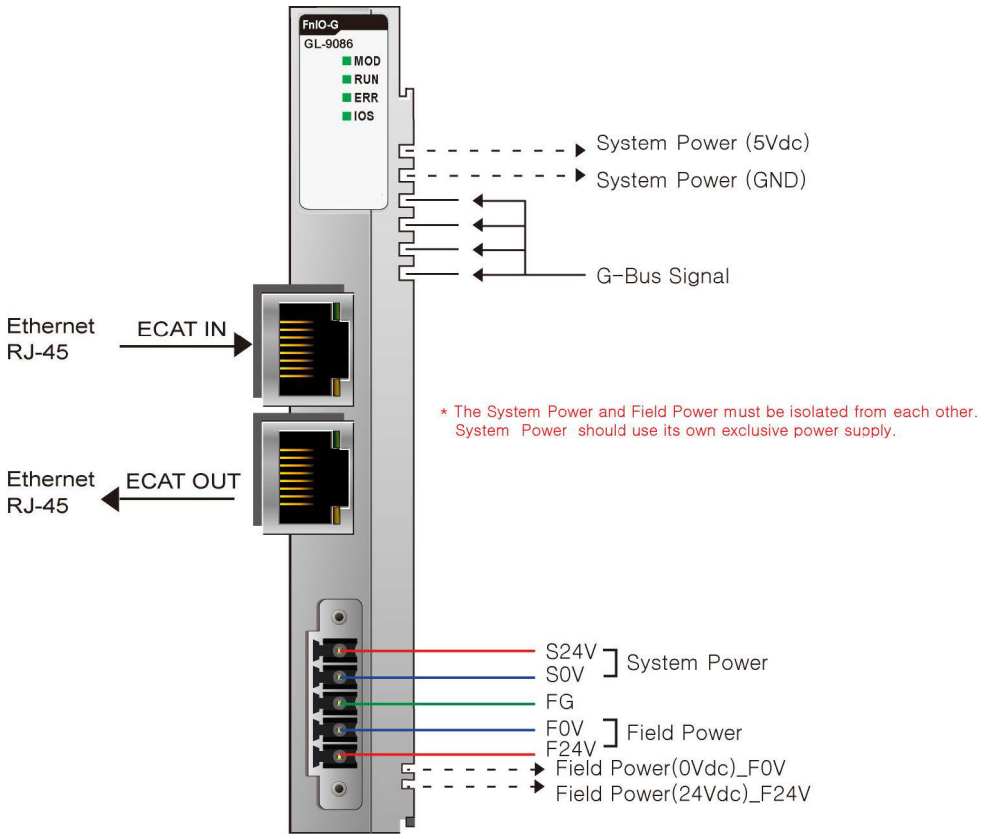
UL system power	Supply voltage: 24 VDC nominal, class 2
System power	Supply voltage: 24 VDC nominal Supply voltage range: 15 - 28.8 VDC Protection: Output current limit (min. 1.5 A) reverse polarity protection
Power dissipation	40 mA typical @ 24 VDC
Current for IO module	1.0 A @ 5 VDC
Isolation	System power to internal logic: Non-isolation System power IO driver: Isolation
UL field power	Supply voltage: 24 VDC nominal, class 2
Field power	Supply voltage: 24 VDC typical (max. 30 VDC) **NOTE! The field power range depends on the IO module series. Refer to the IO module specification for specific details.**
Wiring	IO cable max. 2.0 mm^2 (AWG 14)
Weight	76 g
Dimensions	22 mm x 109 mm x 70 mm

4.3. Communication Interface Specifications

Adapter type	Slave node (EtherCAT ID)
Protocol	EtherCAT
Max. expansion modules	16 slots

IO data size	Max. input data size 256 bytes / Max. output data size 256 bytes
Max length bus line	Up to 100 m from ethernet hub/switch with twisted CAT5 UTP/STP
Max. network node	65,535
Baud rate	10/100 Mbps
Interface connector	RJ-45 socket x 2
Indicators	**4 LEDs** • Module status (MOD) - Green/Red • Current running status (RUN) - Green • Error status (ERR) - Red • Expansion IO module status (IOS) - Green/Red
Module location	Starter module, left side of the G-Series system

5. Wiring Diagram



Pin no.	Signal description
1	System power, 24 V
2	System power, ground
3	Frame ground
4	Field power, ground
5	Field power, 24 V

WARNING
Never connect system power to field power! Use separate power supplies.

6. LED Indicator

LED	Function	Color
MOD	Module status	Green/Red
RUN	Communication status	Green
ERR	Error Status	Red
IOS	Extension module status	Green/Red

6.1. MOD (Module Status)

Status	LED	Indicates
Not powered	OFF	The module has no power.
Normal, operational	Green	The unit is operating in normal condition.
Device in standby	Flashing green	The EEPROM parameter is not initialized yet. Serial number is zero value (0x00000000).
Minor fault	Flashing red	The unit has occurred recoverable fault in self-testing. • EEPROM checksum fault.
Unrecoverable fault	Red	The unit has occurred unrecoverable fault in self-testing. • Firmware fault.

6.2. RUN (Current Running Status)

Status	LED	Indicates
Init	OFF	State of the EtherCAT State Machine: INIT = Initialization.
Pre-operation	Blinking	State of the EtherCAT State Machine: PREOP = Pre-Operation.
Safe-operation	Single flash	State of the EtherCAT State Machine: SAFEOP = Safe-Operation.
Initialization or bootstrap	Flashes	State of the EtherCAT State Machine: BOOT = Bootstrap (update of the coupler firmware).
Operational	ON	State of the EtherCAT State Machine: Operational.

6.3. ERROR (Error State)

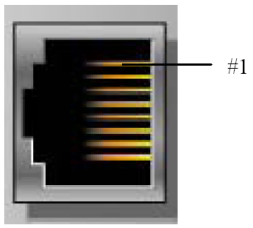
Status	LED	Indicates
No error	OFF	No error.
Invalid configuration	Blinking	Invalid configuration.

6.4. IOS LED (Extension Module Status LED)

Status	LED	Indicates
Not powered	OFF	Device has no expansion module or may not be powered.
Internal bus online, do not exchange IO data	Flashing green	Internal bus is normal but does not exchange IO data (passed the expansion module configuration).
Internal bus connection, is exchanging IO data	Green	Is exchanging IO data.
Internal bus connection error while exchanging IO data	Red	One or more expansion modules occurred in fault state. • Changed expansion module configuration. • Internal bus communication failure. • Mismatch vendor code between adapter and expansion module.
Expansion configuration failed	Flashing red	Failed to initialize expansion module. • Detect invalid expansion module ID. • Overflow input/output size. • No expansion module. • Too many expansion modules. • Initial protocol failure.

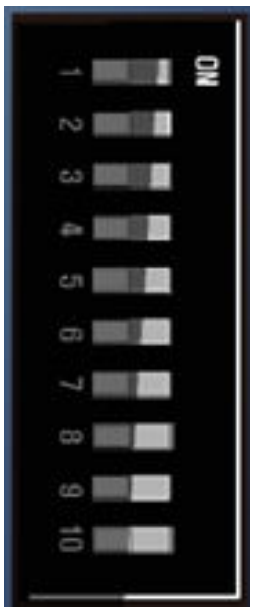
7. RJ-45 Socket

For information on network installation, refer to Network Installation.



RJ-45	Signal name	Description
1	TD+	Transmit +
2	TD-	Transmit -
3	RD+	Receive +
4	-	-
5	-	-
6	RD-	Receive -
7	-	-
8	-	-
Case	Shield	

8. DIP Switch



DIP switch #	Description
1	Identification value, Bit 0
2	Identification value, Bit 1
3	Identification value, Bit 2
4	Identification value, Bit 3
5	Identification value, Bit 4
6	Identification value, Bit 5
7	Identification value, Bit 6
8	Identification value, Bit 7
9	Not used
10	Not used

9. Hardware Setup

CAUTION

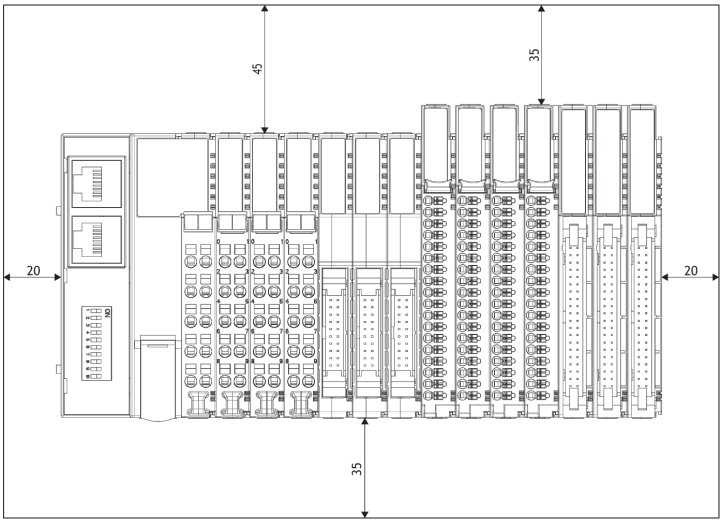
- Always read this chapter before installing the module!
- Hot surface! The surface of the housing can become hot during operation. If the device is used in high ambient temperatures, always let the device cool down before touching it.
- Working on energized devices can damage the equipment! Always turn off the power supply before working on the device.

9.1. Space Requirements

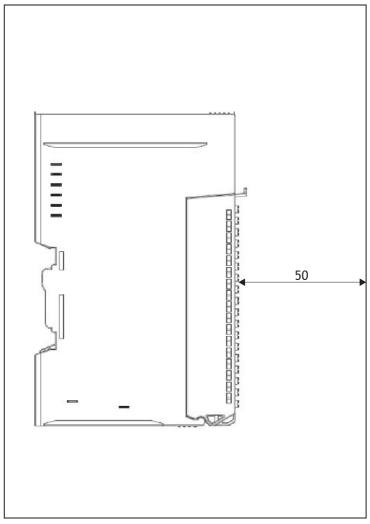
The following drawings show the space requirements when installing the G-series modules. The spacing creates space for ventilation, and prevents conducted electromagnetic interference from influencing the operation. Installation position is valid vertical and horizontal. The drawings are illustrative and may be out of proportion.

CAUTION

Not following the space requirements may result in damaging the product.



Vertical and horizontal space requirements



Required distance to door

9.2. Mount Module to DIN Rail

The following chapters describe how to mount the module to the DIN rail.

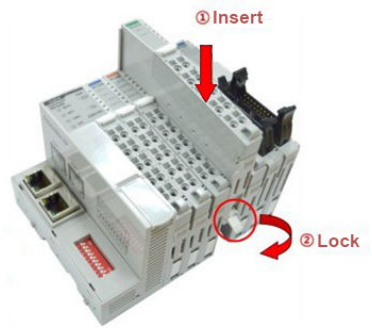
> **CAUTION**
> The module must be fixed to the DIN rail with the locking levers.

9.2.1. Mount GL-9XXX or GT-XXXX Module

The following instructions apply to these module types:

- **GL-9XXX**
- **GT-1XXX**
- **GT-2XXX**
- **GT-3XXX**
- **GT-4XXX**
- **GT-5XXX**
- **GT-7XXX**

GN-9XXX modules have three locking levers, one at the bottom and two on the side. For mounting instructions, refer to Mount GN-9XXX Module.

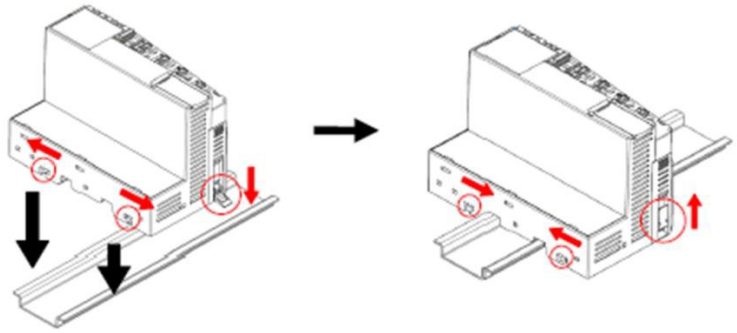


Mount to DIN rail

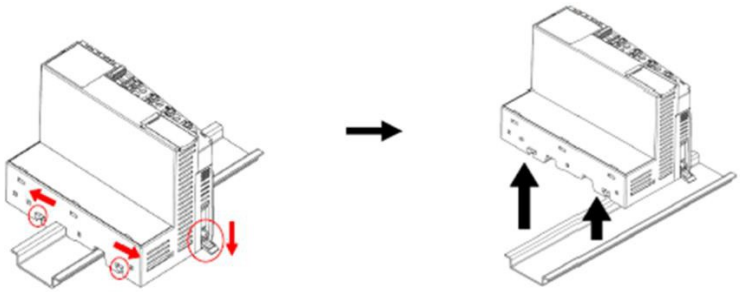
Dismount from DIN rail

9.2.2. Mount GN-9XXX Module

To mount or dismount a **network adapter** or **programmable IO** module with the product name **GN-9XXX**, for example GN-9251 or GN-9371, see the following instructions:



Mount to DIN rail



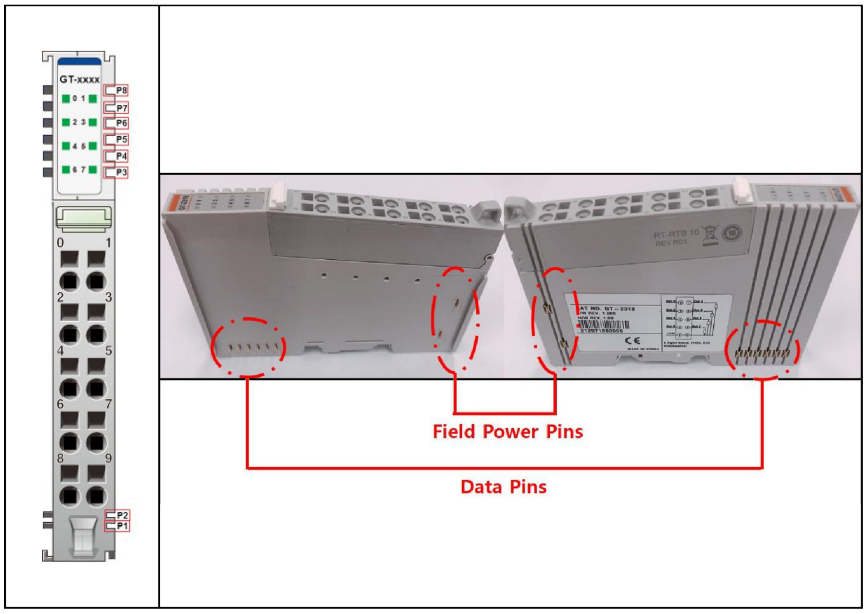
Dismount from DIN rail

9.3. Field Power and Data Pins

Communication between the G-series network adapter and the expansion module, as well as system / field power supply of the bus modules is carried out via the internal bus. It is comprised of **2 Field Power Pins** and **6 Data Pins**.

WARNING

Do not touch the data and field power pins! Touching can result in soiling and damage by ESD noise.



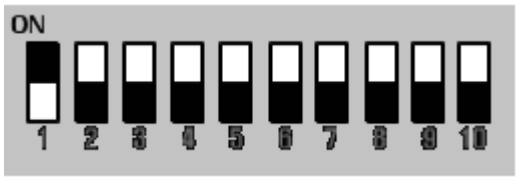
Pin no.	Name	Description
P1	System VCC	System supply voltage (5 VDC)
P2	System GND	System ground
P3	Token output	Token output port of processor module
P4	Serial output	Transmitter output port of processor module
P5	Serial input	Receiver input port of processor module
P6	Reserved	Reserved for bypass token
P7	Field GND	Field ground
P8	Field VCC	Field supply voltage (24 VDC)

10. EtherCAT ID Type Setup

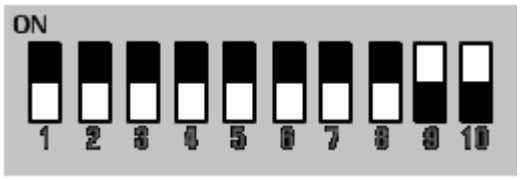
10.1. Hot Connection Settings

The hot connection function can be used to remove a node from a preconfigured configuration or change the location of nodes and flexible. This feature is available only EtherCAT ID Type in TwinCAT.

The user can use the external Dip switch settings of the adapter identification value, see chapter Dip Switch



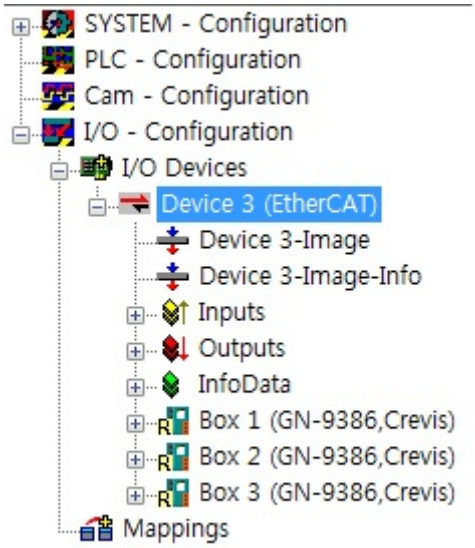
Example 1: node 1 (Min)



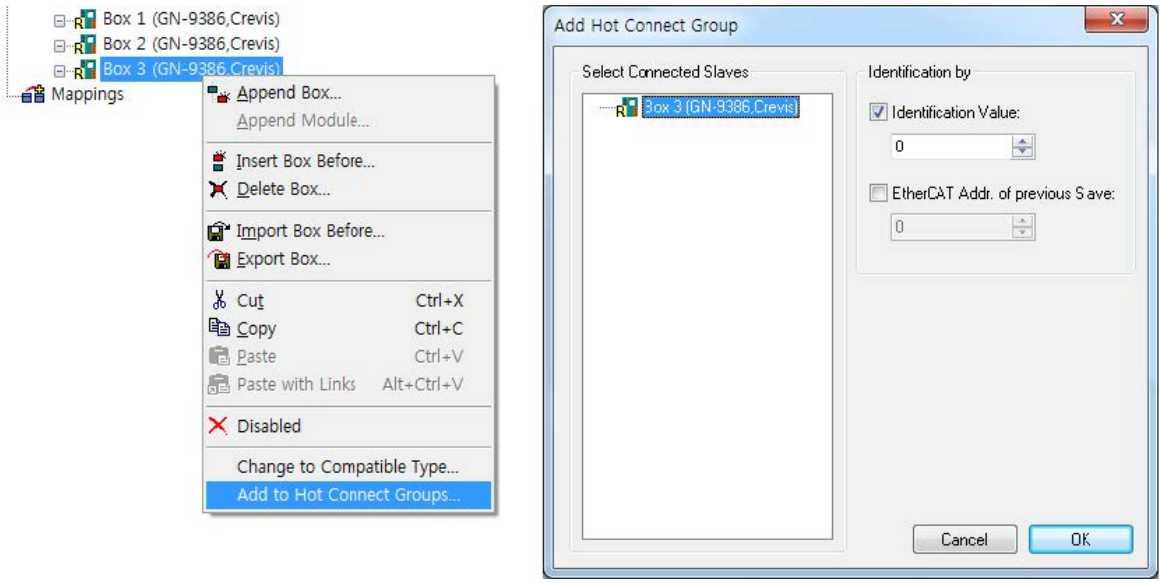
Example 2: node 255 (Max)

Hot Connection setting procedure

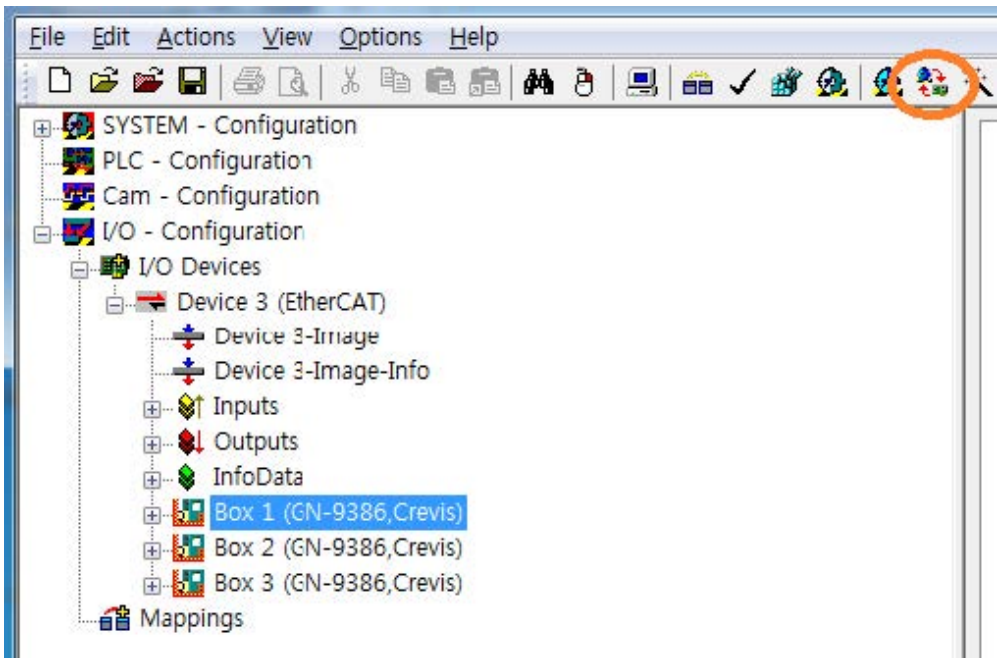
1. Add the EtherCAT ID Type in TwinCAT.



2. In the Hot Connection Group settings, set the identification value same as Dip-switch.



3. When the Hot Connection Group setup is completed, run Reload I/O device (F4).



4. The Hot Connection feature is now operational. Nodes do not overlap between products. In cases where identical nodes exist, adjustments should be made accordingly.

11. IO Process Image Map

For information on the IO process, see chapter IO Process Data Mapping.

11.1. Discrete Input Module

Input Module Data

D3	D2	D1	D0

Input Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Reserved				D3	D2	D1	D0

4 point input module

Input Module Data

D7	D6	D5	D4	D3	D2	D1	D0

Input Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	D7	D6	D5	D4	D3	D2	D1	D0

8 point input module

Input Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	D7	D6	D5	D4	D3	D2	D1	D0

Input Module Data

D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8

16 point input module

Input Module Data

D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8
D23	D22	D21	D20	D19	D18	D17	D16
D31	D30	D29	D28	D27	D26	D25	D24

Input Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	D7	D6	D5	D4	D3	D2	D1	D0
Byte 1	D15	D14	D13	D12	D11	D10	D9	D8
Byte 2	D23	D22	D21	D20	D19	D18	D17	D16
Byte 3	D31	D30	D29	D28	D27	D26	D25	D24

32 point input module

11.2. Discrete Output Module

Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Reserved				D3	D2	D1	D0

Output Module Data

D3	D2	D1	D0

4 point output module

Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	D7	D6	D5	D4	D3	D2	D1	D0

Output Module Data

D7	D6	D5	D4	D3	D2	D1	D0

8 point output module

Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	D7	D6	D5	D4	D3	D2	D1	D0
Byte 1	D15	D14	D13	D12	D11	D10	D9	D8

Output Module Data

D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8

16 point output module

Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	D7	D6	D5	D4	D3	D2	D1	D0
Byte 1	D15	D14	D13	D12	D11	D10	D9	D8
Byte 2	D23	D22	D21	D20	D19	D18	D17	D16
Byte 3	D31	D30	D29	D28	D27	D26	D25	D24

Output Module Data

D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8
D23	D22	D21	D20	D19	D18	D17	D16
D31	D30	D29	D28	D27	D26	D25	D24

32 point output module

11.3. Analog Input Module

Input Module Data

Analog Input Ch0
Analog Input Ch1
Analog Input Ch2
Analog Input Ch3

Input Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Input Ch0 low byte							
Byte 1	Analog Input Ch0 high byte							
Byte 2	Analog Input Ch1 low byte							
Byte 3	Analog Input Ch1 high byte							
Byte 4	Analog Input Ch2 low byte							
Byte 5	Analog Input Ch2 high byte							
Byte 6	Analog Input Ch3 low byte							
Byte 7	Analog Input Ch3 high byte							

4 channel analog input module

Input Module Data

Analog Input Ch0
Analog Input Ch1
Analog Input Ch2
Analog Input Ch3
Analog Input Ch4
Analog Input Ch5
Analog Input Ch6
Analog Input Ch7

Input Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Input Ch0 low byte							
Byte 1	Analog Input Ch0 high byte							
Byte 2	Analog Input Ch1 low byte							
Byte 3	Analog Input Ch1 high byte							
Byte 4	Analog Input Ch2 low byte							
Byte 5	Analog Input Ch2 high byte							
Byte 6	Analog Input Ch3 low byte							
Byte 7	Analog Input Ch3 high byte							
Byte 8	Analog Input Ch0 low byte							
Byte 9	Analog Input Ch0 high byte							
Byte 10	Analog Input Ch1 low byte							
Byte 11	Analog Input Ch1 high byte							
Byte 12	Analog Input Ch2 low byte							
Byte 13	Analog Input Ch2 high byte							
Byte 14	Analog Input Ch3 low byte							
Byte 15	Analog Input Ch3 high byte							

8 channel analog input module

11.4. Analog Output Module

Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Output Ch0 low byte							
Byte 1	Analog Output Ch0 high byte							
Byte 2	Analog Output Ch1 low byte							
Byte 3	Analog Output Ch1 high byte							
Byte 4	Analog Output Ch2 low byte							
Byte 5	Analog Output Ch2 high byte							
Byte 6	Analog Output Ch3 low byte							
Byte 7	Analog Output Ch3 high byte							

Output Module Data

Analog Output Ch0
Analog Output Ch1
Analog Output Ch2
Analog Output Ch3

4 channel analog output module

Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Output Ch0 low byte							
Byte 1	Analog Output Ch0 high byte							
Byte 2	Analog Output Ch1 low byte							
Byte 3	Analog Output Ch1 high byte							
Byte 4	Analog Output Ch2 low byte							
Byte 5	Analog Output Ch2 high byte							
Byte 6	Analog Output Ch3 low byte							
Byte 7	Analog Output Ch3 high byte							
Byte 8	Analog Output Ch4 low byte							
Byte 9	Analog Output Ch4 high byte							
Byte 10	Analog Output Ch5 low byte							
Byte 11	Analog Output Ch5 high byte							
Byte 12	Analog Output Ch6 low byte							
Byte 13	Analog Output Ch6 high byte							
Byte 14	Analog Output Ch7 low byte							
Byte 15	Analog Output Ch7 high byte							

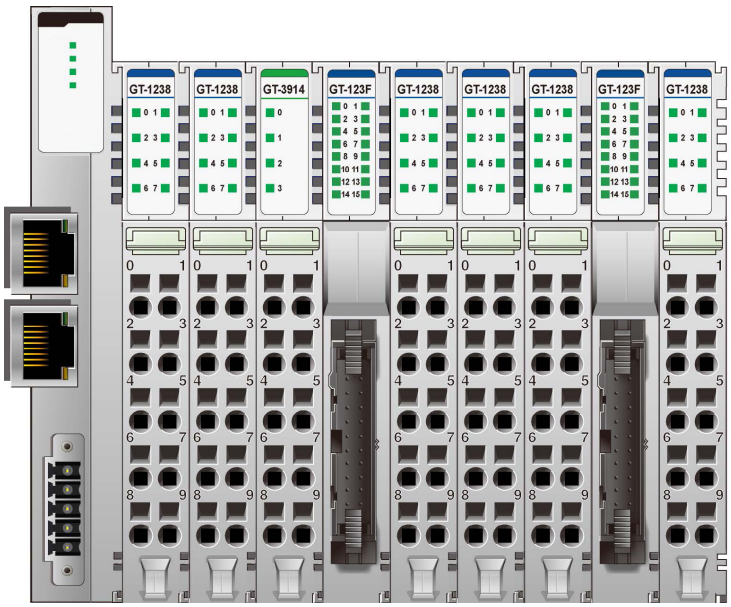
Output Module Data

Analog Output Ch0
Analog Output Ch1
Analog Output Ch2
Analog Output Ch3
Analog Output Ch4
Analog Output Ch5
Analog Output Ch6
Analog Output Ch7

8 channel analog output module

11.5. Example of Input Process Image (Input Register) Map

Input image data depends on slot position and expansion slot data type. Input process image data is only ordered by expansion slot position.



Slot configuration (example)

Slot address	Module description
#0	EtherCAT adapter

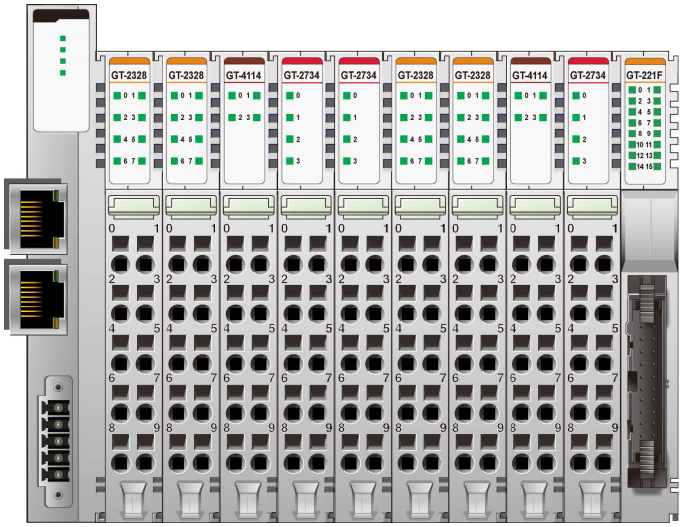
Slot address	Module description
#1	8-discrete input
#2	8-discrete input
#3	4-analog input
#4	16-discrete input
#5	8-discrete input
#6	8-discrete input
#7	8-discrete input
#8	16-discrete input
#9	8-discrete input

Input process image

Address	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2
0x0000	Discrete input 8 pts (Slot#2)								Discrete input 8 pts (Slot#1)					
0x0001	Analog input Ch0 high byte (Slot#3)								Analog input Ch0 low byte (Slot#3)					
0x0002	Analog input Ch1 high byte (Slot#3)								Analog input Ch1 low byte (Slot#3)					
0x0003	Analog input Ch2 high byte (Slot#3)								Analog input Ch2 low byte (Slot#3)					
0x0004	Analog input Ch3 high byte (Slot#3)								Analog input Ch3 low byte (Slot#3)					
0x0005	Discrete input 8 pts (Slot#4)								Discrete input 8 pts (Slot#4)					
0x0006	Discrete input 8 pts (Slot#6)								Discrete input 8 pts (Slot#5)					
0x0007	Discrete input 8 pts (Slot#8)								Discrete input 8 pts (Slot#7)					
0x0008	Discrete input 8 pts (Slot#9)								Discrete input 8 pts (Slot#8)					

11.6. Example of Output Process Image (Output Register) Map

Output image data depends on slot position and expansion slot data type. Output process image data is only ordered by expansion slot position.



Slot configuration (example)

Slot address	Module description
#0	EtherCAT adapter

Slot address	Module description
#1	8-discrete output
#2	8-discrete output
#3	4-analog output
#4	4-relay output
#5	4-relay output
#6	8-discrete output
#7	8-discrete output
#8	4-analog output
#9	4-relay output
#10	16-discrete output

Output process image

Address	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0x0800	Discrete output 8 pts (Slot#2)								Discrete input 8 pts (Slot#1)							
0x0801	Analog output Ch0 high byte (Slot#3)								Analog input Ch0 low byte (Slot#3)							
0x0802	Analog output Ch1 high byte (Slot#3)								Analog input Ch1 low byte (Slot#3)							
0x0803	Analog output Ch2 high byte (Slot#3)								Analog input Ch2 low byte (Slot#3)							
0x0804	Analog output Ch3 high byte (Slot#3)								Analog input Ch3 low byte (Slot#3)							
0x0805	N/A				Discrete output 4 pts (Slot#5)				N/A				Discrete output 4 pts (Slot#4)			
0x0806	Discrete output low 8 pts (Slot#7)								Discrete output low 8 pts (Slot#6)							
0x0807	Analog output Ch0 high byte (Slot#8)								Analog output Ch0 low byte (Slot#8)							
0x0808	Analog output Ch1 high byte (Slot#8)								Analog output Ch1 low byte (Slot#8)							
0x0809	Analog output Ch2 high byte (Slot#8)								Analog output Ch2 low byte (Slot#8)							
0x080A	Analog output Ch3 high byte (Slot#8)								Analog output Ch3 low byte (Slot#8)							
0x080B	Discrete output low 8 pts (Slot#10)								N/A				Discrete output 4 pts (Slot#9)			
0x080C	N/A								Discrete output high 8 pts (Slot#10)							

12. EtherCAT Basics

The EtherCAT protocol uses an officially assigned EtherType inside the Ethernet Frame. The use of this EtherType allows transport of control data directly within the Ethernet frame without redefining the standard Ethernet frame. The frame may consist of several sub-telegrams, each serving a particular memory area of the logical process images that can be up to 4 gigabytes in size. Addressing of the Ethernet terminals can be in any order because the data sequence is independent of the physical order. Broadcast, Multi-cast and communication between slaves are possible

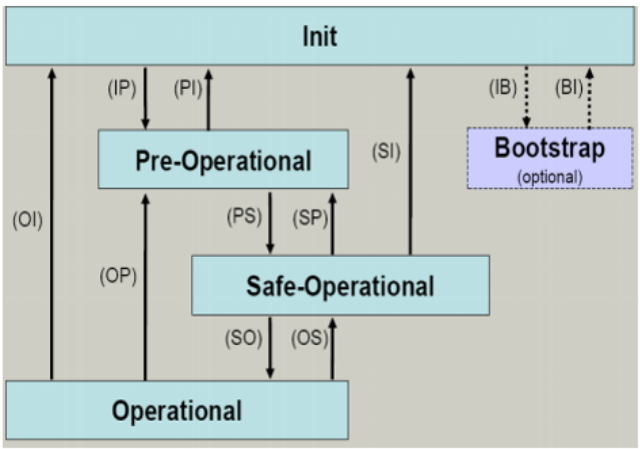
12.1. EtherCAT State Machine

The state of the EtherCAT slave is controlled via the EtherCAT State Machine (ESM). Depending upon the state, different functions are accessible or executable in the EtherCAT slave. Specific commands must be sent by the EtherCAT master to the device in each state, particularly during the boot up of the slave.

A distinction is made between the following states:

- Init
- Pre-Operational
- Safe-Operational and
- Operational
- Bootstrap

The regular state of each EtherCAT slave after bootup is the OP state.



12.1.1. Init

After switch-on the EtherCAT slave in the Init state. No mailbox or process data communication is possible.

The EtherCAT master initializes sync manager channels 0 and 1 for mailbox communication.

12.1.2. Pre-Operational (Pre-Op)

During the transition between Init and Pre-Op the EtherCAT slave checks whether the mailbox was initialized correctly.

In Pre-Op state mailbox communication is possible, but not process data communication. The EtherCAT master initializes the sync manager channels for process data (from sync manager channel 2), the FMMU channels and, if the slave supports configurable mapping, PDO mapping or the sync

manager PDO assignment. In this state the settings for the process data transfer and perhaps terminal-specific parameters that may differ from the default settings are also transferred.

12.1.3. Safe-Operational (Safe-Op)

During transition between Pre-Op and Safe-Op the EtherCAT slave checks whether the sync manager channels for process data communication and, if required, the distributed clocks settings are correct. Before it acknowledges the change of state, the EtherCAT slave copies current input data into the associated DP-RAM areas of the EtherCAT slave controller (ECSC).

In Safe-Op state mailbox and process data communication is possible, although the slave keeps its outputs in a safe state, while the input data are updated cyclically.

12.1.4. Operational (Op)

Before the EtherCAT master switches the EtherCAT slave from Safe-Op to Op it must transfer valid output data. In the Op state the slave copies the output data of the masters to its outputs. Process data and mailbox communication is possible.

12.1.5. Bootstrap

In the Boot state the slave firmware can be updated. The Boot state can only be reached via the Init state. In the Boot state mailbox communication via the file access over EtherCAT (FoE) protocol is possible, but no other mailbox communication and no process data communication.

12.2. CoE Interface

12.2.1. Parameter Management in the EtherCAT System

The CiA organization (CAN in Automation) pursues among other things the goal of creating order and exchange ability between devices of the same type by the standardization of device descriptions. For this purpose so-called profiles are defined, which conclusively describe the changeable and unchangeable parameters of a device. Such a parameter encompasses at least the following characteristics:

- Index number – for the unambiguous identification of all parameters. The index number is divided into a main index and a subindex in order to mark and arrange associated parameters.
  - Main index
  - Subindex, offset by a colon ‘:’
- Official name – in the form of an understandable, self-descriptive text
- Specification of changeability, e.g. whether it can only be read or can also be written
- A value – depending upon the parameter the value can be a text, a number or another parameter index.

Index Range

The relevant ranges for EtherCAT fieldbus users are:

- **x1000** : This is where fixed identity information for the device is stored, including name, manufacturer, serial number etc., plus information about the current and available process data configurations.
- **x8000** : This is where the operational and functional parameters for all channels are stored, such as filter settings or output frequency.

Other important ranges are:

- **x4000** : In some EtherCAT devices the channel parameters are stored here (as an alternative to the x8000 range).

- **x6000** : Input PDOs ("input" from the perspective of the EtherCAT master).
- **x7000** : Output PDOs ("output" from the perspective of the EtherCAT master).

12.2.2. Communication Objects

Index	Sub-index	Name	Flags	Default value
1000	Device type		RO	0x00001389
1001	Gbus status		RO	Normal operation: 0x00 **
1002	Master fault action		RW	0x00
1008	Device name		RO	GL-9086(Crevis)
1009	Hardware version		RO	GL-9086.v1
100A	Software version		RO	1.000
1018	**Identity**		RO	0x05
	01	Vendor ID (Crevis: 029D)	RO	0x0000029D
	02	Product code	RO	0x4E419386
	03	Revision	RO	0x0001000
	04 *	Serial number	RO	0xFFFFFFFF
	05	Release date	RO	0x20160823
10F1	**Error settings**		RO	0x02
	01	Local error reaction	RO	0x00000000
	02	Sync error counter limit	RO	0x00000004
1601*	**Slot#x, GT--xxxx,RXPDO**		RO	0xnn
	01	SubIndex 001	RO	0x7010:01, 8
	...	...	...	...
	nn	SubIndex nnn	RO	0x7010:nn, 8
1A01*	**Slot#x, GT-xxxx,TXPDO**		RO	0xnn
	01	SubIndex 001	RO	0x6010:01, 8
	...	...	...	...
	nn	SubIndex nnn	RO	0x6010:nn, 8
1C00	**Sync manager type**		RO	0x04
	01	SubIndex 001	RO	0x01
	02	SubIndex 002	RO	0x02
	03	SubIndex 003	RO	0x03
	04	SubIndex 004	RO	0x04
1C12	**RxPDO assign**		RO	0x01
	01	SubIndex 001	RO	0x1601
1C13	**TxPDO assign**		RO	0x02
	01	SubIndex 001	RO	0x1A01
	02	SubIndex 002	RO	0x1A02
7010 *	**GT-XXXX**		RO	0xnn
	01	Byte#0	RW P	0x00
	...	...	...	...

Index	Sub-index	Name	Flags	Default value
	nn	Byte#nnn	RW P	0x00
8000	**GL-9086(Parameter)**		RO	
	01	Byte#0	RW	
	02	Byte#1	RW	
	03	Byte#2	RW	
	04	Byte#3	RW	
8nn0 *	**GT-XXXX(Parameter)**		RO	
	01	Byte#0	RW	
	...	...	...	...
	nn	Byte#nnn	RW	
F000	**Module device profile**		RO	
	01	Module index distance	RO	
	02	Maximum number of modules	RO	
F010 *	**Module list**		RO	
	01	Subindex 001 (GN-9386)	RO	0x00009386
	...	...	...	...
	63	Subindex 063	RO	0x0000xxxx
F050	**Detected module ident list**		RO	
	01...	SubIndex 001	RO	

* This value can be changed depending on the configuration of expansion modules.

** G-bus status:

- Normal operation: 0x00
- Communication fault: 0x02
- Configuration failed: 0x03
- No expansion module: 0x04
- Vendor error: 0x07
- Not expected slot: 0x08
- CRC error: 0x09