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SIMATIC

ET 200pro distributed I/O system

Operating Instructions

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Appendix A

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

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indicates that minor personal injury can result if proper precautions are not taken.

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indicates that property damage can result if proper precautions are not taken.

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Preface

Purpose of this manual

The information provided in this manual enables you to commission the distributed I/O system.

Basic knowledge required

This manual requires general knowledge of automation engineering.

Scope of the manual

This manual is valid for the specified components of the ET 200pro distributed I/O system.

This manual contains a description of the components which were valid at the time the manual was published. We reserve the right to issue a Product Information which contains up-to-date information about new components and new versions of components.

Changes compared to the previous version

This manual contains the following changes/additions compared to the previous version:

- Wire break check with analog electronic module 4 AI TC High Feature (6ES7144-4PF00-0AB0), see section 4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 401)
- Mounting position when using ET 200pro motor starters, see section Requirements (Page 43)
- Addition to the section Configuration control (option handling) (Page 176)

Position in the information landscape

The table below provides an overview of the contents of the ET 200pro Distributed I/O System manuals. The manuals are available in the Internet (see Service & Support in the Internet).

Manual	Contents
Operating instructions ET 200pro distributed I/O system (http://support.automation.siemens.com/WW/view/en/21210852)	• Mounting and connecting • Commissioning and diagnostics • Functions • Technical specifications – Interface modules – Power modules – Outgoing module – Connection modules – Electronic modules
Operating instructions ET 200pro motor starter (http://support.automation.siemens.com/WW/view/en/22332388)	• Mounting and connecting • Commissioning and diagnostics • Device functions • Technical specifications – Backplane bus module – Special modules – Motor starters
Operating instructions IM 154-8 CPU interface module (http://support.automation.siemens.com/WW/view/en/44251850)	• Communication • Memory concept • Mounting and connecting • Addressing • Commissioning and diagnostics • Technical specifications
Operating instructions Interface module IM 154-6 PN HF IWLAN (http://support.automation.siemens.com/WW/view/en/33401769)	• Mounting and connecting • Configuring • Commissioning • Technical specifications
Operating instructions ET 200pro Distributed I/O System - Fail-Safe Modules (http://support.automation.siemens.com/WW/view/en/22098524)	• Configuring • Addressing and mounting • Diagnostics • Technical specifications – Fail-safe connection modules – Fail-safe electronic modules

Manual	Contents
Operating instructions ET 200pro FC (http://support.automation.siemens.com/WW/view/en/28561828)	• Communication • Mounting and connecting • Addressing • Commissioning and diagnostics • Technical specifications • Alarm, error and system messages
Operating instructions ET 200pro PS (http://support.automation.siemens.com/WW/view/en/36461700)	• Assembly • Configuration • Technical specifications
Operating instructions RFID systems, RF170C (http://support.automation.siemens.com/WW/view/en/32622825)	• Mounting and connecting • Parameter assignment • Maintenance and service • Functions • Technical specifications
System manual PROFINET system description (http://support.automation.siemens.com/WW/view/en/19292127)	• PROFINET basics • Network components and structures • Data exchange and communication • PROFINET engineering
Function manual PROFINET with STEP 7 V13 (https://support.industry.siemens.com/cs/us/en/view/49948856)	• PROFINET basics • PROFINET diagnostics • PROFINET functions
Programming manual From PROFIBUS DP to PROFINET IO (http://support.automation.siemens.com/WW/view/en/19289930)	• Differences • Blocks • System status lists • Diagnostics

Finding your way

The operating instructions contain the following aids that provide quick access to the specific information you need:

- A comprehensive table of contents and a list of tables and figures included in the document are available at the beginning of the operating instructions.
- Important terms are explained in the glossary.
- Navigate to the most important topics in our documents using the index.
- Cross-references are shown as hyperlinks in the running text. By clicking a hyperlink, you can open the associated section in this manual, or access the download page on the Internet that contains this information.

Special notes

In addition to this manual, you also need the manual of your DP master / I/O Controller.

Recycling and disposal

The ET 200pro is low in contaminants and can therefore be recycled. For ecologically compatible recycling and disposal of your old device, contact a certificated disposal service for electronic scrap.

Additional support

If you have questions regarding use of the products described in these operating instructions, and do not find the answers in this document, contact your local Siemens representative.

You can find your representative on the Internet (http://www.automation.siemens.com/partner/).

A guide to the technical documentation for the various SIMATIC products and systems is available on the Internet (http://www.siemens.com/simatic-tech-doku-portal).

The online catalog and online ordering system are available on the Internet (http://mall.industry.siemens.com).

Training Center

Siemens offers a variety of courses to help you get started with the ET 200pro and the SIMATIC S7 automation system. Please contact your regional Training Center, or the central Training Center in D-90327 Nuremberg.

Additional information can be found on the Internet (http://sitrain.automation.siemens.com/sitrainworld).

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You can contact Technical Support for all A&D products using the Support Request Web form on the Internet (https://support.industry.siemens.com/sc/ww/en/sc/2100).

Additional information about Siemens Technical Support is available on the Internet (http://www.siemens.com/automation/service).

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- Manuals, characteristics, operating manuals, certificates
- Product master data

You can find "mySupport" - CAx data on the Internet (http://support.industry.siemens.com/my/ww/en/CAxOnline).

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You will find the application examples on the Internet (https://support.industry.siemens.com/sc/ww/en/sc/2054).

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).
This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.
With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet (http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool).

See also

Service and Support (http://www.siemens.com/automation)

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

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To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet (http://support.industry.siemens.com).

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Description

1

1.1 What are distributed I/O systems?

Distributed I/O systems

Process I/Os are often installed as a central integral in the automation system configuration.

Greater distances between the process I/O and the automation system may require extensive and complex wiring, which could make the system susceptible to electromagnetic interference and thus impair its reliability.

Distributed I/O is the ideal solution for such systems:

- the master CPU is located centrally
- the distributed I/O systems (inputs and outputs, intelligent preprocessing using intelligent slaves) operate locally at a remote location
- the high-performance PROFIBUS DP and its high data transmission rates provide a smooth flow of communication between the CPU and the distributed I/O systems
- PROFINET IO

1.2 What is PROFIBUS DP?

What is PROFIBUS DP?

PROFIBUS DP is an open bus system according to the IEC 61784-1: 2010 Ed3 CP 3/1 standard and is based on the "DP" protocol (DP = Distributed Peripherals).

PROFIBUS DP is implemented either as an electrical network based on shielded twisted-pair cable, or as an optical network based on fiber optic cable.

"DP" is a high-speed protocol for cyclic data exchange between a CPU and distributed I/O systems.

What are DP masters and DP slaves?

A DP master represents the link between the CPU and distributed I/O systems. It exchanges data with the distributed I/O systems via PROFIBUS DP, and monitors the PROFIBUS DP bus.

Distributed I/O systems (=DP slaves) prepare the encoder and actuator data locally for transfer to the CPU via PROFIBUS DP.

Which devices can be connected to PROFIBUS DP?

PROFIBUS DP supports all DP masters or DP slaves which are compatible with the IEC 61784-1: 2010 Ed3 CP 3/1 standard.

Configuration of a PROFIBUS DP network

The figure below illustrates the typical configuration of a PROFIBUS DP network. The DP masters are integrated in the corresponding device. The S7-400 or S7-300, for example, are equipped with a PROFIBUS DP interface. DP slaves are the distributed I/O systems which are connected to the DP masters via PROFIBUS DP.

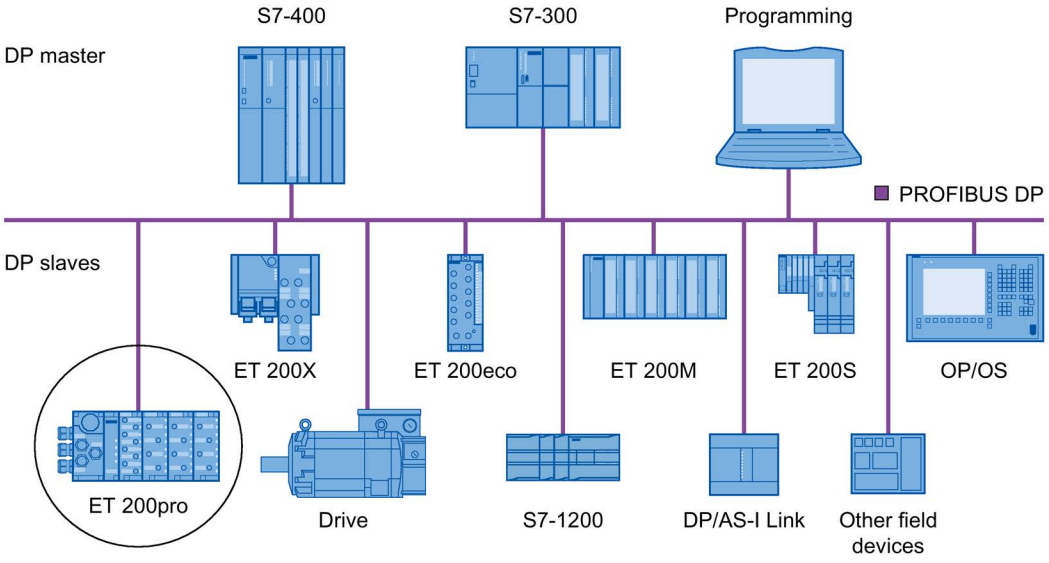


Figure 1-1 Typical configuration of a PROFIBUS DP network

1.3 What is PROFINET IO?

Definition

PROFINET IO is an open transmission system with real-time functionality defined in accordance with the PROFINET standard. This standard defines a manufacturer-independent communication, automation and engineering model.

Accessories for wiring the PROFINET components are available in industrial quality.

- PROFINET does not deploy the hierarchical PROFIBUS master/slave principle. A provider/consumer principle is used instead. The planning process specifies which modules of an IO device an IO controller subscribes to.
- The quantities are extended in accordance with the options offered by the PROFINET IO. Parameter limits are not exceeded during configuration.
- The transmission rate is 100 Mbps.
- The user view during configuration is largely identical to that on PROFIBUS DP.

Structure of a PROFINET IO network

The figure below illustrates the typical layout of a PROFINET IO network. Existing PROFIBUS slaves can be integrated by an IE/PB link.

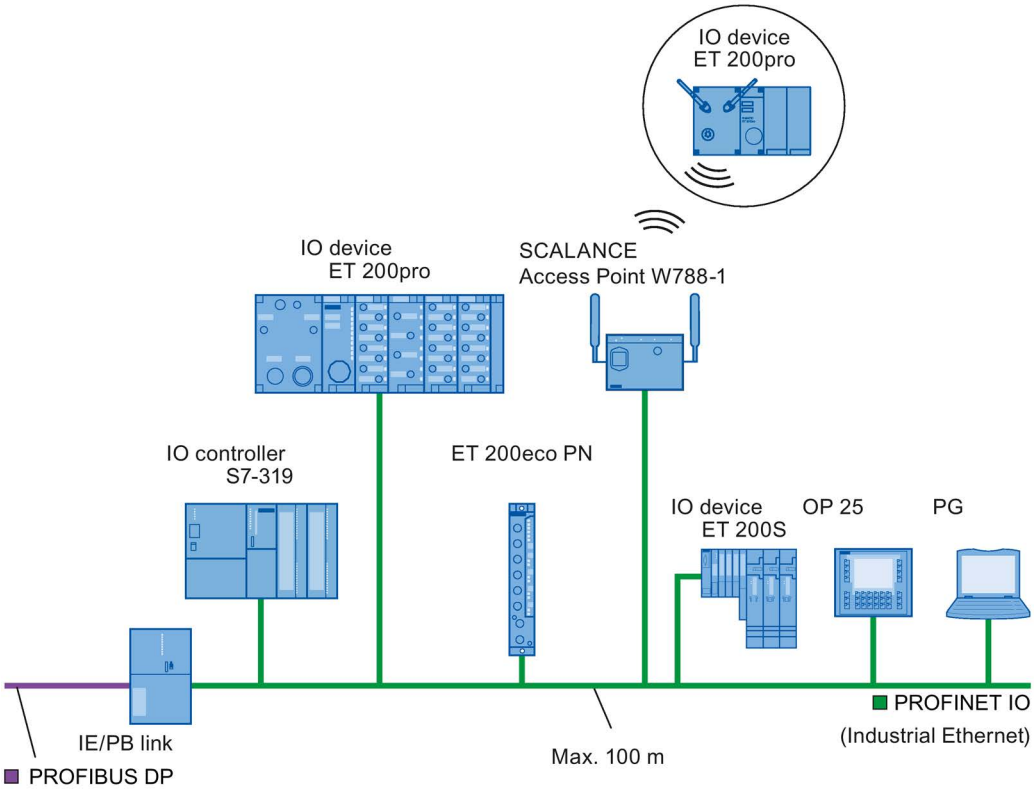


Figure 1-2 Structure of a PROFINET IO network

1.4 ET 200pro distributed I/O system

Definition of ET 200pro

ET 200pro is a modular distributed I/O system available in degrees of protection IP65, IP66, and IP67.

Fields of application

A robust design and degree of protection IP65, IP66, or IP67 make the ET 200pro distributed I/O system particularly suitable for use in rugged industrial environments.

With IP65, IP66 and IP67, the ET 200pro is protected against the ingress of foreign bodies and water. The ET 200pro does not require an additional enclosure.

ET 200pro supports communication with:

- All DP masters compliant with IEC 61784-1: 2010 Ed3 CP 3/1
- All IO controllers compliant with IEC 61158

Configuration

The ET 200pro is installed on a rack and basically consists of the following:

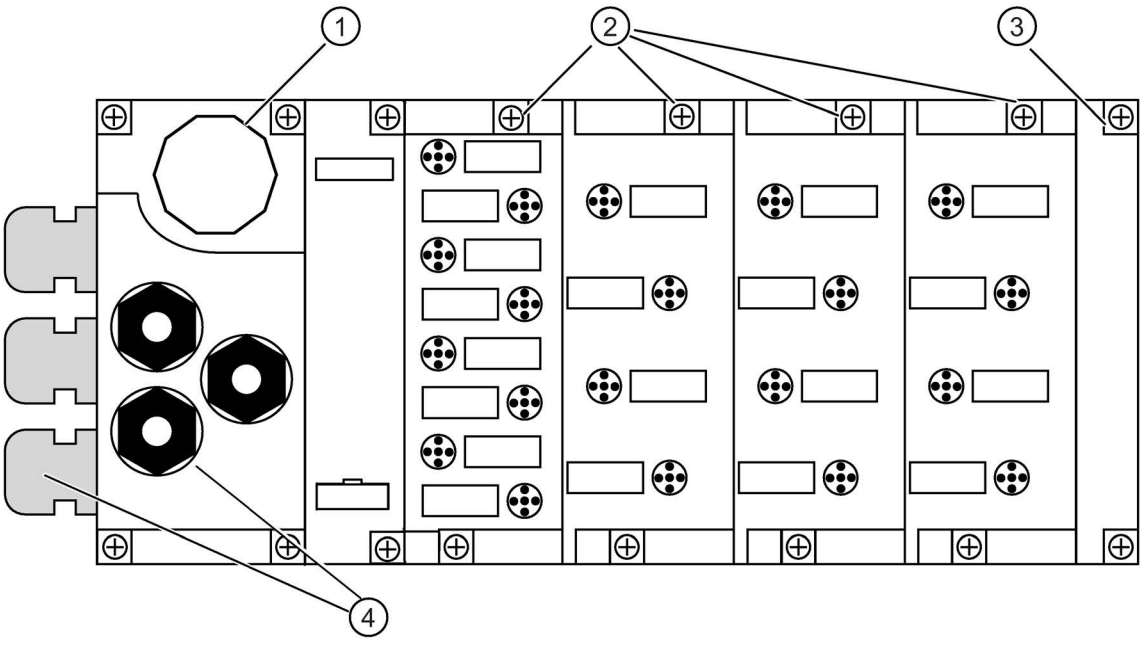
- An interface module that transfers data to the DP master/IO controller
- Up to 16 electronic modules with maximum 1 m total width (without rack)
- Connection modules in various designs for
  - PROFIBUS DP
  - PROFINET IO
  - Supply voltages
  - Inputs and outputs
- Pneumatic interface modules for linking of FESTO valve terminals

You can thus set the focus of your configuration on local requirements.

The convenient handling features of ET 200pro ensure quick commissioning and easy maintenance.

Example configuration

The figure below shows an example configuration of the ET 200pro.



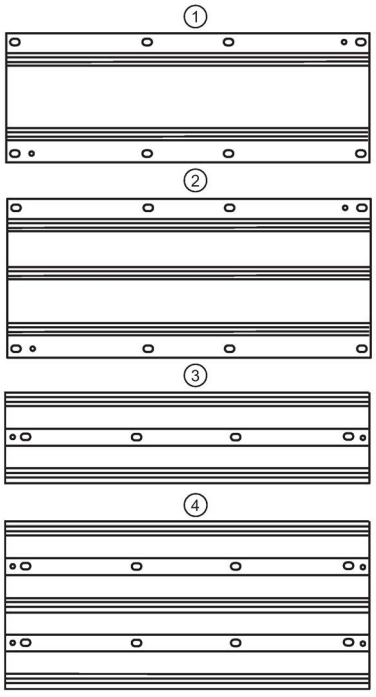
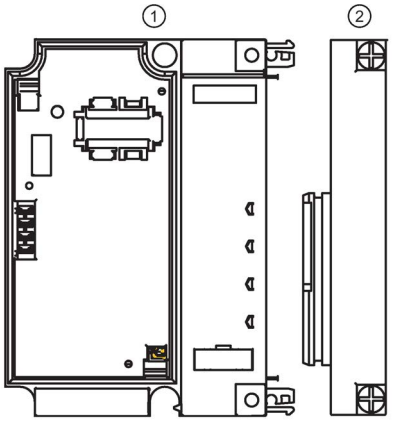
① CM IM DP Direct connection module for the interface module
② Connection modules for electronic modules
③ Terminating module
④ Cable glands for the cables on the connection module

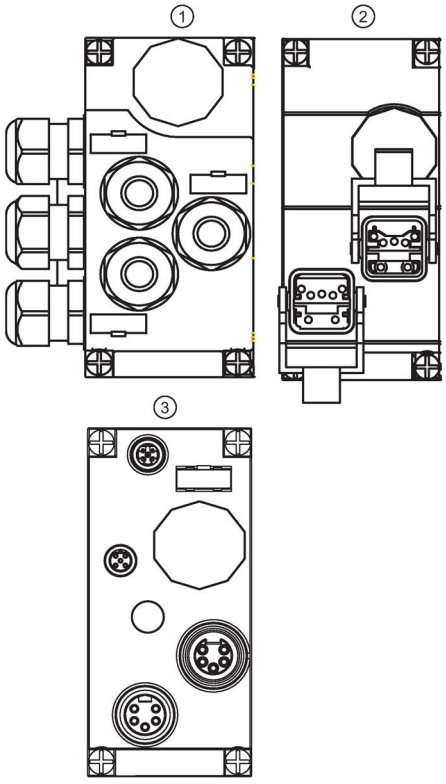
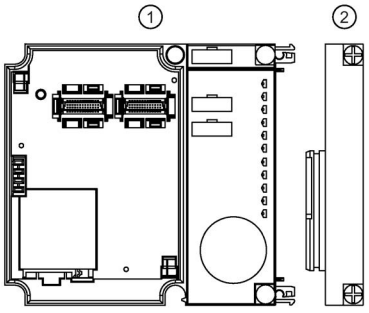
1.5 Components of the ET 200pro distributed IO system

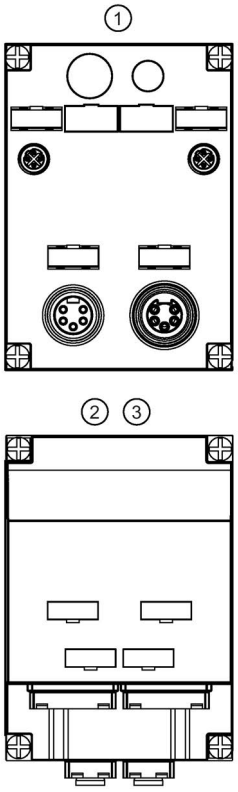
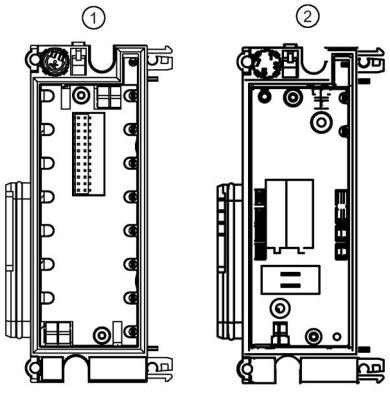
Components of the ET 200pro distributed I/O system

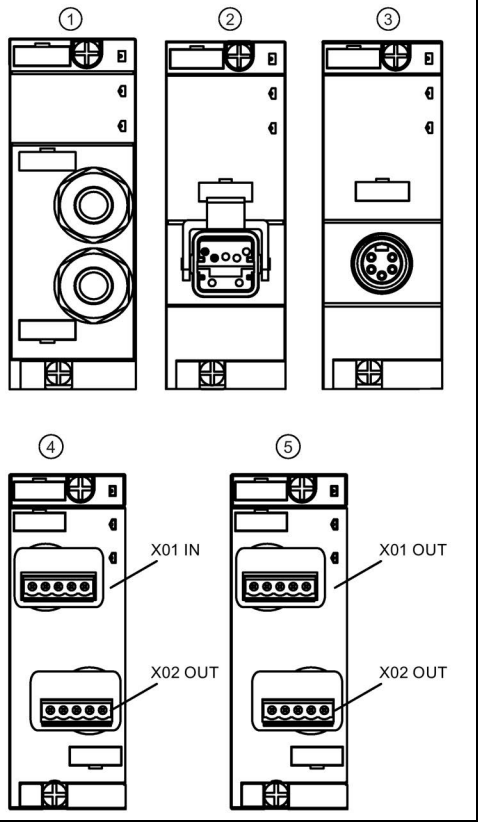
The table below lists the most important components of ET 200pro (Page 470).

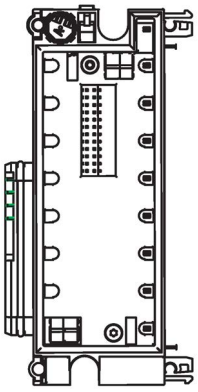
Table 1- 1 Components of ET 200pro

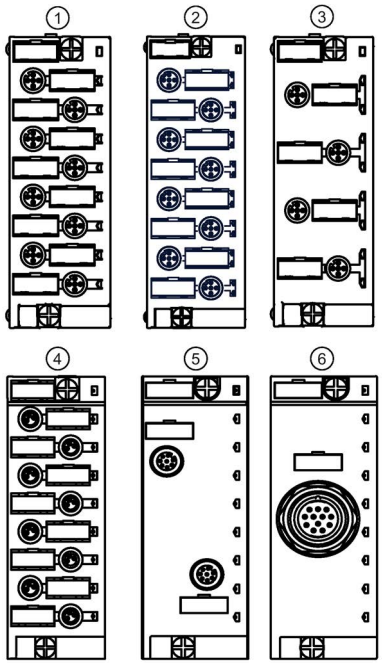
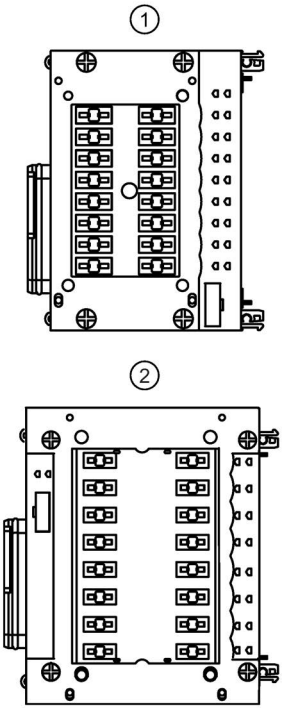
Component	Function	View
Rack	The ET 200pro is mounted onto the rack. 4 versions with different lengths are available: • Rack, narrow ① • Rack, wide ② • Rack, compact-narrow ③ • Rack, compact-wide ④	
Interface module for PROFIBUS DP with bus module and terminating module	The interface module interconnects ET 200pro with the DP master and prepares the data for the electronic modules. The unit is delivered with the terminating module ②, and the interface module ① is already mounted on the bus module. • The bus module is the mechanical and electrical connection element between the various ET 200pro modules. • The terminating module terminates the ET 200pro. The following interface modules are available for PROFIBUS DP: • IM 154-1 DP • IM 154-2 DP High Feature	

Component	Function	View
Connection modules for interface modules with PROFIBUS DP	The connection modules are mounted on the interface modules. They are used to connect PROFIBUS DP, the electronics/encoder supply and the load voltage supply. The following connection modules are available: • Direct connection: CM IM DP Direct ① • ECOFAST: CM IM DP ECOFAST Cu ② • CM IM DP M12, 7/8" ③	
Interface module for PROFINET IO with bus module	The interface module interconnects ET 200pro with the IO controller and prepares the data for the electronic modules. The unit is delivered with the terminating module ②, and the interface module ① is already mounted on the bus module. The following interface module is available for PROFINET IO: • IM 154-4 PN High Feature (6ES7154-4AB10-0AA0)	

Component	Function	View
Connection modules for the interface module (6ES7154-4AB10-0AA0) with PROFINET IO	The connection modules are mounted on the interface module. They are used to connect PROFINET IO and the electronic, encoder, and load voltage supplies. The following connection modules are available: • CM IM PN M12, 7/8" ① • CM IM PN PP Cu ② • CM IM PN PP FO ③	
Power module with bus module and outgoing module	① The power module provides a new potential group for the 2L+ load voltage supply. The unit is shipped with the power module mounted on the bus module. ② The outgoing module enables the 1L+ electronics/ encoder supply and the 2L+ load voltage supply to be tapped.	

Component	Function	View
Connection modules for PM-E power modules and PM-O DC 2x24V outgoing module	The connection modules are mounted on the power modules. They are used to connect the 2L+ load voltage supply. The following connection modules are available: • Direct connection: CM PM Direct ① • ECOFAST: CM PM ECOFAST ② • 7/8” connection: CM PM 7/8" ③ • Push-pull connection: CM PM PP ④ (connection of 1L+ and 2L+) The CM PM-O PP connection module (push-pull connection) ⑤ is mounted on the outgoing module. It enables the 1L+ electronics/encoder supply and the 2L+ load voltage supply to be tapped.	

Component	Function	View
Electronic module with bus module	The electronic module determines the function of the input and output channels. The unit is supplied with the electronic module mounted on the bus module. The bus module is the mechanical and electrical connection element between the various ET 200pro modules. The following electronic modules are available: • Digital: 8 DI DC 24V 16 DI DC 24V 4 DO DC 24V/2.0A 8 DI DC 24V High Feature 4 DO DC 24V/2.0A High Feature 8 DO DC 24V/0.5A 4 DI / 4 DO DC 24V/0.5A 4 DIO / 4 DO DC 24V/0.5A • Analog: 4 AI U High Feature 4 AI I High Feature 4 AI RTD High Feature 4 AI TC High Feature 4 AO U High Feature 4 AO I High Feature	

Component	Function	View
Connection modules for electronic modules	The connection modules are mounted on the electronic modules. They are used to connect sensors and actuators. The following connection modules are available: • 8 circular socket connectors: CM IO 8 x M12 ① CM IO 8 x M12P ① CM IO 8 x M12D ② CM IO 8 x M8 ④ • 4 circular socket connectors: CM IO 4 x M12 ③ CM IO 4 x M12P ③ CM IO 4 x M12 Inverse ③ • 2 circular socket connectors (for 2 actuator/ sensor distributors): CM IO 2 x M12 ⑤ • 1 circular socket connector (for 1 actuator/ sensor distributor) CM IO 1 x M23 ⑥	
Pneumatic interface modules	The pneumatic interface modules allow the linking of FESTO valve terminals CPV10 and CPV14. Each of the two FESTO valve terminals can be equipped with up to 16 valves (standard components of FESTO). The valve terminals differ in terms of nominal flow rate of air (CPV10: 400 l/min; CPV14: 800 l/min). Following pneumatic interface modules are available: • 16 DO DC 24V CPV10 ① • 16 DO DC 24V CPV14 ②	

Application Planning

2

2.1 Modular system

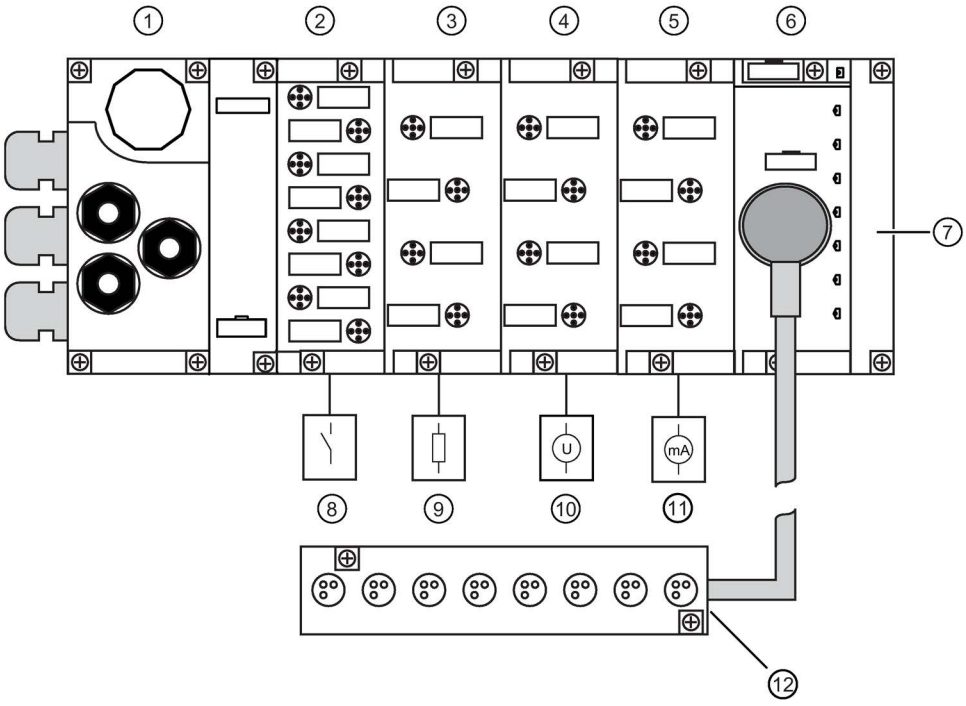
Modular system

A modular system in the context of ET 200pro means: With the extensive ET 200pro product range, you can adapt the configuration to your applications.

Example: ET 200pro with electronic modules

The ET 200pro can be equipped up to the maximum configuration with electronic modules. Between an interface module and a terminating module you can adapt the electronic modules to your application in whatever configuration you require.

The figure below shows an example configuration of the ET 200pro distributed I/O system.

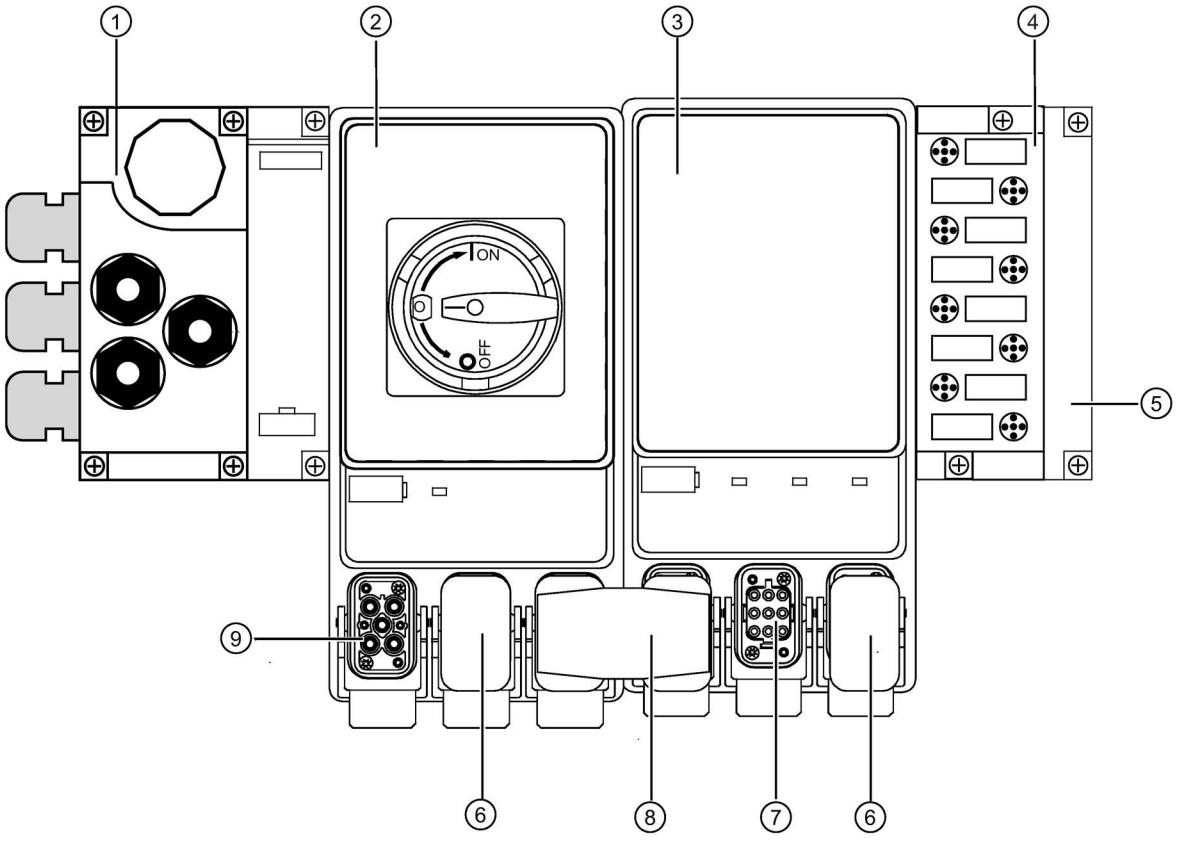


① IM/CM IM DP Direct
② 8 DI DC 24V
③ 4 DO DC 24V/2.0A
④ 4 AI U HF
⑤ 4 AI I HF
⑥ 8 DI DC 24V
⑦ Terminating module
⑧ 8 x switches, sensors
⑨ 4/8 x load
⑩ 4 x voltage measurement
⑪ 4 x current measurement for 2-/4-wire measuring transducer
⑫ Actuator/sensor distributor on the CM IO 1 x M23 connection module

Example: ET 200pro with electronic module and motor starter

Between an interface module and a terminating module you can adapt the electronic modules, motor starters and frequency converters to your applications in whatever configuration you require.

The figure below shows an example configuration of the ET 200pro distributed I/O system with motor starter and repair switch module.



① Interface module
② Repair switch module
③ DSe; Standard
④ 8 DI DC 24V
⑤ Terminating module
⑥ Cap
⑦ Motor connection
⑧ Power jumper plug
⑨ Infeed

2.2 Interface modules to suit your application

Interface module selection guide

The table below provides information to help you select your interface modules:

Table 2- 1 Interface modules to suit your application

Application	Suitable module	Properties of the module
DP slave for PROFIBUS DP	IM 154-1 DP	DPV0 slave DPV1 slave
	IM 154-2 DP High Feature	DPV0 slave DPV1 slave Application of ET 200pro fail-safe modules
IO devices for PROFINET IO	IM 154-4 PN High Feature	IO device Application of ET 200pro fail-safe modules

2.3 Electronic modules to suit your application

Electronic module selection guide

The table below provides information to help you select your electronic modules:

Table 2- 2 Electronic modules to suit your application

Application	Suitable module	Properties of the module
Evaluation of switches, proximity switches, sensors, and encoders	8 DI DC 24V	8 input channels 24 V DC
	16 DI DC 24V	16 input channels 24 V DC
Switching of solenoid valves, DC contactors and indicator lights	4 DO DC 24V/2.0A	4 output channels 24 V DC to 2 A
Evaluation of switches, proximity switches, sensors or encoders, configurable input delay	8 DI DC 24V High Feature	8 input channels 24 V DC single channel diagnostic
Switching of solenoid valves, DC contactors and indicator lights, configurable substitute value	4 DO DC 24V/2.0A High Feature	4 output channels 24 V DC to 2 A single channel diagnostic
	8 DO DC 24V/0.5A	8 output channels 24 V DC to 0.5 A
Digital inputs: Evaluation of switches, proximity switches, sensors, and encoders Digital outputs: Switching of solenoid valves, DC contactors and indicator lights	4 DI / 4 DO DC 24V/0.5A	4 inputs 24 V DC 4 outputs 24 V DC
Digital inputs: Evaluation of switches, proximity switches, sensors, and encoders Digital outputs: Switching of solenoid valves, DC contactors and indicator lights	4 DIO / 4 DO DC 24V/0.5A	4 freely configurable inputs/ outputs 4 outputs 24 V DC
Measuring voltages	4 AI U High Feature	4 input channels ± 10 V; ± 5 V; 1 V to 5 V; 0 V to 10 V
Measuring currents	4 AI I High Feature	4 input channels ± 20 mA; 4 mA to 20 mA; 0 mA to 20 mA
Measuring resistances Measuring temperatures with resistance thermometers	4 AI RTD High Feature	4 input channels Resistance measurement: 150 Ω; 300 Ω; 600 Ω; 3000 Ω Resistance thermometer: Pt100; Ni100; Ni120; Pt200; Ni200; Pt500; Ni500; Pt1000; Ni1000

Application	Suitable module	Properties of the module
Measuring temperatures with thermocouples Measuring voltages	4 AI TC High Feature	4 input channels Type B, E, J, K, L, N, R, S, T ±80 mV
Output of voltages	4 AO U High Feature	4 output channels ± 10 V; 0 to 10 V; 1 to 5 V
Output of currents	4 AO I High Feature	4 output channels ± 20 mA; 0 mA to 20 mA; 4 mA to 20 mA
Controlling valves with FESTO valve terminal	16 DO DC 24V CPV10	FESTO valve terminal CPV10 Nominal flow rate air 400 l/min
	16 DO DC 24V CPV14	FESTO valve terminal CPV14 Nominal flow rate air 800 l/min
Controlling RFID	See RFID systems (http://support.automation.siemens.com/WW/view/en/32622825), RF170C operating instructions.	
Controlling motor starters	See ET 200pro Motor Starter (http://support.automation.siemens.com/WW/view/en/22332388) operating instructions.	
Controlling frequency converters	See SIMATIC ET 200pro FC (http://support.automation.siemens.com/WW/view/en/28561828) operating instructions.	

2.4 Connection Modules to Suit your Application

Connection module selection guide

The table below provides information to help you select your connection modules for the interface module, power/outgoing module, and electronic module.

Connection modules for interface modules with PROFIBUS DP

Table 2- 3 Which connection module is suitable for the interface module with PROFIBUS DP?

Application	Connection module
Connecting and forwarding the PROFIBUS DP using an insulation displacement terminal Connecting and forwarding the supply voltages using screw terminals	CM IM DP Direct
Connecting and forwarding PROFIBUS DP and the supply voltages using ECOFAST cable connectors	CM IM DP ECOFAST Cu
Connecting and forwarding the PROFIBUS DP using M12 cable connectors Connecting and forwarding the supply voltages using 7/8" cable connectors	CM IM DP M12, 7/8"

Connection modules for the interface module with PROFINET IO

Table 2- 4 Which connection module is suitable for the interface module with PROFINET IO?

Application	Connection module
Connecting and forwarding PROFINET IO using M12 cable connectors Connecting and forwarding the supply voltages using 7/8" cable connectors	CM IM PN M12, 7/8"
Connecting and forwarding PROFINET IO using push-pull cable connectors (RJ45) Connecting and forwarding the supply voltages using push-pull cable connectors (1L+/2L+)	CM IM PN PP Cu
Connecting and forwarding PROFINET IO using push-pull cable connectors (SC RJ), fiber optic cables Connecting and forwarding the supply voltages using push-pull cable connectors (1L+/2L+)	CM IM PN PP FO

Connection modules for the power module

Table 2- 5 Which connection module is suitable for the power/outgoing module?

Application	Power module/outgoing module	Connection module
Connecting and forwarding the 2L+ load voltage supply using screw terminals	PM-E	CM PM Direct
Connection of the 2L+ load voltage supply using ECOFAST connectors		CM PM ECOFAST
Connection of the 2L+ load voltage supply using 7/8" connectors		CM PM 7/8"
Connecting and forwarding the 1L+ electronics/encoder supply and the 2L+ load voltage supply using push-pull cable connectors		CM PM PP
Tapping the 1L+ electronics/encoder supply and the 2L+ load voltage supply using push-pull cable connectors	PM-O	CM PM-O PP

Connection modules for the electronic module

The chapter "Options for combining modules" includes an overview in the table Electronic modules in combination with connection modules (Page 38) to show you which connection module can be combined with which electronic module.

See also

Options for Combining Modules (Page 37)

2.5 Options for Combining Modules

Introduction

You can use power/outgoing modules, interface modules, and electronic modules, respectively, with connection modules in various combinations. The following tables show the permitted combinations of connection modules and power/outgoing modules, interface modules, and electronic modules.

Possible combinations of power/outgoing modules and connection modules

Table 2- 6 Power/outgoing modules in combination with connection modules

Power/outgoing module	Connection module for power/outgoing module				
	CM PM Direct	CM PM ECOFAST	CM PM 7/8"	CM PM PP	CM PM-O PP
PM-E DC 24V	•	•	•	•	
PM-O DC 2x24V					•

Possible combinations of interface modules and connection modules

Table 2- 7 Interface modules in combination with connection modules

Interface module	Connection module for interface module						
	CM IM DP Direct	CM IM DP ECOFAST Cu	CM IM DP M12, 7/8"	CM IM PN M12, 7/8"	CM IM PN PP Cu	CM IM PN PP FO	CM IM PN DP M12, 7/8"
IM 154-1 DP	•	•	•				
IM 154-2 DP High Feature	•	•	•				
IM 154-4 PN High Feature 6ES7154-4AB10-0AB0				•	•	•	
IM 154-4-8 CPU 6ES7154-8AB00-0AB0							•

Possible combinations of electronic modules and connection modules

Table 2- 8 Electronic modules in combination with connection modules

Electronic module	Connection module for electronic module							
	CM IO 4 x M12	CM IO 4 x M12P	CM IO 4 x M12 Inverse	CM IO 8 x M12 CM IO 8 x M12P	CM IO 8 x M12D	CM IO 8 x M8	CM IO 2 x M12	CM IO 1 x M23
8 DI DC 24V	•	•		•		•	•	•
8 DI DC 24V High Feature	•	•		•		•		
16 DI DC 24V					•			
4 DO DC 24V/2.0A	•	•	•			•	•	•
4 DO DC 24V/2.0A High Feature	•	•	•			•		
8 DO DC 24V/0.5A	•	•		•		•	•	•
4 DI / 4 DO DC 24V/0.5A	•	•		•		•	•	•
4 DIO / 4 DO DC 24V/0.5A					•			
4 AI U High Feature	•							
4 AI I High Feature	•							
4 AI RTD High Feature	•							
4 AI TC High Feature	•							
4 AO U High Feature	•							
4 AO I High Feature	•							

2.6 Placing Power Modules

2.6.1 Placement of PM-E power module

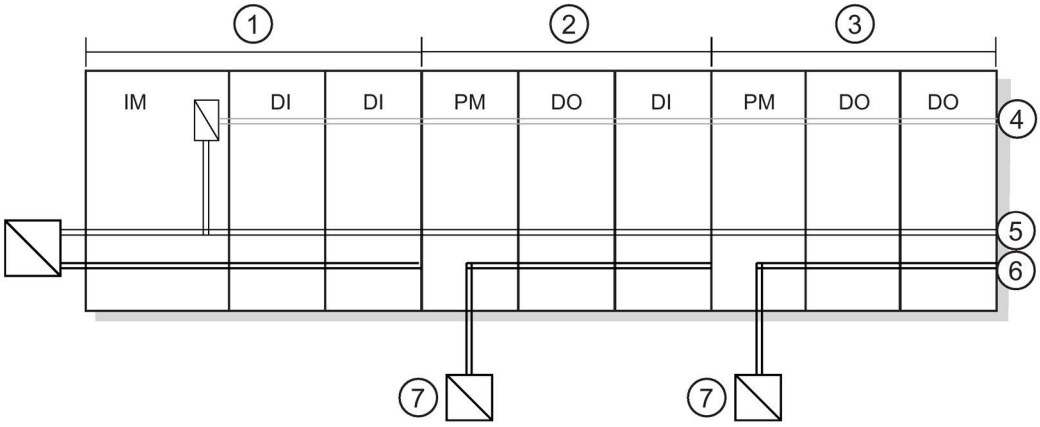
Power modules

In the ET 200pro distributed I/O system, you can place the power modules at any location to the right of the interface module. The first power module is already integrated in the interface module.

Each power module installed in the ET 200pro configuration interrupts the load voltage bus and provides a new potential group (supply source) for the 2L+ load voltage supply. This power module feeds all downstream load supplies of the electronic modules. Each power module is equipped with a replaceable fuse for device protection. Only line protection in accordance with DIN VDE 0100 still has to be provided externally.

The power module does not interrupt the 1L+ electronic/encoder supply, but rather loops it through.

Opening a new potential group



① Potential group 1
② Potential group 2
③ Potential group 3
④ Backplane bus
⑤ 1L+ electronic/encoder supply
⑥ 2L+ load voltage supply
⑦ Opening a new potential group for 2L+ using a power module

See also

PM-E power module (Page 323)

2.6.2 Placement of PM-O DC 2x24V Outgoing Module

Outgoing module

With the ET 200pro distributed I/O system, you ideally place the outgoing module directly to the right of the F-switch during ET 200pro installation.

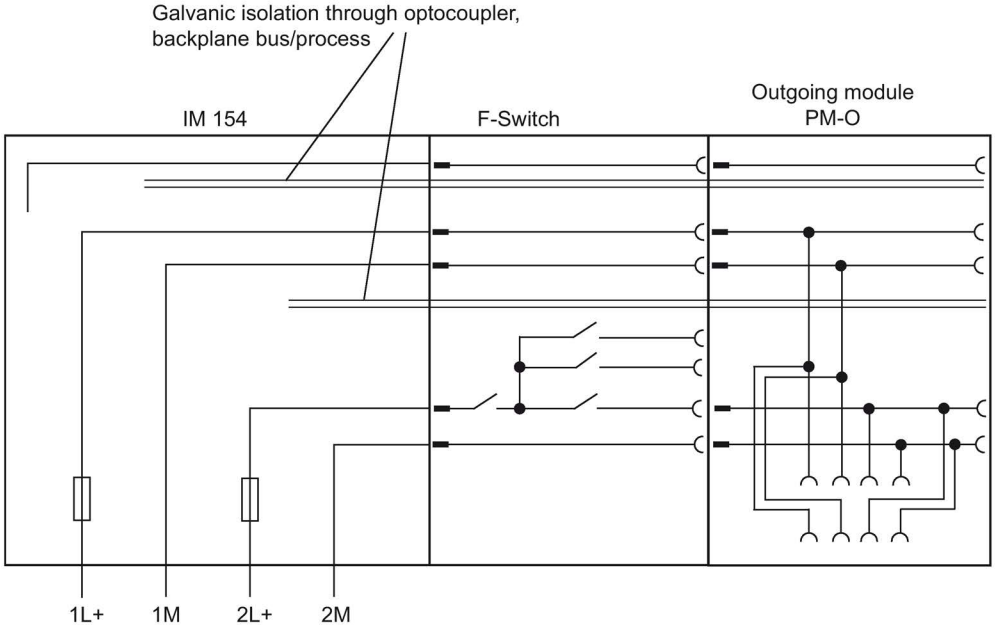
You can install additional power and electronic modules on the right of the outgoing module.

You can find information on other possible installations of the outgoing module in the FAQs for ET 200pro (http://support.automation.siemens.com/WW/view/en/26694409).

The 1L+ electronic/encoder supply of the outgoing module is protected by means of an electronic circuit and is short-circuit proof. The 2L+ load voltage supply is protected by means of the PM-E power module or the interface module of the ET 200pro distributed I/O system.

Tapping of the electronic/encoder supply and load voltage supply

In this example, the PM-O DC 2x24V outgoing module is placed after an F-switch. The F-switch provides for safe shutdown of the loads connected to the outgoing module.



Additional information regarding the F-switch

You can find additional information regarding the F-switch in the ET 200pro Distributed I/O System - Fail-Safe Modules (http://support.automation.siemens.com/WW/view/en/22098524) operating instructions.

See also

PM-O DC 2x24V outgoing module (Page 328)

2.7 Maximum configuration

Mechanical maximum configuration

The maximum configuration of an ET 200pro is reached when one of the rules outlined below applies:

Table 2- 9 Mechanical maximum configuration

Properties	Rule
Number of modules	max. 16 electronic modules
Width of ET 200pro	max. 1 m mounting width (without rack)

Electrical maximum configuration

- 1L+ electronics/encoder supply:
  - supplies power to the internal electronic circuit of the modules and to external encoders
  - electrically isolated to the backplane bus of ET 200pro, to 2L+ and to PROFIBUS DP/PROFINET IO
- 2L+ load voltage supply:
  - supplies power to the external actuators
  - electrically isolated to the backplane bus, to 1L+ and to PROFIBUS DP/ PROFINET IO

Table 2- 10 Electrical maximum configuration

Properties	Rule
1L+ electronics/encoder supply	max. 5 A per ET 200pro station
2L+ load voltage supply	max. 10 A per potential group

2.8 TIA Selection Tool

TIA Selection Tool

The TIA Selection Tool supports you in configuring your ET 200pro stations. You can download the tool from the Internet for free: TIA Selection Tool (https://eb.automation.siemens.com/mall/en/DE/Catalog/Products/10007261?tree=CatalogTree)

The tool is located in the "Configurators" tab. Select the TIA Selection Tool in the drop-down list.

Mounting

3

3.1 Requirements

Preassembling ET 200pro modules

The ET 200pro modules can be preassembled on a narrow or wide rack version before installing the rack on site.

Mounting position

An ET 200pro can be mounted in any position.

Restrictions regarding the mounting position:

- If you configure the ET 200pro Distributed I/O System with the ET 200pro FC frequency converter, observe the restrictions regarding the mounting position. You can find additional information in the ET 200pro FC Frequency Converter (http://support.automation.siemens.com/WW/view/en/28561828) operating instructions.
- If you set up the ET 200pro distributed I/O system with ET 200pro motor starters, observe the restrictions regarding the mounting position. You can find additional information in the ET 200pro Motor starters (https://support.industry.siemens.com/cs/us/en/view/22332388) manual on the Internet.

3.2 Rack

3.2.1 Rack

Rack versions

The following rack types are available for the ET 200pro: narrow, wide, compact-narrow, and compact-wide. The modules can be preassembled on the narrow and wide rack versions.

Versions	Properties	Length
Rack, narrow	• For interface / power / electronic modules • Module preassembly is possible	• 500 mm long, with mounting holes • 1000 mm long, with mounting holes • 2000 mm long, without mounting holes
Rack, wide	• For interface/power/electronic modules, motor starters, and frequency converters • Pre-assembly of modules, motor starters, and frequency converters possible	
Rack, compact-narrow	• For interface / power / electronic modules	
Rack, compact-wide	• For interface/power/electronic modules, motor starters, and frequency converters	

Vibration resistance

In order to achieve the guaranteed vibration resistance of all ET 200pro modules, always use **all** mounting holes to mount the rack.

Rack with a length of 2000 mm

Cut the 2000 mm rack to suit your requirements, and drill mounting holes for the M8 screws. In order to achieve the guaranteed vibration resistance of all ET 200pro modules, position the first holes at a distance of 12 mm to both ends, and the intermediate holes at an even pitch of max. 200 mm.

Rule

Always connect the rack to functional ground (FG). The connection to functional ground is required to discharge interference and for EMC compatibility.

Note

Low-impedance connection to ground potential

Always make sure you have a low-impedance connection between the rack and ground potential.
If you do **not** install the rack on a grounded surface, always create a low-impedance connection to ground potential, for example, with the help of a copper braid.

3.2.2 Mounting wide and narrow racks

Introduction

The ET 200pro is preassembled on a narrow or wide rack.

Dimensions for the narrow rack

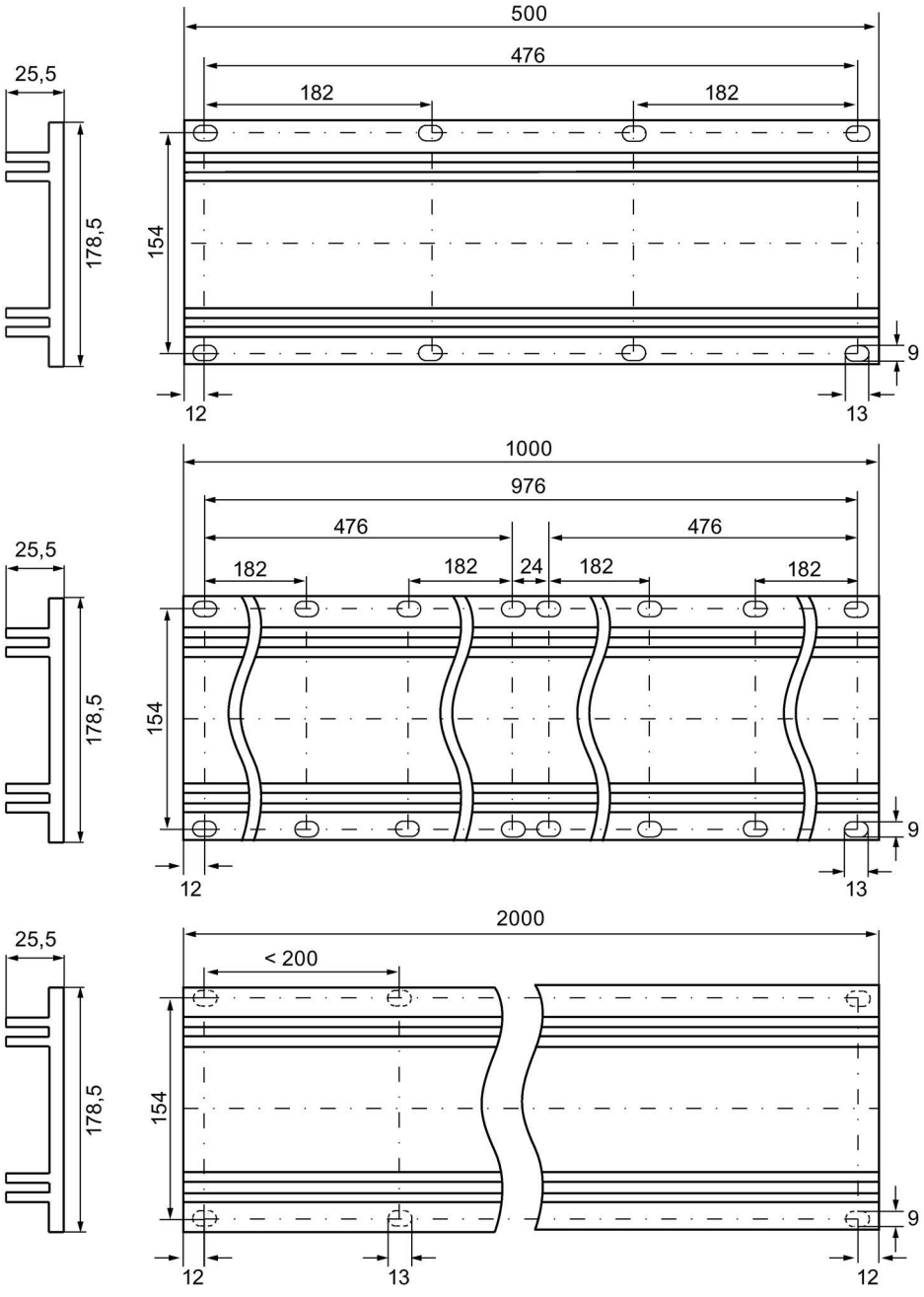


Figure 3-1 Dimension drawing for narrow rack

Dimensions for the wide rack

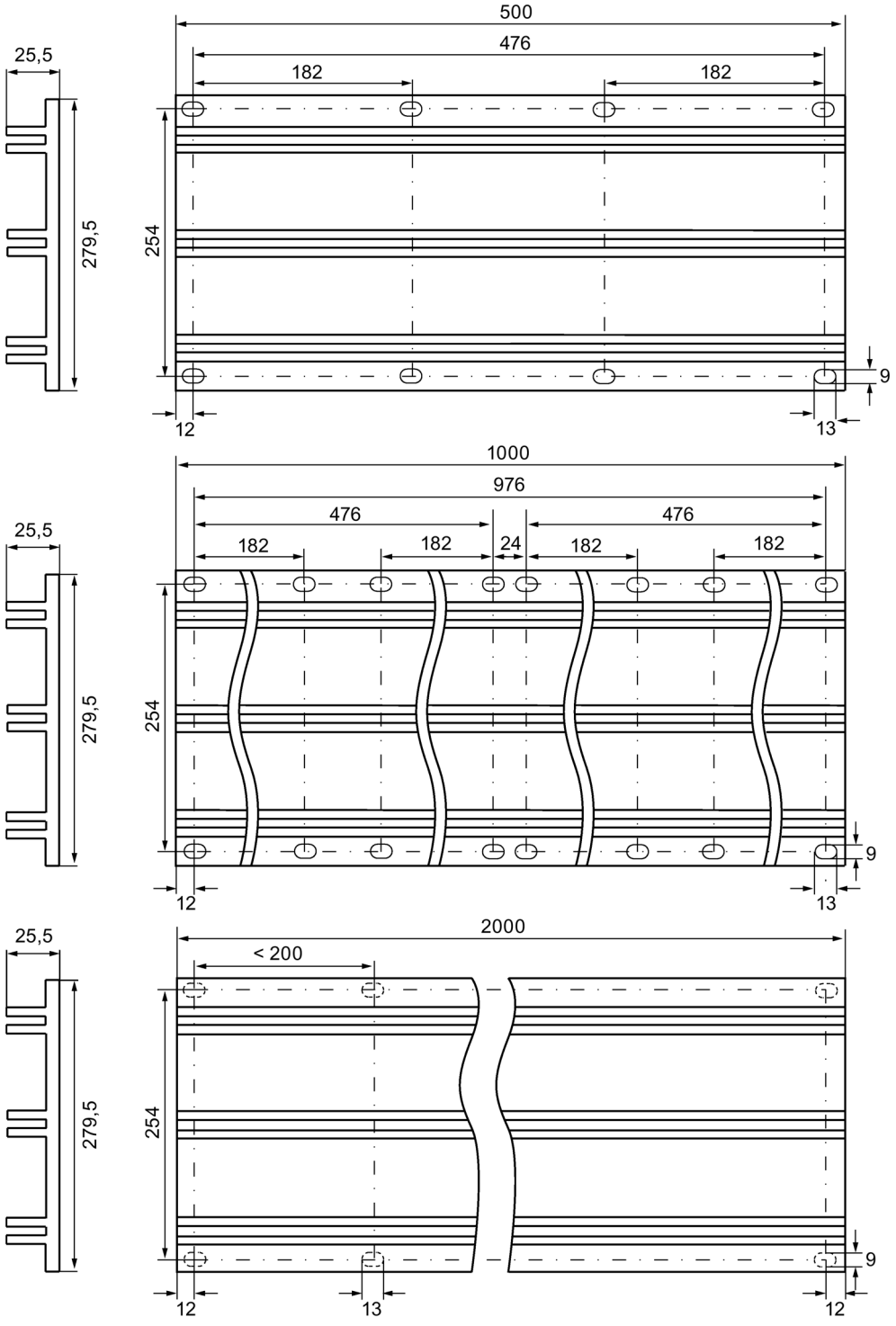


Figure 3-2 Dimension drawing for the wide rack

Required tools

- Wrench or screwdriver, matching the selected fixing screws.
- Stripping tool and crimp tool for the grounding cable.

Required accessories

Table 3- 1 Rack and grounding cable

For...	you can use...	Description
Outer fixing screws	M8 cylindrical head screw in accordance with ISO 1207/ISO 1580 (DIN 84/DIN 85)	Select the screw length to match your setup. You also need 8.4 mm washers according to ISO 7092 (DIN 433)
	M8 hexagonal head screw according to ISO 4017 (DIN 4017)	
Grounding cable	Insulated cable, conductor cross-section: min. 4 mm^2	You also need an M8 ring cable lug and an M8 spring lock washer

Mounting the rack and connecting functional ground (FG)

1. If necessary, mark the mounting holes on the mounting base, then drill holes with a diameter of 8.5 $mm^{\pm 0.2}$ mm.
2. Screw-mount (M8 screws) the rack onto the carrier.
3. Strip the grounding conductor and functional ground (FG) (Cu braid, for example), then crimp on an M8 ring cable lug.
4. Fasten the grounding conductor using one of the bore holes of the rack: Slip the spring lock washer, the washer and the cable lug onto the mounting screw, then screw the rack onto the carrier.
5. Connect the opposite end of the grounding cable to ground potential.

Note

Ensure adequate equipotential bonding.

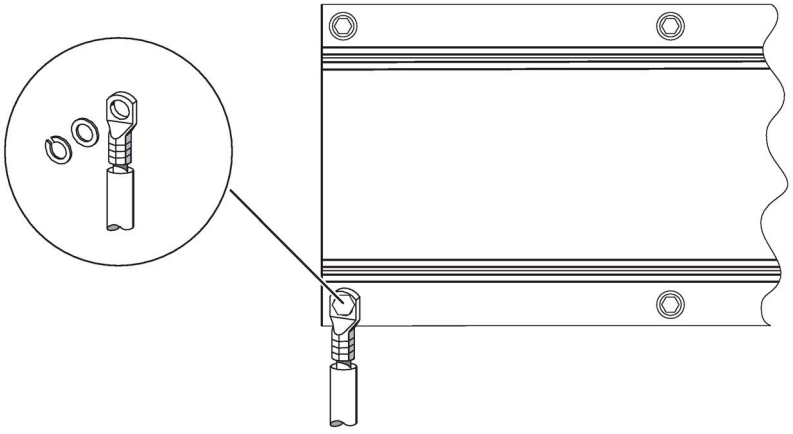


Figure 3-3 Grounding a narrow rack

3.2.3 Mounting Compact Type Racks

Introduction

Mount the compact type rack onto the carrier before you mount your ET 200pro.

Dimensions of the compact-narrow rack

The dimensional drawing below shows the mounting hole dimensions of the compact-narrow type rack.

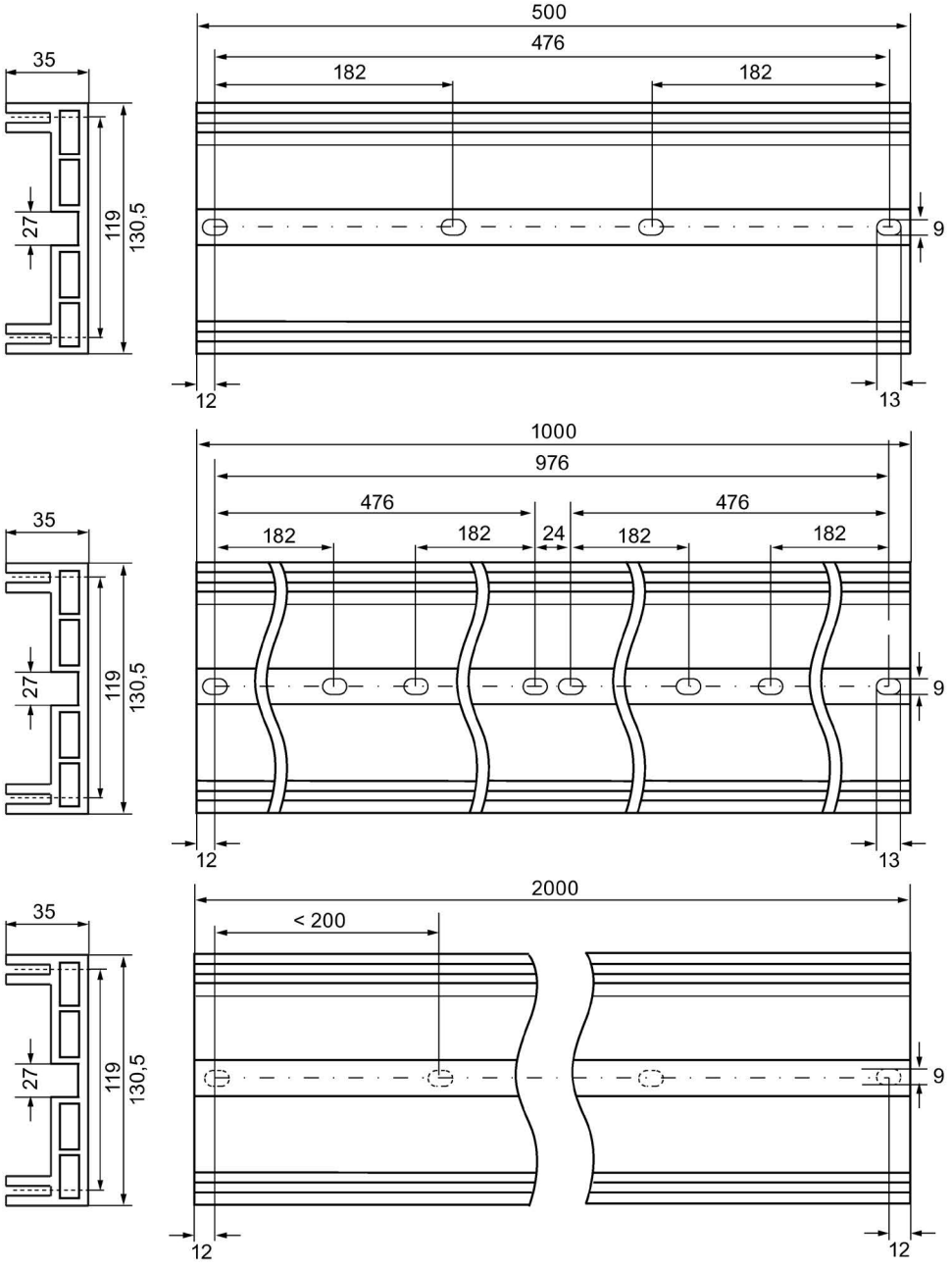


Figure 3-4 Dimension drawing of compact-narrow rack

Dimensions of the compact-wide rack

The dimension drawing below shows the mounting hole dimensions of the compact-wide type rack.

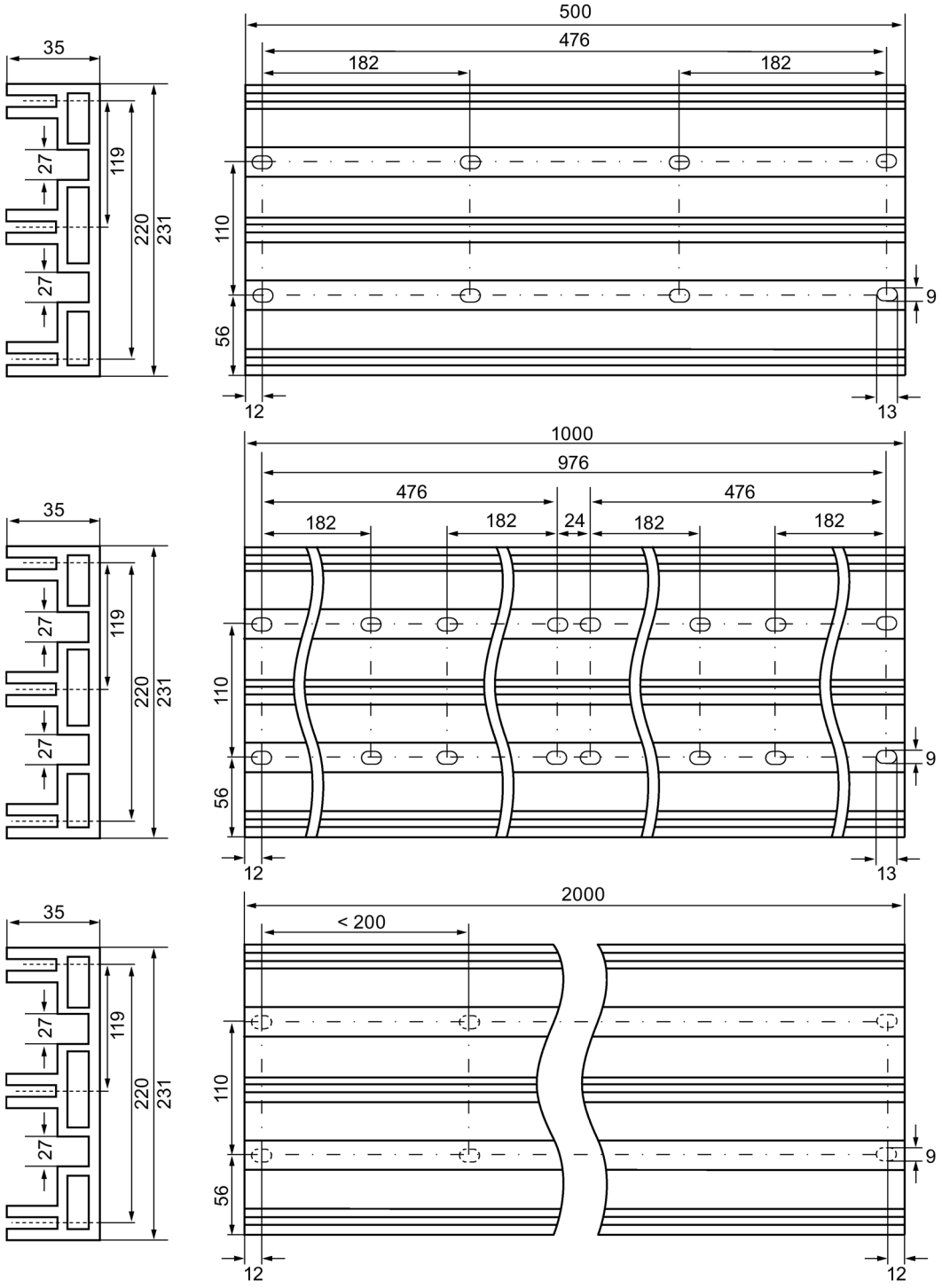


Figure 3-5 Dimension drawing of compact-wide rack

Required tools

- Wrench or screwdriver, matching the selected fixing screws.
- Stripping tool and crimp tool for the grounding cable.

Required accessories

Table 3- 2 Rack and grounding cable

For...	you can use...	Description
Outer fixing screws	M6 cylinder head screw according to ISO 1207/ISO 1580 (DIN 84/DIN 85)	Select the screw length to match your setup. You also need 8.4 mm washers according to ISO 7092 (DIN 433)
	M8 hexagonal head screw according to ISO 4017 (DIN 4017)	
Grounding cable	Insulated cable, conductor cross-section: min. 4 mm^2	You also need an M8 ring cable lug and an M8 spring lock washer

Mounting the rack and connecting functional ground (FG)

1. Make allowances for sufficient installation space when you mount the rack onto the carrier.
2. If necessary, mark the mounting holes on the mounting base, then drill holes with a diameter of 8.5 $mm^{\pm 0.2}$ mm.
3. Screw-mount (M8 screws) the rack onto the carrier.
4. Strip the grounding conductor (Cu braid, for example) and functional ground (FG), then crimp on an M8 ring cable lug.
5. Fasten the grounding conductor using one of the bore holes of the rack: Slip the spring lock washer, the washer and the cable lug onto the mounting screw, then screw the rack onto the carrier.
6. Connect the opposite end of the grounding cable to ground potential.

Note

Ensure adequate equipotential bonding.

3.3 Mounting the Interface Module

Introduction

The interface module interconnects ET 200pro with PROFIBUS DP/ PROFINET IO and supplies power to the electronic modules.

Requirements

- The terminating module is removed from the interface module.
- The rack has been mounted.

Required tools

Cross-tip screwdriver, size 2

Procedure

1. Snap-mount the interface module onto the rack, then slide it into the correct position.
2. Screw-mount the Interface module onto the rack.
   – Interface modules for PROFIBUS DP/PROFINET IO (without connection module): 2 recessed head screws on the front: top and bottom, tightening torque 1.5 N/m

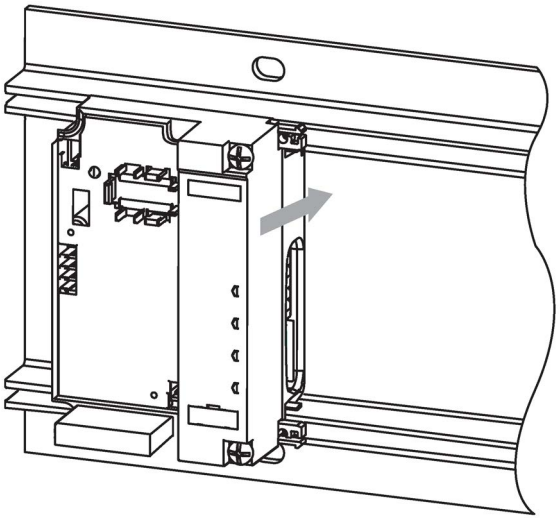


Figure 3-6 Mounting the interface module for PROFIBUS DP (example)

See also

Connecting the Interface Module to a CM IM DP ECOFAST Cu Connection Module (Page 83)

Connecting the Interface Module to the CM IM DP M12, 7/8" Connection Module (Page 88)

3.4 Mounting the Power Module

Introduction

You connect the 2L+ load voltage supply to the power module. The power module opens a new load group (sourcing) for the electronic modules of ET 200pro. The power module and the corresponding bus module are supplied in gray color in order to prevent mistakes.

Requirements

- The power module is mounted on the corresponding bus module (delivery state).
- The connection module may not be installed when you slide the power module to the left.

Note

CM PM Direct connection module

You need to remove the cover from the CM PM Direct connection module in order to wire the cables. Recommendation: Do not mount the connection or power modules onto the rack before you have completed the wiring.

Required tools

Cross-tip screwdriver, size 2

Proceed as follows

1. Snap-mount the power module onto the rack.
2. Apply some pressure **on the connector of the bus module** (not on the power module!), then slide the power module to the left to engage it on the previous electronic module.

Note

Points to note when installing:

- The power module may not become skewed when you move it.
- You need to apply more pressure to engage it on the previous electronic module, and to achieve seal tightness.

3.5 Mounting the Electronic Module

Introduction

The electronic module determines the function of the input and output channels. The connection module is mounted onto the electronic module.

Requirements

- The interface module is mounted onto the rack.
- All electronic modules must be installed to the right side of the interface module.
- The interface module is inserted into the relevant bus module (as delivered).
- The connection module may not be installed when you move the electronic module to a position further on the left side.

Proceed as follows

1. Clip the electronic module onto the rack. Make sure that the mechanical interlock engages.
2. Apply some pressure **on the connector of the bus module** (not on the electronic module!), then slide the electronic module to the left to engage it with the interface module, or on the previous electronic module.

Note

Points to note when installing:

- The electronic module may not become skewed when you move it.
- You will need to apply some more pressure in order to engage the module with the interface module or previous electronic module and to achieve appropriate seal tightness.

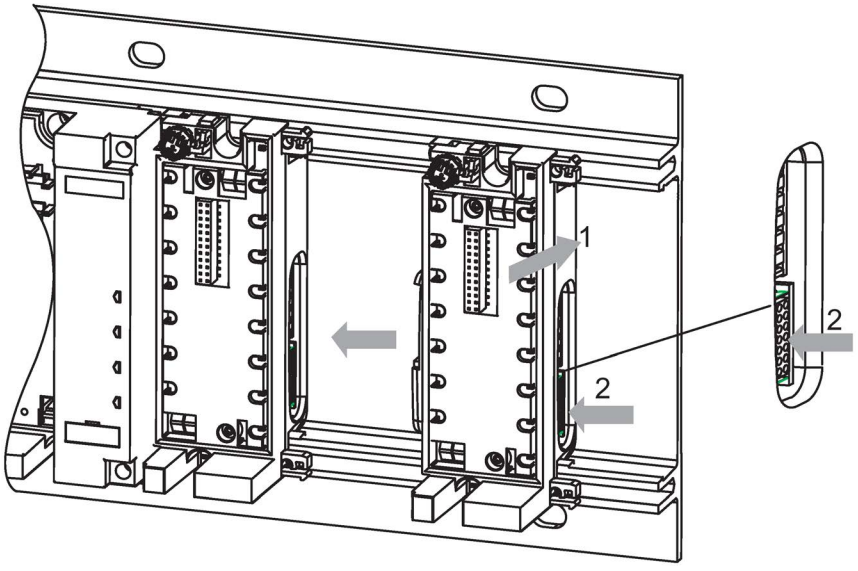


Figure 3-7 Mounting electronic modules

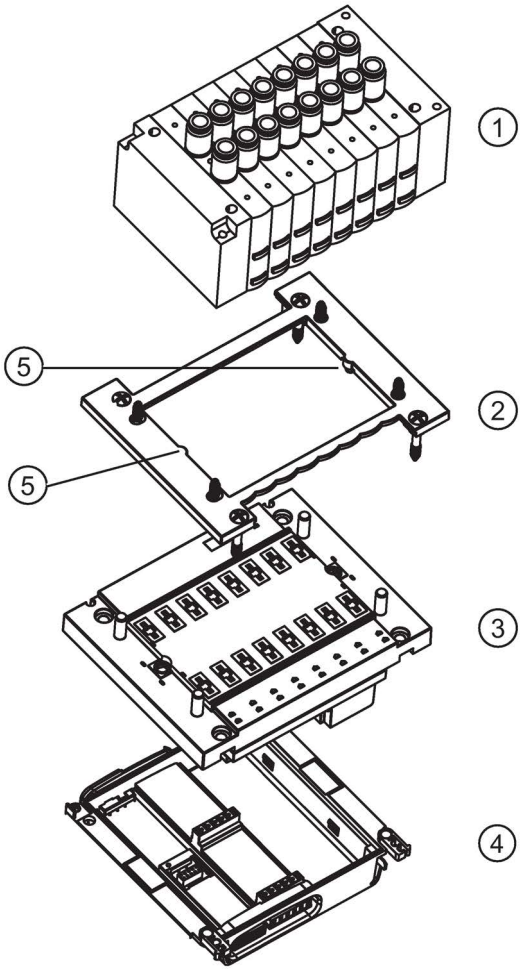
See also

Replacing a bus module (Page 160)

3.6 Installing the pneumatic interface module

Introduction

The pneumatic interface module is first mounted onto the rack. The FESTO valve terminal is then fixed with screws to the connection plate. This unit is then mounted on the pneumatic interface module.



① FESTO valve terminal with sponge-rubber seal (on the bottom)
② Connection plate
③ Pneumatic interface module
④ Bus module
⑤ Position of the O-rings for sealing

Figure 3-8 Installing the pneumatic interface module

Requirements

- The interface module is mounted onto the rack.
- All pneumatic interface modules must be mounted on the right side of the interface module.
- The pneumatic interface module is mounted in the corresponding bus module (as-delivered state).
- In the as-delivered state there is a screw on the FESTO valve terminal for attaching the functional earth. This screw is not needed when the FESTO valve terminal is used in the ET 200pro and must be removed prior to mounting.

Note

For compliance with degree of protection IP65, you must install a flat gasket between the FESTO valve terminal (CPV10 or CPV14) and the pneumatic interface module (16 DO DC 24V CPV10 or 16 DO DC 24V CPV14).

The flat gasket is not shipped with the FESTO valve terminal (CPV10 or CPV14); it must be ordered separately from Festo AG & Co. KG. The order numbers can be found in the Appendix (Page 456).

Required tools

- Cross-tip screwdriver, size 1
- Cross-tip screwdriver, size 2

Required accessories

- FESTO valve terminal CPV10 or CPV14
- 4 recessed head screws 3x16 (supplied together with pneumatic interface module)
- 4 recessed head screws 5x30 (supplied together with pneumatic interface module)

Mounting the pneumatic interface module on the rack

1. Remove the connection plate from the pneumatic interface module.
2. Place the pneumatic interface module on the rack, then push it on until it engages.
3. Slide the pneumatic interface module to the right until it snaps into place on the previous module.

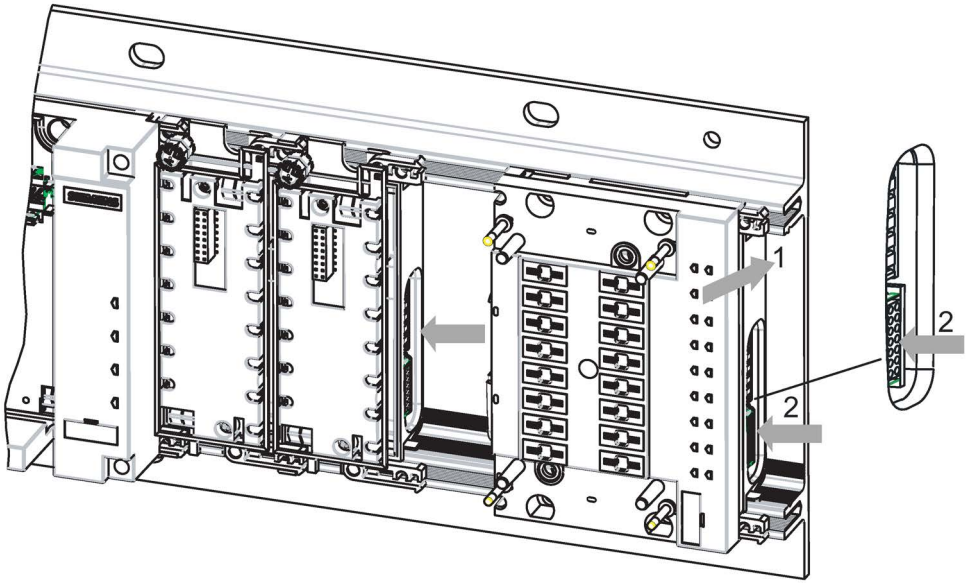


Figure 3-9 Mounting the pneumatic interface module on the rack

Note

The pneumatic interface module may not become skewed when you move it.

An increased force has to be exercised to get the module to snap into the previous module and achieve a tight seal.

Mounting the FESTO valve terminal on the pneumatic interface module

1. Place the FESTO valve terminal on the connection plate. The undulatory edges on the connection plate and the pneumatic interface module must fit together.
2. From below, attach the connection plate with screws (2 Nm torque) to the FESTO valve terminal. To do so, use the size 1 cross-tip screwdriver and the four 3x16 recessed head screws.
3. Press the flat gasket onto the bottom of the FESTO valve terminal. Make sure that the flat gasket is seated correctly in the center.
4. Place the FESTO valve terminal with the connection plate on the pneumatic interface module. The undulatory edges are on the LED side.
5. Screw the connection plate to the pneumatic interface module (2 Nm torque). To do so, use the size 2 cross-tip screwdriver and the 5x30 recessed head screws.

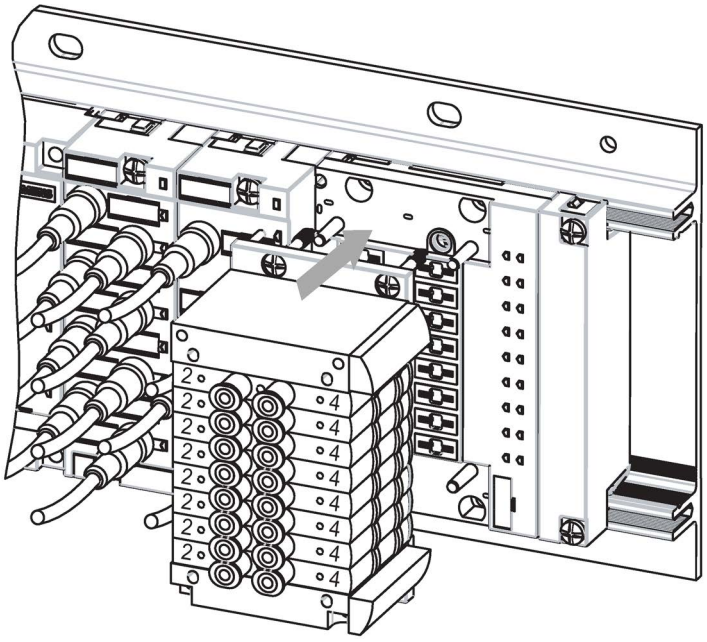


Figure 3-10 Mounting the FESTO valve terminal on the pneumatic interface module

Note

There are two O-rings mounted on the connection plate; these seal the space between the connection plate the electronic module. If you replace the pneumatic interface module you must also replace the two O-rings size 5x1.2.

3.7 Mounting the terminating module

Introduction

The ET 200pro is terminated using a terminating module. The terminating module must be mounted to enable operation of the ET 200pro.

Requirements

- You have mounted all electronic modules of ET 200pro.
- All electronic modules are screwed onto the rack.

Required tools

Cross-tip screwdriver, size 2

Proceed as follows

1. Mount the terminating module onto the rack.
2. Slide the terminating module to the left, up to the last electronic module.

Note

Do not screw the terminating module to the rack (two recessed head screws, torque 1.5 N/m) unless you screwed all connection modules to the electronic modules.

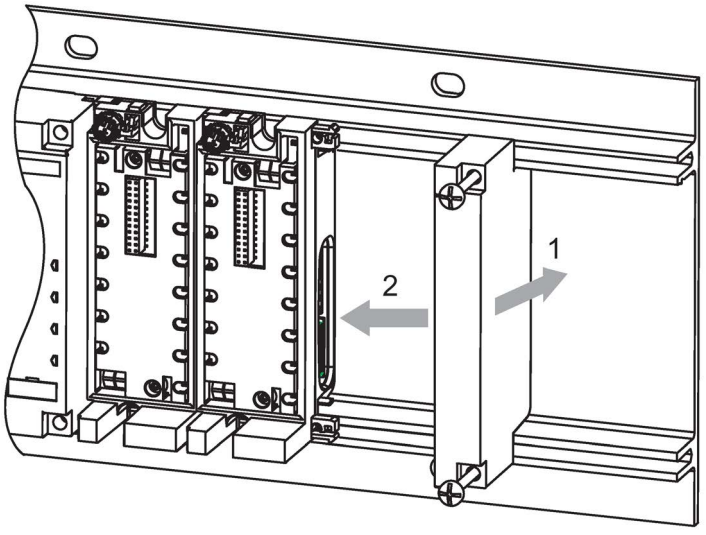


Figure 3-11 Mounting the terminating module

3.8 Replacing Labeling and Module Identification Labels

Introduction

Use the module tags to identify the modules, and the labels to identify their channels and connections. The modules are supplied with the labels clipped on. Replacement labels are available on order.

Module tags in color

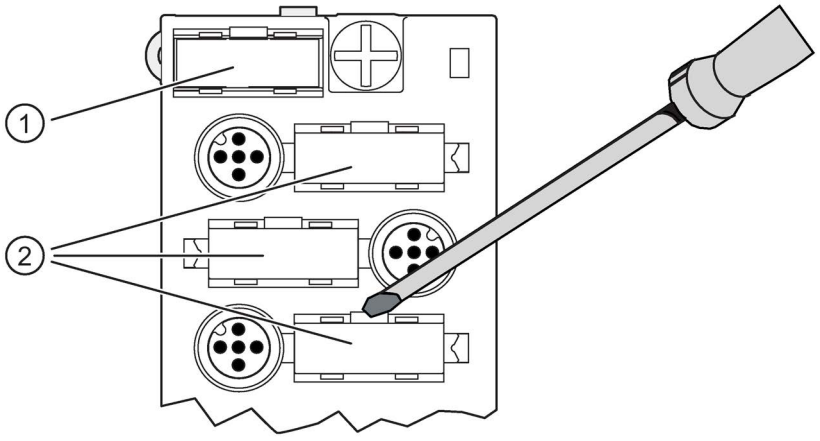
You may use module tags to identify the module class. The tags are available in blue, green, white and red.

Required tools

Screwdriver, size 2.5 mm to 4 mm

Procedure

1. Push the screwdriver into the small opening of the label, and then lever it out.
2. Use your finger to press the new label into the holder of the module.



① Module label
② Labels

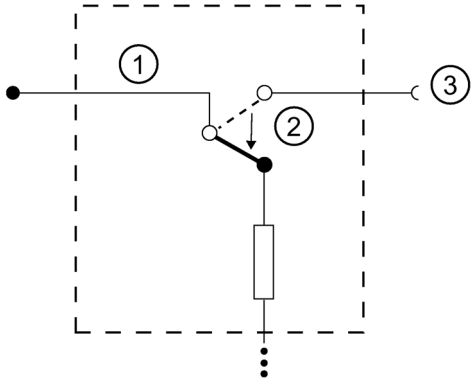
Figure 3-12 Replacing labels

3.9 Setting the PROFIBUS DP Address and Terminating Resistor

Introduction

Set the PROFIBUS DP address and terminating resistor at the connection module for the interface module.

- The PROFIBUS address defines the point of access to the ET 200pro on PROFIBUS DP.
- A PROFIBUS DP segment must be terminated at both ends, in other words on the first and last segment node, with its characteristic impedance. If the ET 200pro is the last PROFIBUS DP node, the integrated terminating resistor has to be activated.
  If you activate the terminating resistor in the middle of a DP segment, all the subsequent DP nodes are disconnected. If you are servicing the system you can use this function to locate errors by a selective activating / deactivating of the terminating resistors of the other DP nodes.



① PROFIBUS DP
② Terminating resistor is activated
③ The other DP nodes are disconnected

Requirements

- Valid PROFIBUS DP addresses are 1 to 125.
- All PROFIBUS DP addresses must be unique.
- The set PROFIBUS DP address must correspond with the definition in the configuration software of this ET 200pro.

Required tools

- Screwdriver with 2.5 mm blade
- 32-mm wrench

Setting the PROFIBUS DP address at the connection module and activating the terminating resistor

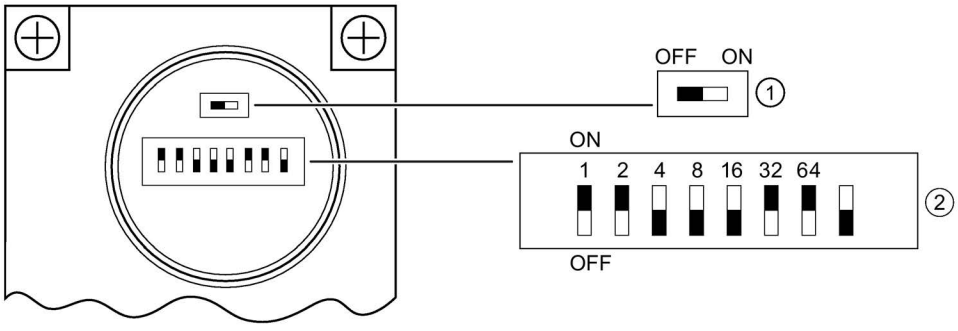
1. Remove the cap from the connection module.
2. Set the PROFIBUS DP address using the DIP switches (see the example below).
3. If this ET 200pro is the last node on PROFIBUS DP, enable the terminating resistor using the DIP switch.

Note

Enable the terminating resistor to terminate the PROFIBUS DP network at this end point.

4. Screw the cap back into the connection module.
5. Hand-tighten the cap (minimum tightening torque 1.0 Nm).

Example



① Enabling and disabling the terminating resistor
② Setting PROFIBUS DP addresses 1 to 125

PROFIBUS DP address set on the DIP switch: 1 + 2 + 32 + 64 = 99

1	2	4	8	16	32	64
ON	ON	OFF	OFF	OFF	ON	ON

Note

Any modification of the PROFIBUS DP address is not validated unless you switch the electronics/encoder power supply 1L+ off and on.

See also

Commissioning ET 200pro (Page 151)

Connection

4

4.1 General rules and regulations for operating the ET 200pro

Introduction

When operating the ET 200pro distributed I/O system as part of a plant or system, special rules and regulations have to be followed depending on the field of application.

This chapter provides an overview of the most important rules you must observe when integrating the ET 200pro distributed I/O system into a plant or system.

Specific application

Note the safety and accident prevention regulations that apply to specific applications (for example, machine protection guidelines).

EMERGENCY-STOP equipment

Emergency-stop devices as defined in IEC 204 (corresponds to DIN VDE 113) must remain effective in all operating modes of the plant or system.

System start-up after specific events

The following table identifies situations you must pay attention to when the system starts up after the occurrence of certain events.

If there is ...	then ...
a restart following a voltage dip or power failure, startup of the ET 200pro after an interruption of bus communication,	dangerous operating states must not occur. If necessary, force an emergency stop!
startup after unlocking of the emergency stop device,	an uncontrolled or undefined start-up must not occur.

24 V DC power supply

The following table identifies requirements you must observe for the 24 V DC supply.

With ...	you must ensure ...	
buildings	external lightning protection	Install lightning protection (e.g. lightning protection elements).
24 V DC power supply cables, signal cables	internal lightning protection	
24 V DC power supply	Safe (electrical) isolation of safety extra-low voltage (SELV)	
Looping-through of the supply voltage	Voltage drop at looping-through	

Protection against external electrical interference

The table below shows how you must protect your system against electrical interference or faults.

With ...	make sure that ...
all plants or systems in which the ET 200pro is integrated	the plant or system must be grounded observing EMC in order to dissipate electromagnetic interferences.
supply/signal/bus cables	the cable routing and installation is correct.
signal and bus cables	a cable/conductor break does not cause undefined plant or system states.

See also

Commissioning ET 200pro (Page 151)

4.2 Operation of the ET 200pro with Grounded Reference Potential

Introduction

This section provides information on the overall configuration of an ET 200pro distributed I/O system on a grounded infeed (TN-S network). The topics covered in this section are in particular:

- Disconnecting devices, short-circuit and overload protection in accordance with VDE 0100 and VDE 0113
- Load voltage supplies and load circuits

Grounded infeed

For grounded infeeds, the neutral conductor of the supply system is grounded. A simple ground fault between a live conductor and ground or a grounded part of the plant trips the protective devices.

Safe electrical isolation (SELV/PELV to IEC 60364-4-41)

ET 200pro may only be operated on power supplies / power supply modules with safe electrical isolation.

Configuring ET 200pro with grounded reference potential

In an ET 200pro configuration with grounded reference potential, any interference current is discharged to protective ground. The connections must be interconnected externally (1M to FE connection).

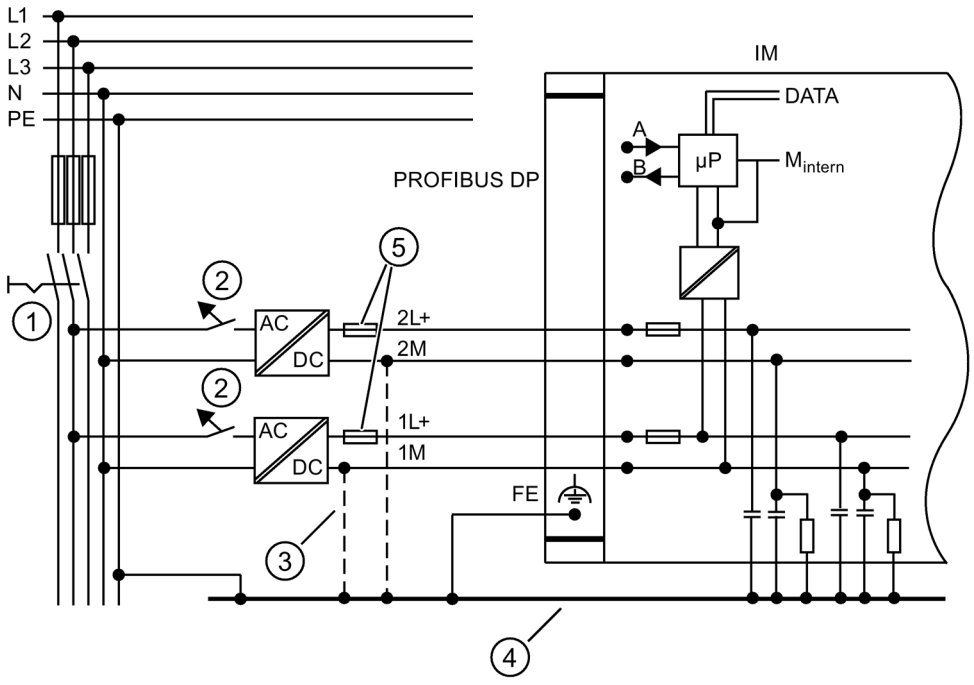
Components and protective measures

A number of components and protective measures are prescribed for the overall system. The type of components and and the binding character of protective measures depend on the DIN regulation applying to your plant. The table refers to the figure below.

Refer to ...	Reference to the figure	DIN VDE 0100	DIN VDE 0113
Disconnecting device for control system, signal transmitters and final controlling elements	①	... Part 460: Main switch	... Part 1: Disconnector
Short-circuit and overload protection	②	... Part 725: Single-pole fusing of circuits	... Part 1: With grounded secondary power circuit: **single-pole** fusing
Line protection	⑤	... Part 430: Protection of cables and lines against overcurrent	

Overall configuration of ET 200pro

The figure below shows the overall configuration of the ET 200pro distributed I/O system (load voltage supply and grounding concept) with infeed from a TN-S network.



① Disconnecting device for control system, signal transmitters and final controlling elements
② Short-circuit and overload protection
③ The connection between 1M and FE is not applicable in an ET 200pro configuration with ungrounded reference potential.
④ Ground busbar
⑤ Fuses for line protection

Note

When ET 200pro is operated with ungrounded reference potential and 1M and FE are not interconnected, any interference currents will be discharged to protective ground via an internal RC circuit.

Insulation monitoring

Insulation monitoring must be provided in the following cases:

- In an ET 200pro configuration with ungrounded reference potential
- If hazardous plant states can be expected as a result of faults.

4.3 Electrical Configuration of ET 200pro

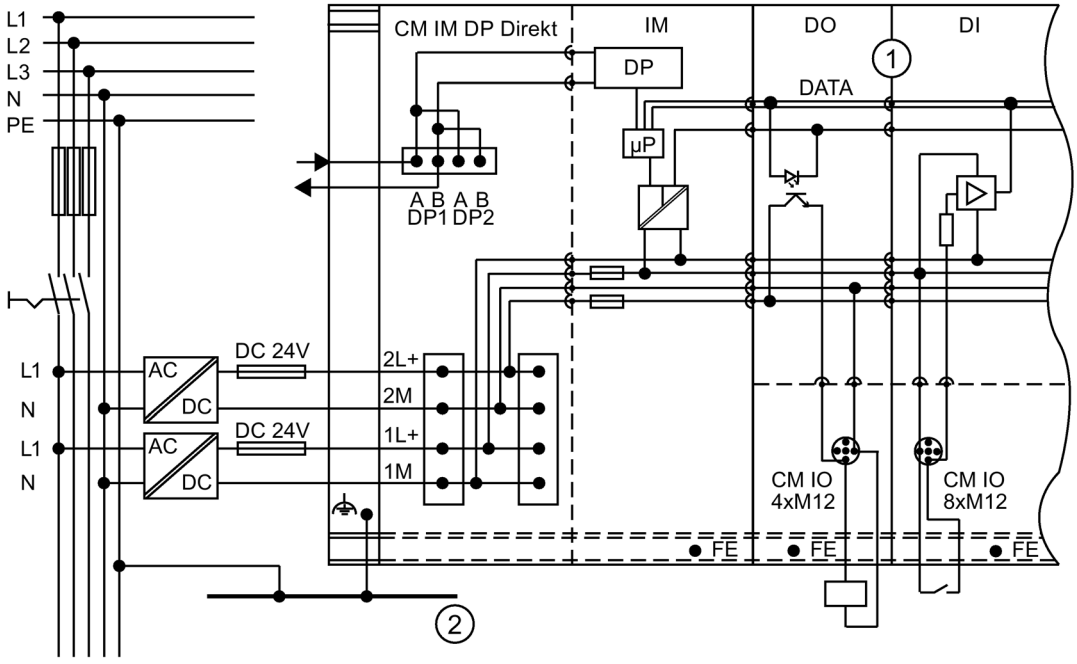
Electrical isolation

The ET 200pro electrical configuration features electrical isolation between:

- 1L+ electronics/encoder supply: Electrically isolated to PROFIBUS DP/ PROFINET IO, 2L+ (load voltage supply), and the backplane bus
- 2L+ load voltage supply: Electrically isolated to all other circuit components
- PROFIBUS DP/PROFINET IO interface: Electrically isolated to all other circuit components
- Backplane bus: Electrically isolated to all other circuit components

ET 200pro configuration with CM IM DP Direct connection module

The figure below shows the electrical potentials of an ET 200pro configuration with the CM IM DP Direct connection module on the IM 154-1 DP or IM 154-2 DP High Feature interface module.

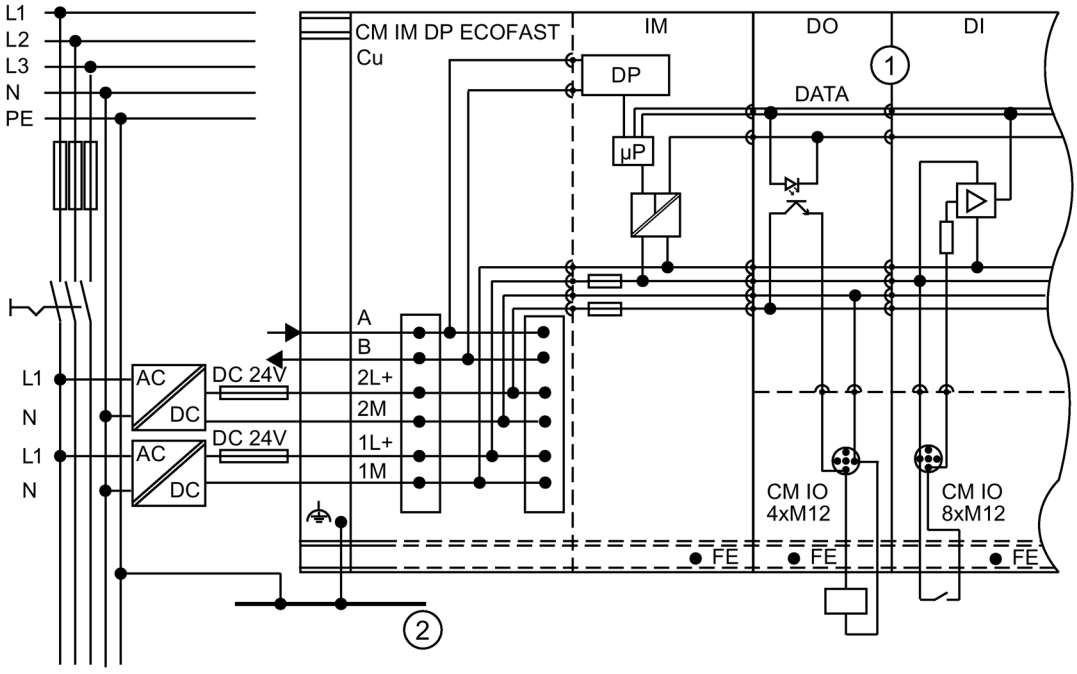


① Backplane bus
② Main ground line

Figure 4-1 ET 200pro configuration with CM IM DP Direct connection module

ET 200pro configuration with CM IM DP ECOFAST Cu connection module

The figure below shows the electrical potentials of an ET 200pro configuration with the CM IM DP ECOFAST Cu connection module on the IM 154-1 DP or IM 154-2 DP High Feature interface module.

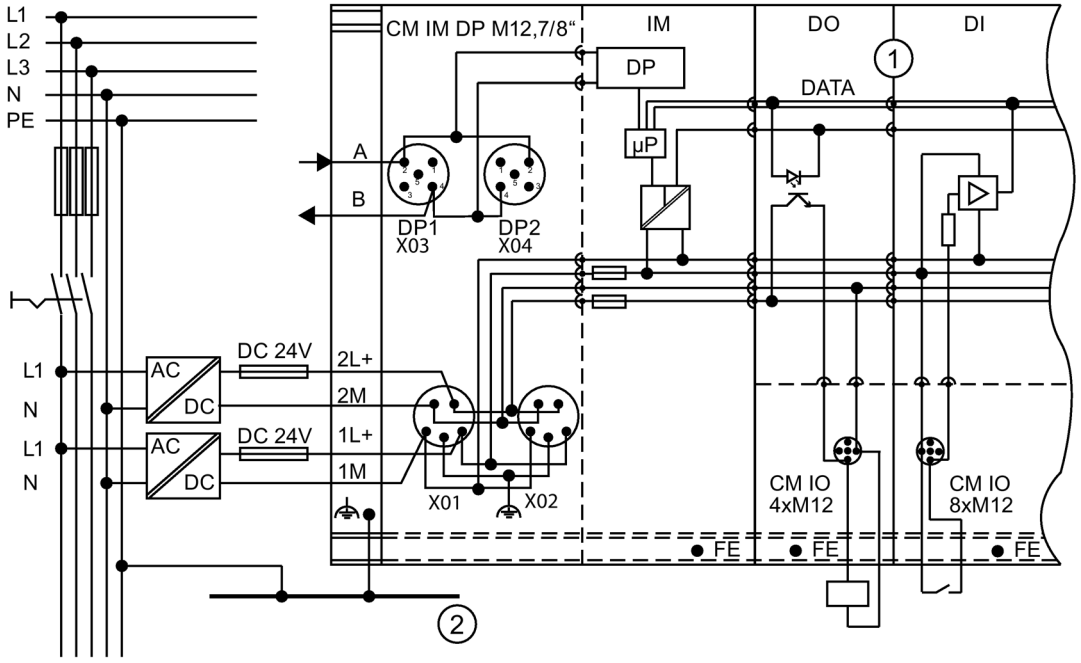


① Backplane bus
② Main ground line

Figure 4-2 ET 200pro configuration with CM IM DP ECOFAST Cu connection module

ET 200pro configuration with CM IM DP M12, 7/8" connection module

The figure below shows the electrical potentials of an ET 200pro configuration with the CM IM DP M12, 7/8" connection module on the IM 154-1 DP or IM 154-2 DP High Feature interface module.



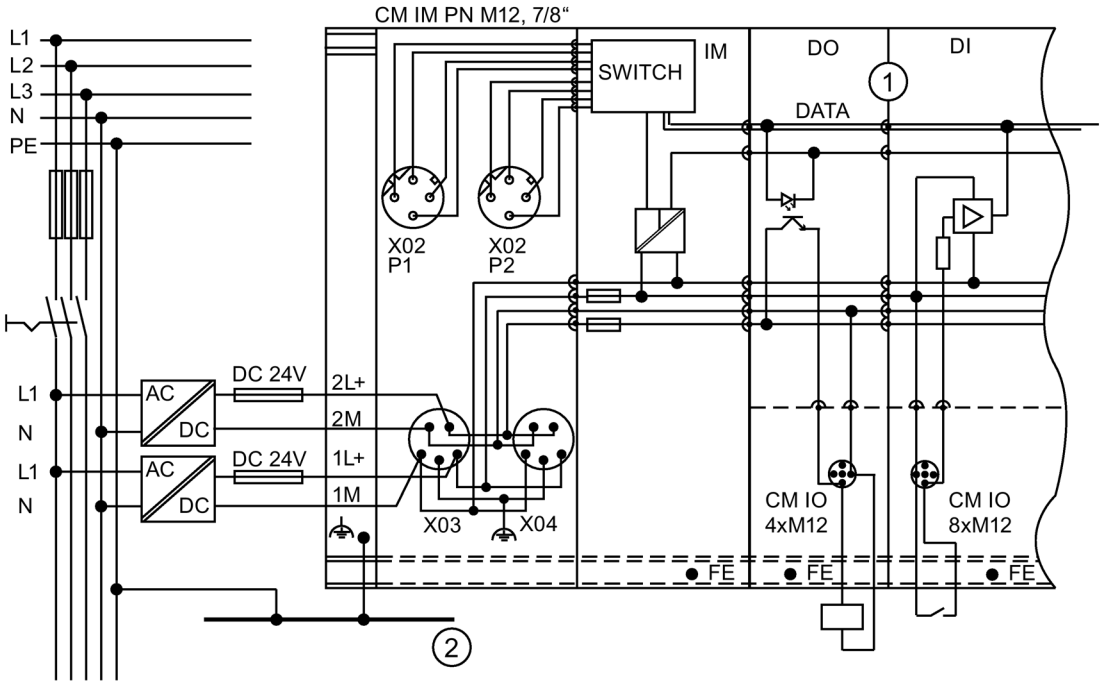
① Backplane bus

② Main ground line

Figure 4-3 ET 200pro configuration with CM IM DP M12, 7/8" connection module

ET 200pro configuration with CM IM PN M12, 7/8" connection module

The figure below shows the electrical potentials of an ET 200pro configuration with a CM IM PN M12, 7/8" connection module on the IM154-4 PN High Feature interface module (6ES7154-4AB10-0AB0).

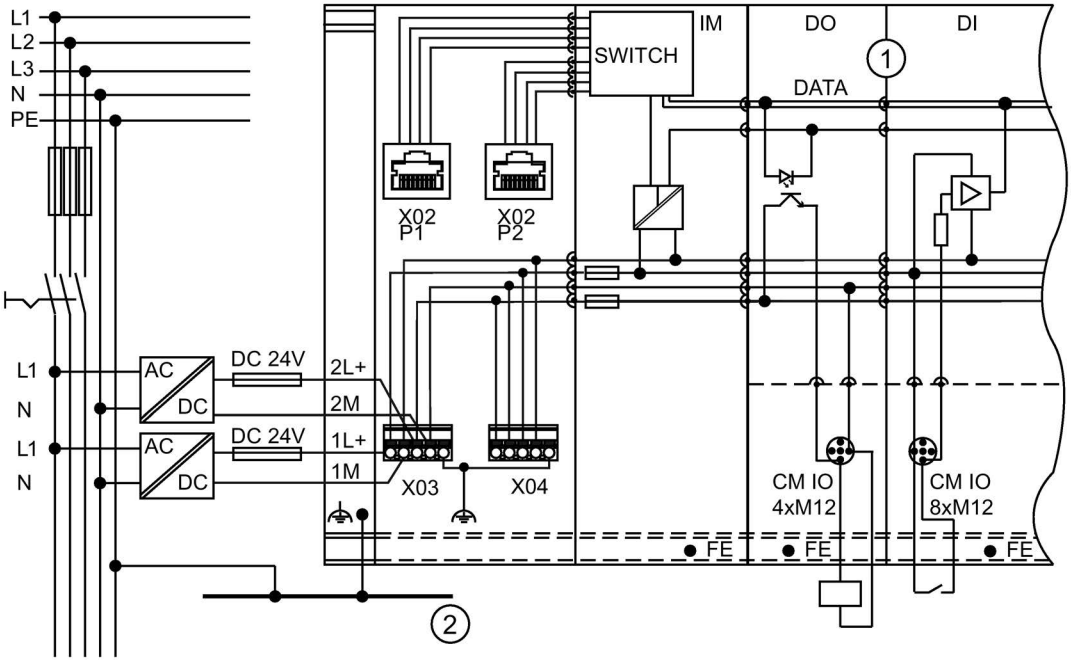


① Backplane bus
② Main ground line

Figure 4-4 ET 200pro configuration with CM IM PN M12, 7/8" connection module

ET 200pro configuration with CM IM PN PP Cu connection module

The figure below shows the electrical potentials of an ET 200pro configuration with a CM IM PN PP Cu connection module on the IM154-4 PN High Feature interface module (6ES7154-4AB10-0AB0).



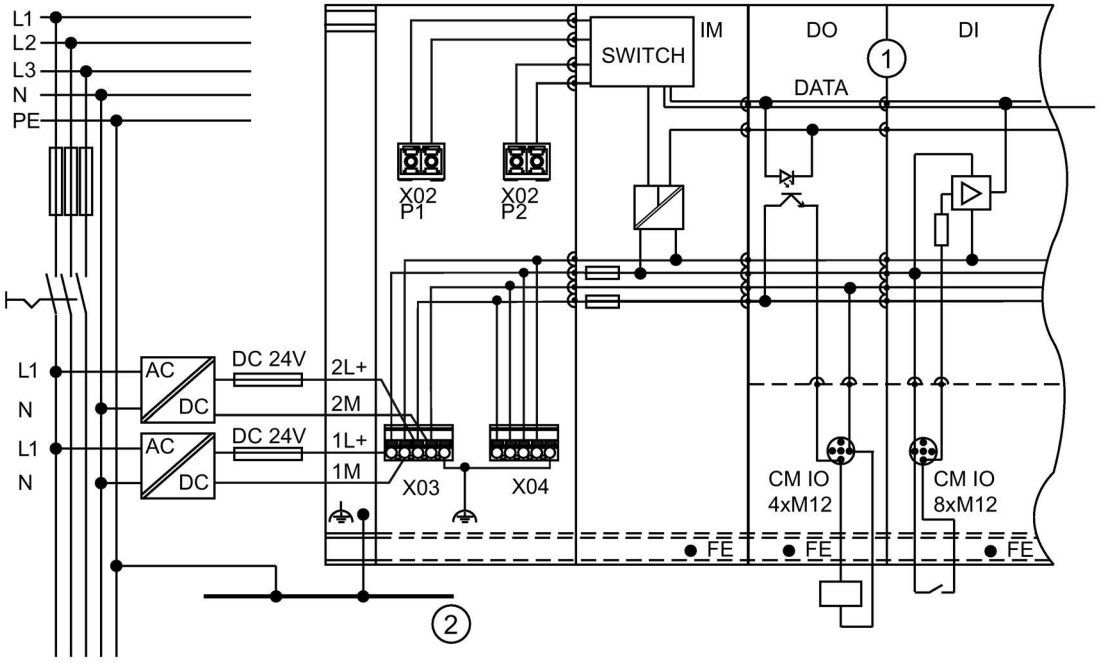
① Backplane bus

② Main ground line

Figure 4-5 ET 200pro configuration with CM IM PN PP Cu connection module

ET 200pro configuration with CM IM PN PP FO connection module

The figure below shows the electrical potentials of an ET 200pro configuration with a CM IM PN PP FO connection module on the IM154-4 PN High Feature interface module (6ES7154-4AB10-0AB0).



① Backplane bus

② Main ground line

Figure 4-6 ET 200pro configuration with CM IM PN PP FO connection module

Line protection

Line protection is required in accordance with DIN VDE 0100, in other words you always need to provide external fusing:

- Interface module:

  Protection of the 1L+ electronics/encoder supply with **miniature circuit-breaker 24 V DC/16 A**, tripping characteristic type B or C.

- Interface module/integrated power module, and power module:

  Protection of the 2L+ load voltage supply with **miniature circuit-breaker 24 V DC/16 A**, tripping characteristic type B or C.

Note

A miniature circuit-breaker 24 V DC/16 A with tripping characteristics type B trips **before** the equipment fuse is tripped.
A miniature circuit-breaker 24 V DC/16 A with tripping characteristics type C trips **after** the equipment fuse trips.

Equipment fusing

Replaceable fuses for protecting the ET 200pro:

- Interface module:

  The bus module of the interface module is equipped with fuses for the electronic/encoder supply 1L+ and load voltage supply 2L+ (glass tube fuse; 5x20; type 194; 12.5 A; fast-blow), and a replacement fuse.

- Power module:

  The rear panel of the power module is equipped with a fuse for the load voltage supply 2L+ (glass tube fuse; 5x20; type 194; 12.5 A; fast-blow), and a replacement fuse.

Note

The CM IM PN PP FO connection module may only be pulled/plugged at zero voltage.

If you pull or plug the CM IM PN PP FO connection module under voltage, the module will not reach ready-to-operate status. In this case, briefly switch the voltage supply off and back on.

See also

IM 154-1 DP interface module (Page 291)

IM 154-2 DP High Feature interface module (Page 298)

PM-E power module (Page 323)

4.4 Technical specifications of the lines

Influence of cable length on the supply voltage

Always make allowances for the influence of cable lengths on the supply voltage of ET 200pro.

Example

On a cable with Ø 1.5 mm^2 and a length of 10 m, the voltage drop is 2.5 V at a load of 10 A. This corresponds with 0.25 V at a load of 1 A.

CAUTION

Always adapt the conductor cross-sections to the max. supply currents, for you would otherwise risk damage to the device as a result of excess heat on the cable insulation and on contacts.

4.5 Connecting the interface module to a CM IM DP Direct connection module

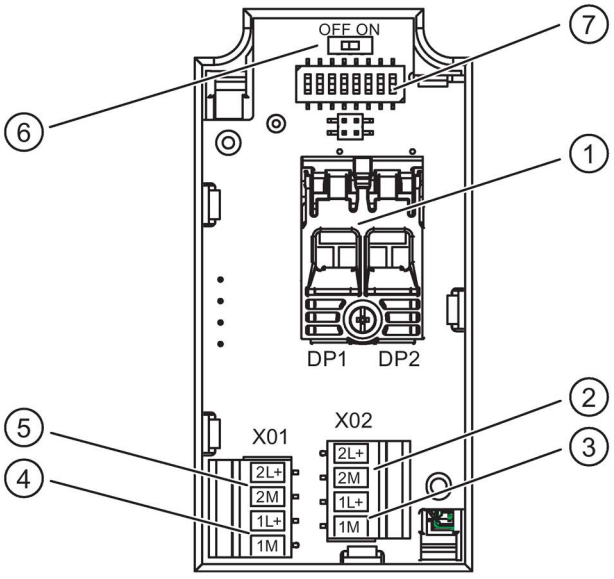
4.5.1 Requirements

Introduction

You connect the power supplies and PROFIBUS DP to the CM IM DP Direct connection module. You can loop the supply voltages and PROFIBUS DP using the relevant terminals.

- Power supplies 1L+, 2L+: The cables are terminated on screw terminals.

PROFIBUS DP: The bus cables are terminated on insulation displacement terminals (Fast Connect technology). The insulation displacement terminals are designed to withstand 10 terminating cycles.



① Insulation displacement terminals for PROFIBUS DP
② Screw terminals for looping the load voltage supply 2L+
③ Screw terminals for looping the electronic / encoder supply 1L+
④ Screw terminals for feeding the electronic / encoder supply 1L+
⑤ Screw terminals for feeding the load voltage supply 2L+
⑥ Terminating resistor for PROFIBUS DP
⑦ DIP switch for setting the PROFIBUS DP address

Requirements

- The interface module and bus module are mounted on the rack.
- You have set the PROFIBUS DP address on the connection module according to your configuration.

Required tools

- Cross-tip screwdriver, size 2
- 3 mm screwdriver
- 25 mm open-end wrench

Required accessories

- PROFIBUS DP cables

  We recommend the use of the SIMATIC NET PROFIBUS cables with the associated order numbers listed in the Appendix (Page 456). Those cables are tested and approved for termination on insulation displacement terminals.
- Cables for feeding and looping the supply voltages:
  - 2-wire flexible Cu cable, conductor cross-section ≤ 2.5 mm^2
  - 4-wire shielded cable, conductor cross-section ≤ 2.5 mm^2
- Hybrid cables for PROFIBUS DP and the supply voltages:
  - PB Hybrid Standard Cable, 4-wire
  - PB Hybrid Standard Cable, 4-wire, suitable for cable carriers
  - PROFIBUS ECOFAST Hybrid Cable, 6-wire, suitable for cable carriers
  - PROFIBUS ECOFAST Hybrid Cable GP, 6-wire, suitable for cable carriers
- M20 cable glands (included). Suitable for a permitted external cable diameter between 7 mm and 13 mm.

Connection examples

The table below shows examples of the supply voltage feed and looping with lines or cables (see Required accessories).

<table>
<tr><th colspan="3">Infeed</th><th colspan="3">Loop-through (optional)</th></tr>
<tr><th>PROFIBUS DP</th><th>1L+ electronics/encoder supply</th><th>2L+ load voltage supply</th><th>PROFIBUS DP</th><th>1L+ electronics/encoder supply</th><th>2L+ load voltage supply</th></tr>
<tr><td colspan="2">PB Hybrid Standard Cable/PB Hybrid Robust Cable</td><td>2-wire cable</td><td colspan="2">PB Hybrid Standard Cable/PB Hybrid Robust Cable</td><td>-</td></tr>
<tr><td colspan="3">PROFIBUS ECOFAST Hybrid Cable/PROFIBUS ECOFAST Hybrid Cable GP</td><td colspan="3">PROFIBUS ECOFAST Hybrid Cable/PROFIBUS ECOFAST Hybrid Cable GP</td></tr>
<tr><td>PROFIBUS cable</td><td colspan="2">4-wire cable</td><td>PROFIBUS cable</td><td colspan="2">4-wire cable</td></tr>
<tr><td>PROFIBUS cable</td><td colspan="2">4-wire cable</td><td colspan="2">PB Hybrid Standard Cable/PB Hybrid Robust Cable</td><td>2-wire cable</td></tr>
<tr><td>PROFIBUS cable</td><td colspan="2">2-wire cable</td><td>PROFIBUS cable</td><td colspan="2">2-wire cable</td></tr>
</table>

See also

Preparing PROFIBUS DP Cables (Page 78)

Preparing PROFIBUS Hybrid Cables for the Connection at CM IM DP Direct (Page 79)

4.5.2 Preparing PROFIBUS DP Cables

Required tools

- Cross-tip screwdriver, size 2
- 25-mm open-end wrench
- PROFIBUS Fast Connect stripping tool

Opening and preparing the connection module

1. Remove the two screws from the bottom of the connection module using a crosstip screwdriver.
2. Remove the cover from the connection module.
3. Install M20 screwed cable glands at the cable inlets using an open-end wrench. The blind plates will break off automatically when you screw in the glands. Tighten the cable glands on the connection module (torque = 3 N/m).
4. Feed the **PROFIBUS DP** cables through the **bottom cable glands** in order to obtain the maximum bending radius.
5. Feed the supply voltage cables through the upper cable glands.

Stripping PROFIBUS DP cables

1. Strip the PROFIBUS DP cable as shown in the figure.

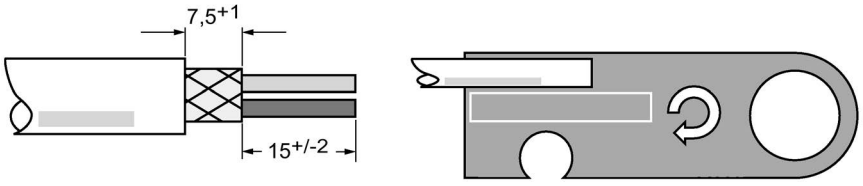


Figure 4-7 Stripping dimensions for the PROFIBUS DP cable

Result

You can now connect the power supply and PROFIBUS DP cables.

See also

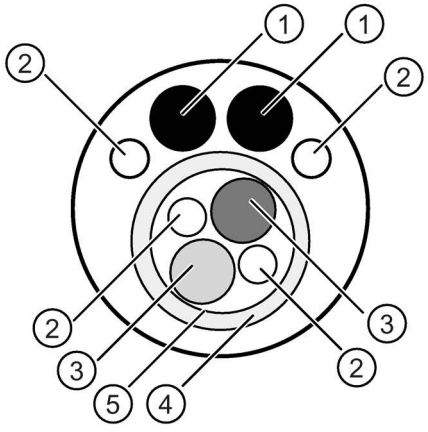
Mounting the Interface Module (Page 53)
Connecting PROFIBUS DP (Page 81)
Connecting the supply voltages (Page 82)

4.5.3 Preparing PROFIBUS Hybrid Cables for the Connection at CM IM DP Direct

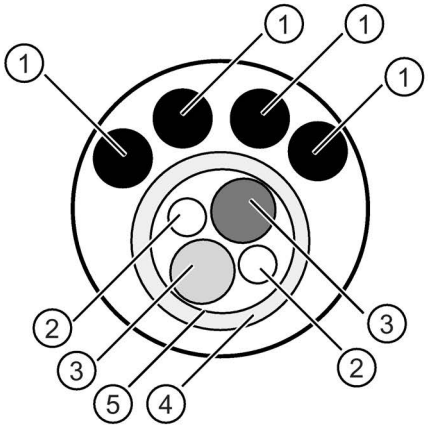
PROFIBUS Hybrid cables

In addition to the lines for load voltage supply 1L+, the PROFIBUS Hybrid cables contain the shielded PROFIBUS DP lines. The 6-wire PROFIBUS Hybrid cables also include the lines for supply voltage 2L+. Versions available:

- PB Hybrid Standard Cable, 4-wire
- PB Hybrid Standard Cable, 4-wire, suitable for cable carriers
- PROFIBUS ECOFAST Hybrid Cable, 6-wire
- PROFIBUS ECOFAST Hybrid Cable GP, 6-wire, suitable for cable carriers



PB Hybrid Standard Cable



PROFIBUS ECOFAST Hybrid Cable

① Conductor for supply voltage
② Filler
③ Conductor for PROFIBUS DP
④ Shielding braid
⑤ Shielding film

Opening and preparing the connection module

1. Remove the two screws from the bottom of the connection module using a crosstip screwdriver.
2. Remove the cover from the connection module.
3. Install M20 screwed cable glands at the cable inlets using an open-end wrench. The blind plates will break off automatically when you screw in the glands. Tighten the cable glands on the connection module (torque = 3 Nm).
4. Feed the PROFIBUS Hybrid cable through the bottom cable gland in order to achieve a maximum possible bending radius.

Stripping PROFIBUS Hybrid cables

1. Strip the PROFIBUS Hybrid over a length of 97 mm.
2. Remove the white filler material, and the two black fillers of the 4-wire PROFIBUS Hybrid cable.
3. Slide the shielding braid back towards the sheath by approx. $15^{+/-2}$ mm.
4. Carefully strip off the shielding film and the two white fillers from the PROFIBUS DP cable.

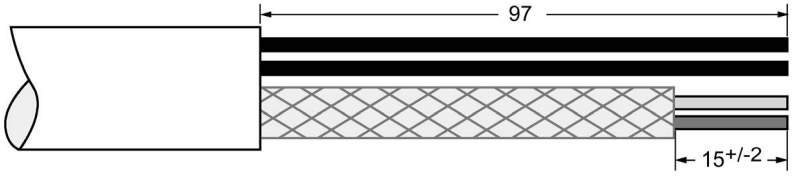


Figure 4-8 Stripping dimensions for PROFIBUS Hybrid cables

Insulate the PROFIBUS DP cables using heat-shrink tubing

1. Cut the piece of heat-shrink tubing included in the CM IM DP Direct package into half.
2. Slide it onto the PROFIBUS Hybrid cable; approximately 7.5^{+1} mm of the shielding braid should remain visible.
3. Shrink the tubing (using a hot-air gun, for example) until it firmly encloses the PROFIBUS DP cables.

Note

Distribute the heat of your heat source in even movements. Avoid any punctual overheating of the heat-shrink tubing.



Figure 4-9 PROFIBUS Hybrid cable with heat-shrink tubing

Result

You can now connect the power supply and PROFIBUS DP cables.

See also

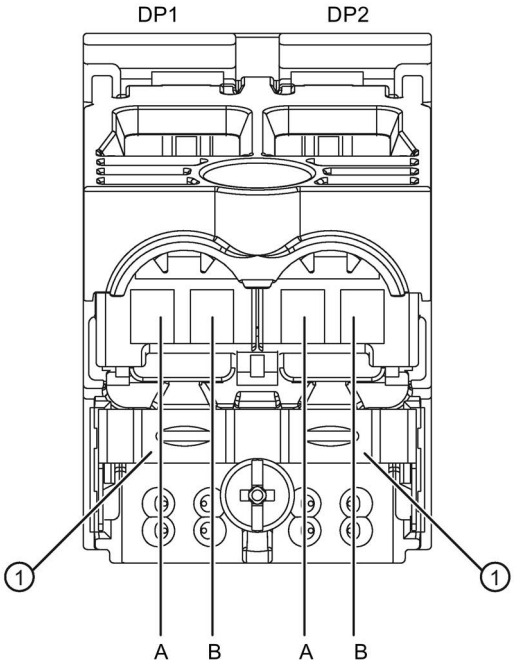
Connecting PROFIBUS DP (Page 81)

Connecting the supply voltages (Page 82)

4.5.4 Connecting PROFIBUS DP

Connecting the PROFIBUS DP cable

1. Open the black strain relief using a crosstip screwdriver.
2. Open the transparent insert of the insulation displacement terminal.
3. Feed the incoming PROFIBUS DP cable into insert A/B of the insulation displacement terminal DP1. Wire red to red, and green to green accordingly.
4. When forwarding the PROFIBUS DP cable, terminate it at insert A/B of the insulation displacement terminal DP2.
5. Push the insert firmly down onto the contact.
6. Secure the black strain relief using a crosstip screwdriver.



① Shield support for cable

Figure 4-10 View of open PROFIBUS cable connector

Note

You may leave insulation residue in the insulation displacement terminal when you open it. This may pose a problem the next time you connect a wire. You should thus always ensure not to leave any insulation residue in the insulation displacement terminal when you open it and remove the wire.

4.5.5 Connecting the supply voltages

Required Tools

- Screwdriver with 3 mm blade

Requirements

Wiring rules		Screw terminals for the supply voltages
Connectable conductor cross-sections of flexible cables	Without wire end ferrule	0.14 mm to 2.5 mm^2
	With wire end ferrule	0.14 mm to 2.5 mm^2
Number of conductors per terminal		1 conductor
Stripped length of the cable insulation		11 mm
Wire end ferrules to DIN 46228	Without insulating collar	design A, length up to 21 mm
	with insulating collar	design E, length up to 12 mm

Connecting the supply voltages

1. Strip the cables to a length of 11 mm, then crimp on the wire end ferrules.
2. Using a 3-mm screwdriver (tightening torque = 0.5 N/m to 0.7 N/m), terminate the supply cables on terminal X01, and the daisy-chaining cables on terminal X02 (electronic / encoder supply 1L+, load voltage supply 2L+).

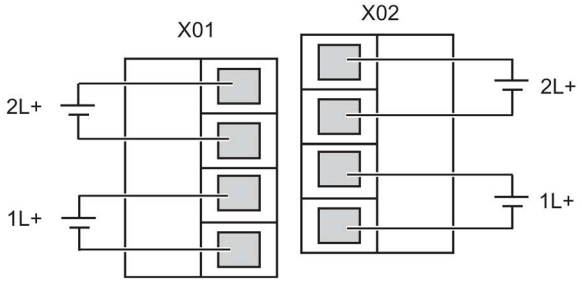


Figure 4-11 Connecting the supply voltage

See also

Terminating and installing the connection module (Page 83)

4.5.6 Terminating and installing the connection module

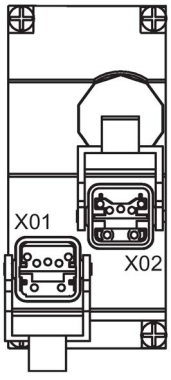
Terminating and installing the connection module

1. Insert the cover onto the connection module, while pulling back the cables through the glands.
2. Tighten the two screws on the bottom of the connection module using a crosstip screwdriver.
3. Tighten the cable strain relief of the M20 cable glands with the open-end wrench (torque = 3 N/m).
4. Insert the connection module into the interface module.
5. Screw down the connection module to the interface module (torque = 1.5 N/m). Tighten the four screws evenly, working in cross-wise passes. The screws are already inserted in the connection module.

4.6 Connecting the Interface Module to a CM IM DP ECOFAST Cu Connection Module

Introduction

You wire the power supplies and PROFIBUS DP to the CM IM DP ECOFAST Cu connection module using ECOFAST cable connectors.



X01 ECOFAST socket (with male contact insert) for feeding the supply voltages and PROFIBUS DP

X02 ECOFAST socket (with female contact insert) for forwarding the supply voltages and PROFIBUS DP

Requirements

- The interface module (including the bus module) and the connection module are mounted on the rack.
- You have set the PROFIBUS DP address on the connection module according to your configuration.
- The terminating resistor must be activated if no loop cables are connected.

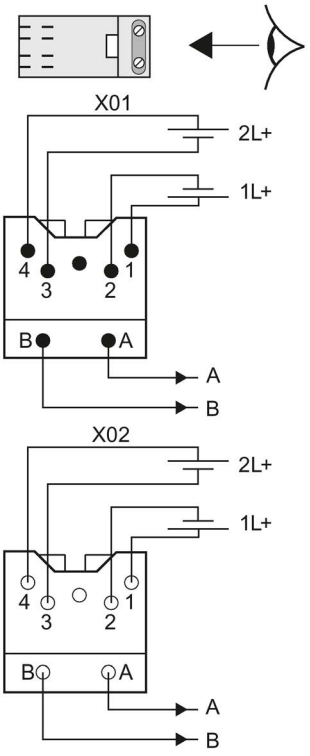
Required tools

Screwdriver, stripping and crimp tool for wiring the ECOFAST cable connector, if you are fabricating your own cables.

Required accessories

- PROFIBUS ECOFAST Hybrid Cable, preassembled at both ends with ECOFAST Hybrid Plug 180. The patch cable is available in various lengths.
- If you are fabricating your own cables:
  - PROFIBUS ECOFAST hybrid cable, unassembled
  - PROFIBUS ECOFAST Hybrid Plug 180 (ECOFAST Cu) with Hanbrid connector
  - PROFIBUS ECOFAST Hybrid Plug, angled, (ECOFAST Cu) with Hanbrid connector

Pin assignment of the ECOFAST cable connector

View of the ECOFAST cable connector	Terminal	Assignment X01 and X02
	**Feed for X01**	
	A	PROFIBUS DP signal A
	B	PROFIBUS DP signal B
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply
	Forwarding X02	
	A	PROFIBUS DP signal A
	B	PROFIBUS DP signal B
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply

Note

The cable shield support is described in the Hardware Installation Instructions for the ECOFAST cable connector.

Connecting the ECOFAST cable connectors

1. Insert the CM IM DP ECOFAST Cu connection module into the interface module.
2. Screw down the CM IM DP ECOFAST Cu connection module to the interface module (torque = 1.5 Nm). Tighten the four screws evenly, working in cross-wise passes. Those screws are already attached to CM IM DP ECOFAST Cu connection module.
3. Press down the interlock mechanism of the ECOFAST cable connectors on the connection module.
4. Plug the ECOFAST cable connectors (1L+, 2L+ and PROFIBUS DP) into the sockets of the connection module. Observe the mechanical coding of the cable connectors for feeding and forwarding.
5. Push up the interlock mechanism of the ECOFAST cable connectors.

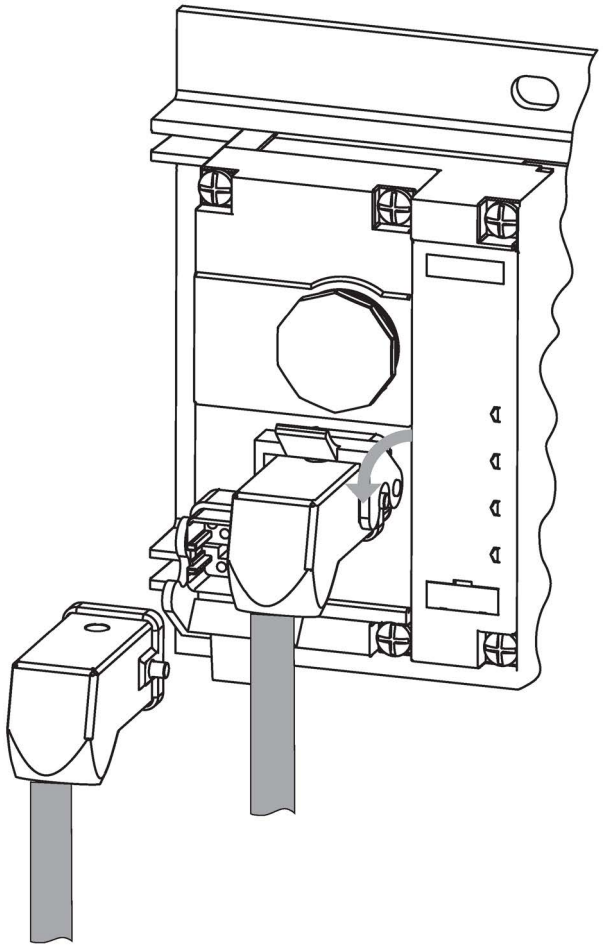


Figure 4-12 Connecting the ECOFAST cable connectors

NOTICE
Removing the ECOFAST cable connector It is not permissible to remove the ECOFAST cable connector while ET 200pro is in operation! Always switch off the 1L+ electronics/encoder supply and the 2L+ load voltage supply before you remove the ECOFAST cable connector.

Note

Removal of the ECOFAST cable connector interrupts the supply to all downstream modules.

Sealing unused sockets

Seal all unused ECOFAST sockets using caps in order to achieve degree of protection IP65, IP66 or IP67.

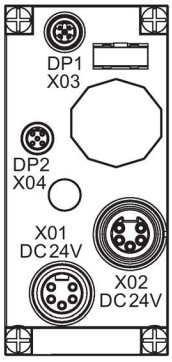
See also

Mounting the Interface Module (Page 53)

4.7 Connecting the Interface Module to the CM IM DP M12, 7/8" Connection Module

Introduction

You connect the power supplies and PROFIBUS DP to the CM IM DP M12, 7/8" connection module.



DP1 X03	M12 circular socket connector (with male contact insert) for feeding PROFIBUS DP
DP2 X04	M12 circular socket connector (with female contact insert) for forwarding PROFIBUS DP
X01 DC 24V	7/8" circular socket connector (with male contact insert) for feeding the 1L+ electronics/ encoder supply and 2L+ load voltage supply
X02 DC 24V	7/8" circular socket connector (with female contact insert), for looping the 1L+ electronics/ encoder supply and 2L+ load voltage supply

Requirements

- The interface module (including the bus module) and the connection module are mounted on the rack.
- You have set the PROFIBUS DP address on the connection module according to your configuration.
- The terminating resistor must be activated if no loop cables are connected.

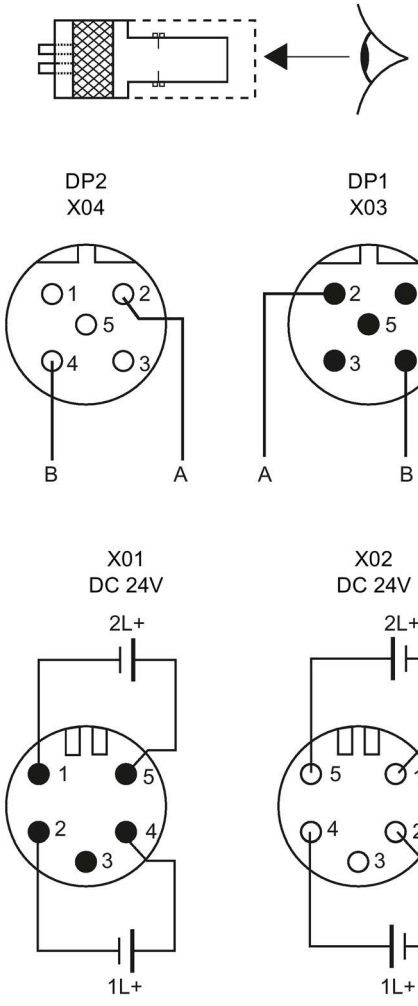
Required tools

Screwdriver and stripping tool for wiring the M12 and 7/8" cable connectors, if you are fabricating your own cables.

Required accessories

- Preassembled cable with M12 and 7/8" cable connectors The cables are available in different lengths.
- If you are fabricating your own cables:
  - M12: 2-core, shielded bus cable, and b-coded M12 cable connectors
  - 7/8": 5-core cable and 7/8" cable connector

Pin assignment of the M12 and 7/8" cable connectors

View of the M12 and 7/8" cable connectors	Terminal	Assignment
	**M12 cable connector, b-coded, for feeding DP1 X03**	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	M12 cable connector, b-coded, for forwarding DP2 X04	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	7/8" cable connector for feeding X01	
	1	Ground for load voltage supply 2M
	2	Ground for electronics/ encoder supply 1M
	3	Functional earth
	4	1L+ electronics/encoder supply
	5	2L+ load voltage supply
	7/8" cable connector for looping X02	
	1	Ground for load voltage supply 2M
	2	Ground for electronics/ encoder supply 1M
	3	Functional earth
	4	1L+ electronics/encoder supply
	5	2L+ load voltage supply

* The voltage may only be used to supply the external terminating resistor. The voltage must not be looped through to the next connector with a cable.

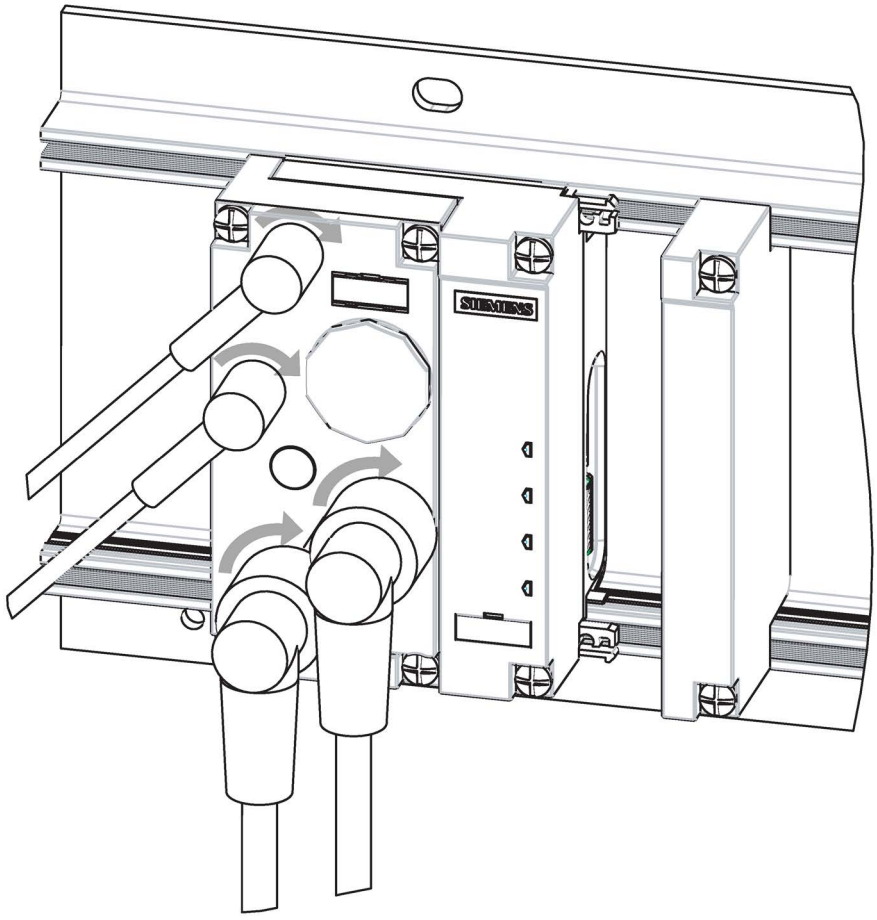
** We recommend that you connect the functional earth via the M12 thread (because it has a larger surface area than terminal 5).

Note

The cable shield support is described in the Hardware Installation Instructions for the M12 cable connector.

Connecting M12 and 7/8" cable connectors

1. Plug the M12 and 7/8" cable connectors into the corresponding circular socket connectors of the CM IM M12, 7/8" connection module. Ensure that the locking mechanism between the connector and socket is properly applied.
2. Tighten the knurled screws of the connectors (torque = 1.5 Nm).



NOTICE

Removing the 7/8" cable connector

It is not permissible to remove the 7/8" cable connectors while ET 200pro is in operation! Always switch off the 1L+ electronics/encoder supply and the 2L+ load voltage supply before you pull or plug the 7/8" cable connector.

Note

Removal of the 7/8" cable connector interrupts the supply to downstream modules.

Sealing unused sockets

Always close all unused sockets using M12 and 7/8" caps in order to achieve degree of protection IP65, IP66 or IP67.

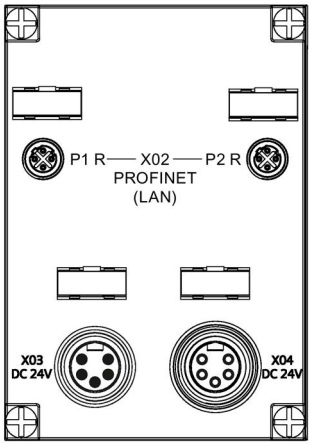
See also

Mounting the Interface Module (Page 53)

4.8 Connecting the IM 154-4 PN High Feature interface module with CM IM PN M12, 7/8"

Introduction

You connect the power supplies and PROFINET IO to the CM IM PN DP M12, 7/8" connection module. The IM 154-4 High Feature interface module is equipped with an internal PROFINET switch. This allows the direct forwarding of PROFINET or the direct connection of an additional IO device (e.g., ET 200pro with IM 154-8 CPU).



X02 P1 R — M12 circular socket connector (with female contact insert) for connection of PROFINET IO

X02 P2 R — M12 circular socket connector (with female contact insert) for connection of PROFINET IO

X03 DC 24V — 7/8" circular socket connector (with male contact insert) for feeding the 1L+ electronics/
encoder supply and 2L+ load voltage supply

X04 DC 24V — 7/8" circular socket connector (with female contact insert), for looping the 1L+ electronics/
encoder supply and 2L+ load voltage supply

Figure 4-13 CM IM PN M12, 7/8" connection module

CAUTION

PROFINET

Modules with PROFINET interfaces may only be operated in LANs (Local Area Networks) in which all connected devices are equipped with SELV/PELV power supplies (or have equivalent protection).

A data transfer terminal (modem, for example) that guarantees this level of safety must be used for the interface to the WAN (Wide Area Network).

Requirements

The IM 154-4 High Feature interface module (including the bus module) and the CM IM PN M12, 7/8" connection module have been installed on the rack.

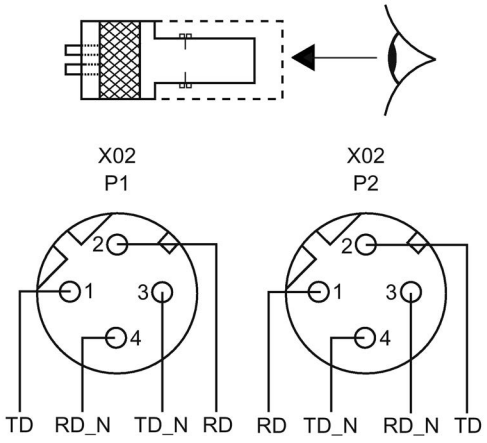
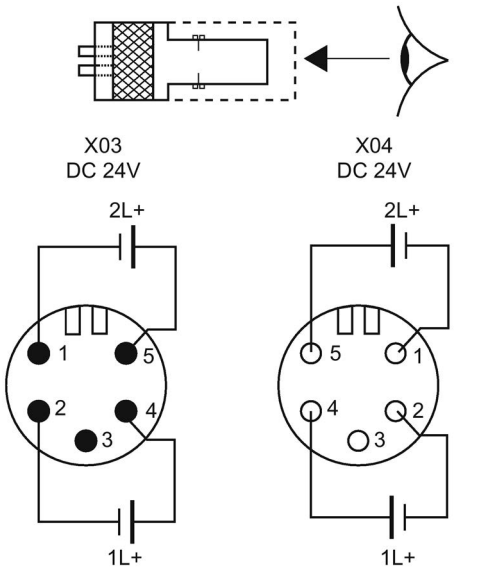
Required tools

- Screwdriver
- Stripping tool for wiring the M12 and 7/8" cable connectors, if you are fabricating your own cables.

Required accessories

- Preassembled cables with M12 and 7/8" cable connectors. The cables are available in different lengths.
- If you are fabricating your own cables:
  - M12: 4-core, shielded bus cable, and d-coded M12 cable connector (PROFINET)
  - 7/8": 5-core cable and 7/8" cable connector

Pin assignment of the M12 and 7/8" cable connectors

<table>
<tr><th>View of the M12 and 7/8" cable connectors</th><th>Terminal</th><th>Assignment</th><th></th></tr>
<tr><td colspan="4">M12 cable connector, d-coded (PROFINET)</td></tr>
<tr><td rowspan="6">
</td><td></td><td>X02 P1 for connecting PROFINET</td><td>X02 P2 for connecting PROFINET</td></tr>
<tr><td>1</td><td>TD (Transmit Data+)</td><td>RD (Receive Data+)</td></tr>
<tr><td>2</td><td>RD (Receive Data+)</td><td>TD (Transmit Data+)</td></tr>
<tr><td>3</td><td>TD_N (Transmit Data-)</td><td>RD_N (Receive Data-)</td></tr>
<tr><td>4</td><td>RD_N (Receive Data-)</td><td>TD_N (Transmit Data-)</td></tr>
<tr><td>Thread</td><td colspan="2">Functional earth</td></tr>
<tr><td colspan="4">7/8" cable connectors (1L+ and 2L+ supply voltages)</td></tr>
<tr><td rowspan="6">
</td><td colspan="3">X03 DC 24V for feeding
X04 DC 24V for looping</td></tr>
<tr><td>1</td><td colspan="2">Ground for load voltage supply 2M</td></tr>
<tr><td>2</td><td colspan="2">Ground for electronics/encoder supply 1M</td></tr>
<tr><td>3</td><td colspan="2">Functional earth</td></tr>
<tr><td>4</td><td colspan="2">1L+ electronics/encoder supply</td></tr>
<tr><td>5</td><td colspan="2">2L+ load voltage supply</td></tr>
</table>

Note

The cable shield support is described in the Hardware Installation Instructions for the M12 cable connector.

Connecting M12 and 7/8" cable connectors

1. Press the M12 and 7/8" cable connectors into the corresponding circular socket connectors of the CM IM PN M12, 7/8" connection module. Ensure that the locking mechanism between the connector and socket is properly applied.
2. Tighten the knurled screws of the connectors (torque = 1.5 Nm).

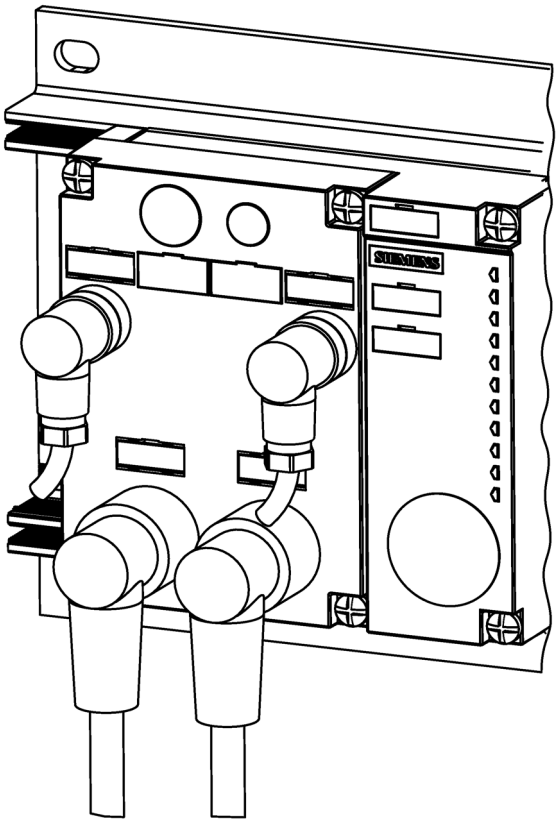


Figure 4-14 Connecting M12 and 7/8" cable connectors

NOTICE
Removing the 7/8" cable connector It is not permissible to remove the 7/8" cable connectors while ET 200pro is in operation! Always switch off the 1L+ electronics/encoder supply and the 2L+ load voltage supply before you pull or plug the 7/8" cable connector.

Note

If you remove the M12 or 7/8" cable connector used for forwarding, downstream modules on PROFINET IO will fail or will no longer be supplied with power.

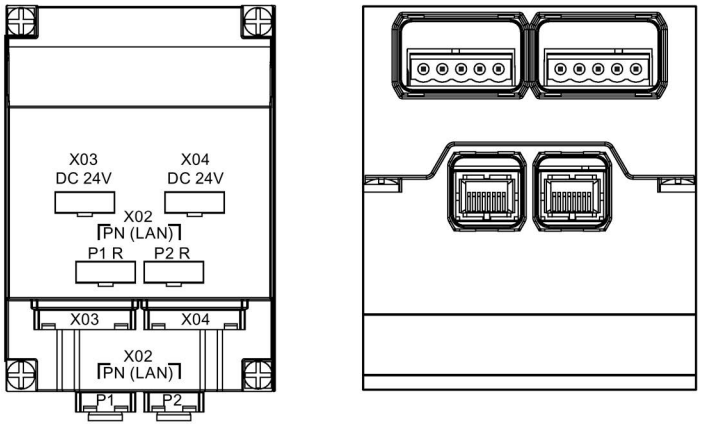
Covering unused sockets

Always close all unused sockets using M12 and 7/8" caps in order to achieve degree of protection IP65, IP66 or IP67.

4.9 Connecting the IM 154-4 PN High Feature Interface Module with CM IM PN PP Cu

Introduction

You connect the power supplies and PROFINET IO to the CM IM PN PP Cu connection module. The IM 154-4 High Feature interface module is equipped with an internal PROFINET switch. This allows the direct forwarding of PROFINET or the direct connection of an additional IO device (e.g., ET 200pro with IM 154-8 CPU).



X03 DC 24V	Push-pull socket (with male connector) for feeding the 1L+ electronics/encoder supply and the 2L+ load voltage supply
X04 DC 24V	Push-pull socket (with male connector) for looping the 1L+ electronics/encoder supply and the 2L+ load voltage supply
X02 P1 R	Push-pull socket for RJ45 for feeding PROFINET IO
X02 P2 R	Push-pull socket for RJ45 for forwarding PROFINET IO

⚠ CAUTION

PROFINET

Modules with PROFINET interfaces may only be operated in LANs (Local Area Networks) in which all connected devices are equipped with SELV/PELV power supplies (or have equivalent protection).

A data transfer terminal (modem, for example) that guarantees this level of safety must be used for the interface to the WAN (Wide Area Network).

Requirements

The IM 154-4 High Feature interface module (including the bus module) and the CM IM PN PP Cu connection module have been installed on the rack.

Required tools

- Screwdriver
- Stripping tool for wiring the push-pull cable connector if you assemble your own cables.

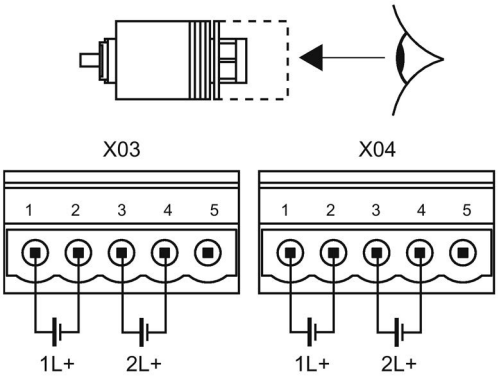
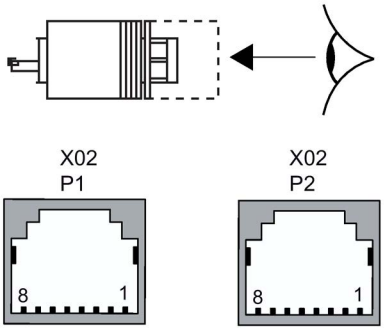
Required accessories

- Preassembled cables with push-pull cable connector for 1L+/2L+ and RJ45. The cables are available in various lengths from appropriate manufacturers.
- If you assemble your own cables:
  - 5-wire cable and push-pull cable connector for 1L+/2L+
  - 4-core, shielded cable (bus cable) and push-pull cable connector for RJ45

Note

Refer to the manufacturer's documentation if you assemble the cables with the push-pull cable connectors.

Pin assignment of push-pull cable connector for 1L+/2L+ and RJ45

View of the push-pull cable connector	Terminal	Assignment	
Push-pull cable connector (1L+ and 2L+ supply voltages)			
	**X03 DC 24V for feeding** **X04 DC 24V for looping**		
	1	1L+ electronics/encoder supply	
	2	Ground for electronics/encoder supply 1M	
	3	2L+ load voltage supply	
	4	Ground for load voltage supply 2M	
	5	Functional earth	
Push-pull cable connector (RJ45)			
		**X02 P1 for connecting PROFINET**	**X02 P2 for connecting PROFINET**
	1	Transmit Data+ TD	Receive Data+ RD
	2	Transmit Data- TD_N	Receive Data- RD_N
	3	Receive Data+ RD	Transmit Data+ TD
	4	Ground GND	
	5	Ground GND	
	6	Receive Data- RD_N	Transmit Data- TD_N
	7	Ground GND	
	8	Ground GND	

Note

The cable shield support is described in the Hardware Installation Instructions for the push-pull cable connector (PROFINET).

Connecting push-pull cable connector

Plug the push-pull cable connector for 1L+/2L+ and RJ45 into the associated sockets on the CM IM PN PP Cu connection module. The connectors must engage. Ensure that the locking mechanism between the connector and socket is properly applied.

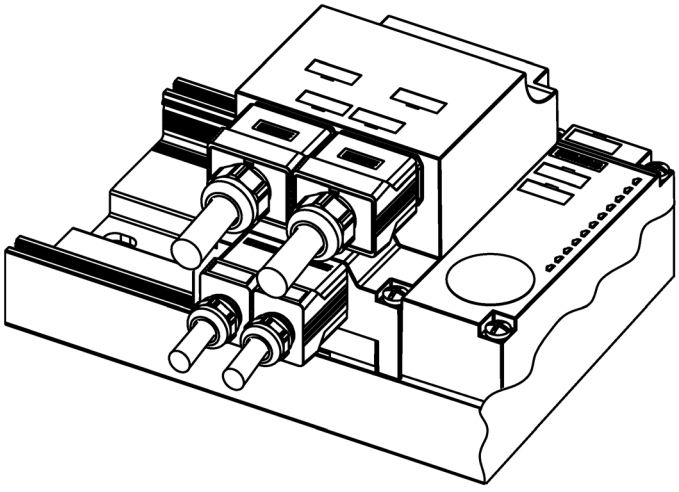


Figure 4-15 Connecting push-pull cable connector

NOTICE
Removing the push-pull cable connectors It is not permissible to remove the push-pull cable connector for 1L+/2L+ while ET 200pro is in operation. Always switch off the 1L+ electronics/encoder supply and the 2L+ load voltage supply before you pull or plug the push-pull cable connector.

Note

If you remove the push-pull cable connector used for looping through of PROFINET IO or 1L+/2L+, the downstream modules on PROFINET IO will fail or will no longer be supplied with power.

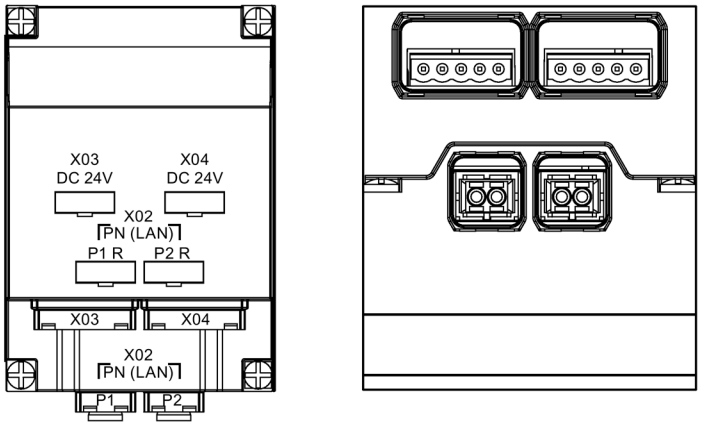
Covering unused sockets

Cover all unused push-pull sockets with caps in order to achieve degree of protection IP65.

4.10 Connecting the IM 154-4 PN High Feature Interface Module with CM IM PN PP FO

Introduction

You connect the power supplies and PROFINET IO (optically via fiber-optic cables) to the CM IM PN PP FO connection module. The IM 154-4 High Feature interface module is equipped with an internal PROFINET switch. This allows direct looping through of PROFINET IO, or the direct connection of a further IO device.



X03 DC 24V	Push-pull socket (with male connector) for feeding the 1L+ electronics/encoder supply and the 2L+ load voltage supply
X04 DC 24V	Push-pull socket (with male connector) for looping the 1L+ electronics/encoder supply and the 2L+ load voltage supply
X02 P1 R	Push-pull socket for SC RJ for feeding of PROFINET IO (fiber-optic cable)
X02 P2 R	Push-pull socket for SC RJ for looping through of PROFINET IO (fiber-optic cable)

Requirements

The IM 154-4 High Feature interface module (including the bus module) and the CM IM PN PP FO connection module have been installed on the rack.

Required tools

- Screwdriver
- Stripping tool for wiring the push-pull cable connector if you assemble your own cables.

Required accessories

- Preassembled cables with push-pull cable connector for 1L+/2L+ and SC RJ. The cables are available in various lengths from appropriate manufacturers.
- If you assemble your own cables:
  - 5-wire cable and push-pull cable connector for 1L+/2L+
  - Fiber-optic cable (IE POF standard cable, IE POF trailing cable) and push-pull cable connector for SC RJ

Note

Refer to the manufacturer's documentation if you assemble the cables with the push-pull cable connectors.

Rules for the structure of a fiber-optic cable network

Note the following for fiber-optic networks with devices having integrated fiber-optic interfaces:

- The fiber-optic network can only be configured as a line.
- If you remove the fiber-optic cable from an integrated fiber-optic cable interface or if the power supply for the interface module fails, then the downstream devices are also no longer accessible.
- The fiber-optic cable may have the following maximum lengths:
  - IE POF standard cable: 50 m
  - IE POF trailing cable: 50 m

Bending radius for the fiber-optic cable

When installing the fiber-optic cable, make sure not to exceed the permissible bending radius:

- IE POF standard cable: 150 mm
- IE POF trailing cable: 60 mm

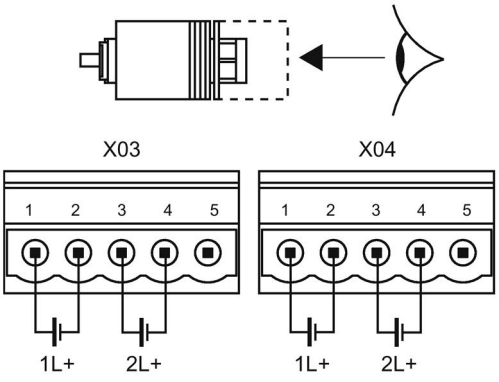
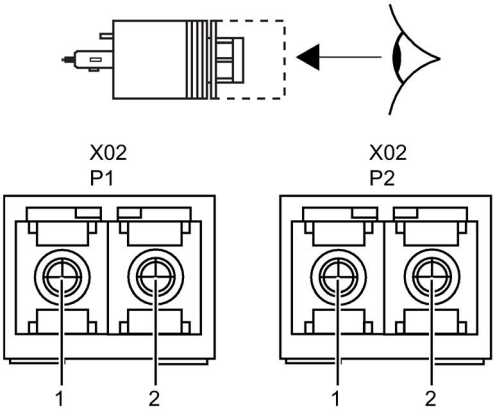
Refer also to the installation guidelines for fiber-optic cable in the *ET 200 Distributed I/O System* Manual or *SIMATIC NET - PROFIBUS Networks* Manual.

Reusing fiber-optic cable

Note

If you are reusing fiber-optic cable, you must shorten both fiber-optic cores by the amount of the curved lengths and reinstall the cable connectors. This will prevent any attenuation losses caused by re-bent, heavily-stressed portions of the fiber-optic cores.

Pin assignment of push-pull cable connectors for 1L+/2L+ and SC RJ

View of the push-pull cable connector	Terminal	Assignment
Push-pull cable connector (1L+ and 2L+ supply voltages)		
	**X03 DC 24V for feeding** **X04 DC 24V for looping**	
	1	1L+ electronic/encoder supply
	2	Ground for electronic/encoder supply 1M
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth
Push-pull cable connector (SC RJ)		
	**X02 P1 for feeding of PROFINET** **X02 P2 for looping through of PROFINET**	
	1	TX (Transmit Data)
	2	RX (Receive Data)

Connecting push-pull cable connector

Press the push-pull cable connector for 1L+/2L+ and SC RJ into the associated sockets on the CM IM PN PP FO connection module. The connectors must engage. Ensure that the locking mechanism between the connector and socket is properly applied.

⚠ CAUTION

Risk of damage to eyes

Do not look directly into the opening of the optical transmit diodes. The emitted light beam can damage your eyes.

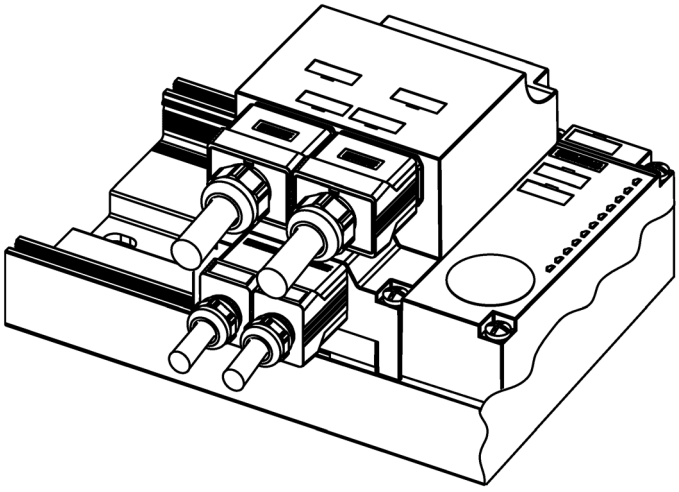


Figure 4-16 Connecting push-pull cable connector

NOTICE

Removing the push-pull cable connectors

It is not permissible to remove the push-pull cable connector for 1L+/2L+ while ET 200pro is in operation. Always switch off the 1L+ electronic/encoder supply and the 2L+ load voltage supply before you remove or insert the push-pull cable connector.

Note

If you remove the push-pull cable connector used for looping through of PROFINET IO or 1L+/2L+, the downstream modules on PROFINET IO will fail or will no longer be supplied with power.

Covering unused sockets

Cover all unused push-pull sockets with caps in order to achieve degree of protection IP65.

4.11 Wiring the Electronic Module using the Connection Module

4.11.1 Introduction

Introduction

You can connect the actuators and sensors to the electronic modules using the following types of connection module.

- CM IO 4 x M12, CM IO 4 x M12P, CM IO 4 x M12 Inverse, CM IO 8 x M12, CM IO 8 x M12P or CM IO 8 x M12D connection module by means of 5-pin M12 circular socket connectors (X1 to X4 or X1 to X8)
- CM IO 8 x M8 connection module by means of 3-pin M8 circular socket connectors (X1 to X8)
- Connection module CM IO 2 x M12 by means of 8-pin M12 circular socket connectors for 2 actuator/sensor distributors (X1 and X2)
- CM IO 1 x M23 connection module by means of an M23 circular socket connector for one actuator/sensor distributor (X1)

If you want to configure the cables yourself you will require a suitable circular connector and cable. The order numbers can be found in the Appendix (Page 456).

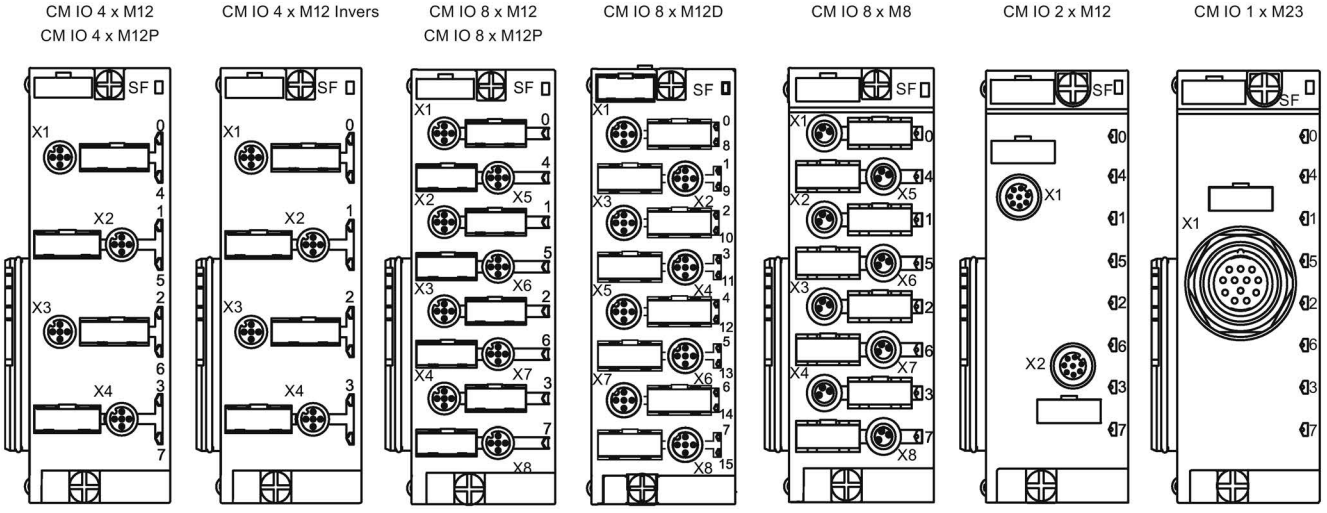


Figure 4-17 Sockets and LEDs of the connection modules

Requirements

Before you start to wire the connection modules of the electronic modules, switch off the supply voltage or disassemble the connection module.

Note

It is easier to wire the connection module after you removed it from the electronic module.

Required tools

You need a stripping tool and a screwdriver for wiring the M12 connector, if you are fabricating your own cables.

Accessories required for digital electronic modules

Connection module	Required accessories	
CM IO 4 x M12 CM IO 4 x M12P CM IO 4 x M12 Inverse CM IO 8 x M12 CM IO 8 x M12P CM IO 8 x M12D	Preassembled cable with 5-pin M12 connector	Alternatively: 2-, 3-, 4-, or 5-wire flexible copper cable, conductor cross-section ≤ 0.75 mm^2 and 5-pin M12 connector Optional: Shielded cables
CM IO 8 x M8	Preassembled cable with 3-pin M8 connector	Alternatively: 3-wire flexible copper cable, conductor cross-section ≤ 0.75 mm^2 and 3-pin M8 connector Optional: Shielded cables
CM IO 2 x M12	Actuator/sensor distributor with assembled cable and 8-pin M12 connector	---
CM IO 1 x M23	Actuator/sensor distributor with assembled cable and 12-pin M23 connector	---

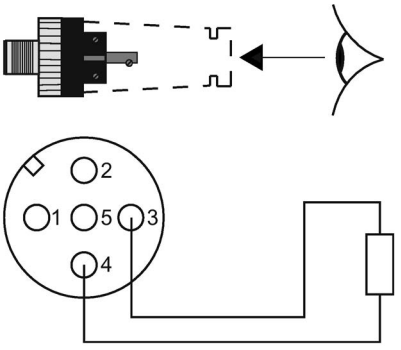
Accessories required for analog electronic modules

- Preassembled cable with 5-pin M12 connector
- Alternatively: 2-, 3-, 4-, or 5-wire shielded flexible copper cable, conductor cross-section ≤ 0.75 mm^2 and 5-pin M12 connector, shielded
- Shielded cables

4.11.2 Pin assignment for the Digital Electronic Modules

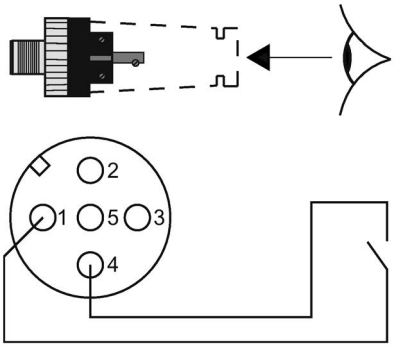
Pin assignment of CM IO 8 x M12, CM IO 8 x M12P connection module and 8 DO DC 24V/0.5A electronic module

Table 4- 1 Pin assignment of CM IO 8 x M12, CM IO 8 x M12P with 8 DO DC 24V/0.5A

View of circular connector	Terminal	Assignment X1 to X8
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4 Output signal DQ_4: Connector X5 Output signal DQ_5: Connector X6 Output signal DQ_6: Connector X7 Output signal DQ_7: Connector X8
	5	Functional earth (FE)

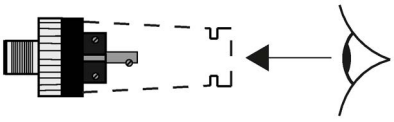
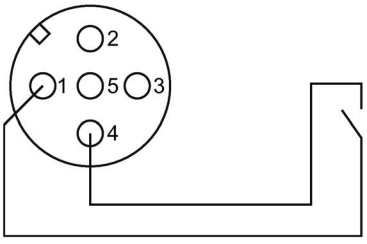
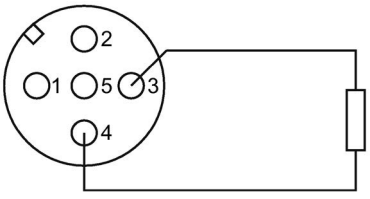
Pin assignment on the CM IO 8 x M12, CM IO 8 x M12P connection module and the 8 DI DC 24V, 8 DI DC 24V High Feature electronic module

Table 4- 2 Pin assignment on the CM IO 8 x M12, CM IO 8 x M12P with 8 DI DC 24V, 8 DI DC 24V High Feature

View of circular connector	Terminal	Assignment X1 to X8
	1	24V encoder supply U_S
	2	Not assigned
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	5	Functional earth (FE)

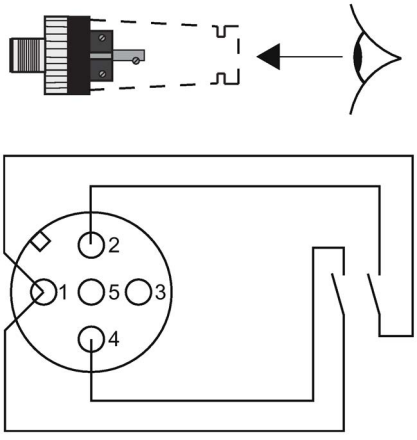
Pin assignment on CM IO 8 x M12, CM IO 8 x M12P connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

Table 4- 3 Pin assignment on CM IO 8 x M12, CM IO 8 x M12P connection module and **4 DI / 4 DO DC 24V/0.5A** electronic module

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1 to X4 (inputs)**
	1	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	2	Not assigned
	3	Ground 2M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)
	**Terminal**	**Pin assignment X5 to X8 (outputs)**
	1	Not assigned
	2	Not assigned
	3	Ground 2M
	4	Output signal DQ_0: Connector X5 Output signal DQ_1: Connector X6 Output signal DQ_2: Connector X7 Output signal DQ_3: Connector X8
	5	Functional earth (FE)

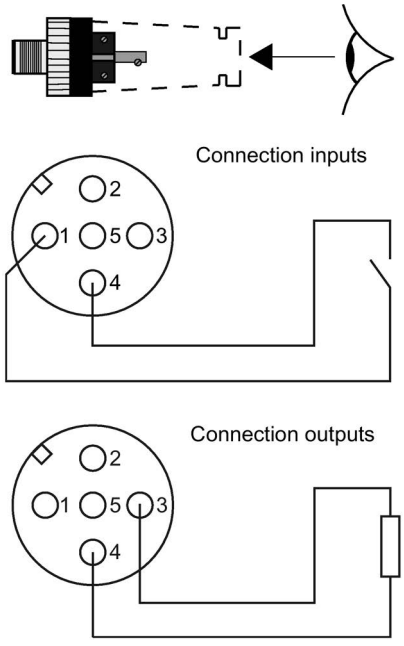
Pin assignment on the CM IO 8 x M12D connection module and the 16 DI DC 24V electronic module

Table 4- 4 Pin assignment of CM IO 8 x M12D with 16 DI DC 24V

View of circular connector	Terminal	Assignment X1 to X8
	1	24V encoder supply U_S
	2	Input signal DI_8: Connector X1 Input signal DI_9: Connector X2 Input signal DI_{10}: Connector X3 Input signal DI_{11}: Connector X4 Input signal DI_{12}: Connector X5 Input signal DI_{13}: Connector X6 Input signal DI_{14}: Connector X7 Input signal DI_{15}: Connector X8
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	5	Functional earth (FE)

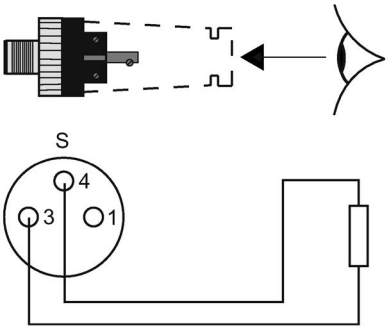
Pin assignment on CM IO 8 x M12D connection module and 4 DIO / 4 DO DC 24V/0,5A electronic module

Table 4- 5 Pin assignment of the X1 to X4 sockets (inputs/outputs) and the X5 to X8 sockets (outputs) on connection module CM IO 8 x M12D

View of circular connector	Terminal	Assignment X1 to X4 (inputs/outputs)
	1	24V encoder supply U_S
	2	Not assigned
	3	Encoder supply ground 1M
	4	Input/output signal DIQ_0: Connector X1 Input/output signal DIQ_1: Connector X2 Input/output signal DIQ_2: Connector X3 Input/output signal DIQ_3: Connector X4
	5	Functional earth (FE)
	Terminal	**Pin assignment X5 to X8 (outputs)**
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_4: Connector X5 Output signal DQ_5: Connector X6 Output signal DQ_6: Connector X7 Output signal DQ_7: Connector X8
	5	Functional earth (FE)

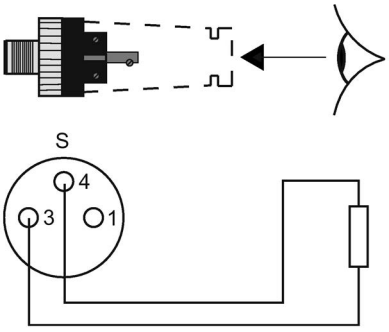
Pin assignment on the CM IO 8 x M8 connection module and the 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature electronic modules

Table 4- 6 Pin assignment of CM IO 8 x M8 with 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature

View of circular connector	Terminal	Assignment X1 to X4
	1	Not assigned
	-	-
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	S (shield)	Functional earth (FE)

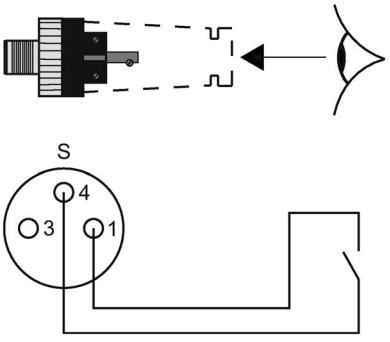
Pin assignment of CM IO 8 x M8 connection module and 8 DO DC 24V/0.5A electronic module

Table 4- 7 Pin assignment of CM IO 8 x M8 with 8 DO DC 24V/0.5A

View of circular connector	Terminal	Assignment X1 to X8
	1	Not assigned
	-	-
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4 Output signal DQ_4: Connector X5 Output signal DQ_5: Connector X6 Output signal DQ_6: Connector X7 Output signal DQ_7: Connector X8
	S (shield)	Functional earth (FE)

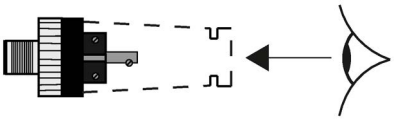
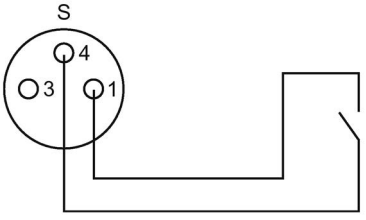
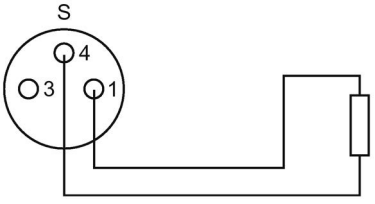
Pin assignment on the CM IO 8 x M8 connection module and the 8 DI DC 24V, 8 DI DC 24V High Feature electronic modules

Table 4- 8 Pin assignment of CM IO 8 x M8 at 8 DI DC 24V, 8 DI DC 24V High Feature

View of circular connector	Terminal	Assignment X1 to X8
	1	24V encoder supply U_S
	-	-
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	S (shield)	Functional earth (FE)

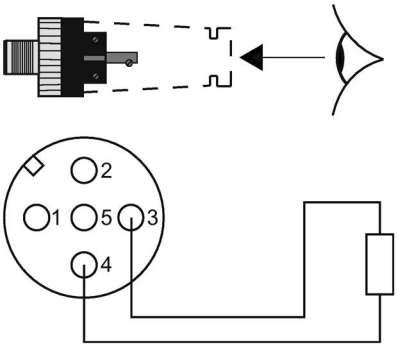
Pin assignment on CM IO 8 x M8 connection module and 4 DI / 4 DO DC 24V/0,5A electronic module

Table 4- 9 Pin assignment on CM IO 8 x M8 connection module and **4 DI / 4 DO DC 24V/0.5A** electronic module

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1 to X4 (inputs)**
	1	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	3	Ground 2M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	S (shield)	Functional earth (FE)
	**Terminal**	**Pin assignment X5 to X8 (outputs)**
	1	Not assigned
	3	Ground 2M
	4	Output signal DQ_0: Connector X5 Output signal DQ_1: Connector X6 Output signal DQ_2: Connector X7 Output signal DQ_3: Connector X8
	S (shield)	Functional earth (FE)

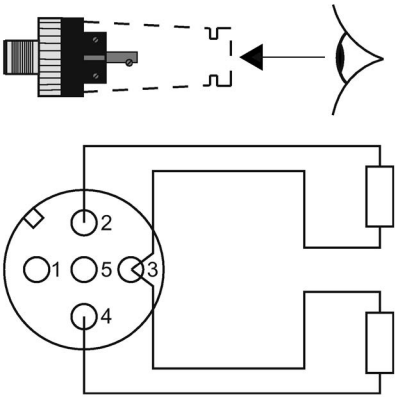
Pin assignment on the CM IO 4 x M12, CM IO 4 x M12P connection module and the 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature electronic modules

Table 4- 10 Pin assignment on the CM IO 4 x M12, CM IO 4 x M12P with 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature

View of circular connector	Terminal	Assignment X1 to X4
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	5	Functional earth (FE)

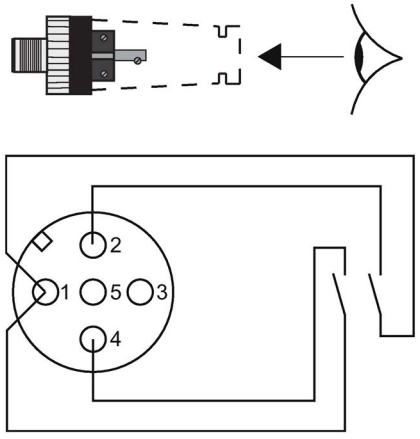
Pin assignment of CM IO 4 x M12, CM IO 4 x M12P connection module and electronic module 8 DO DC 24V/0.5A

Table 4- 11 Pin assignment of CM IO 4 x M12, CM IO 4 x M12P with 8 DO DC 24V/0.5A

View of circular connector	Terminal	Assignment X1 to X4
	1	Not assigned
	2	Output signal DQ_4: Connector X1 Output signal DQ_5: Connector X2 Output signal DQ_6: Connector X3 Output signal DQ_7: Connector X4
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	5	Functional earth (FE)

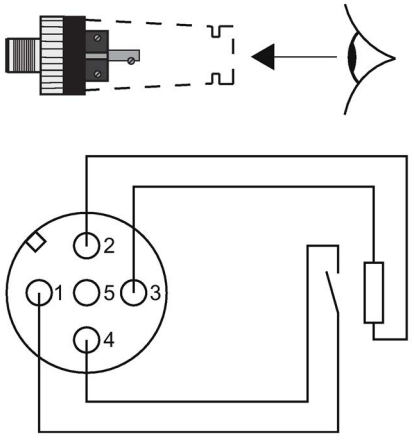
Pin assignment on the CM IO 4 x M12, CM IO 4 x M12P connection module and the 8 DI DC 24V, 8 DI DC 24V High Feature electronic modules

Table 4- 12 Pin assignment on the CM IO 4 x M12, CM IO 4 x M12P with 8 DI DC 24V, 8 DI DC 24V High Feature

View of circular connector	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal DI_4: Connector X1 Input signal DI_5: Connector X2 Input signal DI_6: Connector X3 Input signal DI_7: Connector X4
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)

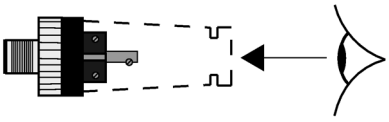
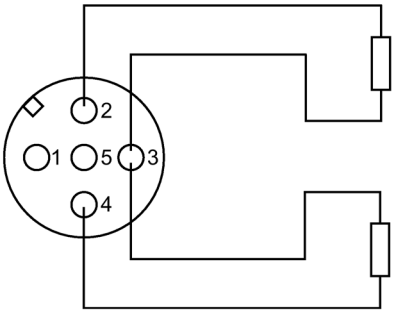
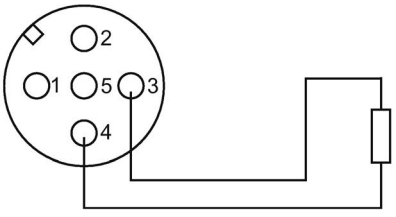
Pin assignment on CM IO 4 x M12, CM IO 4 x M12P connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

Table 4- 13 Pin assignment on CM IO 4 x M12, CM IO 4 x M12P connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

View of circular connector	Terminal	Assignment X1 to X4 (inputs/outputs)
	1	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	2	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	3	Ground 2M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)

Pin assignment on the CM IO 4 x M12 Inverse connection module and the 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature electronic modules

Table 4- 14 Pin assignment of CM IO 4 x M12 Inverse with 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1, X3**
	1	Not assigned
	2	Output signal DQ_1: Connector X1 Output signal DQ_3: Connector X3
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_2: Connector X3
	5	Functional earth (FE)
	**Terminal**	**Assignment X2, X4**
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_1: Connector X2 Output signal DQ_3: Connector X4
	5	Functional earth (FE)

Note

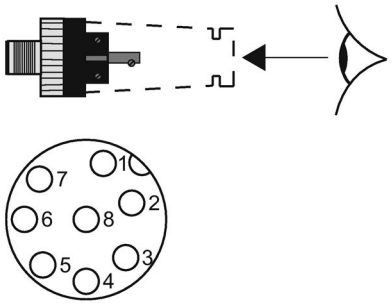
Connection of channel 1 (bit 1) and channel 3 (bit 3)

Channels 1 and 3 are only allowed to be connected to **one** circular socket connector each:

- Channel 1 to circular socket connector X1 or X2.
- Channel 3 to circular socket connector X3 or X4.

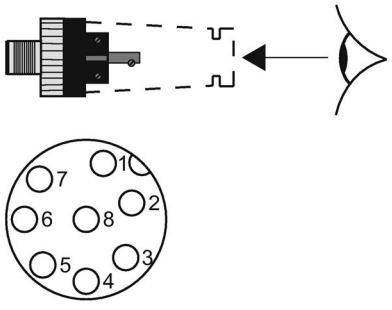
Pin assignment on the CM IO 2 x M12 connection module and the 4 DO DC 24V/2.0A, 8 DO DC 24V/0.5A electronic modules

Table 4- 15 Pin assignment of CM IO 2 x M12 with 4 DO DC 24V/2.0A, 8 DO DC 24V/0.5A

View of circular connector	Terminal	Assignment X1 and X2
	1	Output signal DQ_0: Connector X1 Output signal DQ_4: Connector X2
	2	Output signal DQ_1: Connector X1 Output signal DQ_5: Connector X2
	3	Output signal DQ_2: Connector X1 Output signal DQ_6: Connector X2
	4	Output signal DQ_3: Connector X1 Output signal DQ_7: Connector X2
	5	Not assigned
	6	Not assigned
	7	Ground for load voltage supply 2M
	8	Functional earth (FE)

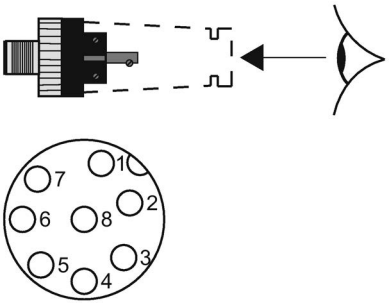
Pin assignment on the CM IO 2 x M12 connection module and the 8 DI DC 24V electronic module

Table 4- 16 Pin assignment of CM IO 2 x M12 at 8 DI DC 24V

View of circular connector	Terminal	Assignment X1 and X2
	1	Input signal DI_0: Connector X1 Input signal DI_4: Connector X2
	2	Input signal DI_1: Connector X1 Input signal DI_5: Connector X2
	3	Input signal DI_2: Connector X1 Input signal DI_6: Connector X2
	4	Input signal DI_3: Connector X1 Input signal DI_7: Connector X2
	5	24V encoder supply U_S
	6	Not assigned
	7	Encoder supply ground 1M
	8	Functional earth (FE)

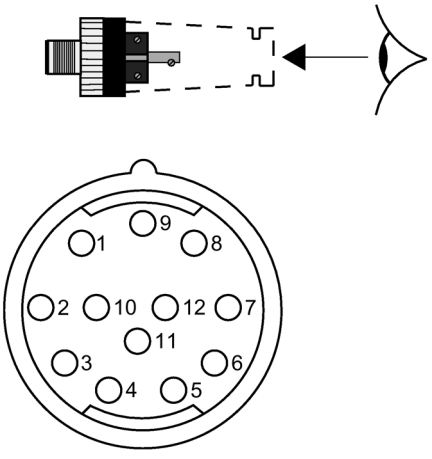
Pin assignment on CM IO 2 x M12 connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

Table 4- 17 Pin assignment on CM IO 2 x M12 connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

View of circular connector	Terminal	Assignment X1 and X2
	1	Input signal DI_0: Connector X1 Output signal DQ_0: Connector X2
	2	Input signal DI_1: Connector X1 Output signal DQ_1: Connector X2
	3	Input signal DI_2: Connector X1 Output signal DQ_2: Connector X2
	4	Input signal DI_3: Connector X1 Output signal DQ_3: Connector X2
	5	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder): Connector X1 Not assigned: Connector X2
	6	Not assigned
	7	Ground 2M
	8	Functional earth (FE)

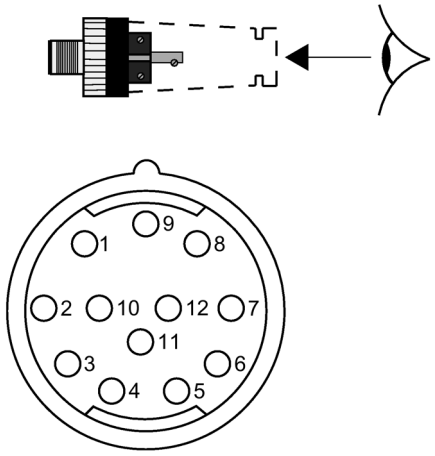
Pin assignment on the CM IO 1 x M23 connection module and the 4 DO DC 24V/2.0A electronic module

Table 4- 18 Pin assignment of CM IO 1 x M23 with 4 DO DC 24V/2.0A

View of circular connector	Terminal	Assignment X1
	1	Output signal DQ_0
	2	Output signal DQ_1
	3	Output signal DQ_2
	4	Output signal DQ_3
	5	Not assigned
	6	Not assigned
	7	Not assigned
	8	Not assigned
	9	Ground for load voltage supply 2M
	10	Ground for load voltage supply 2M
	11	Not assigned
	12	Functional earth (FE)

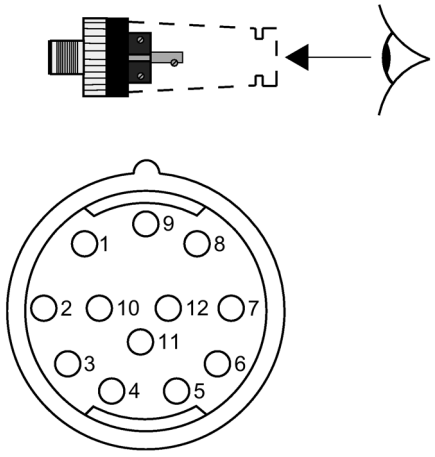
Pin assignment on the CM IO 1 x M23 connection module and the 8 DO DC 24V/0.5A electronic module

Table 4- 19 Pin assignment of CM IO 1 x M23 with 8 DO DC 24V/0.5A

View of circular connector	Terminal	Assignment X1
	1	Output signal DQ_0
	2	Output signal DQ_1
	3	Output signal DQ_2
	4	Output signal DQ_3
	5	Output signal DQ_4
	6	Output signal DQ_5
	7	Output signal DQ_6
	8	Output signal DQ_7
	9	Ground for load voltage supply 2M
	10	Ground for load voltage supply 2M
	11	Not assigned
	12	Functional earth (FE)

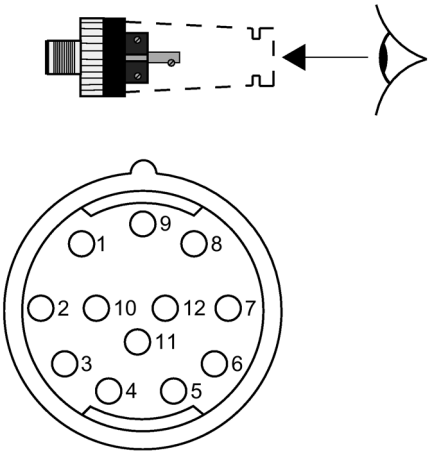
Pin assignment on the CM IO 1 x M23 connection module and the 8 DI DC 24V electronic module

Table 4- 20 Pin assignment of CM IO 1 x M23 at 8 DI DC 24V

View of circular connector	Terminal	Assignment X1
	1	Input signal DI_0
	2	Input signal DI_1
	3	Input signal DI_2
	4	Input signal DI_3
	5	Input signal DI_4
	6	Input signal DI_5
	7	Input signal DI_6
	8	Input signal DI_7
	9	Encoder supply ground 1M
	10	Encoder supply ground 1M
	11	24V encoder supply U_S
	12	Functional earth (FE)

Pin assignment on CM IO 1 x M23 connection module and 4 DI / 4 DO DC 24V/0,5A electronic module

Table 4- 21 Pin assignment on CM IO 1 x M23 connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

View of circular connector	Terminal	Assignment X1 (inputs/outputs)
	1	Input signal DI_0
	2	Input signal DI_1
	3	Input signal DI_2
	4	Input signal DI_3
	5	Output signal DQ_0
	6	Output signal DQ_1
	7	Output signal DQ_2
	8	Output signal DQ_3
	9	Ground 2M
	10	Ground 2M
	11	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	12	Functional earth (FE)

4.11.3 Pin assignment for the analog electronic modules

Using the shield support

To prevent interference we recommend the following for analog electronic modules:

- Use pre-fabricated shielded cables to the connection modules.
- If you are fabricating your own cable, place the cable shield on the ferrous connector enclosure or use terminal 5 for shield support purposes.

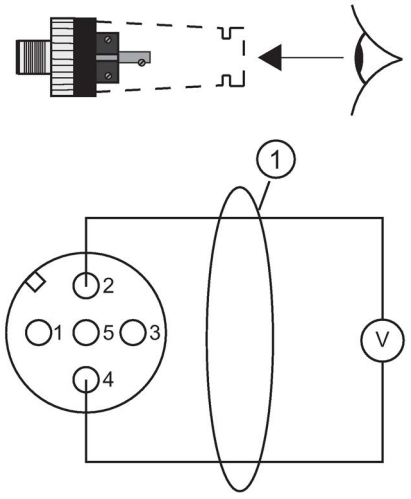
The connection module connects the cable shield with low impedance to the main ground line.

Pin assignment of CM IO 4 x M12 connection module and 4 AI U High Feature electronic module

Note

Only the CM IO 4 x M12 connection module may be used for the electronic module.

Table 4- 22 Pin assignment of CM IO 4 x M12 with 4 AI U High Feature

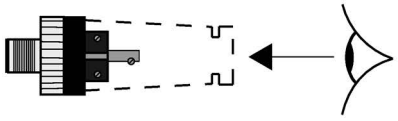
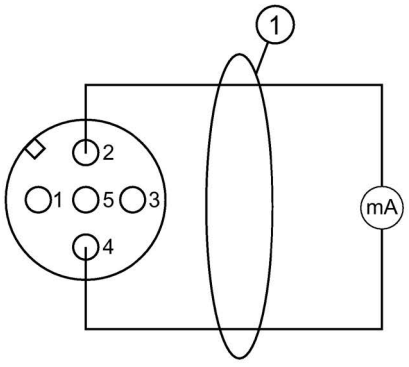
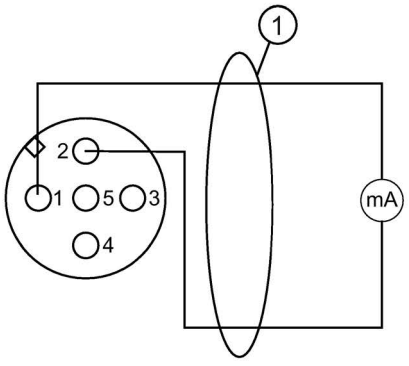
View of the coupler plug	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal DI_0+: Connector X1 Input signal U_1+: Connector X2 Input signal U_2+: Connector X3 Input signal U_3+: Connector X4
	3	Encoder supply ground 1M
	4	Input signal U_0-: Connector X1 Input signal U_1-: Connector X2 Input signal U_2-: Connector X3 Input signal U_3-: Connector X4
	5	Functional earth (FE)
① Shielded copper cables		

Pin assignment of CM IO 4 x M12 connection module and 4 AI I High Feature electronic module

Note

Only the CM IO 4 x M12 connection module may be used for the electronic module.

Table 4- 23 Pin assignment of CM IO 4 x M12 with 4 AI I High Feature

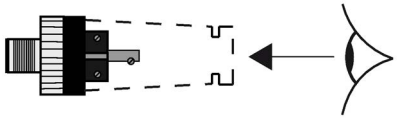
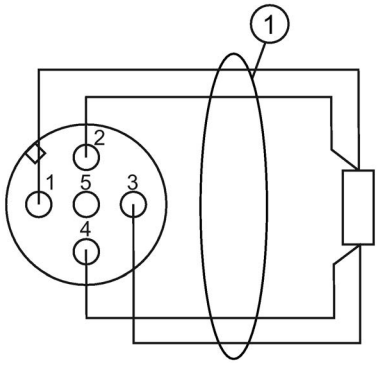
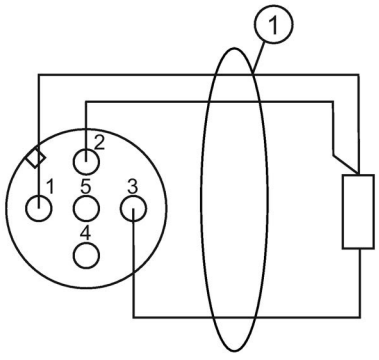
View of the coupler plug	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal I_0+: Connector X1 Input signal I_1+: Connector X2 Input signal I_2+: Connector X3 Input signal I_3+: Connector X4
4-wire transducer 	3	Encoder supply ground 1M
	4	Input signal I_0-: Connector X1 Input signal I_1-: Connector X2 Input signal I_2-: Connector X3 Input signal I_3-: Connector X4
2-wire transducer 	5	Functional earth (FE)
① Shielded copper cables		

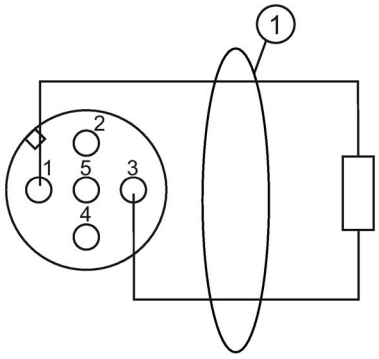
Pin assignment of CM IO 4 x M12 connection module and 4 AI RTD High Feature electronic module

Note

Only the CM IO 4 x M12 connection module may be used for the electronic module.

Table 4- 24 Pin assignment of CM IO 4 x M12 connection module with 4 AI RTD High Feature

View of the coupler plug	Terminal	Assignment X1 to X4
		
	**4-wire**	
	1	Constant current line I_{C0}+: Connector 1 Constant current line I_{C1}+: Connector 2 Constant current line I_{C2}+: Connector 3 Constant current line I_{C3}+: Connector 4
	2	Measuring line M_0+: Connector X1 Measuring line M_1+: Connector X2 Measuring line M_2+: Connector X3 Measuring line M_3+: Connector X4
	3	Constant current line I_{C0}-: Connector 1 Constant current line I_{C1}-: Connector 2 Constant current line I_{C2}-: Connector 3 Constant current line I_{C3}-: Connector 4
	4	Measuring line M_0-: Connector X1 Measuring line M_1-: Connector X2 Measuring line M_2-: Connector X3 Measuring line M_3-: Connector X4
	5	Functional earth (FE)
	**3-wire**	
	1	Constant current line I_{C0}+: Connector 1 Constant current line I_{C1}+: Connector 2 Constant current line I_{C2}+: Connector 3 Constant current line I_{C3}+: Connector 4
	2	Measuring line M_0+: Connector X1 Measuring line M_1+: Connector X2 Measuring line M_2+: Connector X3 Measuring line M_3+: Connector X4
	3	Measuring line M_0-: Connector X1 Measuring line M_1-: Connector X2 Measuring line M_2-: Connector X3 Measuring line M_3-: Connector X4
	4	Not assigned
	5	Functional earth (FE)

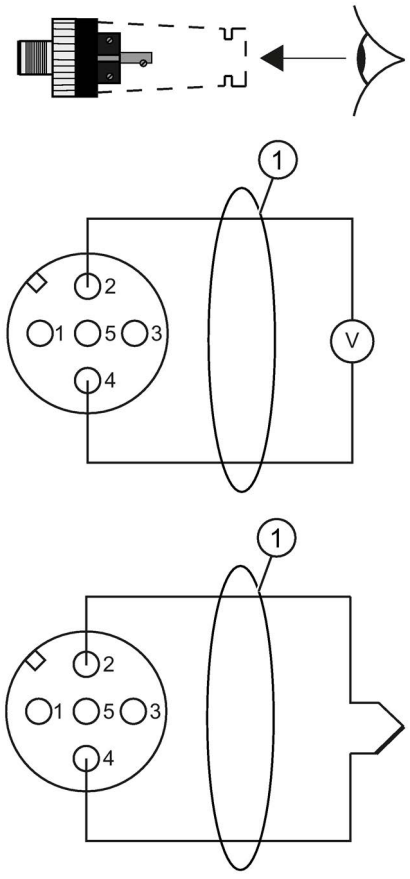
<table>
<tr><td rowspan="6">
</td><td colspan="2">2-wire</td></tr>
<tr><td>1</td><td>Measuring line M $_0$+: Connector X1
Measuring line M_1+: Connector X2
Measuring line M_2+: Connector X3
Measuring line M_3+: Connector X4</td></tr>
<tr><td>2</td><td>Not assigned</td></tr>
<tr><td>3</td><td>Measuring line M $_0$-: Connector X1
Measuring line M_1-: Connector X2
Measuring line M_2-: Connector X3
Measuring line M_3-: Connector X4</td></tr>
<tr><td>4</td><td>Not assigned</td></tr>
<tr><td>5</td><td>Functional earth (FE)</td></tr>
<tr><td colspan="3">① Shielded copper cables</td></tr>
</table>

Pin assignment of CM IO 4 x M12 connection module and 4 AI TC High Feature electronic module

Note

Only the CM IO 4 x M12 connection module may be used for the electronic module.

Table 4- 25 Pin assignment of CM IO 4 x M12 with 4 AI TC High Feature

View of the coupler plug	Terminal	Assignment X1
	1*	Pt1000 resistance thermometer measuring line M+
	2	Input signal M_0+: Channel 0
	3*	Pt1000 resistance thermometer measuring line M-
	4	Input signal M_0-: Channel 0
	5	Functional earth (FE)
	Terminal	**Assignment X2 to X4**
	1	Not assigned
	2	Input signal M_1+: Connector X2 Input signal M_2+: Connector X3 Input signal M_3+: Connector X4
	3	Not assigned
	4	Input signal M_0-: Connector X2 Input signal M_1-: Connector X3 Input signal M_3-: Connector X4
	5	Functional earth (FE)

① Shielded copper cables

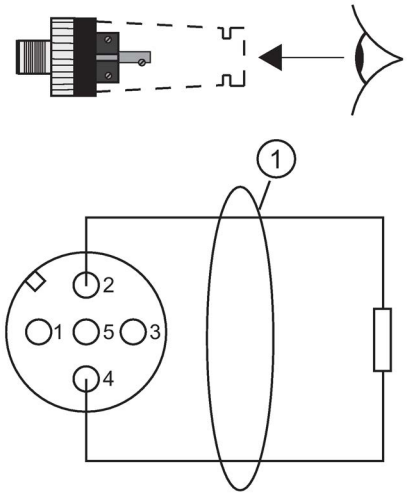
* If the M12 compensation connector is being used (see section titled 4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 401)), the Pt1000 resistance thermometer is already integrated. If an external Pt1000 is connected, α must equal 0.003851.

Pin assignment of CM IO 4 x M12 connection module and 4 AO U High Feature electronic module

Note

Only the CM IO 4 x M12 connection module may be used for the electronic module.

Table 4- 26 Pin assignment of CM IO 4 x M12 with 4 AO U High Feature

View of the coupler plug	Terminal	Assignment X1 to X4*
	1	24V actuator supply U_A
	2	Output signal QV_0+: Connector X1 Output signal QV_1+: Connector X2 Output signal QV_2+: Connector X3 Output signal QV_3+: Connector X4
	3	Actuator supply ground 1M
	4	Output signal QV_0-: Connector X1 Output signal QV_1-: Connector X2 Output signal QV_2-: Connector X3 Output signal QV_3-: Connector X4
	5	Functional earth (FE)

① Shielded copper cables

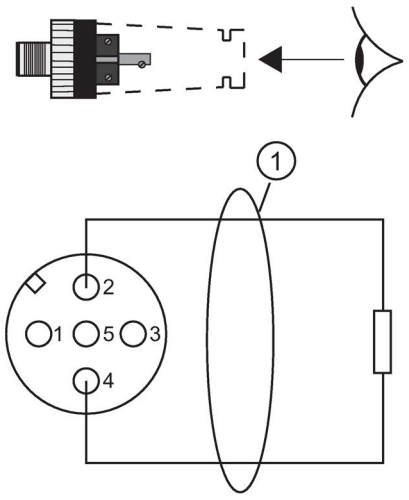
* Please note the changed pin assignment for the ET 200X. The use of actuators that have been wired for ET 200X could result in destruction of the actuator.

Pin assignment of CM IO 4 x M12 connection module and 4 AO I High Feature electronic module

Note

Only the CM IO 4 x M12 connection module may be used for the electronic module.

Table 4- 27 Pin assignment of CM IO 4 x M12 with 4 AO I High Feature

View of the coupler plug	Terminal	Assignment X1 to X4*
	1	24V actuator supply U_A
	2	Output signal QI_0+: Connector X1 Output signal QI_1+: Connector X2 Output signal QI_2+: Connector X3 Output signal QI_3+: Connector X4
	3	Actuator supply ground 1M
	4	Output signal QI_0-: Connector X1 Output signal QI_1-: Connector X2 Output signal QI_2-: Connector X3 Output signal QI_3-: Connector X4
	5	Functional earth (FE)

① Shielded copper cables

* Please note the changed pin assignment for the ET 200X. The use of actuators that have been wired for ET 200X could result in destruction of the actuator.

4.11.4 Connecting the connection module

Connecting the M12/ M8/ M23 connectors

1. Plug the connector into the relevant circular socket connector of the connection module. Make sure the connector and socket are properly interlocked (groove and spring).
2. Tighten the knurled screw of the connector (torque = 1.5 N/m).

Connecting the connection module

1. Insert the connection module into the old electronic module.
2. Screw the connection module onto the rack (2 recessed head screws on the front: top and bottom, tightening torque 1.5 N/m).

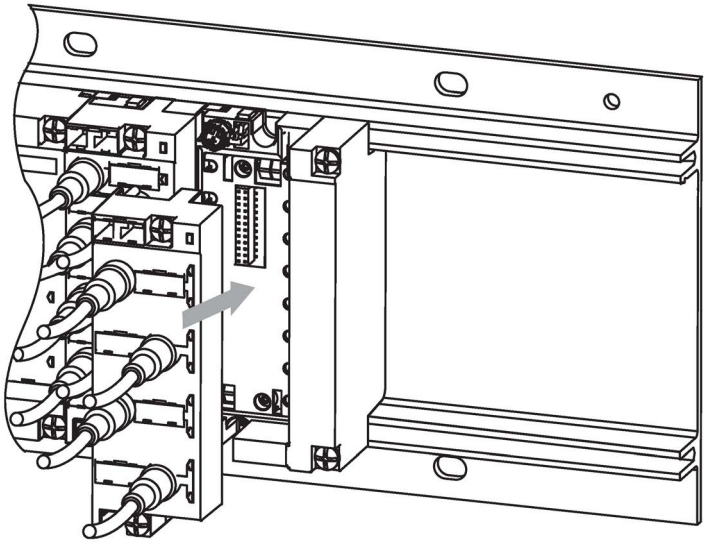


Figure 4-18 Connecting the connection module

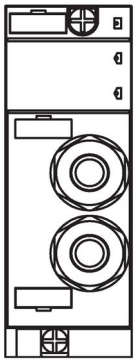
Sealing unused sockets

Always close all unused circular socket connectors using M12 caps in order to achieve the degree of protection IP65, IP66 or IP67.

4.12 Connecting the Power Module with the CM PM-E Direct Connection Module

Introduction

Connect the 2L+ load voltage supply to the screw terminals of the CM PM Direct connection module. You can use additional terminals to loop through the load voltage supply.



Requirements

- The power module and bus module are mounted on the rack.
- Wiring rules for the 2L+ load voltage supply screw terminals:

Wiring rules		Screw terminals for the supply voltages
Connectable conductor cross-sections of flexible cables	Without end sleeve	0.14 to 2.5 mm²
	With end sleeve	0.14 to 2.5 mm²
Number of conductors per terminal		1 conductor
Stripped length of the cable insulation		11 mm
End sleeves according to DIN 46228	Without insulating collar	Design A, length up to 12 mm
	With insulating collar	Design E, length up to 12 mm

Required tools

- Cross-tip screwdriver, size 2
- Screwdriver with 3 mm blade
- 25 mm open-end wrench

Required accessories

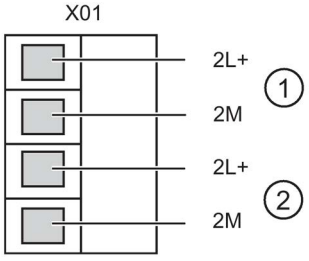
- Cables for feeding and looping through of the 2L+ load voltage supply:
  - 2-core flexible Cu cable, conductor cross-section ≤ 2.5 mm²
  - 4-wire shielded cable, conductor cross-section ≤ 2.5 mm²
- M20 cable glands (included)

Opening and preparing the connection module

1. Remove the two screws from the bottom of the connection module using a crosstip screwdriver.
2. Remove the cover from the connection module.
3. Install M20 screwed cable glands at the cable inlets using an open-end wrench. The blanking plate will break off automatically when you screw in the glands. Tighten the cable glands on the connection module (torque = 3 N/m).
4. Feed the load voltage supply cables through the cable glands.

Connecting the load voltage supply

1. Strip the wires to a length of 11 mm, then crimp the wire end ferrules.
2. Using a 3-mm screwdriver (tightening torque 0.5 N/m to 0.7 N/m), secure the cables for feeding and looping through at Terminal X01 (load voltage supply 2L+).



① Feeding of the 2L+ load voltage supply

② Looping through of the 2L+ load voltage supply

Terminating and installing the connection module

1. Insert the cover onto the connection module, while pulling back the cables through the glands.
2. Tighten the two screws on the bottom of the connection module using a crosstip screwdriver.
3. Tighten the cable strain relief of the M20 cable glands with the open-end wrench (torque = 3 N/m).
4. Insert the connection module into the power module.
5. Screw the connection module into the power module (torque = 1.5 N/m). Tighten both screws evenly. The screws are already inserted in the connection module.

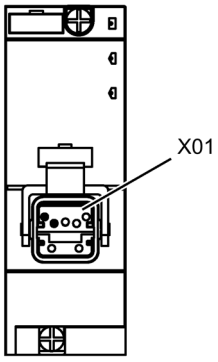
See also

PM-E power module (Page 323)

4.13 Connecting the Power Module with the CM PM-E ECOFAST Connection Module

Introduction

You connect the load voltage supply 2L+ to the CM PM ECOFAST connection module using the ECOFAST cable connector X01.



Requirements

- The power module and bus module are mounted on the rack.

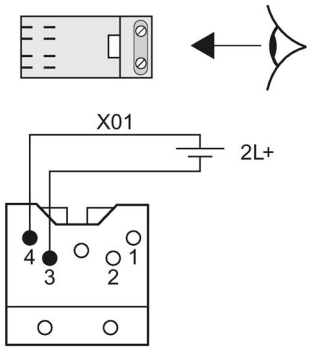
Required tools

Screwdriver, stripping and crimp tool for wiring the ECOFAST cable connector, if you are fabricating your own cables.

Required accessories

- PROFIBUS ECOFAST Hybrid Cable, preassembled at both ends with ECOFAST Hybrid Plug 180. The patch cable is available in various lengths.
- If you are fabricating your own cables:
  - PROFIBUS ECOFAST hybrid cable, unassembled
  - PROFIBUS ECOFAST Hybrid Plug 180 (ECOFAST Cu) with Hanbrid connector
  - PROFIBUS ECOFAST Hybrid Plug, angled, (ECOFAST Cu) with Hanbrid connector

Pin assignment of the ECOFAST cable connector

View of the ECOFAST cable connector	Terminal	Assignment X01
	Feed for X01	
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply

Connecting the ECOFAST cable connectors

1. Insert the CM PM ECOFAST connection module into the power module.
2. Screw the CM PM ECOFAST connection module onto the power module (torque = 1.5 Nm). Tighten both screws evenly. The screws are already inserted in the connection module.
3. Open the interlock for the ECOFAST cable connector on the connection module.
4. Plug the ECOFAST cable connector (2L+) into the socket of the connection module.
5. Close the interlock for the ECOFAST cable connector.

NOTICE
It is not allowed to remove the ECOFAST cable connector while ET 200pro is in operation! Always switch off the load voltage supply (2L+) before you remove the ECOFAST cable connector.

Note

Removal of the ECOFAST cable connector interrupts the supply to all downstream modules.

Closing the unused socket

Always close any unused ECOFAST sockets using a cap in order to achieve the degree of protection IP65, IP66 or IP67.

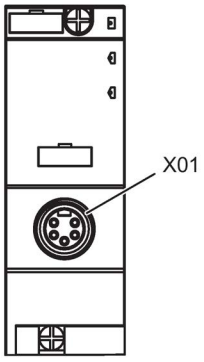
See also

PM-E power module (Page 323)

4.14 Connecting the Power Module with the CM PM-E 7/8" Connection Module

Introduction

You connect the load voltage supply 2L+ to the CM PM 7/8" connection module using the 7/8" connector X01.



Requirements

The power module and bus module are mounted on the rack.

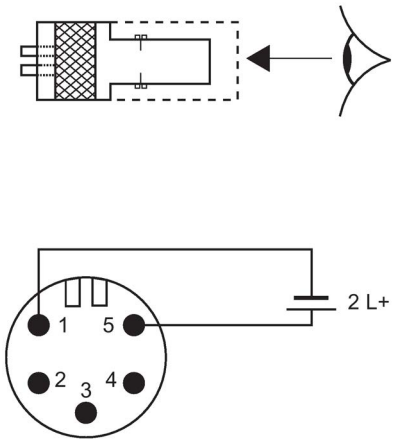
Required tools

Screwdriver and stripping tool for wiring the 7/8" connector, if you are fabricating your own cables.

Required accessories

- Prefabricated cable with 7/8" cable connector. The cable is available in different lengths.
- If you are fabricating your own cables:
  - 7/8" connectors
  - 3-wire cable

Pin assignment of the 7/8" connector

View of the 7/8" connector	Terminal	Assignment
	Feed for X01	
	1	Ground for load voltage supply 2M
	2	Not assigned
	3	Functional earth (FE)
	4	Not assigned
	5	2L+ load voltage supply

Connecting the 7/8" cable connector

1. Insert the CM PM 7/8" connection module into the power module.
2. Screw the CM PM 7/8" connection module into the power module (torque = 1.5 N/m). Tighten both screws evenly. The screws are already inserted in the connection module.
3. Plug the 7/8" connector into the circular socket of the connection module. Ensure that the connector and socket are properly engaged.
4. Tighten the knurled screw of the 7/8" connector (torque = 1.5 N/m).

NOTICE
It is not allowed to remove the 7/8" connector while ET 200pro is in operation! Always switch off the load voltage supply 2L+ before you remove the 7/8" connector.

Closing the unused socket

Always close unused 7/8" circular socket connectors using a 7/8" cap in order to achieve the degree of protection IP65, IP66 or IP67.

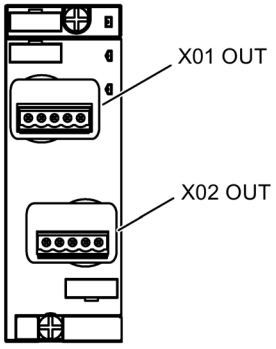
See also

PM-E power module (Page 323)

4.15 Connecting the Outgoing Module with the CM PM-O PP Connection Module

Introduction

You tap the 1L+ electronic/encoder supply and the 2L+ load voltage supply on the CM PM-O PP connection module using the push-pull cable connector X01 OUT or X02 OUT.



Requirements

- The outgoing module and connection module are mounted on the rack.

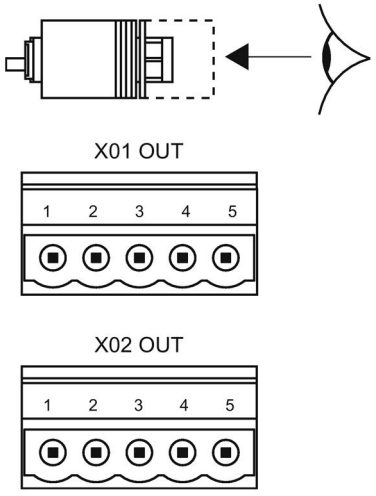
Required tools

Screwdriver and stripping tool for wiring the push-pull cable connector, if you assemble your own cables.

Required accessories

- Preassembled cable with push-pull cable connector. The cables are available in different lengths.
- If you assemble your own cables: 5-wire cable and push-pull cable connector for 1L+/2L+

Pin assignment of the push-pull cable connector

View of the push-pull cable connector	Terminal	Assignment X01 OUT/X02 OUT
	**Electronic/encoder supply and load voltage supply X01 OUT**	
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth
	Electronic/encoder supply and load voltage supply X02 OUT	
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth

Connecting the PP cable connector

1. Insert the CM PM-O PP connection module into the PM-O DC 2x24V outgoing module.
2. Press the push-pull cable connector into the associated sockets on the CM PM-O PP connection module. The connectors must engage. Ensure that the locking mechanism between the connector and socket is properly applied.

Note

The CM PM-O PP connection module can only be mounted on the PM-O outgoing module.

Closing the unused socket

Always cover any unused push-pull sockets with caps in order to achieve degree of protection IP65.

See also

PM-O DC 2x24V outgoing module (Page 328)

Configuring

5

5.1 PROFIBUS DP

5.1.1 Configuring in STEP 7

Introduction

The ET 200pro is listed in the hardware catalog of HW Config after you start STEP 7.

Requirements

- STEP 7 Version 5.3 + SP3 or higher
- STEP 7, Version 5.3 + SP2 or higher and current HSP

Proceed as follows

1. Start SIMATIC Manager.
2. Create a new project.
3. Configure ET 200pro in HW Config.
4. Drag-and-drop the modules from the hardware catalog to the configuration table.
5. Double-click the first module of ET 200pro in the configuration table and set its parameters.
6. Parameterize all other modules of ET 200pro.
7. Save the configuration, or download it to the DP master.

Reference

For further information, refer to the STEP 7 Online Help.

See also

Commissioning ET 200pro (Page 149)

5.1.2 Configuring by Means of GSD File

Introduction

The GSD file allows you to configure ET 200pro using a different software. For this purpose, the GSD file must be installed in the configuration software beforehand.

Requirements

You require a GSD file, available for download from the Internet at:

GSD file (http://support.automation.siemens.com)

- Interface module IM 154-1 DP:
  - GSD file SI018118.GSG for 6ES7154-1AA01-0AB0
  - GSD file SIEM8118.GSG for 6ES7154-1AA00-0AB0
- Interface module IM 154-2 DP High Feature:
  - GSD file SI018119.GSG for 6ES7154-2AA01-0AB0
  - GSD file SIEM8119.GSG for 6ES7154-2AA00-0AB0

Configuring ET 200pro on PROFIBUS DP in STEP 7

1. Start STEP 7, then select **Options > Install New GSD File** in HW Config.
2. Select the GSD file to install from the next dialog box, then confirm with OK. Result: ET 200pro appears in the PROFIBUS DP folder of the hardware catalog.
3. The further procedure is the same as in Configuring in STEP 7 (Page 137).

See also

Procedure when using the GSD file (Page 140)

Commissioning ET 200pro (Page 149)

5.1.3 Grouping electronic modules in the configuration

5.1.3.1 Grouping Modules in Configuration Data (PROFIBUS DP)

Introduction

To better utilize the available address range of the DP master and reduce data exchange between the ET 200pro and the DP master, you can group two digital output modules within one byte in the output area of the process image. Arrange the electronic modules systematically, and label these accordingly.

Requirements

- ET 200pro has a maximum address space of 244 bytes for inputs, and 244 bytes for outputs.
- Grouping of digital output modules
- Other modules may be connected between the modules that can be grouped.
- In the case of CPUs that support swapping interrupts, the swapping interrupt has to be deactivated in HW Config in order to group modules.

Rules

- The modules that you can group within a byte are of the same module type (see above).
- Any other module types may be inserted between the modules that can be grouped.
- There may be no more than 8 channels (1 byte) in total.

5.1.3.2 Procedure in STEP 7

Procedure in STEP 7 V5.3 Service Pack 3 or higher

1. Configure ET 200pro in the configuration table of HW Config.
2. Select two modules to group within a byte.
3. Activate the "Compress addresses" button in the configuration table.

Note

The system does not generate swapping interrupts (OB 83) for modules grouped in STEP 7 applications.

In this case, you can identify a removed module by evaluating the module status returned in the diagnostic frame in the cyclic user program.

See also

Configuring in STEP 7 (Page 137)

5.1.3.3 Procedure when using the GSD file

Procedure when using the GSD file

1. Link the GSD file in your configuration software.

   You can identify the modules which support grouping by a second entry in the hardware catalog of your configuration software. Those modules merely differ by a "*" character in their name.

2. Configure the ET 200pro installation and observe requirements and rules.
3. From the hardware catalog of your configuration software, select the module name **without "*"**.

   This inserts the first module at the relevant slot.

4. From the hardware catalog of your configuration software, select the module name **with "*"**.

   This inserts the second module at the relevant slot.

5. Repeat steps 3 and 4 for all other modules.

Note

Configuring using the GSD file

The configuration software does not verify the proper grouping of modules.
The diagnostics function outputs an error message to indicate faulty configuration of modules which violate the byte limits if your configuration contains more than 8 channels per byte:

Module status → 10_B: wrong module, invalid user data

Those modules will not be addressed.

Principle of operation

The figure below highlights the principles of grouping.

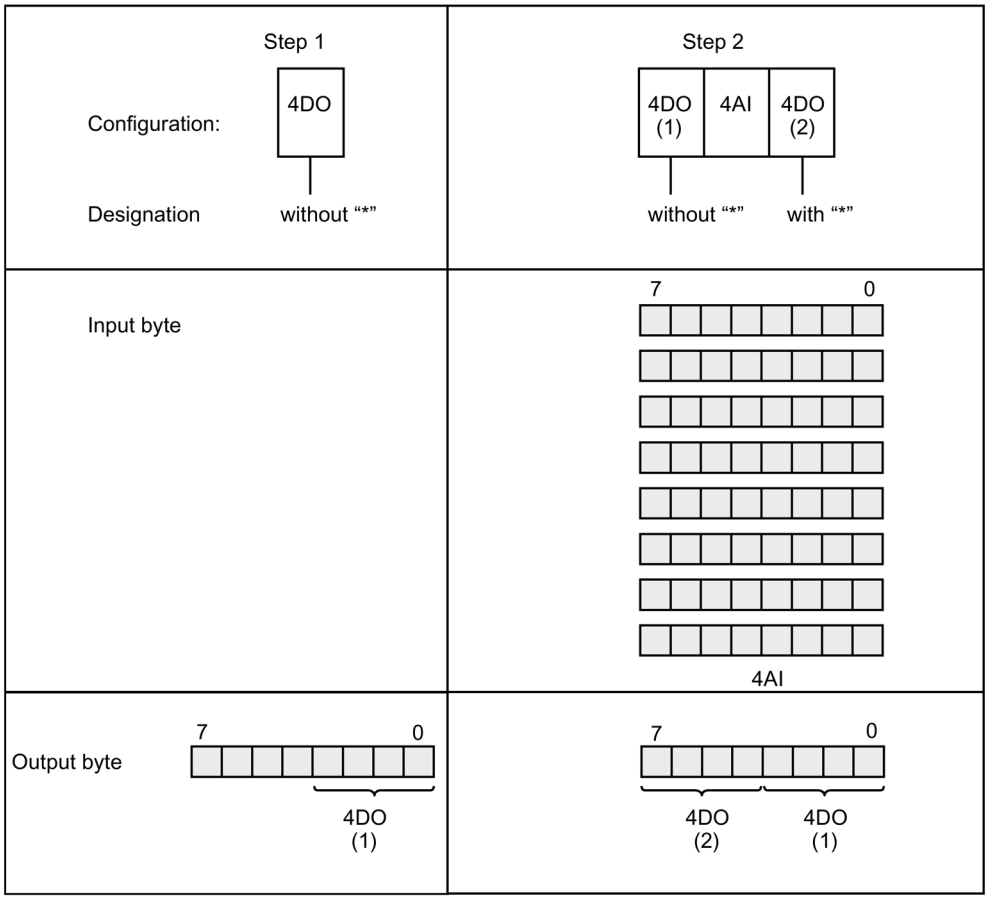


Figure 5-1 Grouping of digital output modules

No grouping of electronic modules

If you choose not to group digital output modules in a single byte when you configure the ET 200pro distributed I/O system, select only the module names which do not contain the "*" character from the hardware catalog of your configuration software.

Each electronic module will then occupy 1 byte in the process output image.

See also

Configuring by Means of GSD File (Page 138)

Example of a configuration (Page 142)

5.1.3.4 Example of a configuration

Introduction

The example below explains how to configure an ET 200pro configuration using the GSD file, and how to group digital output modules in a single byte.

ET 200pro configuration

The diagram below shows a practical example of an ET 200pro configuration using slots 2 to 7:

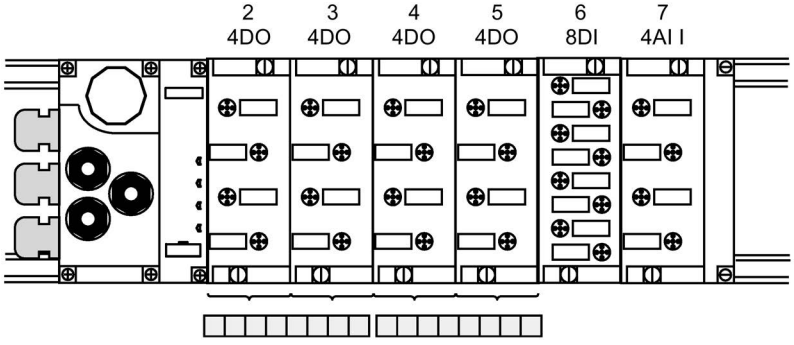


Figure 5-2 Example: Configuring an ET 200pro configuration

Configuration table and address range

The user is free to select the byte addresses of the inputs and outputs, if the configuration software supports this. The bit addresses result automatically from the sequence of the grouped modules.

The table below shows which modules have been grouped and the corresponding address range.

Slot	Module	Grouping	I/O address	
			Inputs	Outputs
2	6ES7142-4BD00-0AA0 4DO DC24V	Yes		0.0 to 0.3
3	6ES7142-4BD00-0AA0* 4DO DC24V			0.4 to 0.7
4	6ES7142-4BD00-0AA0 4DO DC24V	Yes		1.0 to 1.3
5	6ES7142-4BD00-0AA0* 4DO DC24V			1.4 to 1.7
6	6ES7141-4BF00-0AA0 8DI	No	0.0 to 0.7	
7	6ES7144-4GF00-0AB0 4AI I	No	1.0 to 8.7	

See also

Configuring by Means of GSD File (Page 138)

Procedure when using the GSD file (Page 140)

5.2 PROFINET IO

5.2.1 Configuring in STEP 7

Introduction

The ET 200pro is listed in the hardware catalog of HW Config after you start STEP 7.

Requirements

IM 154-4 PN High Feature interface module: 6ES7154-4AB10-0AB0

- STEP 7 V5.4 + SP2 + HSP or higher
- Assignment of a name to the IO device See Section Assigning device names to the I/O device (Page 145)

Procedure

1. Start SIMATIC Manager.
2. Create a new project.
3. Configure ET 200pro in HW Config.
4. Drag-and-drop the modules from the hardware catalog to the configuration table.
5. Double-click the first module of ET 200pro in the configuration table and set its parameters.
6. Parameterize all other modules of ET 200pro.
7. Save the configuration, or download it to the IO controller.

Reference

For additional information, refer to the STEP 7 Online Help.

See also

Assigning device names to the I/O device (Page 145)

Commissioning ET 200pro (Page 151)

5.2.2 Configuring by Means of GSD File

Introduction

The GSD file allows you to configure ET 200pro in STEP 7 V5.3 SP 2 or higher. For this purpose, the GSD file must be installed in the configuration software beforehand.

Requirements

You require a GSD file, available for download from the Internet at:

GSD file (http://support.automation.siemens.com)

IM 154-4 PN High Feature interface module:
GSDML-V2.2-siemens-et200pro-"date in yyyymmdd format".xml

Configuring ET 200pro on PROFINET IO in STEP 7

1. Start STEP 7, then select **Options > Install New GSD File** in HW Config.
2. Select the GSDML file to install from the next dialog box, then confirm with OK. Result: ET 200pro appears in the PROFINET IO folder of the hardware catalog.
3. The further procedure is the same as in Configuring in STEP 7 (Page 143).

See also

Commissioning ET 200pro (Page 151)

5.2.3 Assigning device names to the I/O device

Introduction

All PROFINET IO devices are assigned a unique device ID by the manufacturer, namely the MAC address.

Each ET 200pro IO device is addressed by its device name in the configuration and user program.

For detailed information on addressing in PROFINET IO, refer to the PROFINET system description (http://support.automation.siemens.com/WW/view/en/19292127).

Requirements

- There must be an online PROFINET connection between the PG and IO device to let you assign a device name to the interface module.
- The IO device is configured in HW Config and assigned an IP address.

Assigning device names

1. Switch on the supply voltages on the IM 154-4 PN High Feature.
2. In HW Config, open the "Properties - IM 154-4 PN High Feature" dialog box, enter the device name of the IO device, and then confirm your entry with "OK".
   Do not use the device name "noname".
3. In HW Config, select "PLC > Ethernet > Assign Device Name".
4. Click "Assign Name" in the "Assign Device Name" window.

Result

IM 154-4 PN High Feature (6ES7154-4AB10-0AB0): The device name is stored permanently in the interface module.

Node flash test

When using more than one IO device, the system shows all of those in the "Assign device name" dialog box. In this case, compare the MAC address of the device with the indicated MAC address, then select the relevant IO device.

The identification of an IO device within the system is facilitated by the node flash test. To activate the flash test:

1. Select one of the indicated IO devices from the "Assign device name" dialog box.
2. Select the flash period you want to use.
3. Press the "Flash on" button.

The LINK LED of the selected IO device flashes. If PROFINET IO is looped, both LINK LEDs will flash.

5.2.4 Grouping modules during configuration (PROFINET IO)

Introduction

You can group two digital output modules within a single byte in the process output image to improve utilization of the available address range of the IO controller. Arrange the electronic modules systematically, and label these accordingly.

IM 154-4 PN High Feature has a maximum address space of 256 byte for inputs and 256 byte for outputs.

Asymmetry caused by swapping interrupts of digital output modules

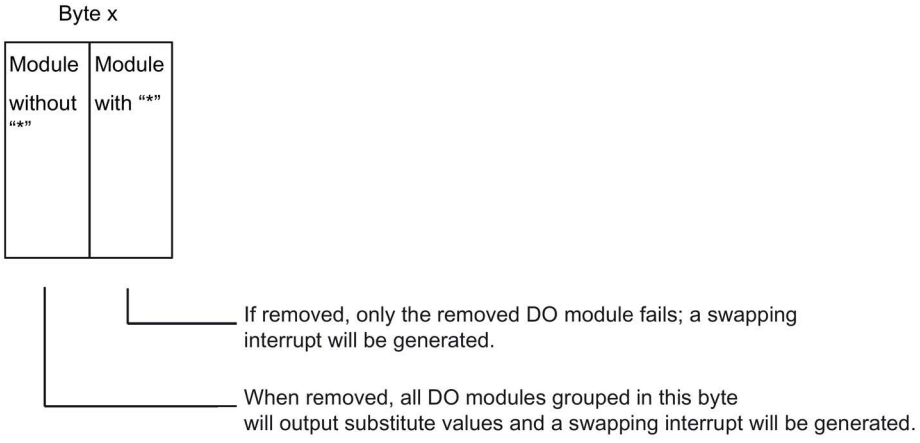


Figure 5-3 Asymmetry caused by swapping interrupts of digital output modules

Procedure

The grouping procedure is identical to the procedure for PROFIBUS DP.

See also

Grouping Modules in Configuration Data (PROFIBUS DP) (Page 139)

5.2.5 Configuring port 1 and port 2

Introduction

The IM154-4 PN High Feature interface module can diagnose two ports: X02 P1 and X02 P2.

Requirements

- The ports must be configured in HW Config.
- The port diagnostics must be released.

Configuring the ports in HW Config

Configure both ports in HW Config in the "Properties of the IM154-4 PN High Feature port..." dialog:

- Addresses tab: Diagnostic address of the respective port.
- Topology tab:

  Select the fiber-optic cables in "Port Interconnection" under "Cable Designation": POF Standard Cable GP or POF Trailing Cable.
- Options tab:

  To enable the port diagnostics, select the following for "Connection" under "Transmission Medium/Duplex": "Automatic Settings (monitor)".

Reference

See *STEP 7* online help.

Commissioning 6

6.1 PROFIBUS DP

6.1.1 Commissioning ET 200pro

Introduction

You commission the automation system according to the relevant plant configuration. The procedure outlined below only describes the commissioning of ET 200pro on a DP master.

Requirements

Table 6- 1 Commissioning requirements

Actions	Reference
ET 200pro is mounted	Section Mounting (Page 43)
The PROFIBUS DP address is set on ET 200pro	Section Mounting (Page 43)
ET 200pro is wired	Section Connection (Page 65)
ET 200pro is configured	Section Configuring (Page 137)
The supply voltage for the DP master is switched on.	Manual on the DP master
DP master switched to RUN operating state	Manual on the DP master

Commissioning ET 200pro

1. Switch on the electronic/encoder supply 1L+ for ET 200pro.
2. Switch on the load voltage supply/supplies 2L+.

Note

Changes to the backplane bus

Always switch off/on power to the electronic/encoder supply 1L+ before you modify the backplane bus configuration (number of modules, PROFIBUS address, removal of the terminating module).

See also

Configuring in STEP 7 (Page 137)

Configuring by Means of GSD File (Page 138)

6.1.2 Startup of ET 200pro

Principle of operation

The diagram below illustrates the startup routine of ET 200pro

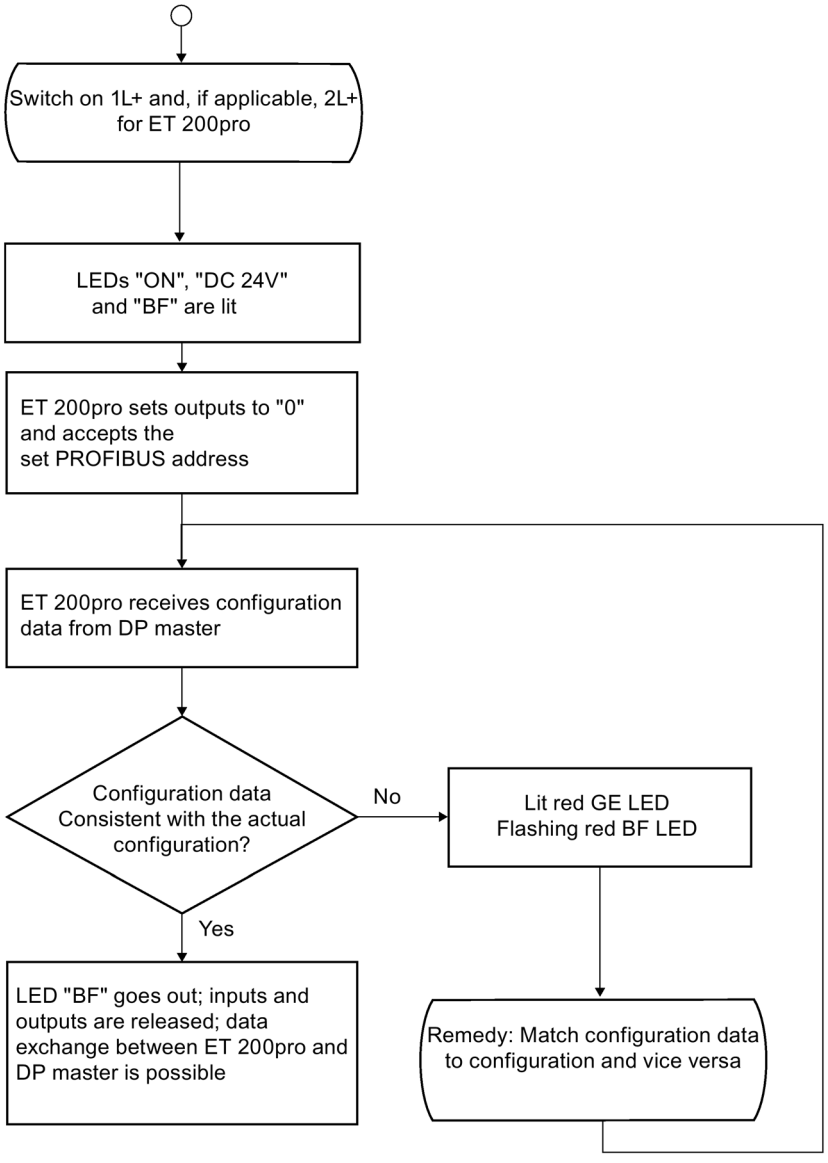


Figure 6-1 Startup of ET 200pro on PROFIBUS DP

6.2 PROFINET IO

6.2.1 Commissioning ET 200pro

Introduction

You commission the automation system according to the relevant plant configuration. The section below describes the procedure of commissioning the ET 200pro connected to an IO controller.

Requirements of ET 200pro on PROFINET IO

Actions	Reference
ET 200pro is mounted	Chapter *Mounting*
ET 200pro is wired	Chapter *Wiring*
The SIMATIC Micro Memory Card is inserted	Chapter *Service and maintenance*
Assigning device names to the I/O device	Chapter *Configuring*
ET 200pro is configured	Chapter *Configuring*
Supply voltage to the I/O controller is switched on	I/O controller manual
I/O controller is in RUN	I/O controller manual

Commissioning ET 200pro

1. Switch on the electronic / encoder supply 1L+ for ET 200pro.
2. Switch on the load voltage supply/ies 2L+.

Note

Changes to the backplane bus

Always switch off/on power to the electronic / encoder supply 1L+ before you modify the backplane bus configuration (number of modules, removal of the terminating module).

See also

Mounting the Interface Module (Page 53)

Configuring by Means of GSD File (Page 144)

Configuring in STEP 7 (Page 143)

6.2.2 Startup of ET 200pro

Principle of operation

The diagram below shows the startup sequence of ET 200pro on PROFINET IO.

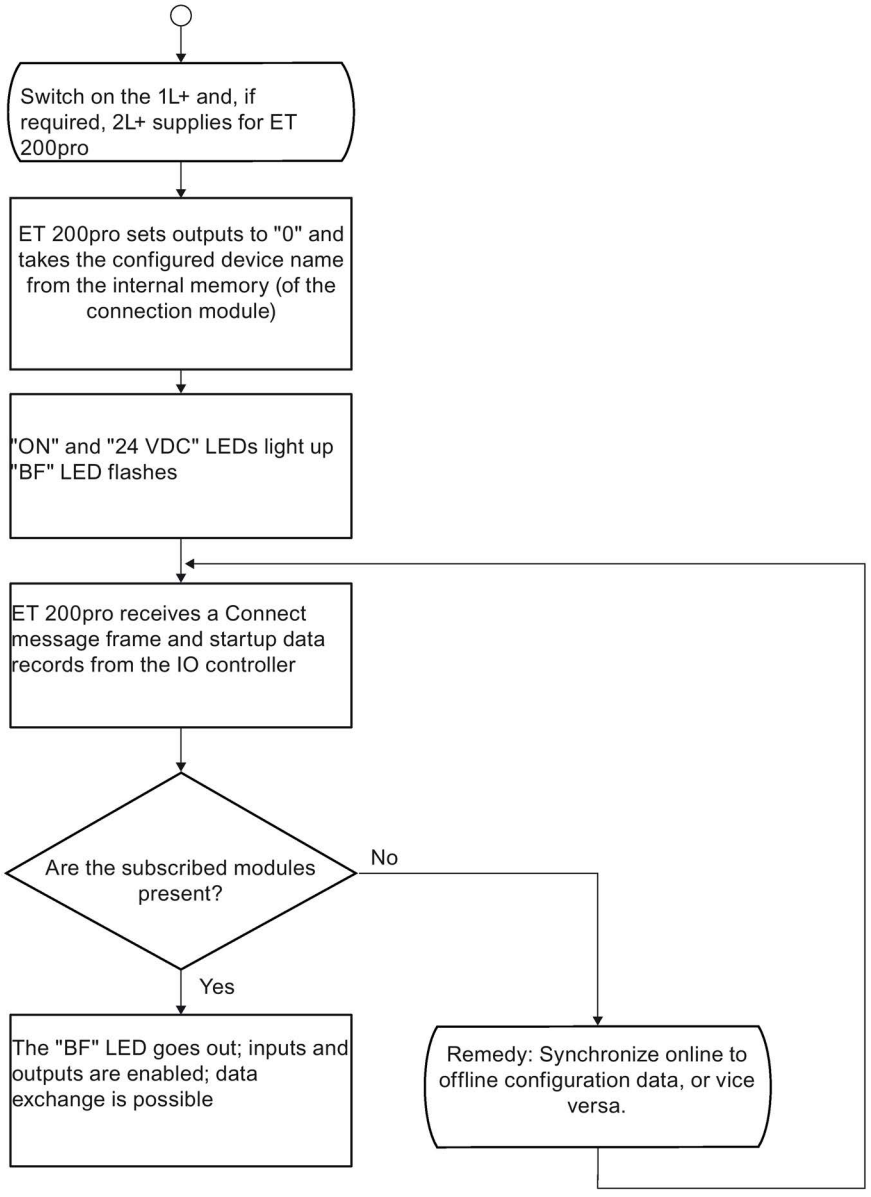


Figure 6-2 Startup of ET 200pro on PROFINET IO

Maintenance and service

7

7.1 Degree of protection IP65, IP66 and IP67

Ensuring the degree of protection IP65, IP66, IP67

⚠ CAUTION

Degree of protection IP65, IP66 and IP67 is not ensured if one of the ET 200pro components listed below is removed, or is not secured by screws as specified:

- Connection module for the interface module or electronic module
- FESTO valve terminal
- Terminating module
- Interface module or electronic module
- Pneumatic interface module
- ECOFAST cable connectors, 7/8" cable connectors, M12 connectors
- Screwed cable glands on connection module CM IM DP Direct
- Caps

Degree of protection IP65, IP66 and IP67 may also be impaired due to damage of the sheath of any cable connected to ET 200pro.

7.2 Removing and Inserting Connection Modules

Introduction

You can hot-swap the connection modules for the interface/power/electronic modules.

CAUTION
In order to prevent damage to your ET 200pro, always deactivate the outputs before you remove any connection modules.

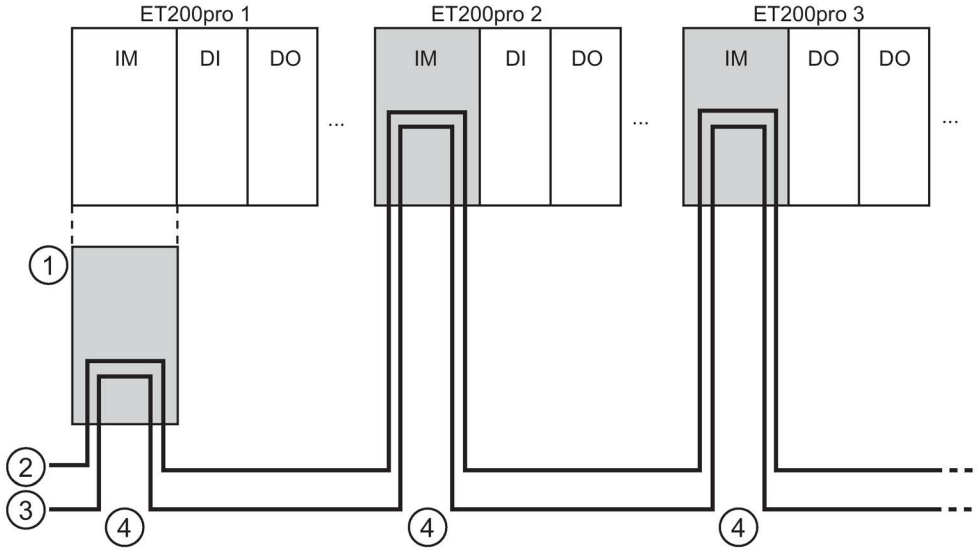
Required tools

Cross-tip screwdriver, size 2

Operating principle: Removing the connection module from an interface module operated on PROFIBUS DP

Result:

- ET 200pro 1 fails.
- ET 200pro 2 and ET 200pro 3 remain in operation.

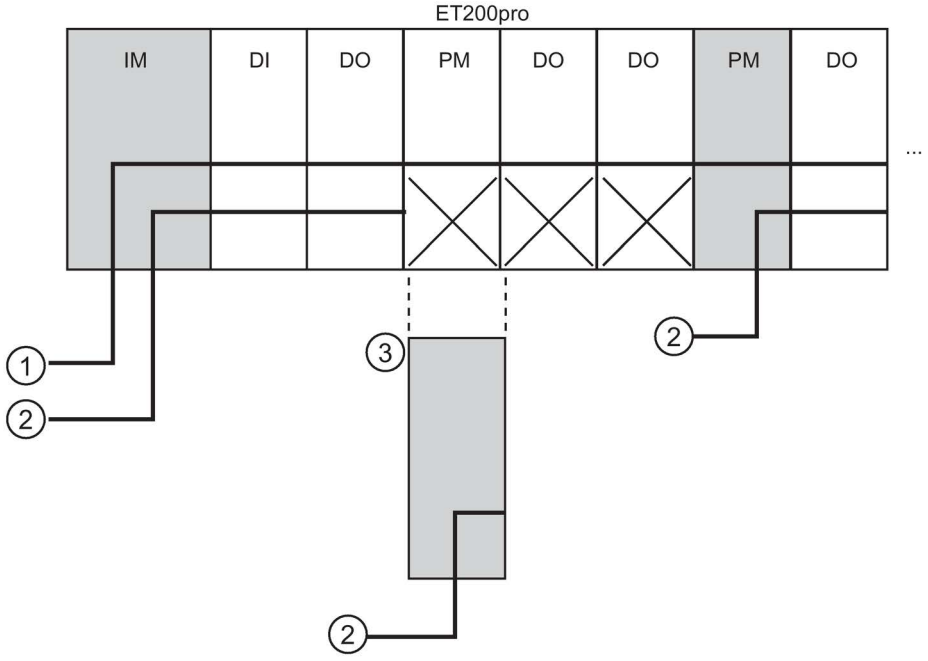


① The connection module is removed from the interface module.
② PROFIBUS DP
③ Suppl voltages 1L+, 2L+
④ PROFIBUS DP and the supply voltages are fed in and looped through.

Operating principle: Removing the connection module from the power module

Result:

- The potential group of the power module fails; the downstream load voltage supplies (2L+) are maintained.
- ET 200pro remains in operation.



① 1L+ electronic/encoder supply
② 2L+ load voltage supply
③ The connection module is removed from the power module.

Removing and inserting the connection module from the interface or power module

1. Remove the four or two screws from the front of the connection module using a crosstip screwdriver.
2. Remove the connection module from the interface or power module.
3. Carry out further maintenance work.
4. Reinstall the connection module on the interface or power module.

Removing and inserting the connection module from the electronic module

Note

The removal of the connection module includes the removal of the electronic module from the bus module.

See also

Removing and Inserting Electronic Modules (Page 156)

7.3 Removing and Inserting Electronic Modules

Introduction

The ET 200pro distributed I/O system supports removal and insertion of one electronic module during operation (one gap).

ET 200pro remains in RUN state when the electronic module is removed.

The ET 200pro station fails if you remove more than one electronic module.

Requirements

- Hot-swapping of electronic modules (in RUN state) is only supported if the "Operation in setpoint<> actual configuration" parameter is enabled at the interface module.
- Only **one** electronic module may be removed at any given time.

Required tools

- Cross-tip screwdriver, size 2
- Pointed pliers

Replacing a (defective) electronic module

1. Remove the two screws from the front, right side top and bottom, of the connection module using a crosstip screwdriver.
2. Remove the connection module alongside with the electronic module from the bus module.
3. While pressing the interlock button on the top of the electronic module, pull the connection module upwards and out of the electronic module.
4. Remove one half of the coding key from the new electronic module (top left).
5. Insert the connection module into the electronic module (same type).
6. Insert the connection module with the electronic module into the bus module and screw it down.

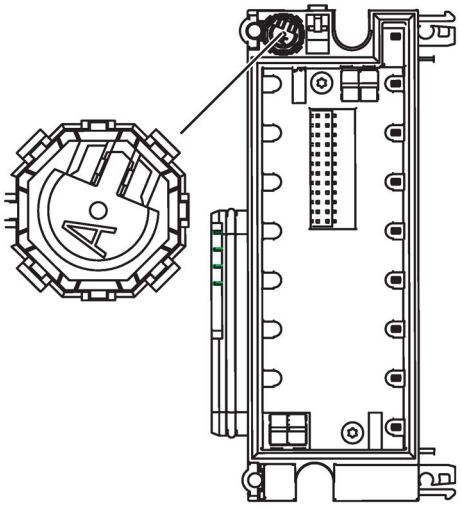


Figure 7-1 Removing the coding key

Electronic module type change

1. Remove the two screws from the front, right side top and bottom, of the connection module using a crosstip screwdriver.
2. Remove the connection module alongside with the electronic module from the bus module.
3. While pressing the interlock button on the top of the electronic module, pull the connection module upwards and out of the electronic module.
4. Use the pointed pliers to remove one half of the coding key from the connection module (top right).
5. Insert the (suitable) connection module into the electronic module (other type).
6. Insert the connection module with the electronic module into the bus module and screw it down.
7. Change the configuration with HW Config and download it to the DP master.

⚠ DANGER

If you change the coding, this can result in dangerous plant conditions.

See also

Removing and Inserting Connection Modules (Page 154)

7.4 Replacing an Interface / Power Module

Introduction

You can replace a defective interface/power module.

Requirements

- To replace the interface / power module, shut down the supply voltages 1L+ and 2L+ of the defective module.
- The removal of the connection module of the interface module leads to the failure of ET 200pro.
- The removal of the connection module of the power module leads to the failure of the corresponding potential group.

Note

PROFIBUS DP: Removing the connection module of the interface module (CM IM)

The bus terminator function may fail if you shut down 1L+ at the first and last ET 200pro of a bus segment or remove the connection module.

NOTICE
PROFINET IO: Removing the IM 154-4 PN interface module or connection module
After you shut down the 1L+ voltage of an ET 200pro, the integrated switch will also cause a failure of all downstream ET 200pro stations.

Required tools

- Cross-tip screwdriver, size 2
- Screwdriver with 3 mm blade

Replacing the interface / power module

1. Remove the four or two screws from the front of the connection module using a crosstip screwdriver.
2. Remove the connection module from the interface or power module.
3. Unscrew the two screws on the front panel of the interface / power module (top and bottom right).
4. Remove the interface / power module from the bus module.
5. Reinstall the new interface / power module and the connection module.
6. Switch on the relevant power supplies.

7.5 Replacing a bus module

Introduction

The bus module represents the mechanical and electrical link in the modular configuration of ET 200pro. You may replace a defective bus module. The electronic module/ pneumatic interface module is supplied installed on the bus module.

Requirements

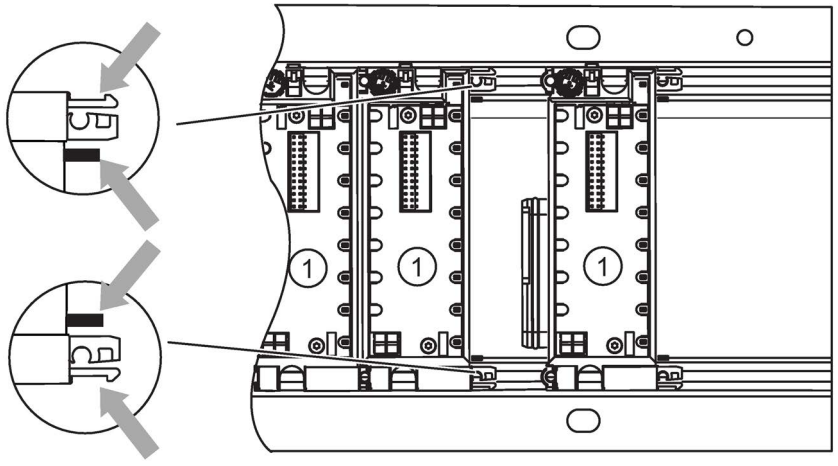
- A bus module may only be disassembled when:
  - the electronics/encoder supply 1L+ and the load voltage(s) 2L+ of ET 200pro are shut down, or
  - the connection module of the interface module has been removed.
- The ET 200pro will be out of operation for the duration of this replacement.

Required tools

Cross-tip screwdriver, size 2

Replacing a bus module

1. Starting on the right side of the assembly, remove all connection modules with the electronic modules and FESTO valve terminals, including those of the slot which holds the defective bus module.
2. Remove the terminating module.
3. Open the interlock on the top and on the bottom of the bus module (see the figure below). Strip the bus module from the previous module, working towards the right side, and then swivel it off the rack.
4. Repeat step 3 until you have removed the defective bus module.
5. Mount the new bus module and all other bus modules of your original ET 200pro configuration.
6. Mount the terminating module.
7. Mount all electronic modules including their connection modules/pneumatic interface modules and FESTO valve terminals on the bus modules.
8. Switch on the voltage supplies 1L+ and 2L+ at the ET 200pro, or mount the connection module on the interface module.



① Bus modules

Figure 7-2 Replacing a bus module

7.6 Replacing a Fuse in the Interface / Power Module

Introduction

Replaceable fuses for protecting the ET 200pro:

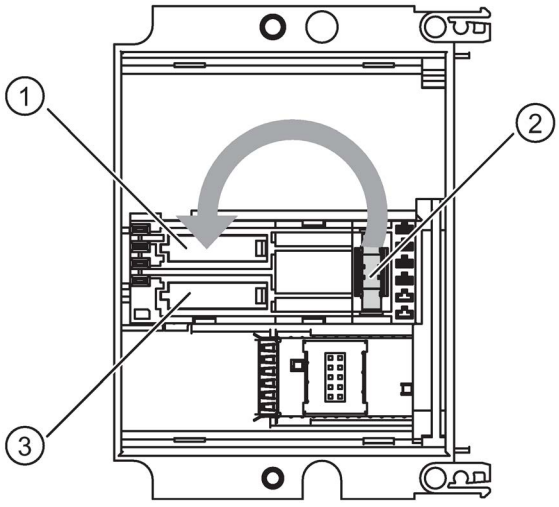
- Interface module:

  The bus module of the interface module is equipped with fuses for the electronic/encoder supply 1L+ and load voltage supply 2L+ (glass tube fuse; 5x20; type 194; 12.5 A; fast-blow), and a replacement fuse.

- Power module:

  The rear panel of the interface module is equipped with a fuse for the load voltage supply 2L+ (glass tube fuse; 5x20; type 194; 12.5 A; fast-blow), and a replacement fuse.

The figure below shows the fuses in the bus module of the interface module.



① Fuses (with cap) for the load voltage supply 2L+
② Spare fuse
③ Fuses (with cap) for the electronic / encoder supply 1L+

Requirements

- To replace a fuse, shut down the 1L+ and 2L+ supply voltages, or remove the connection module from the interface / power module.
  Result: ET 200pro failure, or failure of the potential group of the power module
- Always replace fuses with the same type (the order numbers are available in the Appendix (Page 456)).

Required tools

- Cross-tip screwdriver, size 2
- 3 mm screwdriver

Replacing a fuse of the interface module

1. Remove the screws from the front panel of the connection module using a cross-tip screwdriver.
2. Remove the connection module from the interface module.
3. Loosen the screws on the front panel of the interface module (top and bottom right).
4. Remove the interface module from the bus module.
5. Remove the fuse cap in the bus module and lever the defective fuse out using the screwdriver.
6. Take the replacement fuse from its holder and install it.
7. Close the fuse cover.
8. Install the interface module and the connection modul.
9. Switch on the power supplies.

Replacing a fuse of the power module

1. Remove the screws from the front panel of the connection module using a cross-tip screwdriver.
2. Remove the connection module from the power module.
3. Loosen the screws on the front panel of the power module (top and bottom right) using the cross-tip screwdriver.
4. Remove the power module from the bus module.
5. Open the fuse cover on the rear panel of the power module and lever the defective fuse out using the screwdriver.
6. Take the replacement fuse from its holder and install it.
7. Close the fuse cover.
8. Install the power module and the connection module.
9. Switch on the power supplies.

7.7 Updating the interface module firmware

7.7.1 Introduction

Introduction

After you have implemented (compatible) functional expansions or enhanced performance, you should update the interface module with the latest firmware version.

You can order the latest firmware from your Siemens partner, or download it from the Internet at: Service & Support (http://www.siemens.com/automation/service&support)

Note

If the new firmware causes any problems, you can restore the previous (current) firmware to the interface module. This firmware is also available on the Internet.

Requirements

- Make a note of your current firmware version before you start the update. You can read the version number in HW Config.
- The files (*.UPD) containing the current (new) firmware version must be available in the PG/PC file system.

Procedure

The procedure of the firmware update is determined by the interface module used:

- IM 154-1 DP, IM 154-2 DP High Feature:

  Firmware update with a PG/PC. The firmware is downloaded to the interface module via PROFIBUS DP.

- IM 154-4 PN High Feature (6ES7154-4AB10-0AB0):

  The firmware update is performed online.

7.7.2 Firmware Update of IM 154-1 DP, IM 154-2 DP High Feature

Introduction

The procedure below describes the firmware update of IM 154-1 DP or IM 154-2 DP High Feature interface modules via the PROFIBUS DP interface.

Requirements

- The interface module of the station to be updated must be online.

Procedure

Connect the PG/PC containing the update files via the PROFIBUS DP interface.

For information on procedures, refer to the STEP 7 online help.

Restart after update

On the STEP 7 user interface, you can define

- whether the interface module performs an automatic reset after a successful update to restart with the new firmware
- whether the interface module is to be reset by switching the electronic/encoder supply 1L+ off before the interface module starts with the new firmware after switching 1L+ on again

CAUTION
If the "Update firmware after download" checkbox is set, a brief failure of the ET 200pro station is triggered. If you have not made any provisions for this situation, the update will result in a CPU STOP due to a rack failure.

If the update fails, the interface module will always restart with its current ("old") firmware version after you switch 1L+ off and on.

7.7.3 Updating the firmware online (via networks)

Introduction

To update the firmware of the IM 154-4 PN High Feature (6ES7154-4AB10-0AB0), you require files (*.UPD) containing the latest FW version.

Note

The online update of firmware pertains only to the IM 154-4 PN High Feature interface module. When an online firmware update is performed, other modules in the station assume the configured substitute value behavior or become de-energized.

Requirements

- Online firmware updates can be performed in *STEP 7* V5.4 + SP2 or higher.
- The interface module of the station to be updated must be accessible online.
- The files containing the current firmware versions must be available in the file system of your programming device or PC. A folder may contain only the files of one firmware version.

Performing a firmware update

1. Run *STEP 7* and switch to HW Config.
2. Open the station containing the IM 154-4 PN High Feature you want to update.
3. Select the IM 154-4 PN High Feature.
4. Select the menu command **PLC > Update Firmware**.
5. In the **Update Firmware** dialog, select the path to the firmware update files (*.UPD) using the **Browse** button.
6. After you selected a file, the information in the lower fields of the **Update Firmware** dialog box shows you the suitable module and firmware version for the file.
7. Click the **Run** button. *STEP 7* checks whether the selected file can be interpreted by the IM 154-4 PN High Feature and, if so, downloads the file to the interface module. If this requires changing the operating state of the IM 154-4 PN High Feature, you will be asked to perform these actions in the relevant dialog boxes. The IM 154-4 PN High Feature then automatically updates the firmware.
8. Use *STEP 7* (Read CPU diagnostics buffer) to check whether the IM 154-4 PN High Feature starts up with the new firmware. You can read out the current firmware version in the module status of the IM 154-4 PN High Feature.

Result

You have updated your IM 154-4 PN High Feature online with a new firmware version.

Note

You can also use PROFINET IO to update the firmware, e.g. using HW Config or in SIMATIC Manager via "PLC > Display accessible nodes".

For additional information, refer to the *STEP 7* online help.

Functions

8

8.1 PROFIBUS DP

8.1.1 Direct data exchange

Properties

The ET 200pro can be used as transmitter (publisher) for direct data exchange (slave-to-slave communication).

Requirements

The DP master used must support direct data exchange. For further information, refer to the description of the DP master.

Operating principle

Direct data exchange (slave-to-slave communication) is characterized by PROFIBUS DP nodes that "listen in" on the bus and know which data a DP slave returns to its DP master. This mechanism allows the "listening node" (recipient/subscriber) direct access to deltas of input data of remote DP slaves.

In your STEP 7 configuration, define the address area of the recipient in which the required data of the publisher will be placed, based on the peripheral input addresses.

Example

The diagram below illustrates direct data exchange "relationships" that you can configure with an ET 200pro as publisher and which nodes can "listen in" as potential recipients.

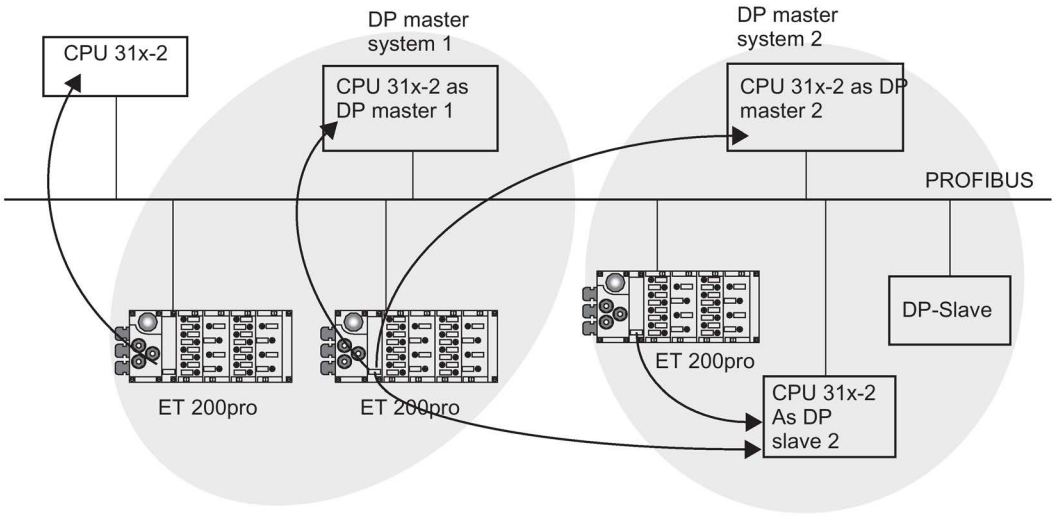


Figure 8-1 Example of data exchange

8.1.2 Identification data for PROFIBUS DP

Definition

Identification data is information stored in a module which assists the user when:

- Checking the system configuration
- Locating hardware changes in a system
- Correcting errors in a system

Identification data enable modules to be uniquely identified online.

STEP 7 displays the identification data in the "Module Information - IM 154" and "Properties" tabs (see STEP 7 online help).

Reading the identification data with DS 255

The IM 154-1 DP/IM 154-2 DP High Feature interface modules (6ES7154-1AA01-0AB0/ 6ES7154-2AA01-0AB0 and higher) also support standardized access to identification data using DS 255 (Index 65000 to 65003). For additional information on the data structure of the DS 255, refer to the specifications in the PROFIBUS Guideline - Order No. 3.502, Version 1.1.1 dated March 2005.

Reading the identification data

Users can directly access specific identification data by selecting **Read data record**. This access requires two operations:

1. Step:

Data record 248 contains a folder which contains the data record numbers associated with the various indexes (see table below).

Table 8- 1 Structure of data record 248 for ET 200pro

Contents	Length (bytes)	Coding (hex)
Header information		
TOC ID	2	00 01
TOC index	2	00 00
Length of succeeding blocks in bytes	2	00 08
Number of blocks	2	00 05
Block information for identification data		
SSL Associated data record number Length of data record Index	2 2 2 2	F1 11 00 E7 00 40 00 01
SSL Associated data record number Length of data record Index	2 2 2 2	F1 11 00 E8 00 40 00 02
SSL Associated data record number Length of data record Index	2 2 2 2	F1 11 00 E9 00 40 00 03
SSL Associated data record number Length of data record Index	2 2 2 2	F1 11 00 EA 00 40 00 04
8 bytes of block information for additional data record objects		
	Σ: 48	

2. Step:

The relevant index assigned to a particular section of the ID data is found in the associated data record number (see the ID data table below).

- All data records with identification data have a length of 64 bytes.
- The data record structure is based on the principle shown in the table below.

Table 8- 2 Basic structure of data records which contain ID data

Contents	Length (bytes)	Coding (hex)
Header information		
SSL	2	F1 11
Index	2	00 0x
Length of identification data	2	00 38
Number of blocks which contain ID data	2	00 01
Identification data		
Index	2	00 0x
Identification data associated with the relevant index (see table below)	54	

The ID data is assigned to the indexes as shown in the table below.

The data structure of data records 231 to 234 is compliant with the PROFIBUS Guideline - Order No. 3.502, Version 1.1, dated May 2003.

Identification data

Table 8- 3 Identification data

Identification data	Access	Default	Description
Identification data 0: Index 1 (data record 231)			
MANUFACTURERORID	Read (2 byte)	2A hex (=42 dec)	The name of the manufacturer is stored here. (42 dec = SIEMENS AG)
ORDER_ID	Read (20 byte)	depends on the module	Order number of the module
SERIAL_NUMBER	Read (16 byte)	depends on the module	Electronic rating plate
HARDWARE_REVISION	Read (2 byte)	depends on the module	Electronic rating plate
SOFTWARE_REVISION	Read (4 bytes)	Firmware	Indicates the firmware version of the module.
REVISIONS_COUNTER	Read (2 byte)	-	Provides information on parameter modifications on the module.
PROFILE_ID	Read (2 byte)	F600 hex	Generic device on interface modules
PROFILE_SPECIFIC_ TYPE	Read (2 byte)	0005 hex	on interface modules
IM_VERSION	Read (2 byte)	0101 hex	Provides information on the ID data version (0101 hex = version 1.1)
IM_SUPPORTED	Read (2 byte)	000E hex	Provides information on existing identification data (index 2 to 4)
Maintenance1: Index 2 (data record 232)			
TAG_FUNCTION	Read/write (32 byte)	-	Enter a identifier here that is unique plant-wide.
TAG_LOCATION	Read/write (22 byte)	-	Define the installation location of the module.
Maintenance2: Index 3 (data record 233)			
INSTALLATION_DATE	Read/write (16 byte)	-	Enter the installation date of the module here.
RESERVED	Read/write (38 byte)	-	Reserved
Maintenance3: Index 4 (data record 234)			
DESCRIPTOR	Read/write (54 byte)	-	Enter a comment describing the module.

8.2 PROFINET IO

8.2.1 Identification data for PROFINET IO

Definition

Identification data is information stored in a module which assists the user when:

- Checking the system configuration
- Locating hardware changes in a system
- Correcting errors in a system

Identification data enable modules to be uniquely identified online.

STEP 7 displays the identification data in the "Module Information - IM 154" and "Properties..." tabs (see STEP 7 online help).

Reading the identification data

You can directly access specific identification data by selecting **Read data record**. Obtain the corresponding part of the identification data under the associated data record index.

The data records are structured as follows:

Table 8- 4 Basic structure of data records with identification data for PROFINET IO

Contents	Length (bytes)	Coding (hex)
Header information		
BlockType	2	I&M0: 0020 I&M1: 0021 I&M2: 0022 I&M3: 0023
BlockLength	2	I&M0: 0038 I&M1: 0038 I&M2: 0012 I&M3: 0038
BlockVersionHigh	1	01
BlockVersionLow	1	00
Identification data		
Identification data (see table below)	I&M0/Index AFF0 hex: 54 I&M1/Index AFF1 hex: 54 I&M2/Index AFF2 hex: 16 I&M3/Index AFF3 hex: 54	

The data structures in the data records correspond to the PROFINET IO definitions.

Table 8- 5 Identification data for PROFINET IO

Identification data	Access	Default	Description
Identification data 0: (data record index AFF0 hex)			
VendorIDHigh	Read (1 byte)	00 hex	The name of the manufacturer is stored here. (42 dec = SIEMENS AG)
VendorIDLow	Read (1 byte)	2A hex	
Order_ID	Read (20 byte)		Order number of the module
IM_SERIAL_NUMBER	Read (16 byte)	-	Serial number (device-specific)
IM_HARDWARE_REVISION	Read (2 byte)	1	According to hardware version
IM_SOFTWARE_REVISION	read	Firmware version	Indicates the firmware version of the module.
• SWRevisionPrefix	(1 byte)	V, R, P, U, T	
• IM_SWRevision_Functional_ Enhancement	(1 byte)	00 - FF hex	
• IM_SWRevision_Bug_Fix	(1 byte)	00 - FF hex	
• IM_SWRevision_Internal_ Change	(1 byte)	00 - FF hex	
IM_REVISION_COUNTER	Read (2 byte)	-	Provides information on parameter modifications on the module.
IM_PROFILE_ID	Read (2 byte)	0000	Generic device
IM_PROFILE_SPECIFIC_TYPE	Read (2 byte)	0005 hex	on interface modules
IM_VERSION	read	0101 hex	Provides information on the identification data version (0101 hex = version 1.1)
• IM_Version_Major	(1 byte)		
• IM_Version_Minor	(1 byte)		
IM_SUPPORTED	Read (2 byte)	000E hex	Provides information on existing identification data (I&M1 to I&M3)
Maintenance data 1: (data record index AFF1 hex)			
IM_TAG_FUNCTION	Read/write (32 byte)	-	Enter a identifier here that is unique plant-wide.
IM_TAG_LOCATION	Read/write (22 byte)	-	Define the installation location of the module.
Maintenance data 2: (data record index AFF2 hex)			
IM_DATE	Read/write (16 byte)	YYYY-MM-DD HH:MM	Enter the installation date of the module here.
Maintenance data 3: (data record index AFF3 hex)			
IM_DESCRIPTOR	Read/write (54 byte)	-	Enter a comment describing the module.

8.3 Configuration control (option handling)

Introduction

With configuration control (option handling), you operate different configuration levels of an application (e.g. standard machine) with a single project without changing the configuration or the user program.

For ET 200pro distributed I/O systems, configuration control is possible with PROFINET interface modules as well as PROFIBUS interface modules.

Operating principle of configuration control

- The station master (maximum configuration) is configured in the project. The station master includes all modules required for all possible components of a modular application (e.g. standard machine).
- The user program of the project includes different station options for different configuration levels of the application as well as the selection of a station option. For example, a station option uses only some of the modules of the station master and these modules are inserted in a modified order.
- The user selects the required station option according to the configuration level of the modular application. Users do not have to change the project or download a modified configuration.

Configuration control enables you to vary the distributed configuration in a flexible manner. A requirement is that the station option can be derived from the station master. Configuration control does not impact I/O addresses, diagnostic addresses or the parameter assignment of the modules.

The figure below shows three configuration levels of an application as an example with the associated station options of the ET 200pro distributed I/O system.

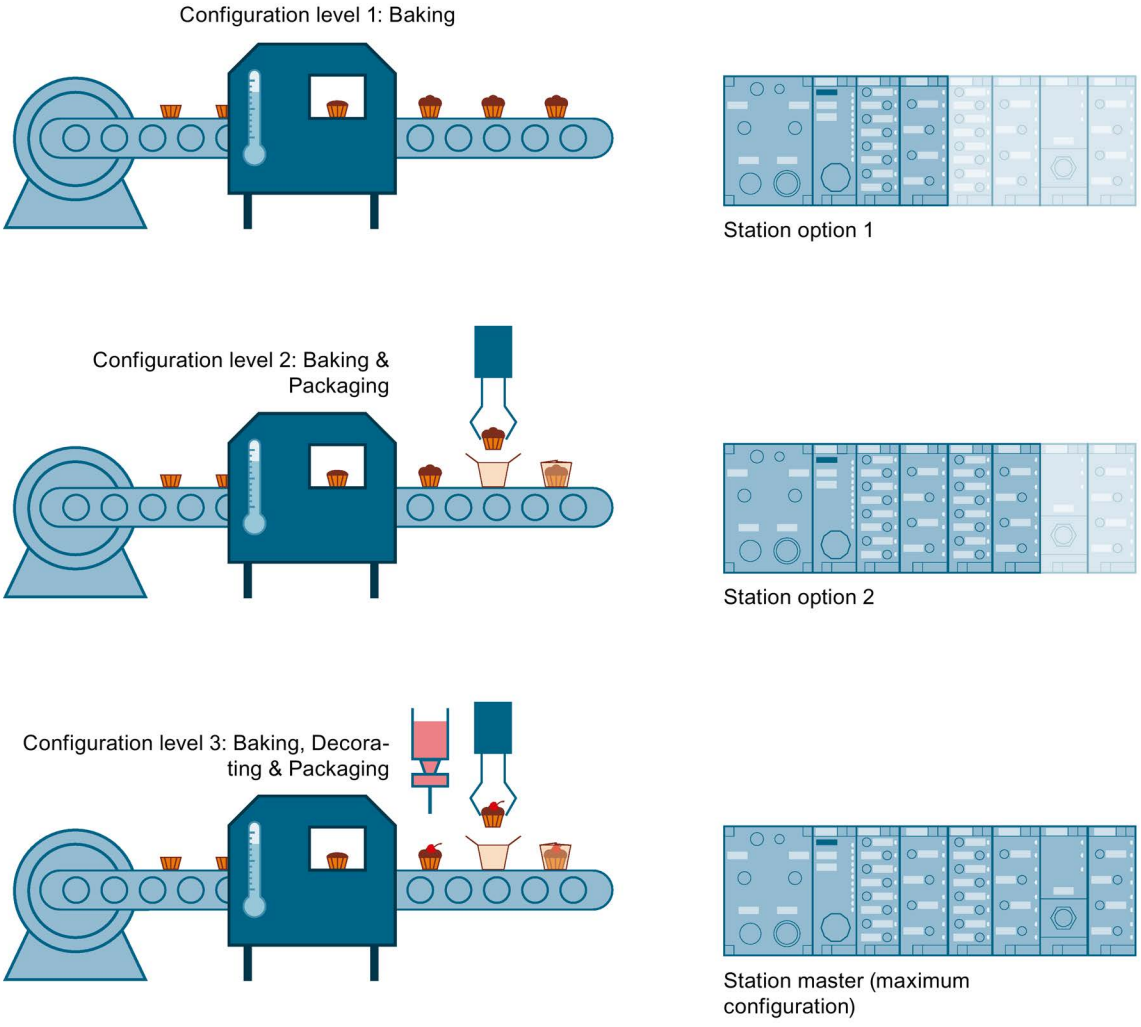


Figure 8-2 Different configuration levels of an application with the associated station options of the ET 200pro distributed I/O system

Advantages

- Easy project execution and commissioning by using a single STEP 7 project for all station options.
- Easy handling during maintenance, versioning and upgrades:
  - The documentation and user program exist only once regardless of the number of machine versions, which greatly reduces the maintenance required for both.
  - Options can be easily retrofitted without reconfiguration. The retrofitted modules can also be placed at the end of the station, regardless of the configured slot.
- Savings on hardware: Only those I/O modules required for the current station option of the machine are installed.
- Potential for savings in the creation, commissioning and documentation of standard machines

"OH_S71x00_Library" block library

The block library OH_S71x00_Library (https://support.industry.siemens.com/cs/#document/29430270?lc=en-WW) is available for download on the Internet. The block library includes data types with the structure of the control data records for the ET 200pro distributed I/O system. You can easily implement your flexible automation solution with the help of these data types.

8.3.1 Configuration control with PROFINET interface module

For configuration control with PROFINET interface module, you specify with a user-programmed control data record which modules in a station option are missing or are located in a different slot as compared to the station master.

Procedure

To set up configuration control for the PROFINET interface module, proceed in the following order:

Step	Procedure	See...
1	Enable configuration control for the interface module	Section Configuring (Page 179)
2	Create control data record	Section Creating the control data record (Page 179)
3	Transfer control data record	Section Transferring the control data record in the start-up routine of the CPU (Page 185)

8.3.1.1 Configuring

Requirements

- STEP 7 (TIA Portal) as of V13 SP1
- STEP 7 as of V5.5 SP4 with HSP0265
- IM 154-4 PN HF as of firmware version V7.1
- GSD file
- You have assigned the interface module to an IO controller in STEP 7.

Required steps

To configure the configuration control for the IM 155-4 PN HF interface module, you need to enable the parameter "Enable configuration control".

Note

When you configure the enable, the ET 200SP distributed I/O system requires a control data record 196 from the user program so that the ET 200SP distributed I/O system can operate the I/O modules.

8.3.1.2 Creating the control data record

Introduction

Required steps

To create a control data record for the configuration control, follow these steps:

1. Create a PLC data type that contains the structure of the control data record. Example: The figure below shows a "CTR_REC" PLC-data type that includes the structure of the control data record for an ET 200pro-interface module.

CTR_REC

	Name	Data type	Default value	A...	V...	S..	Comment
1	Block_Lenght	USInt	21	☑	☑	☐	4 + numbers of slots
2	Block_ID	USInt	196	☑	☑	☐	
3	Version	USInt	1	☑	☑	☐	ET 200pro
4	Subversion	USInt	0	☑	☑	☐	
5	Slot 1	USInt	1	☑	☑	☐	integrated PM
6	Slot 2	USInt	2	☑	☑	☐	assigned "real" slot
7	Slot 3	USInt	3	☑	☑	☐	assigned "real" slot
8	Slot 4	USInt	4	☑	☑	☐	assigned "real" slot
9	Slot 5	USInt	5	☑	☑	☐	assigned "real" slot
10	Slot 6	USInt	6	☑	☑	☐	assigned "real" slot

Figure 8-3 Creating control data record 196 using IM 154-4 PN HF as an example

2. Create a global data block.
3. For each control data record in the data block, declare a tag that uses the PLC data type created above.
4. In the control data records, enter the slot assignments in the "Start value" column.

   Example: The figure below shows the global data block "ConfDB". The data block "ConfDB" contains six control data records of the PLC data type "CTR_REC". The control data records are declared as Array [0..5] here. The user is to select the required control data record later with the retentive "Option" tag.

Conf_DB

	Name	Data type	Start value	R...	A...	V..	S...	Comment
1	Static							
2	Option	SInt	0	☑	☑	☑	☐	Selection of record
3	ConfigControl	Array[0..5] of "CTR_REC"		☐	☑	☑	☐	
4	ConfigControl[0]	"CTR_REC"		☐	☑	☑	☐	
5	ConfigControl[1]	"CTR_REC"		☐	☑	☑	☐	
6	Block_Lenght	USInt	21	☐	☑	☑	☐	4 + numbers of slots
7	Block_ID	USInt	196	☐	☑	☑	☐	
8	Version	USInt	1	☐	☑	☑	☐	ET 200pro
9	Subversion	USInt	0	☐	☑	☑	☐	
10	Slot 1	USInt	1	☐	☑	☑	☐	integrated PM
11	Slot 2	USInt	2	☐	☑	☑	☐	assigned "real" slot
12	Slot 3	USInt	0	☐	☑	☑	☐	assigned "real" slot
13	Slot 4	USInt	3	☐	☑	☑	☐	assigned "real" slot
14	Slot 5	USInt	5	☐	☑	☑	☐	assigned "real" slot
15	Slot 6	USInt	6	☐	☑	☑	☐	assigned "real" slot
		USInt	7					"real" slot

Figure 8-4 Example: Data blocks with control data records

Rules

Observe the following rules:

- The CPU/interface module ignores slot entries in the control data record outside the station master.
- The control data record must include the entries up to the last slot of the station option.
- Multiple configured slots cannot be assigned to the same real slot, which means each slot of a station option can exist only once in the control data record.

Control data record for the ET 200pro distributed I/O system

Slot assignment

The table below shows the different slots available for the different modules for an IM 154-4 PN HF:

Table 8- 6 Slot assignment

Modules	Possible slots	Comment
Interface module	0	The interface module (slot 0) is not an element of the configuration control, but rather controls it.
Integrated power module	1	The integrated power module is always installed in slot 1.
ET 200pro I/O modules	2 - 17	-

Control data record

Define a control data record 196 V1.0 for the configuration control of the ET 200pro distributed I/O system that includes a slot assignment. The table below shows the structure of a control data record with explanations of the individual elements.

Table 8- 7 Configuration control: Structure of the control data record 196 V1.0

Byte	Element	Code	Explanation
0	Block length	4 + maximum slot	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Integrated power module slot	1	The integrated power module is always installed in slot 1.
5	Slot 2 of the station master	Slot assignment in the station option	**Control element** Contains the information on which module is inserted in which slot. The value you have to enter in the respective byte is the result of the following rule: • If the module exists in the station option, enter the slot number of the module. • If the module does not exist in the station option, enter 0.
6	Slot 3 of the station master	Slot assignment in the station option	
:	:	:	
4 + (max. slot no. - 1)	Maximum slot of the station master	Slot assignment in the station option	

Combination of configuration control and shared device

Configuration control is controlled through the interface module (slot 0). In shared device, the configuration control function is therefore reserved only for those modules of the IO controller to which the interface module has subscribed. Modules which have been assigned to a different IO controller are therefore not relevant in the control data record. 1-to-1 assignment is implicitly assumed for these modules.

Combination of configuration control and the packing function

You can combine configuration control with the packing function (grouping of modules within one byte). However, it is not possible to change the slot order of packed modules.

Feedback data record for the ET 200pro distributed I/O system

Operating principle

The feedback data record informs you about the accuracy of the module assignment and gives you the option of detecting assignment errors in the control data record. The feedback data record is mapped via a separate data record 197 V1.0.

Slot assignment

The feedback data record only exists with configured configuration control and always refers to the maximum configuration limits **without interface module**, which means 17 slots. Partial reading of the feedback data record is possible.

The following table shows the slot assignment of the modules:

Table 8- 8 Slot assignment

Modules	Possible slots	Comment
Integrated power module	1	The integrated power module is always installed in slot 1.
ET 200pro I/O modules	2 - 17	-

Feedback data record

Table 8- 9 Feedback data record

Byte	Element	Code	Explanation
0	Block length	66	Header
1	Block ID	197	
2	Version	1	
3		0	
4	Status of integrated power module slot	1	Always included because the integrated power module is always installed in slot 1.
5	Status of slot 2	0/1	Status = 1: • Module from station master is inserted in the station option • Slot is marked as not available in the control data record Status = 0: • Module pulled • Incorrect module inserted in the station option*
:	:	:	
20	Status of slot 17	Maximum slot	

* Not possible if the slot is marked as not available.

Note

The data in the feedback data record is always mapped for all modules. In a Shared Device configuration, it is therefore irrelevant which IO controller the respective modules are assigned to.

As long as no control data record was sent, a one-to-one module assignment is assumed for the compilation of data record 197 (station master → station option).

Error messages

During reading of the feedback data record, the RDREC instruction returns the following error messages through the STATUS block parameter in case of an error:

Table 8- 10 Error messages

Error code	Meaning
$80B1_H$	Invalid length; the length information in data record 197 is not correct.
$80B5_H$	Configuration control not configured
$80B8_H$	Parameter error The following events cause a parameter error: • Incorrect block ID in the header (not equal to 197) • Invalid version identifier in the header • A reserved bit was set • The same slot in the station option has been assigned to multiple slots in the station master

8.3.1.3 Transferring the control data record in the start-up routine of the CPU

Required steps

Transfer the created control data record 196 with the WRREC instruction (write data record) to the CPU/the interface module.

Parameters of the WRREC instruction

Below, you will find explanations of individual parameters of the WRREC instruction which you must supply with specific values in the configuration control context. You can find additional information on the WRREC instruction in the STEP 7 online help.

ID	You address the interface module as follows: • Through the diagnostic address in STEP 7 V5.5 The diagnostic address is located in the properties header of the interface module in the hardware configuration. • Through the HW identifier in STEP 7 (TIA Portal) If you have selected the interface module in the network view or device view, the HW identifier is available in the **System constants** tab of the Inspector window. Use the value of the system constant "<Name_of_the_interface_module>~Head".
INDEX	Data record number: 196 (decimal)
RECORD	Control data record to be transferred. For the structure of the control data record, see section Control data record for the ET 200pro distributed I/O system (Page 181).

Error messages

In case of an error, the WRREC instruction returns the following error messages through the STATUS block parameter:

Table 8- 11 Error messages

Error code	Meaning
$80B1_H$	Impermissible length; the length information in data record 196 is incorrect.
$80B5_H$	Configuration control not assigned parameters.
$80B8_H$	Parameter error The reasons for a parameter error are: • Incorrect block ID in the header (not equal to 196) • Invalid version identifier in the header • A reserved bit was set • An invalid slot in the station option has been assigned to a slot of the station master • The same slot in the station option has been assigned to multiple slots in the station master • With shared device on submodule level: Violation of defined restrictions

Selection of the station option in the user program

You must set up a selection option for the different control data records in the user program so that the CPU knows which station option you want to operate. You can make the selection by means of an INT tag, for example, which references an array element.

Keep in mind that the tag for the selection of the control data record must be located in the retentive memory area. If the tag is not retentive, it is initialized during start-up of the CPU and is therefore useless for the selection of the station option.

Special considerations regarding transfer of the control data record to the interface module

- When you have enabled configuration control, the ET 200pro station is not ready for operation without a control data record. As long as no valid control data record has been transferred, the I/O modules are considered by the CPU to have failed and demonstrate substitute value behavior. The interface module is still exchanging data.
- The control data record is stored retentively in the interface module. Note:
  - If the configuration was not changed, the control data record 196 does not need to be written again during restart.
  - If you are writing a control data record with changed configuration, the result is a station failure in the distributed I/O system. The original data record 196 is deleted and the new data record 196 is saved retentively. Next, the station will restart with the changed configuration.

8.3.1.4 Behavior during operation

Effect of the discrepancy between station master and station option

For the online display and for the display in the diagnostics buffer (module OK or module faulty), the station master is always used and not the differing station option.

Example: A module outputs diagnostics data. This module is configured in slot 4 in the station master, but is inserted in slot 3 in the station option (missing module; see example in the next section). The online view (station master) shows a faulty module in slot 4. In the real configuration, the module in slot 3 indicates an error through the LED display.

Behavior when modules are not present

If modules are entered as not present in the control data record, the automation system behaves as follows:

- Any modules identified as not present in the control data record do not return any diagnostics; their status is always OK. The value status is OK.
- Direct writing access to the outputs that are not present or writing access to the process image of outputs that are not present: Remains without effect; no access error is signaled.
- Direct reading access to the inputs that are not present or reading access to the process image of inputs that are not present: Value "0" is supplied; no access error is signaled.
- Write data record to module that is not present: Remains without effect; no error is signaled.
- Read data record from module that is not present: An error is signaled because a valid data record cannot be returned.

8.3.1.5 Examples of configuration control

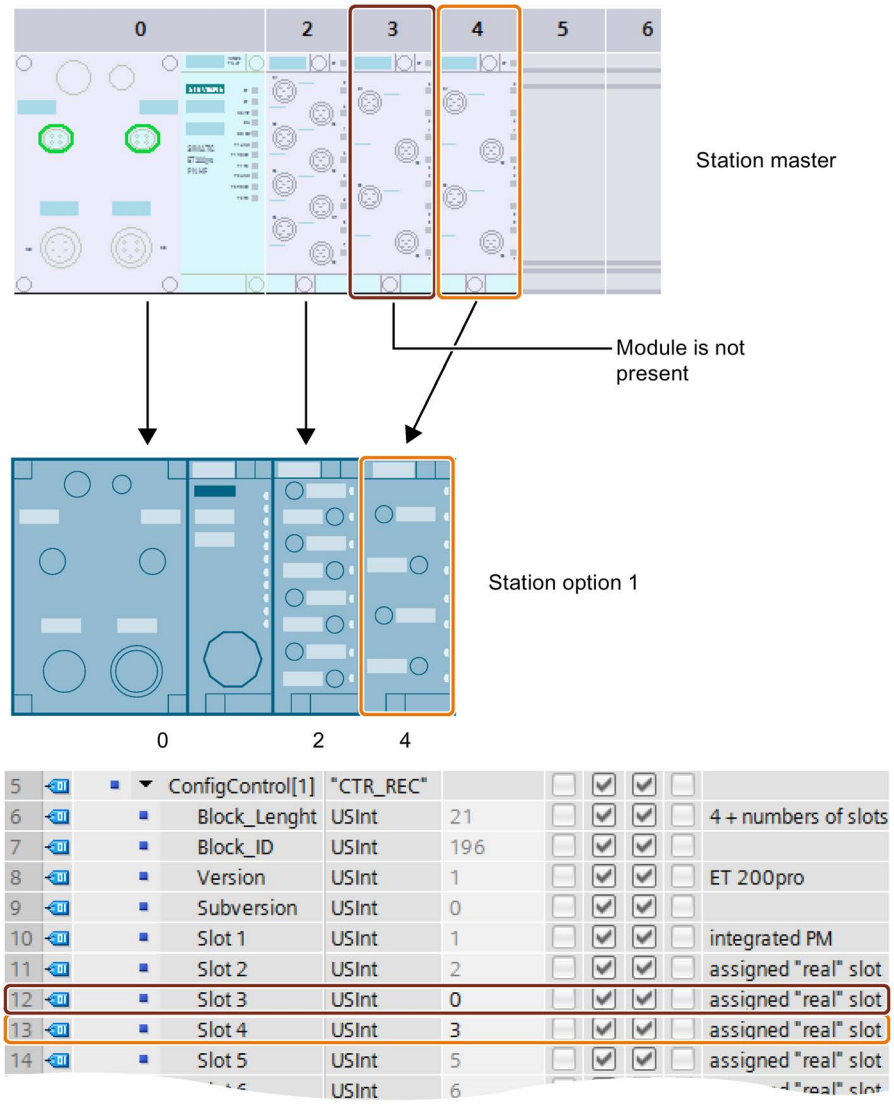
Below, a station master with one interface module and three I/O modules is configured in STEP 7.

Two station options are derived from the station master with the configuration control:

- Station option 1 with module that is not present
- Station option 2 with changed order of modules

Station option 1 with module that is not present

The module that is located in slot 3 in the station master is not present in the station option 1. Label slot 3 with 0 (= not present) in the control data record. The module in slot 4 moves up to slot 3 in station option 1.

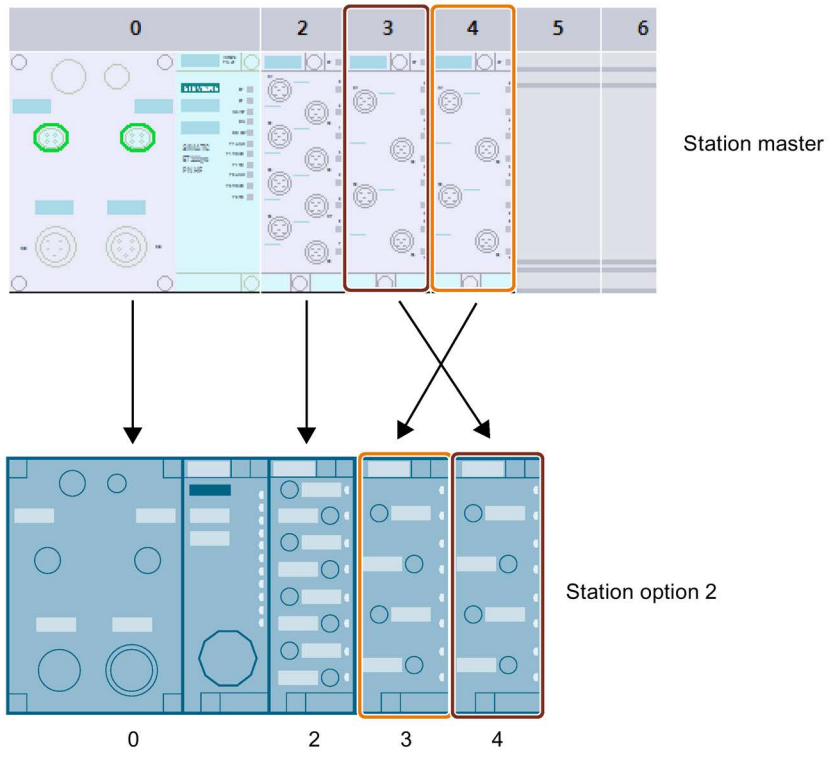


5			ConfigControl[1]	"CTR_REC"					
6			Block_Lenght	USInt	21				4 + numbers of slots
7			Block_ID	USInt	196				
8			Version	USInt	1				ET 200pro
9			Subversion	USInt	0				
10			Slot 1	USInt	1				integrated PM
11			Slot 2	USInt	2				assigned "real" slot
12			Slot 3	USInt	0				assigned "real" slot
13			Slot 4	USInt	3				assigned "real" slot
14			Slot 5	USInt	5				assigned "real" slot
				USInt	6				

Figure 8-5 Example: Hardware configuration of station option 1 with the associated control data record in STEP 7

Station option 2 with changed order of modules

The order of the modules in slots 3 and 4 is mixed up.



6			ConfigControl[2]	"CTR_REC"						
7			Block_Lenght	USInt	21					4 + numbers of slots
8			Block_ID	USInt	196					
9			Version	USInt	1					ET 200pro
10			Subversion	USInt	0					
11			Slot 1	USInt	1					integrated PM
12			Slot 2	USInt	2					assigned "real" slot
13			Slot 3	USInt	4					assigned "real" slot
14			Slot 4	USInt	3					assigned "real" slot
15			Slot 5	USInt	5					assigned "real" slot
				USInt	6					

Figure 8-6 Example: Hardware configuration of station option 2 with the associated control data record in STEP 7

8.3.2 Configuration control with PROFIBUS interface module

For configuration control with the PROFIBUS interface module, you specify through a control interface in the process image output which modules from the station master are present in a station option and which are missing. Unlike with PROFINET interface modules, you cannot change the order of the modules in PROFIBUS interface modules.

Procedure

To set up configuration control for the PROFIBUS interface module, proceed in the following order:

Step	Procedure	See...
1	Configuring and assigning parameters to configuration control in STEP 7	Section Configuring and assigning parameters to configuration control (Page 190)
2	Controlling and monitoring station options through the control interface	Section Controlling and monitoring station options (Page 192)

8.3.2.1 Configuring and assigning parameters to configuration control

Requirements

- STEP 7 (TIA Portal) as of V12
- STEP 7 as of V5.5
- IM 154-1 DP, IM 154-2 DP HF as of firmware version V2.0
- PM E-DC24V

  The PM E-DC24V must be present at least once in the configuration. You cannot use the power module integrated in the interface module for the configuration of the configuration control.
- You have assigned the interface module to a DP master in STEP 7.
- You have enabled the module parameter "Operate if preset configuration does not match actual configuration".

Required steps

1. Drag a PM E-DC24 power module (6ES7148-4CA00-0AA0) with one of the following entries into the configuration table:
   – O (option handling)

   Note

   Enter the power module that ends in O only **once** in the ET 200S configuration.

2. Assign parameters to the interface module as follows:

Interface module	Parameters	Setting	Description
IM154-1 DP (6ES7154-1AA01-0AB0 or higher) IM 154-2 DP High Feature (6ES7-154-2AA01-0AB0 or higher)	Option handling	Enable	Option handling is enabled for the entire ET 200pro.

Behavior during the first startup

With configuration control, the interface module always goes into cyclic data exchange during the first startup. However, the I/O are not enabled until valid information about the options is available from the module. No fault is indicated externally in this state (BF LED of the interface module does not light up). The I/O are not enabled in this state (SF LEDs of electronic modules light up). Evaluate the data of the feedback interface in order to assess this state.

Behavior during a warm restart

Valid information about the options is stored retentively in the interface module. During the warm restart, the interface module goes into cyclic data exchange and the I/O is activated immediately. Has the configuration changed since the last startup (e.g.: incorrect module plugged in or information about options is incorrect), the input/output of the I/O devices is deactivated (depending on the parameter "Operate with set <> actual installation") until the real configuration agrees again with the configured one.

Note

If "Operate if preset configuration does not match actual configuration" is disabled during parameter assignment, the ET 200pro will not start up if a module is missing or if an incorrect module is inserted but the input/output of the I/O devices is not activated.

The diagnostic "No module" or "Incorrect module" is signaled.

When the IM154-1/2 is in this state, the SF LED on the IM154-1/2 lights up and the configured substitute values are output at the existing modules.

8.3.2.2 Controlling and monitoring station options

Introduction

You can use the control interface (PIQ) and feedback interface (PII) to control and monitor options using the user program.

Recommendation: Before working with the ET 200pro optional expansions, use the feedback interface (refer to the table below) to verify that all the required electronic modules are inserted. The contents of the feedback interface must match the specifications of the control interface.

Note

Consistent access to the control and feedback interface is possible with the DPRD_DAT and DPWR_DAT instructions.

Principle

The control and feedback interface is located in the process input and output image of the PM E-DC24V power module.

One bit is available for each ET 200pro electronic module slot:

- Control interface: Slots 2 to 17
- Feedback interface: Slots 2 to 17

	7	6	5	4	3	2	1	0
EB/AB x	7	6	5	4	3	2	1	0
EB/AB x+1	15	14	13	12	11	10	9	8
EB/AB x+2	-	-	-	-	-	-	17	16

Figure 8-7 Control interface (PIQ) and feedback interface (PII)

Control interface PIQ (QB x to QB x+2):

The control interface is used to notify the interface module about the modules that are actually present and which slots have been skipped. The interface module cannot evaluate the configuration until it has received this information. Slot 0 (interface module) and slot 1 (integrated power module PM-E) must be assigned the value 1.

Table 8- 12 Control interface

Slot	Value of the bit	Reaction
0 and 1	0	Content of bit track is not used
	1	Bit track is valid
2 to 17	0	Module is not present in the station option
	1	Module is present in the station option

Feedback interface PII (IB x to IB x+2):

The feedback interface (3 bytes) tells you which module is actually located in a certain slot.

Table 8- 13 Feedback interface

Slot	Value of the bit	Reaction
0 and 1	0	Configuration control is inactive
	1	Configuration control is active
2 to 17	0	Module belongs to an option that is not available or the module status is not OK
	1	Module is available and is OK

If the feedback result of the feedback interface is identical with the specification of the control interface, the configuration is correct.

Procedure

In order to start testing the options, set Bit 0=1 and Bit 1=1 in the first byte (QB x).

Proceed as follows in order to ensure the consistency of the 3 bytes:

- Write the first byte (QB x) last (for direct access with T PQB).

or

- First write the complete information of the control interface in the first byte (QB x) with Bit 0=0 and then set Bit 0=1 in this byte in the subsequent OB1 cycle.

Alternatively, you can use the DPWR_DAT instruction to achieve consistent transfer.

Note

Whenever any change in the 3 bytes of the control interface takes place, this information is stored and used, even if non-relevant bits were changed (bits outside the station master).

Special notes on configuration control

Note the following:

- If the interface module is operated without configuration or without a CPU (DP master), it supplies the configuration as it exists. This is relevant for tools for the wiring test, because the actual slot numbers, from 1 to n without gaps, are used there for Status/Force.
- The I/O address and the diagnostic address of a module are not changed by the configuration control; the configuration is in effect.
- With configuration control, incorrect assembly of the control interface can result in too many inserted modules with a slot number greater than 17 being reported from the perspective of the interface module. Because there is only room for 17 modules in the diagnostic message frame (module status), the most significant bit is set in the "Identifier-related diagnostics" in this case. This produces the following results:
  - The SF LED on the interface module is on.
  - Bit 3 in status byte 1 of the diagnostic message frame is set (external diagnostics available).
  - The "Slot 18 faulty" error message is indicated in STEP 7.
- Access of instructions (e.g. DPNRM_DG) to slots that are not present is answered with an error (80B2).
- There are no limitations when digital modules are packed. Theoretically, the module to which the byte address is assigned in the preset configuration can be missing in the structure.

Note

The configured slot numbers (slot numbers in data records and for events such as diagnostics and interrupts) always apply to slot addressing.

8.3.2.3 Use example

Below, a station master with one interface module and five I/O modules is configured in STEP 7.

In the station option, the modules in slots 3 and 4 are not present. These slots are identified accordingly with 0 in the control interface.

The control interface is located in the process image output (PIQ) of the PM E-DC24V (here: output byte 2 to output byte 4).

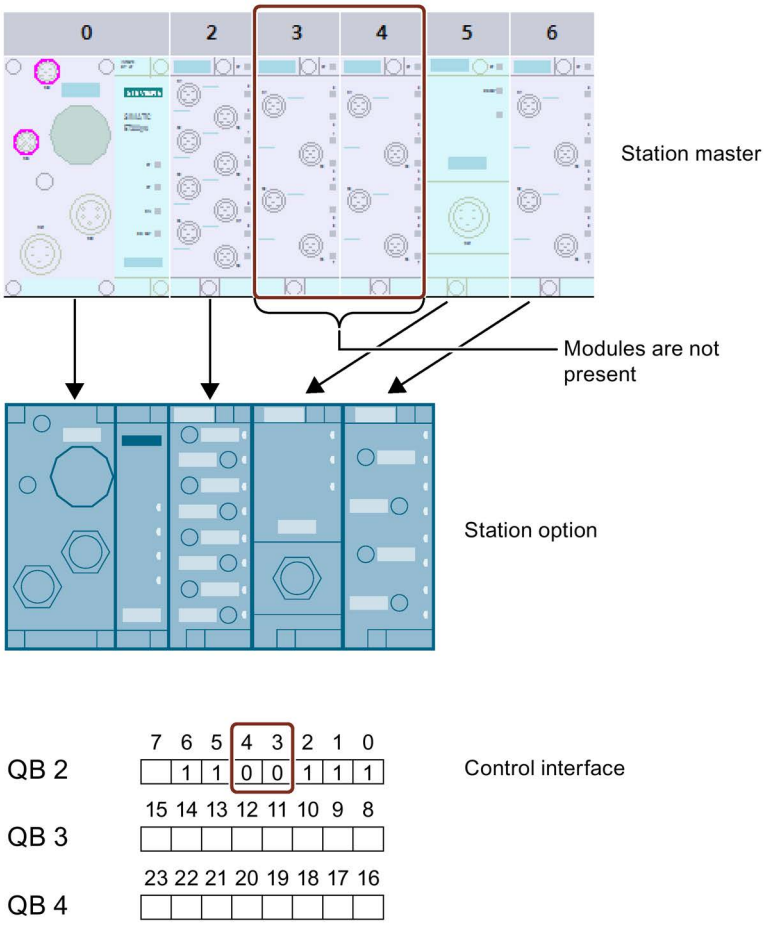


Figure 8-8 Example of the configuration control with an IM 154-2 DP HF

Alarm, error and system messages

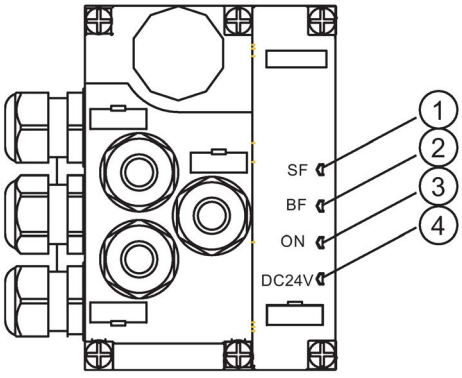
9

9.1 PROFIBUS DP

9.1.1 LED display on the IM 154-1 DP and IM 154-2 DP High Feature interface modules

LED display

The figure below shows the position and layout of the LED display of the interface modules IM 154-1 DP and IM 154-2 DP High Feature.



① GE: Group error (red LED)
② BF: Bus fault (red LED)
③ ON: Electronic/encoder supply 1L+ (green LED)
④ DC24V: Load voltage supply 2L+ (green LED)

Status and error displays GE, BF, ON

Table 9- 1 Status and error displays of IM 154-1 DP and IM 154-2 DP High Feature

LEDs			Meaning	Remedy
GE	BF	ON		
Off	Off	On	No error in current data exchange between the DP slave and the DP master. The interface module is supplied with power (electronic/encoder).	---
Off	Off	Off	Electronic/encoder supply missing or too low at the interface module.	Switch on the electronic/encoder power supply for the DP slave.
			Defective hardware.	Replace the interface module.
*	On	On	DP slave in startup mode.	---
			Connection to DP master failed.	Check the PROFIBUS DP connection.
			DP slave cannot detect the baud rate.	Check the DP master.
			Bus interruption	Check all cables in your PROFIBUS DP network.
			DP slave is out of service	Check whether the PROFIBUS DP connectors are firmly plugged in on the connection module.
On	Off	On	Diagnostic message.	Analyze the diagnostic data.
			ET 200pro hardware fault.	Replace the defective module.
On	Flashing	On	The configuration data transferred from the DP master to the DP slave does not match the DP slave configuration.	Check the DP slave configuration (I/O, PROFIBUS DP address)
Off	Flashing	On	The DP slave has detected the baud rate, but is not addressed by the DP master.	Check the PROFIBUS DP address of the DP slave.
			The DP slave is not configured.	Check the DP slave configuration (station type).
			The set PROFIBUS DP address is not permissible.	Select a valid PROFIBUS DP address.[1]

* irrelevant

[1] After changing the PROFIBUS DP address, you must switch the electronic/encoder power supply 1L+ off and on. The new PROFIBUS DP address is applied when you switch on.

Status indicator DC24V

The green LED DC24V is lit when the 2L+ load voltage supply is connected. If the LED is not lit, check to see if the power supply is switched on and the fuse is functioning.

See also

Evaluating diagnostic messages (Page 200)

Evaluating interrupts (Page 203)

Channel-specific diagnostic data (Page 212)

9.1.2 Reading out the diagnostic data

Introduction

The slave diagnostics function is compliant with IEC 61784-1:2010 Ed3 CP 3/1. Depending on the DP master, the diagnostic data of all DP slaves which conform with this standard can be read using STEP 7.

Options for reading out diagnostic data

The table shows the options for reading out diagnostic data using STEP 7.

Automation system with DP master	Block or register	Application	See...
SIMATIC S7/M7	"DP slave diagnostics" tab	Slave diagnostic information in plain text on the STEP 7 user interface	"Hardware diagnostics" in STEP 7 online help
	SFC 13 "DP NRM_DG"	Reading out slave diagnostic data (save to the data area of the user program)	SFC, refer to the STEP 7 online help
	SFC 59 "RD_REC"	Reading out S7 diagnostic data records (save to the data area of the user program)	See "System and Standard Functions" Reference Manual
	SFB 52 "RDREC"	Reading data records from the DP slave	SFB, refer to STEP 7 online help (system functions/ function blocks)
	SFB 54 "RALRM"	Receiving interrupts from interrupt OBs	SFB, refer to STEP 7 online help (system functions/ function blocks)

Example of reading S7 diagnostic data using SFC 13 "DP NRM_DG"

The following is assumed for the STEP 7 user program:

- The diagnostics address of ET 200pro is 1022 (3FEH).
- Slave diagnostic data should be stored in DB 82: starting at address 0.0, length 128 byte.
- Slave diagnostic data consists of up to 128 byte (IM 154-1).

STL

```
CALL SFC 13
REQ :=TRUE                          % Read request
LADDR :=W#16#3FE                    % Diagnostics address of ET 200pro
RET_VAL :=MW0                       % RET_VAL of SFC 13
RECORD :=P#DB82.DBX 0.0 BYTE 128    % Mailbox for diagnostics in DB 82
BUSY :=M2.0                         % Read operation across several OB 1
cycles
```

9.1.3 Evaluating diagnostic messages

Introduction

You can configure diagnostic alarms for the following modules:

- Digital input modules
- Digital output modules
- Analog input modules
- Analog output modules
- Pneumatic interface modules
- Integrated power module/power module
- Outgoing module

Digital input modules

Diagnostic alarm	Digital input modules	Effective range	Configurable
Parameter assignment error	8 DI DC 24V	Module	No
	16 DI DC 24V		
	8 DI DC 24V High Feature		
Short-circuit	8 DI DC 24V	Module	Yes
	16 DI DC 24V	Module	
	8 DI DC 24V High Feature	Channel	
Wire break	8 DI DC 24V High Feature	Channel	Yes

Digital output modules

Diagnostic alarm	Digital output modules	Effective range	Configurable
Parameter assignment error	4 DO DC 24V/2.0A	Module	No
	8 DO DC 24V/0.5A		
	4 DO DC 24V/2.0A High Feature		
Encoder or load voltage missing	4 DO DC 24V/2.0A High Feature	Module	Yes
Short-circuit	4 DO DC 24V/2.0A	Module	Yes
	8 DO DC 24V/0.5A	Module	
	4 DO DC 24V/2.0A High Feature	Channel	
Wire break	4 DO DC 24V/2.0A High Feature	Channel	Yes

Digital input and output modules

Diagnostic alarm	Digital input and output modules	Effective range	Configurable
Parameter assignment error	4 DI / 4 DO DC 24V/0.5A	Module	No
	4 DIO / 4 DO DC 24V/0.5A		
Error	4 DI / 4 DO DC 24V/0.5A	Module	Yes
Short-circuit	4 DIO / 4 DO DC 24V/0.5A	Module	Yes

Analog input modules

Diagnostic alarm	Analog input modules	Effective range	Configurable
Parameter assignment error	4 AI U High Feature	Channel	No
	4 AI I High Feature		
	4 AI RTD High Feature		
	4 AI TC High Feature		
Short-circuit	4 AI I High Feature	Channel	Yes
Wire break	4 AI U High Feature	Channel	Yes
	4 AI I High Feature		
	4 AI RTD High Feature		
Violation of high limit	4 AI U High Feature	Channel	Yes
	4 AI I High Feature		
	4 AI RTD High Feature		
	4 AI TC High Feature		
Violation of low limit	4 AI U High Feature	Channel	Yes
	4 AI I High Feature		
	4 AI RTD High Feature		
	4 AI TC High Feature		
Error *	4 AI U High Feature	Module	No
	4 AI I High Feature		
	4 AI RTD High Feature		
	4 AI TC High Feature		
Reference channel error	4 AI TC High Feature	Channel	No
External fault	4 AI TC High Feature	Channel	No

* Defect in module

Analog output modules

Diagnostic alarm	Analog output modules	Effective range	Configurable
Parameter assignment error	4 AO U High Feature	Channel	No
	4 AO I High Feature		
Short-circuit	4 AO U High Feature	Channel	Yes
Wire break	4 AO I High Feature	Channel	Yes
Error *	4 AO U High Feature	Module	No
	4 AO I High Feature		

* Defect in module

Pneumatic interface modules

Diagnostic alarm	Effective range	Configurable
Parameter assignment error	Module	No
Encoder or load voltage missing	Module	Yes

Integrated power module/power module

Diagnostic alarm	Effective range	Configurable
Encoder or load voltage missing	Module	Yes

Outgoing module

Diagnostic alarm	Effective range	Configurable
Error (short circuit to M for 1L+)	Module	Yes

Reactions to a diagnostic alarm in DPV1 mode, depending on parameter settings

Actions initiated by diagnostic alarms:

- The diagnostics are reported as diagnostic interrupts.
- In DPV1 mode, diagnostic information is also reported when the CPU is in STOP mode.
- Once a diagnostic alarm is signaled it is
  - Entered in the diagnostic frame as a diagnostic block (one interrupt only)
  - Stored in the diagnostic buffer of the CPU
  - Entered in the channel-specific diagnostic data
- The SF LED of the interface module and, if applicable, on the affected electronic module is lit.
- OB 82 is called. If OB 82 is not available, the CPU goes to STOP.
- Acknowledgment of the diagnostic interrupt The enables a new interrupt.

Reactions to a diagnostic alarm in DPV0 mode, depending on parameter settings

The error is entered in the channel-specific diagnostic information in the diagnostic frame:

- The SF LED of the interface module and, if applicable, on the affected electronic module is lit.
- There can be more than one diagnostic alarm at a given time.

See also

LED display on the IM 154-1 DP and IM 154-2 DP High Feature interface modules (Page 197)

9.1.4 Evaluating interrupts

Introduction

Certain errors trigger an interrupt at the DP slave.

Interrupts supported by ET 200pro:

- Diagnostic interrupts
- Process interrupts
- Swapping interrupts

Evaluating interrupts with DPV1 master

The CPU of the DP master automatically calls the interrupt OBs after an interrupt was generated. Additional information is available in the System and Standard Functions for S7-300/400 (http://support.automation.siemens.com/WW/view/en/1214574) Reference Manual.

Note

The system does not generate any interrupts when ET 200pro is operated with a DPV0 master, or in DPV0 mode (as standard DP slave).

Triggering of a diagnostic interrupt

The module triggers a diagnostic interrupt when it registers incoming or outgoing events, e.g. a cable break, and "Enable diagnostic interrupt" is set.

The CPU interrupts the user program and executes the diagnostics block OB 82. The interrupt triggering event is logged in the start information of OB 82.

Triggering a process interrupt

If there is a process interrupt, the CPU interrupts user program execution and processes the process interrupt block OB 40. The result that triggered the interrupt is added to the start information of OB 40.

Note

Process interrupts should not be used for technological purposes (cyclic generation of process interrupts, for example), because these can become lost in the overall system.

Evaluating process interrupts using STEP 7

If there is a process interrupt, the CPU interrupts the user program and processes the process interrupt block OB 40.

The module channel that triggered the process interrupt will be written to the OB40_POINT_ADDR variable in the start information of OB 40.

For a description of the OBs 40, refer to the System and Standard Functions for S7-300/400 (http://support.automation.siemens.com/WW/view/en/1214574) Reference Manual.

Process interrupts of electronic module 8 DI DC 24V High Feature

The figure below shows the assignment to bits of the local data double word 8 in the start information of OB 40.

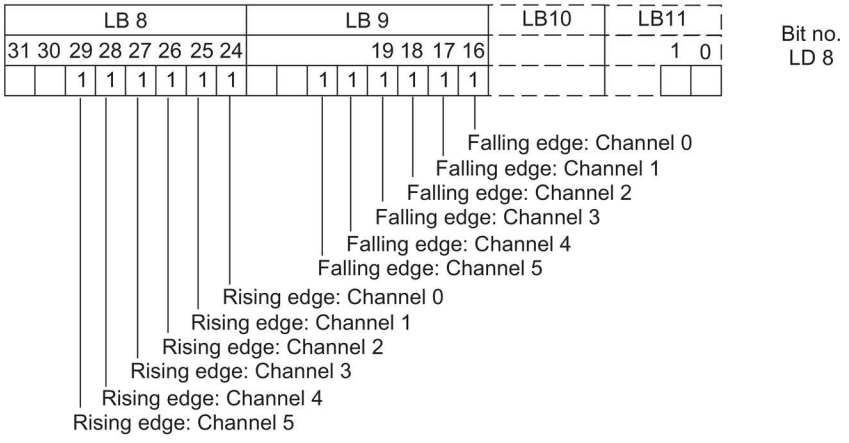


Figure 9-1 Interrupts of 8 DI DC 24V High Feature

Process interrupts with electronic modules 4 AI U, 4 AI I

The figure below shows the assignment to bits of the local data double word 8 in the start information of OB 40.

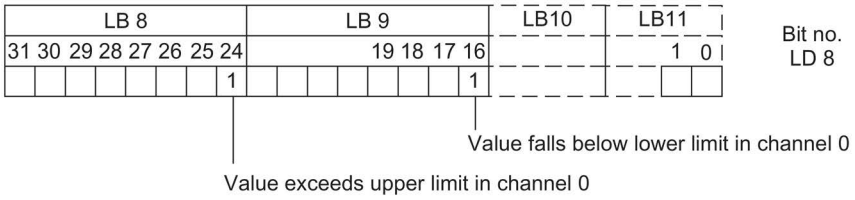


Figure 9-2 Interrupts for analog input modules

Triggering a swapping interrupt

DPV1 mode supports swapping interrupts. The CPU interrupts the user program and processes the diagnostics block OB 83. The interrupt triggering event is logged in the start information of OB 83.

9.1.5 Structure of slave diagnostic data

Structure of slave diagnostic data

The figure below illustrates the structure of slave diagnostics.

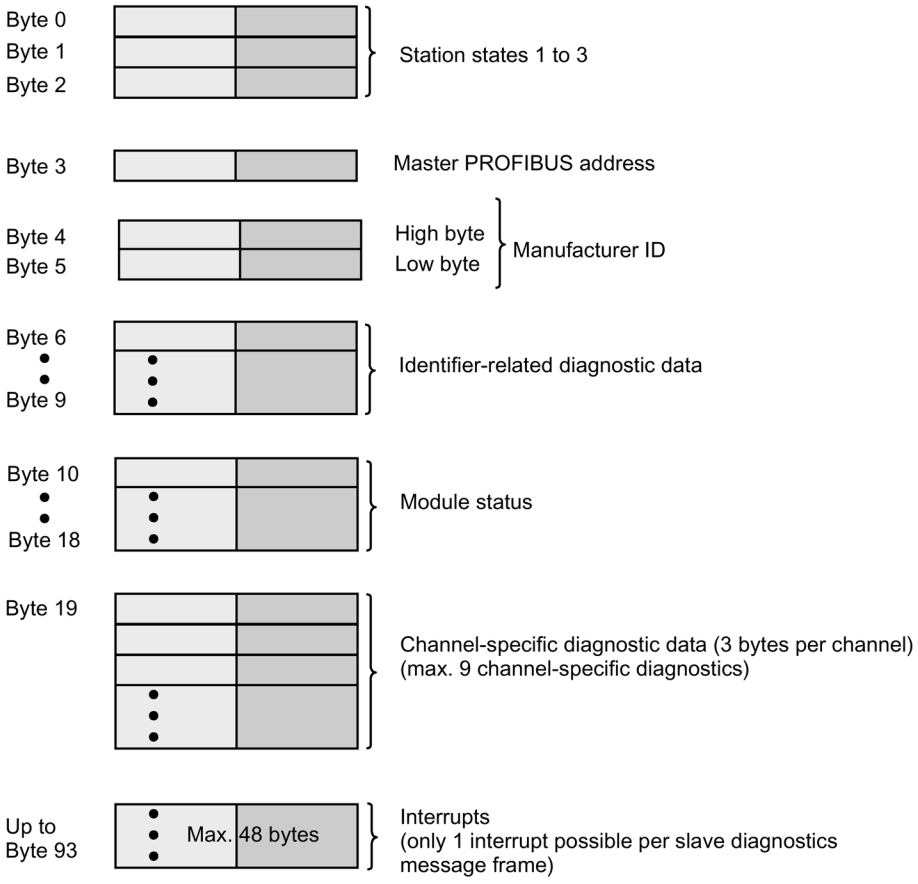


Figure 9-3 Structure of slave diagnostic data

The identifier-related diagnostics, module status, and the channel-specific diagnostics can be deactivated or activated via parameters when configuring is implemented using the GSD file. If you deactivate these diagnostics, they are removed from the diagnostic message frame.

See also

Station states 1 to 3 (Page 208)
Master PROFIBUS address (Page 209)
Manufacturer ID (Page 210)
Identifier-related diagnostic data (Page 210)
Module status (Page 211)
Channel-specific diagnostic data (Page 212)
Interrupts (Page 215)

9.1.6 Station states 1 to 3

Definition

Station states 1 to 3 provide an overview of the status of a DP slave.

Structure of station status 1 (byte 0)

Bit	Meaning	Cause/remedy
0	1: The DP master cannot address the DP slave.	• Check the PROFIBUS address of the DP slave. • Check the PROFIBUS DP connection. • Check the power supply to the DP slave. • Check the settings of the RS 485 repeater. • Check whether the DP slave was reset.
1	1: The DP slave is not yet ready to exchange data.	• Wait, the DP slave is currently starting up.
2	1: The configuration data transferred from the DP master to the DP slave does not match the DP slave configuration.	• Verify the station type and configuration of the DP slave in the configuring software.
3	1: External diagnostic information exists. (group diagnosis display)	• Evaluate the ID-specific and/or channel-specific diagnostic information, and the module status. Bit 3 is reset after all errors are cleared. The bit will be set again if a new diagnostic message is output in the bytes of the diagnostics functions mentioned above.
4	1: The DP slave does not support the requested function (modification of the PROFIBUS address in the software, for example).	• Check the configuration.
5	1: The DP master cannot interpret the response of the DP slave.	• Check the bus configuration.
6	1: The DP slave type does not match the software configuration.	• Compare the preset to the actual configuration
7	1: The DP slave was parameterized by a different DP master (not by the DP master which currently has access to the DP slave).	• The bit is always 1 if, for example, you are currently accessing the DP slave from the PG or a different DP master. • The PROFIBUS address of the DP master which has parameterized the DP slave is in the "Master PROFIBUS address" diagnostics byte.

Structure of station status 2 (byte 1)

Bit	Meaning	
0	1:	The DP slave has to be reparameterized.
1	1:	A diagnostic message is pending. The DP slave will not operate until the error is cleared (static diagnostic message).
2	1:	This bit is always "1" in the DP slave.
3	1:	Response monitoring is enabled for this DP slave.
4	1:	The DP slave has received a "FREEZE" control command [1].
5	1:	The DP slave has received a "SYNC" control command [1].
6	0:	Bit is always "0".
7	1:	The DP slave is disabled, i.e. it is isolated from the current process.
[1] The bit is only updated if a further diagnostic message changes.		

Structure of station status 3 (byte 2)

Bit	Meaning	
0 to 6	0:	Bits are always "0".
7	1:	Insufficient memory on the DP slave for the number of pending diagnostic messages. The DP master is unable to enter all diagnostic messages it received from the DP slave in its diagnostic buffer (channel-specific diagnostics).

9.1.7 Master PROFIBUS address

Definition

The DP master's PROFIBUS address is stored in the master PROFIBUS address diagnostics byte:

- that has parameterized the DP slave and
- that has read and write access to the DP slave.

The master PROFIBUS address is stored in byte 3 of the slave diagnostic data.

9.1.8 Manufacturer ID

Definition

The manufacturer ID contains a code specifying the type of the DP slave.

The table shows the structure of the manufacturer ID (bytes 4 and 5).

Byte 4	Byte 5	Manufacturer ID for
81_H	18_H	ET 200pro with IM154-1 DP
81_H	19_H	ET 200pro with IM154-2 DP High Feature

9.1.9 Identifier-related diagnostic data

Definition

The identifier-related diagnostic data indicates whether or not modules of the ET 200pro signal an error or not. The identifier-related diagnostic data begins as of byte 6 and comprises 4 bytes.

Structure of identifier-related diagnostic data

The identifier-related diagnostic data for the ET 200pro is structured as follows:

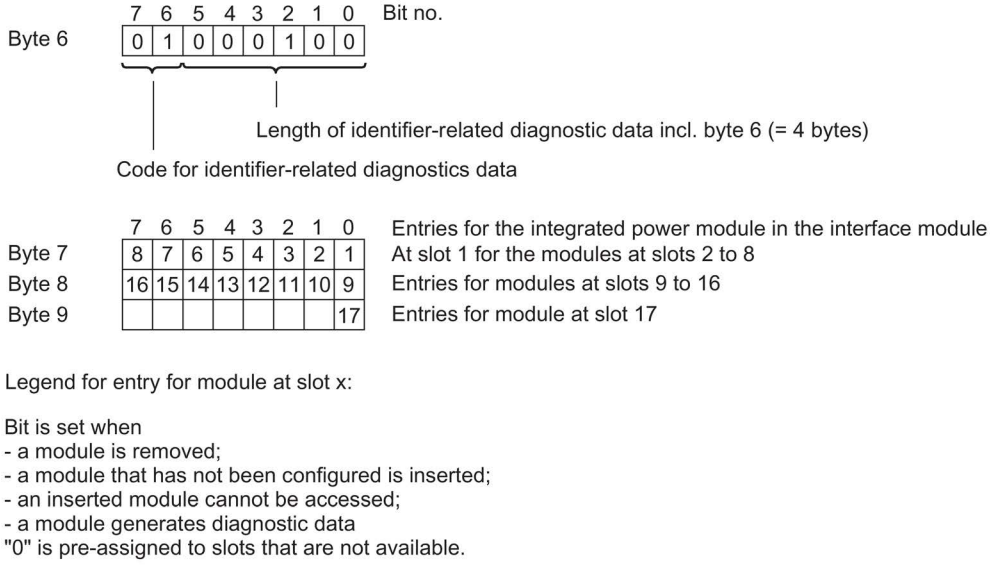


Figure 9-4 Structure of identifier-related diagnostic data

9.1.10 Module status

Definition

The module status indicates the status of the configured modules and provides details of the identifier-related diagnostic data with regard to the configuration. The module status begins after the identifier-related diagnostics and comprises 9 byte.

Structure of the module status

The module status for ET 200pro is structured as follows:

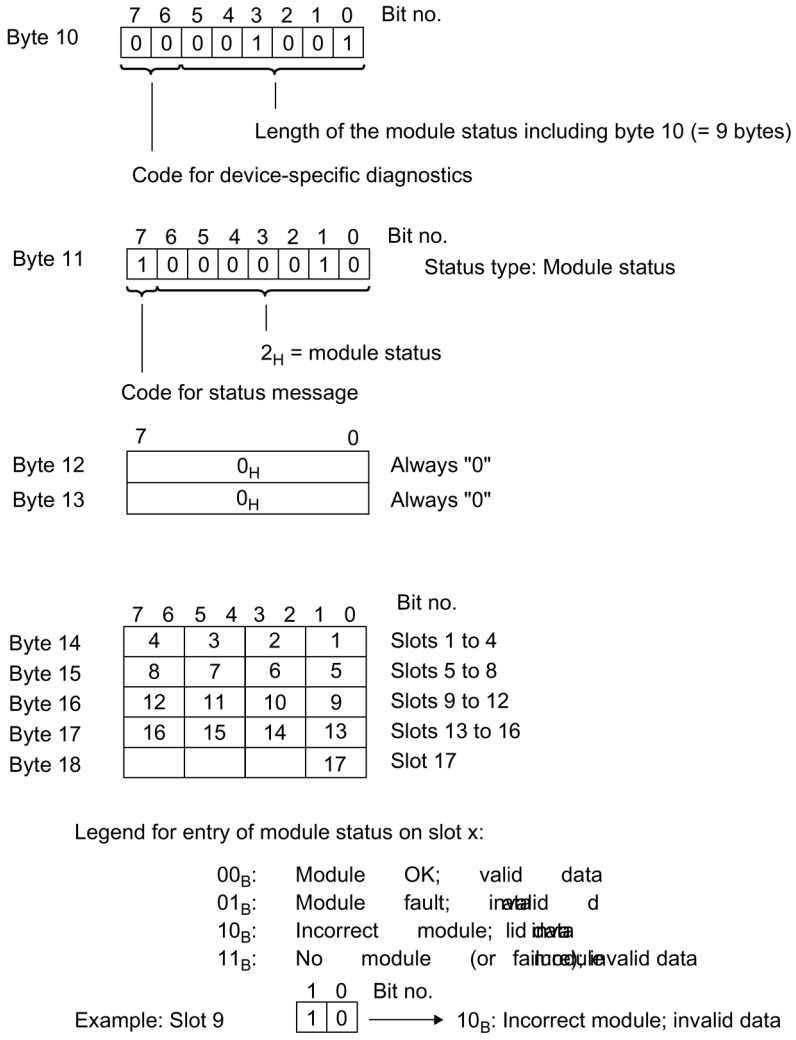


Figure 9-5 Module status

See also

Structure of interrupts (Page 217)

Diagnostics of faulty configuration states of ET 200pro (Page 223)

9.1.11 Channel-specific diagnostic data

Definition

Channel-specific diagnostic data provides information about channel faults of modules and provides details of the identifier-related diagnostic data.

For each channel-specific diagnostics, 3 byte are added according to the IEC 61784-1:2010 Ed3 CP 3/1 standard.

Channel-specific diagnostic data starts after the module status. Channel-specific diagnostic data does not influence the module status.

Structure of channel-specific diagnostic data

The number of channel-specific diagnostic events is limited to 9. The length of slave diagnostic data is determined by the number of current channel-specific diagnostic data. If more than 9 channel-specific diagnostic events are pending, bit 7 "diagnostics overflow" is set in station status 3.

The figure below shows the structure of channel-specific diagnostic data if diagnostic events are selected in the configuration.

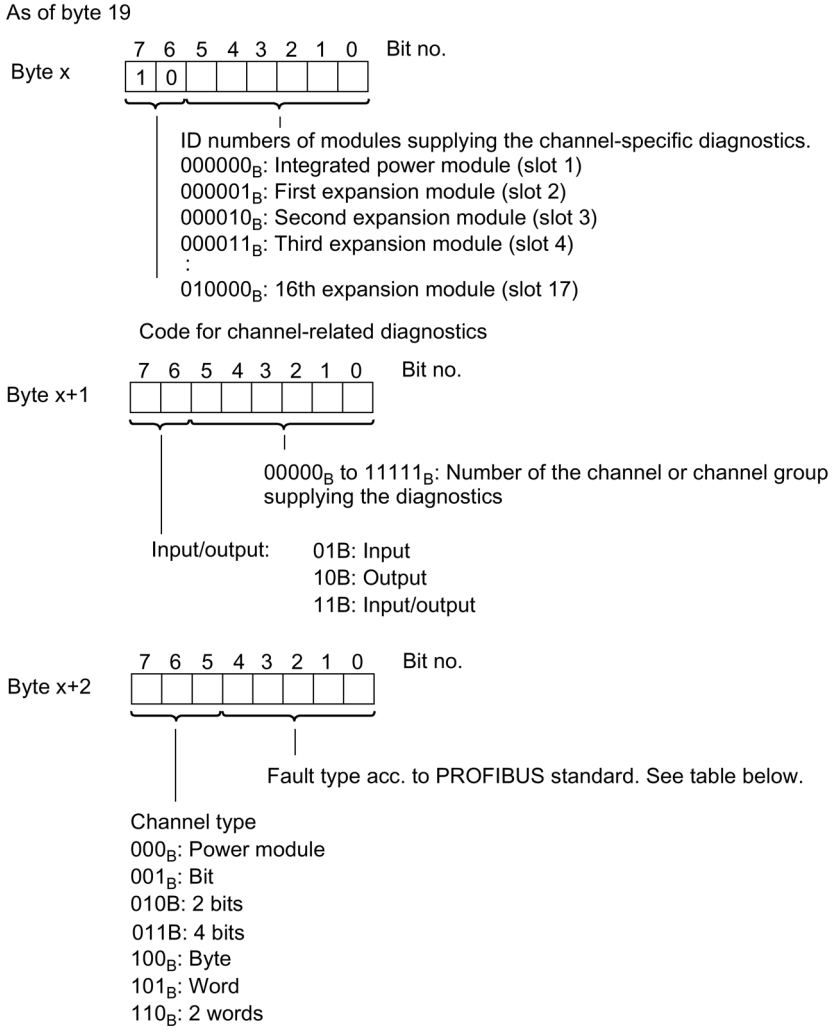


Figure 9-6 Structure of channel-specific diagnostic data

See also

LED display on the IM 154-1 DP and IM 154-2 DP High Feature interface modules (Page 197)

Error types for electronic modules (Page 232)

9.1.12 Error types for electronic modules

Error types and remedies

The table below shows the error types for electronic modules.

Table 9- 2 Error types for electronic modules

Error type		Error text	Meaning	Remedy
00001_B	1_D	Short-circuit	• Short-circuit to M potential at encoder line • Short-circuit to M potential at output line • Short-circuit to P potential or ground at output line • Load impedance too low	• Correct the process wiring • Check encoder or actuator
00110_B	6_D	Cable break	• Signal line to encoder or actuator interrupted • Defective encoder or actuator • Load impedance too high	• Correct the process wiring • Replace the encoder or actuator • Use an encoder with higher impedance • Use an actuator with lower load
00111_B	7_D	Violation of upper limit	The value is above the overrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01000_B	8_D	Violation of lower limit	The value is below the underrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01001_B	9_D	Error	Internal module error (diagnostic message on channel 0 applies to the entire module)	Replace the module
			Short circuit to M. The electronic/encoder supply is short-circuited to M potential (only for the PM-O DC 2x24V outgoing module)	Correct the process wiring
10000_B	16_D	Parameter assignment error	Module not parameterized	Correct the parameters

Error type		Error text	Meaning	Remedy
10001_B	17_D	Encoder voltage or load voltage is missing	• Supply voltages missing or too low • Load voltage supply missing or too low	• Check the supply voltages • Check the load voltage supply • Correct the process wiring
10101_B	21_D	Reference channel error	Measuring line for compensation interrupted	Correct the process wiring
			Data record DS2 incorrect	Check data record DS2
			Timeout for "Dynamic ref. temp."	Send DS2
10110_B	22_D	Process interrupt lost	ET 200pro failed to detect a process interrupt	Correction or coordination of the program, process, module
11010_B	26_B	External error	Error at encoder circuit	Correct the process wiring

9.1.13 Interrupts

9.1.13.1 Interrupts

Definition

The interrupt section of the slave diagnosis provides information on the type of interrupt and the cause that led to the triggering of the interrupt. The interrupt section comprises a maximum of 48 byte.

Position in the diagnostics frame

The position of the interrupt section comes after the channel-specific diagnostic data or after the identifier-related diagnostic data (STEP 7).

Example: If there are 3 channel-specific diagnostics, the interrupt section starts at byte 28.

In the case of an interrupt, the channel-specific diagnostic data is reduced in favor of the interrupt information.

Data records

The diagnostics data of a module can be up to 44 byte in length and is located in data records 0 and 1:

- Data record 0 contains 4 byte of diagnostic data describing the current state of an automation system. DS0 is part of the header information of OB 82 (local data bytes 8 to 11).
- Data record 1 contains the 4 byte of diagnostics data that are also contained in data record 0 and, in addition, up to 40 byte of module-specific diagnostics data.

You can read out DS0 and DS1 via SFB 52. DS0 and DS1 are not generated by the interface module.

Contents

The contents of the interrupt function depend on the type of interrupt:

- In the case of diagnostic interrupts, diagnostic data record 1 (44 byte) is sent as interrupt status information (starting at byte x+4).
- The interrupt status information for hardware interrupts is 4 byte in length.
- In the case of swapping interrupts, the interrupt information is 5 byte long.

See also

Structure of interrupts (Page 217)

9.1.13.2 Structure of interrupts

Interrupt structure

Structure of the interrupt section for ET 200pro:

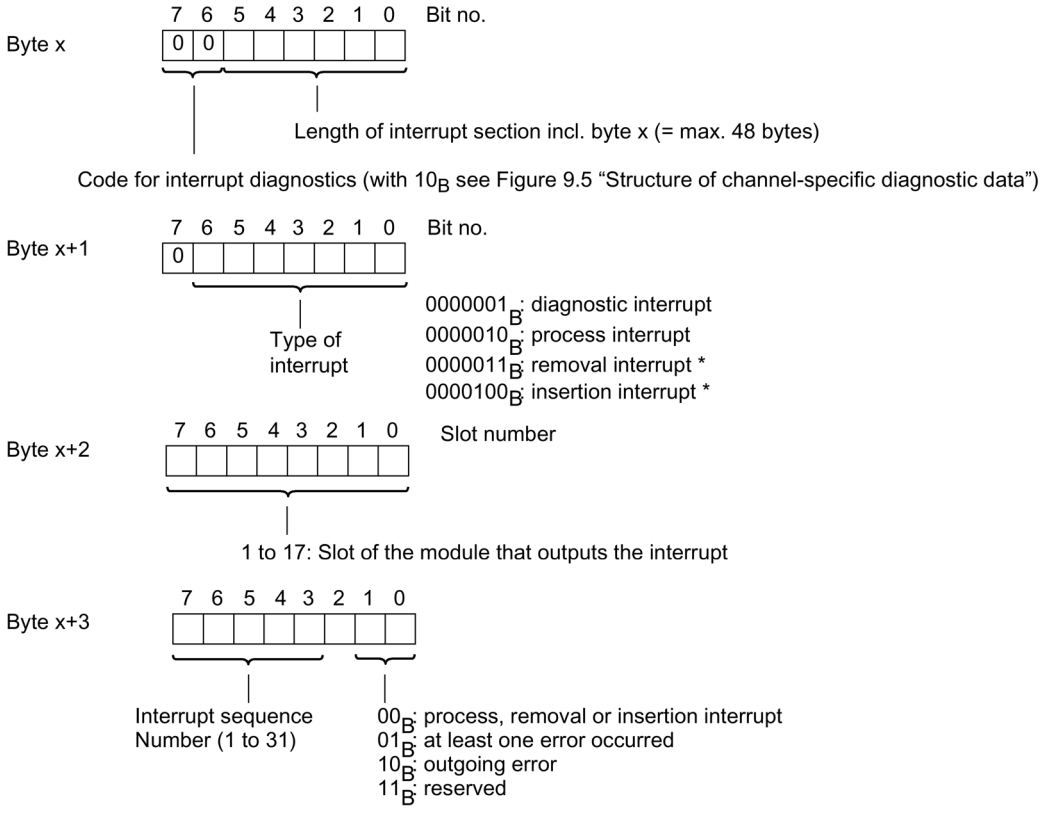
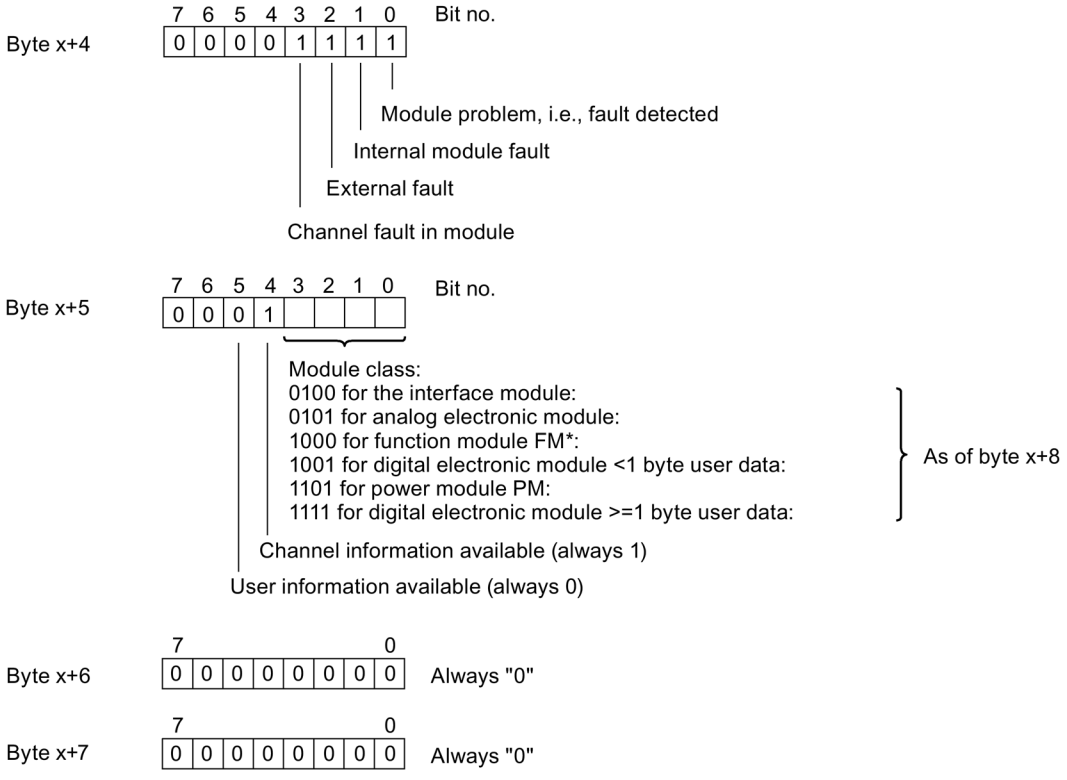


Figure 9-7 Structure of the interrupt status of the interrupt section

* Only for the CPU 318-2DP and S7-400 CPUs

Diagnostic interrupt, Byte x+4 to x+7



* Digital electronic module 16 DI DC 24V is signaled as function module FM

Figure 9-8 Structure of Bytes x+4 to x+7 for diagnostic interrupts

Diagnostic interrupt of the modules

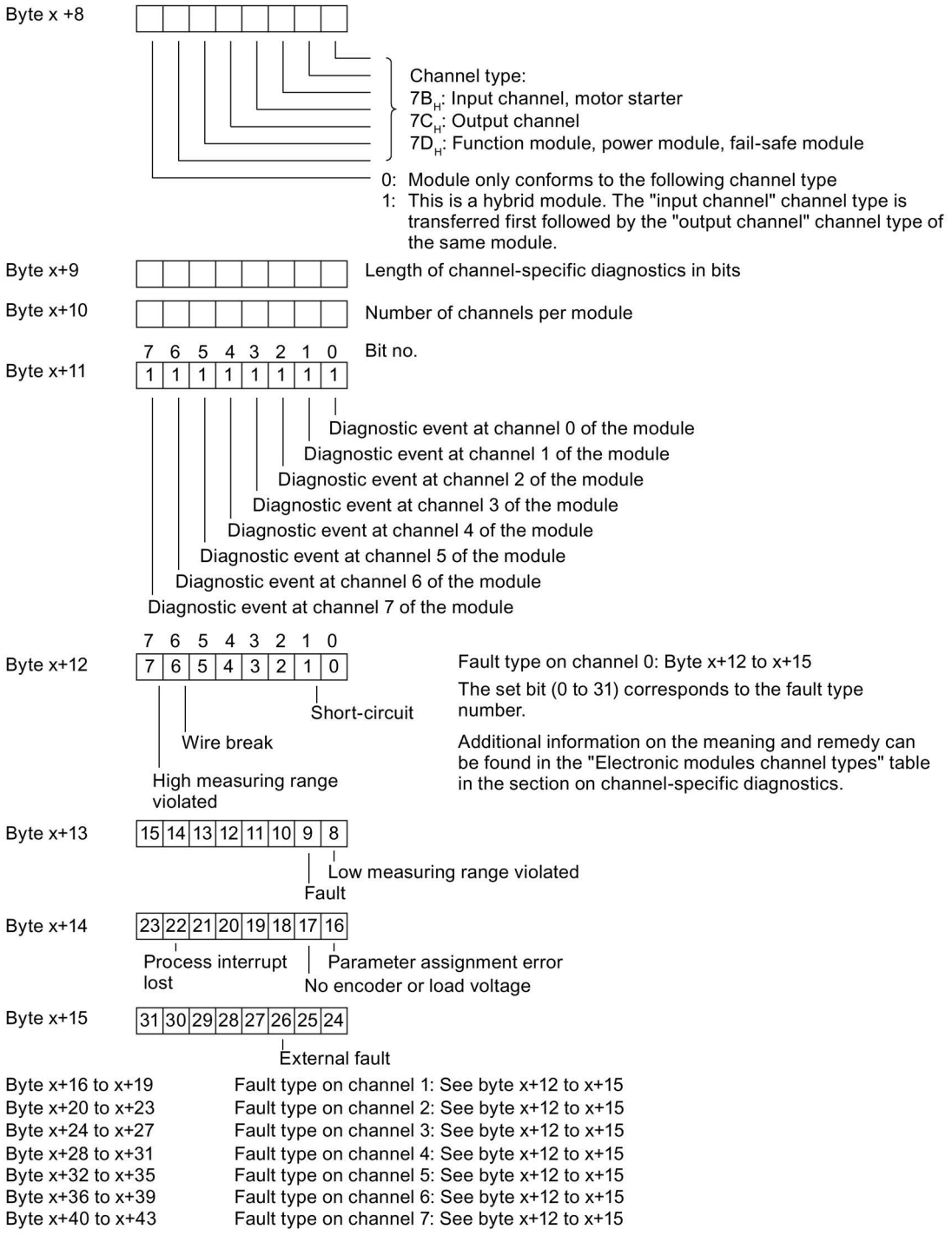


Figure 9-9 Structure of diagnostics interrupts, starting at Byte x+8

See also

Module status (Page 211)

Process interrupt of analog input modules (Page 222)

9.1.13.3 Example of a diagnostic interrupt

Example of a diagnostic interrupt

In the example shown below, the analog electronic module 4 AI I High Feature outputs a diagnostic message to indicate a short-circuit at channel 1.

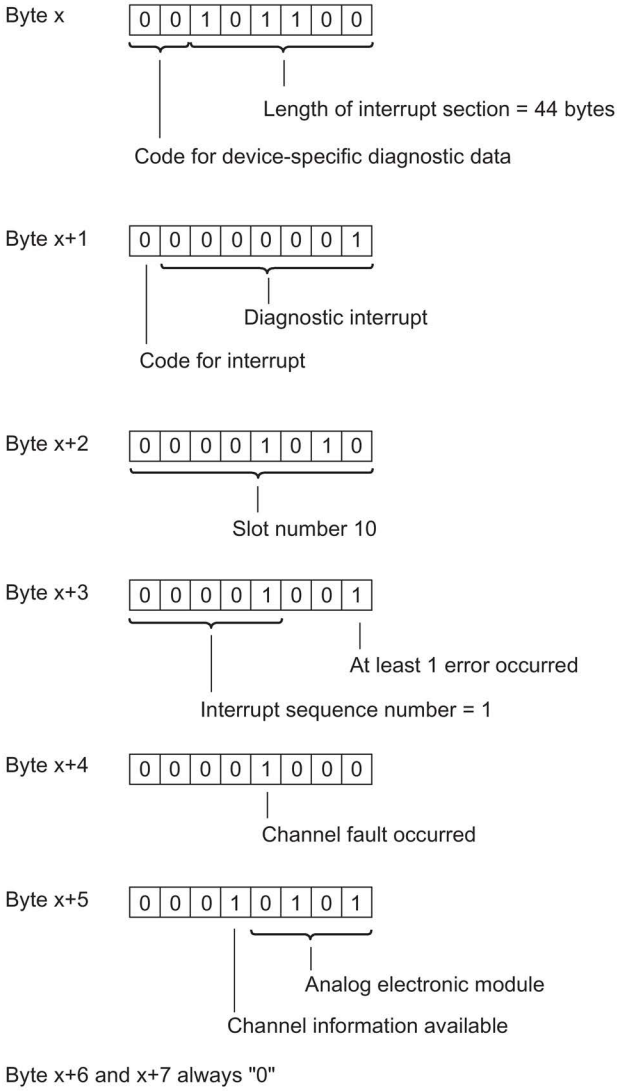


Figure 9-10 Example of a diagnostic interrupt

Example of a diagnostic interrupt (continued)

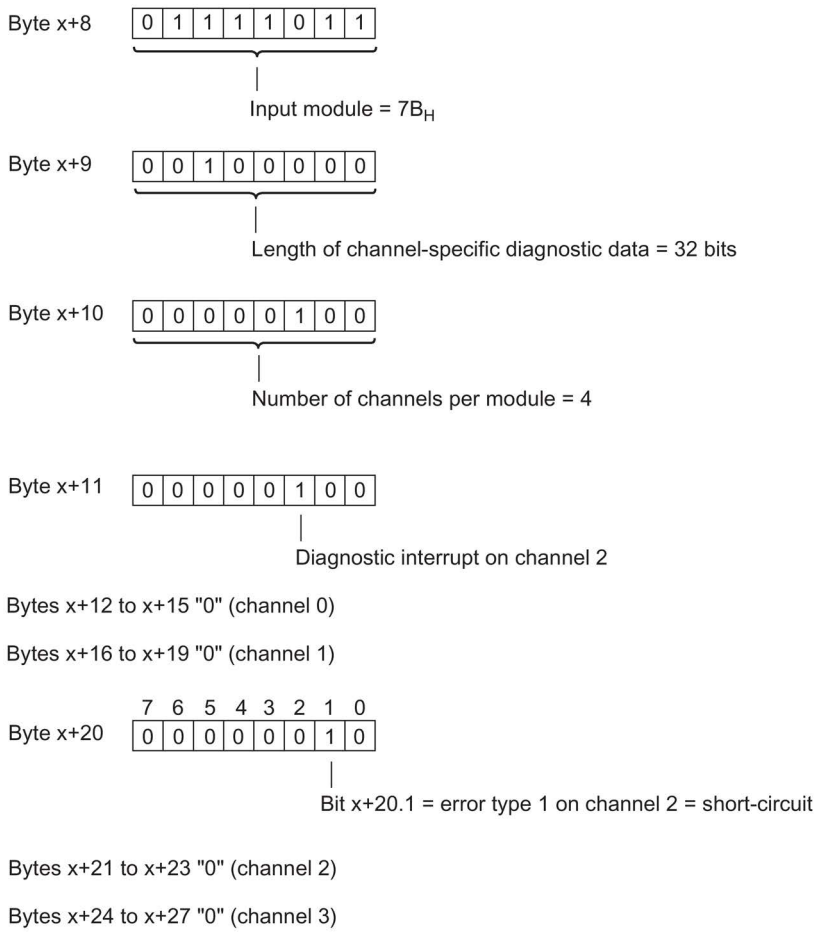


Figure 9-11 Example of a diagnostic interrupt (continued)

9.1.13.4 Process interrupt of digital input modules

Process interrupt of digital electronic module 8 DI DC 24V High Feature

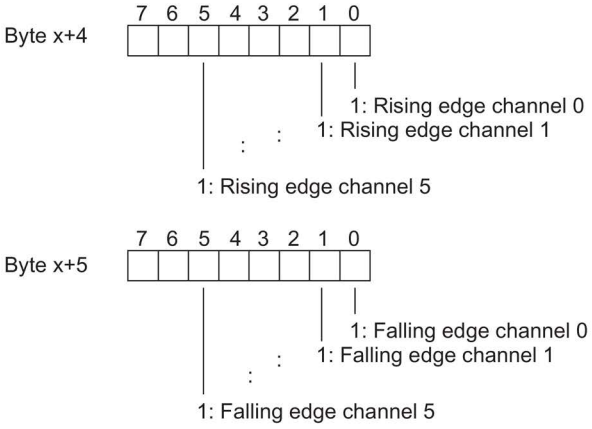


Figure 9-12 Structure as of byte x+4 for process interrupt (8 DI DC 24V High Feature)

9.1.13.5 Process interrupt of analog input modules

Process interrupt of analog input modules

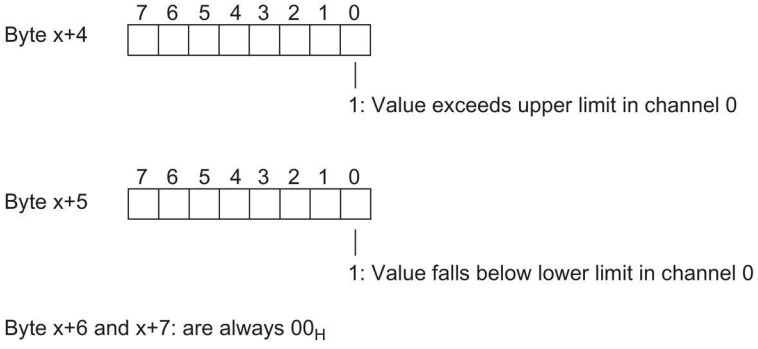


Figure 9-13 Structure as of byte x+4 for process interrupt (analog input)

See also

Structure of interrupts (Page 217)

9.1.14 Diagnostics of faulty configuration states of ET 200pro

Faulty configuration states

The following faulty configuration states of ET 200pro cause a station failure at the ET 200pro or prevent data exchange. The reactions are independent on the release of the IM parameter "Operation with preset <> actual configuration".

- Terminating module missing
- Number of modules exceeds maximum configuration
- Faulty backplane bus, e.g. defective bus module

Diagnostics

You can recognize all faulty configuration states based on the following diagnostic data:

Identifier-related diagnostic data	Module status
all bits of slots 1 to 17 are set	01_B: "Module fault, invalid user data" up to the slot that caused the failure
	11_B: "No module; invalid user data", starting at the slot that caused the failure

See also

Module status (Page 211)

9.1.15 DP slave failure

DP slave failure

DP slave failure means user data exchange will stop, that is, user data (inputs and outputs) will no longer be exchanged between DP master and DP slave.

Events

A DP slave failure can be triggered by the following events:

- DP master events: for example, when loading a new configuration, as a result of a connection interruption, or if a device is switched off
- DP slave events ("DP slave failure"): for example, incorrect expansion states (Page 223)

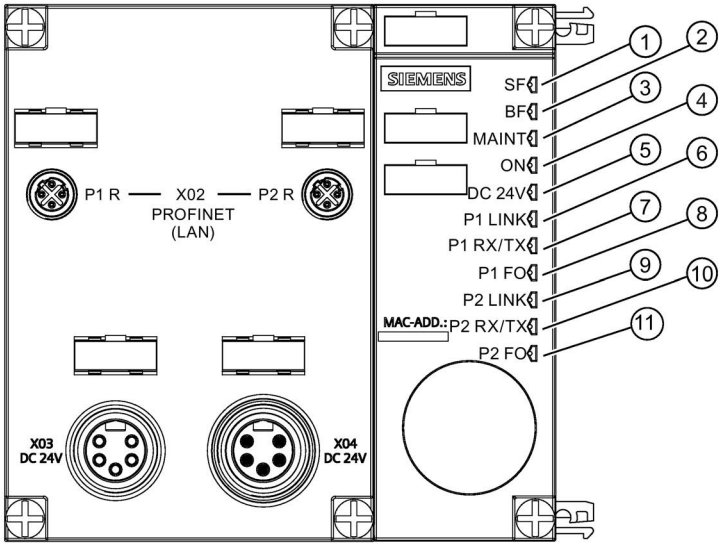
The DP slave still works and communicates, that is, it delivers diagnostics, reacts to I/O module events, and can process data records. The cause of the DP slave failure can be determined from the diagnostics.

9.2 PROFINET IO

9.2.1 LED display on the IM 154-4 PN High Feature interface module (6ES7154-4AB10-0AB0)

LED display

The figure below shows the position and layout of the LED display on the IM 154-4 PN High Feature interface module (6ES7154-4AB10-0AB0) with the CM IM PN M12, 7/8" connection module:



① GE: Group error (red LED)
② BF: Bus monitoring (red LED)
③ MAINT: Maintenance information (yellow)
④ ON: Electronic/encoder supply 1L+ (green LED)
⑤ 24 V DC: Load voltage supply 2L+ (green LED)
⑥ P1 LINK: Connection to a switch or controller (green LED) on port 1
⑦ P1 RX/TX: Data exchange (yellow LED) on port 1
⑧ P1 FO: Status of the FO path (yellow LED) on port 1
⑨ P2 LINK: Connection to a switch or controller (green LED) on port 2
⑩ P2 RX/TX: Data exchange (yellow LED) on port 2
⑪ P2 FO: Status of the FO path (yellow LED) on port 2

Status and error displays GE, BF, ON, LINK, RX/TX, FO

Table 9- 3 Status and error displays of IM 154-4 PN High Feature

LEDs			Meaning	Remedy
GE	BF	ON		
Off	Off	On	IO device is currently exchanging data with the IO controller without errors. The interface module is supplied with power (electronic/encoder).	-
Off	Off	Off	Electronic/encoder supply missing or too low at the interface module.	Switch on the electronic/encoder power supply for the IO device.
			Defective hardware.	Replace the interface module.
*	Flashing	On	Incorrect or no connect frame - no data exchange is occurring between the IO controller and the interface module (IO device). Causes: • Incorrect device name • Configuration error • Parameter assignment error	• Check the interface module. • Check the configuration and parameterization. • Check the device name.
*	On	On	No IO controller on bus Causes: • No bus communication	• Connect to the IO controller. • Assign a valid device name to the interface module. • Check the bus configuration. • Check whether the M12 cable connectors are properly installed. • Check whether the bus cable to the IO controller is interrupted.
On	*	On	The preset configuration of ET 200pro does not match the actual ET 200pro configuration.	Check the ET 200pro configuration to see whether a module missing or defective, or whether a non-configured module is inserted. Check the configuration (using STEP 7, for example), and correct any parameter assignment errors.
			I/O module error or defective interface module. Incoming diagnostics	Replace the interface module, or contact your Siemens representative.
On	On	Off	FW update busy	-

Status and error displays GE, BF, ON, LINK, RX/TX, FO

Table 9- 4 Status and error displays of the IM 154-4 PN High Feature on port 1 (P1) and port 2 (P2)

LEDs			Meaning	Remedy
P1 LINK	P1 RX/TX	P1 FO		
Off	Off	*	No connection to the IO controller (no IO controller available on the network)	• Set uniform baud rate • Autonegotiation not successful
On	*	*	There is a connection to the IO controller. Correct operation	-
On	On	*	Transmission/reception is in progress	-
*	*	On	Maintenance demanded: Attenuation through the fiber-optic cable is so high that operation will soon no longer be possible.	Check the affected data transmission link for the following causes: • Damage to the fiber-optic cable • Correct installation of the PROFINET connector/PROFINET connections • Adherence to the max. length of 50 m for POF cables • Check that the FOC connector is firmly seated
*) not relevant				

LEDs			Meaning	Remedy
P2 LINK	P2 RX/TX	P2 FO		
For meaning, see LEDs on port 1 (P1)				

Maintenance information MAINT

Maintenance information can indicate a maintenance requirement or maintenance request. The MAINT LED lights up yellow when maintenance information from PROFINET is available (see Maintenance alarms (Page 228)). An alarm message is generated in addition to the LED display.

24 V DC status indicator

The green 24 V DC LED is lit when the 2L+ load voltage supply is connected. If the LED is not lit, check to see if the power supply is switched on and the fuse is functioning.

9.2.2 Diagnostic messages of the electronic modules

Actions after a diagnostic message

Actions initiated by diagnostic messages:

- The SF LED of the interface module is lit.
- There can be more than one diagnostic message at the same time.
- Diagnostic data are reported as diagnostic interrupts and can be read from data records.
- Incoming diagnostic messages are saved to the diagnostic buffer of the I/O controller.
- OB 82 is called. If OB 82 is not available, the I/O controller goes into STOP.
- Acknowledgment of the diagnostic interrupt to enable new interrupts.

9.2.3 Evaluating interrupts of ET 200pro

Introduction

The I/O device generates interrupts as a reaction to specific error events. Interrupts are evaluated based on the I/O controller used.

Evaluating interrupts with I/O controllers

The ET 200pro supports the following interrupts

- Diagnostic interrupts
- Process interrupts
- Swapping interrupts

An interrupt automatically initiates execution of interrupt OBs in the CPU of the IO controller (see *System Software for S7-300/S7-400* Programming Manual, under "Program design".

Information on the cause and class of the error is already available, based on the OB number and start information.

Detailed information on the error event can be obtained in the error OB using SFB 54 RALRM (read additional interrupt information).

Triggering of a diagnostic interrupt

When an event (e.g. wire break) comes or goes, the module triggers a diagnostic interrupt if "Enable: diagnostic interrupt" is set.

The CPU interrupts the user program and processes the diagnostics block OB 82. The interrupt triggering event is logged in the start information of OB 82.

Triggering a process interrupt

If there is a process interrupt, the CPU interrupts user program execution and processes the process interrupt block OB 40. The result that triggered the interrupt is added to the start information of OB 40.

Note

Process interrupts should not be used for technological purposes (cyclic generation of process interrupts, for example), because these can become lost in the overall system.

Triggering a swapping interrupt

The CPU interrupts the user program and processes the diagnostics block OB 83. The interrupt triggering event is logged in the start information of OB 83.

9.2.4 Maintenance alarms

Introduction

The PROFINET interfaces of IM154-4 PN High Feature (6ES7154-4AB10-0AB0) support the diagnostic and maintenance concepts in PROFINET in accordance with IEC 61158-6-10. The goal is early detection and correction of potential errors.

Maintenance interrupts with CM IM PN PP Cu connection module

The IM154-4 PN High Feature signals a maintenance interrupt to the higher-level diagnostics unit when the following event occurs:

Maintenance interrupts	Cause	Message/Meaning	LED
Maintenance demanded	Loss of synchronization	• No synchronization message frame received. After parameter assignment or during operation, the sync master did not receive a synchronization message frame within the timeout period. • Successive synchronization message frames lie outside the permitted limits (jitter).	MAINT lights up

System alarms in *STEP 7*

The maintenance information is generated in *STEP 7* with the following system alarms:

- Maintenance required, identified by a yellow wrench per port.

Maintenance interrupts with CM IM PN PP FO connection module

For the IM154-4 PN High Feature, maintenance alarms signal to the user when a fiber-optic cable must be checked or replaced. This depends on the increase of the attenuation value at the PROFINET interface.

The IM154-4 PN High Feature signals the following to the higher-level diagnostics unit:

Maintenance alarms	Cause (limit values)	Message/Meaning	LEDs
Level 1: Maintenance required	After a system reserve of 2 dB[1]	The affected transmission link must be checked. There remains a foreseeable period for replacing the fiber-optic cable before a total failure occurs.	FO LED does not light up
Level 2: Maintenance demanded	After a system reserve of 0 dB	The affected fiber-optic cable must be immediately replaced to prevent total failure of the PROFINET devices.	FO-LED is lit

[1] These diagnostic messages are deleted automatically after 1 second.

Limit values

- The following limit values apply to POF cables (Polymer Optical Fiber cables):
  - Maintenance required: 2 dB
  - Maintenance demanded: 0 dB

System alarms in *STEP 7*

The maintenance information is generated in *STEP 7* with the following system alarms:

- Maintenance required, identified by a yellow wrench per port.
- Maintenance demanded, identified by an orange wrench per port.

9.2.5 Diagnostics in STEP 7

9.2.5.1 Reading out the diagnostic data

Options for reading out diagnostic data

Table 9- 5 Reading out the diagnostic data with STEP 7

Automation system with IO controller	Block or tab in *STEP 7*	Application	See ...
SIMATIC S7	e.g. in HW Config via "Station > Open ONLINE"	Device diagnostics in form of plain text on STEP 7 interface (in the Quick View, Diagnostics View, or Module Information windows)	"Diagnosing hardware" in *STEP 7 online help*
	SFB 52 "RDREC"	Reading data records from the IO device	For SFBs, refer to *STEP 7 online help* (system functions/system function blocks)
	SFB 54 "RALRM"	Receiving interrupts from the IO device	For SFBs, refer to *STEP 7 online help* (system functions/system function blocks)

9.2.5.2 Channel diagnostics

Additional information on the data records for PROFINET IO

Information about the structure of diagnostic data records and programming examples are available in the From PROFIBUS DP to PROFINET IO (http://support.automation.siemens.com/WW/view/en/19289930) Programming Manual.

Structure of the manufacturer-specific diagnostic data records

The structure of the diagnostic data records is differentiated by the BlockVersion. The following BlockVersion applies to the IM 154-4 PN High Feature interface module:

IM 154-4 PN High Feature interface module	BlockVersion
6ES7154-4AB10-0AB0	W#16#0101

Manufacturer-specific diagnostics in the User Structure Identifier (USI)

For the IM 154-4 PN High Feature interface module, the following manufacturer-specific diagnostics in the USI are signaled.

- Interruption of the ET 200pro backplane bus: USI = W#16#0001
- Incorrect module combination: USI = W#16#0002

USI structure = W#16#0001

Table 9- 6 Structure of USI = W#16#0001

Data block name		Contents	Remark	Bytes
USI		W#16#0001	Manufacturer-specific diagnostics for interruption of the ET 200pro backplane bus	2
3 reserved bytes follow				
	Reserved			1
	Reserved			1
	Reserved			1
Then the slot number where the backplane bus interruption begins.				
	Slot number	B#16#00 to B#16#11		1

Structure USI = W#16#0002

Table 9- 7 Structure of USI = W#16#0002

Data block name		Contents	Remark	Bytes
USI		W#16#0002	Manufacturer-specific diagnostics for incorrect module combinations	2
The slot number at which the incorrect combination was configured.				
	Slot number	B#16#00 to B#16#11		1

See also

Error types for electronic modules (Page 232)

9.2.5.3 Error types for electronic modules

Error types and remedies

The table below shows the error types for electronic modules.

Table 9- 8 Error types for electronic modules

Error type		Error text	Meaning	Remedy
00001_B	1_D	Short-circuit	• Short-circuit to M potential at encoder line • Short-circuit to M potential at output line • Short-circuit to P potential or ground at output line • Load impedance too low	• Correct the process wiring • Check encoder or actuator
00110_B	6_D	Cable break	• Signal line to encoder or actuator interrupted • Defective encoder or actuator • Load impedance too high	• Correct the process wiring • Replace the encoder or actuator • Use an encoder with higher impedance • Use an actuator with lower load
00111_B	7_D	Violation of upper limit	The value is above the overrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01000_B	8_D	Violation of lower limit	The value is below the underrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01001_B	9_D	Error	Internal module error (diagnostic message on channel 0 applies to the entire module)	Replace the module
			Short circuit to M. The electronic/encoder supply is short-circuited to M potential (only for the PM-O DC 2x24V outgoing module)	Correct the process wiring
10000_B	16_D	Parameter assignment error	Module not parameterized	Correct the parameters
10001_B	17_D	Encoder voltage or load voltage is missing	• Supply voltages missing or too low • Load voltage supply missing or too low	• Check the supply voltages • Check the load voltage supply • Correct the process wiring
10101_B	21_D	Reference channel error	Measuring line for compensation interrupted	Correct the process wiring
			Data record DS2 incorrect	Check data record DS2
			Timeout for "Dynamic ref. temp."	Send DS2
10110_B	22_D	Process interrupt lost	ET 200pro failed to detect a process interrupt	Correction or coordination of the program, process, module
11010_B	26_B	External error	Error at encoder circuit	Correct the process wiring

See also

Channel-specific diagnostic data (Page 212)

Channel diagnostics (Page 230)

9.2.5.4 Interruption of the ET 200pro backplane bus

Separate diagnostics for bus interruption: USI = W#16#0001

If the ET 200pro does not start up, the causes can include:

- One or several missing modules
- Terminating module missing
- Number of modules exceeds maximum configuration
- Backplane bus fault (for example, defective bus module)

If the data exchange is interrupted, the causes can include:

- At least two modules (compared to a missing module, this is no longer a gap, but rather a loose backplane bus)
- Terminating module missing
- Backplane bus fault (for example, defective bus module)

ET 200pro backplane bus interruptions do not trigger an interrupt.
You can read this information with STEP 7 in SIMATIC Manager via "Accessible nodes" in the "Module information" window. This requires that the programming device is available in the PROFINET subnet. The information is displayed in text format.

See also

Identifier-related diagnostic data (Page 210)

Module status (Page 211)

9.2.5.5 Incorrect module combination

Incorrect module combination (packing): USI = W#16#0002

The module in the slot of ET 200pro is invalid in the event of the following configuration errors:

- The module combination was started with a module designation containing "*".
- A module designation with "*" was selected more than once ("*" "*")

9.2.5.6 Diagnostics of faulty configuration states of ET 200pro on PROFINET IO

Faulty configuration states

The following incorrect configuration states of the ET 200pro lead to the failure of the ET 200pro IO device, or prevent data exchange.

- Terminating module missing
- Number of modules exceeds maximum configuration
- Faulty backplane bus, e.g. defective bus module

Note

If one module is missing (gap) and the ET 200pro is powered on, the startup of the IO device will fail.

9.2.5.7 Failure of the load voltage from the power module

Load voltage failure

Reaction of the digital electronic modules with outputs to failure of the 2L+ load voltage supply:

- The electronic modules do not fail.
- The outputs are no longer supplied.
- A diagnostics event is generated if the **missing load voltage L+** diagnostics is enabled at the electronic module 4 DO DC 24V/2.0A High Feature.

9.2.5.8 STOP of the IO controller and recovery of the IO device

Diagnostics events triggered by a STOP of the IO controller

Diagnostics frames received from the IO device while the IO controller is in STOP do not initiate a call of any corresponding OBs when the IO controller goes into RUN. To obtain an overview of the device state, call OB 100.

Diagnostics after recovery of the IO device

After the recovery of an IO device, call SFB 52 to read data record $E00C_H$. This record contains all diagnostic data for the slots assigned to an IO controller in a device.

9.3 LED display on the power, electronic and pneumatic interface modules

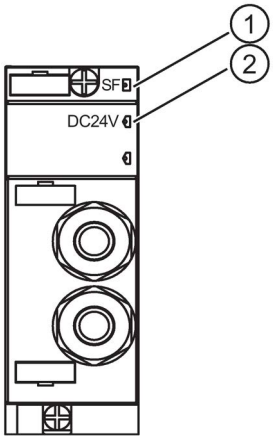
9.3.1 LED display on the PM-E power module

Introduction

The LED display (2 LEDs) resides on the front panel of the power module.

LED display

The figure below shows the layout of the LED display of the PM-E DC 24V power module:



① SF: Group error, red LED
② DC24V: Load voltage supply 2L+ (green LED)

Status and error displays SF, DC24V

Table 9- 9 Status and error displays of PM-E DC 24V

LEDs		Meaning	To correct or avoid errors
SF	DC24V		
*	on	Load voltage 2L+ present at the power module.	---
On	*	Load voltage 2L+ missing at the power module.	Switch on the load voltage 2L+. Check the fuse.
* irrelevant			

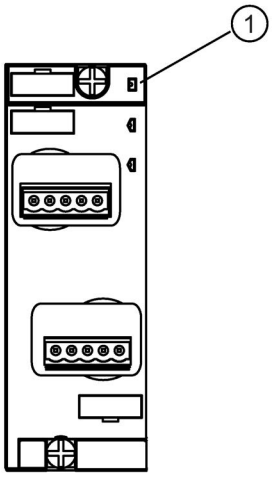
9.3.2 LED displays on the PM-O outgoing module

Introduction

The LED display (1 LED) is on the front panel of the outgoing module.

LED display

The figure below shows the position and layout of the LED display of the PM-O DC 2x24V outgoing module.



① GE: Group error (red LED)

GE error LED

Table 9- 10 Error display on the PM-O DC 2x24V outgoing module

GE LED	Meaning	Remedy
On	1L+ electronic/encoder supply is short-circuited	Check the interconnection for a short circuit.

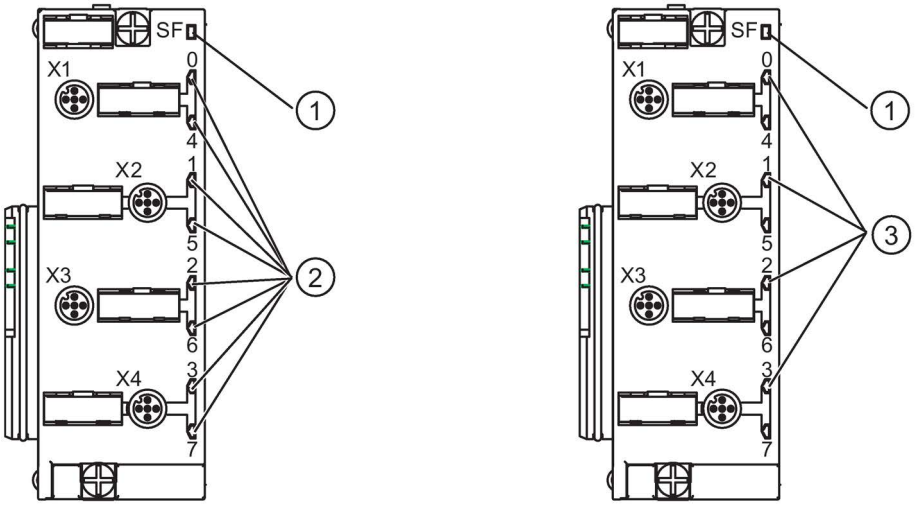
9.3.3 LED display at the electronic module

Introduction

The LED display for the electronic module is on the front panel of the connection modules.

LED display for electronic modules with connection module CM IO 4 x M12 and CM IO 4 x M12P

The figure below shows the position and layout of the LED display on the CM IO 4 x M12 and CM IO 4 x M12P connection modules.



① GE: Group error (red LED)

② Status indicator of 8-channel digital electronic modules (green LEDs)

Status error/channel fault indicator for 8-channel digital High Feature electronic modules (green/red LEDs)

2 inputs/outputs per circular socket connector; both LED displays are used.

③ Status indicator of 4-channel digital electronic modules (green LEDs)

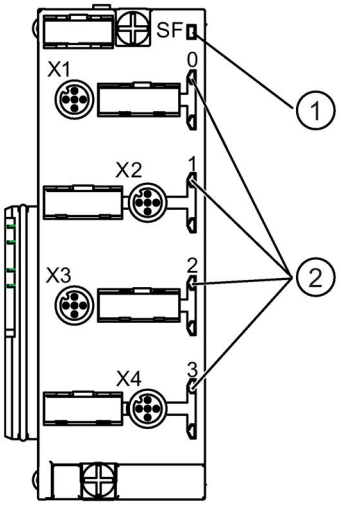
Status error/channel fault indicator for 8-channel digital High Feature electronic modules (green/red LEDs)

Channel fault display of 4-channel analog electronic modules (red LEDs)

1 input/output per circular socket; the top LED display is used.

LED display for electronic modules with the CM IO 4 x M12 Inverse connection module

The figure below shows the position and layout of the LED display on the CM IO 4 x M12 Inverse connection module.



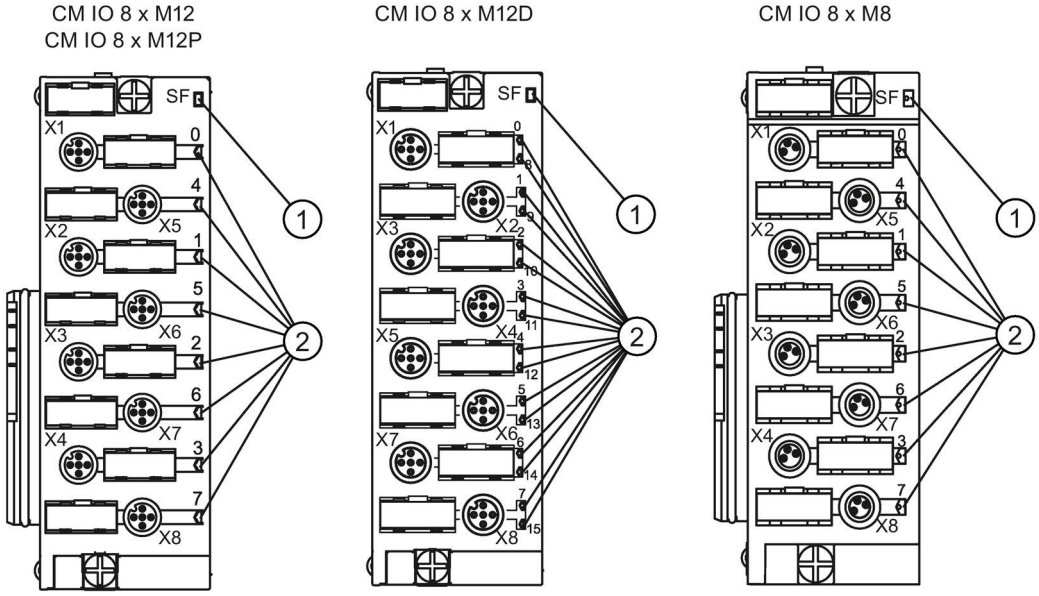
① GE: Group error (red LED)

② Status indicator of 4-channel digital electronic modules (green LEDs)

Status error/channel fault indicator for 4-channel digital High Feature electronic modules (green/red LEDs)

LED display for electronic modules with connection module CM IO 8 x M12, CM IO 8 x M12P, CM IO 8 x M12D, and CM IO 8 x M8

The figure below shows the position and layout of the LED display on the CM IO 8 x M12, CM IO 8 x M12P, CM IO 8 x M12D and CM IO 8 x M8 connection modules.



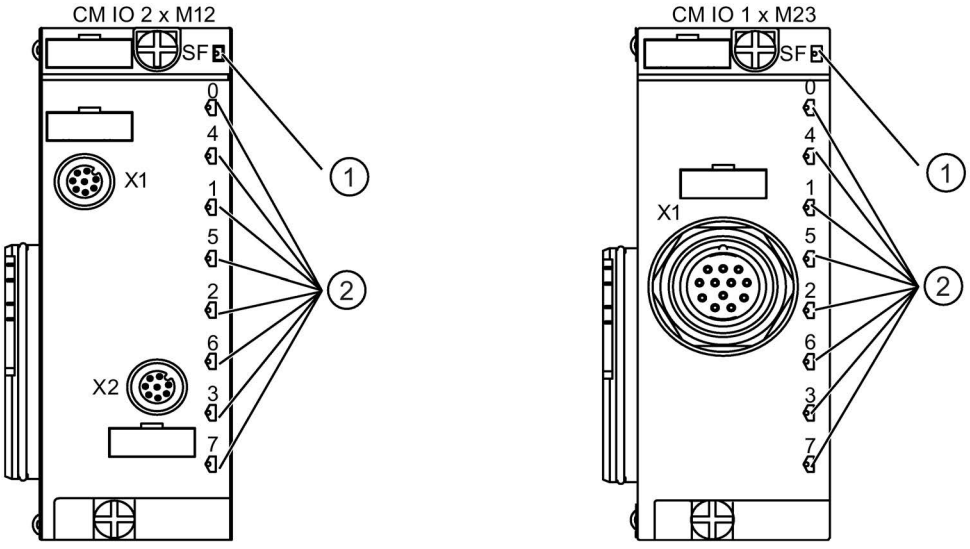
① GE: Group error (red LED)

② Status indicator of digital electronic modules (green LEDs)

Status error/channel fault indicator for digital High Feature electronic modules (green/red LEDs)

LED display for electronic modules with connection module CM IO 2 x M12 and CM IO 1 x M23

The figure below shows the position and layout of the LED display on the CM IO 2 x M12 and CM IO 1 x M23 connection modules.



① GE: Group error (red LED)

② Status indicator of 8-channel digital electronic modules (green LEDs)
1 input/output per channel.

Figure 9-14 LED display on the connection module CM IO 2 x M12 and CM IO 1 x 23

Status and error LEDs for the digital electronic modules with the CM IO 4 x M12, CM IO 4 x M12P, CM IO 4 x M12 Inverse, CM IO 8 x M12, CM IO 8 x M12P, CM IO 8 x M12D, CM IO 8 x M8, CM IO 2 x M12 and CM IO 1 x M23 connection modules

Table 9- 11 Status and error displays with the digital electronic modules with the connection modules

LEDs		Meaning	Remedy
GE	Status and error displays		
On	---	Incoming diagnostic alarm	Analyze the diagnostic data.
		No parameters or faulty parameters	Check the parameter settings.
		8 DI DC 24V, 16 DI DC 24V:	
On	---	Short-circuit at the encoder supply 1L+	Check the wiring.
		4 DO DC 24V/2.0A, 8 DO DC 24V/0.5A:	
On	---	Short-circuit at the outputs	Check the wiring.
		4 DI / 4 DO DC 24V/0.5A:	
On	---	Short-circuit	Check the wiring of the encoder supply or the outputs.
Off	On (green LED)	Input/output at channel X1, X2, X3, X4, X5, X6, X7 or X8 enabled	---
		4 DI / 4 DO DC 24V/0.5A:	
Off	On (green LED)	Input on channel X1, X2, X3 or X4 activated	
		Output on channel X5, X6, X7 or X8 activated	---
		8 DI DC 24V High Feature:	
On	On (red LED)	Short-circuit at the encoder supply 1L+	Check the wiring.
		Sensor signal line interrupted	Check the wiring and the sensors.
		4 DO DC 24V/2.0A High Feature:	
On	On (red LED)	Short-circuit at the outputs	Check the wiring.
		Load signal line interrupted	Check the wiring and the load.
		4 DIO / 4 DO DC 24V/0.5A:	
On	---	Incoming diagnostic alarm	Analyze the diagnostic data.
		No parameters or faulty parameters	Check the parameter settings.
		Short-circuit at the encoder supply 1L+	Check the wiring.
		Short-circuit at the outputs	Check the wiring.
Off	On (green LED)	Input/output enabled at channel X1, X2, X3, or X4	---
		Output enabled at channel X5, X6, X7, or X8	

Note

LEDs

The following applies to the digital electronic module 4 DI / 4 DO DC 24V/0.5A:

The inputs DI_0 to DI_3 are displayed with the LEDs 0 to 3 and the outputs DQ_0 to DQ_3 are displayed with the LEDs 4 to 7.

Status and error LEDs of analog electronic modules with CM IO 4 x M12 connection module

Table 9- 12 Status and error displays of analog electronic modules with CM IO 4 x M12 connection module

LEDs		Meaning	Remedy
GE	Status and error displays		
On	---	Incoming diagnostic alarm	Analyze the diagnostic data.
		No parameters or faulty parameters	Check the parameter settings.
		Short-circuit at the encoder supply 1L+	Check the wiring.
		Channel fault occurred	---
On	On (red LED)	Channel fault at the input/output of channel X1, X2, X3 or X4	---

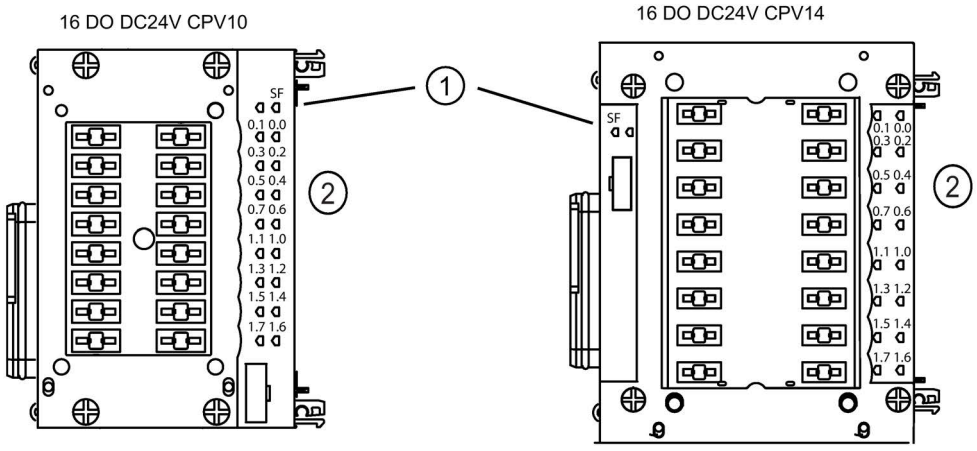
9.3.4 LED display on the electronic interface module

Introduction

The LED display for the pneumatic interface module is on the right side of the front panel.

LED display for the 16 DO 24 V DC CPV10 and 16 DO DC 24V CPV14 pneumatic interface modules

The figure below shows the position and layout of the LED display of the 16 DO DC 24V CPV10 and 16 DO DC 24V CPV14 pneumatic interface modules.



① GE: Group error (red LED)
② Status display (green LEDs)

Status and error LEDs of the pneumatic interface modules

Table 9- 13 Status and error displays of the pneumatic interface modules

LEDs		Meaning	Remedy
SF	Status and error displays		
On	---	Incoming diagnostic message	Analyze the diagnostic data.
		No parameters or faulty parameters	Check the parameter settings.
Off	On (green LED)	Valve 0.0 (OUT0) to 1.7 (OUT15) enabled	---

General technical data

10

10.1 Standards and approvals

Introduction

Contents of general technical specifications:

- The standards and test values which the ET 200pro distributed I/O system complies with and satisfies.
- The test criteria used to test the ET 200pro distributed I/O system.

Note

Information on the nameplate

You will find the current markings and approvals on the nameplate of the respective product.

CE approval

CE

The ET 200pro distributed I/O system meets the requirements and protective objectives of the following EC directives, and satisfies the Harmonized European Standards (EN) for Programmable Logic Controllers which were published in the official pamphlets of the European Community:

- 2006/95/EC "Electrical Equipment Designed for Use within Certain Voltage Limits" (Low-Voltage Directive)
- 2004/108/EC "Electromagnetic Compatibility Directive" (EMC Directive)

The EC Declarations of Conformity are made available to the relevant authorities at the following address:

Siemens AG
Digital Factory

Factory Automation
DF FA AS DH AMB
Postfach 1963
D-92209 Amberg, Germany

These files are also available for download on the Customer Support Internet pages, keyword "Declaration of Conformity".

Approval



Underwriters Laboratories Inc. acc. to

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)

Note

For the pneumatic interface module, no cULus approval has been applied for.

NEMA classification of ET 200pro (for the US market)

The ET 200pro distributed I/O system conforms to the NEMA classification: Enclosure rating type: 4X indoor use only.

Marking for Australia and New Zealand



The ET 200pro distributed I/O system satisfies the requirements of the AS/NZS CISPR 16 standard.

IEC 61131

The ET 200pro distributed I/O system satisfies the requirements and criteria of IEC 61131-2 (Programmable Logic Controllers, Part 2: Equipment Requirements and Tests).

PROFIBUS standard

The ET 200pro distributed I/O system is based on the standard IEC 61784-1: 2010 Ed3 CP 3/1.

Use in industrial environments

SIMATIC products are designed for use in industrial applications.

Area of application	Interference emission requirement	Interference immunity requirement
Industry	EN 61000-6-4: 2007	EN 61000-6-2: 2005

Use in residential areas

Note

The ET 200pro distributed I/O system is intended for use in industrial environments; when used in residential areas, it can affect radio/television reception.

If you use the ET 200pro in residential areas, you must ensure observance of the Class B radio interference limit in accordance with EN 55011 regarding the emission of radio interferences.

Suitable measures for achieving the required Class B radio interference level include, for example:

- Installation of ET 200pro in grounded control cabinets/control boxes.
- Use of filters in the supply lines.

10.2 Electromagnetic compatibility

Definition

Electromagnetic compatibility refers to the capability of electrical equipment of reliably performing its dedicated function in an electromagnetic environment, without causing interference in the same environment.

The ET 200pro distributed I/O system meets all requirements of EMC legislation for the European market. This requires that the ET 200pro distributed I/O system complies with the requirements and guidelines for electrical installation.

Pulse-shaped interference

The following table shows the electromagnetic compatibility of the ET 200pro distributed I/O system relative to pulse-shaped interference.

Pulse-shaped interference	Tested with	Corresponds to degree of severity
Electrostatic discharge according to IEC 61000-4-2.	8 kV 6 kV	3 (air discharge) 3 (contact discharge)
Burst pulses (high-speed transient interference) according to IEC 61000-4-4.	2 kV (supply line) 2 kV (signal line)	3 3
High-energy single pulse (surge) according to IEC 61000-4-5 Only with lightning protection elements (see DP master manual and description of SIMATIC NET PROFIBUS networks)		3
• Asymmetric coupling	2 kV (supply line) 2 kV (signal/data line)	
• Symmetric coupling	1 kV (supply line) 1 kV (signal/data line)	

Sinusoidal interference

The table below shows the electromagnetic compatibility of the ET 200pro Distributed I/O Device with respect to sinusoidal interference.

HF interference according to IEC 61000-4-3 Electromagnetic HF field Amplitude modulated	HF coupling according to IEC 61000-4-6
80 to 1000 MHz; 1.4 to 2 GHz	0.15 to 80 MHz
10 V/m 80% AM (1 kHz)	10 V_{rms} unmodulated
2 to 2.7 GHz	80% AM (1 kHz)
1 V/m at 80% AM (1 kHz)	150 Ω source impedance

Emission of radio interference

Interference emission of electromagnetic fields in accordance with EN 55016: Limit Value Class A, Group 1 (measured at a distance of 10 m).

Frequency	Emitted interference
from 30 to 230 MHz	< 40 dB (µV/m)Q
from 230 to 1000 MHz	< 47 dB (µV/m)Q

10.3 Shipping and storage conditions

Shipping and storage conditions

The ET 200pro distributed I/O system surpasses the IEC 61131-2 requirements for shipping and storage conditions. The specifications below apply to modules that are transported and stored in their original packaging.

Type of condition	Permissible range
Free fall	≤ 1 m
Temperature	–40 °C to +70 °C
Temperature change	20 K/h
Barometric pressure	1080 hPa to 660 hPa (corresponds to an altitude of 1000 m to 3500 m)
Relative humidity	5% to 95%, without condensation

10.4 Mechanical and climatic environmental conditions

Climatic environmental conditions

The following climatic environmental conditions apply (indoor use only):

Environmental requirements	Areas of application	Remarks
Temperature	0° C to 55° C *	All mounting positions
Temperature change	10 K/h	-
Relative humidity	5% to 100%	with condensation
Barometric pressure	1080 hPa to 795 hPa	Corresponds to an altitude of -1000 m to 2000 m
Concentration of pollutants	SO_2: <0.5 ppm; RH < 60 %, no condensation H_2S: <0.1 ppm; RH < 60 %, no condensation	-
* The FESTO CPV10 and CPV14 valve terminals deviate from the specified operating temperature range of 0 to 55° C. For the temperature operating range of FESTO valve terminals, refer to the corresponding FESTO Operating Manuals.		

Modules for use in the -25° C to 55° C temperature range

The following modules support operation in the -25° C to 55° C temperature range (indoor use only):

Designation	Order number
IM 154-1 DP with terminating module	6ES7154-1AA01-0AB0
IM 154-2 DP High Feature with terminating module	6ES7154-2AA01-0AB0
IM 154-4 PN High Feature with terminating module	6ES7154-4AB10-0AB0
PM-E DC 24V	6ES7148-4CA00-0AA0
PM-O DC 2x24V	6ES7148-4CA60-0AA0
CM IM DP Direct	6ES7194-4AC00-0AA0
CM IM DP ECOFAST Cu	6ES7194-4AA00-0AA0
CM IM DP M12, 7/8"	6ES7194-4AD00-0AA0
CM IM PN M12, 7/8"	6ES7194-4AJ00-0AA0
CM IM PN PP Cu	6ES7194-4AF00-0AA0
CM IM PN PP FO	6ES7194-4AG00-0AA0
CM PM Direct	6ES7194-4BC00-0AA0
CM PM ECOFAST	6ES7194-4BA00-0AA0
CM PM 7/8"	6ES7194-4BD00-0AA0
CM PM PP	6ES7194-4BE00-0AA0
CM PM-O PP	6ES7194-4BH00-0AA0
CM IO 4 x M12	6ES7194-4CA00-0AA0
CM IO 4 x M12P	6ES7194-4CA10-0AA0
CM IO 4 x M12 Inverse	6ES7194-4CA50-0AA0

Designation	Order number
CM IO 8 x M12	6ES7194-4CB00-0AA0
CM IO 8 x M12P	6ES7194-4CB10-0AA0
CM IO 8 x M12D	6ES7194-4CB50-0AA0
CM IO 8 x M8	6ES7194-4EB00-0AA0
CM IO 2 x M12	6ES7194-4FB00-0AA0
CM IO 1 x M23	6ES7194-4FA00-0AA0
8 DI DC 24V	6ES7141-4BF00-0AA0
16 DI DC 24V	6ES7141-4BH00-0AA0
4 DO DC 24V/2.0A	6ES7142-4BD00-0AA0
8 DO DC 24V/0.5A	6ES7142-4BF00-0AA0
8 DI DC 24V High Feature	6ES7141-4BF00-0AB0
4 DO DC 24V/2.0A High Feature	6ES7142-4BD00-0AB0
4 DI / 4 DO DC 24V/0.5A	6ES7143-4BF50-0AA0
4 DIO / 4 DO DC 24V/0.5A	6ES7143-4BF00-0AA0
4 AI U High Feature	6ES7144-4FF00-0AB0
4 AI I High Feature	6ES7144-4GF00-0AB0
4 AI RTD High Feature	6ES7144-4JF00-0AB0
4 AI TC High Feature	6ES7144-4PF00-0AB0
4 AO U High Feature	6ES7145-4FF00-0AB0
4 AO I High Feature	6ES7145-4GF00-0AB0

Mechanical environmental conditions

The table below shows the mechanical environmental conditions in the form of sinusoidal oscillation.

Modules	Frequency range	continuous	infrequent
Interface, electronic, and connection modules; Pneumatic interface modules with FESTO valve terminals	5 ≤ f ≤ 8 Hz	15 mm amplitude	-
	8 ≤ f ≤ 150 Hz	5 g constant acceleration	10 g constant acceleration

Testing mechanical environmental conditions

The table below provides information about the type and scope of mechanical environmental condition tests.

Condition tested	Test standard	Interface, electronic, and connection modules; Pneumatic interface modules with FESTO valve terminals
Vibrations	Vibration test according to IEC 60068-2-6	Type of vibration: Frequency sweeps with a rate of change of 1 octave/minute. 5 Hz ≤ f ≤ 12 Hz, constant amplitude 15 mm 12 Hz ≤ f ≤ 150 Hz, constant acceleration 10 g Duration of vibration: 10 frequency sweeps per axis in each of three perpendicular axes
Shock	Shock, tested according to IEC 60068-2-27	Type of shock: half-sine Shock intensity: 30 g peak value, 18 ms duration Direction of shock: 3 shock tests in +/- direction in each of the 3 perpendicular axes
Continuous shock	Shock, tested according to IEC 60068-29	Type of shock: half-sine Shock intensity: 25 g peak value, 6 ms duration Direction of shock: 1000 shock tests in +/- direction at each of the 3 perpendicular axes

10.5 Specifications for insulation tests, protection class, degree of protection, and rated voltage

Test voltage

The proof of dielectric strength is provided in a type test with the following test voltage according to IEC 61131-2:

Circuits with rated voltage V_e against other circuits or ground.	Test voltage
< 50 V	500 V DC
< 150 V	2500 V DC
< 250 V	4000 V DC

Pollution degree/overvoltage category according to IEC 61131-2

- Pollution degree 2
- Overvoltage category
  - At V_r = 24 V DC: II

Degree of protection IP65

Degree of protection according to IEC 60529

- Protection against the ingress of dust and full touch protection
- Water projected by a nozzle against the enclosure from any direction shall have no harmful effect.

Degrees of protection IP66 and IP67

Degree of protection according to IEC 60529

- Protection against the ingress of dust and full touch protection
- IP66: Water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities.
- IP67: Protection against water when enclosure is immersed at specified pressures over a specified time period (water must not enter the enclosure in any harmful amount)

Rated voltage for operation

The ET 200pro distributed I/O system operates at the following rated voltage and corresponding tolerance.

Rated voltage	Tolerance range
24 V DC	20.4 V DC to 28.8 V DC

Connection modules 11

11.1 Connection modules for interface modules with PROFIBUS DP

11.1.1 Connection module CM IM DP Direct for interface modules

Order number

6ES7194-4AC00-0AA0

Properties

Properties of the CM IM DP Direct connection module:

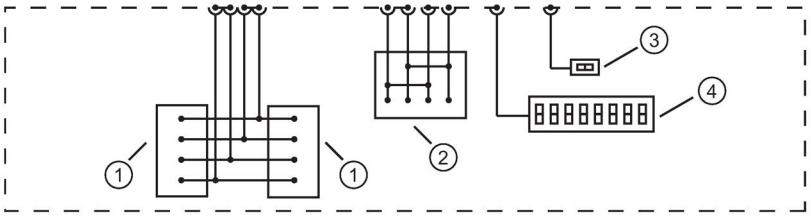
- Can be plugged in and attached with screws to the interface module
- The 1L+ and 2L+ supply voltages are connected via screw terminals, and PROFIBUS DP via insulation displacement terminals.
- You can loop through the power supplies and PROFIBUS DP using additional terminals.
- PROFIBUS DP address 1 to 125 can be set by means of a DIP switch
- Switched terminating resistor for PROFIBUS DP, set by means of DIP switch
- 6 labels

Pin assignment

For information on the pin assignment of CM IM DP Direct, refer to the section *Interface modules*.

Block diagram

The figure below shows the block diagram of the connection module CM IM DP Direct.



① Connections for the electronics/encoder supply and load voltage supply
② Connections for PROFIBUS DP
③ DIP switch for terminating resistor
④ DIP switch for setting the PROFIBUS DP address

Technical specifications

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	90 x 130 x 100
Weight	Approx. 290 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 16 A
• 2L+ load voltage supply	Max. 16 A

Note

Feed current

Maximum permissible load on the internal busbars of ET 200pro:

- At 1L+ 5 A
- At 2L+ 10 A

See also

IM 154-1 DP interface module (Page 291)

IM 154-2 DP High Feature interface module (Page 298)

11.1.2 CM IM DP ECOFAST Cu connection module for interface modules

Order number

6ES7194-4AA00-0AA0

Properties

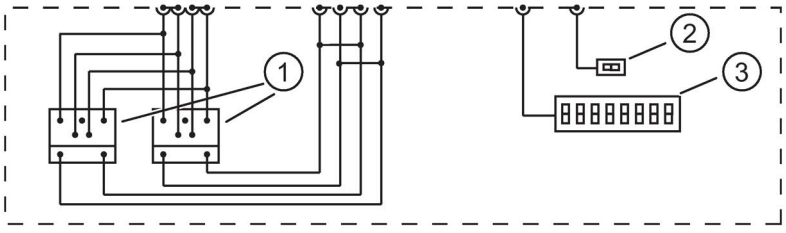
Properties of the CM IM DP ECOFAST Cu connection module:

- Can be plugged in and attached with screws to the interface module
- Connection of the 1L+ and 2L+ supply voltages and PROFIBUS DP using ECOFAST connectors.
- You can loop through the power supplies and PROFIBUS DP using an additional ECOFAST socket.
- PROFIBUS DP address 1 to 125 can be set by means of a DIP switch
- Switched terminating resistor for PROFIBUS DP, set by means of DIP switch
- 1 inscription label

Pin assignment

For information on the pin assignment of CM IM DP ECOFAST Cu, refer to the chapter Interface modules (Page 291).

Block diagram



① Connections for the ECOFAST connector: encoder/electronic/load voltage supply and PROFIBUS DP
② DIP switch for terminating resistor
③ DIP switch for setting the PROFIBUS DP address

Figure 11-1 Block diagram of CM IM DP ECOFAST Cu for interface modules

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 130 x 60
Weight	Approx. 200 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	10 A
• 2L+ load voltage supply	10 A

Note
Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 1L+ 5 A
- At 2L+ 10 A

See also

IM 154-1 DP interface module (Page 291)

IM 154-2 DP High Feature interface module (Page 298)

11.1.3 CM IM DP M12 connection module, 7/8" for interface modules

Order number

6ES7194-4AD00-0AA0

Properties

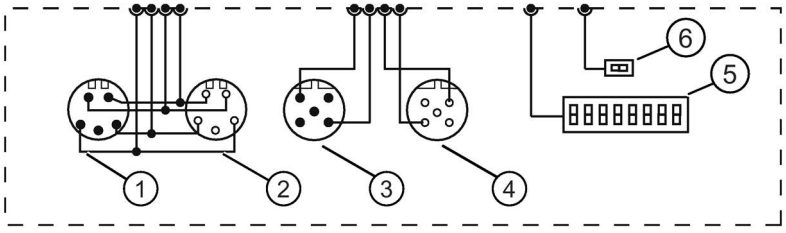
The CM IM DP M12, 7/8" connection module has the following properties:

- Can be plugged in and attached with screws to the interface module
- Connecting the 1L+ and 2L+ power supplies using 7/8" cable connectors
- Connecting PROFIBUS DP using M12 cable connectors
- The supply voltages and PROFIBUS DP can be looped through using additional sockets.
- PROFIBUS DP address 1 to 125 can be set by means of a DIP switch
- Switched terminating resistor for PROFIBUS DP, set by means of DIP switch
- 1 inscription label

Pin assignment

For details on the pin assignment of CM IM DP M12, 7/8", refer to the chapter Interface modules (Page 291).

Block diagram



① Connection for 7/8" cable connectors (with pin insert):
Feeding of encoder/electronic supply, load voltage supply

② Connection for 7/8" cable connectors (with socket insert):
Looping of encoder/electronic supply, load voltage supply

③ Connection for M12 cable connectors (with pin insert): Feeding of PROFIBUS DP

④ Connection for M12 cable connector (with socket insert): Looping through of PROFIBUS DP

⑤ DIP switch for terminating resistor

⑥ DIP switch for setting the PROFIBUS DP address

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 130 x 60
Weight	Approx. 240 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 8 A
• 2L+ load voltage supply	Max. 8 A

Note

Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 1L+ 5 A
- At 2L+ 10 A

See also

IM 154-1 DP interface module (Page 291)

IM 154-2 DP High Feature interface module (Page 298)

11.2 Connection modules for the interface module with PROFINET IO

11.2.1 CM IM PN M12, 7/8" connection module for interface modules

Order number

6ES7194-4AJ00-0AA0

Properties

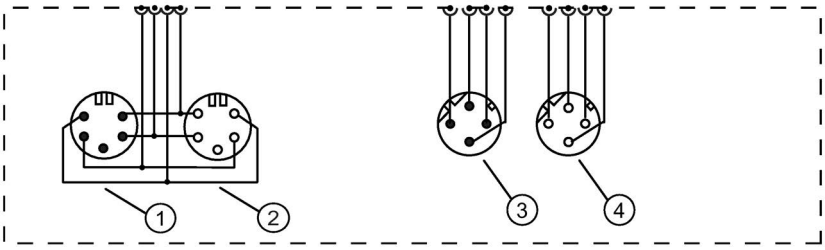
The CM IM PN M12, 7/8" connection module has the following properties:

- Can be plugged in and attached with screws to the IM 154-4 PN High Feature interface module
- Connecting the 1L+ and 2L+ power supplies using 7/8" cable connectors
- Connecting of PROFINET IO using M12 cable connectors
- The supply voltages and PROFINET IO can be looped through using additional sockets.
- 4 labels

Pin assignment

For details on the pin assignment of CM IM PN M12, 7/8", refer to the section *Interface modules*.

Block diagram



① Connection for 7/8" cable connectors (with pin insert): Feed for encoder/electronic supply, load voltage supply
② Connection for 7/8" cable connector (with socket insert): Forwarding of encoder/electronic supply, load voltage supply
③ Connection for M12 cable connector (with socket insert): Feed for PROFINET IO
④ Connection for M12 cable connector (with socket insert): Forwarding of PROFINET IO

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 x 130 x 51
Weight	Approx. 540 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 8 A
• 2L+ load voltage supply	Max. 8 A

Note

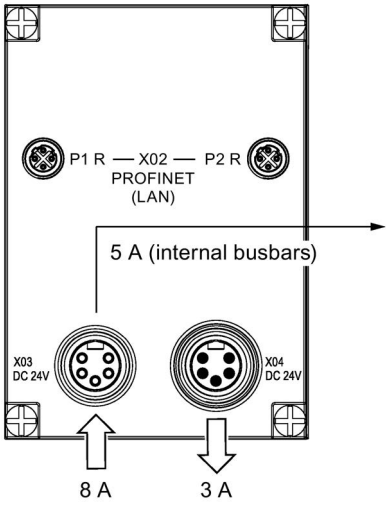
Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 1L+ 5 A
- At 2L+ 10 A

Example of splitting the feed current

- 8 A are fed in at the connection module of IM 154-4 PN High Feature for the 1L+ electronics/encoder supply.
- 5 A flow over the internal busbars for the 1L+ electronics/encoder supply.
- This leaves 3 A for looping the 1L+ electronics/encoder supply.



11.2.2 CM IM PN PP Cu connection module for interface module

Order number

6ES7194-4AF00-0AA0

Properties

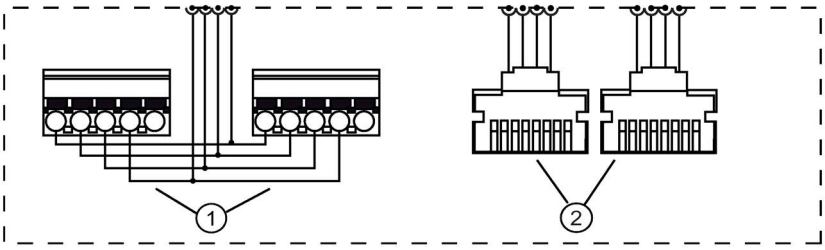
The CM IM PN PP Cu connection module has the following properties:

- Can be plugged in and attached with screws to the IM 154-4 PN High Feature interface module
- Connecting of 1L+ and 2L+ supply voltages using push-pull cable connectors
- Connecting of PROFINET IO using push-pull cable connectors (RJ45)
- The supply voltages and PROFINET IO can be looped through using additional push-pull sockets.
- 4 labels

Pin assignment

For information on the pin assignment of CM IM PN PP Cu, refer to the chapter *Interface modules*.

Block diagram



① Connections for push-pull cable connectors: Encoder/electronic supply, load voltage supply
② Connections for push-pull cable connectors: RJ45 for PROFINET IO

Figure 11-2 CM IM PN PP Cu connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 x 130 x 51
Weight	Approx. 325 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 16 A*, up to 40 °C ambient temperature Max. 8 A*, up to 55 °C ambient temperature
• 2L+ load voltage supply	Max. 16 A*, up to 40 °C ambient temperature Max. 8 A*, up to 55 °C ambient temperature
* Observe the permitted current carrying capacity of the cable.	

Note

Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 1L+ 5 A
- At 2L+ 10 A

11.2.3 CM IM PN PP FO connection module for interface modules

Order number

6ES7194-4AG00-0AA0

Properties

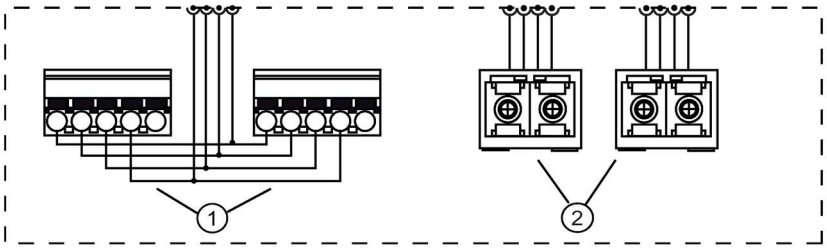
The CM IM PN PP FO connection module has the following properties:

- Can be plugged in and attached with screws to the interface module
- Connecting of 1L+ and 2L+ supply voltages using push-pull cable connectors
- Connecting of PROFINET IO using push-pull cable connectors for SC RJ (fiber-optic cable)
- The supply voltages and PROFINET IO can be looped through using additional sockets.
- 4 labels

Pin assignment

For information on the pin assignment of CM IM PN PP FO, refer to the section *Interface modules*.

Block diagram



① Connections for push-pull cable connectors: Encoder/electronic supply, load voltage supply
② Connections for push-pull cable connectors: SC RJ for PROFINET IO

Figure 11-3 CM IM PN PP FO connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 x 130 x 51
Weight	Approx. 325 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 16 A*, up to 40 °C ambient temperature Max. 8 A*, up to 55 °C ambient temperature
• 2L+ load voltage supply	Max. 16 A*, up to 40 °C ambient temperature Max. 8 A*, up to 55 °C ambient temperature
* Observe the permitted current carrying capacity of the cable.	

Note

Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 1L+ 5 A
- At 2L+ 10 A

Note

The CM IM PN PP FO connection module may only be pulled/plugged at zero voltage.

If you pull or plug the CM IM PN PP FO connection module under voltage, the module will not reach ready-to-operate status. In this case, briefly switch the voltage supply off and back on.

11.3 Connection modules for electronic modules

11.3.1 Connection module CM IO 4 x M12 for electronic modules

Order number

6ES7194-4CA00-0AA0

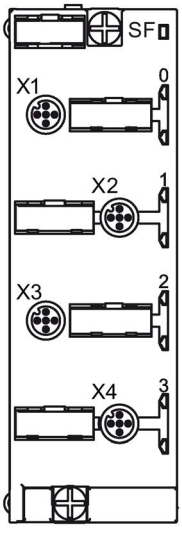
Properties

Properties of the connection module CM IO 4 x M12:

- Can be plugged in and attached with screws to the electronic module
- 4 M12 circular socket connectors
- 4 labels and 1 module tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector
	X3	3. M12 circular socket connector
	X4	4. M12 circular socket connector

Block diagram

The figure below shows the block diagram of the connection module CM IO 4 x M12.

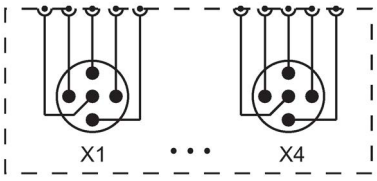


Figure 11-4 Block diagram, CM IO 4 x M12 connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 300 g

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)

Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 339)

Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 354)

Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)

Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

Analog electronic module 4 AI U High Feature (6ES7144-4FF00-0AB0) (Page 385)

Analog electronic module 4 AI I High Feature (6ES7144-4GF00-0AB0) (Page 390)

4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 401)

Analog electronic module 4 AI RTD High Feature (6ES7144-4JF00-0AB0) (Page 395)

Analog electronic module 4 AO U High Feature (6ES7145-4FF00-0AB0) (Page 407)

Analog electronic module 4 AO I High Feature (6ES7145-4GF00-0AB0) (Page 412)

11.3.2 CM IO 4 x M12P connection module for electronic modules

Order number

6ES7194-4CA10-0AA0

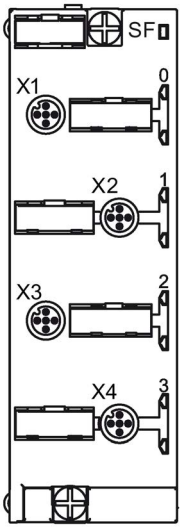
Properties

Properties of the CM IO 4 x M12P connection module:

- Can be plugged in and attached with screws to the electronic module
- 4 M12 circular socket connectors
- 4 labels and 1 module tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector
	X3	3. M12 circular socket connector
	X4	4. M12 circular socket connector

Block diagram

The figure below shows the block diagram of the connection module CM IO 4 x M12P.

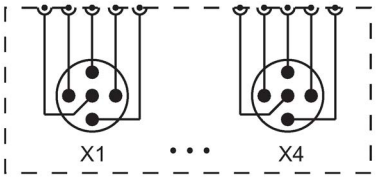


Figure 11-5 Block diagram, CM IO 4 x M12P connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 300 g

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)

Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 339)

Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 354)

Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)

Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

11.3.3 CM IO 4 x M12 Inverse connection module for electronic modules

Order number

6ES7194-4CA50-0AA0

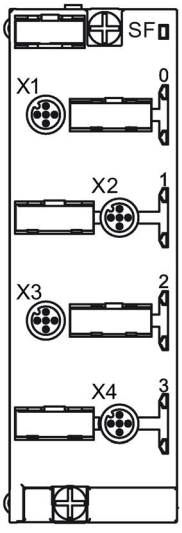
Properties

The CM IO 4 x M12 Inverse connection module has the following properties:

- Can be plugged in and attached with screws to the following electronic modules:
  - 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0)
  - 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0)
- 4 M12 circular socket connectors
- Double assignment of circular socket connectors X1, X3 for 4-channel electronic modules
- 4 labels and 1 module tag (circular socket connectors X1, X3 and the module tag are in white for purposes of identifying the double assignment)

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector
	X3	3. M12 circular socket connector
	X4	4. M12 circular socket connector

Block diagram

The figure below shows the block diagram of the CM IO 4 x M12 Inverse connection module.

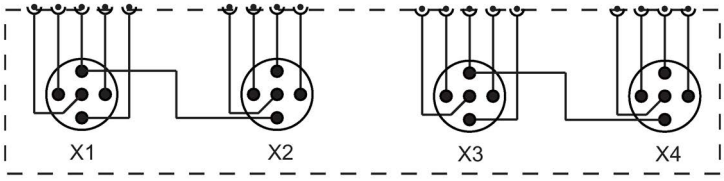


Figure 11-6 Block diagram of CM IO 4 x M12 Inverse connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 300 g

See also

Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 354)

11.3.4 CM IO 8 x M12 connection module for electronic modules

Order number

6ES7194-4CB00-0AA0

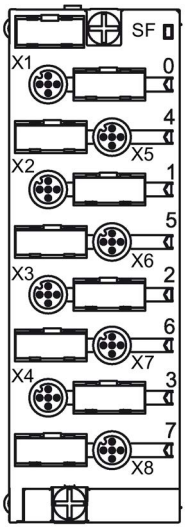
Properties

The CM IO 8 x M12 connection module has the following properties:

- Can be plugged in and attached with screws to the electronic module
- 8 M12 circular socket connectors
- 8 labels and 1 module identification tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector
	X3	3. M12 circular socket connector
	X4	4. M12 circular socket connector
	X5	5. M12 circular socket connector
	X6	6. M12 circular socket connector
	X7	7. M12 circular socket connector
	X8	8. M12 circular socket connector

Block diagram

The figure below shows the block diagram of the connection module CM IO 8 x M12.

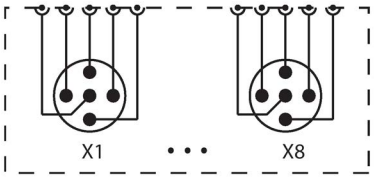


Figure 11-7 Block diagram, CM IO 8 x M12 connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 305 g

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 339)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

11.3.5 CM IO 8 x M12P connection module for electronic modules

Order number

6ES7194-4CB10-0AA0

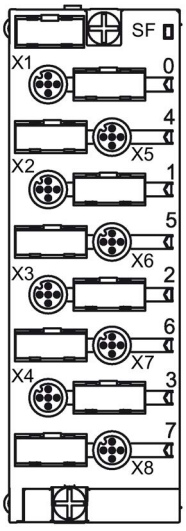
Properties

The CM IO 8 x M12P connection module has the following properties:

- Can be plugged in and attached with screws to the electronic module
- 8 M12 circular socket connectors
- 8 labels and 1 module identification tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector
	X3	3. M12 circular socket connector
	X4	4. M12 circular socket connector
	X5	5. M12 circular socket connector
	X6	6. M12 circular socket connector
	X7	7. M12 circular socket connector
	X8	8. M12 circular socket connector

Block diagram

The figure below shows the block diagram of the connection module CM IO 8 x M12P.

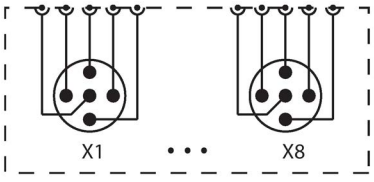


Figure 11-8 Block diagram, CM IO 8 x M12P connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 305 g

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 339)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

11.3.6 CM IO 8 x M12D connection module for electronic modules

Order number

6ES7194-4CB50-0AA0

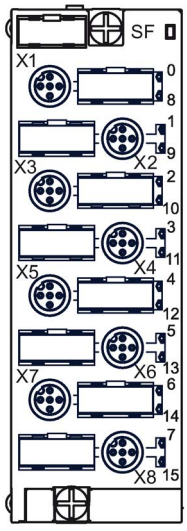
Properties

The CM IO 8 x M12D connection module has the following properties:

- Can be plugged in and attached with screws to the electronic module
- 8 M12 circular socket connectors
- 8 labels and 1 module identification tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector
	X3	3. M12 circular socket connector
	X4	4. M12 circular socket connector
	X5	5. M12 circular socket connector
	X6	6. M12 circular socket connector
	X7	7. M12 circular socket connector
	X8	8. M12 circular socket connector

Block diagram

The block diagram below relates to the CM IO 8 x M12D connection module.

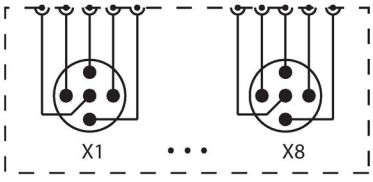


Figure 11-9 Block diagram, CM IO 8 x M12D connection module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 305 g

See also

Digital electronic module 16 DI DC 24V (6ES7141-4BH00-0AA0) (Page 344)

Digital electronic module 4 DIO / 4 DO DC 24V/0.5A (6ES7143-4BF00-0AA0) (Page 373)

11.3.7 CM IO 8 x M8 connection module for electronic modules

Order number

6ES7194-4EB00-0AA0

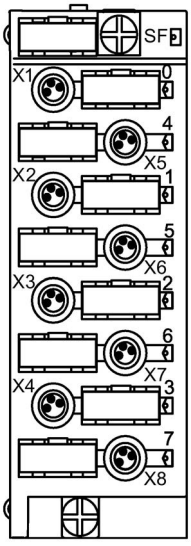
Properties

Properties of the CM IO 8 x M8 connection module:

- Can be plugged in and attached with screws to the electronic module
- 8 M8 circular socket connectors
- 8 labels and 1 module identification tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M8 circular socket connector
	X2	2. M8 circular socket connector
	X3	3. M8 circular socket connector
	X4	4. M8 circular socket connector
	X5	5. M8 circular socket connector
	X6	6. M8 circular socket connector
	X7	7. M8 circular socket connector
	X8	8. M8 circular socket connector

Block diagram

The figure below shows the block diagram of CM IO 8 x M8 connection module.

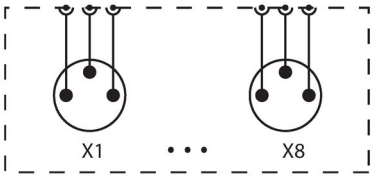


Figure 11-10 Block diagram CM IO 8 x M8

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 39
Weight	Approx. 310 g

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)

Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 339)

Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 354)

Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)

Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

11.3.8 CM IO 2 x M12 connection module for electronic modules

Order number

6ES7194-4FB00-0AA0

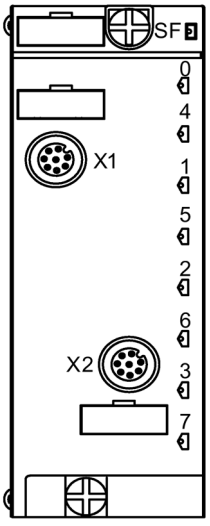
Properties

Properties of the connection module CM IO 2 x M12:

- Can be plugged in and attached with screws to the electronic module
- 2 M12 circular socket connectors (8-pin) for connection of 2 actuator/sensor distributors
- 2 labels and 1 module tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M12 circular socket connector
	X2	2. M12 circular socket connector

Block diagram

The figure below shows the block diagram of the connection module CM IO 2 x M12.

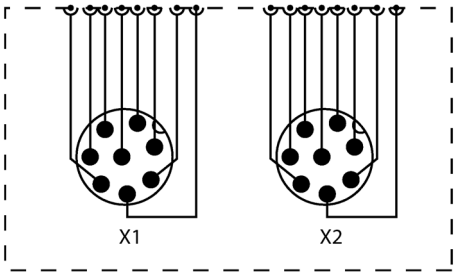


Figure 11-11 Block diagram CM IO 2 x M12

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 40
Weight	Approx. 115 g
Currents	
Total current per M12 circular socket connector	Max. 2 A

Note

The maximum total current per M12 circular socket connector should not exceed 2 A.

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

11.3.9 CM IO 1 x M23 connection module for electronic modules

Order number

6ES7194-4FA00-0AA0

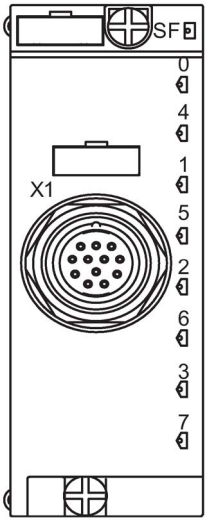
Properties

The CM IO 1 x M23 connection module has the following properties:

- Can be plugged in and attached with screws to the electronic module
- 1 M23 circular socket connectors (12-pin) for connection of one actuator/sensor distributor
- 1 label and 1 module tag

Pin assignment

The pin assignment depends on the electronic module used.

View	Connection	Designation
	X1	1. M23 circular socket connector

Block diagram

The figure below shows the block diagram of the CM IO 1 x M23 connection module.

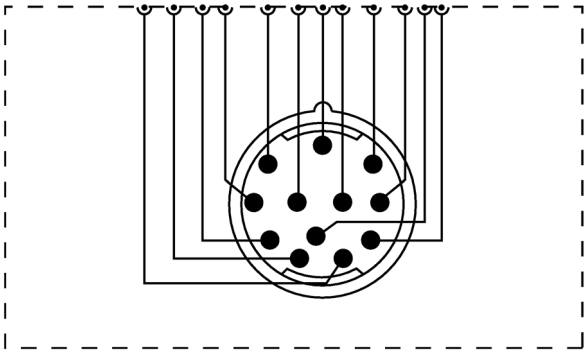


Figure 11-12 Block diagram CM IO 1 x M23

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 61
Weight	Approx. 170 g
Currents	
Total current of M23 circular socket connector	Max. 4 A

Note

The maximum total current per M23 circular socket connector must not exceed 4 A.

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 366)

11.4 Connection modules for power modules

11.4.1 CM PM-E Direct connection module for power modules

Order number

6ES7194-4BC00-0AA0

Properties

The CM PM Direct connection module has the following properties:

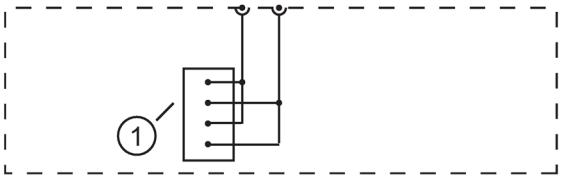
- Can be plugged in and attached with screws to the power module.
- Connecting the 2L+ load voltage supply using screw terminals.
- You can loop through the 2L+ load voltage supply via additional terminals
- 3 inscription labels

Pin assignment

For details on the pin assignment of CM PM Direct, refer to the chapter Power modules (Page 323).

Block diagram

The block diagram shows the CM PM Direct connection module.



① X01: Connection for infeed of the 2L+ load voltage supply

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 100
Weight	Approx. 140 g
Currents	
Feed current	
• 2L+ load voltage supply	16 A

Note

Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 1L+ 5 A
- At 2L+ 10 A

11.4.2 CM PM-E ECOFAST connection module for power modules

Order number

6ES7194-4BA00-0AA0

Properties

The CM PM ECOFAST connection module has the following properties:

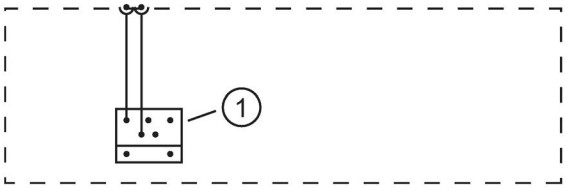
- Can be plugged in and attached with screws to the power module.
- Connecting the 2L+ load voltage supply using an ECOFAST cable connector.
- 2 inscription labels

Pin assignment

For details on the pin assignment of CM PM ECOFAST, refer to the chapter Power modules (Page 323).

Block diagram

The figure below shows the block diagram of the CM PM ECOFAST connection module.



① X01: Connection for infeed of the 2L+ load voltage supply

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 60
Weight	Approx. 125 g
Currents	
Feed current	
• 2L+ load voltage supply	10 A

11.4.3 CM PM-E 7/8" connection module for power modules

Order number

6ES7194-4BD00-0AA0

Properties

Properties of CM PM 7/8" connection module:

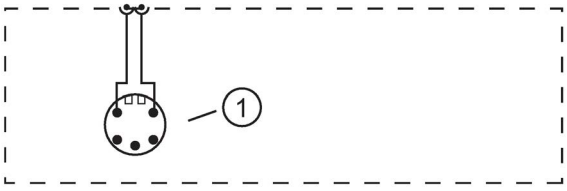
- Can be plugged in and attached with screws to the power module PM-E DC24V
- Connection of the 2L+ load voltage supply using a 7/8" connector
- 2 inscription labels

Pin assignment

For details on the pin assignment of CM PM 7/8", refer to the chapter Power modules (Page 323).

Block diagram

The block diagram below shows the CM PM 7/8" connection module.



① X01: Connection for infeed of the 2L+ load voltage supply

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 48
Weight	Approx. 120 g
Currents	
Feed current	
• 2L+ load voltage supply	8 A

11.4.4 CM PM PP connection module for power modules

Order number

6ES7194-4BE00-0AA0

Properties

The CM PM PP connection module has the following properties:

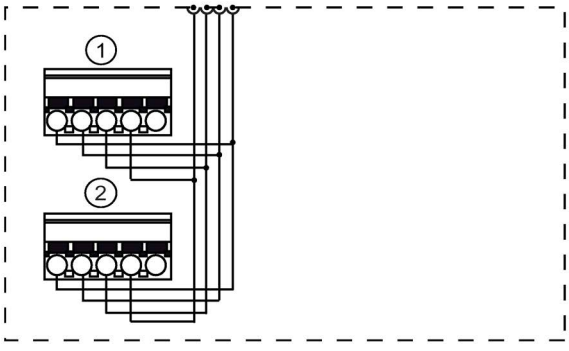
- Can be plugged in and attached with screws to the power module.
- Connecting the 1L+ electronic/encoder supply and the 2L+ load voltage supply using a push-pull cable connector. 2L+ is fed into the ET 200pro. 1L+ is only looped through from socket to socket.
- The 1L+ electronic/encoder supply and 2L+ load voltage supply can be looped through using an additional socket.
- 3 inscription labels

Pin assignment

For details on the pin assignment of CM PM PP, refer to the chapter Power modules (Page 323).

Block diagram

The figure shows the block diagram of the CM PM PP connection module.



① X01 IN: Connection for infeed of the 1L+ electronic/encoder supply and the 2L+ load voltage supply

② X02 OUT: Connection for looping through the 1L+ electronic/encoder supply and the 2L+ load voltage supply

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 61
Weight	Approx. 110 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 16 A*, up to 40 °C ambient temperature Max. 8 A*, up to 55 °C ambient temperature
• 2L+ load voltage supply	Max. 16 A*, up to 40 °C ambient temperature Max. 8 A*, up to 55 °C ambient temperature
* Observe the permitted current carrying capacity of the cable.	

Note

Feed current

The load on the internal busbars of ET 200pro must not exceed the following values:

- At 2L+ 10 A

11.4.5 CM PM-O PP connection module for the PM-O outgoing module

Order number

6ES7194-4BH00-0AA0

Properties

The CM PM-O PP connection module has the following properties:

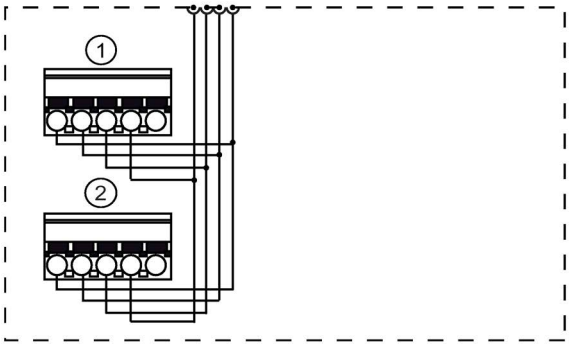
- Can be plugged in and attached with screws to the outgoing module.
- Connecting the 1L+ electronic/encoder supply and the 2L+ load voltage supply using a push-pull cable connector.
- 3 inscription labels

Pin assignment

For details on the pin assignment of CM PM-O PP, refer to the chapter Power modules (Page 323).

Block diagram

The figure below shows the block diagram of the CM PM-O PP connection module.



① X01 OUT: Connection for the 1L+ electronic/encoder supply and the 2L+ load voltage supply
② X02 OUT: Connection for the 1L+ electronic/encoder supply and the 2L+ load voltage supply

Note

Regenerative feedback

Feeding back energy of the 1L+ electronic/encoder supply and 2L+ load voltage supply is not allowed. Regenerative feedback of 1L+/2L+ can lead to undefined system behavior and system damage. For this reason, to prevent damage, never feed back energy of the 1L+ electronic/encoder supply and the 2L+ load voltage supply.

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 61
Weight	Approx. 110 g
Currents	
Discharge currents	
• 1L+ electronics/encoder supply	Max. 2 A
• 2L+ load voltage supply	Max. 6 A

Note

Capacitive loads can influence the switching behavior of the F-switch.

Interface modules

12

12.1 Interface modules for PROFIBUS DP

12.1.1 IM 154-1 DP interface module

Order number

6ES7154-1AA01-0AB0

Properties

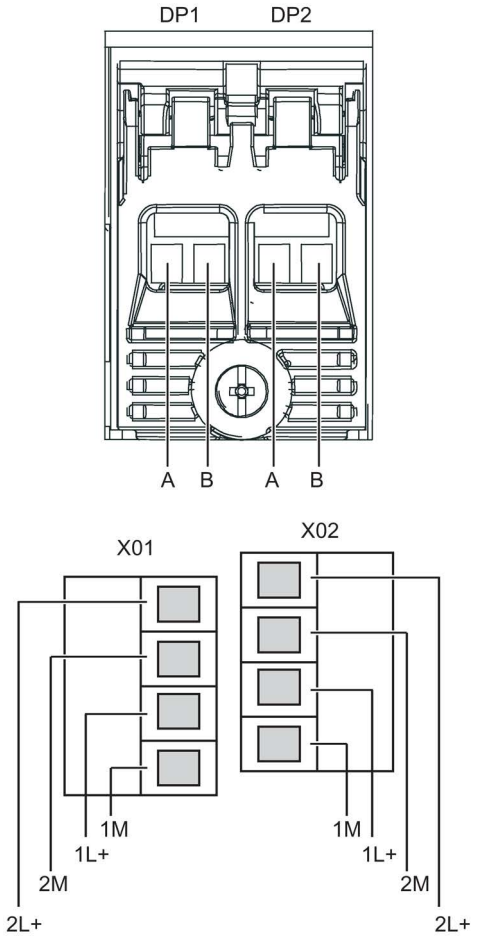
The IM 154-1 DP interface module has the following properties:

- The interface module is installed on the bus module when supplied.
- The module connects the ET 200pro to PROFIBUS DP by means of the connection module.
- The module prepares the data for the connected electronic modules.
- The module supplies the ET 200pro via the connection module with the 1L+ encoder/electronic supply and the 2L+ load voltage supply.
- The PROFIBUS DP address of ET 200pro can be set by means of the connection module.
- The connection module can be used to activate/deactivate the terminating resistor of PROFIBUS DP.
- IM 154-1 DP has a maximum address space of 244 byte for inputs, and 244 byte for outputs.
- Operation as DPV0 slave.
- Operation as DPV1 slave:
  - Diagnostic interrupts
  - Hardware interrupts
  - Swapping interrupts
- IM 154-1 DP supports operation with up to 16 electronic modules.
- Update of the interface module firmware.
- Operation as DPV1 slave on Y Link.
- Option handling
- Integrated power module for the 2L+ load voltage supply of ET 200pro.

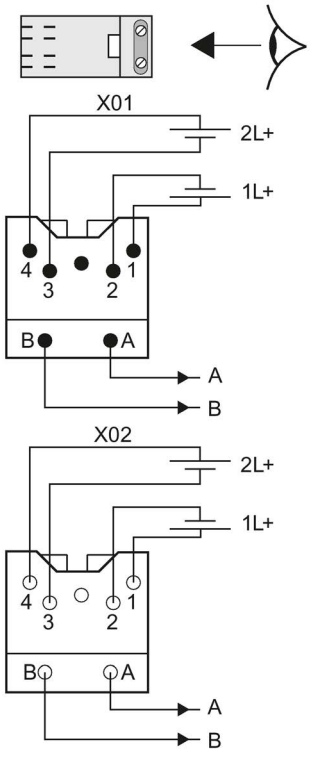
Compatibility with the predecessor module

The IM 154-1 DP interface module with order number 6ES7154-1AA01-0AB0 is compatible with the predecessor module with order number 6ES7154-1AA00-0AB0.

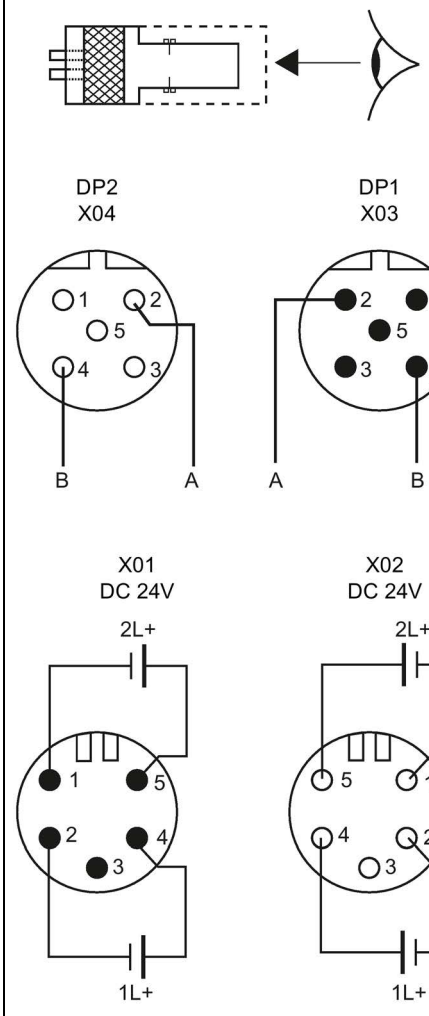
Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP Direct connection module

View of the terminals	Terminal	Assignment
	**Insulation displacement terminal for feeding DP1**	
	A	Data line A
	B	Data line B
	Shield	
	Insulation displacement terminal for looping DP2	
	A	Data line A
	B	Data line B
	Shield	
	Screw terminal for feeding X01	
	1L+	Electronics/encoder supply
	1M	Ground for electronics/encoder supply
	2L+	Load voltage supply
	2M	Ground for load voltage supply
	Screw terminal for forwarding X02	
	1L+	Electronics/encoder supply
	1M	Ground for electronics/encoder supply
	2L+	Load voltage supply
	2M	Ground for load voltage supply

Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP ECOFAST Cu connection module

View of the ECOFAST cable connector	Terminal	Assignment
	**Feed for X01**	
	A	PROFIBUS DP signal A
	B	PROFIBUS DP signal B
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply
	Forwarding X02	
	A	PROFIBUS DP signal A
	B	PROFIBUS DP signal B
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply

Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP M12, 7/8" connection module

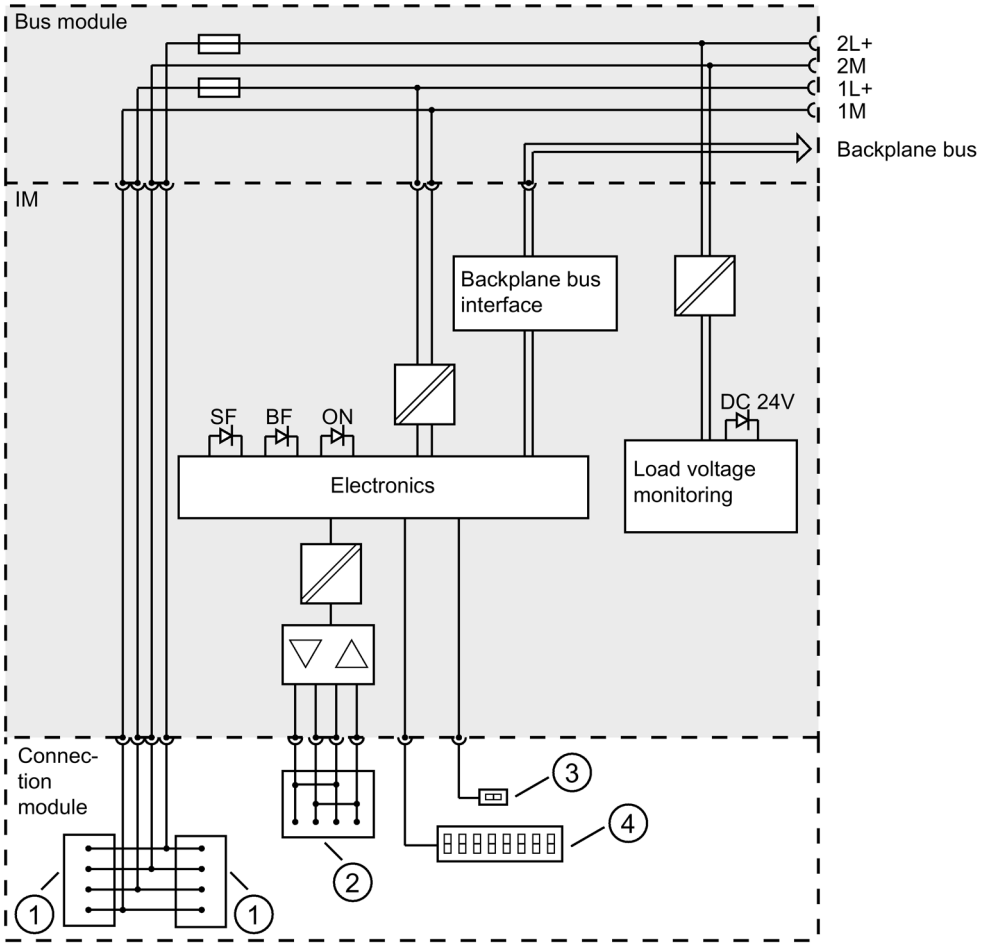
View of the M12 and 7/8" cable connectors	Terminal	Assignment
	**M12 cable connector for feeding DP1 X03**	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	M12 cable connector for looping DP2 X04	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	7/8" cable connector for feeding X01	
	1	Ground for load voltage supply 2M
	2	Ground for electronics/encoder supply 1M
	3	Functional earth
	4	1L+ electronics/encoder supply
	5	2L+ load voltage supply
	7/8" cable connector for looping X02	
	1	Ground for load voltage supply 2M
	2	Ground for electronics/encoder supply 1M
	3	Functional earth
	4	1L+ electronics/encoder supply
	5	2L+ load voltage supply

* The voltage may only be used to supply the external terminating resistor. The voltage must not be looped through to the next connector with a cable.

** We recommend that you connect the functional earth via the M12 thread (because it has a larger surface area than terminal 5).

Block diagram

The figure below shows the block diagram of the IM 154-1 DP interface module with CM IM DP Direct as optional connection module.



① Connections for the electronics/encoder supply and load voltage supply
② Connections for PROFIBUS DP
③ DIP switch for terminating resistor
④ DIP switch for the PROFIBUS DP address

Figure 12-1 Block diagram IM 154-1 DP

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 × 130 × 59.3
Weight	Approx. 375 g
Module-specific data	
Transfer rate	9.6; 19.2; 45.45; 93.75; 187.5; 500 kBaud, 1.5; 3; 6; 12 Mbps
Bus protocol	PROFIBUS DP
Interface	RS 485
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer ID	8118_H
Direct data exchange	Yes
Isochronous mode	No
Voltages and currents	
Rated supply voltage of the electronic components (1L+)	24 V DC
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes; with replaceable fuses
• Feed current 1L+	Max. 5 A; per ET 200pro
Rated load voltage 2L+	24 V DC(integrated power module)
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes, for the potential group
• Feed current 2L+	Max. 10 A per ET 200pro
Current consumption	
From rated supply voltage (1L+)	Typ. 200 mA
Power loss of the module	Typ. 5 W
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between the backplane bus and supply voltages (1L+, 2L+)	Yes
• Between PROFIBUS DP and supply voltages (1L+, 2L+)	Yes
• Between electronics and supply voltages (1L+, 2L+)	Yes

Technical specifications	
Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostic function	Yes
• Group error	Red "SF" LED
• PROFIBUS DP monitoring	Red "BF" LED
• Monitoring of the supply voltage of the electronics	Green "ON" LED
• Monitoring of the rated load voltage 2L+	Green "DC 24V" LED (integrated power module)

Acyclic data traffic class 2 services (PG/OP)

The IM 154-1 DP interface module supports 3 connections via class 2 services (PG/OP).

Configuration with more than 240 bytes of parameter data

For configurations with STEP 7 V5.5 or higher, it is possible to operate the IM 151-1 DP (6ES7154-1AA01-0AB0 or higher) in DPV1 mode with more than 240 byte of parameter data.
A configuration based on the GSD file does not offer this possibility.

Note

If the parameter length exceeds 240 byte, a longer station startup time is to be expected. See also chapter Parameter assignment dependencies (Page 308).

See also

Connection module CM IM DP Direct for interface modules (Page 253)

CM IM DP ECOFAST Cu connection module for interface modules (Page 255)

CM IM DP M12 connection module, 7/8" for interface modules (Page 256)

Electrical Configuration of ET 200pro (Page 69)

12.1.2 IM 154-2 DP High Feature interface module

Order number

6ES7154-2AA01-0AB0

Properties

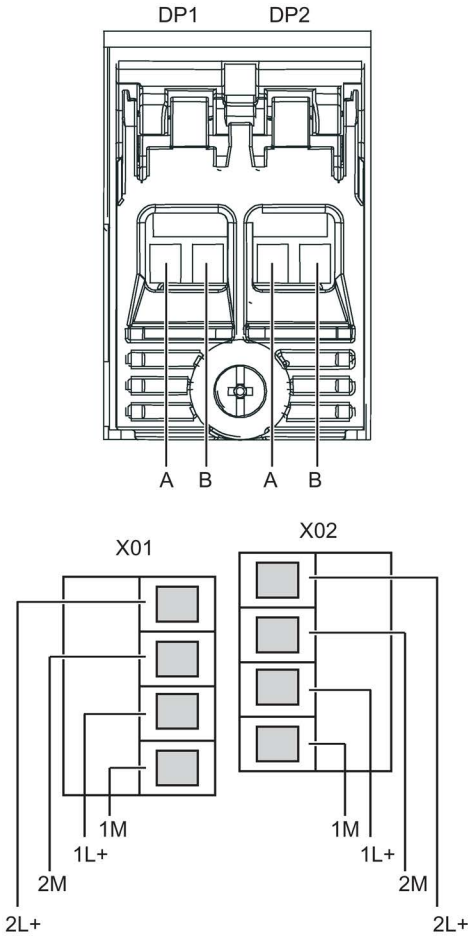
The IM 154-2 DP High Feature interface module has the following properties:

- The interface module is installed on the bus module when supplied.
- The module connects the ET 200pro to PROFIBUS DP by means of the connection module.
- The module prepares the data for the connected electronic modules.
- The module supplies the ET 200pro via the connection module with the 1L+ encoder/electronic supply and the 2L+ load voltage supply.
- The PROFIBUS DP address of ET 200pro can be set by means of the connection module.
- The connection module can be used to activate/deactivate the terminating resistor of PROFIBUS DP.
- IM 154-2 DP High Feature has a maximum address space of 244 byte for inputs, and 244 byte for outputs.
- Operation as DPV0 slave.
- Operation as DPV1 slave:
  - Diagnostic interrupts
  - Hardware interrupts
  - Swapping interrupts
- IM 154-2 DP High Feature supports operation with up to 16 electronic modules.
- Update of the interface module firmware.
- Support of fail-safe modules.
- Operation as DPV1 slave on Y Link.
- Option handling
- Integrated power module for the 2L+ load voltage supply of ET 200pro.

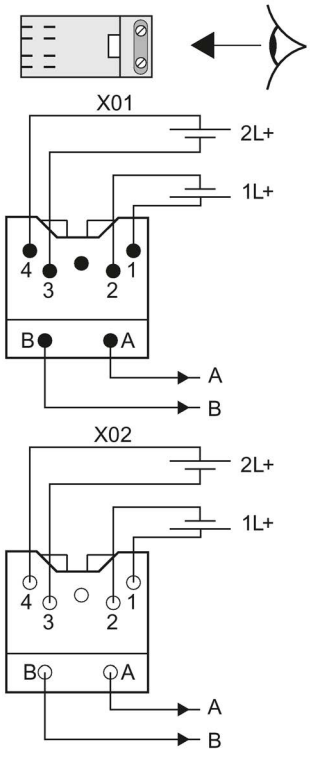
Compatibility with the predecessor module

The IM 154-2 DP interface module with order number 6ES7154-2AA01-0AB0 is compatible with the predecessor module with order number 6ES7154-2AA00-0AB0.

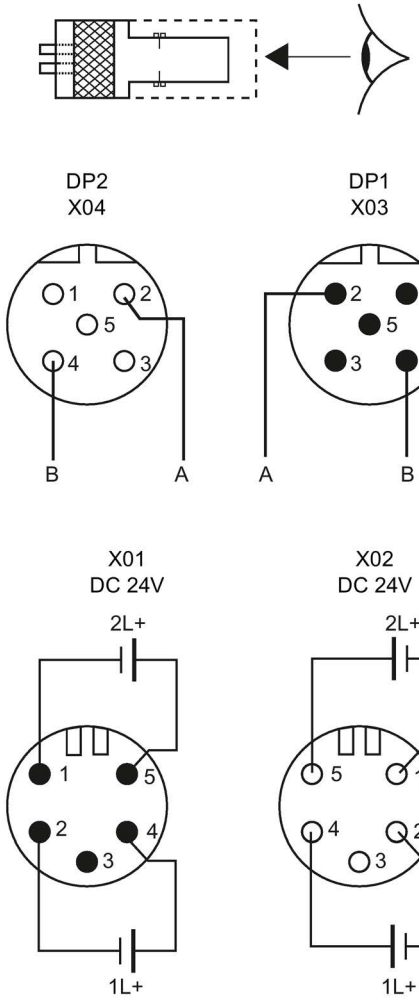
Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP Direct connection module

View of the terminals	Terminal	Assignment
	**Insulation displacement terminal for feeding DP1**	
	A	Data line A
	B	Data line B
	Shield	
	Insulation displacement terminal for looping DP2	
	A	Data line A
	B	Data line B
	Shield	
	Screw terminal for feeding X01	
	1L+	Electronics/encoder supply
	1M	Ground for electronics/encoder supply
	2L+	Load voltage supply
	2M	Ground for load voltage supply
	Screw terminal for forwarding X02	
	1L+	Electronics/encoder supply
	1M	Ground for electronics/encoder supply
	2L+	Load voltage supply
	2M	Ground for load voltage supply

Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP ECOFAST Cu connection module

View of the ECOFAST cable connector	Terminal	Assignment
	**Feed for X01**	
	A	PROFIBUS DP signal A
	B	PROFIBUS DP signal B
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply
	Forwarding X02	
	A	PROFIBUS DP signal A
	B	PROFIBUS DP signal B
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply

Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP M12, 7/8" connection module

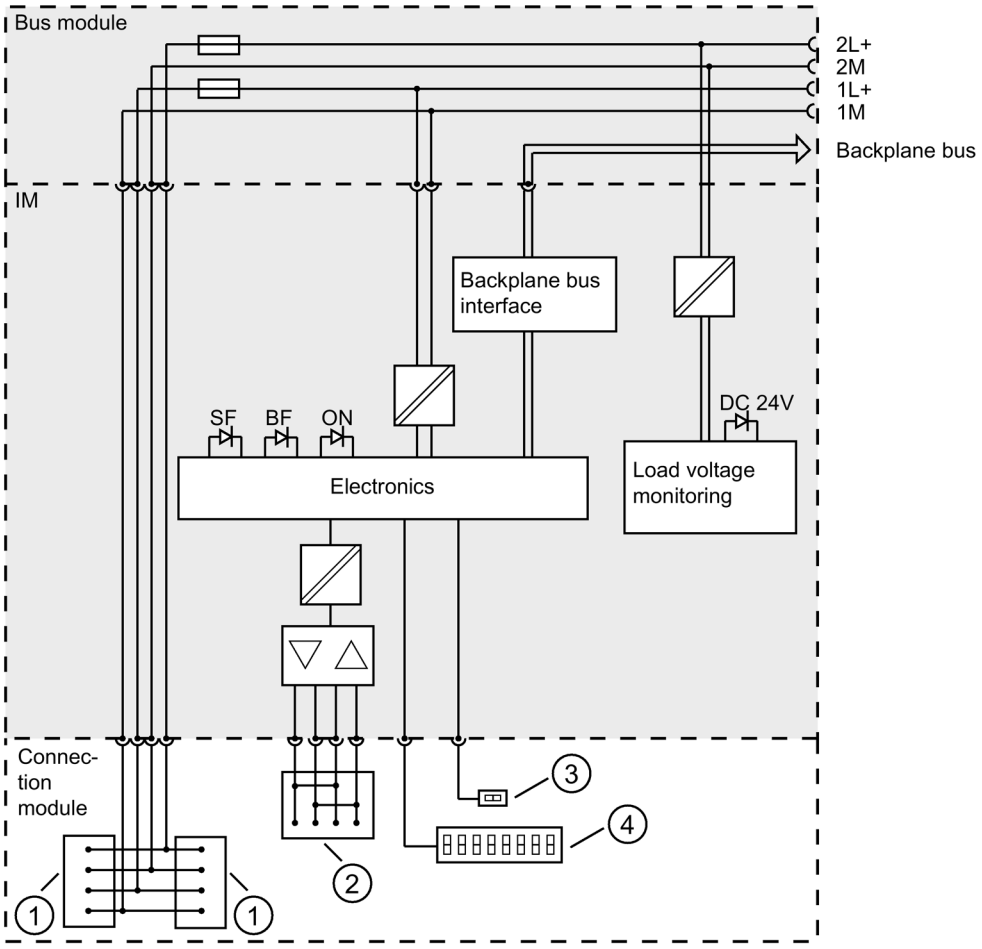
View of the M12 and 7/8" cable connectors	Terminal	Assignment
	**M12 cable connector for feeding DP1 X03**	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	M12 cable connector for looping DP2 X04	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	7/8" cable connector for feeding X01	
	1	Ground for load voltage supply 2M
	2	Ground for electronics/encoder supply 1M
	3	Functional earth
	4	1L+ electronics/encoder supply
	5	2L+ load voltage supply
	7/8" cable connector for looping X02	
	1	Ground for load voltage supply 2M
	2	Ground for electronics/encoder supply 1M
	3	Functional earth
	4	1L+ electronics/encoder supply
	5	2L+ load voltage supply

* The voltage may only be used to supply the external terminating resistor. The voltage must not be looped through to the next connector with a cable.

** We recommend that you connect the functional earth via the M12 thread (because it has a larger surface area than terminal 5).

Block diagram

The figure below shows the block diagram of the IM 154-2 DP High Feature interface module with CM IM DP Direct as optional connection module.



① Connections for the electronics/encoder supply and load voltage supply
② Connections for PROFIBUS DP
③ DIP switch for terminating resistor
④ DIP switch for the PROFIBUS DP address

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 × 130 × 59.3
Weight	Approx. 375 g
Module-specific data	
Transfer rate	9.6; 19.2; 45.45; 93.75; 187.5; 500 kBaud, 1.5; 3; 6; 12 Mbps
Bus protocol	PROFIBUS DP
Interface	RS 485
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer ID	8119_H
Direct data exchange	Yes
Isochronous mode	No
Voltages and currents	
Rated supply voltage of the electronic components (1L+)	24 V DC
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes; with replaceable fuses
• Feed current 1L+	Max. 5 A; per ET 200pro
Rated load voltage 2L+	24 V DC(integrated power module)
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes, for the potential group
• Feed current 2L+	Max. 10 A per ET 200pro
Current consumption	
From rated supply voltage (1L+)	Typ. 200 mA
Power loss of the module	Typ. 5 W
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between the backplane bus and supply voltages (1L+, 2L+)	Yes
• Between PROFIBUS DP and supply voltages (1L+, 2L+)	Yes
• Between electronics and supply voltages (1L+, 2L+)	Yes

Technical specifications	
Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostic function	Yes
• Group error	Red "SF" LED
• PROFIBUS DP monitoring	Red "BF" LED
• Monitoring of the supply voltage of the electronics	Green "ON" LED
• Monitoring of the rated load voltage 2L+	Green "DC 24V" LED (integrated power module)

Acyclic data traffic class 2 (PG/OP)

The IM 154-2 DP High Feature interface module supports 3 connections via class 2 services (PG/OP).

Configuration with more than 240 bytes of parameter data

For configurations with STEP 7 V5.5 or higher, it is possible to operate the IM 151-2 DP High Feature (6ES7154-2AA01-0AB0 or higher) in DPV1 mode with more than 240 byte of parameter data.
A configuration based on the GSD file does not offer this possibility.

Note

If the parameter length exceeds 240 byte, a longer station startup time is to be expected. See also chapter Parameter assignment dependencies (Page 308).

See also

Electrical Configuration of ET 200pro (Page 69)

Connection module CM IM DP Direct for interface modules (Page 253)

CM IM DP ECOFAST Cu connection module for interface modules (Page 255)

CM IM DP M12 connection module, 7/8" for interface modules (Page 256)

12.1.3 Overview of parameters of the interface module

Parameters of IM 154-1 DP and IM 154-2 DP High Feature

Parameters	Value range	Scope
DP interrupt mode	• DPV1 • DPV0	ET 200pro
Diagnostic interrupt (OB 82)	• Disable • Enable	ET 200pro
Process interrupt (OB 40 to OB 47)	• Disable • Enable	ET 200pro
Swapping interrupt (OB 83)	• Disable • Enable	ET 200pro
Operation with preset <> actual configuration	• Disable • Enable	ET 200pro
Identifier-related diagnostic data[1]	• Disable • Enable	ET 200pro
Module status[1]	• Disable • Enable	ET 200pro
Channel-related diagnostics[1]	• Disable • Enable	ET 200pro
Option handling	• Disable • Enable	ET 200pro
[1] This diagnostics function can be disabled.		

Parameters for the integrated power module

Parameters	Value range	Scope
Load voltage diagnostics	• Disable • Enable	ET 200pro

12.1.4 Description of the interface module parameters

DP interrupt mode

This parameter allows you to choose between DPV0 and DPV1 mode of ET 200pro. If DPV1 is set, the system generates interrupts (diagnostic, process, swapping interrupts).
Requirement: The DP master also supports DPV1 mode.

Diagnostic interrupt

This parameter allows you to enable or disable diagnostic interrupts. Diagnostic interrupts are only generated when ET 200pro is operating in DPV1 mode.

Hardware interrupt

This parameter allows you to enable or disable hardware interrupts. Hardware interrupts are only generated when ET 200pro is operating in DPV1 mode.

Swapping interrupt

This parameter allows you to enable or disable swapping interrupts. Swapping interrupts are only generated when ET 200pro is operating in DPV1 mode.

Operation with preset <> actual configuration

If this parameter is enabled and

- you hot-swap an electronic module, this will not cause a failure of the ET 200pro station.
- the preset and actual configurations do not match, ET 200pro can still exchange data with the DP master.

If this parameter is disabled and

- you hot-swap an electronic module, this will cause a failure of the ET 200pro station.
- the preset and actual configurations do not match, ET 200pro cannot exchange data with the DP master.

Identifier-related diagnostic data

This parameter allows you to remove identifier-related diagnostic data from the diagnostic frame. This action reduces the length of the diagnostic frame by the length of identifier-related diagnostic data (4 byte).

Module status

This parameter allows you to remove module status data from the diagnostic frame. This action reduces the length of the diagnostic frame by the length of the module status data (9 byte).

Channel-specific diagnostic data

This parameter allows you to remove channel-specific diagnostic data from the diagnostic frame. This action reduces the length of the diagnostic frame by the length of the channel-specific diagnostic data (max. 94 byte).

Load voltage diagnostics

If you enable this parameter, the system generates diagnostic data when it detects a missing load voltage 2L+.

Option handling

This parameter can be used to enable or disable option handling for the entire ET 200pro.

12.1.5 Parameter assignment dependencies

Combinations

The tables below show how IM154-1/-2 properties can be combined and how this affects parameter assignment in DPV0 and in DPV1 mode.

DPV0 mode

IM154-1/-2... properties			For parameter assignment with...	
Option handling	Y-link	Configuration > 240 bytes of parameter data	ET 200pro motor starter	ET 200pro, all other modules
			Restricted parameter assignment[1]	✓
●				
	●			
●	●			
		●	Not possible	Not possible
●		●		
	●	●		
●	●	●		

[1] See Manual *ET 200pro motor starter, Appendix D.4, Device parameters*.

DPV1 mode

IM154-1/-2... properties			For parameter assignment with...	
Option handling	Y-link	Configuration > 240 bytes of parameter data	ET 200pro motor starter	ET 200pro, all other modules
			✓	✓
●			Restricted parameter assignment[1]	
	●			
●	●			
		●	✓	
●		●	Restricted parameter assignment[1]	
	●	●	Not possible	Not possible
●	●	●		

[1] See Manual *ET 200pro motor starter, Appendix D.4, Device parameters*.

12.2 Interface modules for PROFINET IO

12.2.1 IM 154-4 PN High Feature interface module (6ES7154-4AB10-0AB0)

Order number

6ES7154-4AB10-0AB0

Properties

The IM 154-4 PN High Feature interface module has the following properties:

- The interface module is installed on the bus module when supplied. The connection module determines the connection system.
- The module interconnects ET 200pro with PROFINET IO.
- The module prepares the data for the connected electronic modules.
- The module supplies the ET 200pro via the connection module with the 1L+ encoder/electronic supply and the 2L+ load voltage supply.
- Device name is saved in the internal memory with STEP 7. The SIMATIC Micro Memory Card is not supported. The SIMATIC Micro Memory Card is not supported.
- Updating firmware online
- IM 154-4 PN High Feature has a maximum address space of 256 byte for inputs, and 256 byte for outputs.
- Support of fail-safe modules.
- Supported Ethernet services:
  - PROFINET IO
  - ping, arp
  - Network diagnostics (SNMP)
- Interrupts
  - Diagnostic interrupts
  - Hardware interrupts
  - Swapping interrupts
  - Maintenance interrupts
- IM 154-4 PN High Feature supports operation with up to 16 electronic modules.
- Integrated power module for the 2L+ load voltage supply of ET 200pro.

- The following properties are available with the specified firmware version and higher in conjunction with CM IM PN M12 7/8" (6ES7194-4AJ00-0AA0) or CM IM PN PP Cu (6ES7194-4AF00-0AA0):

Firmware version	Properties
With 6.0.0 and higher	Isochronous real time communication "high flexibility"
	Prioritized startup
	Device replacement without PC
	Changing IO devices during operation (changing partner ports)
With 7.0.0 and higher	Isochronous real time communication "high performance"
	Media redundancy
	Shared device
From 7.1.0 onwards	Configuration control (option handling)

Isochronous real time communication

Synchronized communication protocol for cyclic exchange of IRT data between PROFINET devices. A reserved bandwidth within the send clock is available for the IRT data. The reserved bandwidth ensures that the IRT data can be transmitted at reserved, synchronized intervals while remaining uninfluenced by another greater network load (for example, TCP/IP communication or additional real time communication).

- IRT option "high flexibility":

  Maximum flexibility in planning and extending the system. Topological configuration is not required.

- IRT option "high performance":

  Topological configuration is required.

  Note

  IO controller as a sync master for IRT communication with the option "high performance"

  We recommend also operating the IO controller as a sync master if you configure the IRT communication with the option "high performance".

  Otherwise, IRT and RT configured IO devices may fail if the sync master fails.

For further information about configuring synchronized PROFINET devices in sync domains, refer to the STEP 7 online help and the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) manual.

Prioritized startup

Prioritized startup describes the PROFINET functionality for accelerating the startup of IO devices in a PROFINET IO system with RT and IRT communication.

The function reduces the time that the correspondingly configured IO devices require in order to return to cyclic user data exchange in the following cases:

- After restoration of the voltage supply
- After recovery of a station
- After enabling of IO devices

Note

On startup of an IM 154-4 PN High Feature with "prioritized startup", the function "Reset to factory settings" must be executed twice until the module is reset to the factory settings.

For additional information, refer to the STEP 7 online help and the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) manual.

Device replacement without programming device

IO devices having this function can be replaced in a simple manner:

- The device name does not have to be assigned with the programming device.

The loaded IO device is assigned a device name from the IO controller and not from the removable medium or programming device. To do this, the IO controller uses the configured topology and the neighborhood relationships determined by the IO devices. The configured desired topology must agree with the actual topology.

For additional information, refer to the STEP 7 online help and the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) manual.

Changing IO devices during operation (changing partner ports)

Functionality of a PROFINET device. If the IO controller and IO devices support this functionality, "changing partner ports" of different devices can be assigned to an IO device port by means of configuration, so that communication with each of these changing IO devices is possible at a particular time via the IO device port. However, only the changing device that is currently being communicated with may be physically connected to the changing port.

Media redundancy

Function for ensuring the network and system availability. Redundant transmission links (ring topology) ensure that an alternative communication path is made available if a transmission link fails.

For additional information, refer to the STEP 7 online help and the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) Manual.

Note

Media redundancy is only possible if the IM 154-4 PN High Feature interface module with firmware version 7.0.0 is used. The writing on the terminal module can differ due to different product statuses.

Shared device

IO device which makes its data available to multiple IO controllers.

Note

Please note that the power and electronics modules in a potential group have to be assigned to the same IO controller so that a load voltage failure can be diagnosed.

For additional information, refer to the STEP 7 online help and the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) Manual.

Spare part replacement for IM 154-4 PN High Feature

If a spare part replacement is necessary, an IO device in operation must be reset to the factory settings by using "Reset to factory settings".

Compatibility of actual and preset configuration of the IM 154-4 PN High Feature

Note

If you replace the IM 154-4 PN High Feature 6ES7154-4AB00-0AB0 with the IM 154-4 PN High Feature 6ES7154-4AB10-0AB0, a SIMATIC Micro Memory Card is not required and the device name has to be assigned with STEP 7 on the programming device or PC.

Preset configuration	Actual configuration				
	IM 154-4 PN High Feature 6ES7154-4AB00-0AB0	IM 154-4 PN High Feature V5.0 6ES7154-4AB10-0AB0 with CM IM PN M12, 7/8" or CM IM PN PP Cu	IM 154-4 PN High Feature V5.0 6ES7154-4AB10-0AB0 with CM IM PN PP FO	IM 154-4 PN High Feature V6.0/V7.0 6ES7154-4AB10-0AB0 with CM IM PN M12, 7/8" or CM IM PN PP Cu	IM 154-4 PN High Feature V6.0/V7.0 6ES7154-4AB10-0AB0 with CM IM PN PP FO
IM 154-4 PN High Feature 6ES7154-4AB00-0AB0	Cyclic data exchange	Cyclic data exchange; alarm: Different order numbers	Cyclic data exchange; alarm: Different order numbers	Cyclic data exchange	No cyclic data exchange
IM 154-4 PN High Feature V5.0 with CM IM PN PP Cu 6ES7154-4AB10-0AB0	No cyclic data exchange; alarm: Preset/actual discrepancy	Cyclic data exchange	Cyclic data exchange	Cyclic data exchange	No cyclic data exchange
IM 154-4 PN High Feature V5.0 with CM IM PN PP FO 6ES7154-4AB10-0AB0	No cyclic data exchange; alarm: Preset/actual discrepancy	No cyclic data exchange; alarm: Preset/actual discrepancy	Cyclic data exchange	No cyclic data exchange	Cyclic data exchange
IM 154-4 PN High Feature V6.0/V7.0 with CM IM PN PP Cu 6ES7154-4AB10-0AB0	No cyclic data exchange; alarm: Preset/actual discrepancy	No cyclic data exchange	No cyclic data exchange	Cyclic data exchange	No cyclic data exchange
IM 154-4 PN High Feature V7.0 with CM IM PN PP FO 6ES7154-4AB10-0AB0	No cyclic data exchange; alarm: Preset/actual discrepancy	No cyclic data exchange; alarm: Preset/actual discrepancy	No cyclic data exchange	No cyclic data exchange	Cyclic data exchange

- Cyclic data exchange: SF LED off, BF-LED off
- No cyclic data exchange: SF LED off, BF-LED flashes

Module replacement without programming device or PC

The IM 154-4 PN High Feature interface module and the CM IM PN M12, 7/8" and CM IM PN PP Cu connection modules each have an internal memory in which the device name is saved. As a result, there are different scenarios for the validity of the device name when replacing a module without a programming device.

Device name scenarios	Validity of the device name
Device name in CM and IM = empty	MAC address (no device name)
Device name in CM = IM or IM = CM	Device name in CM
Device name in CM ≠ IM or IM ≠ CM	Device name in CM
Device name in CM = ok and IM = empty	Device name in CM
Device name in IM = ok and in CM = empty	Device name in IM

Note

The CM IM PN PP FO connection module does not have an internal memory, in other words a module cannot be replaced without a programming device or PC. You must assign the device name with STEP 7.

With prioritized startup, the device name of the IM is requested instead of the device name in the CM.

Resetting to factory settings

Resetting to factory settings pertains only to the interface module. When a reset to factory settings is performed, other modules in the station assume the configured substitute value behavior or become de-energized.

Compatibility with the controller

Note

Firmware version of controller used

To use the IM 154-4 PN High Feature interface module (6ES7154-4AB10-0AB0) on a controller, the controller must be operated with one of the firmware versions listed in the table below.

The most recent firmware versions are available from your Siemens representative or from the Internet (http://www.siemens.com/automation/service&support).

The following firmware versions are required for operating non-failsafe I/O modules on the IM 154-4 PN High Feature interface module:

	CPU	CP			SOFTNET PNIO
Controller	315-2 PN/DP 317-2 PN/DP IM 154-8 PN/DP CPU	443-1	343-1		SIMATIC NET-CD
			6GK7343-1EX21..	6GK7343-1GX21..	
Firmware version	≥ V2.3.2	≥ V2.2	≥ V1.1	≥ V1.0	V6.3 Hotfix 1

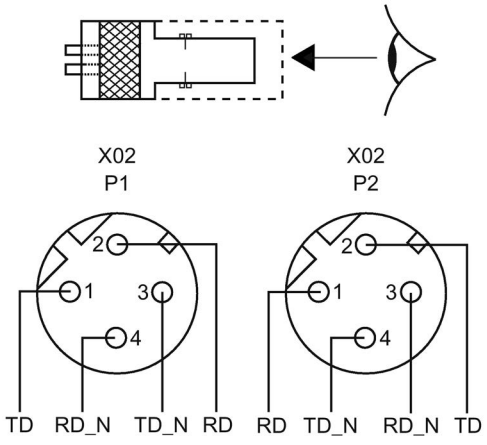
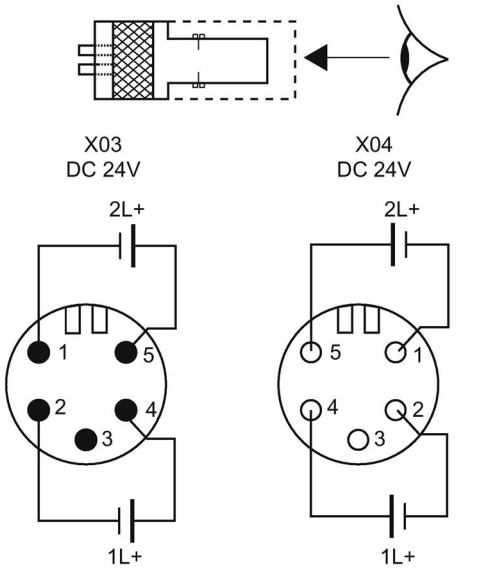
The following firmware versions are required for operating failsafe I/O modules on the IM 154-4 PN High Feature interface module:

	CPU		CP
Controller	315F-2 PN/DP 317F-2 PN/DP IM 154-8 PN/DP F-CPU	416-F	443-1
Firmware version	≥ V2.3.3	≥ V4.1	≥ V2.3

Pin assignment of PROFINET IO and power supplies on the CM IM PN M12, 7/8" connection module

Note

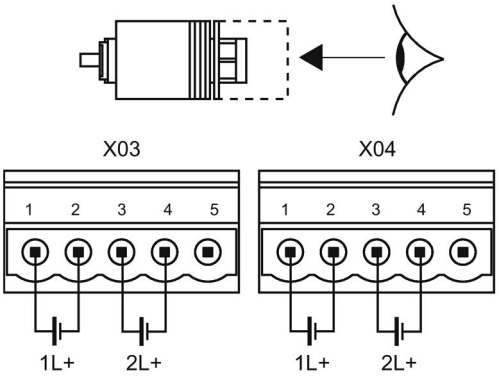
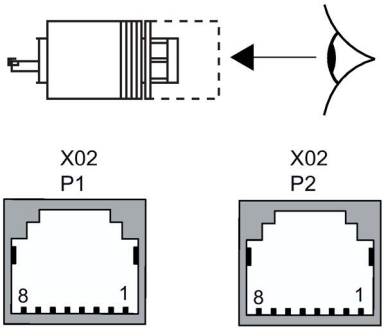
If you deactivate the "Autonegotiation" function in STEP 7, you must observe the changed pin assignment.

<table>
<tr><th>View of the M12 and 7/8" cable connectors</th><th>Terminal</th><th colspan="2">Assignment</th></tr>
<tr><td colspan="4">M12 cable connector, d-coded (PROFINET)</td></tr>
<tr><td rowspan="6">
</td><td></td><td>X02 P1 for connecting PROFINET</td><td>X02 P2 for connecting PROFINET</td></tr>
<tr><td>1</td><td>TD (Transmit Data+)</td><td>RD (Receive Data+)</td></tr>
<tr><td>2</td><td>RD (Receive Data+)</td><td>TD (Transmit Data+)</td></tr>
<tr><td>3</td><td>TD_N (Transmit Data-)</td><td>RD_N (Receive Data-)</td></tr>
<tr><td>4</td><td>RD_N (Receive Data-)</td><td>TD_N (Transmit Data-)</td></tr>
<tr><td>Thread</td><td colspan="2">Functional earth (FE)</td></tr>
<tr><td colspan="4">7/8" cable connectors (1L+ and 2L+ supply voltages)</td></tr>
<tr><td rowspan="6">
</td><td colspan="3">X03 DC 24V for feeding
X04 DC 24V for looping</td></tr>
<tr><td>1</td><td colspan="2">Ground for load voltage supply 2M</td></tr>
<tr><td>2</td><td colspan="2">Ground for electronics/encoder supply 1M</td></tr>
<tr><td>3</td><td colspan="2">Functional earth (FE)</td></tr>
<tr><td>4</td><td colspan="2">1L+ electronics/encoder supply</td></tr>
<tr><td>5</td><td colspan="2">2L+ load voltage supply</td></tr>
</table>

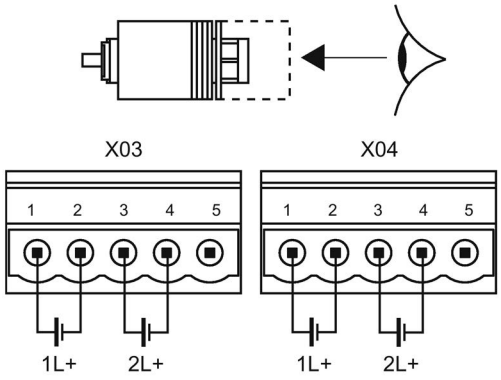
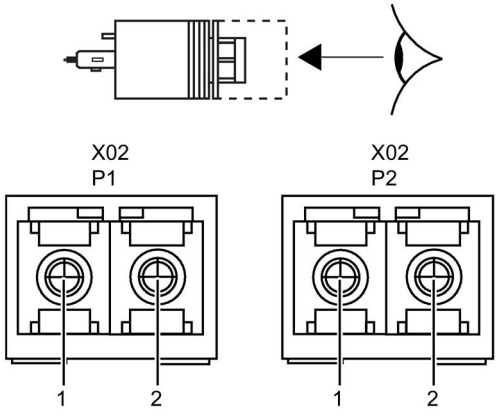
Pin assignment of PROFINET IO and supply voltages on the CM IM PN PP Cu connection module

Note

If you deactivate the "Autonegotiation" function in STEP 7, you must observe the changed pin assignment.

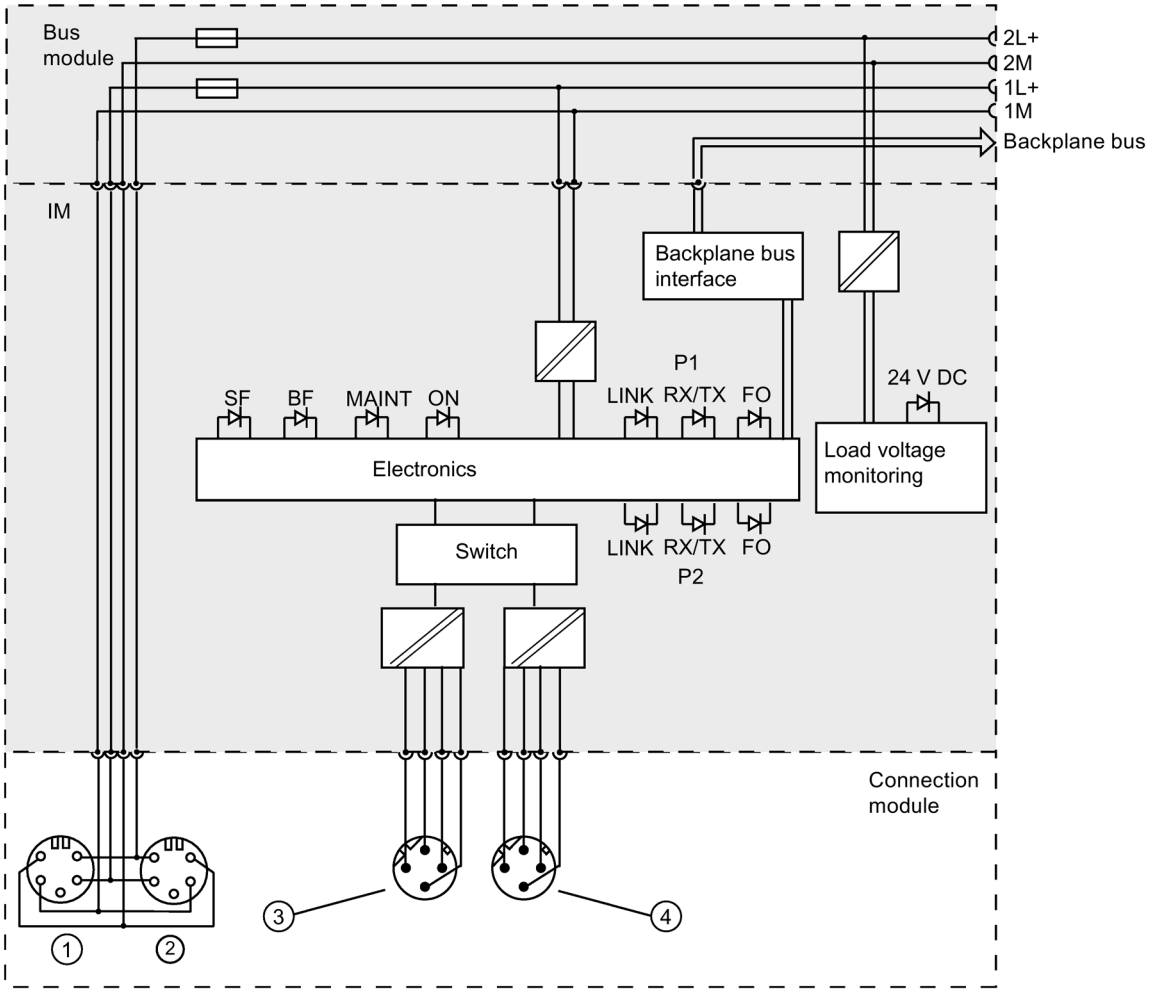
View of the push-pull cable connector	Terminal	Assignment	
Push-pull cable connector (1L+ and 2L+ supply voltages)			
	**X03 DC 24V for feeding** **X04 DC 24V for looping**		
	1	1L+ electronics/encoder supply	
	2	Ground for electronics/encoder supply 1M	
	3	2L+ load voltage supply	
	4	Ground for load voltage supply 2M	
	5	Functional earth (FE)	
Push-pull cable connector (RJ45)			
		**X02 P1 for connecting PROFINET**	**X02 P2 for connecting PROFINET**
	1	Transmit Data+ TD	Receive Data+ RD
	2	Transmit Data- TD_N	Receive Data- RD_N
	3	Receive Data+ RD	Transmit Data+ TD
	4	Ground GND	
	5	Ground GND	
	6	Receive Data- RD_N	Transmit Data- TD_N
	7	Ground GND	
	8	Ground GND	

Pin assignment of PROFINET IO and supply voltages on the CM IM PN PP FO connection module

View of the push-pull cable connector	Terminal	Assignment
Push-pull cable connector (1L+ and 2L+ supply voltages)		
	**X03 DC 24V for feeding** **X04 DC 24V for looping**	
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth (FE)
Push-pull cable connector (SC RJ)		
	**X02 PN1 for feeding PROFINET** **X02 PN2 for forwarding PROFINET**	
	1	TX (Transmit Data)
	2	RX (Receive Data)

Block diagram

The figure below shows the block diagram of the IM 154-4 PN High Feature interface module with CM IM PN M12, 7/8" as a possible connection module.



① Connection for the electronics/encoder supply and load voltage supply (feed)
② Connection for the electronics/encoder supply and load voltage supply (forwarding)
③ Connection for PROFINET IO (feed)
④ Connection for PROFINET IO (forwarding)

Figure 12-2 IM 154-4 PN High Feature block diagram

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W × H × D (mm)	135 x 130 x 60
Weight	Approx. 490 g
Module-specific data	
Transfer rate	100 Mbit/s full duplex
Transmission procedure	100BASE-TX
Autonegotiation	Yes
Bus protocol	PROFINET IO
Supported Ethernet services	PROFINET IO (Device), TCP/IP Protocol Suite: • Network management functions • ping • arp Network diagnostics (SNMP)
PROFINET interface	
• Connection socket	2 x M12 d-coded
• Switch function	Yes, internal
• Auto-cross-over	Yes; for segment expansion with additional IO devices or for connection of a PG
VendorID	$002A_H$
DeviceID	0305_H
Voltages and currents	
Rated supply voltage of the electronic components (1L+)	24 V DC
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes; with replaceable fuses
• Feed current 1L+	Max. 5 A; per ET 200pro
Rated load voltage 2L+	24 V DC(integrated power module)
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes, for the potential group
• Feed current 2L+	Max. 10 A; per ET 200pro
Current consumption	
From rated supply voltage (1L+)	Typ. 250 mA; with CM IM PN M12, 7/8" or CM IM PN PP Cu Typ. 350 mA; with CM IM PN PP FO
Power loss of the module	Typ. 6 W; with CM IM PN M12, 7/8" or CM IM PN PP Cu Typ. 6.7 W; with CM IM PN PP FO

Technical specifications	
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between the backplane bus and supply voltages (1L+, 2L+)	Yes
• Between Ethernet and the supply voltages (1L+, 2L+)	Yes
• Between electronics and supply voltages (1L+, 2L+)	Yes
Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostic function	Yes
• Group error	Red LED (SF)
• Bus monitoring PROFINET IO	Red LED (BF)
• Maintenance information	Yellow LED (MAINT)
• Monitoring of the supply voltage of the electronics	Green LED (ON)
• Monitoring of the rated load voltage 2L+	Green LED (DC24V) (integrated power module)
• Existing connection to network	Green LED (LINK); one LED per feed (P1) and forwarding (P2) of PROFINET IO
• Transmitting/receiving via network	Yellow LED (RX/TX); one LED per feed (P1) and forwarding (P2) of PROFINET IO
• Diagnostics	Yellow LED (FO); one LED per feed (P1) and forwarding (P2) of PROFINET IO

12.2.2 Overview of parameters of the interface module

Parameters of IM 154-4 PN High Feature (6ES7154-4AB10-0AB0)

You can find the representation and description of the parameters (interface, port 1, port 2) in the *STEP 7* online help.

Table 12- 1 Parameters for interface module IM 154-4 PN HF (GSD file)

Parameters	Value range	Default	Effective range
Enable configuration control	Yes/No	No	ET 200pro

Parameters for the integrated power module

Parameters	Value range	Effective range
Load voltage diagnostics	• Disable • Enable	ET 200pro

12.2.3 Description of the interface module parameters

Load voltage diagnostics

If you enable this parameter, the system generates diagnostic data when it detects a missing load voltage 2L+.

Enable configuration control

This parameter allows you to enable the configuration control function (option handling) in the ET 200pro distributed I/O system.

Note

When you configure the enable, the ET 200pro distributed I/O system requires a control data record 196 from the user program so that the ET 200pro distributed I/O system can operate the I/O modules.

For more information on the control data record, refer to section Configuration control (option handling) (Page 176).

Power modules

13

13.1 PM-E power module

Order number

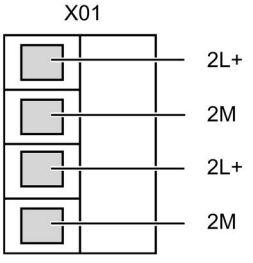
6ES7148-4CA00-0AA0

Properties

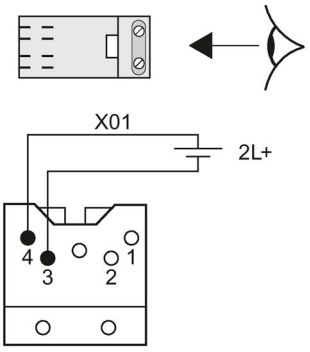
The PM-E power module has the following properties:

- The power module provides a new potential group for the 2L+ load voltage supply.
- It monitors the load voltage of all electronic modules in the potential group.
- The rear panel of the power module contains a replaceable fuse and a spare fuse.
- It supports option handling Configuration control with PROFIBUS interface module (Page 190)

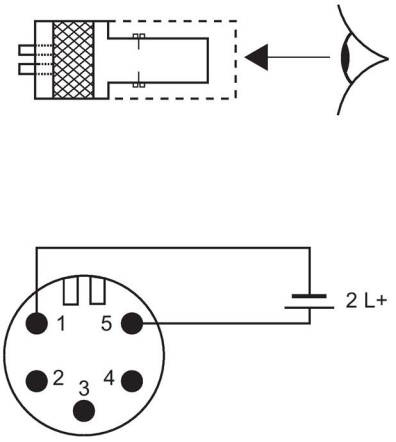
Pin assignment of the load voltage supply at connection module CM PM Direct

View of screw terminal X01	Designation
	**Feeding and forwarding X01**
	2L+ load voltage supply (feed)
	Ground for load voltage supply 2M (feed)
	2L+ load voltage supply (forwarding)
	Ground for load voltage supply 2M (forwarding)

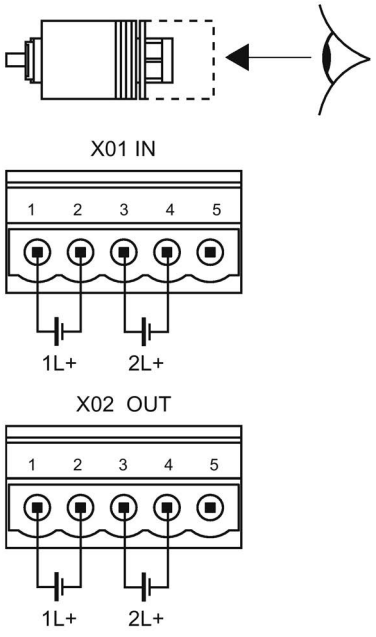
Pin assignment of the load voltage supply at connection module CM PM ECOFAST

View of the ECOFAST connector X01	Terminal	Designation
	**Feed for X01**	
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	2L+ load voltage supply

Pin assignment of the load voltage supply at connection module CM PM 7/8"

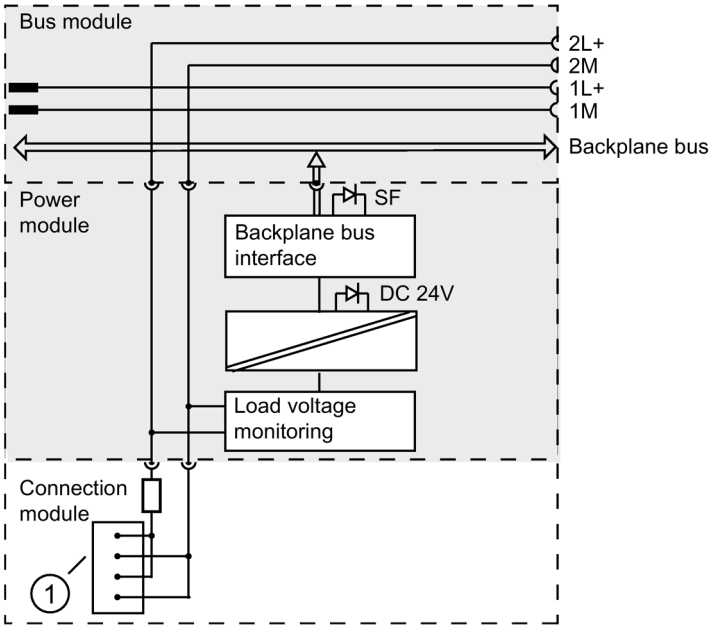
View of the 7/8" connector X01	Terminal	Designation
	**Feed for X01**	
	1	Ground for load voltage supply 2M
	2	Not assigned
	3	Not assigned
	4	Not assigned
	5	2L+ load voltage supply

Pin assignment of the load voltage supply at the CM PM PP connection module

View of the push-pull cable connector	Terminal	Description
	**Feed for X01 IN** **Forwarding X02 OUT**	
	1	1L+ electronics/encoder supply *
	2	Ground for electronics/encoder supply 1M*
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth
* Terminals 1 and 2 are jumpered between X01 IN and X02 OUT in the connection module.		

Block diagram

The figure below shows the block diagram of the power module PM-E



① Connections of the 2L+ load voltage supply

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W × H × D (mm)	45 × 130 × 35
Weight	Approx. 140 g
Voltages and currents	
Rated load voltage	24 V DC
• Overvoltage protection	No
• Reverse polarity protection	Yes; against destruction
Max. current carrying capacity (up to 55° C)	10 A; on the internal busbars of ET 200pro
• Short-circuit protection	Yes; replaceable fuse in the power module
Current consumption	
From load voltage 2L+	Max. 3 mA
Power loss of the module	Typ. 0.1 W
Electrical isolation	
• Between the rated load voltage 2L+ and the backplane bus	Yes
• Between the 1L+ electronics/encoder supply and the backplane bus	Yes
• Between power modules	Yes; if 1M and 2M are not bridged by an external circuit
Insulation	
Insulation tested with	707 V DC (type test)
Status, interrupts, diagnostics	
Diagnostic function	Yes
• Group error	Red "SF" LED
• Rated load voltage monitoring	Green "DC 24V" LED
• Diagnostic information can be read	Yes

Address space for option handling

You can control and monitor option handling using the control interface (PIQ) and feedback interface (PII).

The address range of the control interface (PIQ) and feedback interface (PII) depends on the configuration, in other words, the entry selected in the configuring software.

Table 13- 1 PII feedback interface and PIQ control interface

With STEP 7, HW Config or COM PROFIBUS or other configuration software	PII feedback interface		PIQ control interface	
Standard entry of the power module	---		---	
Entry ending in ...O	IBx ::: IBx+2	Option handling	QBx ::: QBx+2	Option handling

See also

Placement of PM-E power module (Page 39)

Electrical Configuration of ET 200pro (Page 69)

Connecting the Power Module with the CM PM-E Direct Connection Module (Page 128)

Connecting the Power Module with the CM PM-E ECOFAST Connection Module (Page 130)

Connecting the Power Module with the CM PM-E 7/8" Connection Module (Page 132)

13.2 PM-O DC 2x24V outgoing module

Order number

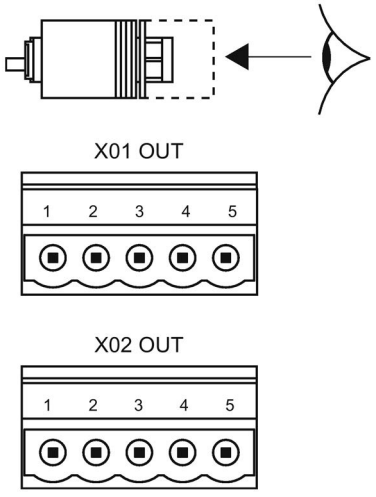
6ES7148-4CA60-0AA0

Properties

The PM-O DC 2x24V outgoing module has the following properties:

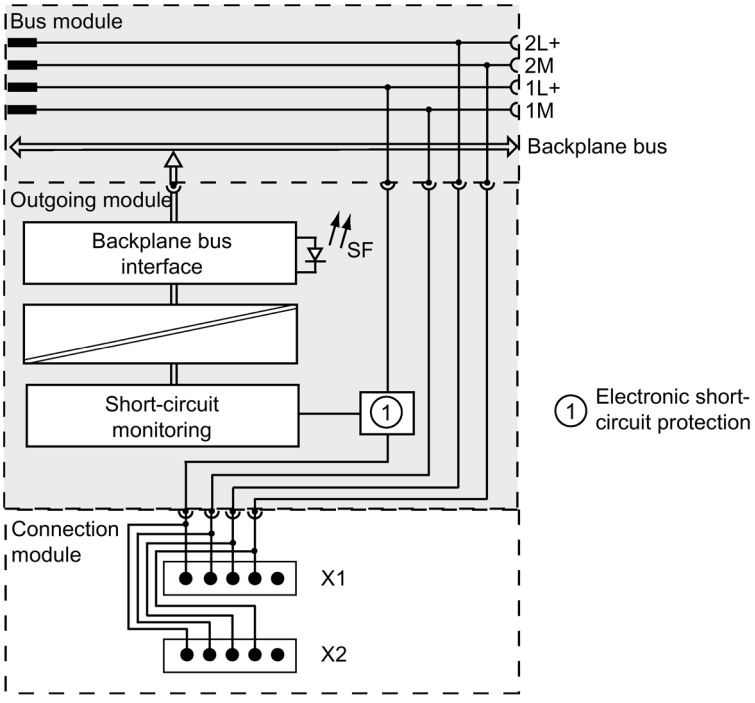
- Tapping the 1L+ electronics/encoder supply and the 2L+ load voltage supply using push-pull cable connectors.

Pin assignment of the load voltage supply at the CM PM-O PP connection module

View of the push-pull cable connector	Terminal	Assignment of X01/X02
	**Electronics/encoder supply and load voltage supply of X01**	
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth
	Electronics/encoder supply and load voltage supply of X02	
	1	1L+ electronics/encoder supply
	2	Ground for electronics/encoder supply 1M
	3	2L+ load voltage supply
	4	Ground for load voltage supply 2M
	5	Functional earth

Block diagram

The figure below shows the block diagram of the PM-O DC 2x24V outgoing module.



Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W × H × D (mm)	45 × 130 × 35
Weight	Approx. 150 g
Voltages and currents	
Rated load voltage	24 V DC
• Overvoltage protection	No
• Reverse polarity protection	Yes; against destruction
Max. current carrying capacity (up to 55° C)	10 A; on the internal busbars of ET 200pro
• 1L+ short circuit	Yes, electronic
• 2L+ short circuit protection	Yes, via a replaceable fuse in the upstream power module or in the integrated power module of the interface module.
Total current of the outputs (per module)	
• 1L+ electronics/encoder supply	2 A
• 2L+ load voltage supply	6 A
Current consumption	
• From backplane bus	5 mA
• From electronics/encoder supply 1L+	3 mA
• From 2L+ load voltage supply	3 mA
Power loss of the module	Typ. 1.1 W
Electrical isolation	
• Between the 2L+ rated load voltage and the backplane bus	Yes
• Between the 1L+ electronics/encoder supply and the backplane bus	Yes
Insulation	
Insulation tested with	707 V DC (type test)
Status, interrupts, diagnostics	
Diagnostic function	Yes
• Group error	Red "SF" LED
• Diagnostic information can be read	Yes

See also

Placement of PM-O DC 2x24V Outgoing Module (Page 40)

13.3 Parameter overview of power/outgoing module

Parameters of the power module

Parameters	Value range	Scope
Load voltage diagnostics	• Disable • Enable	Potential group of the power module

Parameters of outgoing module

Parameters	Value range	Scope
Diagnostics for short circuit to M	• Disable • Enable	Potential group of the outgoing module

13.4 Parameter description for power/outgoing module

Load voltage diagnostics

If you enable this parameter, the system generates diagnostic data when it detects a missing load voltage 2L+.

Diagnostics for short circuit to M

If you enable this parameter, the system generates diagnostic data when an external short-circuit of the 1L+ electronic/encoder supply to M occurs.

Digital electronic modules

14

14.1 Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0)

Order number

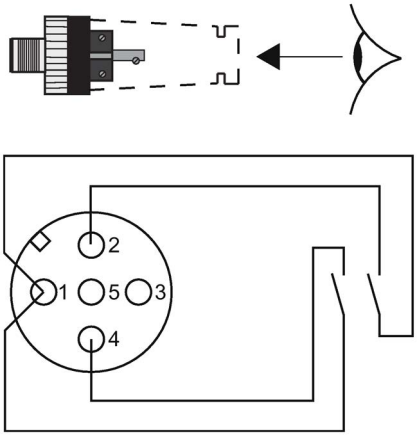
6ES7141-4BF00-0AA0

Properties

- Digital electronic module with eight inputs
- Rated input voltage 24 V DC
- Suitable for switches and proximity switches
- Diagnostics for encoder supply short-circuit to M per module

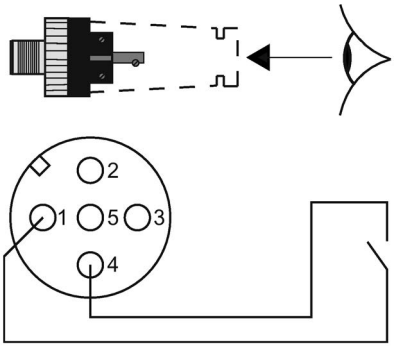
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

The table below shows the pin assignment of the 8 DI DC 24V on the CM IO 4 x M12 and CM IO 4 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X4
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	2	Input signal DI_4: Connector X1 Input signal DI_5: Connector X2 Input signal DI_6: Connector X3 Input signal DI_7: Connector X4
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)

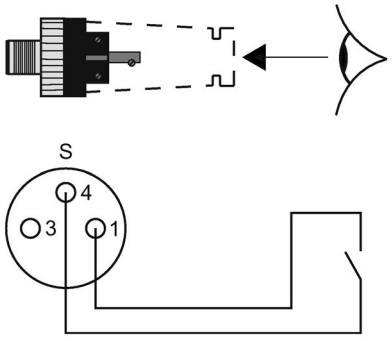
Pin assignment of connection modules CM IO 8 x M12 and CM IO 8 x M12P

The table below shows the pin assignment of the 8 DI DC 24V on the CM IO 8 x M12 and CM IO 8 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X8
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	2	Not assigned
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	5	Functional earth (FE)

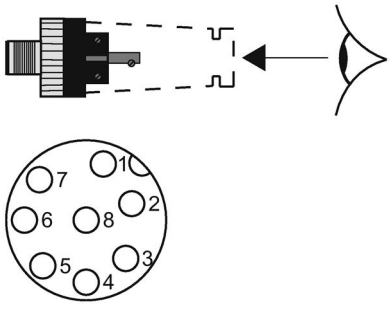
Pin assignment of connection module CM IO 8 x M8

The table below shows the pin assignment of 8 DI DC 24V on the connection module CM IO 8 x M8.

View of circular connector	Terminal	Assignment X1 to X8
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	-	-
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	S (shield)	Functional earth (FE)

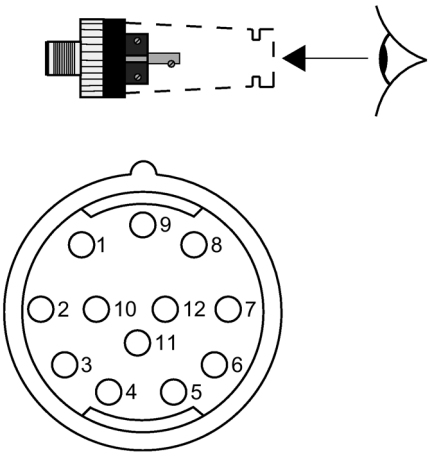
Pin assignment of connection module CM IO 2 x M12

The table below shows the pin assignment of the 8 DI DC 24V on the CM IO 2 x M12 connection module.

View of circular connector	Terminal	Assignment X1 and X2
	1	Input signal DI_0: Connector X1 Input signal DI_4: Connector X2
	2	Input signal DI_1: Connector X1 Input signal DI_5: Connector X2
	3	Input signal DI_2: Connector X1 Input signal DI_6: Connector X2
	4	Input signal DI_3: Connector X1 Input signal DI_7: Connector X2
	5	24V encoder supply U_S
	6	Not assigned
	7	Encoder supply ground 1M
	8	Functional earth (FE)

Pin assignment of connection module CM IO 1 x M23

The table below shows the pin assignment of 8 DI DC 24V on the connection module CM IO 1 x M23.

View of circular connector	Terminal	Assignment X1
	1	Input signal DI_0
	2	Input signal DI_1
	3	Input signal DI_2
	4	Input signal DI_3
	5	Input signal DI_4
	6	Input signal DI_5
	7	Input signal DI_6
	8	Input signal DI_7
	9	Encoder supply ground 1M
	10	Encoder supply ground 1M
	11	24V encoder supply U_S
	12	Functional earth (FE)

Block diagram

The figure below shows the block diagram of the 8 DI DC 24V.

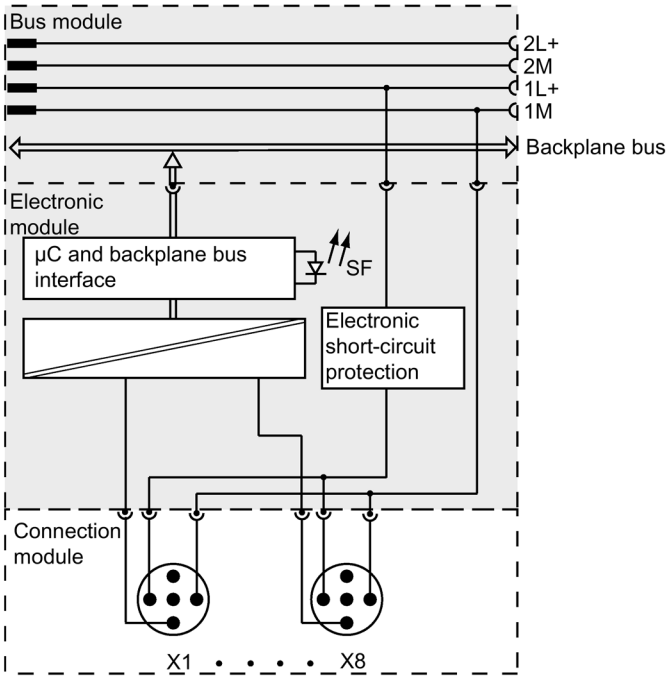


Figure 14-1 Block diagram 8 DI DC 24V

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35; with bus module, without connection module
Weight	Approx. 140 g
Voltages and currents	
Rated supply voltage of electronics/encoder 1L+	24 V DC
Reverse polarity protection	Yes, against destruction; encoder supply outputs are connected with reverse polarity
Current consumption	
• From backplane bus	< 20 mA
• From electronics/encoder supply 1L+ (no load)	< 20 mA
Power loss of the module	Typ. 2.5 W
Digital inputs	
Number of inputs	8
Number of inputs that can be controlled simultaneously	8; up to 55 °C in any mounting position
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Input voltage	
• Rated value	24 V DC
• For "0" signal	-3 V to +5 V
• For "1" signal	11 V to 30 V
Input current	
• With "1" signal	Typ. 7 mA
Input delay	
• At "0" to "1" transition	1.2 ms to 4.8 ms
• At "1" to "0" transition	1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire proximity switch	Supported
• Permissible quiescent current	Max. 1.5 mA
Encoder supply	
Number of encoder supplies	8
Total current up to 55 °C	Max. 1 A
Short-circuit protection	Yes; each module, electronic
• Response threshold	Min. 1.4 A

Technical specifications	
Status, interrupts, diagnostics	
Status display	Green LED; per channel
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	No
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	Yes
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels	No
• Between backplane bus and all other circuit elements	Yes

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)
CM IO 8 x M12 connection module for electronic modules (Page 270)
Response times of digital input modules (Page 500)

14.2 Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0)

Order number

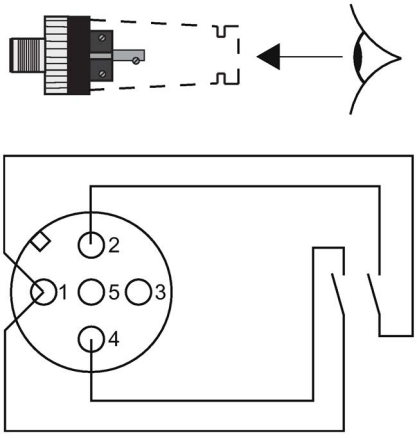
6ES7141-4BF00-0AB0

Properties

- Digital electronic module with eight inputs
- Rated input voltage 24 V DC
- Suitable for switches and proximity switches
- "Encoder supply to M short-circuit" diagnostics for each channel
- "Wire break" diagnostics for each channel
- Hardware interrupt
- Configurable input delay

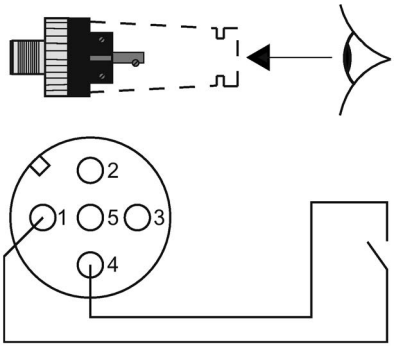
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

The table below shows the pin assignment of the 8 DI DC 24V High Feature on the CM IO 4 x M12 and CM IO 4 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X4
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	2	Input signal DI_4: Connector X1 Input signal DI_5: Connector X2 Input signal DI_6: Connector X3 Input signal DI_7: Connector X4
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)

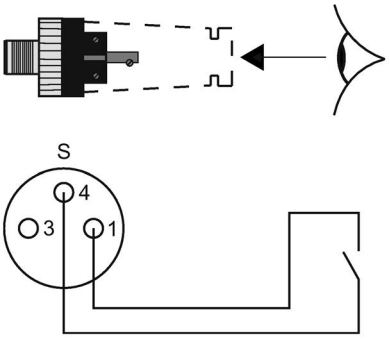
Pin assignment of connection modules CM IO 8 x M12 and CM IO 8 x M12P

The table below shows the pin assignment of the 8 DI DC 24V High Feature on the CM IO 8 x M12 and CM IO 8 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X8
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	2	Not assigned
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	5	Functional earth (FE)

Pin assignment of connection module CM IO 8 x M8

The table below shows the pin assignment of 8 DI DC 24V on the connection module CM IO 8 x M8.

View of circular connector	Terminal	Assignment X1 to X8
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	-	-
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	S (shield)	Functional earth (FE)

Block diagram

The figure below shows the block diagram of 8 DI DC 24V High Feature.

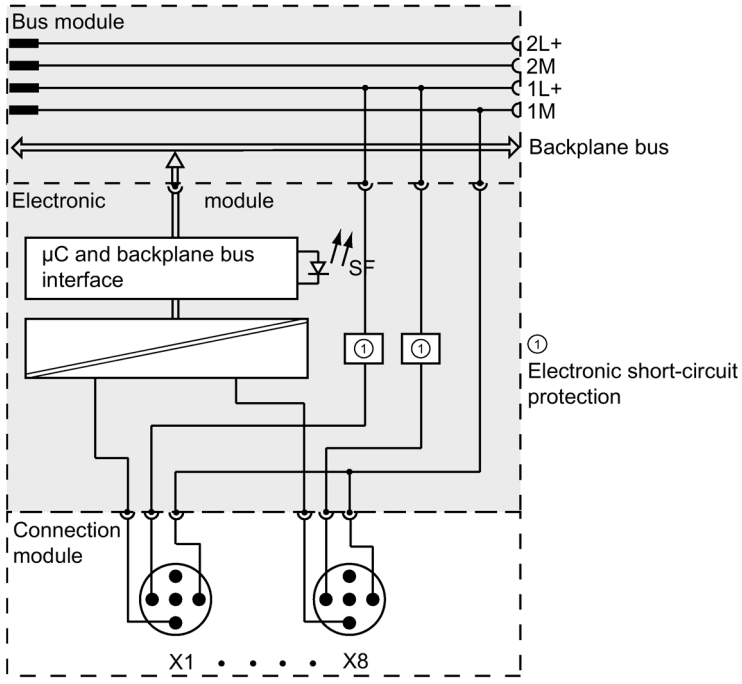


Figure 14-2 8 DI DC 24V High Feature block diagram

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35
Weight	Approx. 140 g
Digital inputs	
Number of inputs	8
Number of simultaneously controlled inputs	8; up to 55 °C in any mounting position
Support of isochronous mode	No
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Short-circuit protection	Yes, electronic, per channel
Voltages and currents	
Rated supply voltage of electronics/encoder 1L+	24 V DC
Reverse polarity protection	Yes; against destruction; encoder supply outputs are connected with reversed polarity.
Current consumption	
• From backplane bus	15 mA
• From electronics/encoder supply 1L+ (no load)	< 40 mA
Power loss of the module	Typ. 2.5 W
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels	No
• Between backplane bus and all other circuit elements	Yes
Insulation	
Insulation tested with	707 V DC (type test)
Status, interrupts, diagnostics	
Status display	Green LED, per channel
Interrupts	
• Diagnostic interrupt	Yes
• Assignable hardware interrupt	Yes, for channels 0 to 5
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	Red LED, per channel; combined with green status LED
• Diagnostic information can be read	Yes

Technical specifications	
Monitoring for	
• Short-circuit	Yes; per channel
• Wire break	Input < 0.3 mA; per channel
Encoder supply	
Number of encoder supplies	8
Output current	
• Rated value	0.5 A; per channel
• Total current of outputs, up to 55° C	Max. 1 A
Short-circuit protection	Yes, electronic, per channel
• Response threshold	Min. 0.7 A
Encoder selection data	
Input voltage	
• Rated value	24 V DC
• For "1" signal	11 V to 30 V
• For "0" signal	-3 V to +5 V
Input current	
• With "1" signal	Typ. 8 mA
Input delay	
• At "0" to "1" transition	0.5 ms/3 ms/15 ms/20 ms
• At "1" to "0" transition	0.5 ms/3 ms/15 ms/20 ms
Input characteristics	to IEC 61131, type 2
Connection of 2-wire proximity switch	Supported
• Permissible quiescent current	Max. 2 mA

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)
CM IO 8 x M12 connection module for electronic modules (Page 270)

14.3 Digital electronic module 16 DI DC 24V (6ES7141-4BH00-0AA0)

Order number

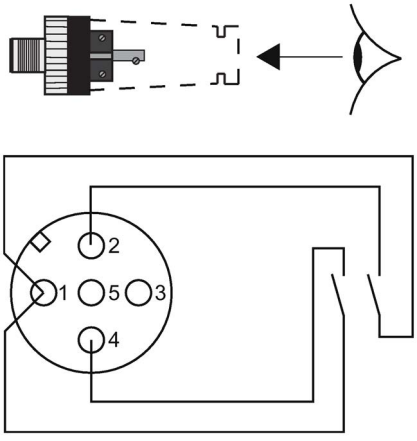
6ES7141-4BH00-0AA0

Properties

- Digital electronic module with 16 inputs
- Rated input voltage 24 V DC
- Suitable for switches and proximity switches
- Diagnostics for encoder supply short-circuit to M per module

Pin assignment of the CM IO 8 x M12D connection module

The table below shows the pin assignment of the 16 DI DC 24V on the CM IO 8 x M12D connection module.

View of circular connector	Terminal	Assignment X1 to X4
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	2	Input signal DI_8: Connector X1 Input signal DI_9: Connector X2 Input signal DI_{10}: Connector X3 Input signal DI_{11}: Connector X4 Input signal DI_{12}: Connector X5 Input signal DI_{13}: Connector X6 Input signal DI_{14}: Connector X7 Input signal DI_{15}: Connector X8
	3	Encoder supply ground 1M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4 Input signal DI_4: Connector X5 Input signal DI_5: Connector X6 Input signal DI_6: Connector X7 Input signal DI_7: Connector X8
	5	Functional earth (FE)

Block diagram

The figure below shows the block diagram of the 16 DI DC 24V.

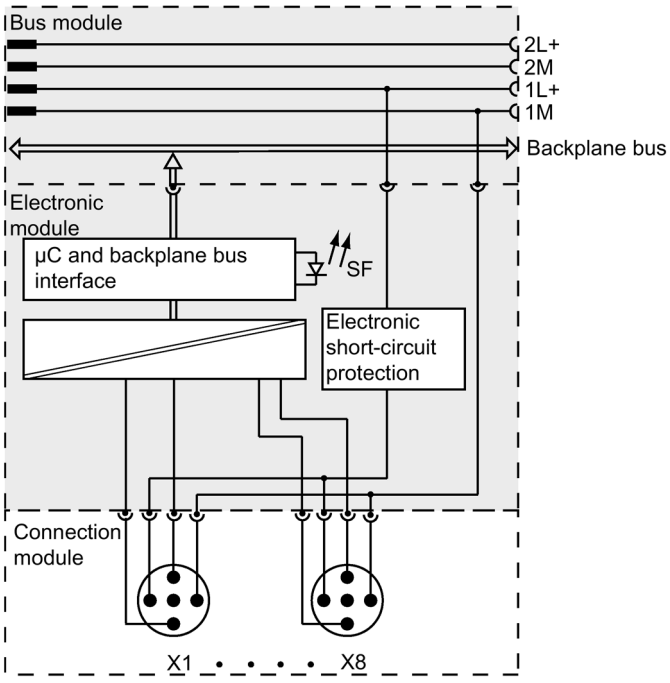


Figure 14-3 Block diagram 16 DI DC 24V

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35; with bus module, without connection module
Weight	Approx. 140 g
Voltages and currents	
Rated supply voltage of electronics/encoder 1L+	24 V DC
Reverse polarity protection	Yes, against destruction; encoder supply outputs are connected with reverse polarity
Current consumption	
• From backplane bus	< 20 mA
• From electronics/encoder supply 1L+ (no load)	< 30 mA
Power loss of the module	Typ. 3 W
Digital inputs	
Number of inputs	16
Number of inputs that can be controlled simultaneously	16; up to 55° C in any mounting position
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Input voltage	
• Rated value	24 V DC
• For "0" signal	-3 V to +5 V
• For "1" signal	11 V to 30 V
Input current	
• With "1" signal	Typ. 4 mA
Input delay	
• At "0" to "1" transition	1.2 ms to 4.8 ms
• At "1" to "0" transition	0.7 ms to 3 ms
Input characteristics	to IEC 61131, type 3
Connection of 2-wire proximity switch	Supported
• Permissible quiescent current	Max. 1.5 mA
Encoder supply	
Number of encoder supplies	8
Total current up to 55 °C	Max. 1 A
Short-circuit protection	Yes; each module, electronic
• Response threshold	Min. 1.4 A

Technical specifications	
Status, interrupts, diagnostics	
Status display	Green LED; per channel
Interrupts	
• Diagnostic interrupt	Configurable[1]
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	No
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	Yes, per module
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels	No
• Between backplane bus and all other circuit elements	Yes

Note

When a diagnostic interrupt occurs, the 16 DI DC 24V signals 1000_B (function module FM) as the module class in byte x+5. See Diagnostic interrupt, byte x+4 to x+7 (Page 217).

See also

CM IO 8 x M12D connection module for electronic modules (Page 274)

14.4 Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0)

Order number

6ES7142-4BD00-0AA0

Properties

- Digital electronic module with four outputs
- Output current per output 2 A
- Rated load voltage 24 V DC
- Suitable for solenoid valves, DC contactors and indicator lights
- Diagnostics of short-circuit outputs to M for each module

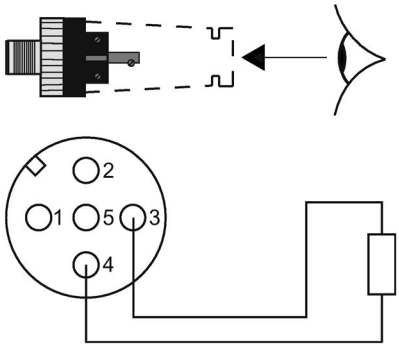
Note

The digital outputs at DQ_0 to DQ_3 (rated load voltage 2L+) can be switched off for safety-related operation.

More detailed information is available in the Appendix in the chapter Fail-safe disconnection of ET 200pro standard output modules (Page 270).

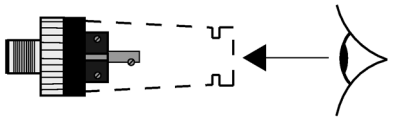
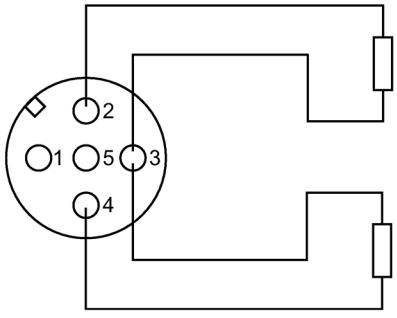
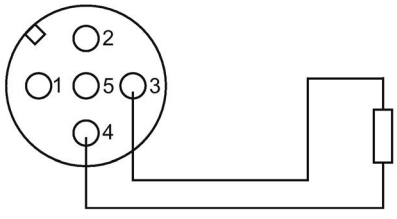
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

The table below shows the pin assignment of the 4 DO DC 24V/2.0A on the CM IO 4 x M12 and CM IO 4 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X4
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	5	Functional earth (FE)

Pin assignment on the CM IO 4 x M12 Inverse connection module

The table below shows the pin assignment of 4 DO DC 24V/2.0A on the CM IO 4 x M12 Inverse connection module.

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1, X3**
	1	Not assigned
	2	Output signal DQ_1: Connector X1 Output signal DQ_3: Connector X3
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_2: Connector X3
	5	Functional earth (FE)
	**Terminal**	**Assignment X2, X4**
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_1: Connector X2 Output signal DQ_3: Connector X4
	5	Functional earth (FE)

Note

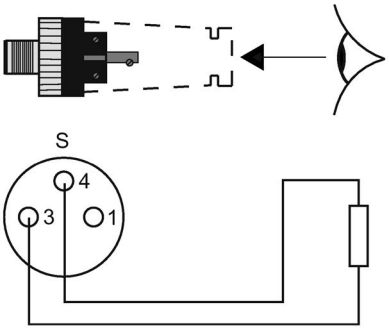
Connection of channel 1 (bit 1) and channel 3 (bit 3)

Channels 1 and 3 are only allowed to be connected to **one** circular socket connector each:

- Channel 1 to circular socket connector X1 or X2.
- Channel 3 to circular socket connector X3 or X4.

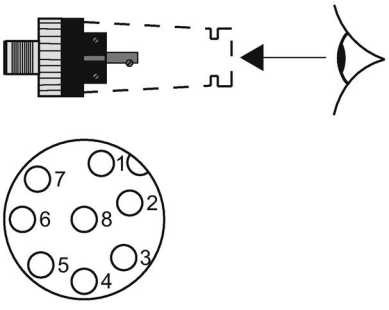
Pin assignment of connection module CM IO 8 x M8

The table below shows the pin assignment of 4 DO DC 24V/2.0A on the connection module CM IO 8 x M8.

View of circular connector	Terminal	Assignment X1 to X8
	1	Not assigned
	-	-
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	S (shield)	Functional earth (FE)
	Connectors X5 to X8 are not assigned	

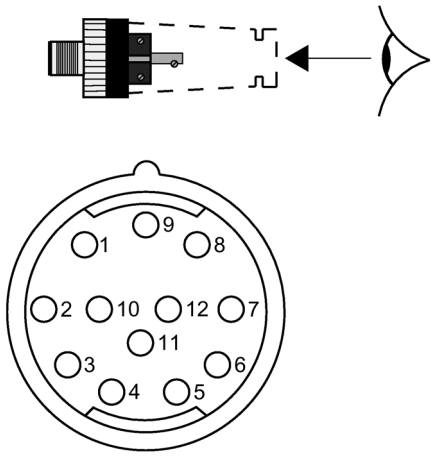
Pin assignment of connection module CM IO 2 x M12

The table below shows the pin assignment of 4 DO DC 24V/2.0A on connection module CM IO 2 x M12.

View of circular connector	Terminal	Assignment X1 and X2
	1	Output signal DQ_0: Connector X1
	2	Output signal DQ_1: Connector X1
	3	Output signal DQ_2: Connector X1
	4	Output signal DQ_3: Connector X1
	5	Not assigned
	6	Not assigned
	7	Ground for load voltage supply 2M
	8	Functional earth (FE)
	Connector X2 is not assigned	

Pin assignment of connection module CM IO 1 x M23

The table below shows the pin assignment of 4 DO DC 24V/2.0A on connection module CM IO 1 x M23.

View of circular connector	Terminal	Assignment X1
	1	Output signal DQ_0
	2	Output signal DQ_1
	3	Output signal DQ_2
	4	Output signal DQ_3
	5	Not assigned
	6	Not assigned
	7	Not assigned
	8	Not assigned
	9	Ground for load voltage supply 2M
	10	Ground for load voltage supply 2M
	11	Not assigned
	12	Functional earth (FE)

Block diagram

The figure below shows the block diagram of the 4 DO DC 24V/2.0A.

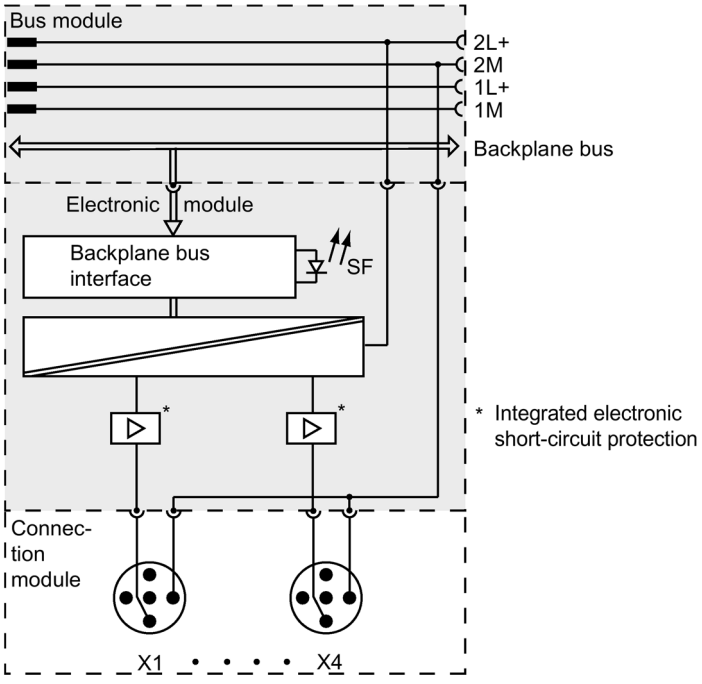


Figure 14-4 Block diagram 4 DO DC 24V

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35; with bus module, without connection module
Weight	Approx. 140 g
Voltages and currents	
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes; against destruction; loads will be activated
• Short-circuit protection	Yes; per channel
Total current of the outputs	
• All mounting positions up to 40 °C	6 A
• All mounting positions up to 55 °C	4 A
Current consumption	
• From backplane bus	< 20 mA
• From load voltage 2L+ (without load)	< 20 mA
Power loss	Typ. 2 W
Digital outputs	
Number of digital outputs	4
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Short-circuit protection of the output	Yes, electronic, per channel
• Response threshold	Min. 2.8 A
Limitation of the inductive cut-off voltage to lamp load	Typ. 2L+ (-47 V)
Lamp load	Max. 10 W
Control of a digital input	Yes; no electrical isolation between 1L+ and 2L+, because 1M and 2M are jumpered
Output voltage	
• Rated value	24 V DC
• With "1" signal	Min. 2L+ (-0.8 V)
Output current	
• With "1" signal	2 A
• With "0" signal (residual current)	Max. 0.5 mA
Wiring 2 outputs in parallel	
• For performance increase	No
• For redundant control of a load	Supported

Technical specifications	
Switching frequency	
• With resistive load	100 Hz
• With inductive load	0.5 Hz
• With lamp load	1 Hz
Load resistance range	
• Low limit	12 Ω
• High limit	4 kΩ
Status, interrupts, diagnostics	
Status display	Green LED (per channel)
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	No
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	Yes
Insulation	
Insulation tested	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No

See also

Fail-safe shutdown of the ET 200pro Standard edition modules (Page 515)
Connection module CM IO 4 x M12 for electronic modules (Page 264)
CM IO 4 x M12 Inverse connection module for electronic modules (Page 268)
Response times for digital output and pneumatic interface modules (Page 500)

14.5 Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0)

Order number

6ES7142-4BD00-0AB0

Properties

- Digital electronic module with four outputs
- Output current per output 2 A
- Rated load voltage 24 V DC
- Suitable for solenoid valves, DC contactors and indicator lights
- "Short-circuit outputs to M" diagnostics for each channel
- "Short-circuit outputs to P" diagnostics for each channel
- "Wire break at outputs" diagnostics for each channel
- "Missing load voltage" diagnostics for each module
- Configurable substitute value

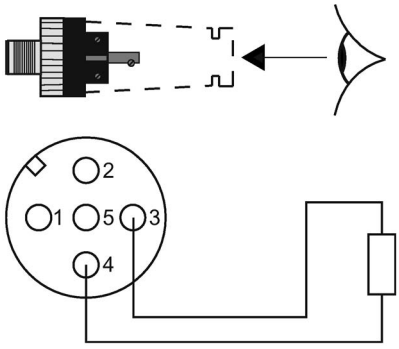
Note

The digital outputs at DQ_0 to DQ_3 (rated load voltage 2L+) can be switched off for safety-related operation.

More detailed information is available in the Appendix in the chapter Fail-safe disconnection of ET 200pro standard output modules (Page 515).

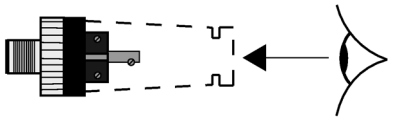
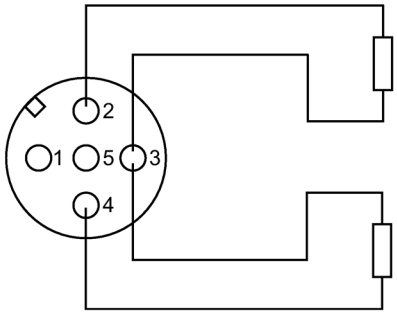
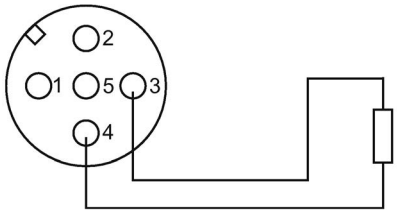
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

The table below shows the pin assignment of the 4 DO DC 24V/2.0A High Feature on the CM IO 4 x M12 and CM IO 4 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X4
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	5	Functional earth (FE)
	Connectors X5 to X8 are not assigned	

Pin assignment on the CM IO 4 x M12 Inverse connection module

The table below shows the pin assignment of 4 DO DC 24V/2.0A High Feature on the CM IO 4 x M12 Inverse connection module.

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1, X3**
	1	Not assigned
	2	Output signal DQ_1: Connector X1 Output signal DQ_3: Connector X3
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_2: Connector X3
	5	Functional earth (FE)
	**Terminal**	**Assignment X2, X4**
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_1: Connector X2 Output signal DQ_3: Connector X4
	5	Functional earth (FE)

Note

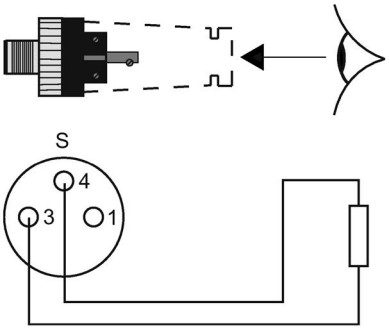
Connection of channel 1 (bit 1) and channel 3 (bit 3)

Channels 1 and 3 are only allowed to be connected to **one** circular socket connector each:

- Channel 1 to circular socket connector X1 or X2.
- Channel 3 to circular socket connector X3 or X4.

Pin assignment of connection module CM IO 8 x M8

The table below lists the pin assignment of 4 DO DC 24V/2.0A High Feature on the connection module CM IO 8 x M8.

View of circular connector	Terminal	Assignment X1 to X8
	1	Not assigned
	-	-
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	S	Functional earth (FE)
	Connectors X5 to X8 are not assigned	

Block diagram

The figure below shows the block diagram of 4 DO DC 24V/2.0A High Feature.

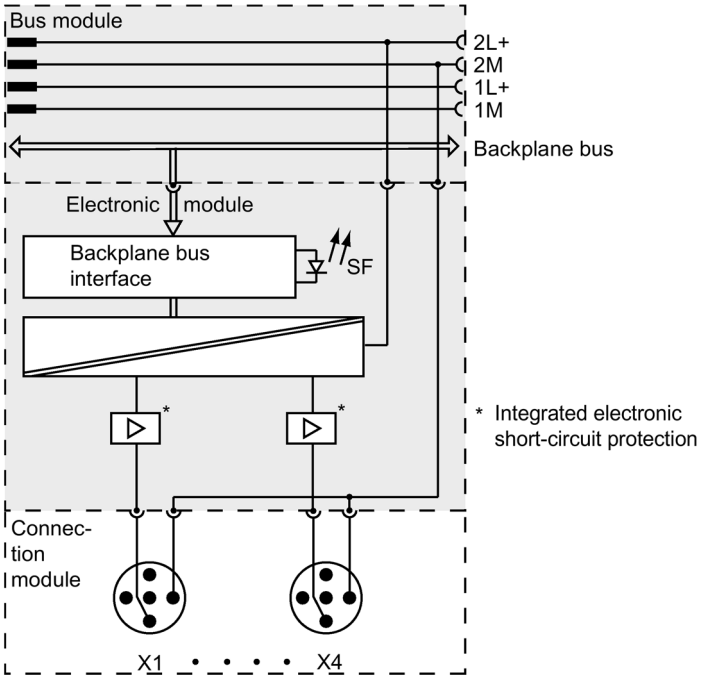


Figure 14-5 Block diagram of 4 DO DC 24V/2.0A High Feature

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35; with bus module, without connection module
Weight	Approx. 140 g
Digital outputs	
Number of outputs	4
Support of isochronous mode	No
Cable length, unshielded	Max. 30 m
Short-circuit protection of the output	Yes, electronic, per channel
• Response threshold	Min. 2.8 A
Voltages and currents	
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes, per module, against destruction, loads actuated
• Short-circuit protection	Yes; per channel
Total current of the outputs	
• All mounting positions up to 40 °C	6 A
• All mounting positions up to 55 °C	4 A
Current consumption	
• From backplane bus	< 30 mA
• From load voltage 2L+	< 40 mA
Power loss of the module	Typ. 2.5 W
Electrical isolation	
• Between channels and backplane bus	Yes
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No
Insulation	
Insulation tested	707 V DC (type test)
Status, interrupts, diagnostics	
Status display	Green LED, per channel
Interrupts	
• Diagnostic interrupt	Configurable

Technical specifications	
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	Red LED, per channel; combined with green status LED
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	Yes; per channel
• Wire break	Yes; per channel
Actuator selection data	
Output voltage	
• Rated value	24 V DC
• With "1" signal	Min. 2L+ (-0.8 V)
Output current	
• With "1" signal	2 A
• With "0" signal (residual current)	Max. 0.5 mA
Load resistance range	12 Ω to 4 kΩ
Lamp load	Max. 10 W
Wiring 2 outputs in parallel	
• For redundant control of a load	Supported
• For performance increase	No
Control of a digital input	Possible; electrical isolation between 1L+ and 2L+ no longer given, because 1M and 2M are bridged.
Switching frequency	
• With resistive load	100 Hz
• With inductive load	0.5 Hz
• With lamp load	1 Hz
Limiting (internal) of inductive shut-down voltage	Typ. 2L+ (-53 V)

See also

Digital electronic modules (Page 333)

CM IO 4 x M12 Inverse connection module for electronic modules (Page 268)

CM IO 8 x M12 connection module for electronic modules (Page 270)

14.6 Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0)

Order number

6ES7142-4BF00-0AA0

Properties

- Digital electronic module with eight outputs
- Output current per output 0.5 A
- Rated load voltage 24 V DC
- Suitable for solenoid valves, DC contactors and indicator lights
- Diagnostics of short-circuit outputs to M for each module

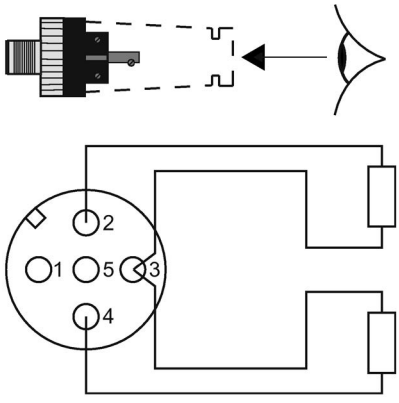
Note

The digital outputs at DQ_0 to DQ_7 (rated load voltage 2L+) can be switched off for safety-related operation.

More detailed information is available in the Appendix in the chapter Fail-safe disconnection of ET 200pro standard output modules (Page 515).

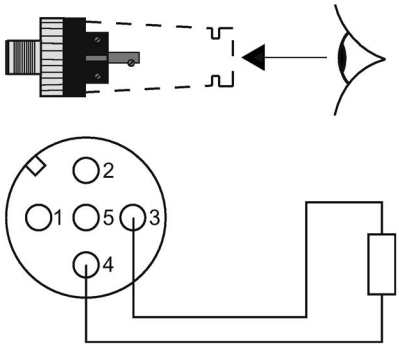
Pin assignment of connection modules CM IO 4x M12 and CM IO 4x M12P

The table below shows the pin assignment of the 8 DO DC 24V/0.5A on the CM IO 4 x M12 and CM IO 4 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X4
	1	Not assigned
	2	Output signal DQ_4: Connector X1 Output signal DQ_5: Connector X2 Output signal DQ_6: Connector X3 Output signal DQ_7: Connector X4
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	5	Functional earth (FE)
① 4 or 5-core copper cable		

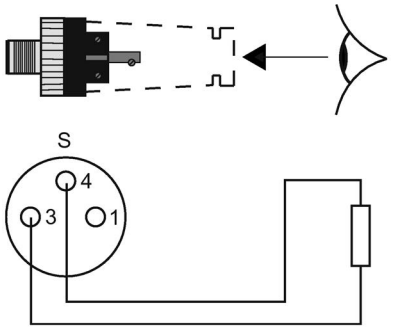
Pin assignment of connection modules CM IO 8 x M12 and CM IO 8 x M12P

The table below shows the pin assignment of the 8 DO DC 24V/0.5A on the CM IO 8 x M12 and CM IO 8 x M12P connection modules.

View of circular connector	Terminal	Assignment X1 to X8
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4 Output signal DQ_4: Connector X5 Output signal DQ_5: Connector X6 Output signal DQ_6: Connector X7 Output signal DQ_7: Connector X8
	5	Functional earth (FE)
① 3, 4 or 5-core copper cable		

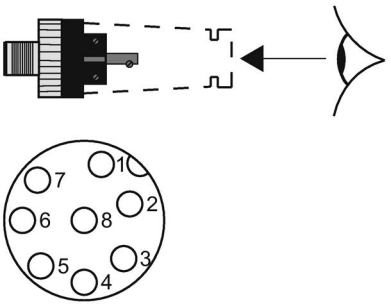
Pin assignment of connection module CM IO 8 x M8

The table below shows the pin assignment of 8 DO DC 24V/0.5A on the connection module CM IO 8 x M8.

View of circular connector	Terminal	Assignment X1 to X8
	1	Not assigned
	-	-
	3	Ground for load voltage supply 2M
	4	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4 Output signal DQ_4: Connector X5 Output signal DQ_5: Connector X6 Output signal DQ_6: Connector X7 Output signal DQ_7: Connector X8
	S	Functional earth (FE)
① 3-core copper cable		

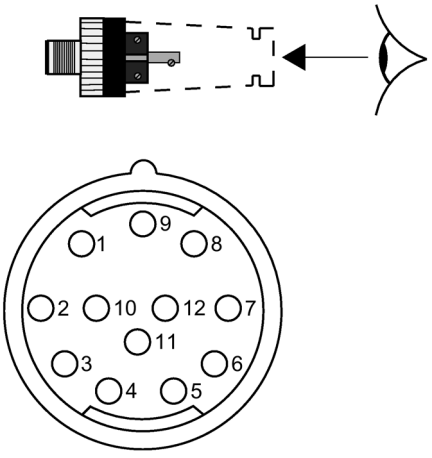
Pin assignment of connection module CM IO 2 x M12

The table below shows the pin assignment of 8 DO DC 24V/0.5A on connection module CM IO 2 x M12.

View of circular connector	Terminal	Assignment X1 and X2
	1	Output signal DQ_0: Connector X1 Output signal DQ_4: Connector X2
	2	Output signal DQ_1: Connector X1 Output signal DQ_5: Connector X2
	3	Output signal DQ_2: Connector X1 Output signal DQ_6: Connector X2
	4	Output signal DQ_3: Connector X1 Output signal DQ_7: Connector X2
	5	Not assigned
	6	Not assigned
	7	Ground for load voltage supply 2M
	8	Functional earth (FE)

Pin assignment of connection module CM IO 1 x M23

The table below shows the pin assignment of 8 DO DC 24V/0.5A on connection module CM IO 1 x M23.

View of circular connector	Terminal	Assignment X1
	1	Output signal DQ_0
	2	Output signal DQ_1
	3	Output signal DQ_2
	4	Output signal DQ_3
	5	Output signal DQ_4
	6	Output signal DQ_5
	7	Output signal DQ_6
	8	Output signal DQ_7
	9	Ground for load voltage supply 2M
	10	Ground for load voltage supply 2M
	11	Not assigned
	12	Functional earth (FE)

Block diagram

The figure below shows the block diagram of the 8 DO DC 24V/0.5A.

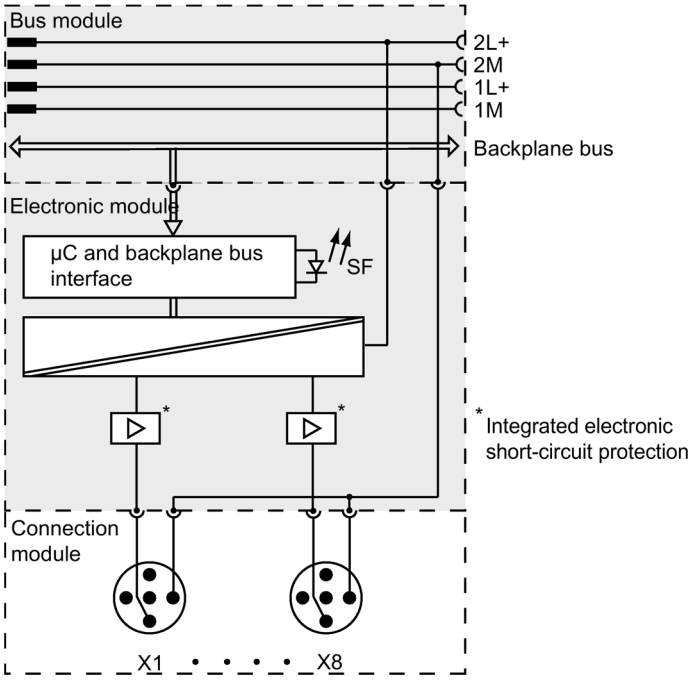


Figure 14-6 Block diagram 8 DO DC 24V/0.5A

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35; with bus module, without connection module
Weight	Approx. 140 g
Voltages and currents	
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes; against destruction; loads will be activated
• Short-circuit protection	Yes; per channel
Total current of the outputs	
• All mounting positions up to 40 °C	4 A
• All mounting positions up to 55 °C	4 A
Current consumption	
• From backplane bus	< 30 mA
• From load voltage 2L+ (without load)	< 30 mA
Power loss	Typ. 2 W

Technical specifications	
Digital outputs	
Number of digital outputs	8
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Short-circuit protection of the output	Yes, electronic, per channel
• Response threshold	Min. 0.7 A
Limitation of the inductive cut-off voltage to lamp load	Typ. 2L+ (-47 V)
Lamp load	Max. 5 W
Control of a digital input	Yes; no electrical isolation between 1L+ and 2L+, because 1M and 2M are jumpered
Output voltage	
• Rated value	24 V DC
• With "1" signal	Min. 2L+ (-0.8 V)
Output current	
• With "1" signal	0.5 A
• With "0" signal (residual current)	Max. 0.5 mA
Wiring 2 outputs in parallel	
• For performance increase	No
• For redundant control of a load	Supported
Switching frequency	
• With resistive load	100 Hz
• With inductive load	0.5 Hz
• With lamp load	1 Hz
Load resistance range	
• Low limit	48 Ω
• High limit	4 kΩ
Status, interrupts, diagnostics	
Status display	Green LED (per channel)
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	No
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	Yes

Technical specifications	
Insulation	
Insulation tested	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No

14.7 Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0)

Order number

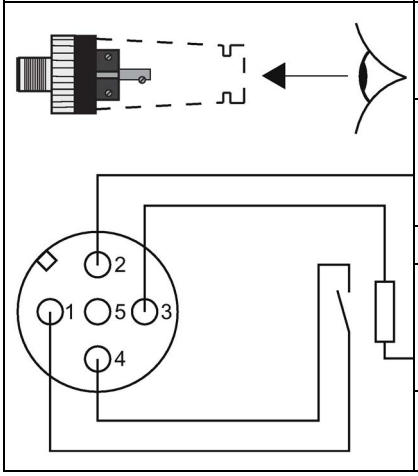
6ES7143-4BF50-0AA0

Properties

- Digital electronic module with 8 channels:
  - 4 digital inputs, supplied from supply voltage 2L+
  - 4 digital outputs 0.5 A, supplied from supply voltage 2L+
  - Rated input voltage and rated load voltage 24 V DC
  - Suitable for switches and proximity switches
  - Outputs suitable for solenoid valves, DC contactors and indicator lights
- Diagnostics for short-circuit of encoder supply to ground and short-circuit of outputs

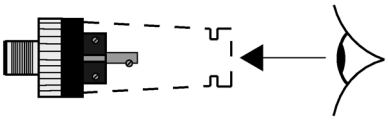
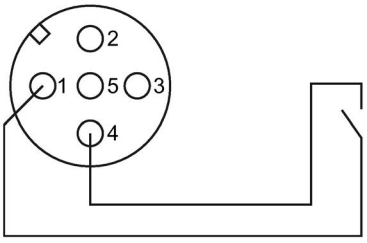
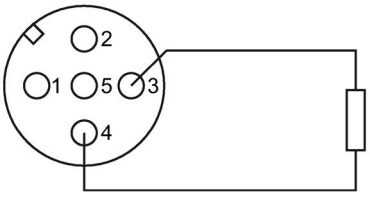
Pin assignment on connection modules CM IO 4 x M12 and CM IO 4 x M12P

The table below shows the pin assignment of the 4 DI / 4 DO DC 24V/0.5A on connection modules CM IO 4 x M12 and CM IO 4 x M12P.

View of circular connector	Terminal	Assignment X1 to X4 (inputs/outputs)
	1	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	2	Output signal DQ_0: Connector X1 Output signal DQ_1: Connector X2 Output signal DQ_2: Connector X3 Output signal DQ_3: Connector X4
	3	Ground 2M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)

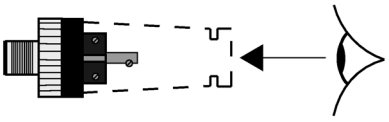
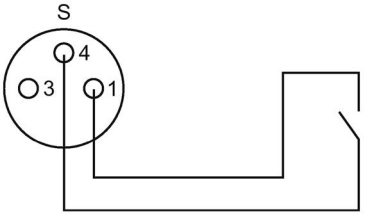
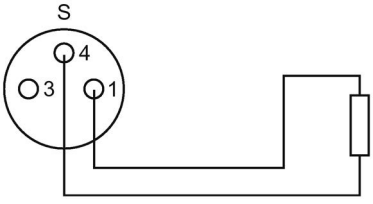
Pin assignment on connection modules CM IO 8 x M12 and CM IO 8 x M12P

The table below shows the pin assignment of the 4 DI / 4 DO DC 24V/0.5A on connection modules CM IO 8 x M12 and CM IO 8 x M12P.

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1 to X4 (inputs)**
	1	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	2	Not assigned
	3	Ground 2M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	5	Functional earth (FE)
	**Terminal**	**Pin assignment X5 to X8 (outputs)**
	1	Not assigned
	2	Not assigned
	3	Ground 2M
	4	Output signal DQ_0: Connector X5 Output signal DQ_1: Connector X6 Output signal DQ_2: Connector X7 Output signal DQ_3: Connector X8
	5	Functional earth (FE)

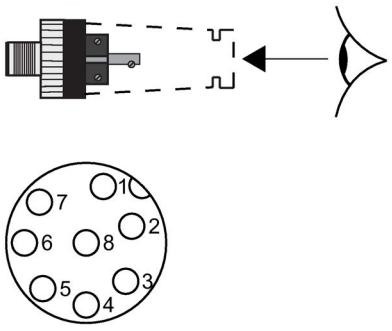
Pin assignment on the CM IO 8 x M8 connection module

The table below shows the pin assignment of the 4 DI / 4 DO DC 24V/0.5A on connection module CM IO 8 x M8.

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1 to X4 (inputs)**
	1	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	3	Ground 2M
	4	Input signal DI_0: Connector X1 Input signal DI_1: Connector X2 Input signal DI_2: Connector X3 Input signal DI_3: Connector X4
	S (shield)	Functional earth (FE)
	**Terminal**	**Pin assignment X5 to X8 (outputs)**
	1	Not assigned
	3	Ground 2M
	4	Output signal DQ_0: Connector X5 Output signal DQ_1: Connector X6 Output signal DQ_2: Connector X7 Output signal DQ_3: Connector X8
	S (shield)	Functional earth (FE)

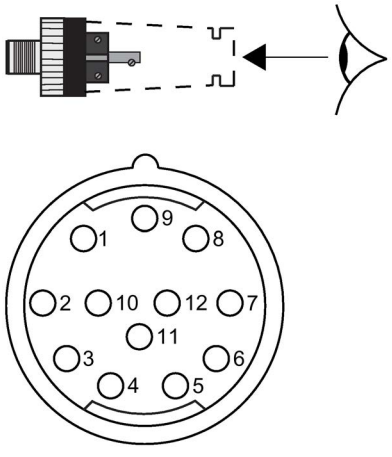
Pin assignment on the CM IO 2 x M12 connection module

The table below shows the pin assignment of the 4 DI / 4 DO DC 24V/0.5A on connection module CM IO 2 x M12.

View of circular connector	Terminal	Assignment X1 (inputs)
	1	Input signal DI_0
	2	Input signal DI_1
	3	Input signal DI_2
	4	Input signal DI_3
	5	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	6	Not assigned
	7	Ground 2M
	8	Functional earth (FE)
	Terminal	**Assignment X2 (outputs)**
	1	Output signal DQ_0
	2	Output signal DQ_1
	3	Output signal DQ_2
	4	Output signal DQ_3
	5	Not assigned
	6	Not assigned
	7	Ground 2M
	8	Functional earth (FE)

Pin assignment on the CM IO 1 x M23 connection module

The table below shows the pin assignment of the 4 DI / 4 DO DC 24V/0.5A on connection module CM IO 1 x M23.

View of circular connector	Terminal	Assignment X1 (inputs/outputs)
	1	Input signal DI_0
	2	Input signal DI_1
	3	Input signal DI_2
	4	Input signal DI_3
	5	Output signal DQ_0
	6	Output signal DQ_1
	7	Output signal DQ_2
	8	Output signal DQ_3
	9	Ground 2M
	10	Ground 2M
	11	24 V encoder supply U_S (from 2L+) (is supplied by the ET 200pro to the connected encoder)
	12	Functional earth (FE)

Block diagram with CM IO 4 x M12

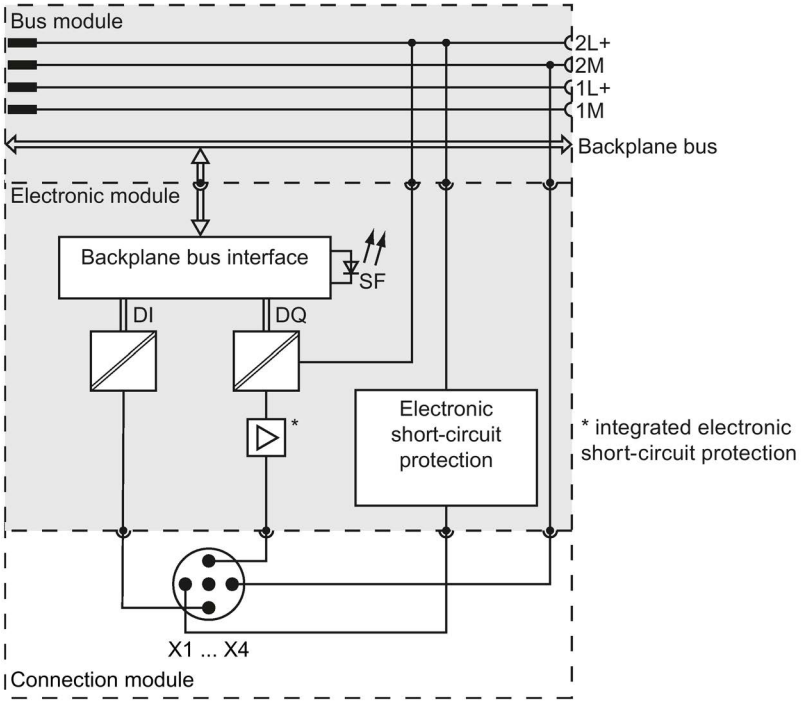


Figure 14-7 Block diagram 4 DI / 4 DO DC 24V/0.5A for CM IO 4 x M12

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 × 130 × 35; with bus module, without connection module
Weight	Approx. 140 g
Voltages and currents	
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes, against destruction, encoder supply outputs are connected with reversed polarity Loads activated
• Short-circuit protection	Yes, per output
Total current of the outputs	
• All mounting positions up to 55 °C	2 A
Current consumption	
• From backplane bus	< 20 mA
• From load voltage 2L+ (without load)	< 20 mA

Technical specifications	
Encoder supply	
Number of encoder supplies	4, supplied from 2L+
Total current up to 55 °C	Max. 1 A
Short-circuit protection	Yes, per module, electronic
• Response threshold	Min. 1.4 A
Channels	
Number of digital channels	8
Digital inputs	
Number of inputs	4
Number of inputs that can be controlled simultaneously	4, for all mounting positions up to 55 °C
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Input voltage	
• Rated value	24 V DC
• For "0" signal	-3 V to +5 V
• For "1" signal	11 V to 30 V
Input current	
• With "1" signal	Typ. 7 mA
Input delay	
• At "0" to "1" transition	Typ. 3 ms
• At "1" to "0" transition	Typ. 3 ms
Input characteristics	to IEC 61131, type 3
Connection of 2-wire proximity switch	Supported
• Permissible quiescent current	Max. 1.5 mA
Digital outputs	
Number of digital outputs	4
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Output voltage	
• Rated value	24 V DC
• With "1" signal	Min. 2L+ (-0.8 V)
Output current	
• With "1" signal	0.5 A
• With "0" signal (residual current)	Max. 0.5 mA
Short-circuit of the output	Yes, per channel, electronic
• Response threshold	Min. 0.7 A
Limitation of the inductive cut-off voltage to lamp load	Typ. 2L+ (-47 V)

Technical specifications	
Lamp load	Max. 5 W
Switching frequency	
• With resistive load	100 Hz
• With inductive load	0.5 Hz
• With lamp load	1 Hz
Load resistance range	
• Low limit	48 Ω
• High limit	4 kΩ
Status, interrupts, diagnostics	
Status display	Green LED (per channel)
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	No
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit encoder supply	Yes
• Short-circuit at the output	Yes
Reaction to CPU/master STOP	
• Configurable	Yes (outputs at zero current and zero voltage, hold last value)
Insulation	
Insulation tested	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No

14.8 Digital electronic module 4 DIO / 4 DO DC 24V/0.5A (6ES7143-4BF00-0AA0)

Order number

6ES7143-4BF00-0AA0

Properties

- Digital electronic module with:
  - 4 freely configurable inputs/outputs
  - 4 outputs
- Digital inputs:
  - Suitable for switches and proximity switches
  - Rated input voltage 24 V DC
  - Diagnostics for encoder supply short-circuit to M per module
- Digital outputs:
  - Suitable for solenoid valves, DC contactors and indicator lights
  - Rated load voltage 24 V DC
  - Output current per output 0.5 A
  - Diagnostics of short-circuit outputs to M for each module

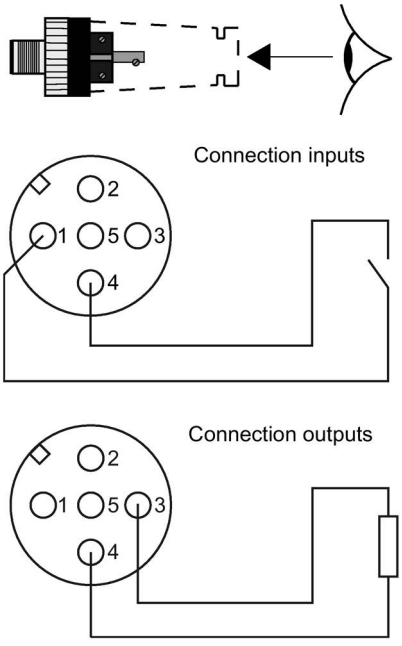
Note

The digital outputs at DQ_4 to DQ_7 (rated load voltage 2L+) can be switched off for safety-related operation.

More detailed information is available in the Appendix in the chapter Fail-safe disconnection of ET 200pro standard output modules (Page 515).

Pin assignment of connection module CM IO 8 x M12D

The table below shows the pin assignment of the 4 DIO / 4 DO DC 24V/0.5A on connection module CM IO 8 x M12D.

View of circular connector	Terminal	Assignment X1 to X4 (inputs/outputs)
	1	24 V encoder supply U_S (provided by ET 200pro for the connected encoder)
	2	Not assigned
	3	Encoder supply ground 1M
	4	Input/output signal DIQ_0: Connector X1 Input/output signal DIQ_1: Connector X2 Input/output signal DIQ_2: Connector X3 Input/output signal DIQ_3: Connector X4
	5	Functional earth (FE)
	Terminal	**Pin assignment X5 to X8 (outputs)**
	1	Not assigned
	2	Not assigned
	3	Ground for load voltage supply 2M
	4	Output signal DQ_4: Connector X5 Output signal DQ_5: Connector X6 Output signal DQ_6: Connector X7 Output signal DQ_7: Connector X8
	5	Functional earth (FE)

Block diagram

The following figure shows the block diagram of 4 DIO / 4 DO DC 24V/0.5A.

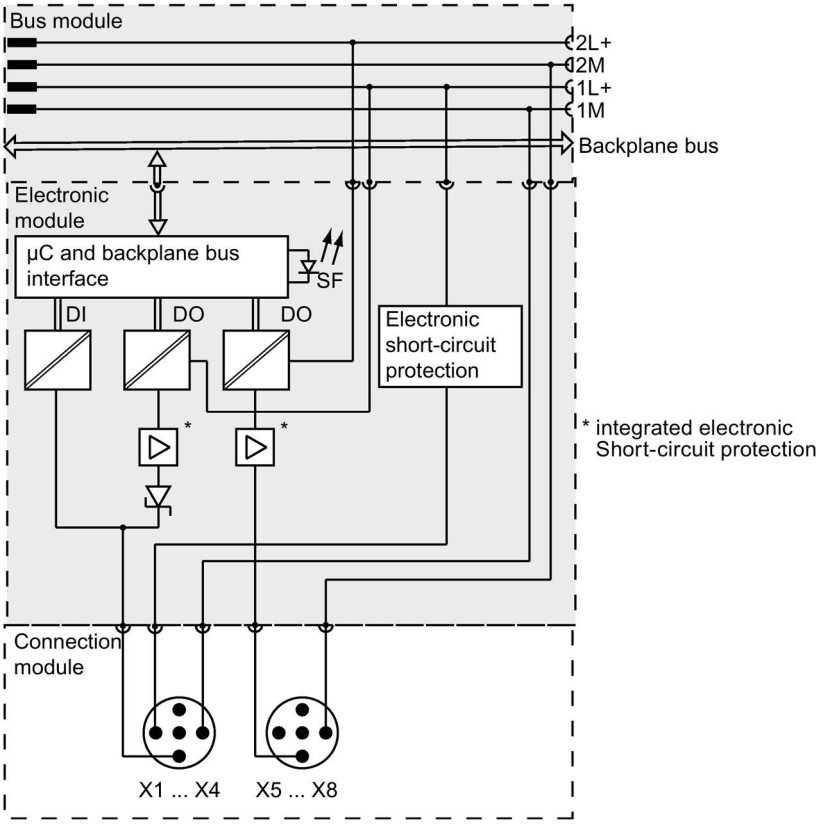


Figure 14-8 Block diagram 4 DIO / 4 DO DC 24V/0.5A

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35; with bus module, without connection module
Weight	Approx. 140 g
Voltages and currents	
Rated supply voltage of electronics/encoder 1L+	24 V DC
• Reverse polarity protection	Yes, against destruction; encoder supply outputs are connected with reverse polarity
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes; against destruction; loads will be activated
• Short-circuit protection	Yes; per channel

Technical specifications	
Total current of the outputs	
• All mounting positions up to 40 °C	4 A
• All mounting positions up to 55 °C	4 A
Current consumption	
• From backplane bus	< 30 mA
• From electronics/encoder supply 1L+ (no load)	< 20 mA
• From rated load voltage 2L+ (without load)	< 20 mA
Power loss	Typ. 3 W
Encoder supply	
Number of encoder supplies	4
Total current up to 55 °C	Max. 1 A
Short-circuit protection	Yes; each module, electronic
• Response threshold	Min. 1.4 A
Digital inputs/digital outputs	
Number of channels	8; 4 x configurable inputs/outputs and 4 x outputs
Digital inputs	
Number of inputs	4[1]
Number of inputs that can be controlled simultaneously	4; up to 55° C in any mounting position
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Input voltage	
• Rated value	24 V DC
• For "0" signal	-3 V to +5 V
• For "1" signal	11 V to 30 V
Input current	
• With "1" signal	Typ. 7 mA
Input delay	
• At "0" to "1" transition	1.2 ms to 4.8 ms
• At "1" to "0" transition	1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 3
Connection of 2-wire BEROs	supported
• Permissible quiescent current	Max. 1.5 mA

Technical specifications	
Digital outputs	
Number of digital outputs	8[2]
Cable length, shielded	Max. 30 m
Cable length, unshielded	Max. 30 m
Short-circuit protection of the output	Yes; per channel, electronic[3]
• Response threshold	Min. 0.7 A
Limitation of the inductive cut-off voltage to lamp load	Typ. 1L+/2L+ (-47 V)
Lamp load	Max. 5 W
Control of a digital input	Yes; no electrical isolation between 1L+ and 2L+, because 1M and 2M are jumpered[4]
Output voltage	
• Rated value	24 V DC
• With "1" signal	Min. 1L+/2L+ (-0.8 V)
Output current	
• With "1" signal	0.5 A
• With "0" signal (residual current)	Max. 0.5 mA
Wiring 2 outputs in parallel	
• For performance increase	No
• For redundant control of a load	Supported
Switching frequency	
• With resistive load	100 Hz
• With inductive load	0.5 Hz
• With lamp load	1 Hz
Load resistance range	
• Low limit	48 Ω
• High limit	4 kΩ
Status, interrupts, diagnostics	
Status display	Green LED (per channel)
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	No
• Diagnostic information can be read	Yes

Technical specifications	
Monitoring for	
• Short-circuit encoder supply	Yes
• Short-circuit at the output	Yes
Insulation	
Insulation tested	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No; within the channel groups to 1L+ and 2L+
	Yes; between the channel groups to 1L+ and 2L+

1 configurable X1 to X4 powered from 1L+

2 configurable X1 to X4 powered from 1L+, and X5 to X8 powered from 2L+

3 In the overload range, the digital output can be activated/deactivated at cyclic intervals

4 applies only to outputs operated on 2L+ potential

14.9 Overview of parameters of the digital electronic modules

Parameters of 8 DI DC 24V

Parameters	Value range	Default	Effective range
Diagnostics for short circuit to M	• Disable • Enable	Disable	Module

Parameters of 8 DI DC 24V High Feature

Parameters	Value range	Default	Effective range
Group diagnostics	• Disable • Enable	Disable	Module
Hardware interrupt enable	• Disable • Enable	Disable	Module
Input delay (ms)	• 0.5 • 3 • 15 • 20	3	Module
Diagnostics: Short-circuit to M 24 V encoder supply (channels 0 to 7 *)	• Disable • Enable	Disable	Channel
Diagnostics: Wire break (channels 0 to 7)	• Disable • Enable	Disable	Channel
Hardware interrupt at rising edge (channels 0 to 5)	• Disable • Enable	Disable	Channel
Hardware interrupt at falling edge (channels 0 to 5)	• Disable • Enable	Disable	Channel
* If you use the electronic module with the connection module CM IO 4xM12, channels 4 to 7 are mapped to channels 0 to 3. A precise channel-specific diagnosis "Short-circuit to M" is not therefore possible.			

Parameters of 4 DO DC 24V/2.0A

Parameters	Value range	Default	Effective range
Diagnostics: Short-circuit to M	• Disable • Enable	Disable	Module
Reaction to CPU/master STOP	• Shutdown • Hold last value	Shutdown	Module

Parameters of 4 DO DC 24V/2.0A High Feature

Parameters	Value range	Default	Effective range
Group diagnostics	• Disable • Enable	Disable	Module
Diagnostics: Missing load voltage L+	• Disable • Enable	Disable	Module
Reaction to CPU/master STOP	• Shutdown • Hold last value • Output substitute values	Shutdown	Module
Diagnostics: Short-circuit to M (channels 0 to 3)	• Disable • Enable	Disable	Channel
Diagnostics: Short-circuit to L+ (channels 0 to 3)	• Disable • Enable	Disable	Channel
Diagnostics: Wire break (channels 0 to 3)	• Disable • Enable	Disable	Channel
Substitute values (channels 0 to 3)	• 0 • 1	0	Channel

Parameters of 8 DO DC 24V/0.5A

Parameters	Value range	Default	Effective range
Diagnostics: Short-circuit to M	• Disable • Enable	Disable	Module
Reaction to CPU/master STOP	• Shutdown • Hold last value • Output substitute values	Shutdown	Channel
Substitute values (channels 0 to 7)	• 0 • 1	0	Channel

Parameters for 4 DI / 4 DO DC 24V/0.5A

Parameters	Value range	Default	Effective range
Reaction to CPU/master STOP	• Shutdown • Hold last value	Shutdown	Module
Diagnostics: Short-circuit	• Disable • Enable	Disable	Module

Parameters for 4 DIO / 4 DO DC 24V/0.5A

Parameters	Value range	Default	Effective range
Group diagnostics	• Disable • Enable	Disable	Module
Reaction to CPU/master STOP	• Shutdown • Hold last value	Shutdown	Module
Diagnostics for short circuit to M (DI)	• Disable • Enable	Disable	Module
Diagnostics for short circuit to M (DO)	• Disable • Enable	Disable	Module
Freely configurable channel 0	• DI • DO	DI	Channel
Freely configurable channel 1	• DI • DO	DI	Channel
Freely configurable channel 2	• DI • DO	DI	Channel
Freely configurable channel 3	• DI • DO	DI	Channel

See also

Overview of parameters of the digital electronic modules (Page 382)

14.10 Overview of parameters of the digital electronic modules

Group diagnostics

The parameter "Group diagnostics" enables or disables the generation and transmission of module-specific diagnostic alarms (e.g. short-circuit to M) of the module to the CPU.

The "Fault" and "Parameter assignment error" diagnostic functions are always enabled independent of the group diagnostics.

Diagnostics: Wire break

If this parameter is enabled, the system generates a diagnostics event when a wire break is detected.

Diagnostics: Missing load voltage L+

If this parameter is enabled, the check for missing load voltage is enabled for the affected module.

Diagnostics: Short-circuit

If this parameter is enabled, the check for short-circuit is enabled for the module.

Diagnostics: Short-circuit to L+

If this parameter is enabled, the system generates a diagnostics event when a short-circuit to L+ is detected.

Diagnostics: Short-circuit to M (DI)

If this parameter is enabled, the check for short-circuit of the encoder supply to ground is enabled for the module.

Diagnostics: Short-circuit to M (DO)

If this parameter is enabled, the check for short-circuit of the output signal to ground is enabled for the module.

Diagnostics: Short-circuit to M 24 V encoder supply

If this parameter is enabled, the system generates a diagnostics event when it detects a short-circuit of the encoder supply to ground.

Input delay

You can set an input delay to suppress coupled-in interference.

This will suppress interference pulses from 0 ms through to the set input delay (in ms). The configured input delay has a tolerance as described in the technical specifications for the module.

A long input delay will suppress longer interference pulses; a short input delay will suppress shorter interference pulses.

Hardware interrupt enable

If this parameter is enabled, the hardware interrupt for the entire module is enabled. You can then configure channel-by-channel whether a hardware interrupt is triggered and the edge that triggers it.

The CPU's operating system calls a hardware interrupt OB (e.g. OB 40) at a hardware interrupt. In the hardware interrupt OB, you can program the desired response to the edge transition.

Freely configurable channel 0 - 3

With this parameter, you configure whether the channel is to be operated as an input or output.

Hardware interrupt on falling edge

With an enabled hardware interrupt (for the entire module), you can configure channel-by-channel whether a hardware interrupt is to be triggered on a falling edge.

Hardware interrupt on rising edge

With an enabled hardware interrupt (for the entire module), you can configure channel-by-channel whether a hardware interrupt is to be triggered on a rising edge.

Reaction to CPU/master STOP

Use this parameter to set the reaction of the module to a CPU/master STOP:

- Shutdown: The digital output is de-energized.
- Hold last value: The last value of the digital output remains active.
- Output substitute values: The module outputs a configured substitute value.

Special cases for 4DIO/4DO

Error diagnostics

The two diagnostic events "short-circuit to M (DI)" (triggered by short-circuit of the encoder supply) and "short-circuit to M (DO)" (triggered by short-circuit of the output) are displayed in an "Error" diagnostic alarm.

Diagnostics: Short-circuit to M (DI)

If this parameter is enabled, the system generates an "Error" diagnostics when it detects a short-circuit of the outputs to ground.

Diagnostics: Short-circuit to M (DO)

If this parameter is enabled, the system generates an "Error" diagnostics when it detects a short-circuit of the encoder supply to ground.

See also

Overview of parameters of the digital electronic modules (Page 379)

Analog electronic modules 15

15.1 Analog electronic module 4 AI U High Feature (6ES7144-4FF00-0AB0)

Order number

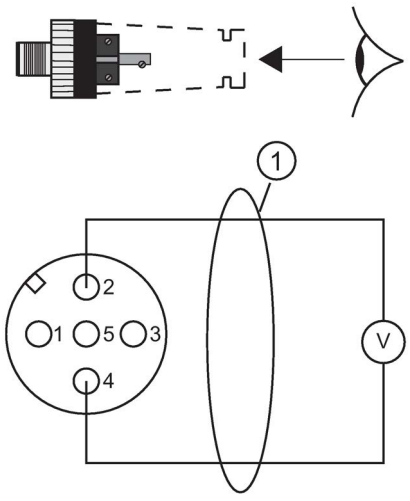
6ES7144-4FF00-0AB0

Properties

- 4 inputs for voltage measurement
- Input ranges:
  - ± 10 V, resolution 15 bit + sign
  - ± 5 V, resolution 15 bit + sign
  - 0 V to 10 V, resolution 15 bit
  - 1 V to 5 V, resolution 15 bit
- Inputs are electrically isolated from load voltage 2L+
- Diagnostics for encoder supply short-circuit to M per module
- Diagnostics for short-circuit, diagnostics for wire break per channel (based on the measuring range)
- Hardware interrupt on limit violation at channel 0
- Permitted common-mode voltage 5 V AC_{PP}

Pin assignment of connection module CM IO 4 x M12

The table below shows the pin assignment of the 4 AI U High Feature for the connection module CM IO 4 x M12.

View of circular connector	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal DI_0+: Connector X1 Input signal U_1+: Connector X2 Input signal U_2+: Connector X3 Input signal U_3+: Connector X4
	3	Encoder supply ground 1M
	4	Input signal U_0-: Connector X1 Input signal U_1-: Connector X2 Input signal U_2-: Connector X3 Input signal U_3-: Connector X4
	5	Functional earth (FE)
① Shielded copper cables		

Block diagram

The figure below shows the block diagram of 4 AI U High Feature.

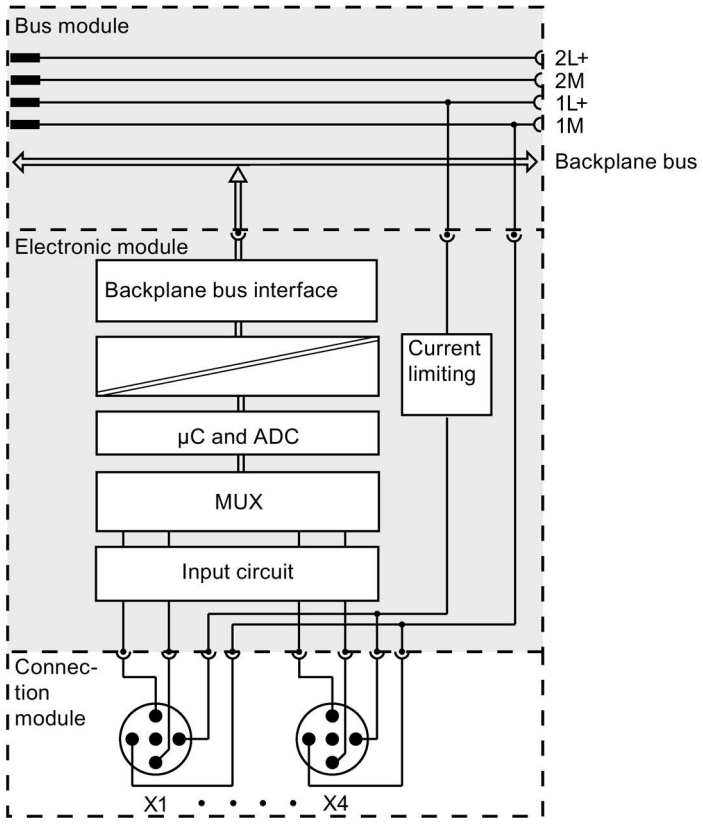


Figure 15-1 Block diagram 4 AI U High Feature

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35
Weight	Approx. 150 g
Voltages and currents	
1L+ electronics/encoder supply	24 V DC
Reverse polarity protection	Yes; against destruction
Current consumption	
• From backplane bus	Typ. 10 mA
• From 1L+ electronics/encoder supply (no encoder connected)	Typ. 45 mA
Power loss of the module	Typ. 1.1 W

Technical specifications			
Analog inputs			
Number of inputs		4	
Cable length, shielded		Max. 30 m	
Encoder supply			
Number of encoder supplies		4	
Total current up to 55 °C		Max. 1 A	
Short-circuit protection		Yes, electronic, for each module, to ground	
• Response threshold		Min. 1.4 A	
Encoder selection data			
Input ranges (rated value)/input resistance			
• Voltage		±10 V/100 kΩ ±5 V/100 kΩ 0 V to 10 V/100 kΩ 1 V to 5 V/100 kΩ	
Permissible voltage at voltage input (destruction limit)		35 V	
Connection of signal transmitters			
• For voltage measurement		Yes	
Analog value generation			
Measuring principle		Integrating	
Integration time and cycle time/resolution (per channel)			
• Integration time can be assigned		Yes	
• Interference frequency suppression in Hz		50	60
• Integration time in ms		20	16.667
• Conversion time in ms		66.667	66.667
• Cycle time in ms (see Appendix *Response times*)		Number of active channels per module x conversion time	
• Resolution (including overrange)		± 10 V/15 bit + sign ± 5 V/15 bit + sign 0 V to 10 V/15 bit; 14 bit with low-level smoothing. 1 V to 5 V/15 bit; 14 bit with low-level smoothing.	
Measured value smoothing		Yes, can be assigned in 4 steps	
	Step	**Time constant**	
	None Weak Medium Strong	1 x cycle time 4 x cycle time 16 x cycle time 64 x cycle time	

Technical specifications	
Interference suppression, error limits	
Interference voltage suppression for f = n x (f1 ±1 %), (f1 = interference frequency)	
• Common mode interference (interference voltage < 5 V)	Min. 70 dB
• Series-mode interference (signal value + peak value of interference < rated value of input range)	Min. 50 dB
Crosstalk between inputs	Max. -50 dB
Operational limit (across temperature range, referenced to input range)	±0.15%
Basic error limit (operational limit at 25 °C, referenced to input range)	±0.1%
Temperature error (referenced to input range)	Max. ±0.002 %/K
Linearity error (referenced to input range)	±0.01%
Repeat accuracy (in steady state at 25 °C, referenced to input range)	±0.025%
Status, interrupts, diagnostics	
Interrupts	
• Process interrupt (limit value interrupt)	Configurable for channel 0
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	Yes
• Diagnostic functions can be read out	Yes
Monitoring for	
• Short-circuit	Yes, at 1 V to 5 V
• Wire break	Yes, at 1 V to 5 V
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and the 1L+ electronics/ encoder supply	No
• Between channels	No
Permitted potential difference	
• Between the inputs and 1M (U_{CM})	5 V AC_{pp}

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)

Response times for analog input modules (Page 501)

15.2 Analog electronic module 4 AI I High Feature (6ES7144-4GF00-0AB0)

Order number

6ES7144-4GF00-0AB0

Properties

- 4 inputs for current measurement
- 2 and 4-wire transmitters can be connected
- Input ranges:

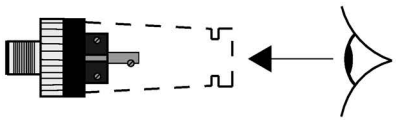
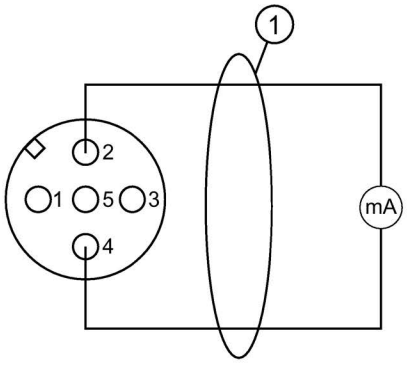
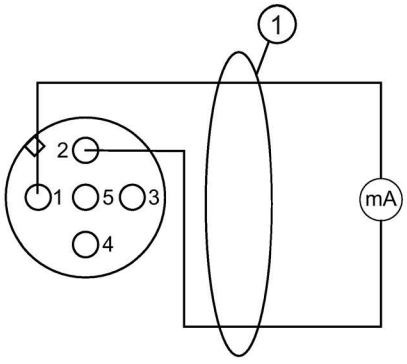
  ± 20 mA, resolution 15 bit + sign

  0V to 20 mA, resolution 15 bit

  4 to 20 mA, resolution 15 bit
- Inputs are electrically isolated from load voltage 2L+
- Diagnostics for encoder supply short-circuit to M per module
- Diagnostics for short-circuit/wire break per channel (based on the measuring range)
- Hardware interrupt on limit violation at channel 0
- Permitted common-mode voltage 5 V AC_{PP}

Pin assignment of connection module CM IO 4 x M12

The table below shows the pin assignment of 4 AI I High Feature for connection module CM IO 4 x M12.

View of circular connector	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal I_0+: Connector X1 Input signal I_1+: Connector X2 Input signal I_2+: Connector X3 Input signal I_3+: Connector X4
4-wire transducer 	3	Encoder supply ground 1M
	4	Input signal I_0-: Connector X1 Input signal I_1-: Connector X2 Input signal I_2-: Connector X3 Input signal I_3-: Connector X4
	5	Functional earth (FE)
2-wire transducer 		
① Shielded copper cables		

Note

2-wire transducer

A configuration as 2-wire transducer will destroy the electronic module in case of a short-circuit to encoder supply (U_S).

Block diagram

The figure below shows the block diagram of 4 AI I High Feature.

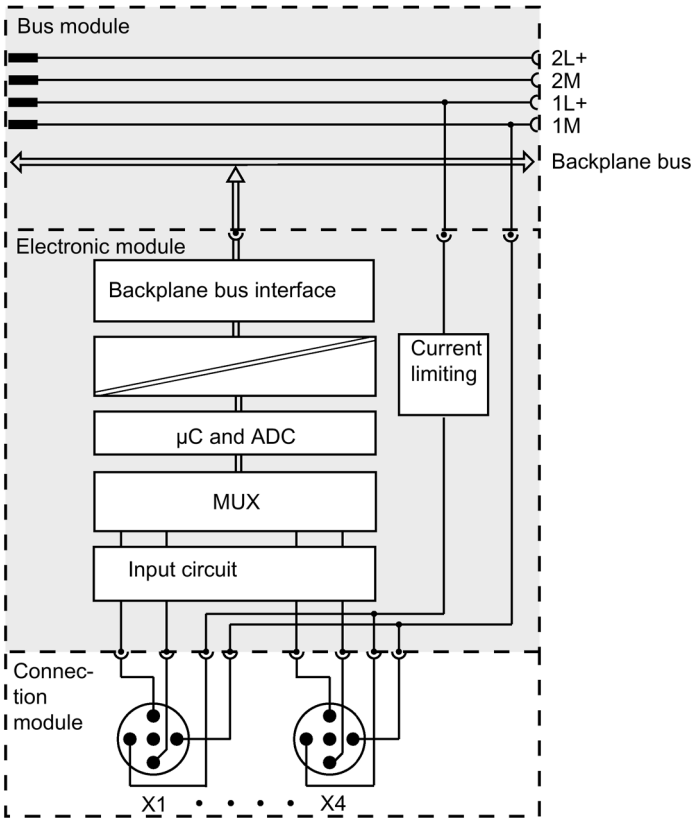


Figure 15-2 Block diagram, 4 AI I High Feature

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35
Weight	Approx. 150 g
Voltages and currents	
Rated supply voltage for 1L+ electronics/encoder	24 V DC
Reverse polarity protection	Yes; against destruction
Current consumption	
• From backplane bus	Typ. 10 mA
• From electronics/encoder supply 1L+	Typ. 45 mA
Power loss of the module	Typ. 1.1 W
Analog inputs	
Number of analog inputs	4
Cable length, shielded	Max. 30 m

Technical specifications		
Encoder supply		
Number of encoder supplies	4	
Total current up to 55 °C	Max. 1 A	
Short-circuit protection	Yes, electronic, for each module, to ground	
• Response threshold	Min. 1.4 A	
Encoder selection data		
Input ranges (rated value)/input resistance		
• Current	±20 mA/50 Ω 0 to 20 mA/50 Ω 4 to 20 mA/50 Ω	
Permissible current at current input (destruction limit)	40 mA	
Connection of signal transmitters		
• For current measurement – As 2-wire transducer – As 4-wire transducer	Yes	
Analog value generation		
Measuring principle	Integrating	
Integration time and cycle time/resolution (per channel)		
• Integration time can be assigned	Yes	
• Interference frequency suppression in Hz	50	60
• Integration time in ms	20	16.667
• Conversion time in ms	66.667	66.667
• Cycle time in ms (see Appendix Response times)	Number of active channels per module x conversion time	
• Resolution (including overrange)	±20 mA/15 bit + sign 0 to 20 mA/15 bit; 14 bit with low-level smoothing. 4 to 20 mA/15 bit; 14 bit with low-level smoothing.	
Measured value smoothing	Yes, can be assigned in 4 steps	
Step None Weak Medium Strong	**Time constant** 1 x cycle time 4 x cycle time 16 x cycle time 64 x cycle time	
Interference suppression, error limits		
Interference voltage suppression for f = n x (f1 ±1 %), (f1 = interference frequency)		
• Common mode interference (interference voltage < 5 V)	Min. 70 dB	
• Series-mode interference (signal value + peak value of interference < rated value of input range)	Min. 50 dB	
Crosstalk between inputs	Max. -50 dB	

Technical specifications	
Operational limit (across temperature range, referenced to input range)	±0.15%
Basic error limit (operational limit at 25 °C, referenced to input range)	±0.1%
Temperature error (referenced to input range)	±0.002 %/K
Linearity error (referenced to input range)	±0.01%
Repeat accuracy (in steady state at 25 °C, referenced to input range)	±0.025%
Status, interrupts, diagnostics	
Interrupts	
• Process interrupt (limit value interrupt)	Configurable for channel 0
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	Yes
• Diagnostic functions can be read out	Yes
Monitoring for	
• Short-circuit to ground (1M)	Yes, at 4 to 20 mA
• Wire break	Yes, at 4 to 20 mA
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and the 1L+ electronics/ encoder supply	No
• Between channels	No
Permitted potential difference	
• Between the inputs and 1M (U_{CM})	5 V AC_{pp}

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)

Response times for analog input modules (Page 501)

15.3 Analog electronic module 4 AI RTD High Feature (6ES7144-4JF00-0AB0)

Order number

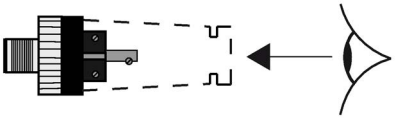
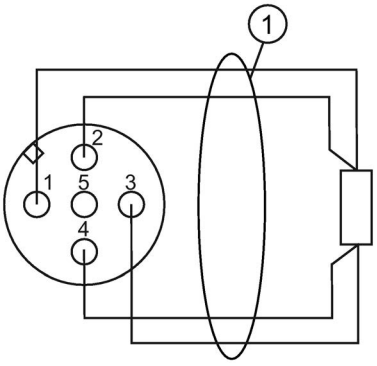
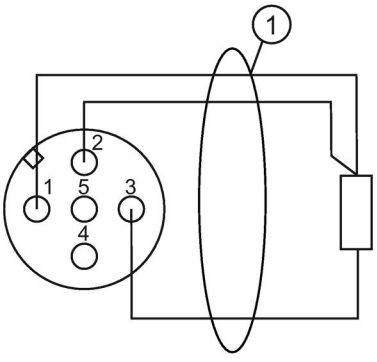
6ES7144-4JF00-0AB0

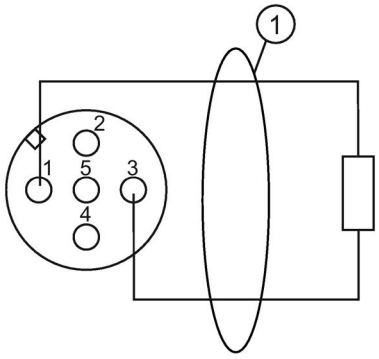
Properties

- 4 inputs for isolated (floating) resistance measurement or resistance thermometer in 2, 3 and 4-wire connection system
- Input ranges:
  - Resistance measurement: 150 Ω; 300 Ω; 600 Ω; 3000 Ω; resolution 15 bit
  - Resistance thermometers: Pt100; Ni100; Ni120; Pt200; Ni200; Pt500; Ni500; Pt1000; Ni1000; resolution 15 bit + sign
- Automatic compensation of the line resistance with 3 and 4-wire connection system
- Parameterizable temperature coefficient for resistance-type transmitters
- Inputs are electrically isolated from encoder voltage supply 1L+ and load voltage supply 2L+
- Linearization of the encoder characteristic curves
- Wire break diagnostics per channel (terminals 1 and 3 are monitored for wire break)

Pin assignment of connection module CM IO 4 x M12

The table below shows the pin assignment of the 4 AI RTD High Feature for the connection module CM IO 4 x M12.

View of circular connector	Terminal	Assignment X1 to X4
		
	**4-wire**	
	1	Constant current line I_{C0}+: Connector 1 Constant current line I_{C1}+: Connector 2 Constant current line I_{C2}+: Connector 3 Constant current line I_{C3}+: Connector 4
	2	Measuring line M_0+: Connector X1 Measuring line M_1+: Connector X2 Measuring line M_2+: Connector X3 Measuring line M_3+: Connector X4
	3	Constant current line I_{C0}-: Connector 1 Constant current line I_{C1}-: Connector 2 Constant current line I_{C2}-: Connector 3 Constant current line I_{C3}-: Connector 4
	4	Measuring line M_0-: Connector X1 Measuring line M_1-: Connector X2 Measuring line M_2-: Connector X3 Measuring line M_3-: Connector X4
	5	Functional earth (FE)
	**3-wire**	
	1	Constant current line I_{C0}+: Connector 1 Constant current line I_{C1}+: Connector 2 Constant current line I_{C2}+: Connector 3 Constant current line I_{C3}+: Connector 4
	2	Measuring line M_0+: Connector X1 Measuring line M_1+: Connector X2 Measuring line M_2+: Connector X3 Measuring line M_3+: Connector X4
	3	Measuring line M_0-: Connector X1 Measuring line M_1-: Connector X2 Measuring line M_2-: Connector X3 Measuring line M_3-: Connector X4
	4	Not assigned
	5	Functional earth (FE)



2-wire	
1	Measuring line M_0+: Connector X1 Measuring line M_1+: Connector X2 Measuring line M_2+: Connector X3 Measuring line M_3+: Connector X4
2	Not assigned
3	Measuring line M_0-: Connector X1 Measuring line M_1-: Connector X2 Measuring line M_2-: Connector X3 Measuring line M_3-: Connector X4
4	Not assigned
5	Functional earth (FE)

① Shielded copper cables

Block diagram

The figure below shows the block diagram of the 4 AI RTD High Feature.

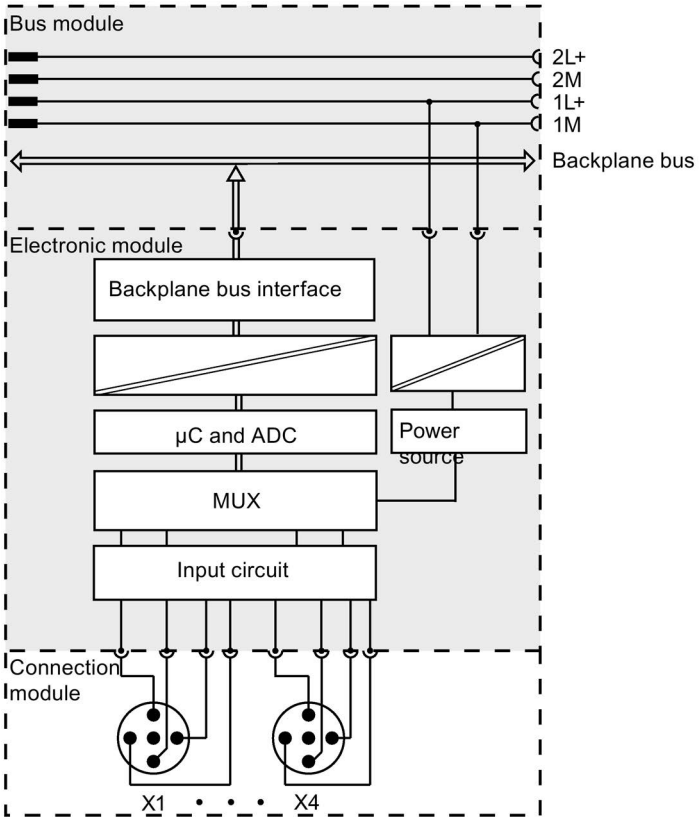


Figure 15-3 Block diagram 4 AI RTD High Feature

Technical specifications

Technical specifications		
Dimensions and weight		
Dimensions W x H x D (mm)		45 x 130 x 35
Weight		Approx. 150 g
Voltages and currents		
Rated supply voltage for 1L+ electronics/ encoder		24 V DC
Reverse polarity protection		Yes; against destruction
Transmitter power supply		Yes
• Constant power supply for resistance-type encoders		Approx. 1.25 mA (<500 Ω) Approx. 0.5 mA (≥500 Ω)
• Short-circuit protection		Yes
Current consumption		
• From backplane bus		Typ. 10 mA
• From electronics/encoder supply 1L+		Typ. 27 mA
Power loss of the module		Typ. 0.7 W
Analog inputs		
Number of analog inputs		4
Cable length, shielded		Max. 30 m
Encoder selection data		
Input ranges (rated value)/input resistance		
• Resistance		150 Ω/10 MΩ 300 Ω/10 MΩ 600 Ω/10 MΩ 3000 Ω/10 MΩ
• Resistance thermometer		Pt100/10 MΩ Ni100/10 MΩ Ni120/10 MΩ Pt200/10 MΩ Ni200/10 MΩ Pt500/10 MΩ Ni500/10 MΩ Pt1000/10 MΩ Ni1000/10 MΩ
Permissible input voltage (destruction limit)		9 V
Connection of signal transmitters		
• For resistance measurement, resistance thermometer	As 4-wire	Yes
	As 3-wire	Yes
	As 2-wire	Yes, line resistances are also measured
Characteristic linearization		Yes, can be assigned for Ptxxx, Nixxx

Technical specifications			
Analog value generation			
Measuring principle		Integrating	
Integration time and cycle time/resolution (per channel)			
• Integration time can be assigned		Yes	
• Interference frequency suppression in Hz		50	60
• Integration time in ms		20	16.667
• Integration time in ms *		20.625	17.25
• Cycle time in ms (see Appendix *Response times* in the ET 200pro manual)		Number of active channels per module x conversion time	
• Resolution (including overrange)		150 Ω; 300 Ω; 600 Ω; 3000 Ω/15 bit Pt100; Ni100; Ni120; Pt200; Ni200; Pt500; Ni500; Pt1000; Ni1000/15 bit + sign	
Measured value smoothing		Yes, can be assigned in 4 steps	
	Step None Weak Medium Strong	**Time constant** 1 x cycle time 4 x cycle time 16 x cycle time 64 x cycle time	
Interference suppression, error limits			
Interference voltage suppression for f = n x (f1 ±0.5 %), (f1 = interference frequency)			
• Common mode interference (interference voltage < 5 V)		Min. 70 dB	
• Series-mode interference (signal value + peak value of interference < rated value of input range)		Min. 50 dB	
Crosstalk between inputs		Max. -70 dB	
Operational limit (across temperature range, referenced to input range)		±0.175%	
Basic error limit (operational limit at 25 °C, referenced to input range)		±0.125%	
Temperature error (referenced to input range)		Max. ±0.002 %/K	
Linearity error (referenced to input range)		± 0.05%	
Repeat accuracy (in steady state at 25 °C, referenced to input range)		± 0.015%	
Status, interrupts, diagnostics			
Interrupts			
• Diagnostic interrupt		Configurable	
Diagnostic functions			
• Group error display		Red LED (SF)	
• Channel error display		Yes	
• Diagnostic functions can be read out		Yes	

Technical specifications	
Monitoring for	
• Wire break	Yes, between terminals 1 and 3
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and electronics/ encoder supply 1L+, 2L+	Yes
• Between channels	No
Permitted potential difference	
• Between inputs (U_{CM})	10 V AC_{pp}
* With 3-wire resistance measurement (and resistance thermometer), the values of the measuring resistances and the line resistances are updated in alternating cycles.	

Note

The module achieves the highest accuracy with the 4-wire connection system (see technical specifications above).

Although the 3-wire connection system compensates for the missing wire, the accuracy is impaired. With the 2-wire connection system, the line resistances considerably impair the accuracy.

In the last two cases this impairment is not determinable.

Note

With the 3-wire connection system, the compensation for the missing line is only ensured if the length and cross section of all 3 wires in the cable are the same.

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)

Response times for analog input modules (Page 501)

15.4 4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0)

Order number

6ES7144-4PF00-0AB0

Properties

- 4 inputs for isolated/non-isolated thermocouples or voltage measurement
- Input ranges:
  - Voltage measurement: ± 80 mV
  - Thermocouples: Type B, E, J, K, L, N, R, S, T
- Inputs are electrically isolated from encoder voltage supply 1L+ and load voltage supply 2L+
- Linearization of the voltage characteristic (conversion of the thermoelectric voltage to a temperature value)
- Smoothing
- Interference frequency suppression
- Various options to compensate for the reference junction temperature
- Diagnostics for wire break per channel, depending on the measuring range (as of functional status 2 with firmware version V2.0.0)
- Overflow and underflow diagnostics

Note

Compatibility

- The functional status 2 of the module is a compatible successor to the functional status 1 with firmware V1.0.0.
- With enabled wire break check in the configuration, the use of a module with functional status 1 with firmware V1.0.0 is not possible. The diagnostics alarm "Parameter assignment error" is generated.

Cycle time of the electronic module

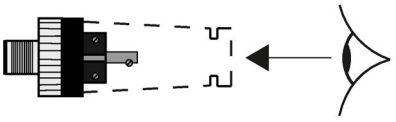
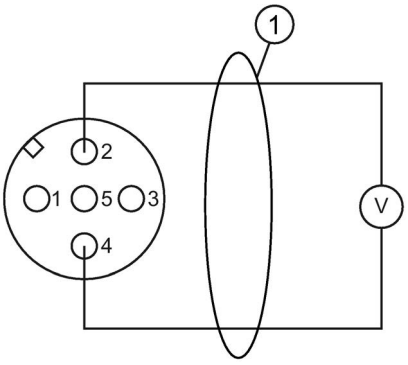
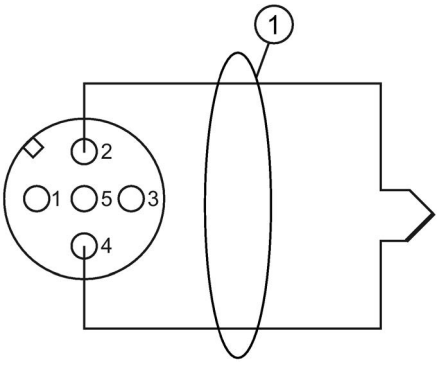
The electronic module needs an additional 40 ms for the wire break check. This time is independent of the number of channels that you have configured with wire break check.

The module cycle time is calculated according to the following formula:

Module cycle time = number of active channels per module × conversion time + 40 ms for wire break check.

Pin assignment of connection module CM IO 4 x M12

The table below shows the pin assignment of 4 AI TC High Feature for the CM IO 4 x M12 connection module.

View of circular connector	Terminal	Assignment
		
	**Terminal**	**Assignment X1**
	1 *	Pt1000 resistance thermometer measuring line M+
	2	Input signal M_0+: Connector X1
	3 *	Pt1000 resistance thermometer measuring line M-
	4	Input signal M_0-: Connector X1
	5	Functional earth (FE)
	**Terminal**	**Assignment X2 to X4**
	1 *	Not assigned
	2	Input signal M_1+: Connector X2 Input signal M_2+: Connector X3 Input signal M_3+: Connector X4
	3 *	Not assigned
	4	Input signal M_1-: Connector X2 Input signal M_2-: Connector X3 Input signal M_3-: Connector X4
	5	Functional earth (FE)

① Shielded copper cables or cables made from thermocouple materials

* If the M12 compensation connector is being used, the Pt1000 resistance thermometer is already integrated. If an external Pt1000 is connected, a resistance thermometer should be used (where α = 0.003851).

M12 compensation connector for thermocouples

M12 compensation connectors are designed for "RTD (0)" temperature compensation (provided the "Reference junction" parameter is set to "RTD (0)"). M12 compensation connectors are not required for any other type of temperature compensation.

M12 compensation connector contains an integrated Pt1000 resistance thermometer (where α = 0.003851) to compensate for the reference junction temperature for thermocouples. The α value conforms to the EN 60751, GOST 6651, JIS C 1604, and ASTM E-1137 standards.

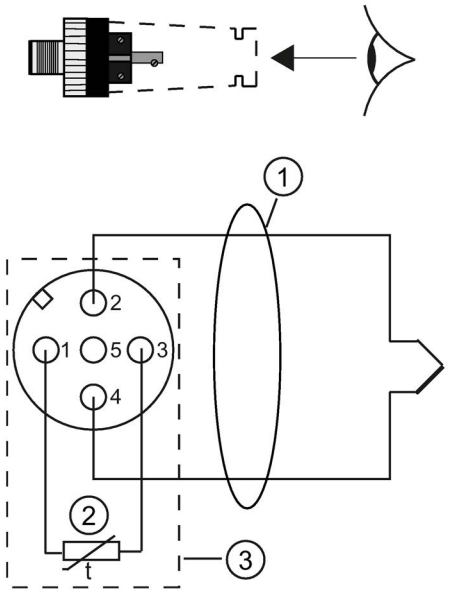
M12 compensation connectors need to be assembled after delivery. You can connect thermocouples via terminals 2 and 4 of M12 compensation connectors.

The M12 compensation connector on the CM IO 4 x M12 connection module is screwed to circular socket connector X1 (torque: 1.5 Nm). The procedure is the same as for M12 connectors (see section Connecting the connection module (Page 127)).

Note

M12 compensation connector is only designed to be used with the 4 AI TC High Feature electronic module. In order to comply with degree of protection IP67, operation without cables is not permitted.

The table below shows the pin assignment for M12 compensation connectors:

View of an M12 compensation connector	Terminal	Assignment X1
	1	Measuring line positive M+ assigned with internal Pt1000
	2	Input signal M_0+: Connector X1
	3	Measuring line negative M- assigned with internal Pt1000
	4	Input signal M_0-: Connector X1
	5	Functional earth (FE)
① Wire of cable made from thermocouple materials ② Integrated Pt1000 resistance thermometer ③ M12 compensation connector		

Block diagram

The block diagram below relates to the 4 AI TC High Feature.

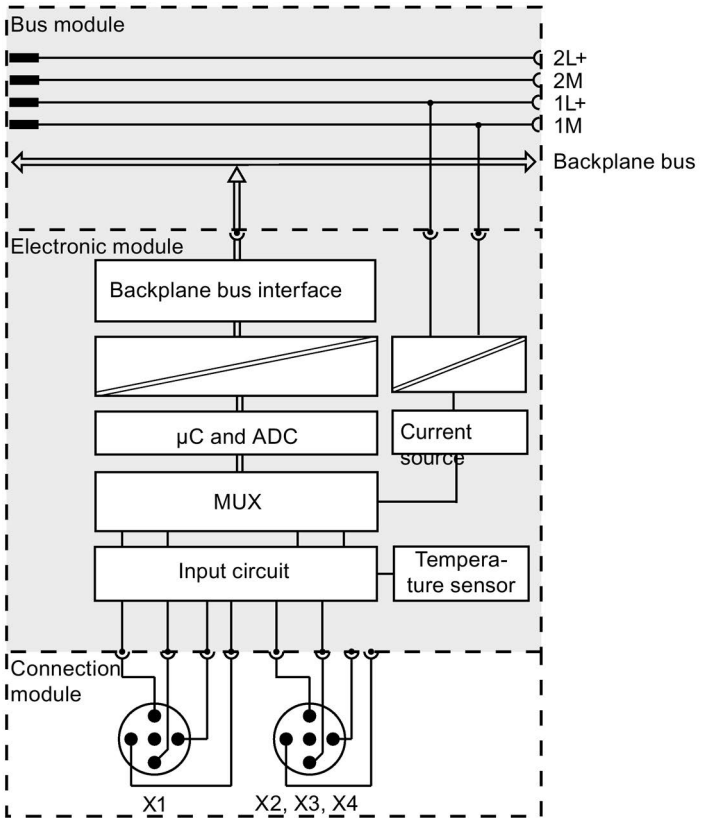


Figure 15-4 Block diagram 4 AI TC High Feature

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35
Weight	Approx. 150 g
Voltages and currents	
1L+ electronics/encoder supply	24 V DC
Reverse polarity protection	Yes; against destruction
Current consumption	
• From backplane bus	Typ. 20 mA
• From electronics/encoder supply 1L+	Typ. 34 mA
Power loss of the module	Typ. 0.8 W
Analog inputs	
Number of analog inputs	4
Cable length, shielded	Max. 30 m

Technical specifications					
Encoder selection data					
Input ranges (rated value)/input resistance					
• Voltage		±80 mV/10 MΩ			
• Thermocouple		Type B, E, J, K, L, N, R, S, T/10 MΩ			
Permissible voltage at voltage input (destruction limit)		20 V			
Connection of signal transmitters					
• For voltage measurement		Yes			
• For thermocouples		Yes			
Temperature compensation[1]					
• None		Yes, can be assigned			
• Internal		Yes, can be assigned			
• RTD (0)		Yes, can be assigned			
• Dynamic reference temperature		Yes, can be assigned			
• Fixed reference temperature		Yes, can be assigned			
Technical unit of temperature measurement		°C, °F, K			
Encoder selection data					
Measuring principle		Integrating			
Integration time and cycle time/resolution (per channel)					
• Integration time can be assigned		Yes			
• Interference frequency suppression in Hz		10	50	60	Off[2]
• Integration time in ms		100	20	16.667	2.5
• Conversion time in ms		102	22	19	4.7
• Cycle time in ms[3] (see Appendix *Response times* in ET 200pro manual)		Number of active channels per module x conversion time			
• Resolution (including overrange)		15 bit + sign			
Measured value smoothing		Yes, can be assigned in 4 steps			
	Step None Weak Medium Strong	**Time constant** 1 x cycle time 4 x cycle time 16 x cycle time 64 x cycle time			
Interference suppression, error limits					
Interference voltage suppression for f = n x (f1 ±0.5 %), (f1 = interference frequency)					
• Common mode interference (interference voltage < 10 V)		Min. 85 dB			
• Series-mode interference (signal value + peak value of interference < rated value of input range)		Min. 42 dB			

Technical specifications		
Crosstalk between inputs	Max. -90 dB	
Operational limit (over the entire temperature range, referenced to the input range)[4]	Positive ambient temperature: ±0.12%	Negative ambient temperature: ±0.15%
Basic error limit (operational limit at 25 °C, referenced to input range)[4]	±0.1%	
Temperature error (referenced to input range)	Positive ambient temperature: ±0.0004% /°C	Negative ambient temperature: ±0.001%/°C
Linearity error (referenced to input range)	±0.01%	
Repeat accuracy (in steady state at 25 °C, referenced to input range)	±0.001%	
Basic error limit for internal temperature sensor (in static thermal state)	±3%	
Basic error limit for internal temperature sensor (in static thermal state)	±2%	
Status, interrupts, diagnostics		
Interrupts		
• Diagnostic interrupt	Configurable	
Diagnostic functions		
• Group error display	Red LED (SF)	
• Channel error display	Yes	
• Diagnostic functions can be read out	Yes	
Monitoring for		
• Wire break	No	
• Underflow and overflow	Yes	
Insulation		
Insulation tested with	707 V DC (type test)	
Electrical isolation		
• Between channels and backplane bus	Yes	
• Between channels and the 1L+ electronics/ encoder supply	Yes	
• Between channels	No	
Permitted potential difference		
• Between inputs (U_{CM})	20 V AC_{pp}	

[1] If a type B thermocouple or the ±80 mV measuring method is being used, "No temperature compensation" will be performed regardless of the temperature compensation parameter assignment.

[2] Equates to 400 Hz

[3] With temperature compensation involving RTD (0), the cycle time increases by 1× conversion time.

[4] With thermocouples, this is based on a temperature range between -100 °C and the rated value (exceptions: type R, S between -50 °C and rated value; type B between +250 °C and rated value).

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)

Response times for analog input modules (Page 501)

15.5 Analog electronic module 4 AO U High Feature (6ES7145-4FF00-0AB0)

Order number

6ES7145-4FF00-0AB0

Properties

- 4 voltage outputs
- Output ranges:

  ± 10 V, resolution 15 bit + sign

  1 V to 5 V, resolution 14 bit

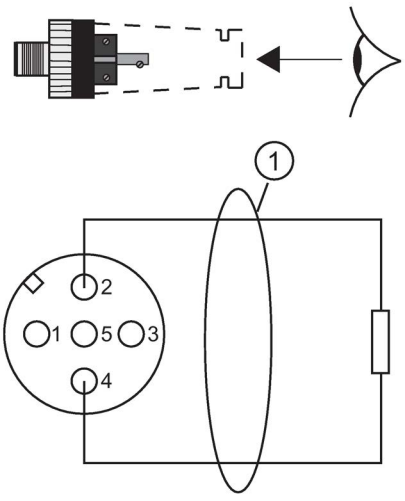
  0 V to 10 V, resolution 15 bit
- Outputs are electrically isolated from encoder voltage supply 1L+ and load voltage supply 2L+
- Diagnostics for encoder supply short-circuit to M per module
- Diagnostics for short-circuit at outputs per channel
- Output of substitute value

Note

Incorrect intermediate values may be generated at the output when you switch the 1L+ electronics/encoder supply on and off.

Pin assignment of connection module CM IO 4 x M12

The table below lists the terminal assignment of 4 AO U High Feature for connection module CM IO 4 x M12.

View of circular connector	Terminal	Assignment X1 to X4*
	1	24V actuator supply U_S
	2	Output signal QV_0+: Connector 1 Output signal QV_1+: Connector 2 Output signal QV_2+: Connector 3 Output signal QV_3+: Connector 4
	3	Actuator supply ground 1M
	4	Output signal QV_0-: Connector 1 Output signal QV_1-: Connector 2 Output signal QV_2-: Connector 3 Output signal QV_3-: Connector 4
	5	Functional earth (FE)
① Shielded copper cables * Please note the changed pin assignment for the ET 200X.		

Block diagram

The figure below shows the block diagram of 4 AO U High Feature.

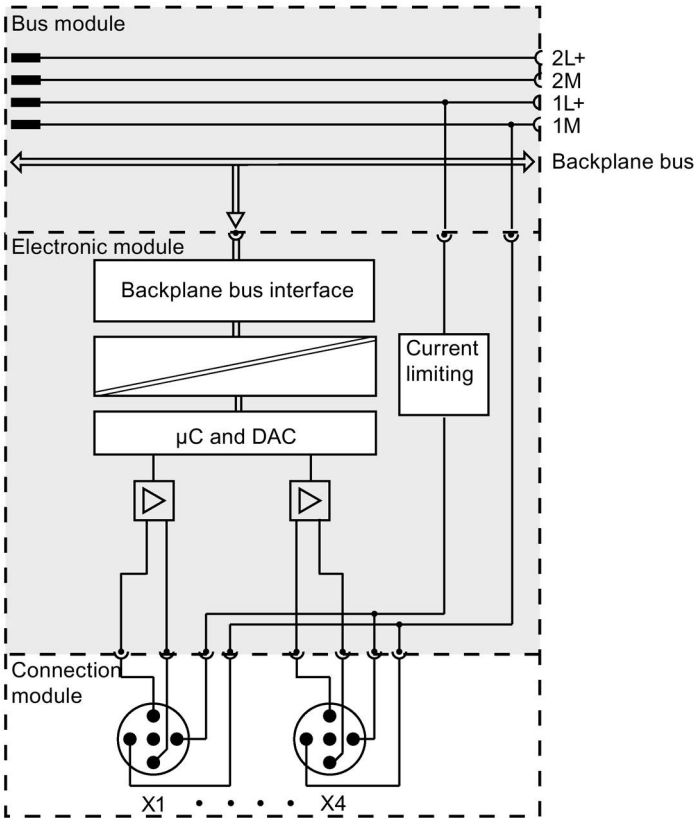


Figure 15-5 Block diagram of 4 AO U High Feature

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35
Weight	Approx. 150 g
Voltages and currents	
1L+ electronics/encoder supply	24 V DC
Short-circuit protection	Yes
Reverse polarity protection	Yes; against destruction
Current consumption	
• From backplane bus	10 mA
• From 1L+ electronics/encoder supply (no encoder connected)	65 mA
Power loss of the module	Typ. 1.7 W

Technical specifications	
Analog outputs	
Number of analog outputs	4
Cable length, shielded	Max. 30 m
Short-circuit protection	Yes, electronic, at each channel, to ground
Short-circuit current	Max. 50 mA
Actuator supply	
Number of actuator supplies	4
Total current up to 55 °C	Max. 1 A
Short-circuit protection	Yes, electronic, for each module, to ground
• Response threshold	Min. 1.4 A
Actuator selection data	
Output ranges (nominal value)	
• Voltage	± 10 V 1 V to 5 V 0 V to 10 V
Load impedance (in the nominal range of the output)	
• For voltage outputs	Min. 1 kΩ
• At voltage outputs, capacitive load	Max. 1 µF
Permissible input voltage for voltage output (destruction limit)	16 V
Wiring the actuators	
• At voltage output with 2-wire connection	Yes
• At voltage output with 4-wire connection	Yes
Analog value generation	
Conversion principle	R network
Conversion time per channel, in ms	0.7 ms
• Cycle time in ms (see Appendix *Response times*)	Number of active channels per module x conversion time
• Resolution (including overrange)	± 10 V/15 bit + sign 1 V to 5 V/14 bit 0 V to 10 V/15 bit
Settling time	
• With resistive load	0.1 ms
• With capacitive load	6 ms
Injection of substitution values	Yes
Interference suppression, error limits	
Crosstalk between outputs	Max. -40 dB
Operational limit (over the entire temperature range, referenced to output range)	±0.2%
Basic error limit (operational limit at 25 °C, referenced to output range)	±0.15%
Temperature error (referenced to output range)	Max. ±0.01%/K

Technical specifications	
Linearity error (referenced to output range)	±0.02% [1]
Repeat accuracy (in steady state at 25 °C, referenced to output range)	± 0.05%
Output ripple (referenced to output range), bandwidth 0 to 50 kHz	±0.02%
Status, interrupts, diagnostics	
Interrupts	
• Hardware interrupt	No
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	Yes
• Diagnostic functions can be read out	Yes
Monitoring for	
• Short-circuit	Yes; however, the diagnostic function cannot detect a short-circuit in the zero range
• Wire break	No
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and the 1L+ electronics/ encoder supply	Yes
• Between channels	No
[1] Up to product version 5: ±0.1%	

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)

Response times for analog input modules (Page 501)

15.6 Analog electronic module 4 AO I High Feature (6ES7145-4GF00-0AB0)

Order number

6ES7145-4GF00-0AB0

Properties

- 4 current outputs
- Output ranges:

  ± 20 mA, resolution 15 bit + sign

  4 to 20 mA, resolution 14 bit

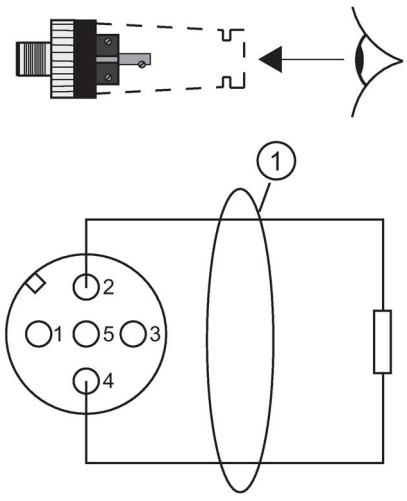
  0V to 20 mA, resolution 15 bit
- Outputs are electrically isolated from encoder voltage supply 1L+ and load voltage supply 2L+
- Diagnostics for encoder supply short-circuit to M per module
- Diagnostics for wire break per channel
- Output of substitute value

Note

Incorrect intermediate values may be generated at the output when you switch the 1L+ electronics/encoder supply on and off.

Pin assignment of connection module CM IO 4 x M12

The table below lists the terminal assignment of 4 AO I High Feature for connection module CM IO 4 x M12.

View of circular connector	Terminal	Assignment X1 to X4*
	1	24 V actuator supply 1L+
	2	Output signal QI_0+: Connector X1 Output signal QI_1+: Connector X2 Output signal QI_2+: Connector X3 Output signal QI_3+: Connector X4
	3	Actuator supply ground 1M
	4	Output signal QI_0-: Connector X1 Output signal QI_1-: Connector X2 Output signal QI_2-: Connector X3 Output signal QI_3-: Connector X4
	5	Functional earth (FE)
① Shielded copper cables * Please note the changed pin assignment for the ET 200X.		

Block diagram

The figure below shows the block diagram of 4 AO I High Feature.

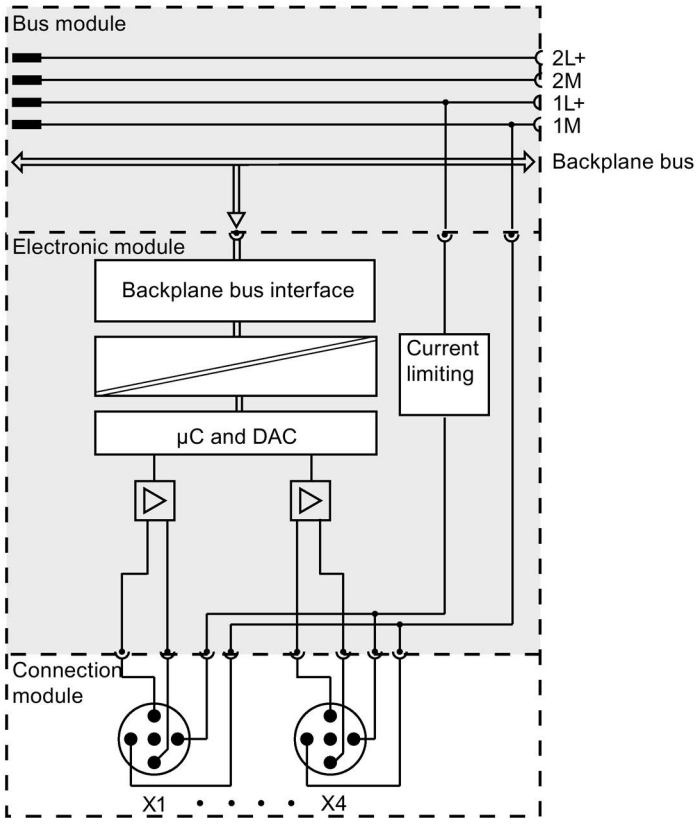


Figure 15-6 Block diagram of 4 AO I High Feature

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	45 x 130 x 35
Weight	Approx. 150 g
Voltages and currents	
1L+ electronics/encoder supply	24 V DC
Short-circuit protection	Yes
Reverse polarity protection	Yes; against destruction
Current consumption	
• From backplane bus	10 mA
• From 1L+ electronics/encoder supply (no encoder connected)	110 mA
Power loss of the module	Typ. 2.3 W

Technical specifications	
Analog outputs	
Number of analog outputs	4
Cable length, shielded	Max. 30 m
No-load voltage	Max. 16 V
Actuator supplies	
Number of actuator supplies	4
Total current up to 55 °C	Max. 1 A
Short-circuit protection	Yes, electronic, for each module, to ground
• Response threshold	Min. 1.4 A
Actuator selection data	
Output ranges (nominal value)	
• Current	±20 mA 4 to 20 mA 0 to 20 mA
Load impedance (in the nominal range of the output)	
• For current outputs	Max. 0.6 kΩ
• At current outputs with inductive load	Max. 1 mH
Permitted current at current output (destruction limit)	100 mA
Wiring the actuators	
• At current output with 2-wire connection	Yes
Analog value generation	
Conversion principle	R network
Conversion time per channel, in ms	0.7 ms
• Cycle time in ms (see Appendix *Response times*)	Number of active channels per module x conversion time
• Resolution (including overrange)	±20 mA/15 bit + sign 4 to 20 mA/14 bit 0 to 20 mA/15 bit
Settling time	
• With resistive load	0.1 ms
• With inductive load	1 ms
Injection of substitution values	Yes
Interference suppression, error limits	
Crosstalk between outputs	Max. -40 dB
Operational limit (over the entire temperature range, referenced to output range)	±0.2%
Basic error limit (operational limit at 25 °C, referenced to output range)	±0.15%
Temperature error (referenced to output range)	Max. ±0.01%/K
Linearity error (referenced to output range)	±0.02% [1]

Technical specifications	
Repeat accuracy (in steady state at 25 °C, referenced to output range)	± 0.05%
Output ripple (referenced to output range), bandwidth 0 to 50 kHz	±0.02%
Status, interrupts, diagnostics	
Interrupts	
• Hardware interrupt	No
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Channel error display	Yes
• Diagnostic functions can be read out	Yes
Monitoring for	
• Short-circuit	No
• Wire break	Yes; however, the diagnostic function cannot detect a wire break in the zero range
Insulation	
Insulation tested with	707 V DC (type test)
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and the 1L+ electronics/ encoder supply	Yes
• Between channels	No
Permitted potential difference	
• Between outputs and ground	2 V AC_{pp}
[1] Up to product version 5: ±0.1%	

See also

Connection module CM IO 4 x M12 for electronic modules (Page 264)

Response times for analog input modules (Page 501)

15.7 Parameter overview for analog electronic modules

Parameters for the 4 AI U High Feature, 4 AI I High Feature analog input modules

Parameters		Value range	Default	Effective range
4 AI U High Feature	4 AI I High Feature			
Group diagnostics		• Disable • Enable	Disable	Module
Process interrupt (limit value interrupt)		• Disable • Enable	Disable	Channel 0
Interference frequency suppression		• 50 Hz • 60 Hz	50 Hz	Module
Measuring method	—	• Disabled • Voltage	Voltage	Channel
Measuring range	—	• ±5 V • 1 V to 5 V • 0 V to 10 V • ±10 V	±10 V	Channel
—	Measuring method	• Disabled • Current (4 DMU) • Current (2 DMU)[2]	Current (4 DMU)	Channel
—	Measuring range	• 0 mA to 20 mA • 4 mA to 20 mA • ±20 mA	4 mA to 20 mA	Channel
Diagnostics of encoder supply short-circuit to M[1]		• Disable • Enable	Disable	Module
Short-circuit diagnostics[3]		• Disable • Enable	Disable	Channel
Diagnostics of wire break[3]		• Disable • Enable	Disable	Channel
Overflow/underflow diagnostics		• Disable • Enable	Disable	Channel
High limit		Low to high limit of the overrange	27648	Channel

Parameters		Value range	Default	Effective range
4 AI U High Feature	**4 AI I High Feature**			
Low limit		Low to high limit of the overrange	0	Channel
[1] The diagnostics function for the detection of a short-circuit of the encoder supply to M is enabled alongside with the group diagnostics function. [2] Restrictions for common mode voltage V_{CM} [3] For 4 AI U High Feature, only from 1 V to 5 V, for 4 AI I High Feature, only from 4 mA to 20 mA.				

Parameters for 4 AI RTD High Feature analog input module

Parameters	Value range	Default	Effective range
Group diagnostics	• Disable • Enable	Disable	Module
Interference frequency suppression	• 50 Hz • 60 Hz	50 Hz	Module
Temperature unit	• Celsius • Fahrenheit	Celsius	Module
Smoothing	• None • Weak • Average • Strong	None	Channel
Diagnostics: Wire break	• Disable • Enable	Disable	Channel
Diagnostics: Overflow/underflow	• Disable • Enable	Disable	Channel
Measuring method (see the following table: Measuring method for 4 AI RTD High Feature)	• Disabled • 4-wire resistor • 3-wire resistor • 2-wire resistor • 4-wire thermal resistor • 3-wire thermal resistor • 2-wire thermal resistor	Thermal resistor 4-wire	Channel

Parameters	Value range	Default	Effective range
Measuring range	• 150 Ω • 300 Ω • 600 Ω • 3000 Ω • Pt100 climatic range • Ni100 climatic range • Pt100 standard range • Ni100 standard range • Pt500 standard range • Pt1000 standard range • Ni1000 standard range • Pt200 climatic range • Pt500 climatic range • Pt1000 climatic range • Ni1000 climatic range • Pt200 standard range • Ni120 standard range • Ni120 climatic range • Ni200 standard range • Ni200 climatic range • Ni500 standard range • Ni500 climatic range	Pt100 standard	Channel
Temperature coefficient	• Pt 0.003851[1] • Pt 0.003916 • Pt 0.003902 • Pt 0.003920 • Pt 0.003850 • Ni 0.006180 • Ni 0.006720	Pt 0.003851[1]	Channel
[1] This value can also be represented as α = 0.00385055 in the parameter assignment.			

Measuring method for 4 AI RTD High Feature

The following table lists the temperature coefficients and measuring ranges you can set for each measurement method:

Measuring method	Temperature coefficient	Measuring range
Disabled	–	–
4-wire resistor 3-wire resistor 2-wire resistor	–	150 Ω/300 Ω/600 Ω/3000 Ω
3-wire thermal resistor [1]	Pt 0.003851[2] [3]/ Pt 0.003916/ Pt 0.003902/ Pt 0.003920/ Pt 0.003850	Pt 100 climatic range/ Pt 100 standard range/ Pt 200 climatic range/ Pt 200 standard range/ Pt 500 climatic range/ Pt 500 standard range/ Pt 1000 climatic range/ Pt 1000 standard range
	Ni 0.006180[2]/ Ni 0.006720	Ni100 climatic range/ NI100 standard range/ Ni120 climatic range/ Ni120 standard range/ Ni200 climatic range/ Ni200 standard range/ Ni500 climatic range/ Ni500 standard range/ Ni1000 climatic range/ Ni1000 standard range
2-wire thermal resistor [1] 4-wire thermal resistor [1]	Pt 0.003851[3]/ Pt 0.003916/ Pt 0.003902/ Pt 0.003920/ Pt 0.003850	Pt 100 climatic range/ Pt 100 standard range/ Pt 200 climatic range/ Pt 200 standard range/ Pt 500 climatic range/ Pt 500 standard range/ Pt 1000 climatic range/ Pt 1000 standard range
	Ni 0.006180/ Ni 0.006720	Ni100 climatic range/ Ni100 standard range/ Ni120 climatic range/ Ni120 standard range/ Ni200 climatic range/ Ni200 standard range/ Ni500 climatic range/ Ni500 standard range/ Ni1000 climatic range/ Ni1000 standard range

[1] In accordance with EN 60751, ASTM E 1137, GOST 6651, JIS C1604

[2] The preset temperature coefficient is valid for Europe.

[3] This value can also be represented as α = 0.00385055 in the parameter assignment.

Parameters for 4 AI TC High Feature analog input modules

Parameters	Value range	Default	Effective range
Group diagnostics	• Disable • Enable	Disable	Module
Temperature unit	• Celsius • Fahrenheit • Kelvin	Celsius	Module
Interference frequency suppression	• Off • 10 Hz • 50 Hz • 60 Hz	50 Hz	Module
Reference temperature [1]	See below, *"Reference temperature" parameter for 4 AI TC High Feature*		
Measuring method	• Disabled • Thermocouple • Voltage ±80 mV	Thermocouple	Channel
Measuring range [2]	• Type B [PtRh-PtRh] • Type E [NiCr-CuNi] • Type J [Fe-CuNi] • Type K [NiCr-Ni] • Type L [Fe-CuNi] • Type N [NiCrSi-NiSi] • Type R [PtRh-Pt] • Type S [PtRh-Pt] • Type T [Cu-CuNi]	Type K [NiCr-Ni]	Channel
Diagnostics: Wire break [3]	• Disable • Enable	Disable	Channel
Diagnostics: Overflow/underflow	• Disable • Enable	Disable	Channel
Smoothing	• None • Weak • Average • Strong	None	Channel

Parameters	Value range	Default	Effective range
Reference junction	• None • Internal • RTD (0) • Dynamic ref. Temp. (see below) • Fixed ref. Temp. (see below)	Internal	Channel
[1] Only possible if the "Reference junction" parameter is set to "Fixed ref. temp.". [2] In accordance with EN 60584, ASTM E 230, GOST R8.585, JIS C1602; type L according to DIN 43710 [3] The wire break check function is not supported in the measurement type voltage ±80 mV of the module.			

"Reference temperature" parameter for 4 AI TC High Feature

The "Reference temperature" parameter can only be set if you have selected "Fix. ref. temp." for the "Reference junction" parameter.

Temperature unit	Value range in HW Config	Decimal	Default
Celsius	-145.0 °C to 155.0 °C	-1450 to 1550	0.0 °C
Fahrenheit	-229.0 °F to 311.0 °F	-2290 to 3110	32.0 °F
Kelvin	128.2 K to 428.2 K	1282 to 4282	273.2 K

Parameters of analog output modules

Parameters		Value range	Default	Effective range
4 AO U High Feature	**4 AO I High Feature**			
Group diagnostics		• Disable • Enable	Disable	Module
Output type	—	• Disabled • Voltage	Voltage	Channel
Output range	—	• 1 V to 5 V • ±10 V • 0 V to 10 V	±10 V	Channel
—	Output type	• Disabled • Current	Current	Channel
—	Output range	• 4 mA to 20 mA • ±20 mA • 0 mA to 20 mA	4 mA to 20 mA	Channel
Diagnostics of encoder supply short-circuit to M[1]		• Disable • Enable	Disable	Module
Diagnostics of short-circuit at outputs	---	• Disable • Enable	Disable	Channel
---	Wire break diagnostics	• Disable • Enable	Disable	Channel
Response to CPU/Master STOP		• Output at zero current and zero voltage • Hold last value • Output substitute values	Output at zero current and zero voltage	Module
Substitute value		Each value in the rated and in the over-shoot/undershoot ranges	0	Channel
[1] Diagnostics of short-circuits of the encoder supply to M is enabled alongside with the group diagnostics function.				

See also

Overview of parameters of the analog electronic modules (Page 424)

15.8 Overview of parameters of the analog electronic modules

Group diagnostics

You can generally enable/disable the module's diagnostic function by setting this parameter.

Process interrupt (limit value interrupt)

If this parameter is enabled, the system generates a process interrupt when the measured value

- overshoots the high limit (see **High limit** parameter),
- undershoots the low limit (see the **Low limit** parameter).

Interference frequency suppression

With this parameter you set the integration time of the module based on the selected interference frequency. Select the frequency of the applied supply voltage.

Measurement type/output type

With this parameter you set the measurement type/output type, e.g. voltage. For any unused channels, select the **disabled** setting. The conversion and integration time of the disabled channel is "0" and the cycle time is reduced.

Measuring range/output range

With this parameter you set the range of the selected type of measurement, or the output range of the selected type of output.

Temperature coefficient

The correction factor for the temperature coefficient (α value) indicates by what extent the resistance of specific material changes relatively if the temperature increases from 0 °C to 100 °C.

The α values correspond to the standards EN 60751, GOST 6651, JIS C 1604, and ASTM E-1137.

The temperature coefficient is dependent on the chemical composition of the material. In Europe only one value is used per sensor type (preset value).

The other α values allow a corresponding adjustment to the sensor type used.

Smoothing

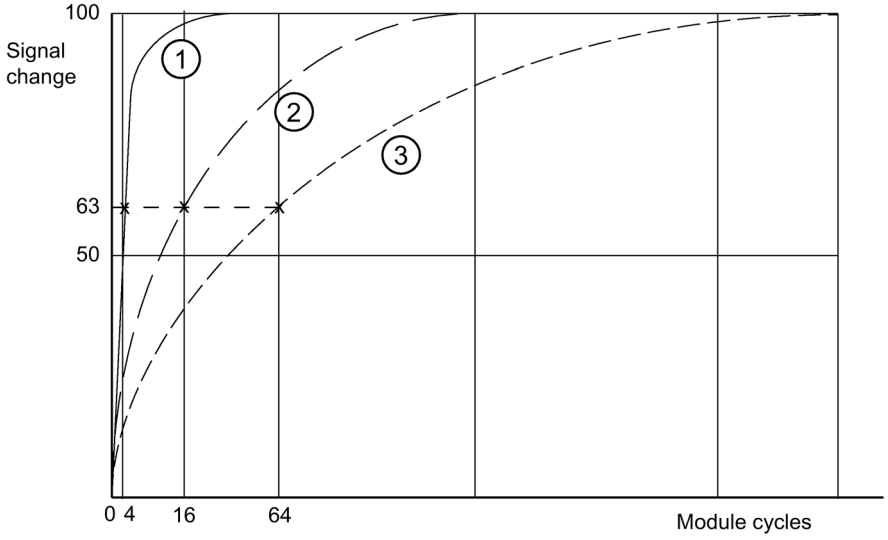
Smoothing of the analog values produces a reliable analog signal for further processing. The smoothing of analog values is useful when handling measured values with a slow rate of change, for example, temperature measurements.

The measured values are smoothed by means of digital filtering. Smoothing is achieved by the module calculating a mean value based on a defined number of converted (digitized) analog values.

The user assigns parameters to smoothing at not more than four levels (none, weak, medium, strong). The level determines the number of module cycles from which the mean value is derived.

The stronger the smoothing, the greater the stability of the smoothed analog value. The time until the smoothed analog value is present after the signal change depends on the level of the smoothing (see figure below).

The figure below shows the number of cycles a module requires to apply an almost 100% analog value after a step response, based on the smoothing function settings. The figure applies to all signal changes at the analog input. The smoothing value defines the number of cycles a module requires to reach 63% of the end value of the changed signal.



① Low level smoothing
② Medium level smoothing
③ High level smoothing

Diagnostics of encoder supply short-circuit to M

If this parameter is enabled, the system generates a diagnostics event when it detects a short-circuit of the sensor supply to ground. This diagnostics function is enabled alongside with the group diagnostics function.

Diagnostics of short-circuit (inputs)

If this parameter is enabled, the system generates **short-circuit** diagnostic data when a short-circuit between signal lines is detected.

Diagnostics of short-circuit (outputs)

If this parameter is enabled, the system generates diagnostic data when a short-circuit between the output line and P potential or ground is detected.

Wire break diagnostics

If this parameter is enabled, the system generates **wire break** diagnostic data when a wire break is detected.

Analog input modules: Observe the rules outlined below in case of a wire break in the 1 V to 5 V and 4 mA to 20 mA measuring ranges:

Parameters	Event	Measured value	Explanation
Wire break diagnostics enabled[1]	Wire break	$7FFF_H$	**Wire break** diagnostics
Wire break diagnostics disabled[1] Overflow/underflow enabled	Wire break	8000_H	Measured value after leaving the undershoot range Diagnostics message **Value below high limit/low limit**
Wire break diagnostics disabled[1] Overflow/underflow disabled	Wire break	8000_H	Measured value after leaving the undershoot range
[1] Measured value limits for wire break and measuring range undershoot detection: • 1 V to 5 V: At 0.296 V • 4 mA to 20 mA At 1.185 mA			

Overflow/underflow diagnostics

If this parameter is enabled,

- the **overflow** diagnostics is generated when the measured value reaches the overflow range.
- the **underflow** diagnostics is generated when the measured value reaches the underflow range.

Reference junction

A difference in temperature between the measuring point and the reference junction (free ends of the thermocouple at the terminal point) generates a voltage between the free ends, namely the thermoelectric voltage. The level of the thermoelectric voltage depends on:

- The difference between the temperature at the measuring point and the temperature at the free ends
- The combination of materials used to make the thermocouple

Because a thermocouple always detects any temperature difference, the temperature at the reference junction must be determined in order to establish the temperature at the measuring point.

The following parameters enable you to switch between the following compensation types:

Compensation type	Explanation
None	**Properties** With this compensation type, the reference junction temperature for thermocouples is measured outside the 4 AI TC High Feature electronic module. You can, for example, connect a compensating box to the thermocouple for this purpose. **Principle of operation** With this compensation type, the temperature at the reference junction is defined as 0 °C. This can be achieved using a compensating box. A compensating box is required for each thermocouple. **Connection** Use copper cables to connect the compensating box to the CM IO 4 x M12 of the 4 AI TC High Feature (see the example in the Appendix, Connecting thermocouples to analog inputs (Page 511)). Note: Type B thermocouples do not need a compensating box.
Internal	**Properties** With this compensation type, the reference junction temperature is established using an internal temperature sensor integrated in the 4 AI TC High Feature electronic module. Note: Please note the response time when the ambient temperature changes. **Principle of operation** The temperature at the reference junction is recorded using an internal temperature sensor. All the 4 AI TC High Feature channels you select for this compensation type obtain the same reference junction temperature. **Connection** Connect the thermocouples to the CM IO 4 x M12 of the 4 AI TC High Feature either directly or using compensating lines (see the example in the Appendix, Connecting thermocouples to analog inputs (Page 511)).

Compensation type	Explanation
RTD (0)	**Properties** The compensation is based on a measurement of the resistance value of a Pt1000 at the contact point of the M12 compensation connector or an external resistance value Pt1000. The resistance measurement is only possible at the circular socket X1 (channel 0). **Principle of operation** The temperature at the reference junction can be determined from the Pt1000 resistance value. All the 4 AI TC High Feature channels you select for this compensation type obtain the same reference junction temperature. **Connection** • With an M12 compensation connector: Connect the thermocouple to the M12 compensation connector either directly or using compensating lines. Fit the M12 compensation connector onto circular socket connector X1 (channel 0) of the CM IO 4 x M12 on the 4 AI TC High Feature. • Without an M12 compensation connector: – Connect an external Pt1000 (where α = 0.03851) to terminals 1 and 3 using copper cables to record the reference junction temperature. The Pt1000 thermal resistor must be positioned near the reference junction. – Connect the thermocouples to terminals 2 and 4 using copper cables from the reference junction. Additional thermocouples can be connected to circular socket connectors X2 to X4 on the CM IO 4 x M12 of the 4 AI TC High Feature. The reference junction temperature recorded by measuring the resistance value at circular socket connector X1 applies to all the module's channels you have selected for this compensation type (see the example in the Appendix, Connecting thermocouples to analog inputs (Page 511)).

Compensation type	Explanation
Dynamic ref. temp.	**Properties** With this form of compensation, the reference junction temperature can be measured using an external module on another station. **Principle of operation** The temperature at the reference junction is communicated to the 4 AI TC High Feature electronic module by data record DS2 from the CPU using SFB 53. Each channel you select for this compensation type can be assigned its own reference junction temperature via the user program. For more information, please refer to the section titled Dynamic reference temperature for the 4 AI TC High Feature electronic module (Page 430). **Connection** Connect the thermocouples to terminals 2 and 4 using copper cables from the reference junction. If you record the reference junction temperature directly at the M12 connector on the CM IO 4 x M12 of the 4 AI TC High Feature, you will also be able to connect the thermocouples either directly or using compensating lines (see the example in the Appendix, Connecting thermocouples to analog inputs (Page 511)).
Fixed ref. temp.	**Properties** With this compensation type, the reference junction temperature is stored as a fixed value. **Principle of operation** The temperature at the reference junction is defined in the "Reference temperature" parameter. The table titled *"Reference temperature" parameter for 4 AI TC High Feature* in the section titled Parameter overview for analog electronic modules (Page 417) shows the possible value range. The reference junction temperature which has been programmed applies to all the module channels you have selected for this compensation type. **Connection** Connect the thermocouples to terminals 2 and 4 using copper cables from the reference junction. If you record the reference junction temperature directly at the M12 connector on the CM IO 4 x M12 of the 4 AI TC High Feature, you will also be able to connect the thermocouples either directly or using compensating lines (see the example in the Appendix, Connecting thermocouples to analog inputs (Page 511)).

Note

If a type B thermocouple or the ±80 mV measuring method is being used, "No" temperature compensation will be performed regardless of the temperature compensation parameter assignment.

15.9 Dynamic reference temperature for the 4 AI TC High Feature electronic module

Properties

You can use the "Dynamic reference temperature" compensation type to measure the reference junction temperature at the measuring point via the 4 AI RTD High Feature electronic module or another station's external module. This involves transferring the reference junction temperature to the 4 AI TC High Feature electronic module using SFB 53 "WRREC" via data record DS2.

Requirements

- SFB 53 "WRREC" standard function block
- User program (see example below)

Programming

Please note the following information regarding the user program:

- The permissible value range for the reference junction temperature with standard resolution corresponds to the Pt100 climatic temperature range for platinum RTDs, and can be seen in the table titled *"Reference temperature" parameter for 4 AI TC High Feature* in the section titled Parameter overview for analog electronic modules (Page 417).
- If a reference junction temperature outside the permissible value range is received in data record DS2, a "Reference channel error" diagnostic interrupt is reported, assuming the "Group diagnostics" parameter is enabled.
- When the 4 AI TC High Feature electronic module starts up, all the inputs report an overflow (32767). Once a compensation value has been received via data record DS2, the electronic module starts to read the TC inputs and report the correct data. If the electronic module does not receive any DS2 data within 5 minutes of starting up, a "Reference channel error" diagnostic interrupt is reported, assuming the "Group diagnostics" parameter is enabled.
- The 4 AI TC High Feature electronic module features time monitoring (watchdog) set to 5 minutes, which is reset when a new compensation value is received via DS2. If the electronic module does not receive any DS2 data within the 5 minutes of time monitoring during normal operation, a "Reference channel error" diagnostic interrupt is reported, assuming the "Group diagnostics" parameter is enabled.
- If ET 200pro modules or other modules are being used to measure the reference junction temperature, the RTD module parameters for the output structure and measuring accuracy in DS2 must be represented by bytes 0 and 1. This can be seen in the "Data record DS2 structure" figure below.

Data record DS2 structure

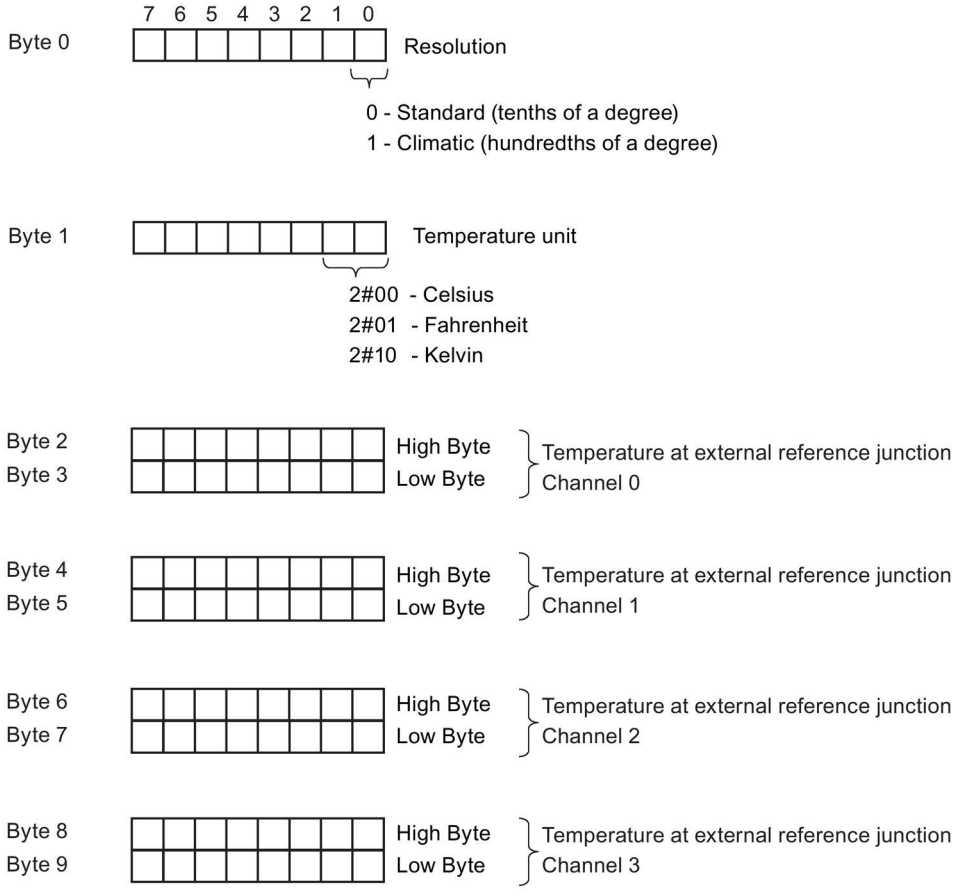


Figure 15-7 Data record DS2 structure

Temperature unit	Decimal	Hexadecimal
Celsius (standard)	-1450 to 1550	$FA56_H$ to $60E_H$
Fahrenheit (standard)	-2290 to 3110	$F70E_H$ to $C26_H$
Kelvin (standard)	1282 to 4282	502_H to $10BA_H$
Celsius (climatic)	-14500 to 15500	$C75C_H$ to $3C8C_H$
Fahrenheit (climatic)	-22900 to 31100	$A68C_H$ to $797C_H$
Kelvin (climatic)	12815 to 32760	$23FF_H$ to $7FF8_H$

Note

The flexibility of the data record DS2 structure enables you to use a separate reference junction for each channel. The channels can also be combined via the user program in such a way that they use the same reference junction. This is only possible if you specify the same temperature value in DS2 for all the channels operating at the same reference junction temperature.

User program

The following user program shows an example of the "Dynamic ref. temp." compensation type for channels 0 to 3 of an RTD module's 4 AI TC High Feature electronic module. The reference junction temperature of the RTD module applies to all the channels of the 4 AI TC High Feature electronic module.

Requirements:

- Input address of the 4 AI TC High Feature electronic module: 120 (module address)
- Input address of the RTD module: 128 (channel address)
- Requirement bit for "WRREC" SFB: M 20.0
- Busy bit for "WRREC" SFB: M 20.1
- Memory for data transfer: MW 0 to MW 8

```
STL                                 Explanation
UN M 20.0                           Check the requirement: New dynamic ref. temp.
UN M 20.1                           Check whether WRREC is "Busy"
SPB END                             Skip if no transfer is required
U M 20.1                            Check whether WRREC is "Busy"
SPB WRT
// Create memory for data transfer
L B#16#1                            Convert the temperature into hundredths of degrees (Pt 100 climatic)
T MB 0
L B#16#0                            Convert the temperature into Celsius
T MB 1
L PEW 128                           Read in the reference junction temperature of the RTD module
T MW 2                              For channel 0 of the 4 AI TC High Feature
T MW 4                              For channel 1 of the 4 AI TC High Feature
T MW 6                              For channel 2 of the 4 AI TC High Feature
T MW 8                              For channel 3 of the 4 AI TC High Feature
// Transfer the reference junction temperature to the 4 AI TC High Feature
WRT :CALL "WRREC", DB53
REQ :=M20.0                         Requirement bit for data transfer
ID :=DW#16#80                       Input address 128 of the 4 AI TC High Feature
INDEX :=2                           Data record no. must be set to 2
```

```
STL                                 Explanation
LEN :=10                            Length 10 bytes
DONE :=
BUSY :=M20.1                        Busy bit of "WRREC" SFB
ERROR :=
STATUS :=MD24
RECORD :=P#M0.0 BYTE 10             Pointer on the memory for data transfer, length 10 bytes
U M 20.1                            Check whether WRREC is "Busy"
SPB END
CLR
= M 20.0                            Reset requirement for dynamic ref. temp.
END :NOP 0
```

This is just an example. The logic and memory allocation must be adapted to the structure of the particular PLC program used.

For further information on the "WRREC" SFB 53, refer to the manual titled System Software for S7-300/400 System and Standard Functions (http://support.automation.siemens.com/WW/view/en/1214574).

15.10 Analog value representation for measuring ranges with SIMATIC S7

Representation of analog values

With the same nominal range, the digitized analog value is the same for input and output values. Analog values are visualized in two's complement.

The table below shows the visualization of the analog value of analog electronic modules.

Table 15- 1 Analog value visualization (SIMATIC S7 format)

Resolution	Analog value															
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit significance	Sign	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}

Sign

The sign of the analog value is always set at bit number 15:

- "0" → +
- "1" → -

Measured value resolution

The table below shows the representation of binary analog values and of the associated decimal and hexadecimal units of the analog values.

The table below shows the resolutions of 12, 13, 14, and 15 bits + sign. Each analog value is written left aligned to the ACCU. The bits marked with "x" are set to "0".

Table 15- 2 Resolution of measured analog values (SIMATIC S7 format)

Resolution in bits	Units		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
12+S	8	8_H	S 0 0 0 0 0 0 0	0 0 0 0 1 x x x
13+S	4	4_H	S 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
14+S	2	2_H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
15+S	1	1_H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

15.11 Measuring ranges of the analog input modules in S7 format

Voltage measuring ranges: 1 to 5 V

Measuring range 1 to 5 V	Units		Range
	Decimal	Hexadecimal	
> 5.704 V	32767	$7FFF_H$	Overflow
5.704 V	32511	$7EFF_H$	Overrange
	27649	$6C01_H$	
5 V	27648	$6C00_H$	Nominal range
4 V	20736	5100_H	
1 V + 144.7 µV	1	0001_H	
1 V	0	0000_H	
	-1	$FFFF_H$	Underrange
0.296 V	-4864	$ED00_H$	
< 0.296 V	32767	$7FFF_H$	Wire break
	- 32768	8000_H	Underflow

Voltage measuring ranges: 0 to 10 V

Measuring range	Units		Range
0 to 10 V	Decimal	Hexadecimal	
> 11.759 V	32767	$7FFF_H$	Overflow
11.759 V	32511	$7EFF_H$	Overrange
	27649	$6C01_H$	
10 V	27648	$6C00_H$	Nominal range
7.5 V	20736	5100_H	
0 V + 361.7 µV	1	0001_H	
0 V	0	0000_H	
	-1	$FFFF_H$	Underrange
-1.759 V	-4864	$ED00_H$	
< -1.759 V	- 32768	8000_H	Underflow

Voltage measuring ranges: ± 5 V, ± 10 V

Measuring range ± 5 V	Measuring range ± 10 V	Units		Range
		Decimal	Hexadecimal	
> 5.879 V	> 11,759	32767	$7FFF_H$	Overflow
5.879 V	11,759	32511	$7EFF_H$	Overrange
		27649	$6C01_H$	
5 V	10 V	27648	$6C00_H$	Nominal range
3.750 V	7.5 V	20736	5100_H	
180.850 µV	361.7 µV	1	0001_H	
0 V	0 V	0	0000_H	
		-1	$FFFF_H$	
-3.750 V	-7.5 V	-20736	$AF00_H$	
-5 V	-10 V	-27648	9400_H	
		-27649	$93FF_H$	Underrange
-5.879 V	-11.759 V	-32512	8100_H	
< -5.879 V	< -11.759 V	-32768	8000_H	Underflow

Voltage measuring range: ±80 mV

Measuring range ±80 mV	Units		Range
	Decimal	Hexadecimal	
> 94.1 mV	32767	$7FFF_H$	Overflow
94.1 mV	32511	$7EFF_H$	Overrange
	27649	$6C01_H$	
80 mV	27648	$6C00_H$	Nominal range
60 mV	20736	5100_H	
2.89 µV	1	0001_H	
0 mV	0	0000_H	
	-1	$FFFF_H$	
-60 mV	-20736	$AF00_H$	
-80 mV	-27648	9400_H	
	-27649	$93FF_H$	Underrange
-94.1 mV	-32512	8100_H	
< -94.1 mV	-32768	8000_H	Underflow

Current measuring range: 0 to 20 mA

Measuring range 0 mA to 20 mA	Units		Range
	Decimal	Hexadecimal	
> 23.52 mA	32767	$7FFF_H$	Overflow
23.52 mA	32511	$7EFF_H$	Overrange
	27649	$6C01_H$	
20 mA	27648	$6C00_H$	Nominal range
15 mA	20736	5100_H	
723.4 nA	1	0001_H	
0 mA	0	0000_H	
	- 1	$FFFF_H$	Underrange
-3.52 mA	-4864	$ED00_H$	
< -3.52 mA	32768	8000_H	Underflow

Current measuring range: 4 to 20 mA

Measuring range 4 mA to 20 mA	Units		Range
	Decimal	Hexadecimal	
> 22.81 mA	32767	$7FFF_H$	Overflow
22.81 mA	32511	$7EFF_H$	Overrange
	27649	$6C01_H$	
20 mA	27648	$6C00_H$	Nominal range
16 mA	20736	5100_H	
4 mA + 578.7 nA	1	0001_H	
4 mA	0	0000_H	
	- 1	$FFFF_H$	Underrange
1.185 mA	-4864	$ED00_H$	
< 1.185 mA	32767	$7FFF_H$	Wire break
	-32768	8000_H	Underflow

Current measuring range: ± 20 mA

Measuring range ± 20 mA	Units		Range
	Decimal	Hexadecimal	
> 23.52 mA	32767	$7FFF_H$	Overflow
23.52 mA	32511	$7EFF_H$	Overrange
	27649	$6C01_H$	
20 mA	27648	$6C00_H$	Nominal range
15 mA	20736	5100_H	
723.4 nA	1	0001_H	
0 mA	0	0000_H	
	-1	$FFFF_H$	
-15 mA	-20736	$AF00_H$	
-20 mA	-27648	9400_H	
	-27649	$93FF_H$	Underrange
-23.52 mA	-32512	8100_H	
< -23.52 mA	-32768	8000_H	Underflow

Resistance-type encoder measuring ranges: 150 Ω, 300 Ω, 600 Ω, 3 kΩ

Measuring range 150 Ω	Measuring range 300 Ω	Measuring range 600 Ω	Measuring range 3 kΩ	Units		Range
				Decimal	Hexadec-imal	
> 176.38 Ω	> 352.77 Ω	> 705.53 Ω	> 3.53 kΩ	32767	$7FFF_H$	Overflow
176.38 Ω	352.77 Ω	705.53 Ω	3.53 kΩ	32511	$7EFF_H$	Overrange
				27649	$6C01_H$	
150 Ω	300 Ω	600 Ω	3 kΩ	27648	$6C00_H$	Nominal range
112.5 Ω	225 Ω	450 Ω	2.25 kΩ	20736	5100_H	
5.43 mΩ	10.85 mΩ	21.70 mΩ	108.05 mΩ	1	0001_H	
0 Ω	0 Ω	0 Ω	0 Ω	0	0000_H	
Negative values are physically impossible						

Measuring ranges for Pt x00 standard thermal resistor

Pt x00 Standard in °C (1 digit = 0.1 °C)	Units		Pt x00 Standard in °F (1 digit = 0.1 °F)	Units		Range
	Decimal	Hexadeci-mal		Decimal	Hexadec-imal	
> 1000,0	32767	$7FFF_H$	> 1832,0	32767	$7FFF_H$	Overflow
1000,0 : 850,1	10000 : 8501	2710_H : 2135_H	1832,0 : 1562,1	18320 : 15621	4790_H : $3D05_H$	Overrange
850,0 : -200,0	8500 : -2000	2134_H : $F830_H$	1562,0 : -328,0	15620 : -3280	$3D04_H$: $F330_H$	Nominal range
-200,1 : -243,0	-2001 : -2430	$F82F_H$: $F682_H$	-328,1 : -405,4	-3281 : -4054	$F32F_H$: $F02A_H$	Underrange
< -243,0	-32768	8000_H	< -405,4	-32768	8000_H	Underflow

Measuring ranges for Pt x00 climatic thermal resistor

Pt x00 climatic in °C (1 digit = 0.01 °C)	Units		Pt x00 climatic in °F (1 digit = 0.01 °F)	Units		Range
	Decimal	Hexadeci-mal		Decimal	Hexadec-imal	
> 155,00	32767	$7FFF_H$	> 311,00	32767	$7FFF_H$	Overflow
155,00 : 130,01	15500 : 13001	$3C8C_H$: $32C9_H$	311,00 : 266,01	31100 : 26601	$797C_H$: $67E9_H$	Overrange
130,00 : -120,00	13000 : -12000	$32C8_H$: $D120_H$	266,00 : -184,00	26600 : -18400	$67E8_H$: $B820_H$	Nominal range
-120,01 : -145,00	-12001 : -14500	$D11F_H$: $C75C_H$	-184,01 : -229,00	-18401 : -22900	$B81F_H$: $A68C_H$	Underrange
< -145,00	-32768	8000_H	< -229,00	-32768	8000_H	Underflow

Measuring ranges for Ni x00 standard thermal resistor

Ni x00 Standard in °C (1 digit = 0.1 °C)	Units		Ni x00 Standard in °F (1 digit = 0.1 °F)	Units		Range
	Decimal	Hexadeci-mal		Decimal	Hexadec-imal	
> 295,0	32767	$7FFF_H$	> 563,0	32767	$7FFF_H$	Overflow
295,0 : 250,1	2950 : 2501	$B86_H$: $9C5_H$	563,0 : 482,1	5630 : 4821	$15FE_H$: $12D5_H$	Overrange
250,0 : -60,0	2500 : -600	$9C4_H$: $FDA8_H$	482,0 : -76,0	4820 : -760	$12D4_H$: $FD08_H$	Nominal range
-60,1 : -105,0	-601 : -1050	$FDA7_H$: $FBE6_H$	-76,1 : -157,0	-761 : -1570	$FD07_H$: $F9DE_H$	Underrange
< -105,0	-32768	8000_H	< -157,0	-32768	8000_H	Underflow

Measuring ranges for Ni cx00 climatic thermal resistor

Ni x00 climatic in °C (1 digit = 0.01 °C)	Units		Ni x00 climatic in °F (1 digit = 0.01 °F)	Units		Range
	Decimal	Hexadeci-mal		Decimal	Hexadec-imal	
> 155,00	32767	$7FFF_H$	> 311,00	32767	$7FFF_H$	Overflow
155,00 : 130,01	15500 : 13001	$3C8C_H$: $32C9_H$	311,00 : 266,01	31100 : 26601	$797C_H$: $67E9_H$	Overrange
130,00 : -60,00	13000 : -6000	$32C8_H$: $E890_H$	266,00 : -76,00	26600 : -7600	$67E8_H$: $E250_H$	Nominal range
-60,01 : -105,00	-6001 : -10500	$E88F_H$: $D6FC_H$	-76,01 : -157,00	-7601 : -15700	$E24F_H$: $C2AC_H$	Underrange
< -105,00	-32768	8000_H	< -157,00	-32768	8000_H	Underflow

Measuring range for type B thermocouple

Table 15- 3

Type B in °C	Units		Type B in °F	Units		Type B in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexa-decimal		Decimal	Hexadec-imal	
> 2070,0	32767	$7FFF_H$	> 3276,6	32767	$7FFF_H$	> 2343,2	32767	$7FFF_H$	Overflow
2070,0 : 1820,1	20700 : 18201	$50DC_H$: 4719_H	3276,6 : 2786,6	32766 : 27866	$7FFE_H$: $6CDA_H$	2343,2 : 2093,3	23432 : 20933	$5B88_H$: $51C5_H$	Overrange
1820,0 : 0,00	18200 : 0	4718_H : 0000_H	2786,5 : 32,0	27865 : 320	$6CD9_H$: 0140_H	2093,2 : 273,2	20932 : 2732	$51C4_H$: $0AAC_H$	Nominal range
< -0,0	-32768	8000_H	< 32,0	-32768	8000_H	< 273,2	-32768	8000_H	Underflow

Measuring range for type E thermocouple

Table 15- 4

Type E in °C	Units		Type E in °F	Units		Type E in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexadec-imal		Decimal	Hexa-decimal	
> 1200,0	32767	$7FFF_H$	> 2192,0	32767	$7FFF_H$	> 1473,2	32767	$7FFF_H$	Overflow
1200,0 : 1000,1	12000 : 10001	$2EE0_H$: 2711_H	2192,0 : 1832,1	21920 : 18321	$55A0_H$: 4791_H	1473,2 : 1273,3	14732 : 12733	$398C_H$: $31BD_H$	Overrange
1000,0 : -270,0	10000 : -2700	2710_H : $F574_H$	1832,0 : -454,0	18320 : -4540	4790_H : $EE44_H$	1273,2 : 3,2	12732 : 32	$31BC_H$: 0020_H	Nominal range
< -270,0	-32767	8000_H	< -454,0	-32768	8000_H	<3,2	-32768	8000_H	Underflow

Measuring range for type J thermocouple

Table 15- 5

Type J in °C	Units		Type J in °F	Units		Type J in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexa-decimal		Decimal	Hexa-decimal	
> 1450,0	32767	$7FFF_H$	> 2642,0	32767	$7FFF_H$	> 1723,2	32767	$7FFF_H$	Overflow
1450,0 : 1200,1	14500 : 12001	$38A4_H$: $2EE1_H$	2642,0 : 2192,1	26420 : 21921	6734_H : $55A1_H$	1723,2 : 1473,3	17232 : 14733	4350_H : $398D_H$	Overrange
1200,0 : -210,0	12000 : -2100	$2EE0_H$: $F7CC_H$	2192,0 : -346,0	21920 : -3460	$55A0_H$: $F27C_H$	1473,2 : 63,2	14732 : 632	$398C_H$: 0278_H	Nominal range
< -210,0	-32768	8000_H	<-346,0	-32768	8000_H	< 63,2	-32768	8000_H	Underflow

Measuring range for type K thermocouple

Table 15- 6

Type K in °C	Units		Type K in °F	Units		Type K in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexa-decimal		Decimal	Hexa-decimal	
> 1622,0	32767	$7FFF_H$	> 2951,6	32767	$7FFF_H$	> 1895,2	32767	$7FFF_H$	Overflow
1622,0 : 1372,1	16220 : 13721	$3F5C_H$: 3599_H	2951,6 : 2501,7	29516 : 25017	$734C_H$: $61B9_H$	1895,2 : 1645,3	18952 : 16453	$4A08_H$: 4045_H	Overrange
1372,0 : -270,0	13720 : -2700	3598_H : $F574_H$	2501,6 : -454,0	25061 : -4540	$61B8_H$: $EE44_H$	1645,2 : 3,20	16452 : 32	4044_H : 0020_H	Nominal range
< -270,0	-32768	8000_H	< -454,0	-32768	8000_H	< 3,2	-32768	8000_H	Underflow

Measuring range for type L thermocouple

Table 15- 7

Type L in °C	Units		Type L in °F	Units		Type L in K	Units		Range
	Decimal	Hexadec-imal		Decimal	Hexadec-imal		Decimal	Hexadec-imal	
> 1150,0	32767	$7FFF_H$	> 2102,0	32767	$7FFF_H$	> 1423,2	32767	$7FFF_H$	Overflow
1150,0 : 900,1	11500 : 9001	$2CEC_H$: 2329_H	2102,0 : 1652,1	21020 : 16521	$521C_H$: 4089_H	1423,2 : 1173,3	14232 : 11733	3798_H : $2DD5_H$	Overrange
900,0 : -200,0	9000 : -2000	2328_H : $F830_H$	1652,0 : -328,0	16520 : -3280	4088_H : $F330_H$	1173,2 : 73,2	11732 : 732	$2DD4_H$: $02DC_H$	Nominal range
< -200,0	-32768	8000_H	< -328,0	-32768	8000_H	< 73,2	-32768	8000_H	Underflow

Measuring range for type N thermocouple

Table 15- 8

Type N in °C	Units		Type N in °F	Units		Type N in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexa-decimal		Decimal	Hexadec-imal	
> 1550,0	32767	$7FFF_H$	> 2822,0	32767	$7FFF_H$	> 1823,2	32767	$7FFF_H$	Overflow
1550,0 : 1300,1	15500 : 13001	$3C8C_H$: $32C9_H$	2822,0 : 2372,1	28220 : 23721	$6E3C_H$: $5CA9_H$	1823,2 : 1573,3	18232 : 15733	4738_H : $3D75_H$	Overrange
1300,0 : -270,0	13000 : -2700	$32C8_H$: $F574_H$	2372,0 : -454,0	23720 : -4540	$5CA8_H$: $EE44_H$	1573,2 : 3,2	15732 : 32	$3D74_H$: 0020_H	Nominal range
< -270,0	-32768	8000_H	< -454,0	-32768	8000_H	< 3,2	-32768	8000_H	Underflow

Measuring range for type R, S thermocouple

Table 15- 9

Type R, S in °C	Units		Type R, S in °F	Units		Type R, S in K	Units		Range
	Deci-mal	Hexa-decimal		Decimal	Hexa-decimal		Decimal	Hexa-decimal	
> 2019,0	32767	$7FFF_H$	> 3276,6	32767	$7FFF_H$	> 2292,2	32767	$7FFF_H$	Overflow
2019,0 : 1768,1	20190 : 17681	$4EDE_H$: 4511_H	3276,6 : 3216,3	32766 : 32163	$7FFE_H$: $7DA3_H$	2292,2 : 2042,3	22922 : 20423	$598A_H$: $4FC7_H$	Overrange
1768,0 : -50,0	17680 : -500	4510_H : $FE0C_H$	3216,2 : -58,0	32162 : -580	$7DA2_H$: $FDBC_H$	2042,2 : 223,2	20422 : 2232	$4FC6_H$: $08B8_H$	Nominal range
-50,1 : -170,0	-501 : -1700	$FE0B_H$: $F95C_H$	-58,1 : -274,0	-581 : -2740	$FDBB_H$: $F54C_H$	223,1 : 103,2	2231 : 1032	$08B7_H$: 0408_H	Underrange
< -170,0	-32768	8000_H	< -274,0	-32768	8000_H	< 103,2	-32768	8000_H	Underflow

Measuring range for type T thermocouple

Type T in °C	Units		Type T in °F	Units		Type T in K	Units		Range
	Decimal	Hexadecimal		Decimal	Hexadecimal		Decimal	Hexadecimal	
> 540,0	32767	$7FFF_H$	> 1004,0	32767	$7FFF_H$	> 813,2	32767	$7FFF_H$	Overflow
540,0 : 400,1	5400 : 4001	1518_H : $0FA1_H$	1004,0 : 752,1	10040 : 7521	2738_H : $1DC1_H$	813,2 : 673,3	8132 : 6733	$1FC4_H$: $1AAD_H$	Overrange
400,0 : -270,0	4000 : -2700	$0FA0_H$: $F574_H$	752,0 : -454,0	7520 : -4540	$1D60_H$: $EE44_H$	673,2 : 3,2	6732 : 32	$1AAC_H$: 0020_H	Nominal range
< -270,0	-32768	8000_H	< -454,0	-32768	8000_H	< 3,2	-32768	8000_H	Underflow

15.12 Output ranges of the analog output modules in S7 format

Voltage and current output ranges: ± 10 V ; ± 20 mA

Output range ±10 V	Output range ±20 mA	Units		Range
		Decimal	Hexadecimal	
0.00 V	0.00 mA	32767	$7FFF_H$	Overflow
		32512	$7F00_H$	
11.76 V	23.52 mA	32511	$7EFF_H$	Overrange
		27649	$6C01_H$	
10 V	20 mA	27648	$6C00_H$	Nominal range
7.50 V	15 mA	20736	5100_H	
361.70 µV	723.40 nA	1	0001_H	
0 V	0 mA	0	0000_H	
-361.70 µV	-723.40 nA	-1	$FFFF_H$	
-7.50 V	-15 mA	-20736	$AF00_H$	
-10 V	-20 mA	-27648	9400_H	
-11.76 V	-23.52 mA	-27649	$93FF_H$	Undershoot range
		-32512	8100_H	
0.00 V	0.00 mA	-32513	$80FF_H$	Underflow
		-32768	8000_H	

Voltage and current output ranges: 1 V to 5 V; 4 mA to 20 mA

Output range 1 V to 5 V	Output range 4 mA to 20 mA	Units		Range
		Decimal	Hexadecimal	
0.00 V	0.00 mA	32767	$7FFF_H$	Overflow
		32512	$7F00_H$	
5.70 V	22.81 mA	32511	$7EFF_H$	Overrange
		27649	$6C01_H$	
5 V	20 mA	27648	$6C00_H$	Nominal range
4 V	16 mA	20736	5100_H	
1 V + 144.70 µV	4 mA + 578.70 nA	1	0001_H	
1 V	4 mA	0	0000_H	
0 V	0 mA	-1	$FFFF_H$	Undershoot range
		-6912	$E500_H$	
0.00 V	0.00 mA	-6913	$E4FF_H$	Underflow
		-32768	8000_H	

Voltage and current output ranges: 0 V to 10 V; 0 mA to 20 mA

Output range 0 V to 10 V	Output range 0 V to 20 mA	Units		Range
		Decimal	Hexadecimal	
0.00 V	0.00 mA	32767	$7FFF_H$	Overflow
		32512	$7F00_H$	
11.76 V	23.52 mA	32511	$7EFF_H$	Overrange
		27649	$6C01_H$	
10 V	20 mA	27648	$6C00_H$	Nominal range
7.50 V	15 mA	20736	5100_H	
361.70 µV	723.40 nA	1	0001_H	
0 V	0 mA	0	0000_H	
0.00 V	0.00 mA	-1	$FFFF_H$	Underflow
		-32768	8000_H	

15.13 Influence of the range of values

Influence of analog signals on input values

The reaction of electronics modules with analog inputs depends on the position of input values within the range of values. The table below shows this dependency.

The measured value is	Result	GE LED	Diagnostics data range of the module	Interrupt
Within the nominal range	Measured value	-	-	-
Within the overrange/undershoot range	Measured value	-	-	-
Within the overflow range	$7FFF_H$	lit	Entry[1]	Diagnostic interrupt[1]
Within the underflow range	8000_H	lit	Entry[1]	Diagnostic interrupt[1]
Above the high limit, or below the low limit	Measured value	-	-	Process interrupt[2]
Out of the parameterization range, or with faulty parameters	$7FFF_H$/measured value[3]	lit	Entry	Diagnostic interrupt

[1] If the **group diagnostics** and **measuring range** parameters are enabled at the analog input module.
[2] If the **process interrupt** parameter is enabled at the analog input module.
[3] A module parameterized correctly continues operation with its correct parameters.

Influence of output values on analog outputs

The reaction of electronic modules with analog outputs depends on the position of the input values within the range of values. The table below shows this dependency.

The output value is	Result	GE LED	Diagnostics data range of the module	Interrupt
Within the nominal range	Value from the DP master/IO controller	-	-	-
Within the overrange/undershoot range	Value from the DP master/IO controller	-	-	-
Within the overflow range	0 signal	-	-	-
Within the underflow range	0 signal	-	-	-
Out of the parameterization range, or with faulty parameters	0 signal	lit	Entry	Diagnostic interrupt

Pneumatic interface modules

16

16.1 Pneumatic interface module 16 DO DC 24V CPV10 (6ES7148-4EA00-0AA0)

Order number

6ES7148-4EA00-0AA0

Properties

- Pneumatic interface module with 16 outputs
- Output current matched to FESTO CPV10 valve terminal
- Rated load voltage 24 V DC
- Suitable for FESTO valve terminal CPV10 with up to 16 valves (OUT0 to OUT15) and relays
- "Missing load voltage" diagnostics for each module
- Safe restarting of valves after a "missing load voltage"

Note

Valves

The valves can be disconnected for safety reasons.

More detailed information is available in the Appendix in the chapter Fail-safe shutdown of the ET 200pro Standard edition modules (Page 515).

Block diagram

The figure below shows the block diagram of the 16 DO DC 24V CPV10.

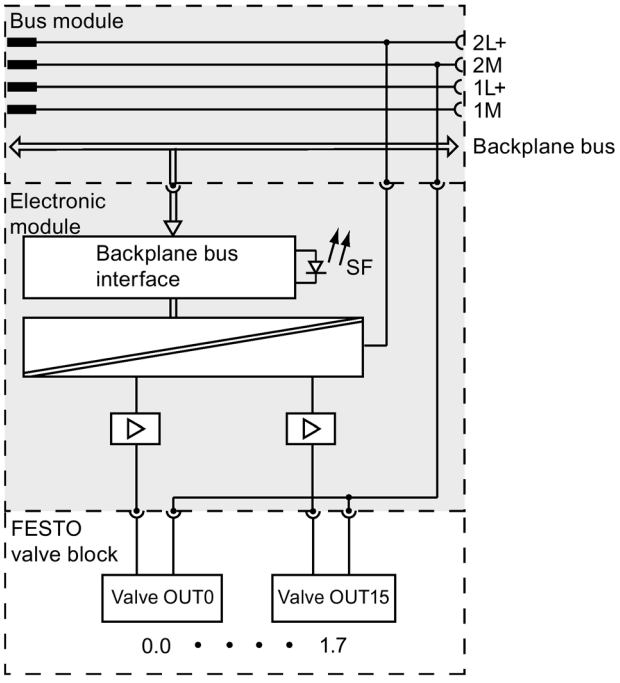


Figure 16-1 Block diagram 16 DO DC 24V CPV10

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 × 130 × 47; with bus module, without FESTO valve terminal CPV10
Weight	Approx. 415 g
Digital outputs	
Number of outputs	16
Support of isochronous mode	No
Voltages and currents	
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes, per module
Current consumption	
• From backplane bus	Max. 25 mA
• From load voltage 2L+	Max. 300 mA, all valves on
Power loss of the module	Typ. 2.6 W

Technical specifications	
Electrical isolation	
• Between channels and backplane bus	Yes
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No
Insulation	
Insulation tested	707 V DC (type test)
Status, interrupts, diagnostics	
Status display	Green LED, per channel
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Diagnostic information can be read	Yes
Data for selection of valve terminal[1]	
Medium	Compressed air: Filtered (40 µm); oiled (oil: VG 32); not oiled/vacuum
Pressure range	3 bar to 8 bar
Nominal flow rate	400 l/min
Valve switchover times	
• On, by	17 ms
• Off	25 ms
Current consumption per valve	20 mA
[1] For detailed information on valve terminals, refer to the FESTO documentation on the valve terminals.	

16.2 Pneumatic interface module 16 DO DC 24V CPV14 (6ES7148-4EB00-0AA0)

Order number

6ES7148-4EB00-0AA0

Properties

- Pneumatic interface module with 16 outputs
- Output current matched to FESTO valve island CPV14
- Rated load voltage 24 V DC
- Suitable for FESTO valve terminal CPV14 with up to 16 valves and relays
- "Missing load voltage" diagnostics for each module
- Safe restarting of valves after a "missing load voltage"

Note

Valves

The valves can be disconnected for safety reasons.

More detailed information is available in the Appendix in the chapter Fail-safe shutdown of the ET 200pro Standard edition modules (Page 515).

Block diagram

The figure below shows the block diagram of the 16 DO DC 24V CPV14.

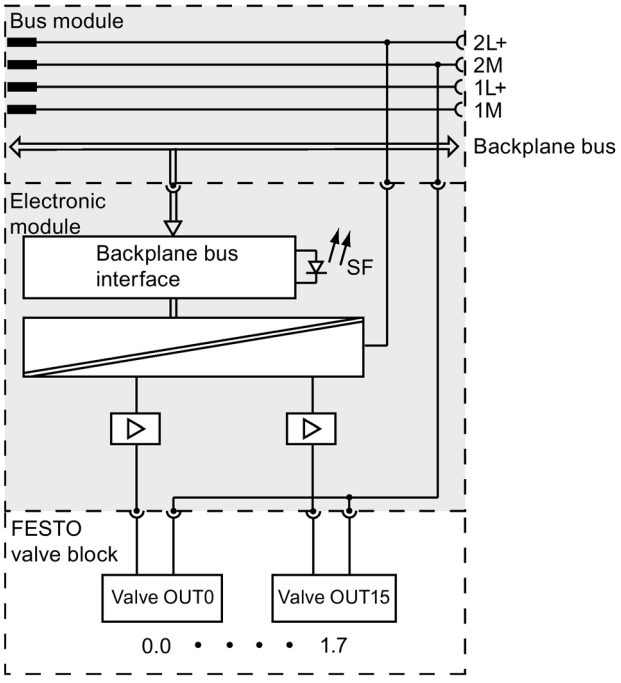


Figure 16-2 Block diagram 16 DO DC 24V CPV14

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	120 × 152 × 47; with bus module, without FESTO valve terminal CPV14
Weight	Approx. 560 g
Digital outputs	
Number of outputs	16
Support of isochronous mode	No
Voltages and currents	
Rated load voltage 2L+	24 V DC
• Reverse polarity protection	Yes, per module
Current consumption	
• From backplane bus	Max. 25 mA
• From load voltage 2L+	Max. 370 mA, all valves on
Power loss of the module	Typ. 3.7 W
Electrical isolation	
• Between channels and backplane bus	Yes

Technical specifications	
• Between backplane bus and all other circuit elements	Yes
• Between channels and electronics power supply	Yes
• Between channels	No
Insulation	
Insulation tested	707 V DC (type test)
Status, interrupts, diagnostics	
Status display	Green LED, per channel
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	
• Group error display	Red LED (SF)
• Diagnostic information can be read	Yes
Data for selection of valve terminal[1]	
Medium	Compressed air: Filtered (40 µm); oiled (oil: VG 32); not oiled/vacuum
Pressure range	3 bar to 8 bar
Nominal flow rate	800 l/min
Valve switchover times	
• On, by	24 ms
• Off	30 ms
Current consumption per valve	32 mA
[1] For detailed information on valve terminals, refer to the FESTO documentation on the valve terminals.	

16.3 Overview of parameters of pneumatic interface module

Parameters of the power module

Parameters	Value range	Default	Scope
Diagnostics missing load voltage L+	• Disable • Enable	Disable	Module

Appendix

A

A.1 Order numbers

A.1.1 Module order numbers

Interface modules

Table A- 1 Interface module order numbers

Designation	Order number
IM154-1 DP interface module with terminating module, 1 item	6ES7154-1AA01-0AB0
IM154-2 DP High Feature interface module with terminating module, 1 item	6ES7154-2AA01-0AB0
IM 154-4 PN High Feature interface module with terminating module (V5.0 or higher), 1 item	6ES7154-4AB10-0AB0

Power module/outgoing module

Table A- 2 Power module/outgoing module order number

Designation	Order number
PM-E DC 24V, 1 item	6ES7148-4CA00-0AA0
PM-O DC 2x24V, 1 item	6ES7148-4CA60-0AA0

Connection modules

Table A- 3 Connection module order numbers

Designation	Order number
CM IM DP Direct, 1 item	6ES7194-4AC00-0AA0
CM IM DP ECOFAST Cu, 1 item	6ES7194-4AA00-0AA0
CM IM DP M12, 7/8", 1 item	6ES7194-4AD00-0AA0
CM IM PN M12, 7/8", 1 item	6ES7194-4AJ00-0AA0
CM IM PN PP Cu, 1 item	6ES7194-4AF00-0AA0
CM IM PN PP FO, 1 item	6ES7194-4AG00-0AA0
CM PM Direct, 1 item	6ES7194-4BC00-0AA0
CM PM ECOFAST, 1 item	6ES7194-4BA00-0AA0
CM PM 7/8", 1 item	6ES7194-4BD00-0AA0
CM PM PP, 1 item	6ES7194-4BE00-0AA0
CM PM-O PP, 1 item	6ES7194-4BH00-0AA0
CM IO 4 x M12, 1 item	6ES7194-4CA00-0AA0
CM IO 4 x M12P, 1 item	6ES7194-4CA10-0AA0
CM IO 4 x M12 Inverse, 1 item	6ES7194-4CA50-0AA0
CM IO 8 x M12, 1 item	6ES7194-4CB00-0AA0
CM IO 8 x M12P, 1 item	6ES7194-4CB10-0AA0
CM IO 8 x M12D, 1 item	6ES7194-4CB50-0AA0
CM IO 8 x M8, 1 item	6ES7194-4EB00-0AA0
CM IO 2 x M12, 1 item	6ES7194-4FB00-0AA0
CM IO 1 x M23, 1 item	6ES7194-4FA00-0AA0

Digital electronic modules

Table A- 4 Digital electronic module order numbers

Designation	Order number
8 DI DC 24V, 1 item	6ES7141-4BF00-0AA0
8 DI DC 24V High Feature, 1 item	6ES7141-4BF00-0AB0
16 DI DC 24V, 1 item	6ES7141-4BH00-0AA0
4 DI / 4 DO DC 24V/0.5A, 1 item	6ES7143-4BF50-0AA0
4 DIO / 4 DO DC 24V/0.5A, 1 item	6ES7143-4BF00-0AA0
4 DO DC 24V/2.0A, 1 item	6ES7142-4BD00-0AA0
4 DO DC 24V/2.0A High Feature, 1 item	6ES7142-4BD00-0AB0
8 DO DC 24V/0.5A, 1 item	6ES7142-4BF00-0AA0

Analog electronic modules

Table A- 5 Analog electronic module order numbers

Designation	Order number
4 AI U High Feature, 1 item	6ES7144-4FF00-0AB0
4 AI I High Feature, 1 item	6ES7144-4GF00-0AB0
4 AI RTD High Feature, 1 item	6ES7144-4JF00-0AB0
4 AI TC High Feature, 1 item	6ES7144-4PF00-0AB0
4 AO U High Feature, 1 item	6ES7145-4FF00-0AB0
4 AO I High Feature, 1 item	6ES7145-4GF00-0AB0

Pneumatic interface modules

Table A- 6 Pneumatic interface module order numbers

Designation	Order number
16 DO DC 24V CPV10, 1 item	6ES7148-4EA00-0AA0
16 DO DC 24V CPV14, 1 item	6ES7148-4EB00-0AA0

A.1.2 Order numbers for accessories

ET 200pro accessories

Table A- 7 Order numbers of ET 200pro accessories

Designation	Order number
Rack, narrow type, length 500 mm (ready for installation), 1 item	6ES7194-4GA00-0AA0
Rack, narrow type, length 1000 mm (ready for installation), 1 item	6ES7194-4GA60-0AA0
Rack, narrow type, length 2000 mm, 1 item	6ES7194-4GA20-0AA0
Rack, wide type, length 500 mm (ready for installation), 1 item	6ES7194-4GB00-0AA0
Rack, wide type, length 1000 mm (ready for installation), 1 item	6ES7194-4GB60-0AA0
Rack, wide type, length 2000 mm, 1 item	6ES7194-4GB20-0AA0
Rack, compact-narrow type, length 500 mm (ready for installation), 1 item	6ES7194-4GC70-0AA0
Rack, compact-narrow type, length 1000 mm (ready for installation), 1 item	6ES7194-4GC60-0AA0
Rack, compact-narrow type, length 2000 mm, 1 item	6ES7194-4GC20-0AA0
Rack, compact-wide type, length 500 mm (ready for installation), 1 item	6ES7194-4GD00-0AA0
Rack, compact-wide type, length 1000 mm (ready for installation), 1 item	6ES7194-4GD10-0AA0
Rack, compact-wide type, length 2000 mm, 1 item	6ES7194-4GD20-0AA0
Labels 20 x 7 mm, pale turquoise, 340 items per pack	3RT1900-1SB20
Colored module tags for the identification of IO connection modules; Package of 100 labels 20 x 7 in red, green, blue, and white, 1 package	6ES7194-4HA00-0AA0
12.5 A quick-response spare fuse, 10 items per package, 1 package	6ES7194-4HB00-0AA0

Accessories for CM IM DP Direct connection module

Table A- 8 Accessories CM IM DP Direct connection module, order numbers

Designation	Order number
Raw cables:	
PB Hybrid Standard Cable PVC sheath, 4-wire Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	6XV1860-2R
PB Hybrid Robust Cable PUR sheath, 4-wire, suitable for cable carriers Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	6XV1860-2S
PROFIBUS FC cable Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	
• FC Trailing Cable	6XV1830-3EH10
• FC Food Cable (PE sheath)	6XV1830-0GH10
• FC Robust Cable (PUR sheath)	6XV1830-0JH10
Energy Cable trailing-type power cable, 5 x 1.5 mm^2 Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	6XV1830-8AH10

Accessories for CM IM DP ECOFAST Cu connection module

Table A- 9 Accessories for CM IM DP ECOFAST Cu connection module, order numbers

Designation		Order number
Preassembled cables and connectors:		
PROFIBUS ECOFAST Hybrid Cable Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2 Preassembled with ECOFAST Hybrid Plug 180 at both ends fixed lengths, 1 item	1.5 m	6XV1830-7BH15
	3.0 m	6XV1830-7BH30
	5.0 m	6XV1830-7BH50
	10.0 m	6XV1830-7BN10
	15.0 m	6XV1830-7BN15
	20.0 m	6XV1830-7BN20
	25.0 m	6XV1830-7BN25
	30.0 m	6XV1830-7BN30
	35.0 m	6XV1830-7BN35
	40.0 m	6XV1830-7BN40
	45.0 m	6XV1830-7BN45
	50.0 m	6XV1830-7BN50
PROFIBUS ECOFAST Hybrid Cable GP Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2, UL approval Preassembled with ECOFAST Hybrid Plug 180 at both ends Fixed lengths, 1 item:	1.5 m	6XV1860-3PH15
	3.0 m	6XV1860-3PH30
	5.0 m	6XV1860-3PH50
	10.0 m	6XV1860-3PN10
	15.0 m	6XV1860-3PN15
	20.0 m	6XV1860-3PN20
	25.0 m	6XV1860-3PN25
	30.0 m	6XV1860-3PN30
	35.0 m	6XV1860-3PN35
	40.0 m	6XV1860-3PN40
	45.0 m	6XV1860-3PN45
	50.0 m	6XV1860-3PN50
Raw cables and connectors:		
PROFIBUS ECOFAST Hybrid Plug 180 (ECOFAST Cu), with socket insert (HanBrid connector) 5 items per package, 1 package		6GK1905-0CB00
PROFIBUS ECOFAST Hybrid Plug 180 (ECOFAST Cu), with pin insert (HanBrid connector) 5 items per package, 1 package		6GK1905-0CA00
PROFIBUS ECOFAST Hybrid Plug angled (ECOFAST Cu), with socket insert (HanBrid connector) 5 items per package, 1 package		6GK1905-0CD00
PROFIBUS ECOFAST Hybrid Plug angled (ECOFAST Cu), with pin insert (HanBrid connector) 5 items per package, 1 package		6GK1905-0CC00

Designation		Order number
PROFIBUS ECOFAST Hybrid Cable Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm² Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	20.0 m	6XV1830-7AN20
	50.0 m	6XV1830-7AN50
	100.0 m	6XV1830-7AT10
PROFIBUS ECOFAST Hybrid Cable Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm² Raw cable, sold by the meter		6XV1 830-7AH10
PROFIBUS ECOFAST Hybrid Cable GP Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm², UL approval Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	50.0 m	6XV1860-4PN20
	50.0 m	6XV1860-4PN50
	100.0 m	6XV1860-4PT10
Cover caps for unused ECOFAST sockets, 10 items per package, 1 package		6ES7194-1JB10-0XA0

Accessories for CM IM DP M12, 7/8" connection module

Table A- 10 Accessories for CM IM DP M12, 7/8" connection module, order numbers

Designation		Order number
Preassembled cables and connectors:		
PROFIBUS M12 connecting cable Trailing-type cable, 2-wire • Preassembled with PROFIBUS M12 connectors 180 at both ends, fixed lengths, 1 item:	0.3 m	6XV1830-3DH30
	0.5 m	6XV1830-3DH50
	1.0 m	6XV1830-3DH10
	1.5 m	6XV1830-3DH15
	2.0 m	6XV1830-3DH20
	3.0 m	6XV1830-3DH30
	5.0 m	6XV1830-3DH50
	10.0 m	6XV1830-3DN10
	15.0 m	6XV1830-3DN15
PROFIBUS M12 connecting cable Trailing-type cable, 2-wire • Preassembled with PROFIBUS M12 angled connectors at both ends, fixed lengths, 1 item:	1.5 m	(on request)
	2.0 m	(on request)
	3.0 m	3RK1902-1NB30
	5.0 m	3RK1902-1NB50
	10.0 m	3RK1902-1NC10
	15.0 m	(on request)
PROFIBUS M12 connecting cable Trailing-type cable, 2-wire	3.0 m	3RK1902-1GB30
	5.0 m	3RK1902-1GB50

Designation		Order number
• Preassembled with PROFIBUS M12 angled connector at one end (one end with pin, one end open), fixed lengths, 1 item:	10.0 m	3RK1902-1GC10
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled cable with 7/8" connectors 180 at both ends, fixed lengths, 1 item:	1.5 m	6XV1822-5BH15
	2.0 m	6XV1822-5BH20
	3.0 m	6XV1822-5BH30
	5.0 m	6XV1822-5BH50
	10.0 m	6XV1822-5BN10
	15.0 m	6XV1822-5BN15
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled cable with 7/8" angled connectors at both ends, fixed lengths, 1 item	1.5 m	(on request)
	2.0 m	(on request)
	3.0 m	3RK1902-3NB30
	5.0 m	3RK1902-3NB50
	10.0 m	3RK1902-3NC10
	15.0 m	(on request)
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled with 7/8" angled connector at one end (one end with socket, one end open), fixed lengths, 1 item	3.0 m	3RK1902-3GB30
	5.0 m	3RK1902-3GB50
	10.0 m	3RK1902-3GC10
Raw cables and connectors:		
PROFIBUS M12 connector, pin insert 5 items per package		6GK1905-0EA00
BUS M12 connector fast connect, pin insert 5 items per package		6GK1905-0EA10
PROFIBUS M12 connector, socket insert 5 items per package		6GK1905-0EB00
PROFIBUS M12 connector fast connect, socket insert 5 items per package		6GK1905-0EB10
PROFIBUS M12 connector, angled, pin insert 5 items per package		3RK1902-1BA00
PROFIBUS M12 connector, angled, socket insert 5 items per package		3RK1902-1DA00
7/8" connector (screw mechanism), pin insert 5 items per package		6GK1905-0FA00
7/8" connector (screw mechanism), socket insert 5 items per package		6GK1905-0FB00
7/8" connector (screw mechanism), angled, pin insert 5 items per package		3RK1902-3BA00
7/8" connector (screw mechanism), angled, socket insert 5 items per package		3RK1902-3DA00
PROFIBUS FC cable Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m		
• FC Standard Cable		6XV1830-0EH10

Designation	Order number
• FC Trailing Cable	6XV1830-3EH10
• FC Food Cable (PE sheath)	6XV1830-0GH10
• FC Robust Cable (PUR sheath)	6XV1830-0JH10
Energy Cable Trailing-type power cable, 5 x 1.5 mm^2 Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	6XV1830-8AH10
M12 cover caps 10 items per package, 10 items	3RX9802-0AA00
7/8" cover caps 10 items per package, 1 item	6ES7194-3JA00-0AA0

Accessories for IM 154-4 PN High Feature interface module with CM IM PN M12, 7/8" connection module

Table A- 11 Accessories for the IM 154-4 PN High Feature interface module, order numbers

Designation		Order number
Preassembled cables and connectors:		
IE M12 connecting cable Trailing-type cable • Preassembled with M12 connectors 180 at both ends, fixed lengths, 1 unit:	0.3 m	6XV1870-8AE30
	0.5 m	6XV1870-8AE50
	1.0 m	6XV1870-8AH10
	1.5 m	6XV1870-8AH15
	2.0 m	6XV1870-8AH20
	3.0 m	6XV1870-8AH30
	5.0 m	6XV1870-8AH50
	10.0 m	6XV1870-8AN10
	15.0 m	6XV1870-8AN15
IE M12 connecting cable Trailing-type cable • Preassembled with angled M12 connectors 180° at both ends, fixed lengths, 1 item:	3.0 m	3RK1902-2NB30
	5.0 m	3RK1902-2NB50
	10.0 m	3RK1902-2NC10
IE M12 connecting cable Trailing-type cable • Preassembled with angled M12 connector 180° at one end (one end with pin, one end open), fixed lengths, 1 item:	3.0 m	3RK1902-2HB30
	5.0 m	3RK1902-2HB50
	10.0 m	3RK1902-2HC10
IE M12 connecting cable Trailing-type cable • Preassembled with M12 connector 180° (pin) at one end, other end with RJ45 Plug 145°, fixed lengths, 1 item:	2.0 m	6XV1871-5TH20
	3.0 m	6XV1871-5TH30
	5.0 m	6XV1871-5TH50
	10.0 m	6XV1871-5TN10
	15.0 m	6XV1871-5TN15

Designation		Order number
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled cable with 7/8" connectors 180 at both ends, fixed lengths, 1 item:	0.3 m	6XV1822-5BH30
	0.5 m	6XV1822-5BH50
	1.0 m	6XV1822-5BH10
	1.5 m	6XV1822-5BH15
	2.0 m	6XV1822-5BH20
	3.0 m	6XV1822-5BH30
	5.0 m	6XV1822-5BH50
	10.0 m	6XV1822-5BN10
	15.0 m	6XV1822-5BN15
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled cable with 7/8" angled connectors at both ends, fixed lengths, 1 item	1.5 m	(on request)
	2.0 m	(on request)
	3.0 m	3RK1902-3NB30
	5.0 m	3RK1902-3NB50
	10.0 m	3RK1902-3NC10
	15.0 m	(on request)
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled with 7/8" angled connector at one end (one end with socket, one end open), fixed lengths, 1 item	3.0 m	3RK1902-3GB30
	5.0 m	3RK1902-3GB50
	10.0 m	3RK1902-3GC10
Raw cables and connectors:		
7/8" connector (screw mechanism), pin insert 5 items per package		6GK1905-0FA00
7/8" connector (screw mechanism), socket insert 5 items per package		6GK1905-0FB00
7/8" connector (screw mechanism), angled, pin insert 5 items per package		3RK1902-3BA00
7/8" connector (screw mechanism), angled, socket insert 5 items per package		3RK1902-3DA00
PROFINET M12 connector d coded with FastConnect connection system, 180	1 item per package	6GK1901-0DB10-6AA0
	8 items per package	6GK1901-0DB10-6AA8
PROFINET M12 connector d-coded with FastConnect connection system, 180	1 item per package	6GK1901-0DB20-6AA0
	8 items per package	6GK1901-0DB20-6AA8
PROFINET M12 connector d-coded, angled		3RK1902-2DA00
PROFINET FC cable		
• FC TP Standard Cable		6XV1840-2AH10
• FC TP Trailing Cable		6XV1840-3AH10
• FC TP Trailing Cable GP		6XV1870-2D

Designation	Order number
• FC TP Marine Cable	6XV1840-4AH10
• FC TP Torsion Cable	6XV1870-2F
Energy Cable Trailing-type power cable, 5 x 1.5 mm^2 Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	6XV1830-8AH10
M12 cover caps 10 items per package, 10 items	3RX9 802-0AA00
7/8" cover caps 10 items per package, 1 item	6ES7194-3JA00-0AA0

Accessories of CM IM PN PP Cu connection module

Table A- 12 Order numbers of accessories of CM IM PN PP Cu connection module

Designation	Order number
Preassembled cables and connectors:	
Push-pull connecting cables for 1L+/2L+, preassembled	(on request)
Push-pull connecting cables for RJ45, preassembled	
Push-pull connecting cables for RJ45, preassembled, one end push-pull RJ45, other end RJ45, crossover cable	6GT891-1HN10
Raw cables and connectors:	
Push-pull cable connector for 1L+/2L+	6GK1907-0AB10-6AA0
Push-pull cable connector for RJ45	6GK1901-1BB10-6AA0
Push-pull cable connector for RJ45, fast connect	6GK1901-1BB20-6AA0
Cover caps for push-pull sockets (1L+/2L+), 5 items per package, 1 item	6ES7194-4JA50-0AA0
Cover caps for push-pull sockets RJ45, 5 items per package, 1 item	6ES7194-4JD50-0AA0

Accessories of CM IM PN PP FO connection module

Table A- 13 Order numbers of accessories of CM IM PN PP FO connection module

Designation	Order number
Preassembled cables and connectors:	
Push-pull connecting cables (1L+/2L+), preassembled	(on request)
Push-pull connecting cables for SC RJ, preassembled	
Raw cables and connectors:	
Push-pull connectors (1L+/2L+)	6GK1907-0AB10-6AA0
Push-pull connectors for SC RJ	6GK1900-0MB00-6AA0
Cover caps for push-pull sockets (1L+/2L+), 5 items per package, 1 item	6ES7194-4JA50-0AA0
Cover caps for push-pull sockets (SC RJ), 5 items per package, 1 item	6ES7194-4JD50-0AA0

Accessories of CM IO 4 x M12, CM IO 4 x M12P, CM IO 4 x M12 Inverse, CM IO 8 x M12, CM IO 8 x M12P, CM IO 8 x M12D connection module

Table A- 14 Accessories of CM IO 4 x M12, CM IO 4 x M12P, CM IO 4 x M12 Inverse, CM IO 8 x M12, CM IO 8 x M12P, CM IO 8 x M12D connection module order numbers

Designation		Order number
Preassembled cables and connectors:		
M12 connecting cables Shielded, for connecting digital and analog sensors and actuators		(on request)
• 3 x 0.34 mm², fixed lengths, 1 item	1.5 m	3RK1 902-4PB15-3AA0
M12 cover caps 10 items per package, 10 items		3RX9 802-0AA00
Y-cable for the double connection of I/Os		6ES7194-6KA00-0XA0
M12 compensation connector for thermocouples		6ES7194-4AB00-0AA0
Raw cables and connectors:		
M12 connector, 5-pin, for connecting digital sensors and actuators, 1 item		3RK1 902-4BA00-5AA0

Accessories for CM IO 8 x M8 connection module

Table A- 15 Accessories for CM IO 8 x M8 connection module, order numbers

Designation	Order number
M8 cover caps 10 items per package, 10 items	3RK1901-1PN00

Accessories for CM IO 2 x M12 connection module

Table A- 16 Accessories for CM IO 2 x M23 connection module, order numbers

Designation	Order number
Raw cables and connectors:	
M12 connector, 8-pin, max. 0.75 mm², screw terminal	(on request)

Accessories for CM IO 1 x M23 connection module

Table A- 17 Accessories for CM IO 1 x M23 connection module, order numbers

Designation	Order number
Raw cables and connectors:	
M23 connector, 12-pin	(on request)

Accessories for CM PM Direct connection module

Table A- 18 Accessories for CM PM Direct connection module, order numbers

Designation	Order number
Raw cables and connectors:	
Energy Cable Trailing-type power cable, 5 x 1.5 mm^2 Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	6XV1830-8AH10

Accessories for CM PM ECOFAST connection module

Table A- 19 Accessories for CM PM ECOFAST connection module, order numbers

Designation		Order number
Preassembled cables and connectors:		
PROFIBUS ECOFAST Hybrid Cable Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2 Preassembled with ECOFAST Hybrid Plug 180 at both ends fixed lengths, 1 item	1.5 m	6XV1830-7BH15
	3.0 m	6XV1830-7BH30
	5.0 m	6XV1830-7BH50
	10.0 m	6XV1830-7BN10
	15.0 m	6XV1830-7BN15
	20.0 m	6XV1830-7BN20
	25.0 m	6XV1830-7BN25
	30.0 m	6XV1830-7BN30
	35.0 m	6XV1830-7BN35
	40.0 m	6XV1830-7BN40
	45.0 m	6XV1830-7BN45
	50.0 m	6XV1830-7BN50
PROFIBUS ECOFAST Hybrid Cable GP Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2 Preassembled with ECOFAST Hybrid Plug 180 at both ends Fixed lengths, 1 item:	1.5 m	6XV1860-3PH15
	3.0 m	6XV1860-3PH30
	5.0 m	6XV1860-3PH50
	10.0 m	6XV1860-3PN10
	15.0 m	6XV1860-3PN15
	20.0 m	6XV1860-3PN20
	25.0 m	6XV1860-3PN25
	30.0 m	6XV1860-3PN30
	35.0 m	6XV1860-3PN35
	40.0 m	6XV1860-3PN40
	45.0 m	6XV1860-3PN45
	50.0 m	6XV1860-3PN50

Designation		Order number
Raw cables and connectors:		
PROFIBUS ECOFAST Hybrid Cable Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm² Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	20.0 m	6XV1830-7AN20
	50.0 m	6XV1830-7AN50
	100.0 m	6XV1830-7AT10
	Sold by the meter	6XV1830-7AH10
PROFIBUS ECOFAST Hybrid Cable GP Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm², UL approval Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	20.0 m	6XV1860-4PN20
	50.0 m	6XV1860-4PN50
	100.0 m	6XV1860-4PT10
PROFIBUS ECOFAST Hybrid Plug 180 (ECOFAST Cu), with socket insert (HanBrid connector) 5 items per package, 1 package		6GK1905-0CB00
PROFIBUS ECOFAST Hybrid Plug angled (ECOFAST Cu), with socket insert (HanBrid connector) 5 items per package, 1 package		6GK1905-0CD00
Cover caps for unused ECOFAST sockets, 10 items per package, 1 package		6ES7194-1JB10-0XA0

Accessories for CM PM 7/8" connection module

Table A- 20 Accessories for CM PM 7/8" connection module, order numbers

Designation		Order number
Preassembled cables and connectors:		
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm2 • Preassembled cable with 7/8" connectors 180 at both ends, fixed lengths, 1 item:	0.3 m	6XV1822-5BE30
	0.5 m	6XV1822-5BE50
	1.0 m	6XV1822-5BE10
	1.5 m	6XV1822-5BH15
	2.0 m	6XV1822-5BH20
	3.0 m	6XV1822-5BH30
	5.0 m	6XV1822-5BH50
	10.0 m	6XV1822-5BN10
	15.0 m	6XV1822-5BN15
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled cable with 7/8" angled connectors at both ends, fixed lengths, 1 item	1.5 m	(on request)
	2.0 m	(on request)
	3.0 m	3RK1902-3NB30
	5.0 m	3RK1902-3NB50
	10.0 m	3RK1902-3NC10
	15.0 m	(on request)

Designation		Order number
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Preassembled with 7/8" angled connector at one end (one end with socket, one end open), fixed lengths, 1 item	3.0 m	3RK1902-3GB30
	5.0 m	3RK1902-3GB50
	10.0 m	3RK1902-3GC10
Raw cables and connectors:		
7/8" connector (screw mechanism), socket insert 5 items per package		6GK1905-0FB00
7/8" connector (screw mechanism), angled, socket insert 5 items per package		3RK1902-3DA00
Energy Cable Trailing-type power cable, 5 x 1.5 mm² Sold by the meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m		6XV1830-8AH10
7/8" cover caps 10 items per package, 1 item		6ES7194-3JA00-0AA0

Accessories of CM PM PP connection module

Table A- 21 Order numbers of accessories of CM PM PP connection module

Designation	Order number
Preassembled cables and connectors:	
Push-pull connecting cables for 1L+/2L+, preassembled with socket insert at both ends	(on request)
Cover caps for push-pull sockets, 5 items per package, 1 item	6ES7194-4JA50-0AA0
Raw cables and connectors:	
Push-pull cable connector for 1L+/2L+ with socket insert	6GK1907-0AB10-6AA0

Accessories of CM PM-O PP connection module

Table A- 22 Accessories of CM PM-O PP connection module

Designation	Order number
Preassembled cables and connectors:	
Push-pull connecting cables for 1L+/2L+, preassembled with socket insert at both ends	(on request)
Cover caps for push-pull sockets, 5 items per package, 1 item	6ES7194-4JA50-0AA0
Raw cables and connectors:	
Push-pull cable connector for 1L+/2L+ with socket insert	6GK1907-0AB10-6AA0

Accessories for pneumatic interface module

Table A- 23 Accessories for pneumatic interface module

Designation	Order number
FESTO valve terminal CPV10	Festo AG & Co. KG Postfach 73726 Esslingen Ruiter Straße 82 Festo (http://www.festo.com)
FESTO valve terminal CPV14	
Flat gasket for CPV10 valve terminal: Part No. 380631, description: CPV10-GE-8 flat gasket	
Flat gasket for CPV10 valve terminal: Part No. 380635, description: CPV14-GE-8 flat gasket	

A.1.3 Order numbers for manuals

ET 200 in SIMATIC S7

The following manual is required to program and commission ET 200pro with STEP 7 or with COM PROFIBUS.

Table A- 24

Designation	Order number	Contents
ET 200 Distributed I/O System	6ES5 998-3ES12	For example, • Description and installation of a DP system • Programming and commissioning of COM PROFIBUS

Decentralization with PROFIBUS DP, technical book

Table A- 25

Technical book	Order numbers	Contents
Decentralization with PROFIBUS DP - Structure, configuration and use of PROFIBUS DP with SIMATIC S7 - Josef Weigmann, Gerhard Kilian Publicis MCD Verlag, 2nd Edition, 1998	In bookstores: ISBN 3-89578-123-1 At your local SIEMENS office: A19100-L531-B772	Textbook for getting started with PROFIBUS DP and the implementation of automation tasks with PROFIBUS DP and SIMATIC S7. Shows many practical examples of PROFIBUS DP applications based on SIMATIC S7.

PROFINET IO

Technical book	Order numbers	Contents
Automating with PROFINET - Industrial communication based on Industrial Ethernet	In bookstores: ISBN 3-89578-244-0	This book offers an introduction to PROFINET technology

SIMATIC Manual Collection

Designation	Order number	Contents
SIMATIC Manual Collection	6ES7998-8XC01-8YE0	Contains all SIMATIC manuals in electronic format

Technical Product Data - CD ROM

Table A- 26

Designation	Order number	Contents
Technical Product Data for Cax Applications	6ES7991-0CC00-0YX0	Contains the following technical product data for CAD/CAE systems: • Technical data according to the ECAD components standard V1.2 • Graphical data (drawings) • Circuit diagram macros

A.2 Dimension drawings

A.2.1 Interface module with connection module for PROFIBUS DP

IM 154-1/IM 154-2 DP High Feature interface module with CM IM DP Direct connection module

Top: With narrow type rack. Bottom: With compact type rack.

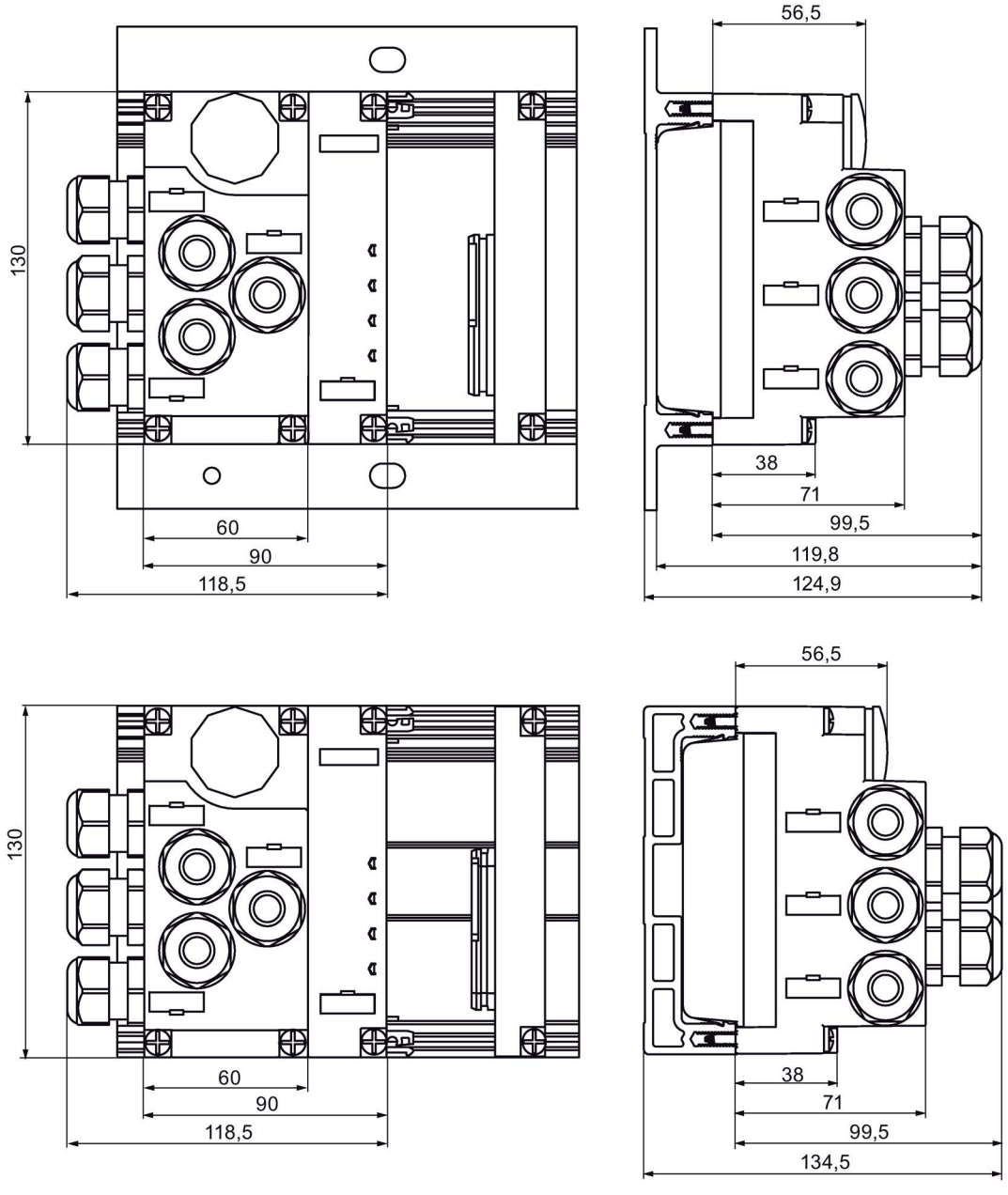


Figure A-1 Dimensional drawing of IM 154-1 DP/IM 154-2 DP High Feature interface module with CM IM DP Direct connection module

IM 154-2 DP High Feature interface module with CM IM DP ECOFAST Cu connection module

Top: With narrow type rack. Bottom: With compact type rack.

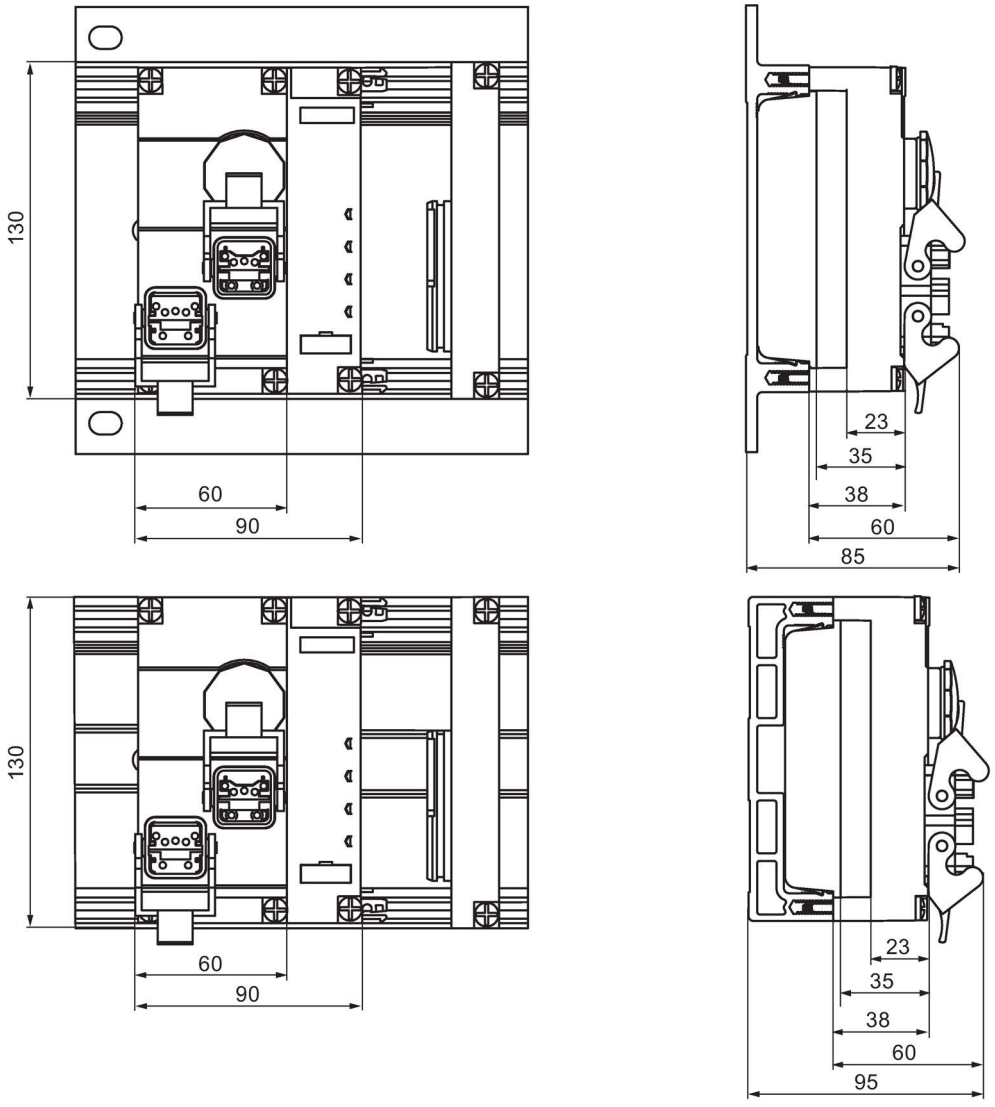


Figure A-2 Dimensional drawing of IM 154-2 DP High Feature interface module with CM IM DP ECOFAST Cu connection module

IM 154-2 DP High Feature interface module with CM IM DP M12, 7/8" connection module

Top: With narrow type rack. Bottom: With compact type rack.

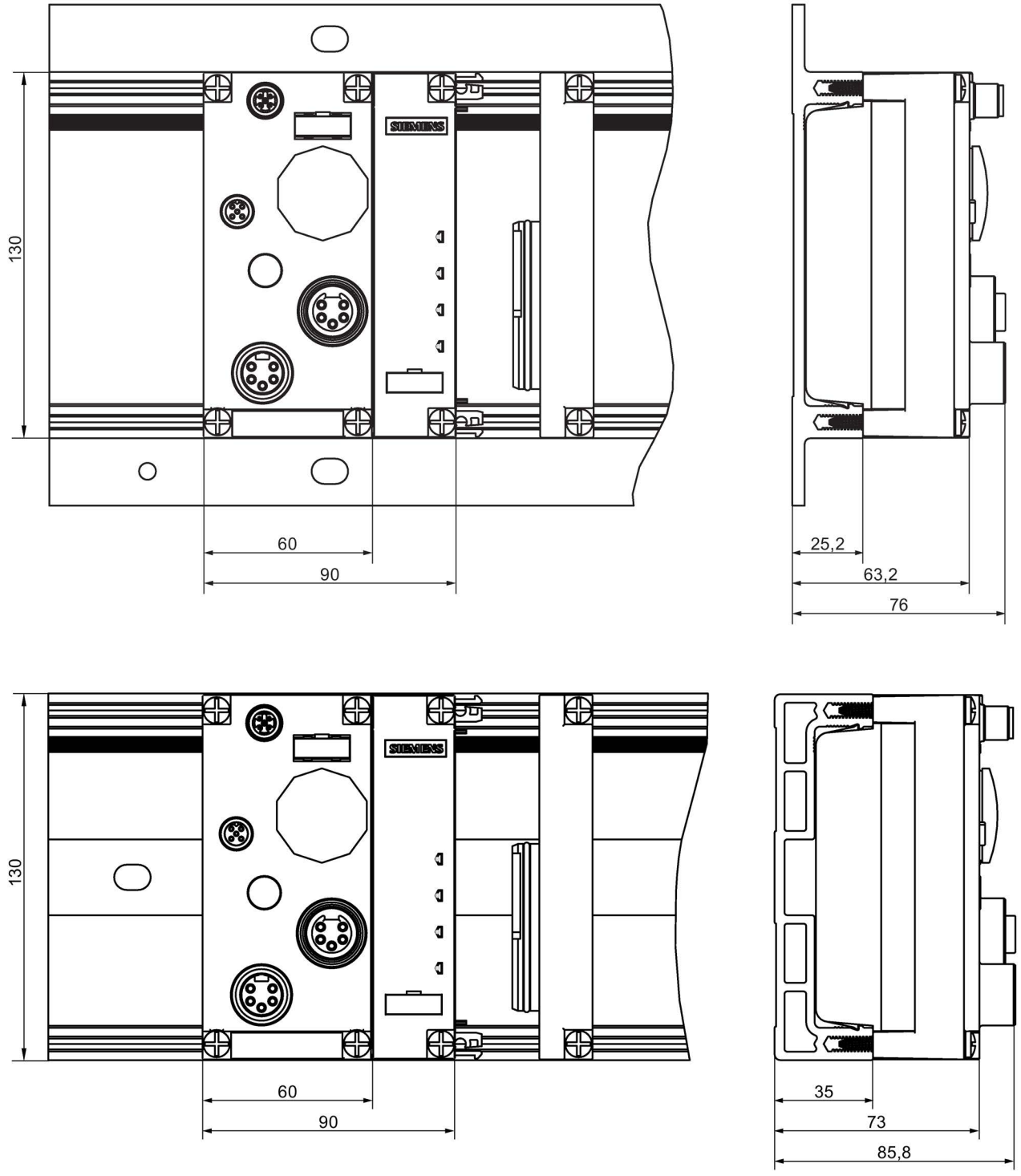


Figure A-3 Dimensional drawing of IM 154-2 DP High Feature interface module with CM IM DP M12, 7/8" connection module

A.2.2 Interface module with connection module for PROFINET IO

IM 154-4 PN High Feature interface module with CM IM PN M12, 7/8" connection module

Top: with narrow type rack; bottom: with compact type rack.

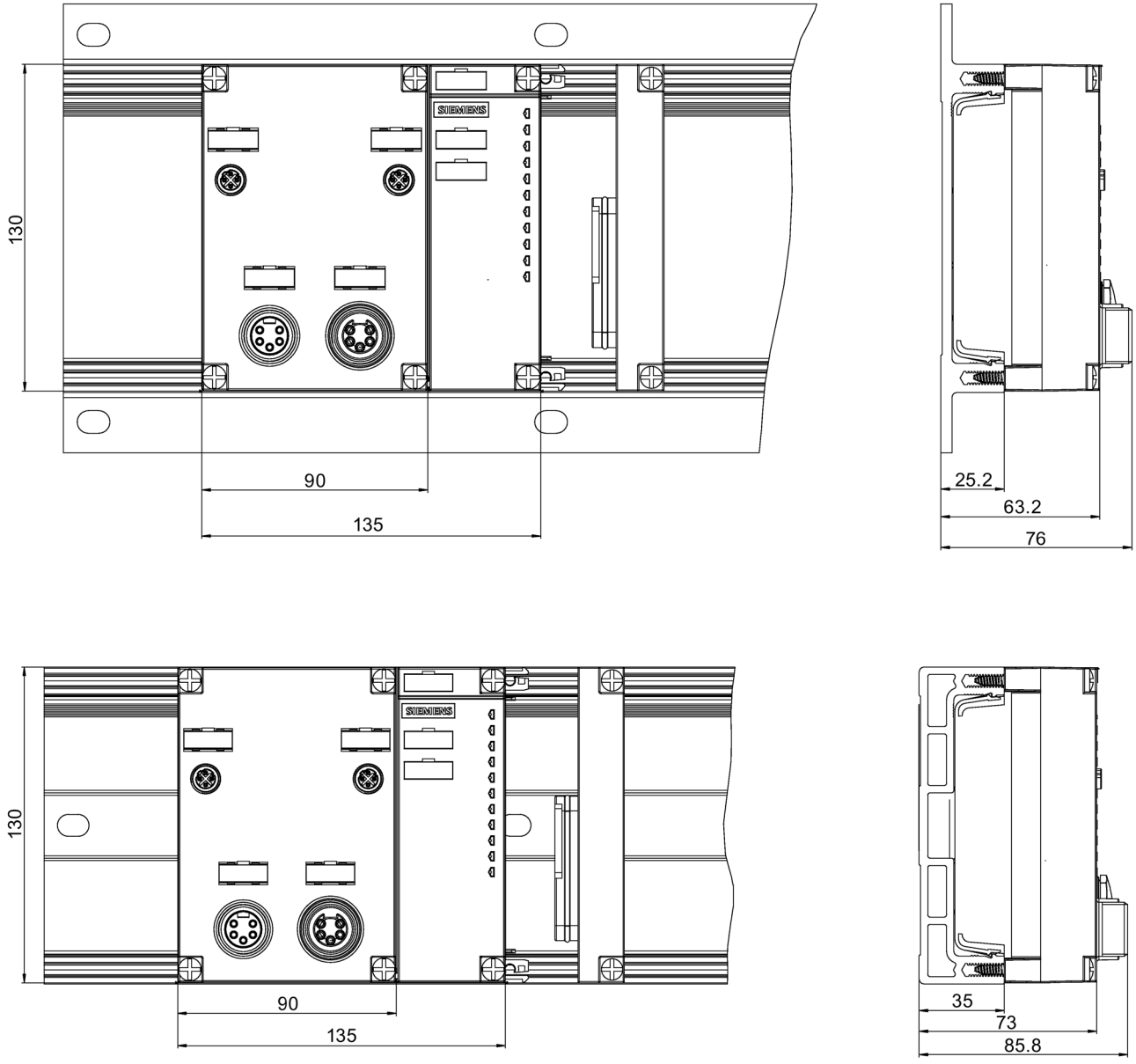


Figure A-4 IM 154-4 PN High Feature interface module with CM IM PN M12, 7/8" connection module

IM 154-4 PN High Feature interface module with CM IM PN PP Cu/CM IM PN PP FO connection module

Top: with narrow type rack; bottom: with compact type rack.

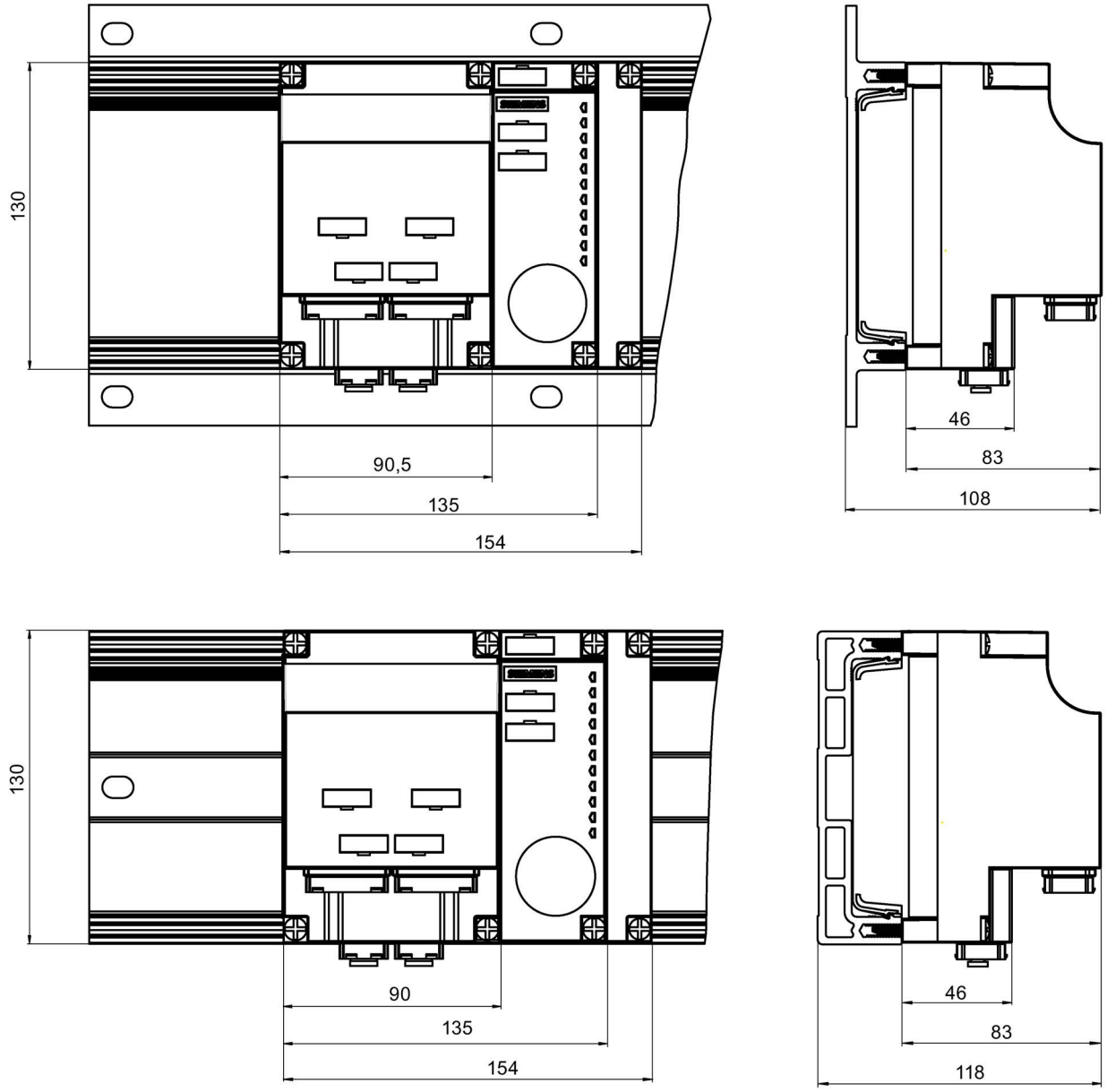


Figure A-5 IM 154-4 PN High Feature interface module with CM IM PN PP Cu/CM IM PN PP FO connection module

A.2.3 Electronic module with connection module

Electronic module with CM IO 8 x M12, CM IO 8 x M12P, CM IO 8 x M12D, CM IO 4 x M12, CM IO 4 x M12P, CM IO 4 x M12 Inverse, CM IO 8 x M8 connection module

The figure below shows as example the dimension drawing of an electronic module with a mounted CM IO 8 x M12 connection module. Top: with narrow type rack; bottom: with compact type rack. The dimensions are identical for the CM IO 8 x M12P, CM IO 8 x M12D, CM IO 4 x M12, CM IO 4 x M12P and CM IO 8 x M8 connection module.

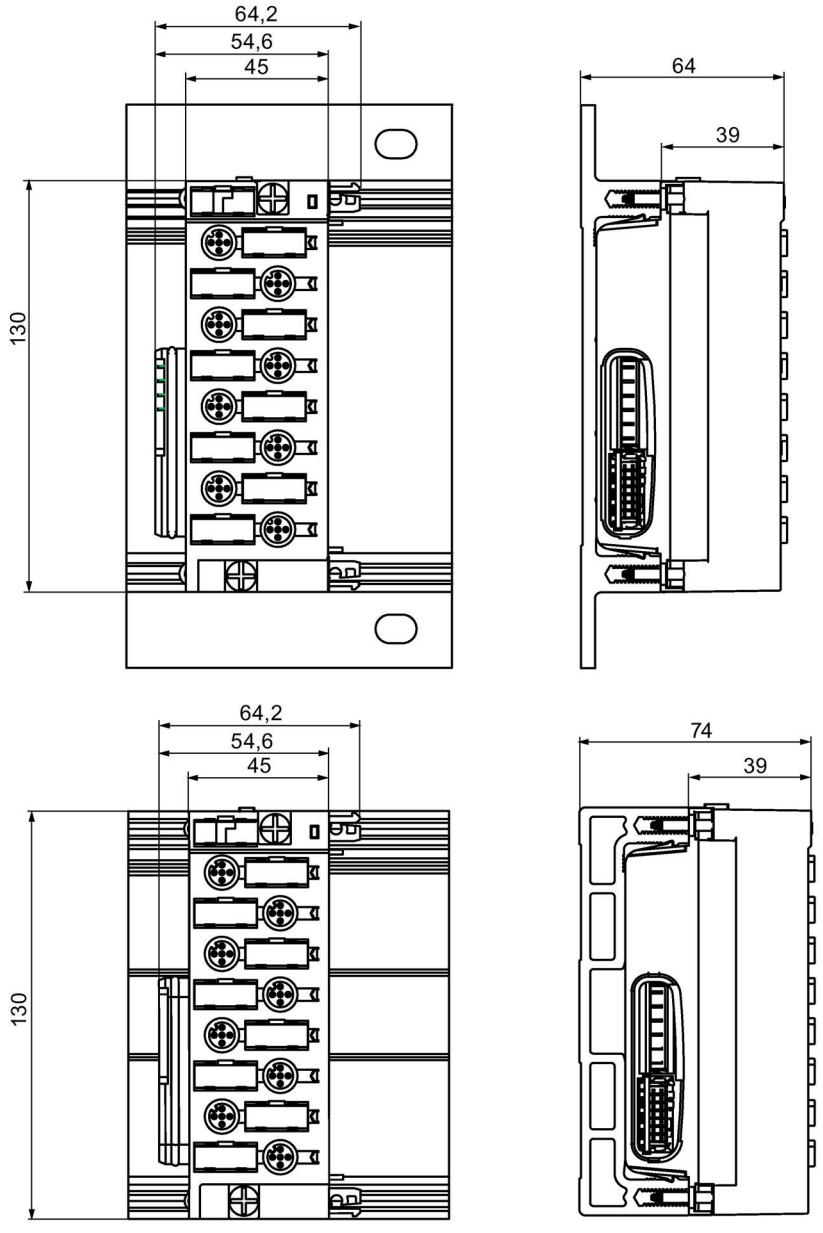


Figure A-6 Dimension drawing of an electronic module with CM IO 8 x M12 connection module

Electronic module with CM IO 2 x M12 connection module

Top: with narrow type rack; bottom: with compact type rack.

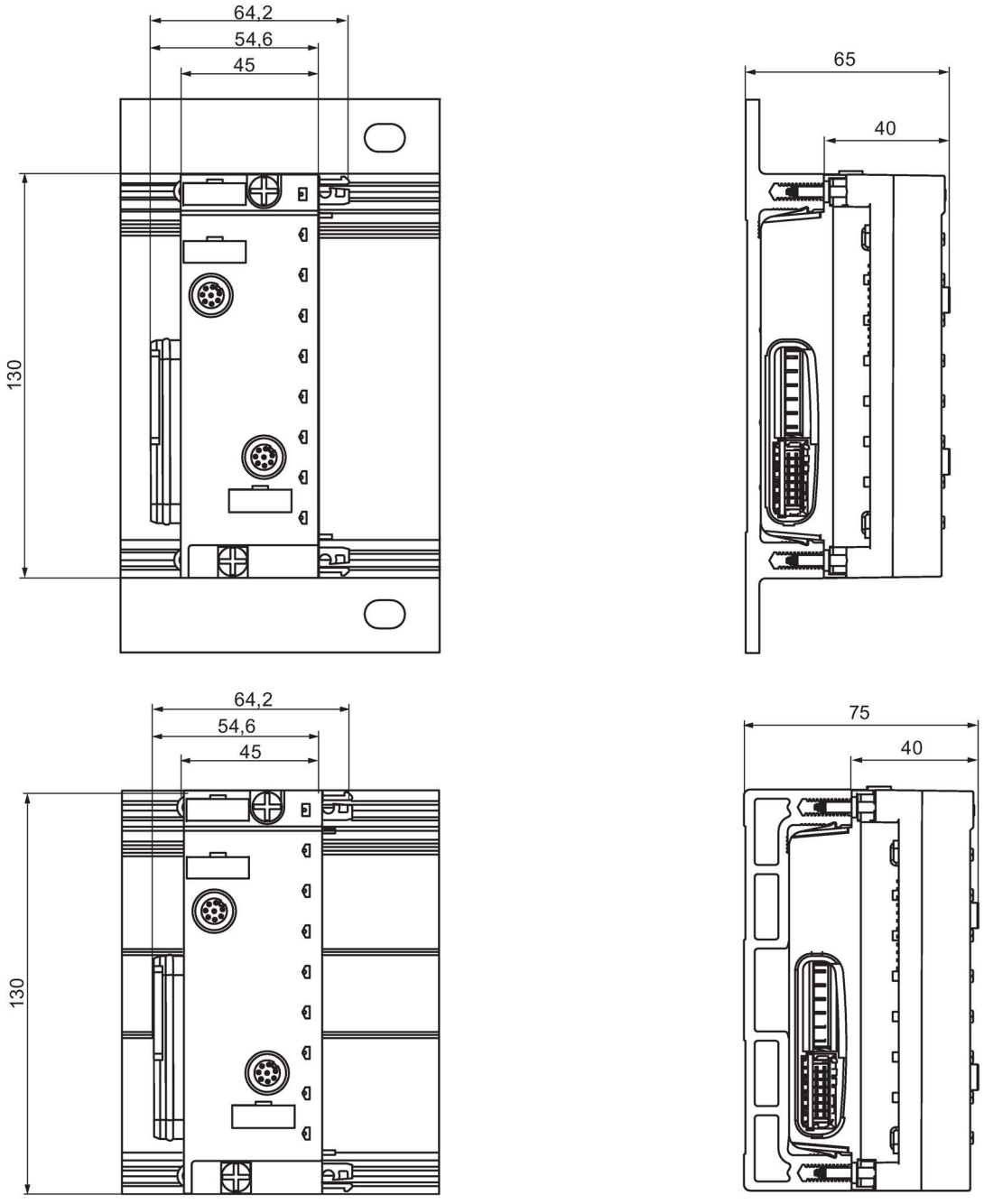


Figure A-7 Dimension drawing of electronic module with CM IO 2xM12 connection module

Electronic module with CM IO 1 x M23 connection module

Top: with narrow type rack; bottom: with compact type rack.

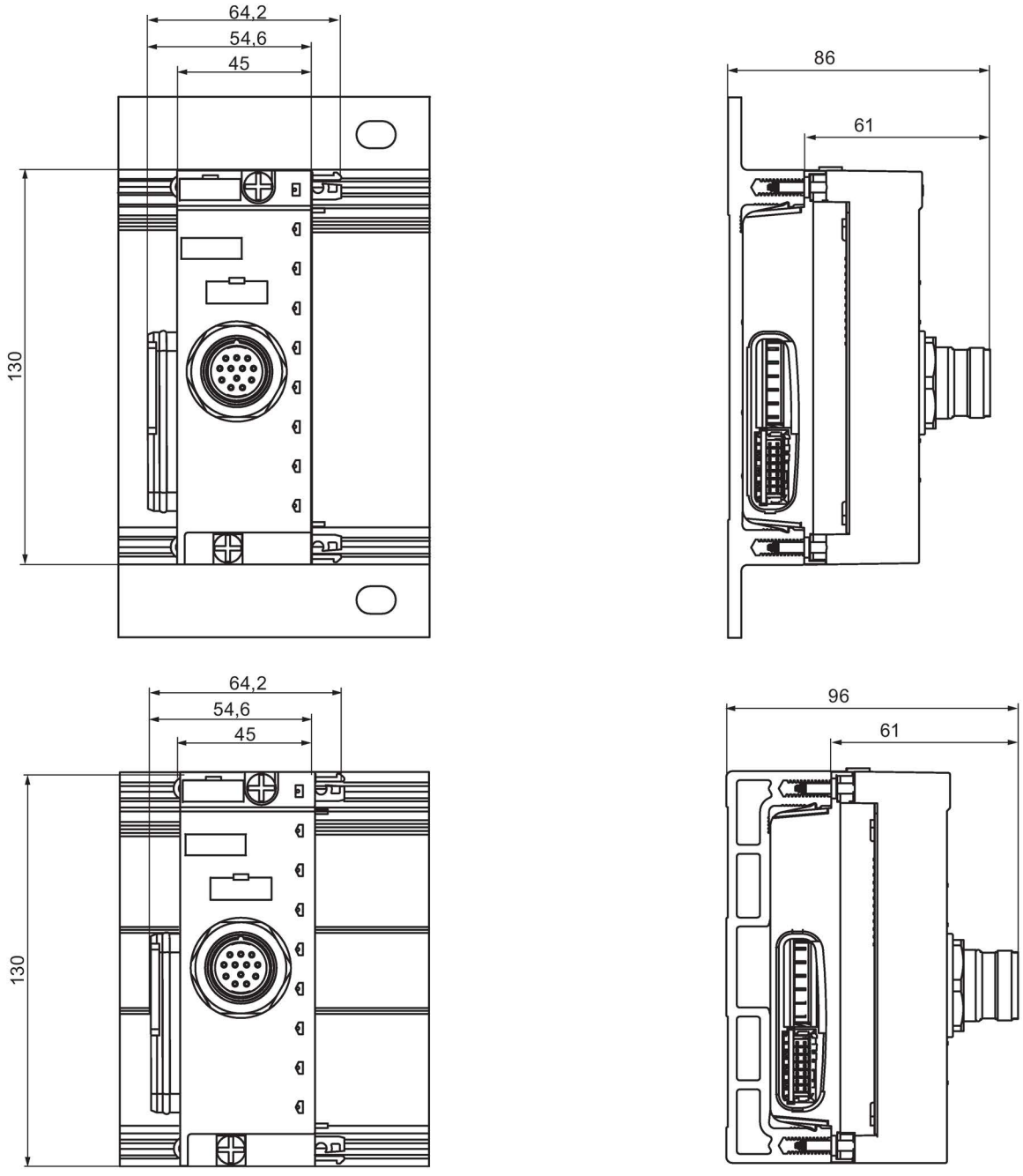
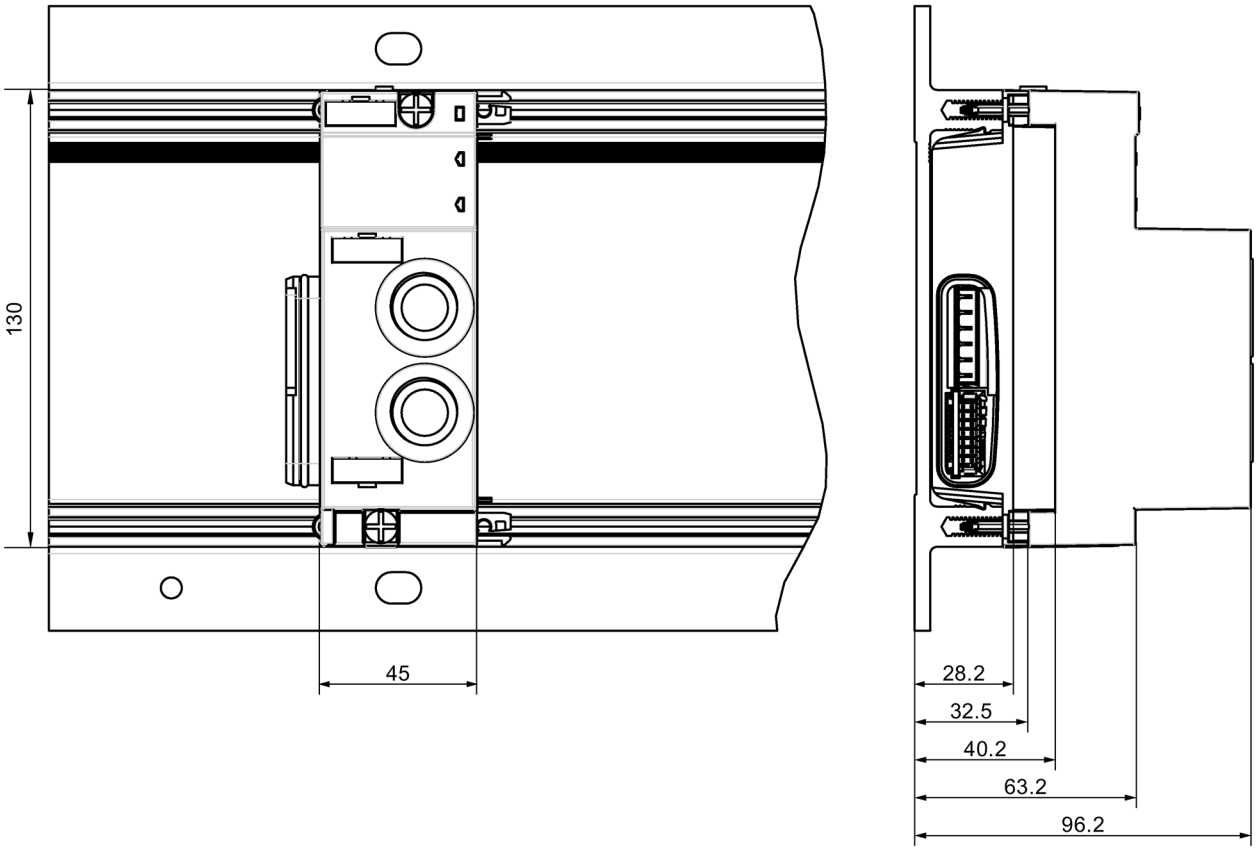


Figure A-8 Dimension drawing of electronic module with CM IO 1xM23 connection module

A.2.4 PM-E power module with connection module

PM-E power module with CM PM Direct connection module

Top: With narrow type rack. Bottom: With compact type rack.



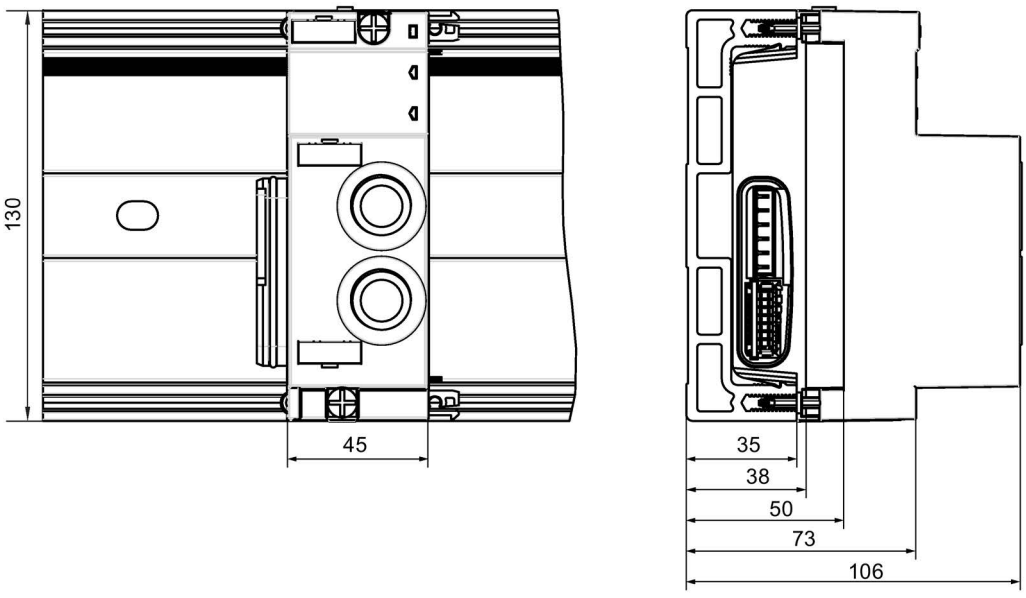


Figure A-9 Dimensional drawing of the power module with CM PM Direct connection module

PM-E power module with CM PM ECOFAST connection module

Top: With narrow type rack. Bottom: With compact type rack.

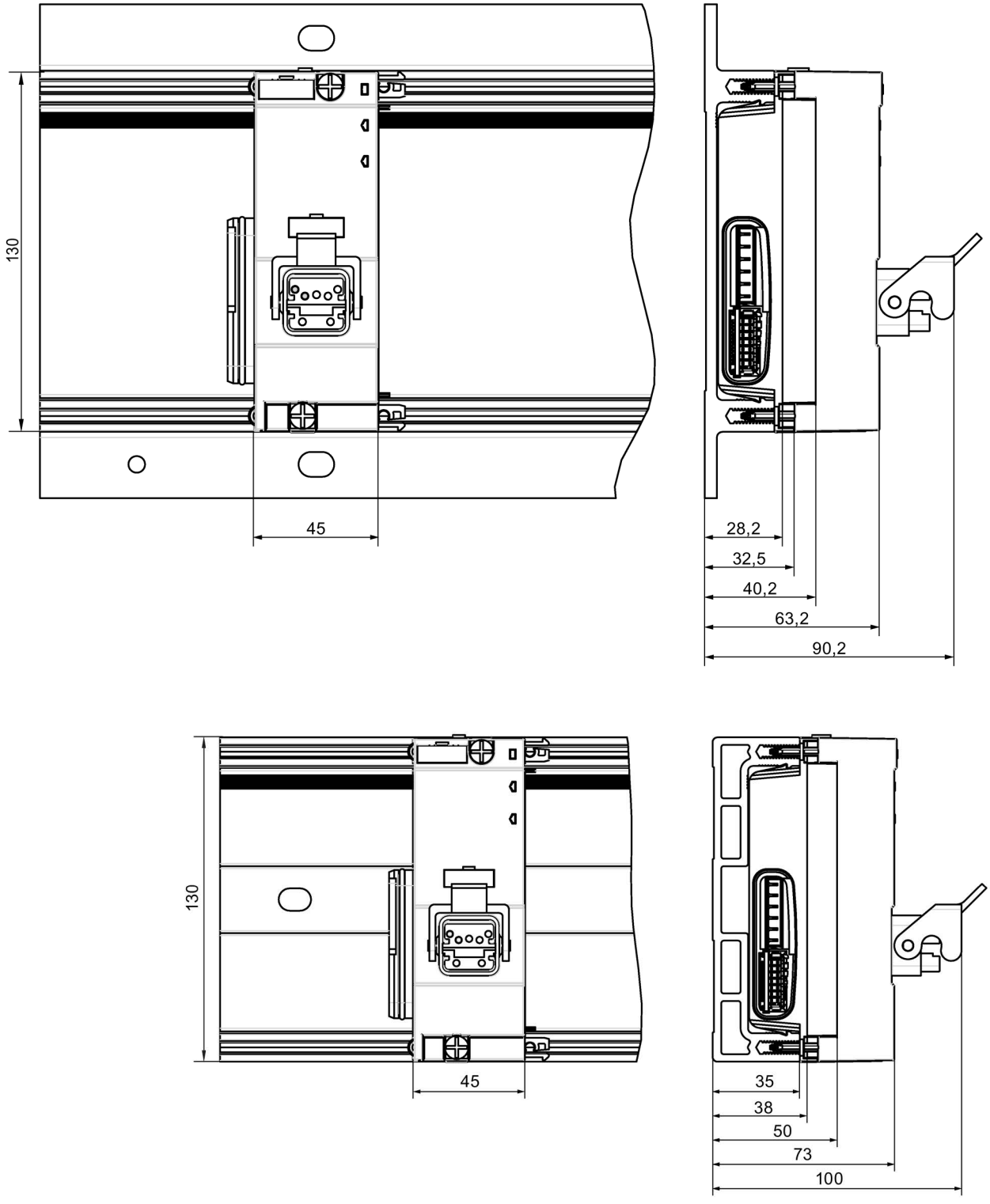
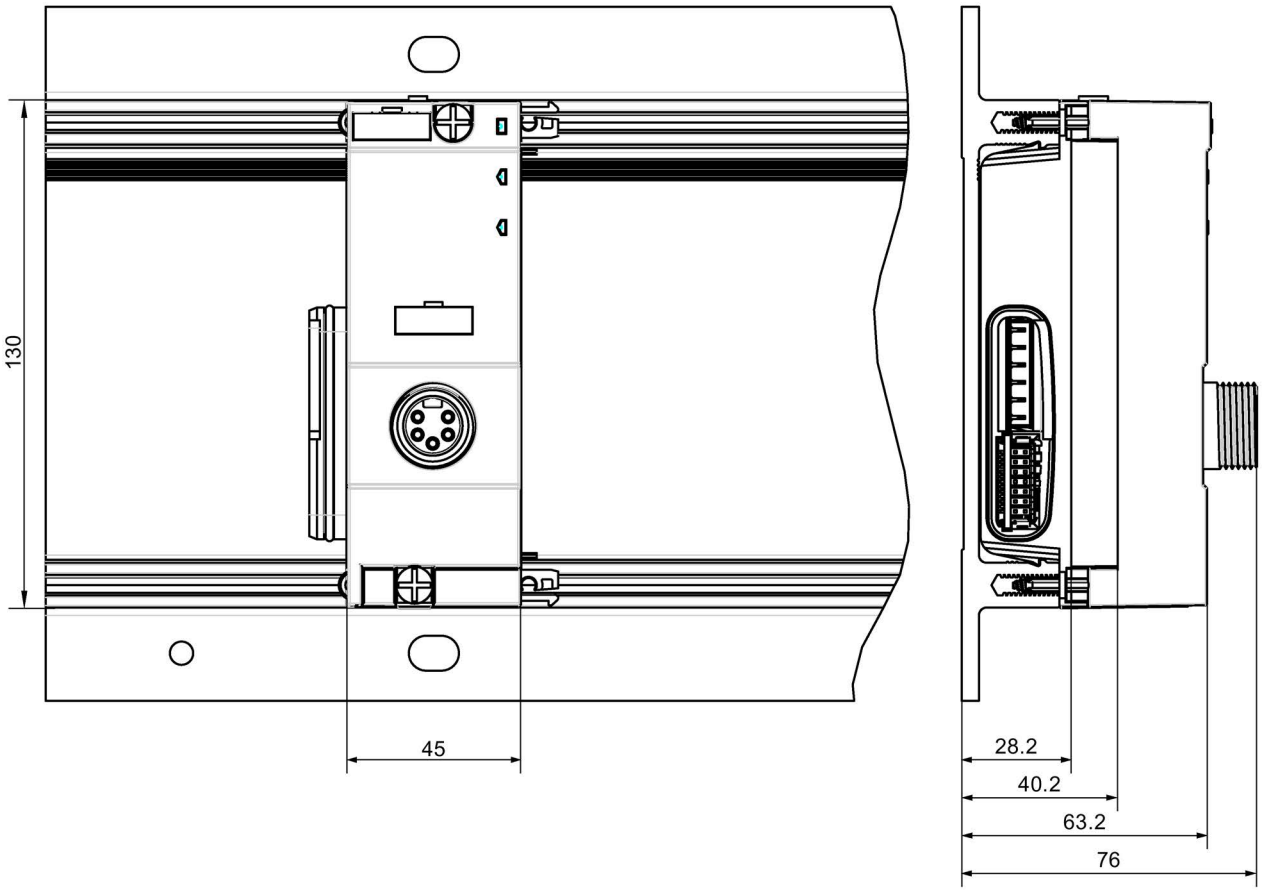


Figure A-10 Dimensional drawing of the power module with CM PM ECOFAST connection module

PM-E power module with CM PM 7/8" connection module

Top: With narrow type rack. Bottom: With compact type rack.



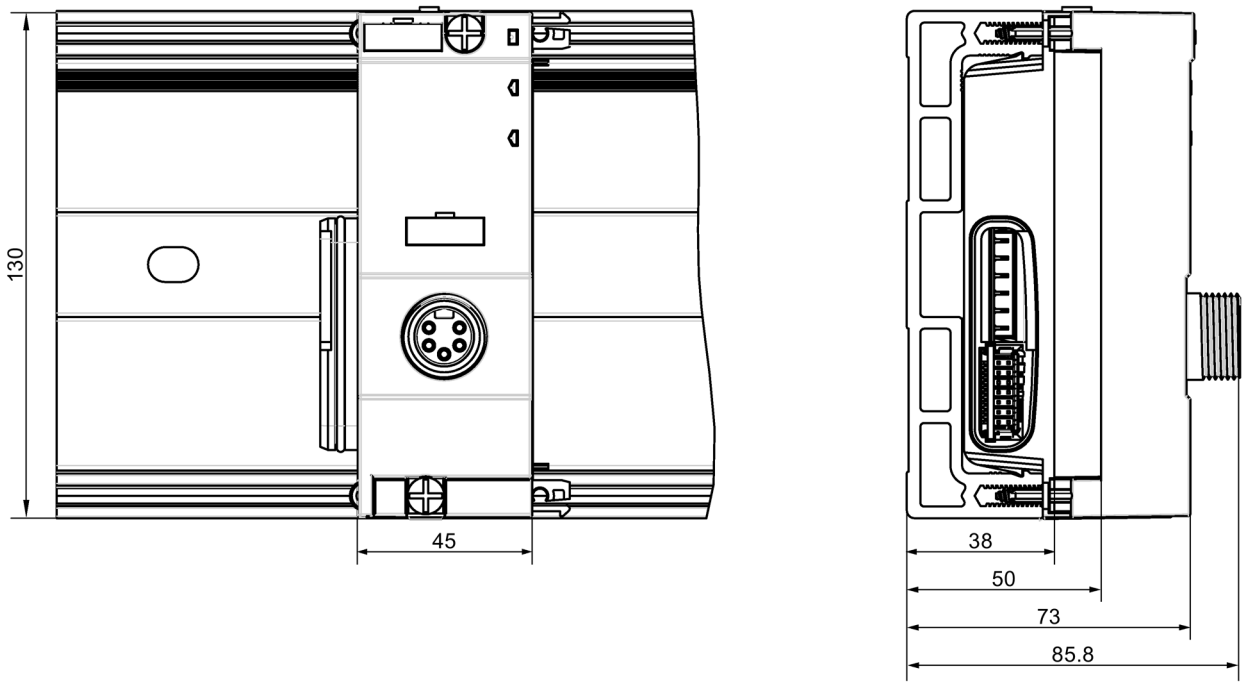


Figure A-11 Dimensional drawing of the power module with CM PM 7/8" connection module

PM-E power module with CM PM PP connection module

Top: With narrow type rack. Bottom: With compact type rack.

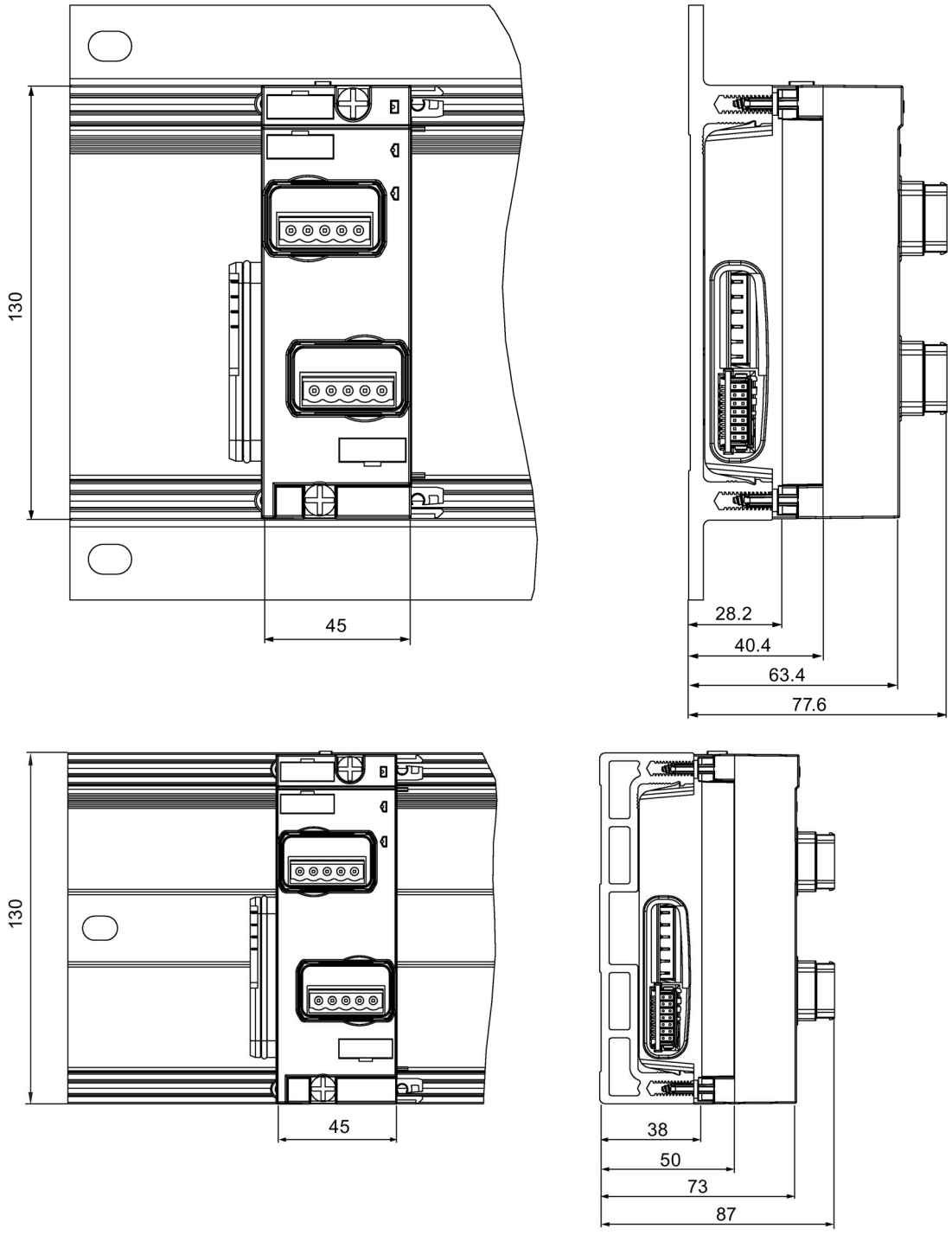


Figure A-12 Dimensional drawing of the power module with CM PM PP connection module

A.2.5 PM-O PP outgoing module with connection module

PM-O outgoing module with CM PM-O PP connection module

Top: With narrow type rack. Bottom: With compact type rack.

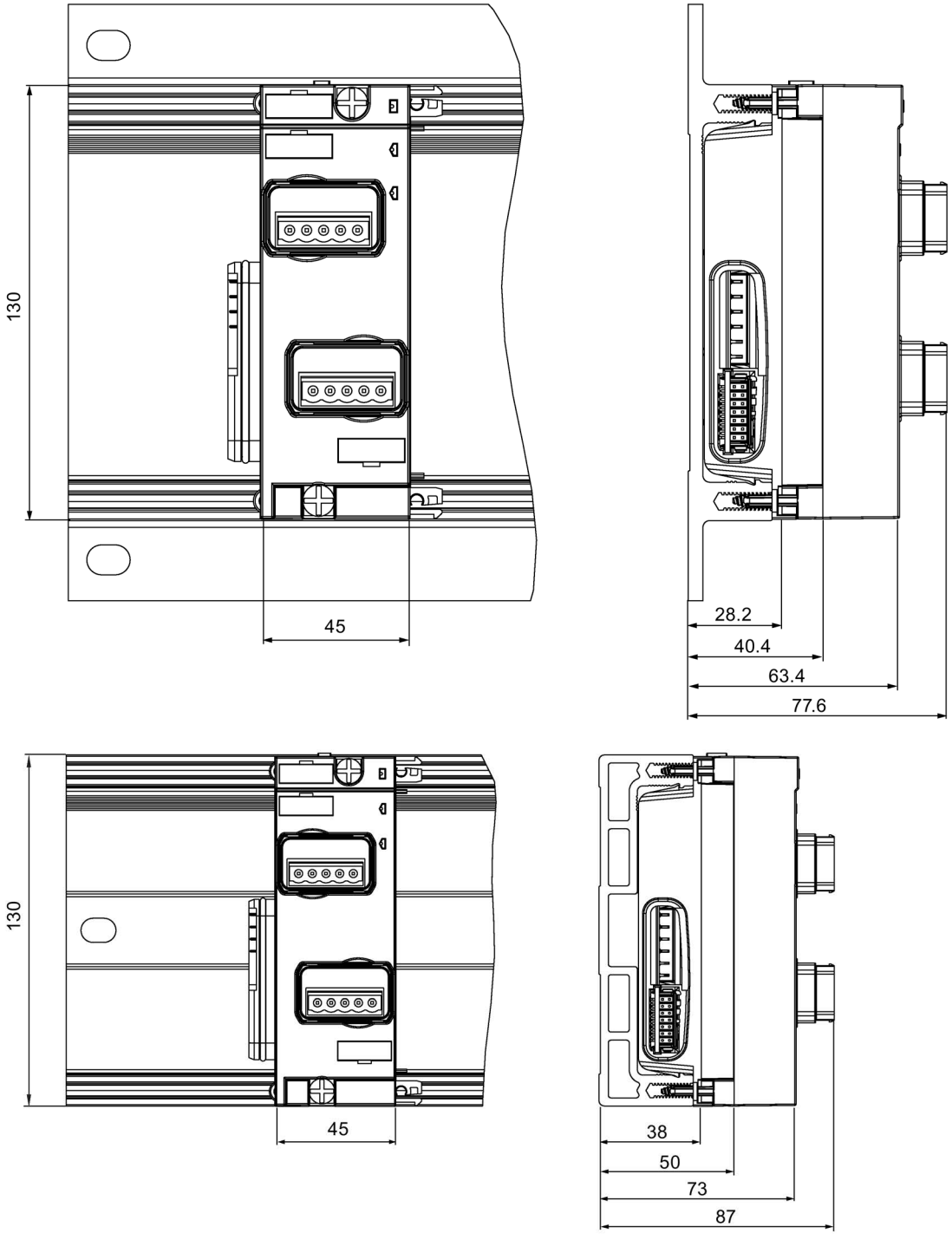


Figure A-13 Dimension drawing of the outgoing module with CM PM-O PP connection module

A.2.6 Pneumatic interface module with FESTO valve terminal

Pneumatic interface module with FESTO valve terminal

The following dimension drawings of the installed valve terminals CPV10 and CPV14 of the 16 DO DC 24V CPV10 and 16 DO DC 24V CPV14 pneumatic interface modules are provided as examples. Top: with narrow type rack; bottom: with compact type rack.

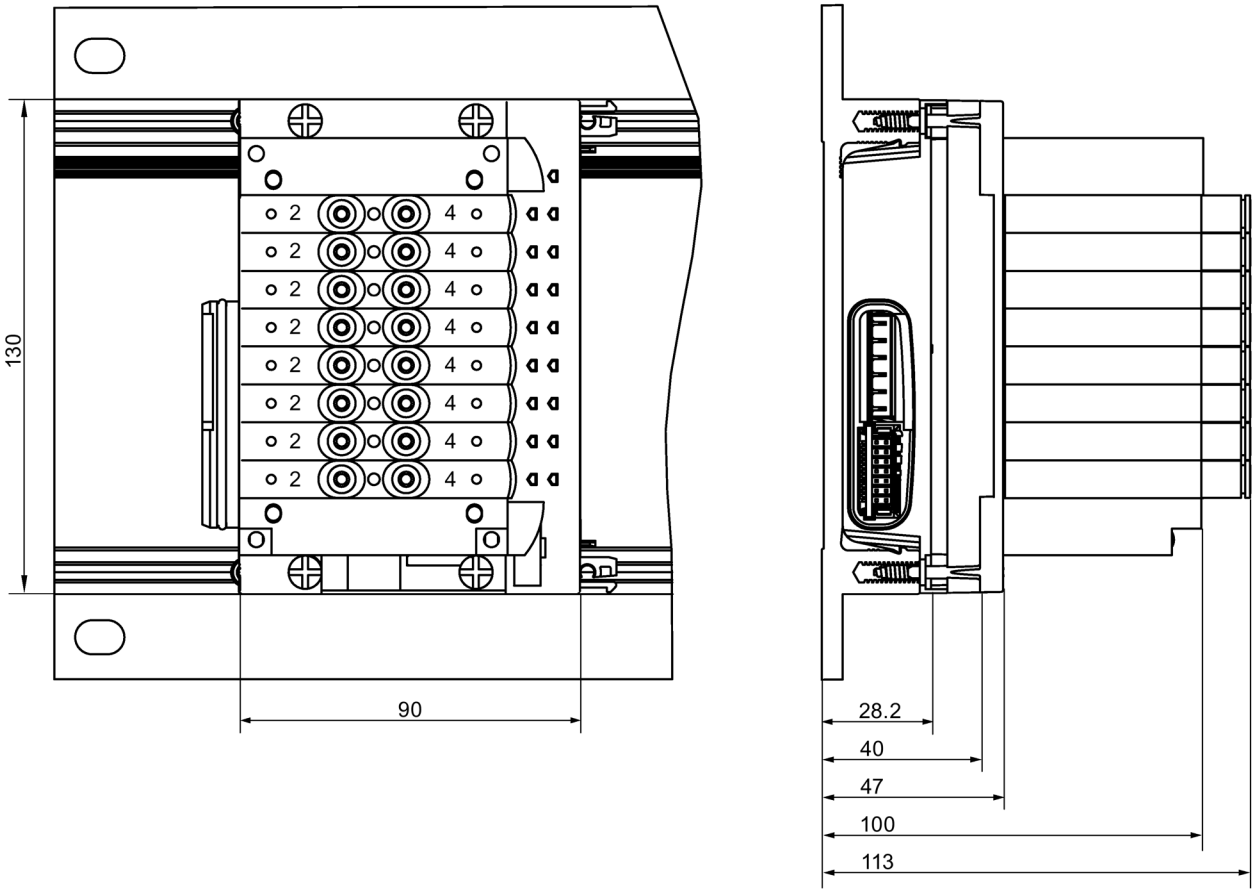


Figure A-14 Dimension drawing of 16 DO DC 24V CPV10 pneumatic interface module with FESTO valve terminal CPV10 on compact type rack

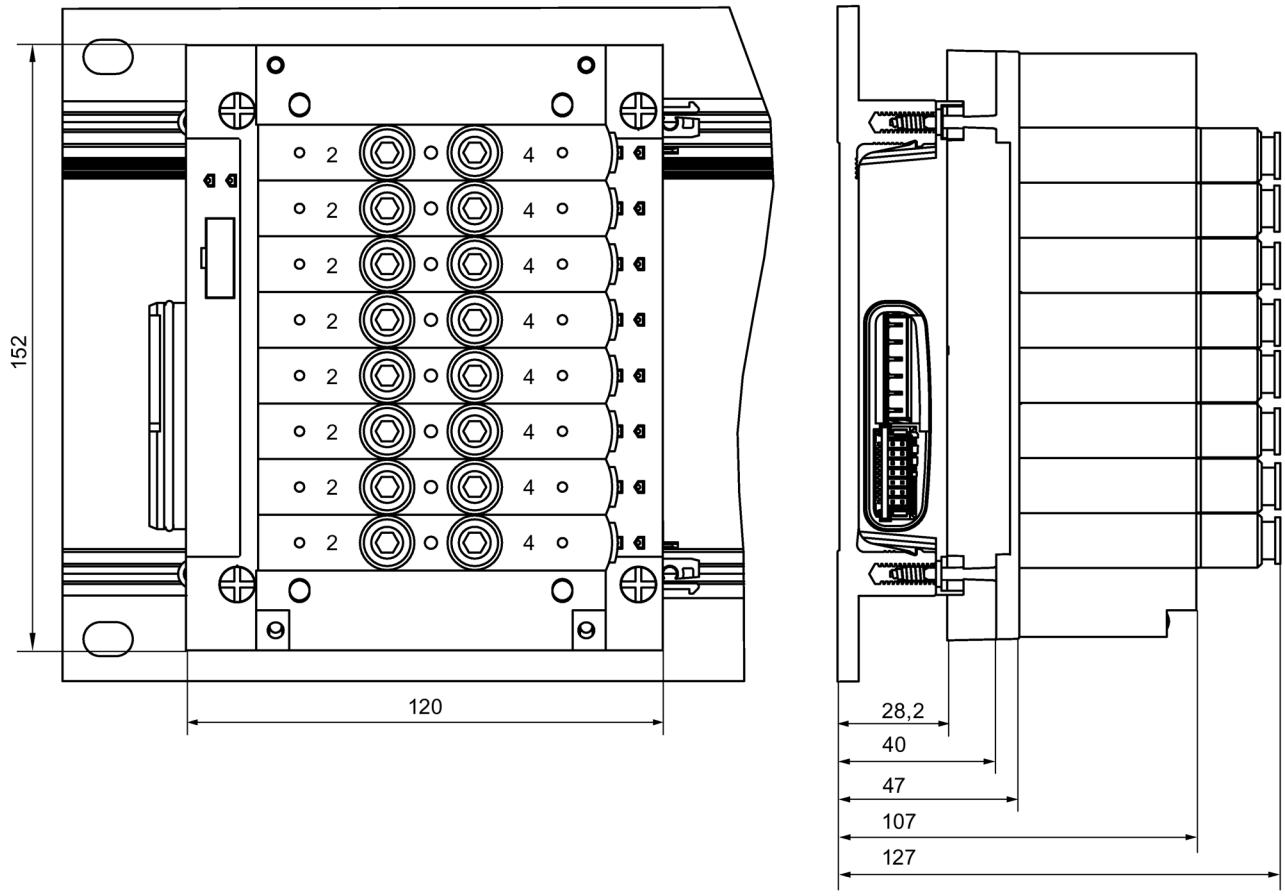


Figure A-15 Dimension drawing of 16 DO DC 24V CPV14 pneumatic interface module with FESTO valve terminal CPV14 on compact type rack

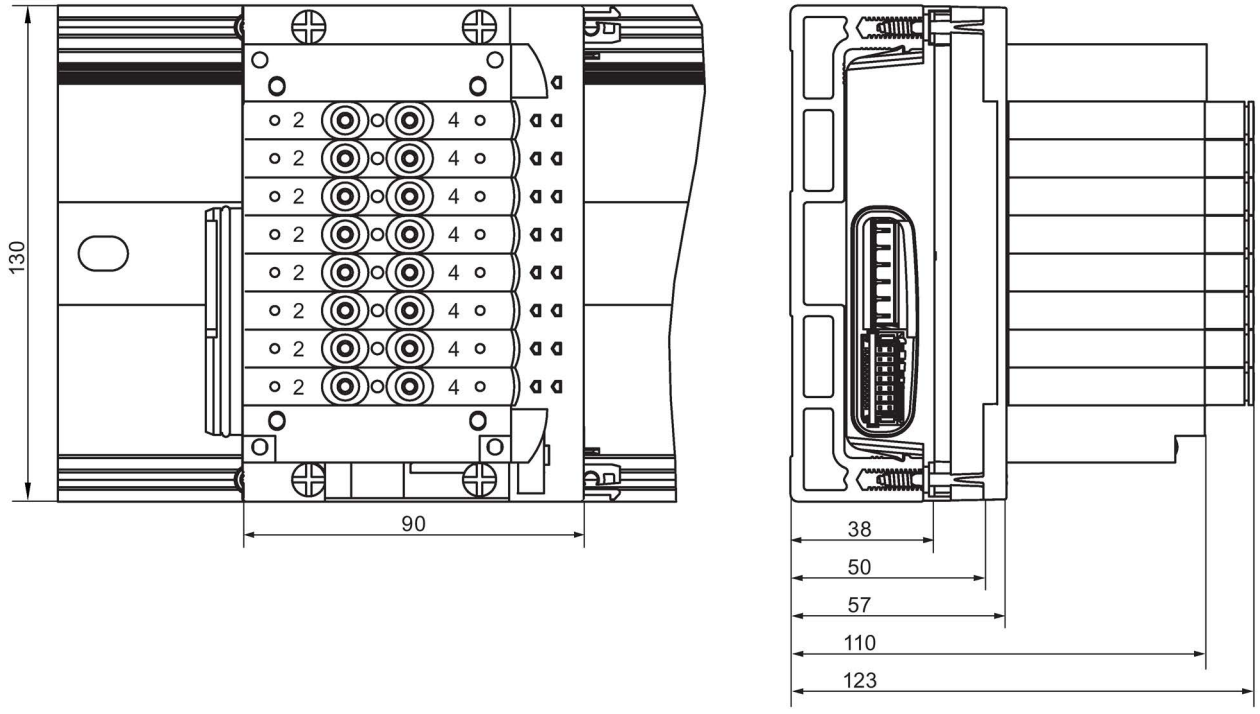


Figure A-16 Dimension drawing of 16 DO DC 24V CPV10 pneumatic interface module with FESTO valve terminal CPV10 on compact type rack

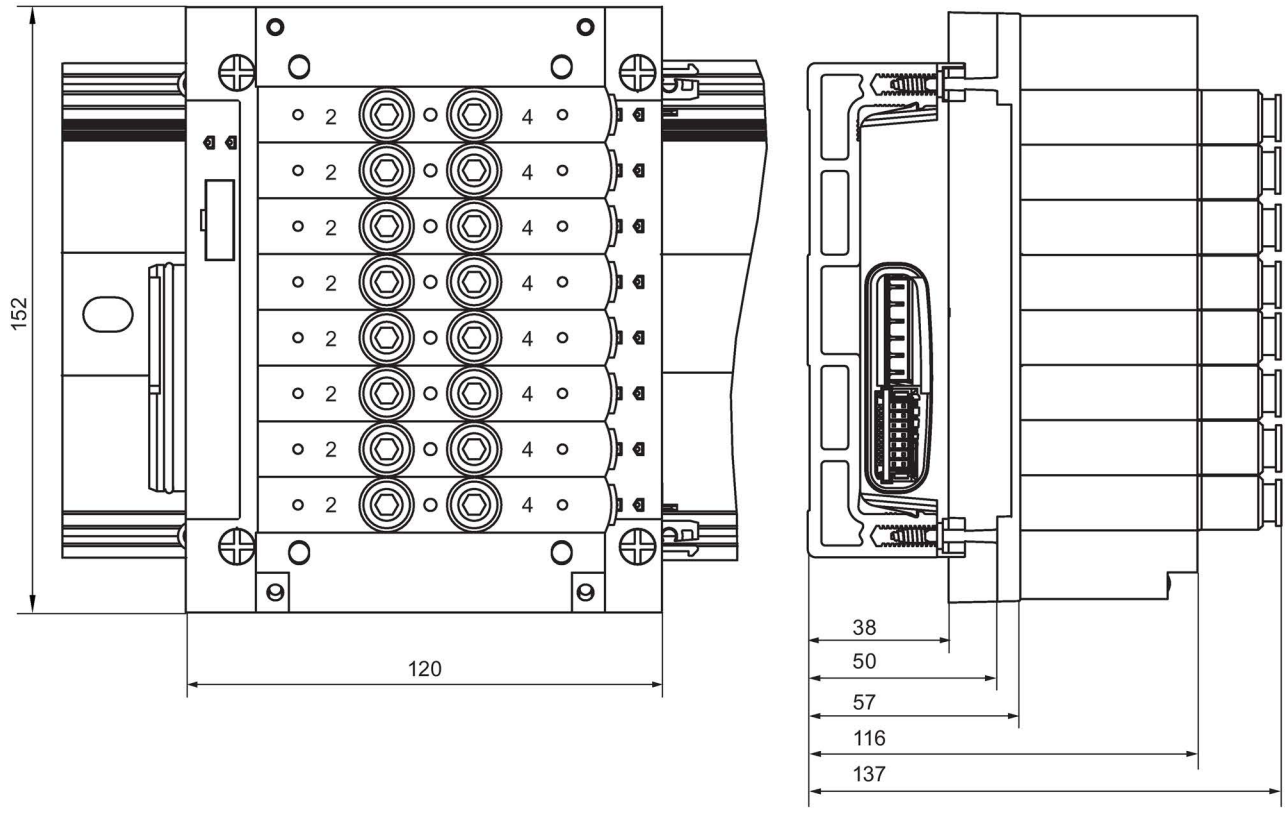


Figure A-17 Dimension drawing of 16 DO DC 24V CPV14 pneumatic interface module with FESTO valve terminal CPV14 on compact type rack

A.2.7 Terminating module

Terminating module

The figure below shows the dimension drawing of the terminating module Top: with narrow type rack; bottom: with compact type rack.

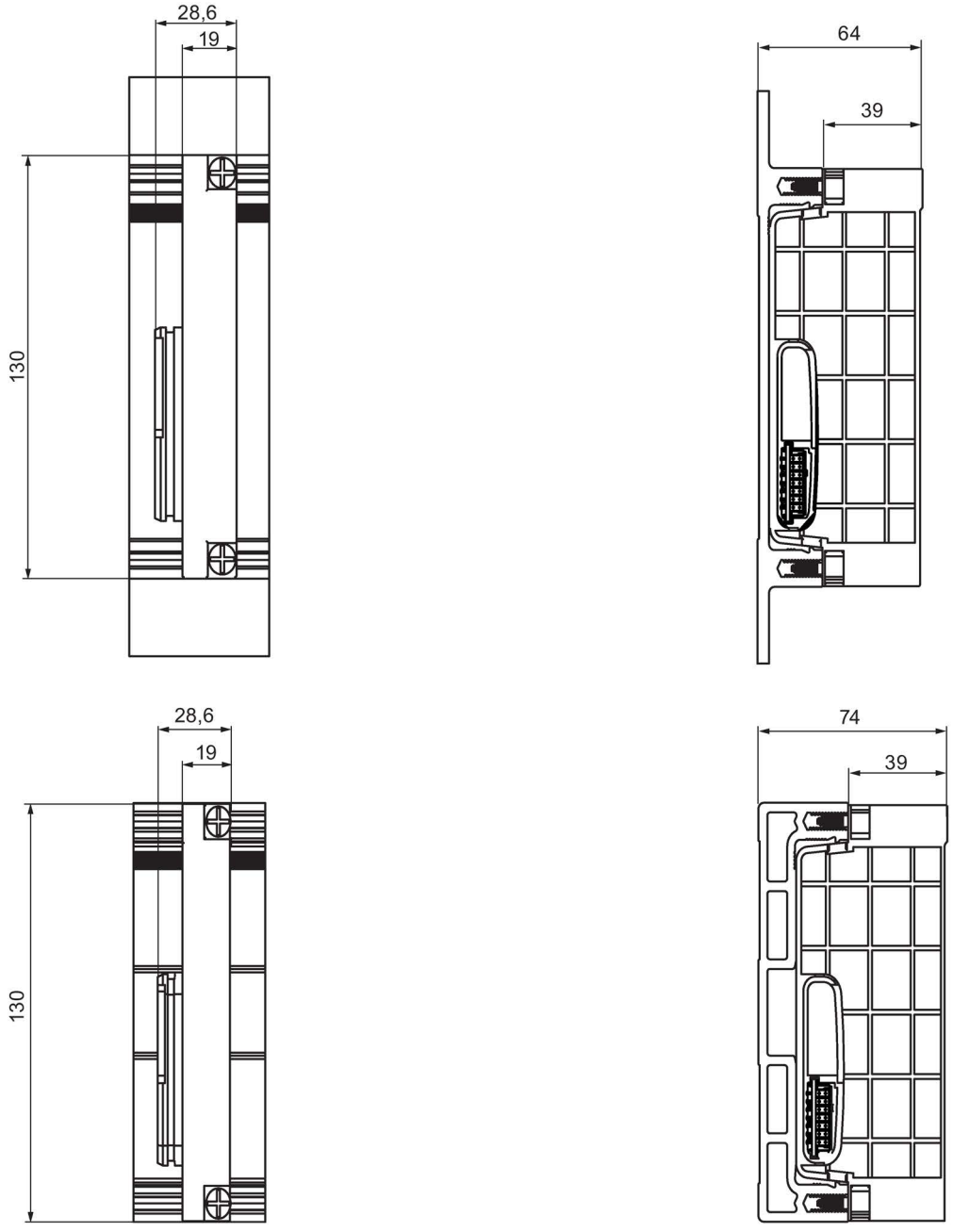
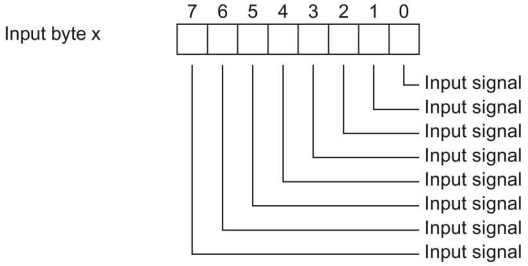


Figure A-18 Dimension drawing of terminating module

A.3 IO address space

A.3.1 Digital input modules

Address space for 8 DI DC 24V



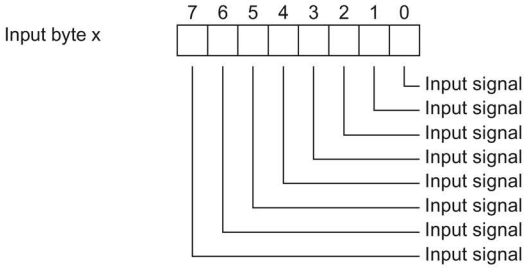
CM IO 8 x M8 CM IO 8 x M12 CM IO 8 x M12P	CM IO 4 x M12 CM IO 4 x M12P	Channel
X1 at terminal 4	X1 at terminal 4	0
X2 at terminal 4	X2 at terminal 4	1
X3 at terminal 4	X3 at terminal 4	2
X4 at terminal 4	X4 at terminal 4	3
X5 at terminal 4	X1 at terminal 2	4
X6 at terminal 4	X2 at terminal 2	5
X7 at terminal 4	X3 at terminal 2	6
X8 at terminal 4	X4 at terminal 2	7

CM IO 2 x M12	Channel
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3
X2 at terminal 1	4
X2 at terminal 2	5
X2 at terminal 3	6
X2 at terminal 4	7

CM IO 1 x M23	Kanal
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3
X1 at terminal 5	4
X1 at terminal 6	5
X1 at terminal 7	6
X1 at terminal 8	7

Figure A-19 Address space for 8 DI DC 24V

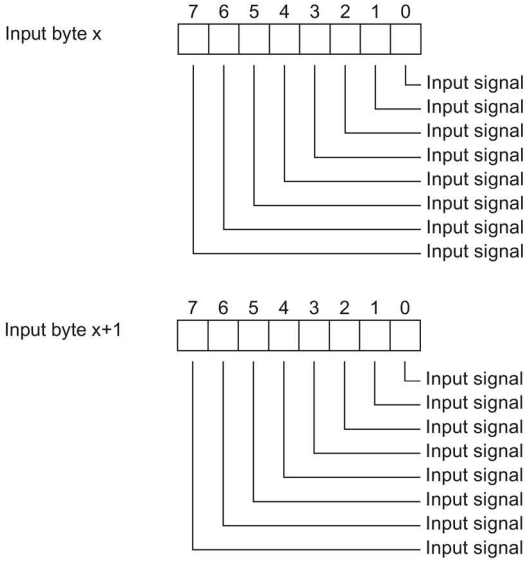
Address space for 8 DI DC 24V High Feature



CM IO 8 x M8 CM IO 8 x M12 CM IO 8 x M12P	CM IO 4 x M12 CM IO 4 x M12P	Channel
X1 at terminal 4	X1 at terminal 4	0
X2 at terminal 4	X2 at terminal 4	1
X3 at terminal 4	X3 at terminal 4	2
X4 at terminal 4	X4 at terminal 4	3
X5 at terminal 4	X1 at terminal 2	4
X6 at terminal 4	X2 at terminal 2	5
X7 at terminal 4	X3 at terminal 2	6
X8 at terminal 4	X4 at terminal 2	7

Figure A-20 Address space 8 DI DC 24V High Feature

Address space for 16 DI DC 24V



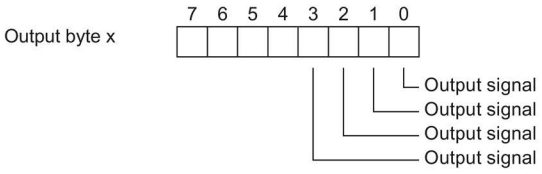
CM IO 8 x M12D	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3
X5 at terminal 4	4
X6 at terminal 4	5
X7 at terminal 4	6
X8 at terminal 4	7

CM IO 8 x M12D	Channel
X1 at terminal 2	8
X2 at terminal 2	9
X3 at terminal 2	10
X4 at terminal 2	11
X5 at terminal 2	12
X6 at terminal 2	13
X7 at terminal 2	14
X8 at terminal 2	15

Figure A-21 Address space for 16 DI DC 24V

A.3.2 Digital output module

Address space for 4 DO DC 24V/0.2A



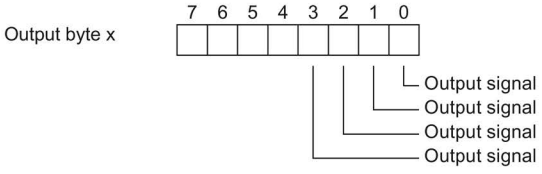
CM IO 4 x M12 CM IO 4 x M12P CM IO 4 x M12 Invers	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

CM IO 8 x M8	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

CM IO 2 x M12 CM IO 1 x M23	Channel
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3

Figure A-22 Address space 4 DO DC 24V/0.2A

Address space for 4 DO DC 24V/0.2A High Feature

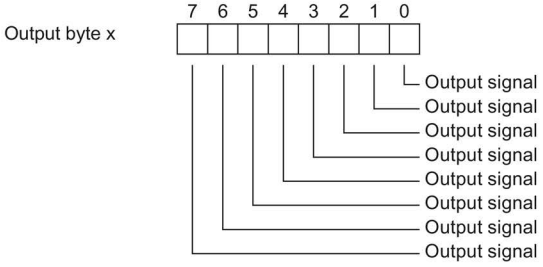


CM IO 4 x M12 CM IO 4 x M12P CM IO 4 x M12 Invers	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

CM IO 8 x M8	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

Figure A-23 Address space 4 DO DC 24V/0.2A High Feature

Address space for 8 DO DC 24V/0.5A



CM IO 8 x M8 CM IO 8 x M12 CM IO 8 x M12P	CM IO 4 x M12 CM IO 4 x M12P	Channel
X1 at terminal 4	X1 at terminal 4	0
X2 at terminal 4	X2 at terminal 4	1
X3 at terminal 4	X3 at terminal 4	2
X4 at terminal 4	X4 at terminal 4	3
X5 at terminal 4	X1 at terminal 2	4
X6 at terminal 4	X2 at terminal 2	5
X7 at terminal 4	X3 at terminal 2	6
X8 at terminal 4	X4 at terminal 2	7

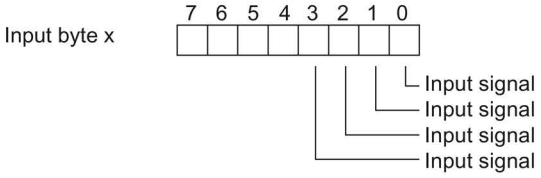
CM IO 1 x M23	Channel
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3
X1 at terminal 5	4
X1 at terminal 6	5
X1 at terminal 7	6
X1 at terminal 8	7

CM IO 2 x M12	Channel
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3
X2 at terminal 1	4
X2 at terminal 2	5
X2 at terminal 3	6
X2 at terminal 4	7

Figure A-24 Address space 8 DO DC 24V/0.5A

A.3.3 Digital input/output module

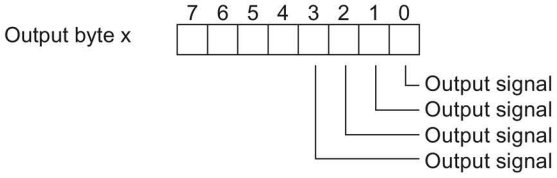
Address space for 4 DI / 4 DO DC 24V/0.5A



CM IO 4 x M12 CM IO 4 x M12P	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

CM IO 8 x M8 CM IO 8 x M12 CM IO 8 x M12P	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

CM IO 2 x M12 CM IO 1 x M23	Channel
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3



CM IO 4 x M12 CM IO 4 x M12P	Channel
X1 at terminal 2	0
X2 at terminal 2	1
X3 at terminal 2	2
X4 at terminal 2	3

CM IO 8 x M8 CM IO 8 x M12 CM IO 8 x M12P	Channel
X5 at terminal 4	0
X6 at terminal 4	1
X7 at terminal 4	2
X8 at terminal 4	3

CM IO 2 x M12	Channel
X2 at terminal 1	0
X2 at terminal 2	1
X2 at terminal 3	2
X2 at terminal 4	3

CM IO 1 x M23	Channel
X1 at terminal 5	0
X1 at terminal 6	1
X1 at terminal 7	2
X1 at terminal 8	3

Figure A-25 Address space 4 DI / 4 DO DC 24V/0.5A

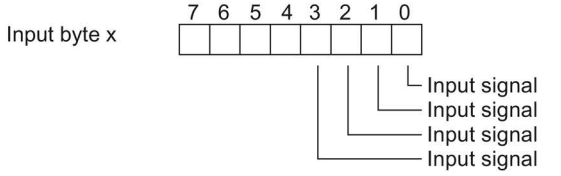
Note

Grouping electronic modules in the configuration

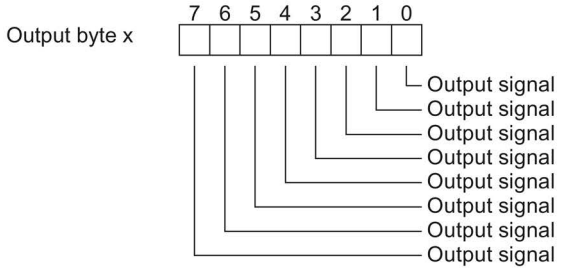
You can group two identical digital electronic modules of type 4 DI / 4 DO DC 24V/0.5A within a byte in the input and output range of the process image.

You can find more information on this topic in the chapter Grouping electronic modules in the configuration (Page 139).

Address space for 4 DIO / 4 DO DC 24V/0.5A



CM IO 8 x M12D	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3



CM IO 8 x M12D	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3
X5 at terminal 4	4
X6 at terminal 4	5
X7 at terminal 4	6
X8 at terminal 4	7

Figure A-26 Address space 4 DIO / 4 DO DC 24V/0.5A

Note

Input/output bits 0 to 3

Read or write access is always possible to the input/output bit, regardless of the parameter settings.

If a channel is configured as output, the value at the input bit is "0". If a channel is configured as input, and an output bit is written to it, it has no effect.

A.3.4 Analog input module

Address range for 4 AI

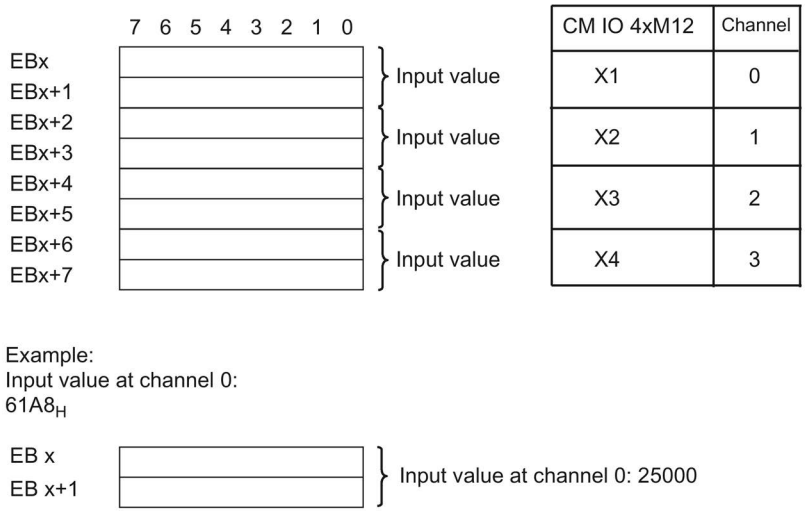


Figure A-27 Address range for 4 AI

A.3.5 Analog output module

Address range for 4 AI

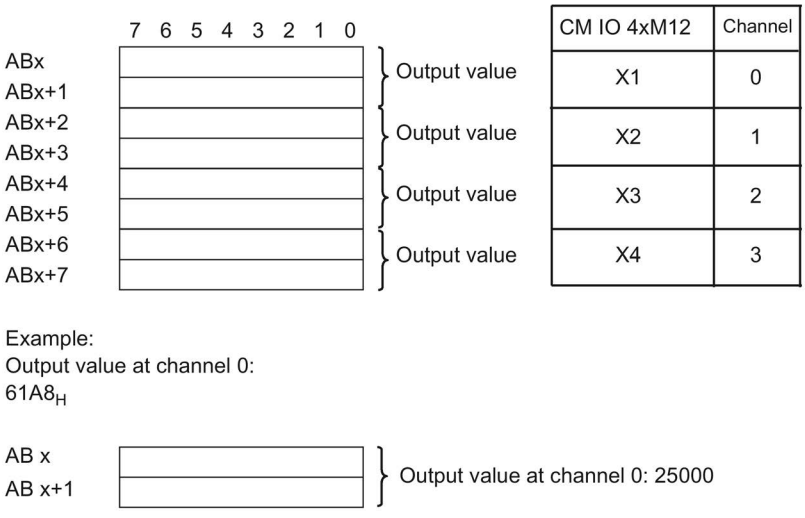


Figure A-28 Address range for 4 AI

A.3.6 Pneumatic interface module

Address range for pneumatic interface module

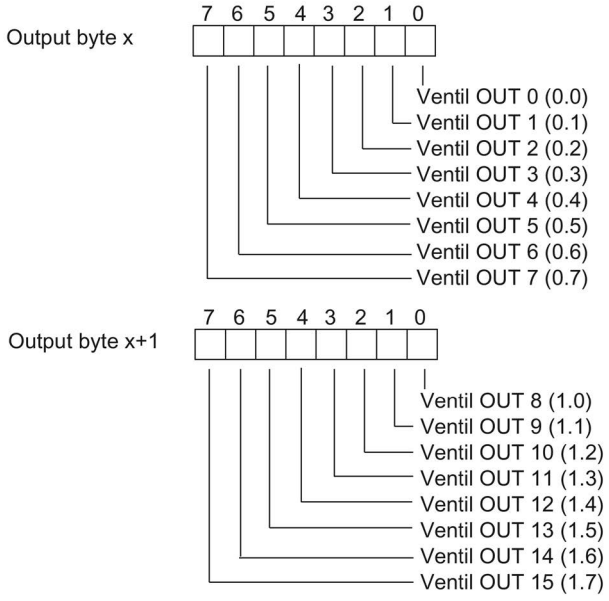


Figure A-29 Address range 16 DO DC24V

A.4 Response times

A.4.1 Response times between the DP master and ET 200pro

Principle of operation

The figure below shows the various reaction times between the DP master and ET 200pro

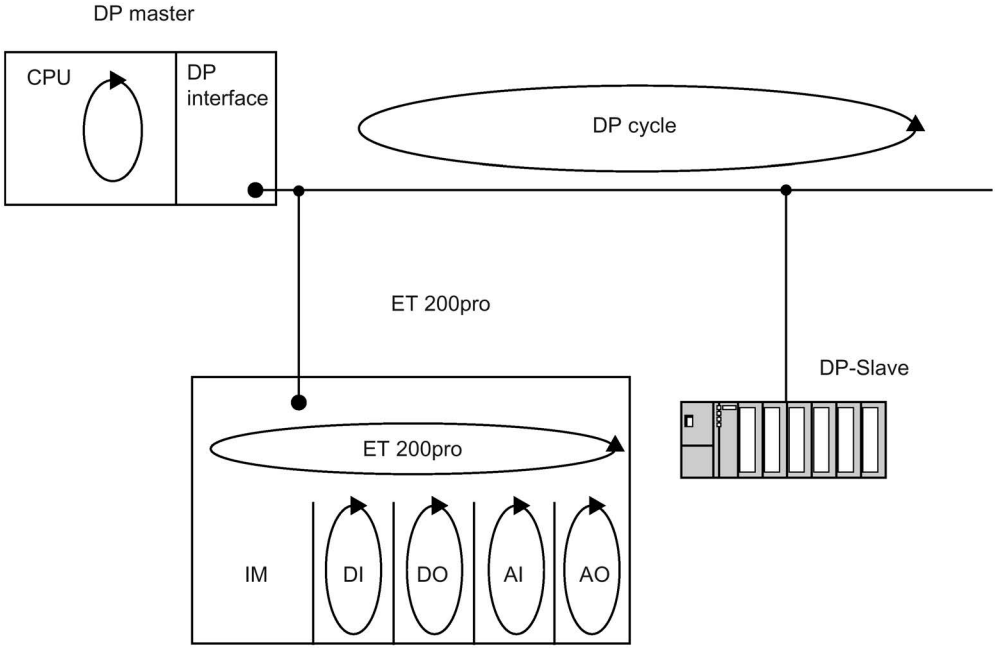


Figure A-30 Reaction times between the DP master and ET 200pro

A.4.2 DP master response times

Response time

For information on response times, refer to the DP master manual.

A.4.3 Reaction times at ET 200pro

Rules

The response time of ET 200pro is determined by

- The number of modules
- The number of diagnostic messages
- Removal and insertion of modules
- Interrupts

Calculating the response time

The equation below can be used to calculate the approximate response time of ET 200pro:

Response time [µs] = 55 • m + 110 • a + 190

m	Total of all electronic and pneumatic interface modules in the ET 200pro station
a	Total of all analog electronic modules in the ET 200pro station

Example of calculating the ET 200pro response time

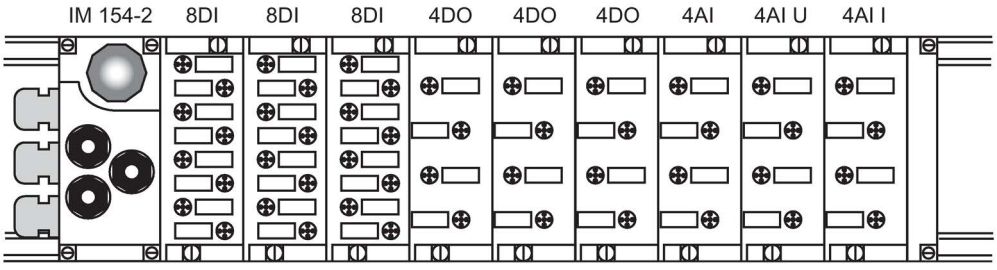


Figure A-31 Example of calculating the response time for IM 154-2 DP High Feature

Response time = 55 • 9 + 110 • 3+190

Response time = 495 + 330+190

Response time = 1015 µs

A.4.4 Response times of digital input modules

Input delay

The response times of digital input modules depend on the input delay. Refer to the technical specifications of the digital electronic modules.

See also

Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0) (Page 333)

Digital electronic module 16 DI DC 24V (6ES7141-4BH00-0AA0) (Page 344)

Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 339)

A.4.5 Response times for digital output and pneumatic interface modules

Output delay

The response times correspond to the output delay. Refer to the technical specifications of the digital electronic modules.

See also

Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 348)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 354)

Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 360)

Pneumatic interface module 16 DO DC 24V CPV10 (6ES7148-4EA00-0AA0) (Page 447)

Pneumatic interface module 16 DO DC 24V CPV14 (6ES7148-4EB00-0AA0) (Page 450)

A.4.6 Response times for analog input modules

Conversion time

The basic conversion time depends directly on the conversion method of the analog input channel (integrating method, actual value conversion). The integration time of integrating conversions has a direct influence on conversion times. The integration time depends on the interference frequency suppression.

For information on the basic conversion times and additional processing times of the individual analog modules, refer to the technical specifications of the corresponding analog electronic modules.

Cycle time

The analog/digital conversion and the transfer of the digitized measured values to memory or to the backplane bus take place sequentially. In other words, the analog input channels are converted one after the other. The cycle time, i.e. the time until an analog input value is converted again, is equivalent to the sum of the conversion times of all active analog input channels of the analog input modules. Unused analog input channels should be disabled in the parameter settings in order to reduce the cycle time. The conversion and integration time of disabled channels is 0.

Note

With the 4 AI TC High Feature electronic module, the cycle time increases by 1× conversion time in the case of temperature compensation involving RTD (0).

The figure below provides an overview of the cycle time elements of an n-channel analog module.

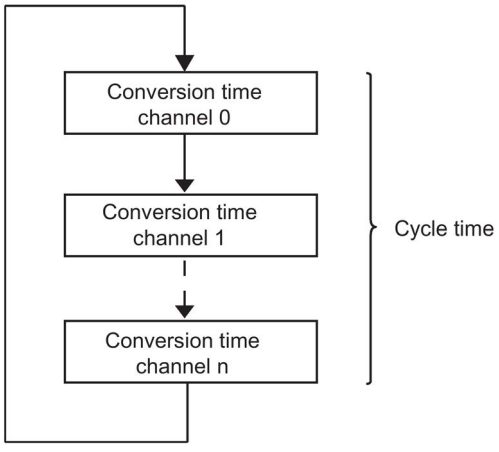


Figure A-32 Cycle time of analog input modules

Settling time

See *Smoothing*.

See also

Analog electronic module 4 AI U High Feature (6ES7144-4FF00-0AB0) (Page 385)

Analog electronic module 4 AI RTD High Feature (6ES7144-4JF00-0AB0) (Page 395)

Analog electronic module 4 AI I High Feature (6ES7144-4GF00-0AB0) (Page 390)

4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 401)

A.4.7 Response times of analog output modules

Conversion time

The conversion time of the analog output channels includes the time required to apply the digitized output values from the internal memory plus the digital-to-analog conversion.

Cycle time

Conversion of the analog output channels of the module is based on a specific execution time plus the sequential conversion time at Channels 0, 1, 2 and 3.

The cycle time, i.e the time required to reconvert an analog output value, is equivalent to the cumulative conversion times of all enabled analog output channels plus the processing time of the analog output module.

The figure below provides an overview of the factors determining the cycle time of an analog output module.

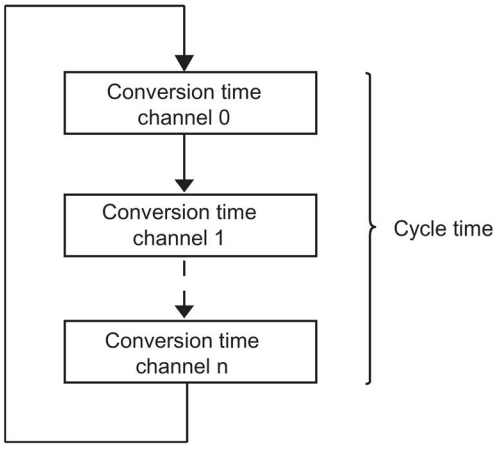


Figure A-33 Cycle time of analog output modules

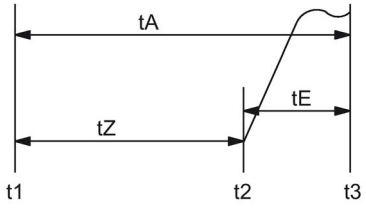
Settling time

The settling time (t_2 to t_3), meaning the time between the input of a converted value and its output at the analog output, is load-dependent. A distinction must be made between resistive, capacitive, and inductive loads.

Response time

The worst-case response time (t_1 to t_3), meaning the expiring between the input of digital output values to internal memory and the settling time of the specified value at the analog output, is equivalent to the total of the cycle time plus the settling time. The worst-case factor is given if the analog channel was converted immediately before a new output value was transferred, and is not converted again unless all other channels have been converted (cycle time).

The figure below shows the response time of an analog output channel.



t_A Response time

t_C Cycle time, equivalent to the processing time of the module plus the channel conversion time

t_S Settling time

t_1 New digital output value is available

t_2 Output value accepted and converted

t_3 Specified output value reached

Figure A-34 Response time of an analog output channel

See also

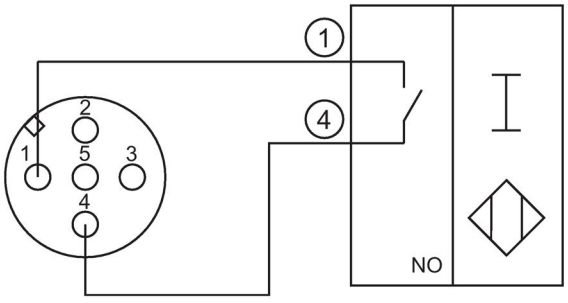
Analog electronic module 4 AO U High Feature (6ES7145-4FF00-0AB0) (Page 407)

Analog electronic module 4 AO I High Feature (6ES7145-4GF00-0AB0) (Page 412)

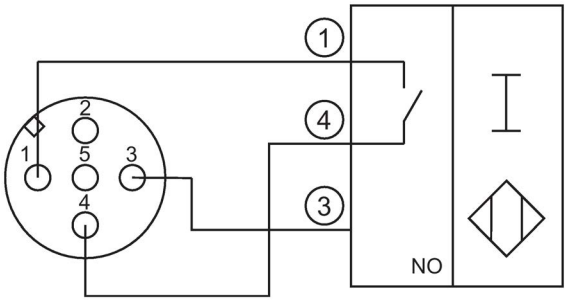
A.5 Connection examples

A.5.1 Connecting proximity switches to digital inputs

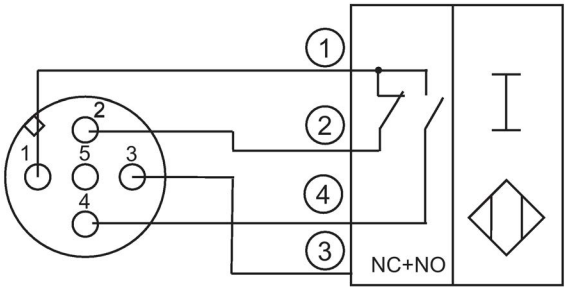
2-wire proximity switch



3-wire proximity switch



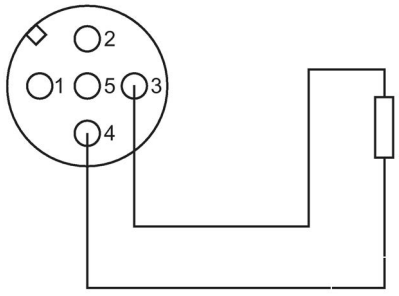
4-wire proximity switch



A.5.2 Connecting actuators to digital inputs

Connection example 4 DO DC 24V/2.0A

2-wire



A.5.3 Connection of actuator/sensor distributors to the digital inputs and outputs

Connection of an actuator/sensor distributor to the digital inputs using the connection module CM IO 2 x M12

Connection of an actuator/sensor distributor to the digital inputs using the connection module CM IO 2 x M12

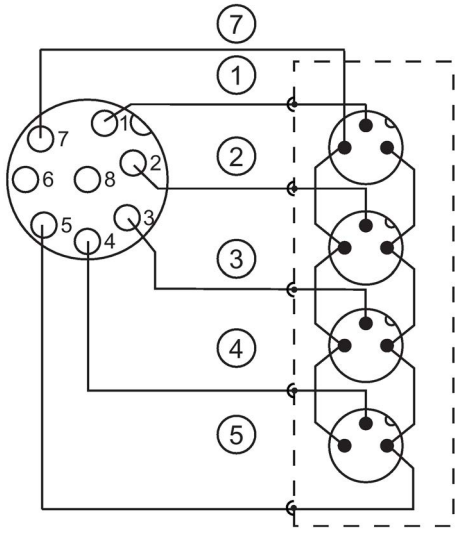


Figure A-35 Actuator/sensor distributor to digital inputs with connection module CM IO 2 x M12

Connection of an actuator/sensor distributor to the digital inputs using the connection module CM IO 1 x M23

Connection of an actuator/sensor distributor to the digital inputs using the connection module CM IO 1 x M23

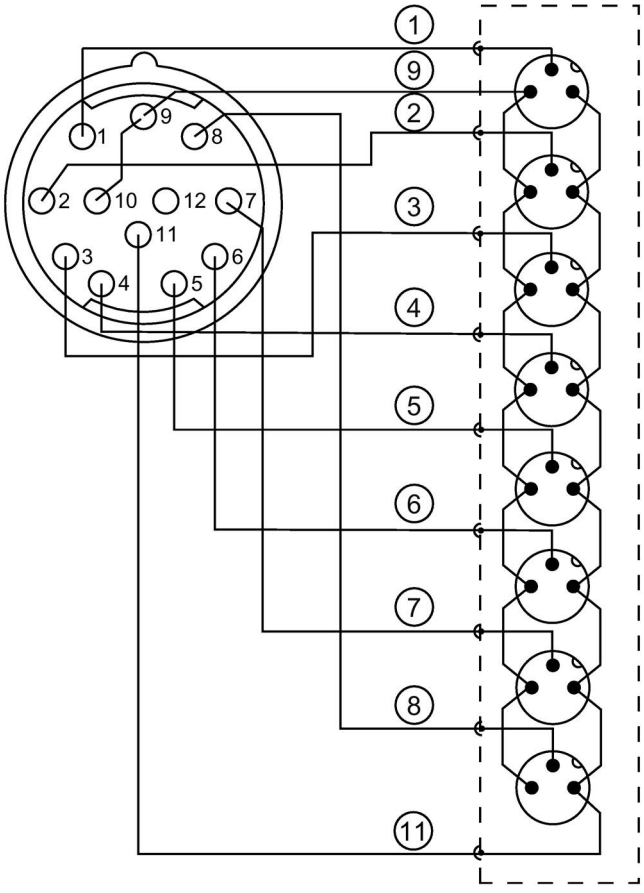


Figure A-36 Actuator/sensor distributor to digital inputs with connection module CM IO 1 x M23

Connection of an actuator/sensor distributor to the digital outputs using the connection module CM IO 2 x M12

Connection of an actuator/sensor distributor to the digital outputs using the connection module CM IO 2 x M12

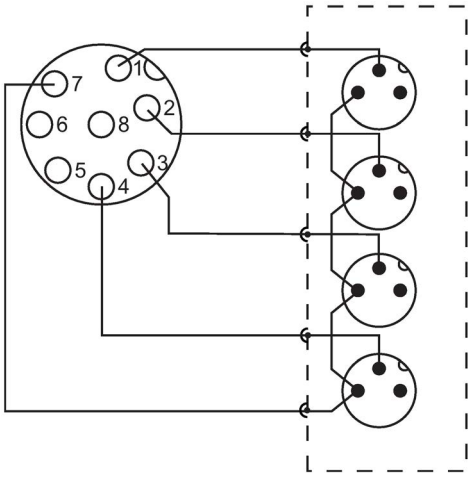


Figure A-37 Actuator/sensor distributor to digital outputs with connection module CM IO 2 x M12

Connection of an actuator/sensor distributor to the digital outputs using the connection module CM IO 1 x M23

Connection of an actuator/sensor distributor to the digital outputs using the connection module CM IO 1 x M23

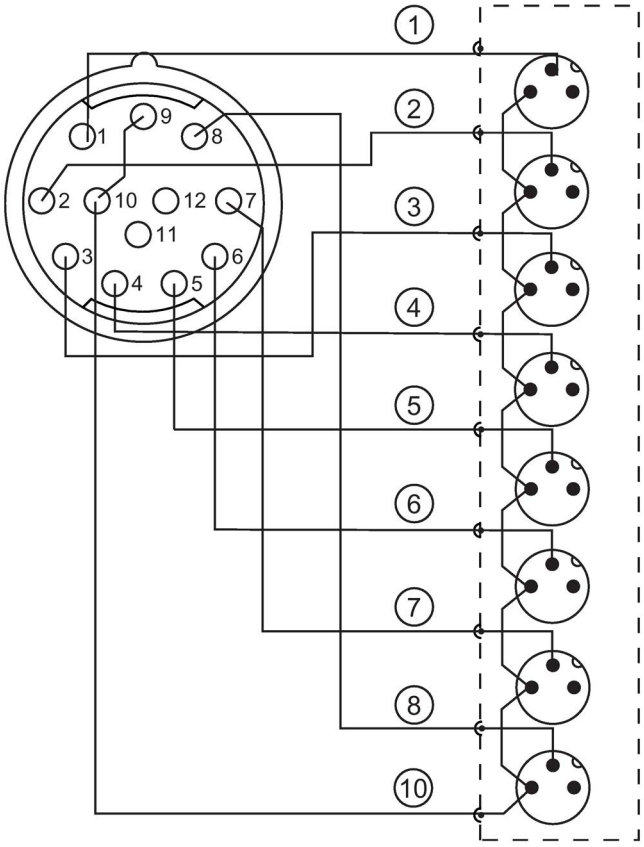
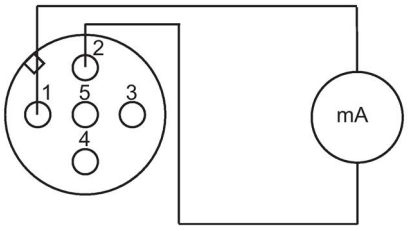


Figure A-38 Actuator/sensor distributor to digital outputs with connection module CM IO 1 x M23

A.5.4 Connecting transducers to the analog inputs

Current transmitter as 2-wire transducer

2-wire



CAUTION

2-wire transducer

A configuration as 2-wire transducer will destroy the electronic module in case of a short-circuit to encoder supply 1L+.

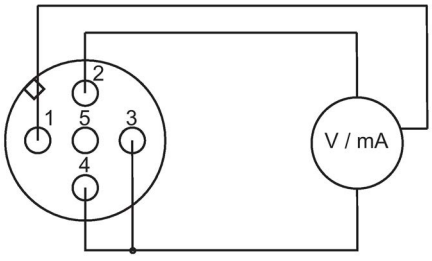
Current transmitter and voltage sensor as 4-wire transducer

3-wire

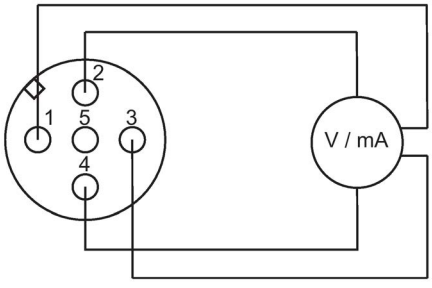
Note

Connecting a 3-wire unit

Provide for an external jumper 3/4, e.g. in the M12 connector or in the cable.



4-wire

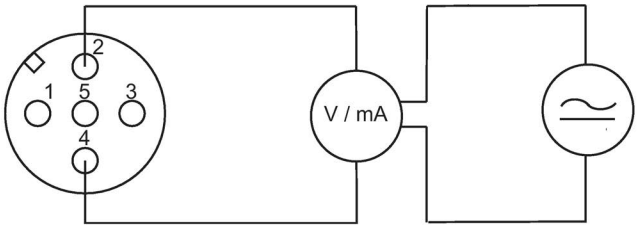


Voltage sensors and current transmitters as 4-wire transducer with external power supply

Note

Non-isolated transducers

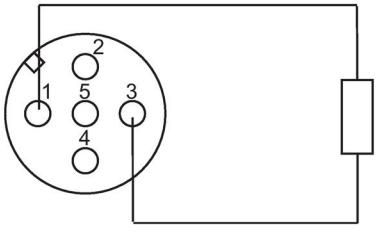
When wiring non-isolated transducers, always make sure to wire M to the correct terminal.



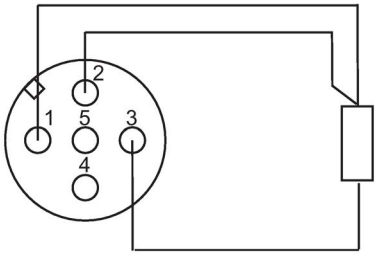
A.5.5 Connecting resistance thermometers to analog inputs

Connection example 4 AI RTD High Feature

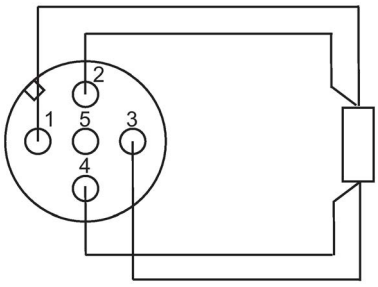
2-wire



3-wire



4-wire

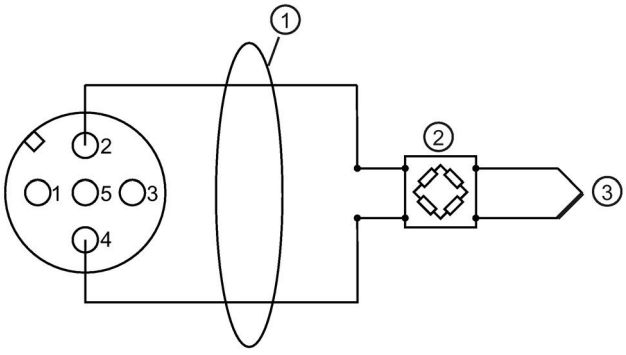


A.5.6 Connecting thermocouples to analog inputs

Introduction

The 4 AI TC High Feature analog electronic module offers various options in terms of compensating for the reference junction temperature. The connection examples reflecting these are shown below. Other types of connection may also be possible in practice, depending on local conditions.

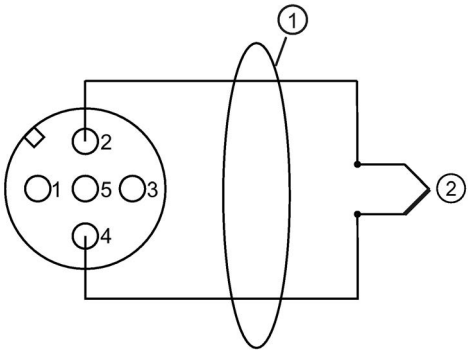
Connection example based on "No" compensation as the reference junction



① Copper cables
② E.g. compensating box (per channel); type B thermocouple does not need a compensating box
③ Thermocouple

Figure A-39 Connection example based on "No" compensation as the reference junction

Connection example based on "Internal" compensation or "Fixed ref. temp." as the reference junction

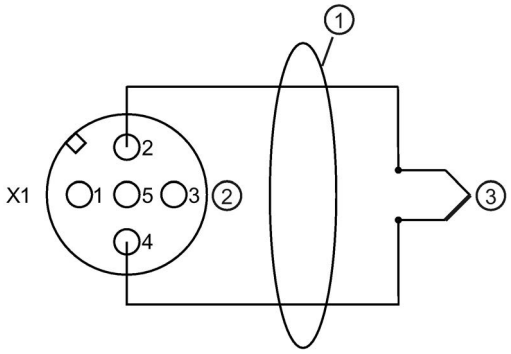


① Connecting the thermocouple directly or using compensating lines
② Thermocouple

Figure A-40 Connection example based on "Internal" compensation or "Fixed ref. temp." as the reference junction

Connection example based on "RTD (0)" as the reference junction

- With M12 compensation connector (integrated Pt1000 resistance thermometer)



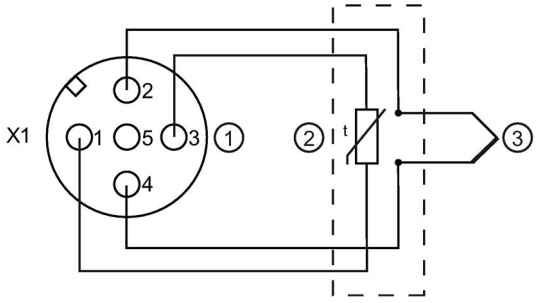
① Connecting the thermocouple directly or using compensating lines

② M12 compensation connector (terminals 1 and 3 with internal Pt1000 assigned), at circular socket connector X1 only The setpoint for the M12 compensation connector (Page 401) at circular socket connector X1 also applies to the thermocouples at X2, X3, and X4.

③ Thermocouple

Figure A-41 Connection example based on "RTD (0)" as the reference junction in the M12 compensation connector

- With external Pt1000 resistance thermometer



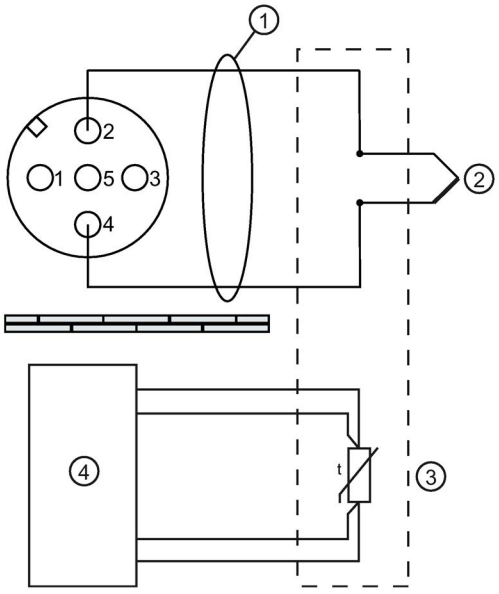
① M12 connector at circular socket connector X1 only

② External Pt1000 (α = 0.003851) in the vicinity of the reference junction with copper cables at terminals 1 and 3. The setpoint for the external Pt1000 at circular socket connector X1 also applies to the thermocouples at X2, X3, and X4.

③ Thermocouple

Figure A-42 Connection example based on "RTD (0)" as the reference junction with external Pt1000

Connection example based on "Dynamic ref. temp." as the reference junction



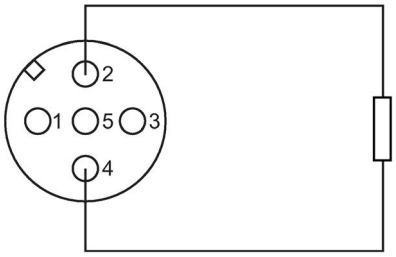
① Copper cables
② Thermocouple at 4 AI TC High Feature
③ E.g. Pt100 in the vicinity of the reference junction
④ Another station's RTD module

Figure A-43 Connection example based on "Dynamic ref. temp." as the reference junction

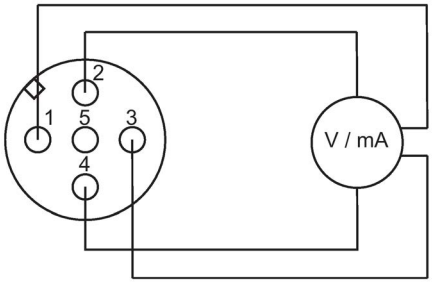
A.5.7 Connecting actuators to the analog inputs

Example connection 4 AO U High Feature and 4 AO I High Feature

2-wire



4-wire



A.6 Fail-safe shutdown of the ET 200pro Standard edition modules

Introduction

The following structure describes how to implement a fail-safe shutdown of the ET 200pro Standard modules.

Through the displayed structure (with the safety shutdown device: e.g. 3TK28), all outputs of the connected ET 200pro Standard edition modules are switched into the safe OFF state. Safety class SIL2/Category 3 is reached.

Principle of operation

The higher-level safety shutdown device, e.g. 3TK28, disconnects the supplies 2L+ and 2M (24 V). The ET 200pro Standard edition modules operated on the voltage buses 2L+ and 2M and their outputs are switched into the safe status. The supply via the 1L+ and 1M bus is not used by these modules. The connections are not occupied.

Block diagram

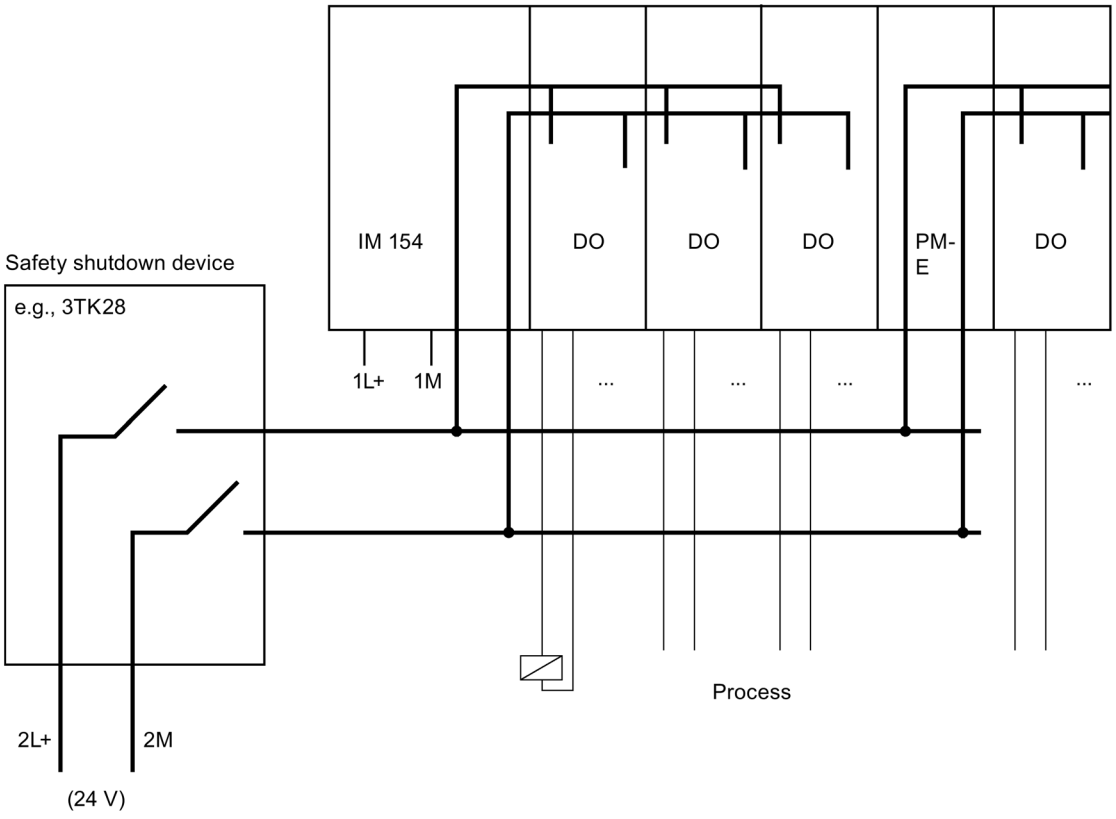


Figure A-44 Higher-level safety circuit with safety shutdown device

WARNING

To avoid cross circuits between the current-sourcing switch and current-sinking switch of a fail-safe digital output, you must route the cable for connecting the relays at the current-sourcing and current-sinking switches such that they are cross-circuit proof (e.g. through kink-proof routing in a conduit or in cable duct).

Note the EN 60204-1 standard, "Safely protected routing"!

F-switch PROFIsafe

Fail-safe shutdown (system-integrated solution, see section Placement of PM-O DC 2x24V Outgoing Module (Page 40)) is also possible with the F-switch PROFIsafe electronic module (6ES7148-4FS00-0AB0).

The fail-safe F-switch PROFIsafe records the signal states of safety-related encoders and sends corresponding safety message frames to the F-CPU. It is suitable for connecting frequency converters, motors, and output modules.

You can find additional information in the ET 200pro Distributed I/O System - Fail-Safe Modules (http://support.automation.siemens.com/WW/view/en/22098524) Operating Instructions and in the following TÜV certificate.

Request TÜV certificate (Report no. SA66851 T, Revision 1.1, June 6, 2007)

You can request copies of the TÜV certificate and the accompanying report at the following address:

Siemens AG
Automation & Drives
A&D AS RD ST
P.O. Box 1963
92209 Amberg, Germany

Glossary

Aggregate current

Accumulated current of all output channels of a digital output module.

Automation system

Programmable logic controller, consisting of at least one CPU, diverse I/O modules, and HMI devices.

Autonegotiation

Configuration protocol in the Fast Ethernet. Before the actual data transfer, the devices on the network agree on a transfer mode that each participating device can master (100 Mbps or 10 Mbps, full duplex or half duplex).

Backplane bus

Serial data bus used via which the interface module communicates with electronic modules and supplies them with power. The various modules are interconnected via bus modules.

Baud rate

Data transfer speed, defines the number of transferred bits per second.

ET 200pro supports a baud rate of between 9.6 kBaud and 12 MBaud.

Bus

Shared transfer path to which all devices are connected. It has two defined ends.

In an ET 200 system, the bus is a two-wire line or fiber-optic cable.

Bus connector

Physical connection between the bus device and the bus cable.

Bus device

Device which sends, receives and amplifies data via the bus. Example: DP master, DP slave, RS 485 repeater.

Bus segment

The bus line between two terminating resistors. Contains up to 32 → bus devices. Bus segments can be coupled via RS 485 repeaters.

Chassis ground

Chassis ground includes all the interconnected inactive parts of equipment that must not carry a hazardous voltage even in the event of a fault.

CM

Connection Module: Connection module

CM IM

Connection module for interface modules: These modules are mounted onto the interface modules. They are used to connect PROFIBUS DP, the electronics/encoder/load voltage supply.

CM IO

Connection module for electronic modules: These modules are mounted onto the electronic modules. They are used to connect sensors and actuators.

CM PM

Connection module for power modules: These modules are mounted onto the power modules. They are used to connect the 2L+ load voltage supply.

Connection to common potential

The opening of a new potential group by a power module. Allows individual connection to common potential of encoder and load supplies.

Definition of ET 200pro

ET 200pro is a modular distributed I/O system available in degrees of protection IP65, IP66, and IP67.

Device name

Because a fixed IP address is assigned to the device name, an IO device must have a device name in order to be addressed by an IO controller. With PROFINET, this procedure is used because names are easier to handle than complex IP addresses.

The assignment of a device name for a specific IO device can be compared with the setting of the PROFIBUS address for a DP slave.

An IO device is delivered without a device name. The IO device can only be addressed by an IO controller after the device has been assigned a device name with the IO supervisor/PC, for example, for the transfer of configuration data (IP address, for example) during startup or for the exchange of user data in cyclic operation.

The device name can alternatively be written in the programming device directly on the SIMATIC Micro Memory Card (for the ET 200pro IO device).

Diagnostics

The detection, localization, classification, visualization and further evaluation of errors, disturbances and alarms.

Provides monitoring functions which are executed automatically when the system is in RUN. Increases plant availability by reducing commissioning times and downtimes.

Distributed I/O systems

I/O systems that are not integrated into the central controller, but rather at distributed remote locations. Example:

- ET 200M, ET 200X, ET 200L, ET 200S, ET 200pro
- DP/AS-I Link
- S5-95U with PROFIBUS DP slave interface
- Further DP slaves supplied by Siemens or other vendors.

Distributed I/O systems are interconnected with the DP master via PROFIBUS DP.

DP master

A → master which operates in compliance with IEC 61784-1: 2010 Ed3 CP 3/1.

DP slave

A → slave which operates on PROFIBUS based on the PROFIBUS DP protocol in compliance with IEC 61784-1: 2010 Ed3 CP 3/1.

DP standard

Bus protocol of the ET 200 distributed I/O system according to IEC 61784-1:2010 Ed3 CP 3/1.

DSe

Direct starter, electronically switched

Equipotential bonding

An electrical connection (equipotential bonding conductor) that ties parts of electrical equipment and extraneous conductive parts to the same or approximately the same potential to prevent disturbing or dangerous voltages between these parts.

ET 200

An ET 200 distributed I/O system based on the PROFIBUS DP protocol supports the connection of distributed I/O to a CPU or a suitable DP master. ET 200 is characterized by high-speed response times due to a minimum data transfer volume (bytes).

The ET 200 is based on the IEC 61784-1: 2010 Ed3 CP 3/1 standard.

ET 200 operates according to the master-slave principle. The master interface IM308-C or a 315-2 DP CPU can be a DP master.

Distributed I/O ET 200M, ET 200X, ET 200L, ET 200S, or DP slaves of Siemens or other manufactures may be used as DP slaves.

Fast Ethernet

Fast Ethernet describes the standard for transferring data at 100 Mbit/s. This transmission technology utilizes the 100 Base-T standard for this.

FREEZE

Control command that the DP master sends to a group of DP slaves.

When it receives a FREEZE command, the DP slave freezes the current status of the inputs and transfers the input data cyclically to the DP master.

The DP slave freezes its input status again after each new FREEZE command.

The DP slave does not resume the transfer of input data to the DP master until the DP master has sent the UNFREEZE control command.

Grounding

Refers to the bonding of conductive elements to ground via a grounding system.

GSD file

The properties of a PROFINET device are described in a GSD file (Generic Station Description), which contains all required information for the configuration.

A PROFINET device can also be integrated into STEP 7 by means of a GSD file, in the same way as PROFIBUS.

In the case of PROFINET IO, the GSD file is in XML format. The structure corresponds to ISO 15734, the worldwide standard for device specifications.

For PROFIBUS, the GSD file is in ASCII format (according to IEC 61784-1:2002 Ed1 CP 3/1).

Hot-swapping

The removal and insertion of modules while ET 200pro is in run.

IM

Interface module: The interface module interconnects ET 200pro with the DP master and prepares the data for the electronic modules.

Industrial Ethernet

Industrial Ethernet (previously SINEC H1) is a technology that allows data to be transferred fail-safely in an industrial environment.

Standard Ethernet components can be used since PROFINET is an open system. However, we recommend setting up PROFINET as Industrial Ethernet.

Industrial Wireless LAN

In addition to data communication, Industrial Wireless LAN from SIMATIC NET with the standard IEEE 802.11, offers a multitude of extensions (I-Features) that are of great benefit to industrial users. IWLAN is particularly suited for complex industrial applications with requirement for reliable radio communication, owing to:

- Automatic roaming if connection to Industrial Ethernet is interrupted (Rapid Roaming)
- Cost savings generated by using a single wireless network for secure operation of a process with both process-critical data (e.g. alarm message) and non-critical communication (e.g. service and diagnostics)
- Cost-effective connection to devices in remote, difficult-to-access environments

Isolated

The reference potentials of the control and load circuit of isolated I/O modules are electrically isolated, for example, by means of optocouplers, relays or transformers. The I/O circuits can be connected to a common potential.

Master

A master which is in possession of the token can send data to other devices and request data from them (= active device). DP masters are, for example, the 315-2 DP CPU or IM308-C.

Non-isolated

The reference potentials of the control and load circuit of non-isolated I/O modules are electrically interconnected.

Parameter assignment

Refers to the transfer of slave parameters from the DP master to the DP slave.

PELV

Protective Extra Low Voltage = extra low voltage with safe isolation

PM

Power module: The power module provides a new potential group for the 2L+ load voltage supply.

Potential group

A group of electronic modules supplied by one power module.

Process image

The process image forms part of system memory in the DP master. At the start of the cyclic program, the signal states of the input modules are transferred to the process input image (PII). And the end of the cyclic program, the process output image (POI) is transferred to the DP slave as signal state.

PROFIBUS

PROcess FIeldBUS; German process and fieldbus standard according to IEC 61784-1:2002 Ed1 CP 3/1. Specifies the functional, electrical and mechanical characteristics of a serial bit stream fieldbus system.

PROFIBUS is available with the protocols DP (= Distributed Peripherals), FMS (= Fieldbus Message Specification), PA (= Process Automation), or TF (= Technological Functions).

PROFIBUS address

Each bus device must be assigned a unique PROFIBUS address in order to allow its identification on PROFIBUS.

PCs/PGs are assigned PROFIBUS address "0".

The ET 200pro distributed I/O system supports the PROFIBUS addresses 1 to 125.

PROFIBUS International

Technical committee dedicated to the definition and development of the PROFIBUS and PROFINET standard.

Also known as the PROFIBUS User Organization e. V.(PNO).

PROFINET

Within the framework of Totally Integrated Automation (TIA), PROFINET represents a consequent enhancement of:

- PROFIBUS DP, the established fieldbus, and
- Industrial Ethernet, the communication bus for the cell level.

Experience gained from both systems was and is being integrated into PROFINET.

PROFINET is an Ethernet-based automation standard of PROFIBUS International (previously PROFIBUS User Organization e. V), and defines a multi-vendor communication, automation, and engineering model. PROFINET has been part of the standard IEC 61158 since 2003.

See PROFIBUS International

PROFINET components

A PROFINET component encompasses the entire data of the hardware configuration, the parameters of the modules, and the corresponding user program. The PROFINET component is comprised of:

- Technological function

  The (optional) technological (software) function includes the interface to other PROFINET components in the form of interconnectable inputs and outputs.

- Device

  The device is the representation of the physical automation device or field device including the IO devices, sensors, actuators, mechanics, and device firmware.

PROFINET device

Each device has at least one Industrial Ethernet connection. A PROFINET device can also have a PROFIBUS interface as master with proxy functionality.

PROFINET IO controller

Device used to address connected I/O devices. That means: The IO controller exchanges input and output signals with assigned field devices. The IO controller is usually the controller running the automation program.

PROFINET IO device

Distributed field device which is assigned to one of the I/O controllers (e.g. remote IO, valve terminals, frequency converters, switches).

PROFINET IO

As part of PROFINET, PROFINET IO is a communication concept that is used to implement modular, distributed applications.

PROFINET IO allows you to create automation solutions which are familiar to you from PROFIBUS.

PROFINET IO is implemented by the PROFINET standard for automation devices on the one hand, and on the other hand by the engineering tool STEP 7. This means that you have the same application view in STEP 7, regardless of whether you configure PROFINET or PROFIBUS devices. Programming your user program is essentially the same for PROFINET IO and PROFIBUS DP if you use the extended blocks and system status lists for PROFINET IO.

Reference potential

Reference potential for the evaluation/measuring of the voltages of participating circuits.

SELV

Safety Extra Low Voltage

Shared device

IO device which makes its data available to multiple IO controllers.

Slave

A slave may only exchange data with a → master when requested to do so. Slaves are all DP slaves such as ET 200X, ET 200M, ET 200S.

SNMP

SNMP (Simple Network Management Protocol) is the standardized protocol for diagnosing and also configuring the Ethernet infrastructure.

In the office area and in automation technology, devices support a wide range of manufacturers on the Ethernet SNMP.

SNMP-based applications can be operated in parallel with PROFINET applications on the same network.

The scope of the supported functions varies depending on the device type. A switch, for example, has more functions than a CP 1616.

SSI

The position data is transferred synchronously according to the SSI protocol (synchronous serial interface). The SSI protocol is used with absolute value encoders.

Switch

PROFIBUS is based on a line topology. Communication devices are interconnected by means of a passive line, namely the bus.

By contrast, Industrial Ethernet is made up of point-to-point connections: Each communication device is connected directly with one other communication device.

A device is interconnected with several other communication device via the port of an active network component (switch). Other communications devices (including switches) can then be connected to the other ports of the switch. The connection between a communication device and the switch remains a point-to-point connection.

The task of a switch is thus to regenerate and distribute received signals. The switch "learns" the Ethernet address(es) of a connected PROFINET device or of other switches, and forwards only the signals intended for the connected PROFINET device or switch.

A switch has a certain number of ports. Connect only one PROFINET device or a further switch to any one of the ports.

SYNC

Control command that the DP master sends to a group of DP slaves.

The DP master outputs a SYNC control command to the DP slave in order to freeze the slave's outputs at the current value. The DP slave stores the output data contained in the next frames, but does not change the state of its outputs.

After each new SYNC control command, the DP slave sets the outputs it saved as output data. The outputs are not updated cyclically again until the DP master has sent a UNSYNC control command.

Terminating module

The ET 200pro distributed I/O system is terminated with a terminating module. An ET 200pro is not ready for operation without an inserted terminating module.

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