SIEMENS

SIMATIC

ET 200pro distributed I/O system

Operating Instructions

01/21

A5E00335544-AO

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.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Ⓟ 01/2021 Subject to change

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:

- Supplement in the section Pin assignment for the analog electronic modules (Page 111).

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.

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 local training center.

Additional information can be found on the Internet (https://support.industry.siemens.com/cs/ww/en/sc/2226).

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

Customer is responsible to prevent unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under (http://www.siemens.com/industrialsecurity).

Siemens Industry Online Support

You can find current information on the following topics quickly and easily here:

- **Product support**

  All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**

  Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**

  Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**

  For answers and solutions concerning automation technology.

- **mySupport**

  Your personal working area in Industry Online Support for messages, support queries, and configurable documents.

This information is provided by the Siemens Industry Online Support in the Internet (https://support.industry.siemens.com).

The Industry Mall is the catalog and order system of Siemens AG for automation and drive solutions on the basis of Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

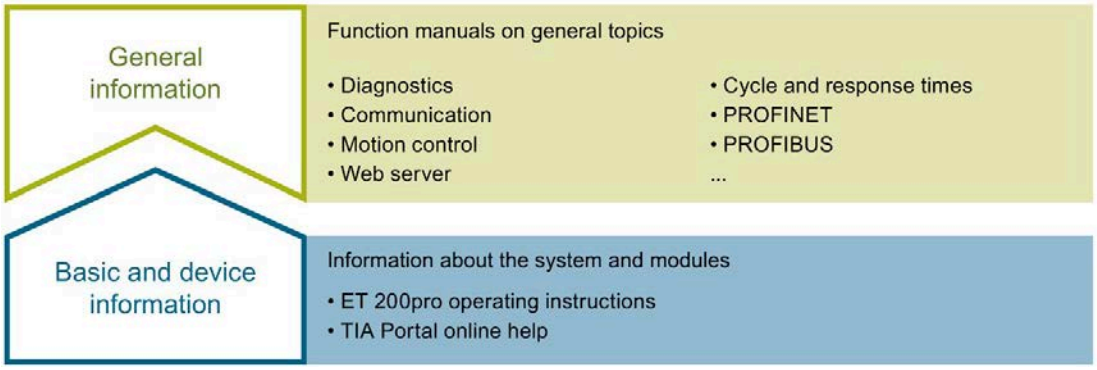
You can find catalogs for all automation and drive products on the Internet (https://mall.industry.siemens.com).

Table of contents

Documentation guide

1

The documentation for the distributed I/O system ET 200pro and for the S7-1500 based CPU 1516pro-2 PN is arranged into various areas. This arrangement enables you to access the specific content you require.



Basic and device information

The operating instructions describe in detail the configuration, installation, wiring and commissioning of the ET 200pro distributed I/O system. In addition, the operating instructions also contain device information such as properties, wiring diagrams, characteristics, and technical specifications. The STEP 7 online help supports you in the configuration and programming.

General information

The function manuals contain detailed descriptions on general topics such as diagnostics, communication, Motion Control, Web server, OPC UA.

You can download the documentation free of charge from the Internet (http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/Pages/Default.aspx).

Changes and supplements to the manuals are documented in a Product Information.

"mySupport"

With "mySupport", your personal workspace, you make the best out of your Industry Online Support.

In "mySupport", you can save filters, favorites and tags, request CAx data and compile your personal library in the Documentation area. In addition, your data is already filled out in support requests and you can get an overview of your current requests at any time.

You must register once to use the full functionality of "mySupport".

You can find "mySupport" on the Internet (https://support.industry.siemens.com/My/ww/en).

"mySupport" - Documentation

In the Documentation area in "mySupport" you can combine entire manuals or only parts of these to your own manual.
You can export the manual as PDF file or in a format that can be edited later.

You can find "mySupport" - Documentation on the Internet (http://support.industry.siemens.com/My/ww/en/documentation).

"mySupport" - CAx data

In the CAx data area in "mySupport", you can access the current product data for your CAx or CAe system.

You configure your own download package with a few clicks.

In doing so you can select:

- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files
- 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).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independent of the TIA Portal.

General function overview:

- Network browsing and creation of a table showing the accessible devices in the network.
- Flashing of device LEDs or HMI display to locate a device
- Downloading of addresses (IP, subnet, gateway) to a device
- Downloading the PROFINET name (station name) to a device
- Placing a CPU in RUN or STOP mode
- Setting the time in a CPU to the current time of your PG/PC
- Downloading a new program to a CPU or an HMI device
- Downloading from CPU, downloading to CPU or deleting recipe data from a CPU
- Downloading from CPU or deleting data log data from a CPU
- Backup/restore of data from/to a backup file for CPUs and HMI devices
- Downloading service data from a CPU
- Reading the diagnostics buffer of a CPU
- Performing a CPU memory reset
- Resetting devices to factory settings
- Downloading a firmware update to a device

You can find the SIMATIC Automation Tool on the Internet (https://support.industry.siemens.com/cs/ww/en/view/98161300).

PRONETA

With SIEMENS PRONETA (PROFINET network analysis), you analyze the PROFINET network during commissioning. PRONETA features two core functions:

- The topology overview independently scans PROFINET network and all connected components.
- The IO check is a fast test of the wiring and the module configuration of a system.

You can find SIEMENS PRONETA on the Internet (https://support.industry.siemens.com/cs/ww/en/view/67460624).

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and optimal exploitation of resources

You can find SINETPLAN on the Internet (https://www.siemens.com/sinetplan).

Description

2

2.1 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

2.2 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.

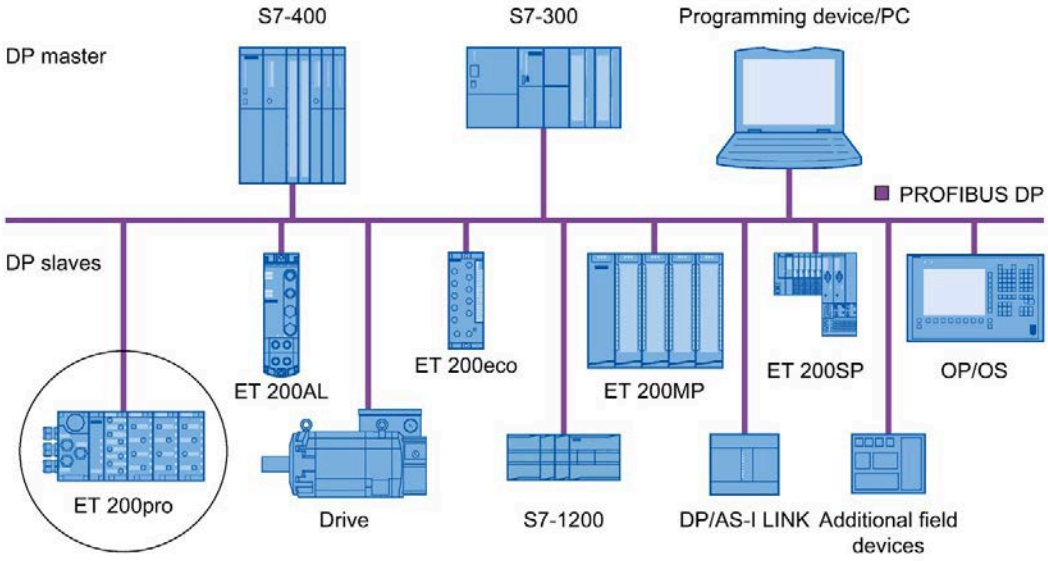


Figure 2-1 Typical configuration of a PROFIBUS DP network

2.3 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.

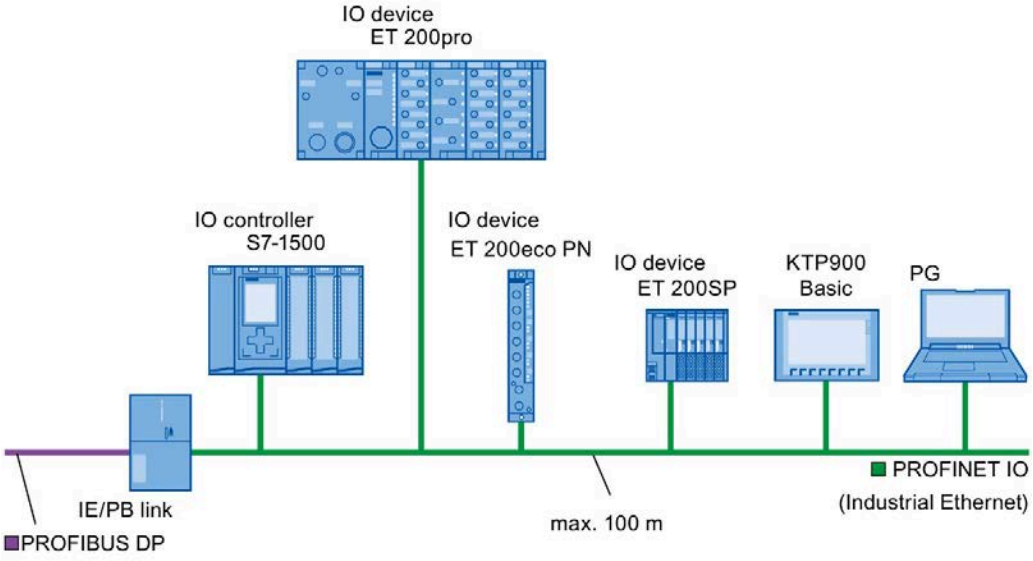


Figure 2-2 Structure of a PROFINET IO network

2.4 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 generally comprises:

- An interface module that transfers data to the DP master/IO controller
- Up to 16 electronic modules with maximum 1 m mounting width (without rack)

  Note

  Maximum mounting width

  When the IM 154-3 PN HF interface module is used, the maximum mounting width is 1.2 m (without a rack).

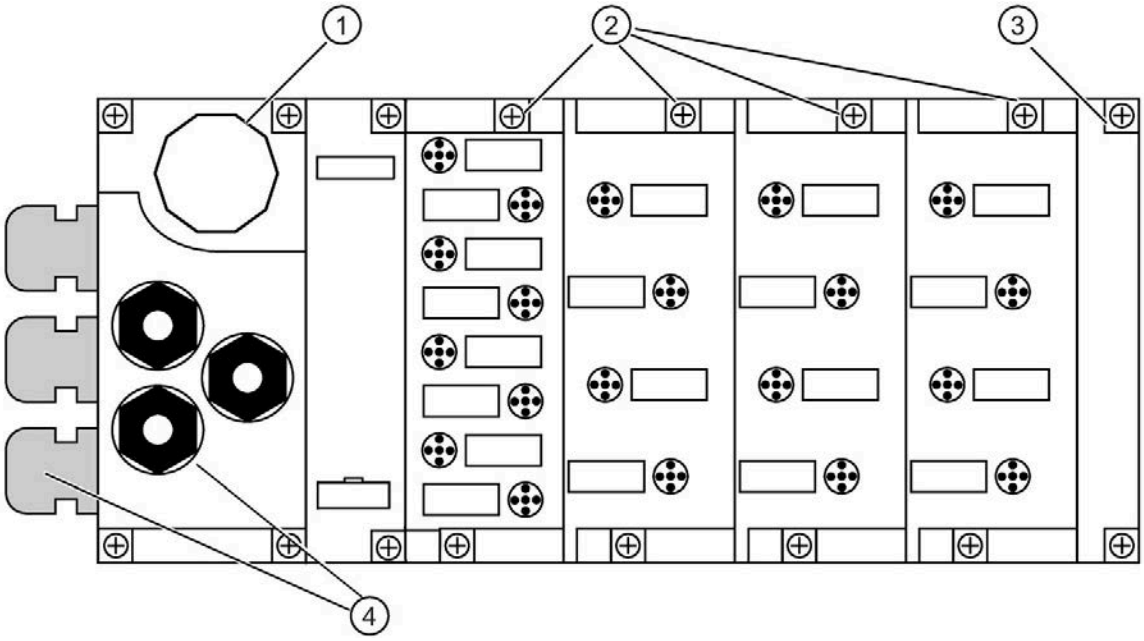
- Connection modules in various designs for:
  - PROFIBUS DP
  - PROFINET IO
  - Supply voltages
  - Inputs and outputs
- Power modules for opening new potential groups and outgoing modules for tapping supply voltages
- Pneumatic interface modules for coupling FESTO valve islands
- Motor starters
- Frequency converters
- RFID systems

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.



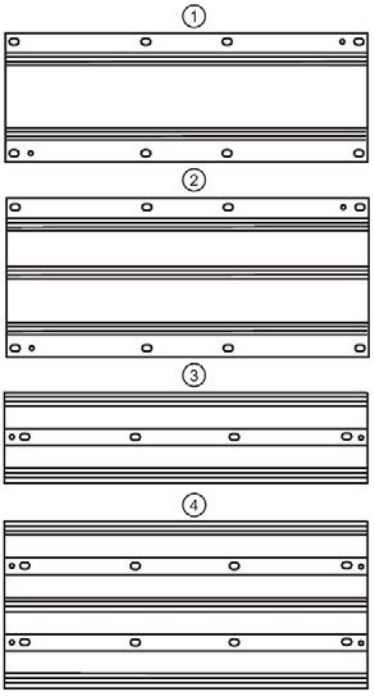
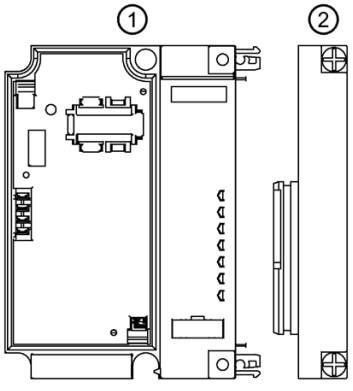
① CM IM DP Direct connection module for the interface module
② Connection modules for electronic modules
③ Terminating module
④ Cable glands for the cables on the connection module

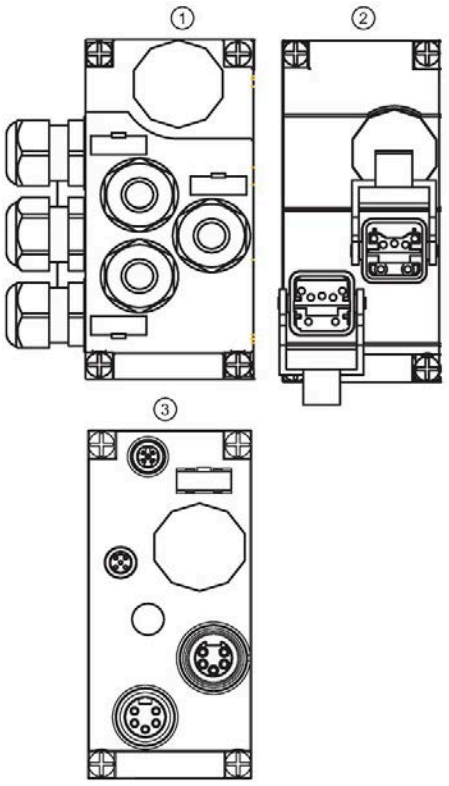
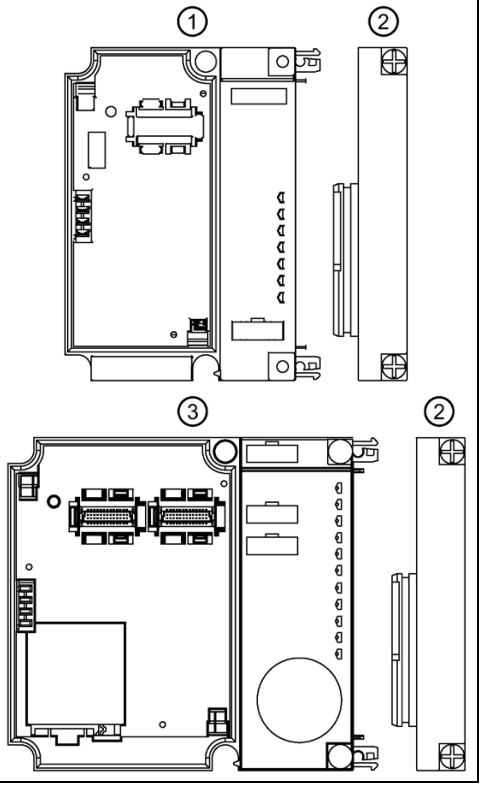
2.5 Components of the ET 200pro distributed IO system

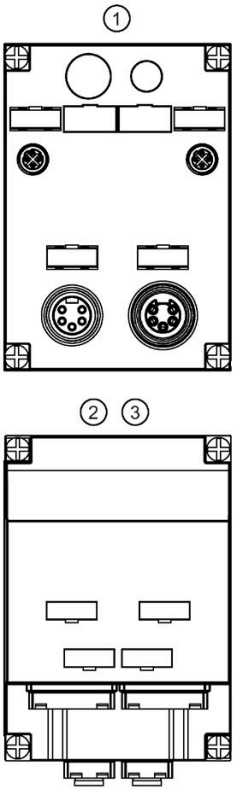
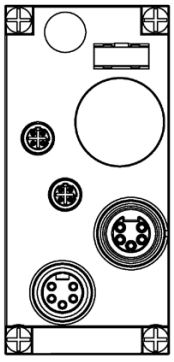
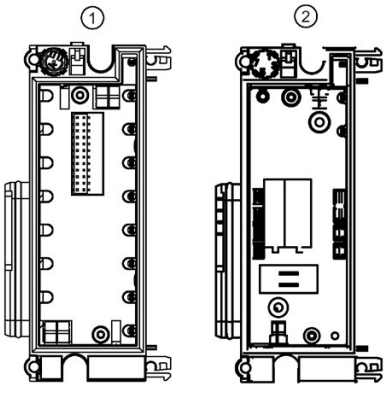
Components of the ET 200pro distributed I/O system

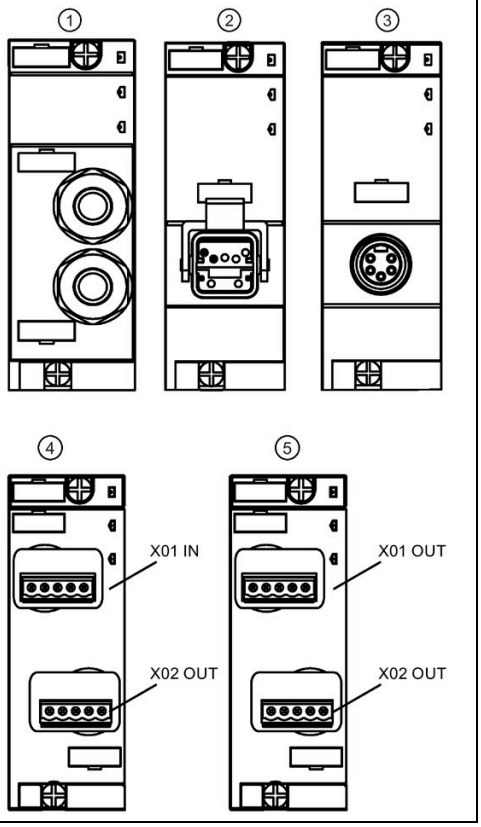
The table below lists the most important components of ET 200pro (Page 456).

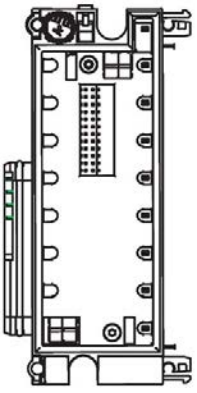
Table 2- 1 Components of ET 200pro

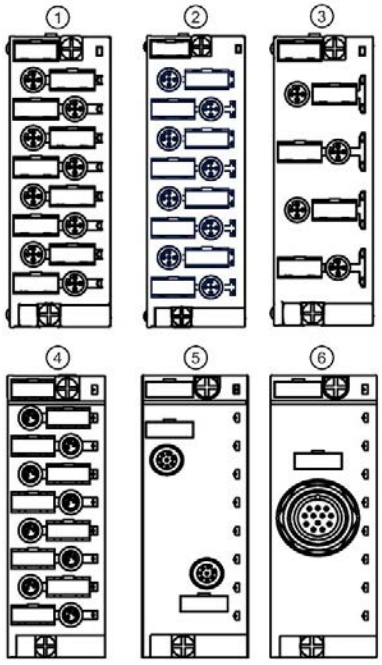
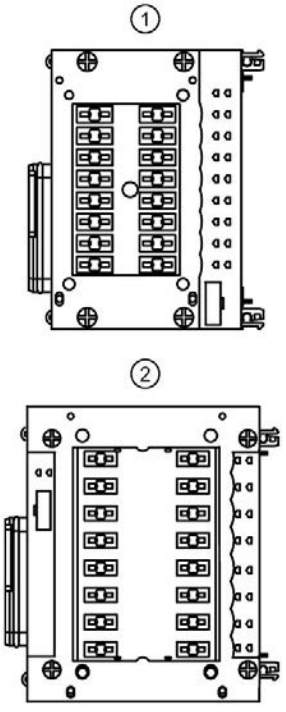
Component	Function	View
Rack	The ET 200pro is mounted onto the rack. 4 versions with different lengths are available: • Rack, narrow ① • Rack, wide ② • Rack, compact-narrow ③ • Rack, compact-wide ④	
Interface module for PROFIBUS DP with bus module and terminating module	The interface module interconnects 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 termination module ② is included and the interface module is installed on the bus module in the factory state. The following interface modules are available for PROFINET IO: • IM 154-3 PN High Feature (6ES7154-3AB00-0AB0) ① • IM 154-4 PN High Feature (6ES7154-4AB10-0AB0) ③	

Component	Function	View
Connection modules for the interface module (6ES7154-4AB10-0AB0) 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	
Connection module for the interface module (6ES7154-3AB00-0AB0) with PROFINET IO	The connection module is mounted on the interface module. It is used to connect PROFINET IO and the electronics, encoder, and load voltage supplies. The following connection module is available: • CM IM PN M12, 7/8" S	
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 CPV10① • 16 DO DC 24V CPV14②	

Application Planning

3

3.1 Modular system

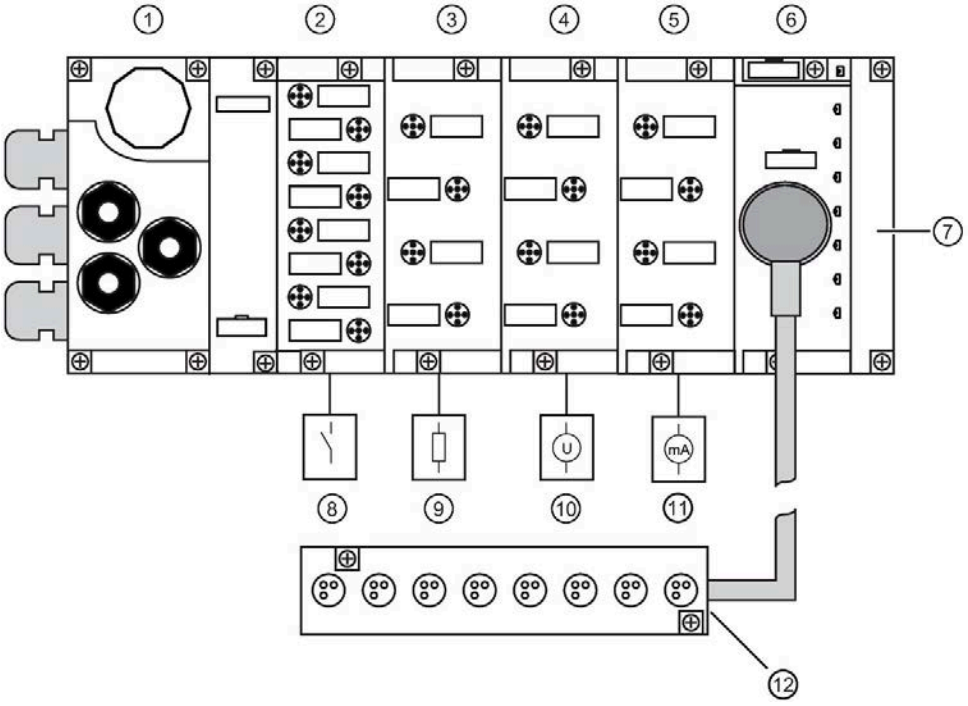
Modular system

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.

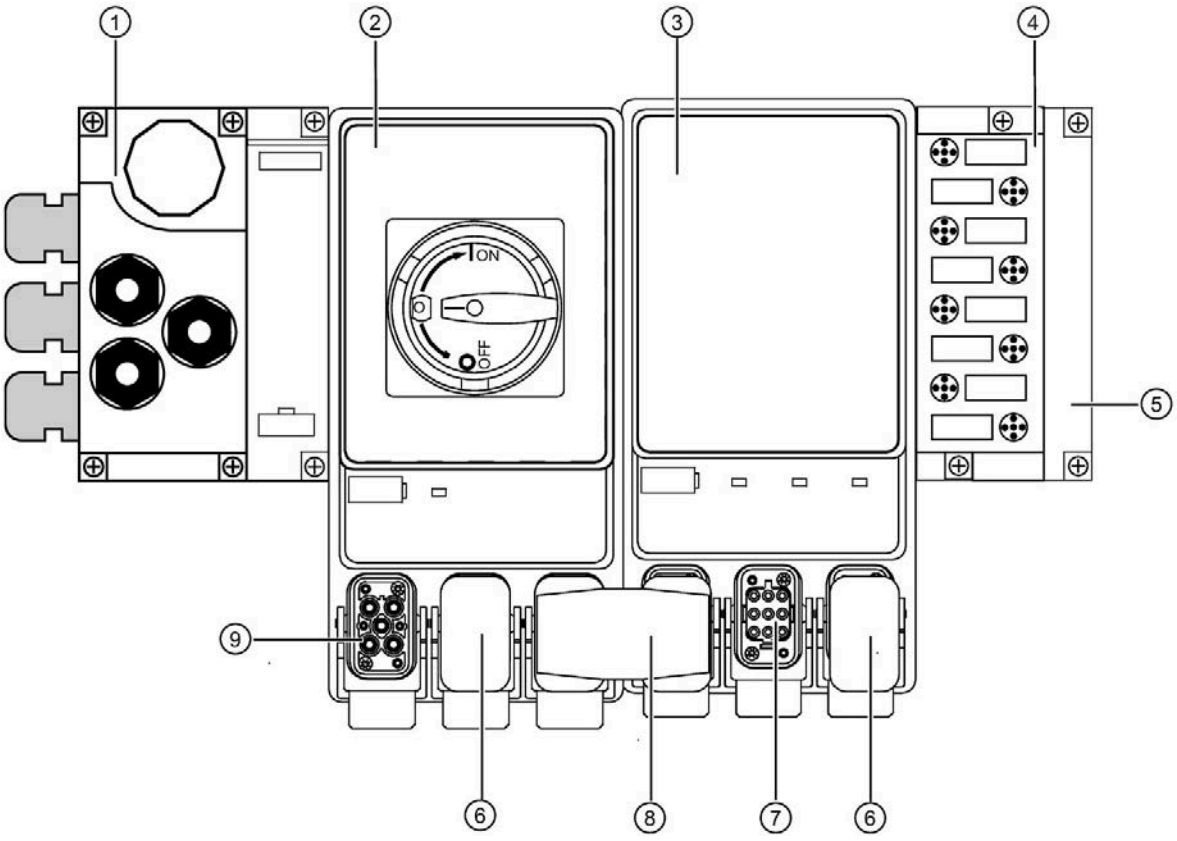


① IM/CM IM DP Direct
② 8 DI DC 24V
③ 4 DO DC 24V/2.0A
④ 4 AI U HF
⑤ 4 AI I HF
⑥ 8 DI DC 24V
⑦ Terminating module
⑧ 8 x switches, sensors
⑨ 4/8 x load
⑩ 4 x voltage measurement
⑪ 4 x current measurement for 2-/4-wire measuring transducer
⑫ Actuator/sensor distributor on the CM IO 1 x M23 connection module

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

3.2 Interface modules to suit your application

Interface module selection guide

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

Table 3- 1 Interface modules to suit your application

Application	Suitable module	Properties of the module	Maximum mounting width
DP slave for PROFIBUS DP	IM 154-1 DP	DPV0 slave DPV1 slave	1.0 m
	IM 154- 2 DP High Feature	DPV0 slave DPV1 slave Application of ET 200pro fail-safe modules	
IO devices for PROFINET IO	IM 154- 3 PN High Feature	IO device Application of ET 200pro fail-safe modules	1.2 m
	IM 154- 4 PN High Feature		1.0 m

3.3 Electronic modules to suit your application

Electronic module selection guide

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

Table 3- 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

Application	Suitable module	Properties of the module
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
Connection of IO-Link devices	4 IO-LINK High Feature see manual ET 200pro IO-Link Master (https://support.industry.siemens.com/cs/ww/en/view/109738534)	4 IO-Link ports (Port Class B)
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
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 (https://support.industry.siemens.com/cs/ww/en/view/109738885) operating instructions.	

3.4 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 3- 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 interface modules with PROFINET IO

Table 3- 4 Which connection module is suitable for the interface module with PROFINET IO?

Interface module	Application	Connection module
IM 154-3 PN High Feature	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" S
IM 154-4 PN High Feature	Connecting and forwarding PROFINET IO via the M12 cable connector Connecting and forwarding the supply voltages via the 7/8" cable connector	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 power modules

Table 3- 5 Which connection module is suitable for the power/outgoing module?

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

Connection modules for the electronic module

The section "Options for combining modules" includes an overview in the table Electronic modules in combination with connection modules (Page 34) to show you which connection module can be combined with which electronic module.

See also

Options for Combining Modules (Page 33)

3.5 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 3- 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 3- 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" S	CM IM PN M 12, 7/8"	CM IM PN PP Cu	CM IM PN PP FO
IM 154-1 DP	•	•	•				
IM 154-2 DP High Feature	•	•	•				
IM 154-3 PN High Feature				•			
IM 154-4 PN High Feature					•	•	•

Possible combinations of electronic modules and connection modules

Table 3- 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	•							

3.6 Placing Power Modules

3.6.1 Placement of PM-E power module

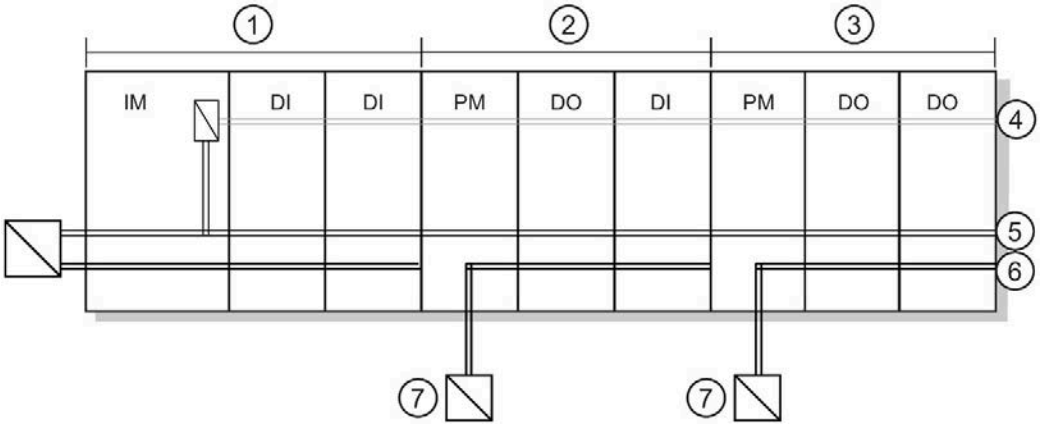
Power modules

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 312)

3.6.2 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.

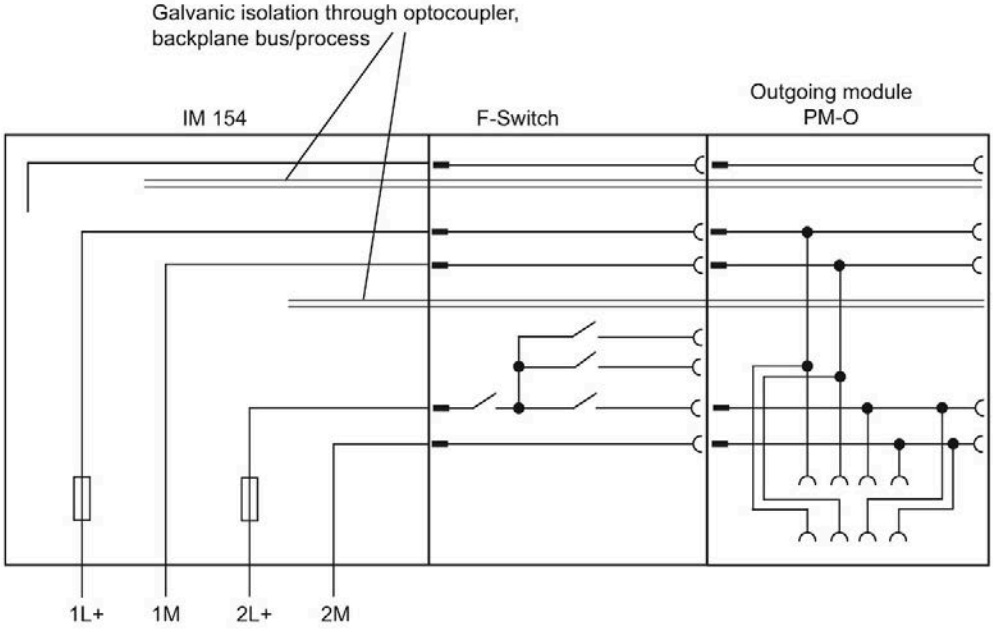
You can install additional power and electronic modules on the right of the outgoing module.

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 317)

3.7 Maximum configuration

Mechanical maximum configuration

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

Table 3- 9 Mechanical maximum configuration

Properties	Rule
Number of modules	max. 16 electronic modules
Width of ET 200pro	Maximum 1 m mounting width without rack When using the IM 154-3 PN HF: Max. 1.2 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 3- 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

4 Mounting

4.1 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 (https://support.industry.siemens.com/cs/ww/en/view/109738885) 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.

4.2 Rack

4.2.1 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.

4.2.2 Mounting wide and narrow racks

Introduction

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

Dimensions for the narrow rack

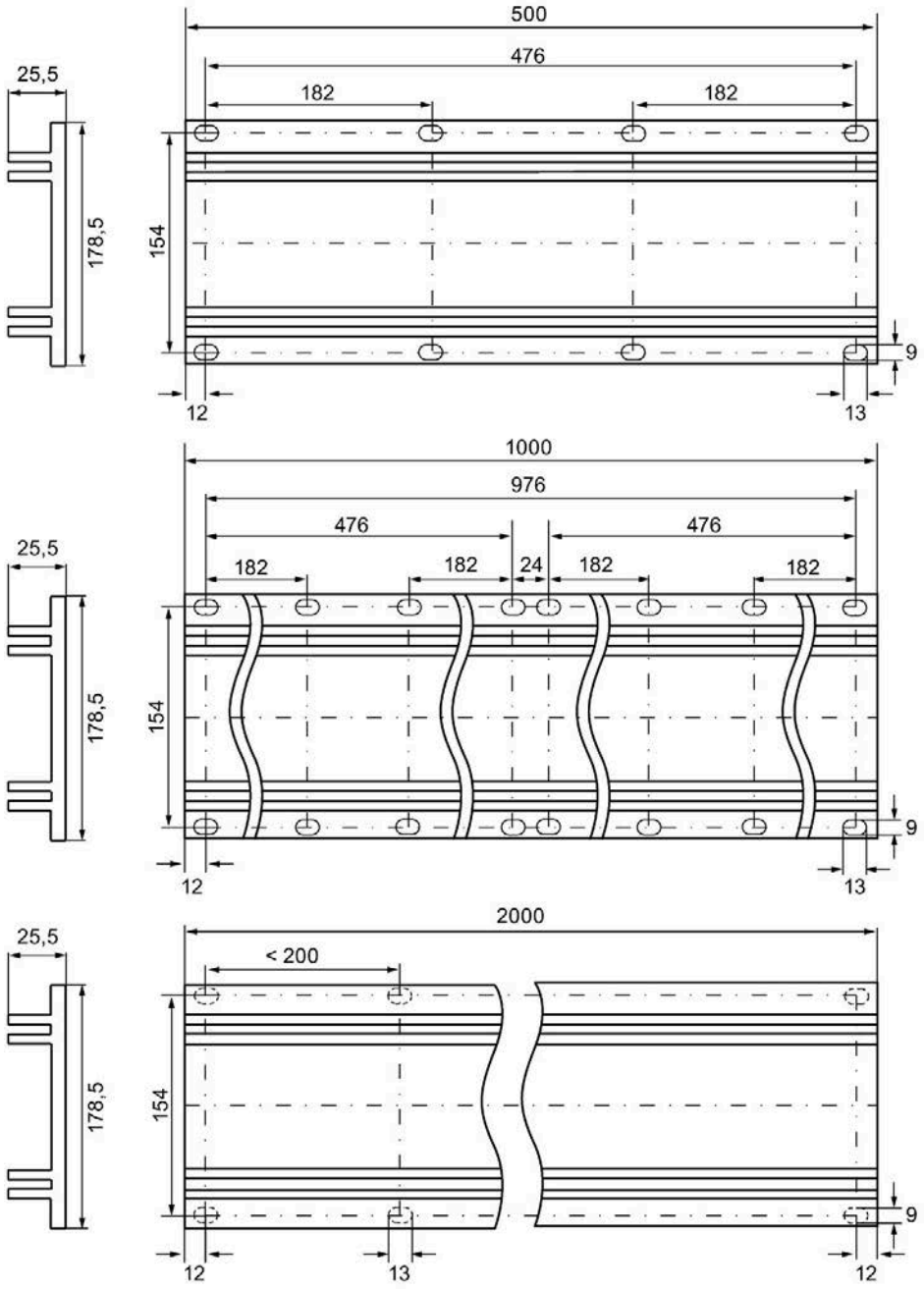


Figure 4-1 Dimension drawing for narrow rack

Dimensions for the wide rack

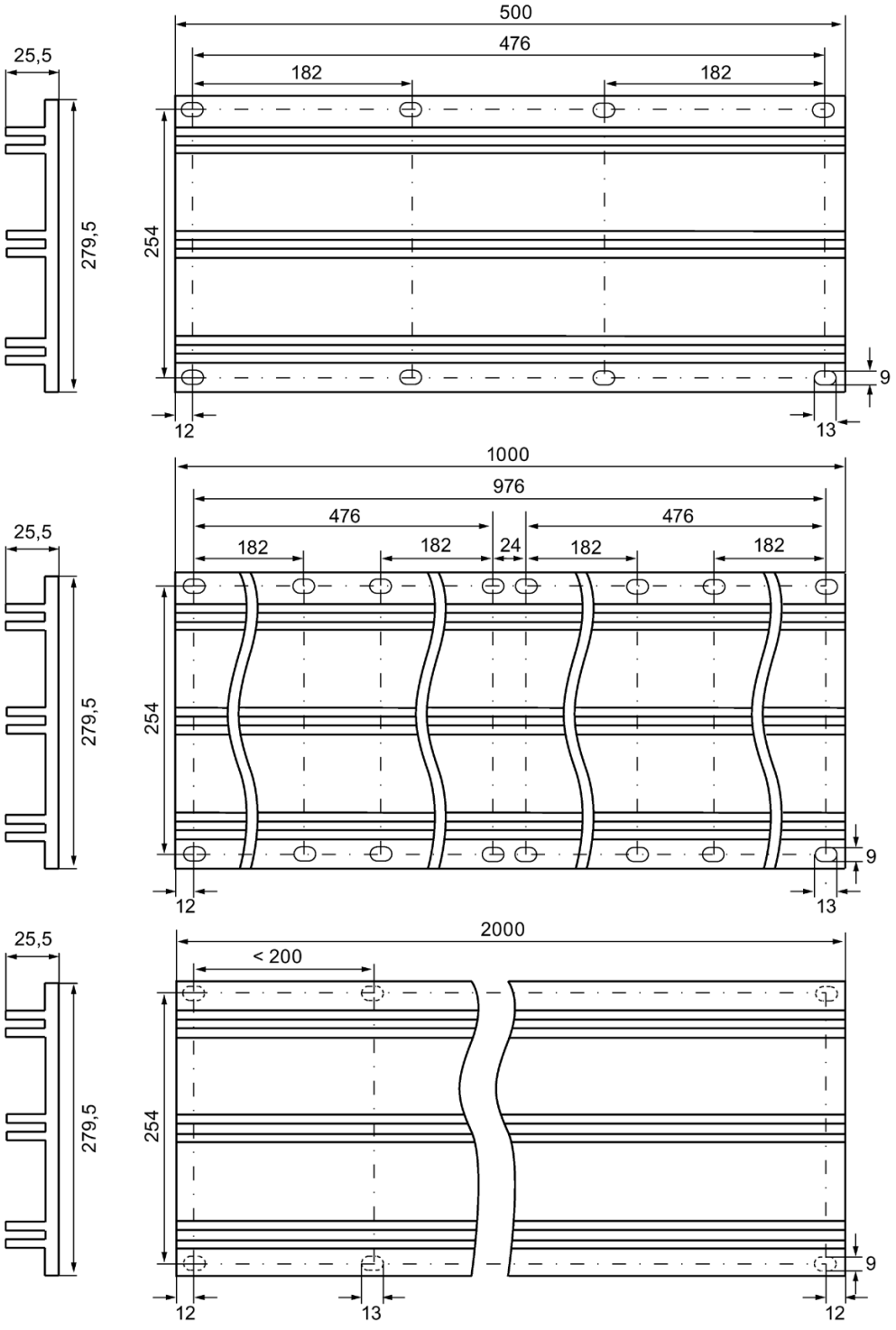


Figure 4-2 Dimension drawing for the wide rack

Required tools

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

Required accessories

Table 4- 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.

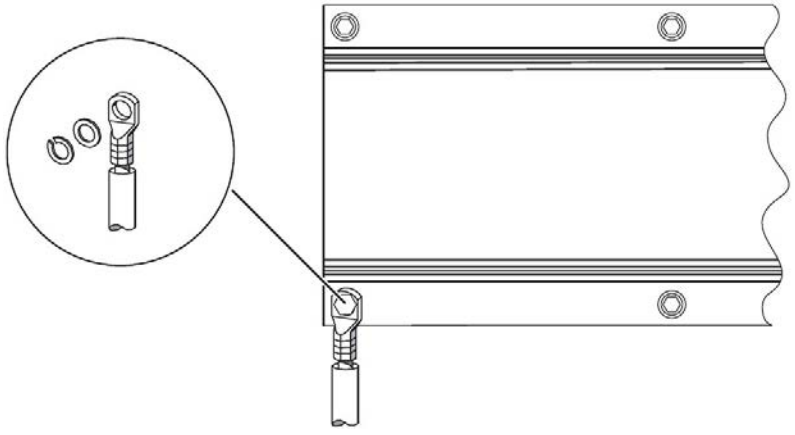


Figure 4-3 Grounding a narrow rack

4.2.3 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.

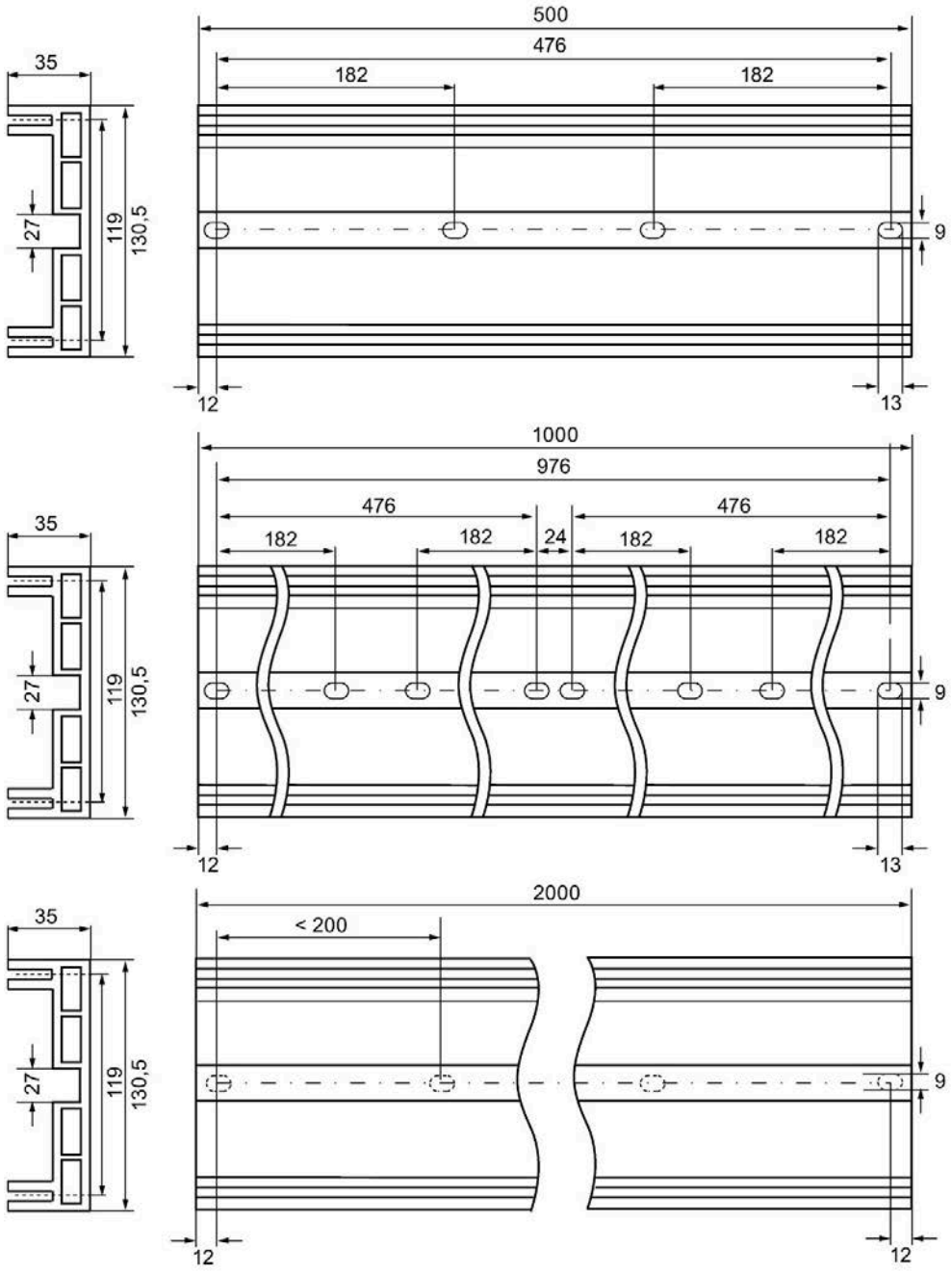


Figure 4-4 Dimension drawing of compact-narrow rack

Dimensions of the compact-wide rack

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

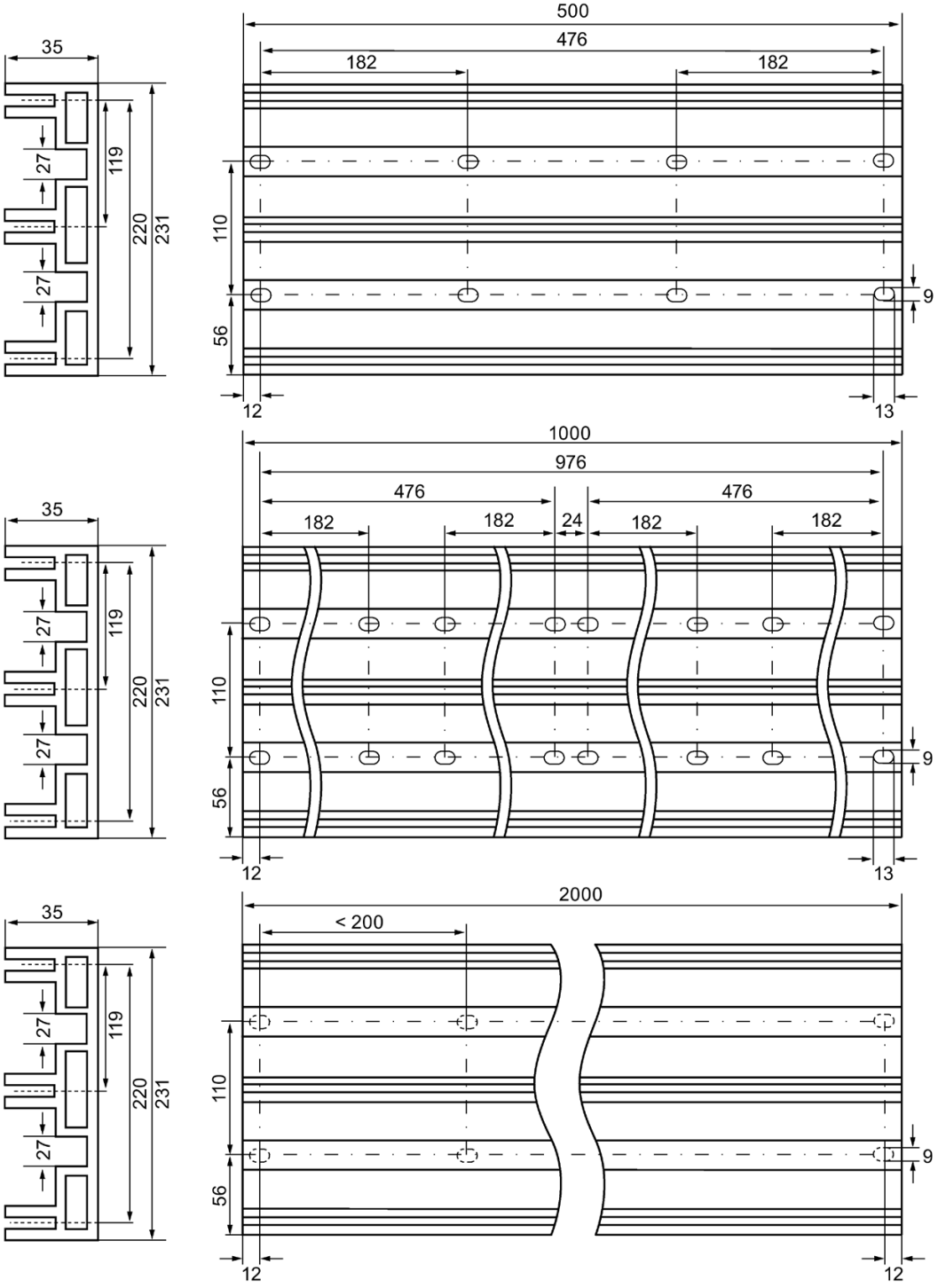


Figure 4-5 Dimension drawing of compact-wide rack

Required tools

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

Required accessories

Table 4- 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.

4.3 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

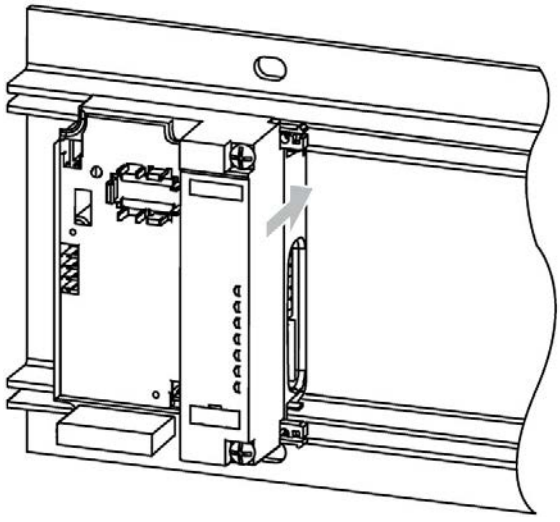


Figure 4-6 Mounting the interface module for PROFIBUS DP (example)

4.4 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.

4.5 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.

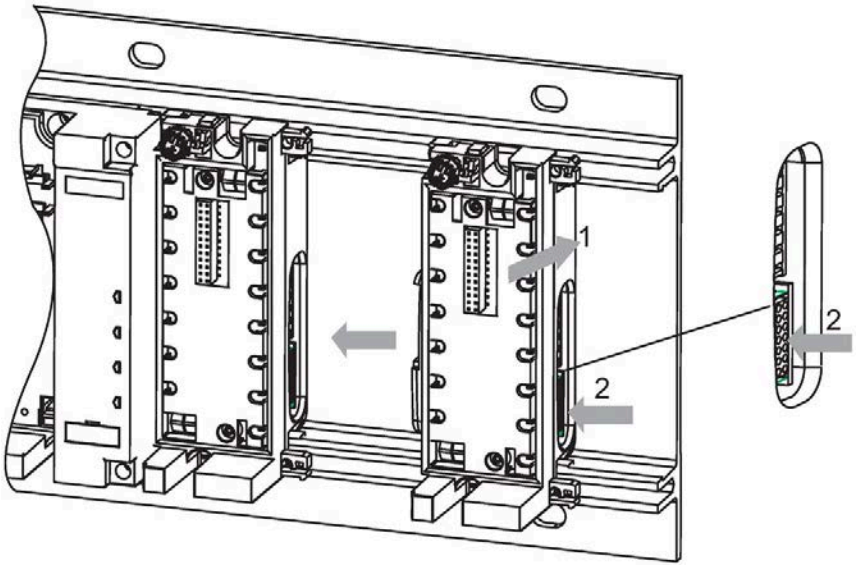


Figure 4-7 Mounting electronic modules

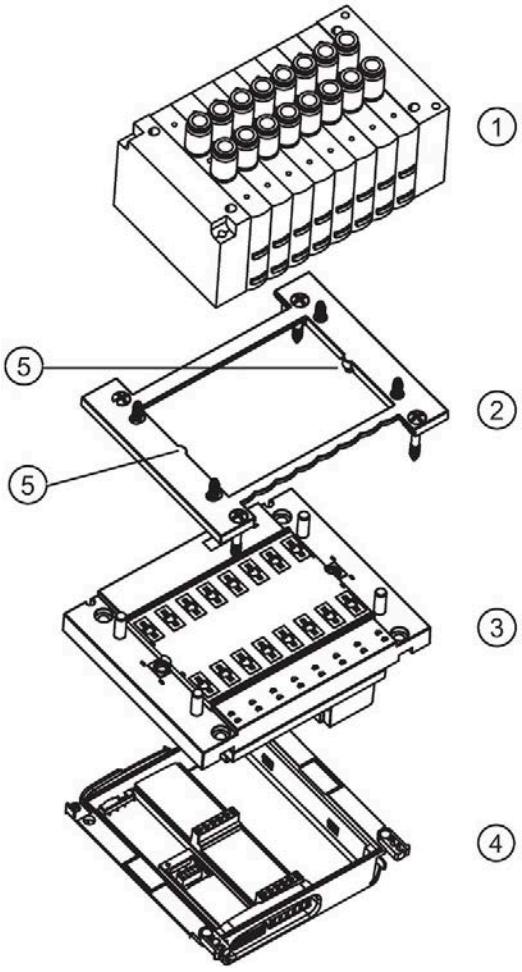
See also

Replacing a bus module (Page 149)

4.6 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 4-8 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 442).

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.

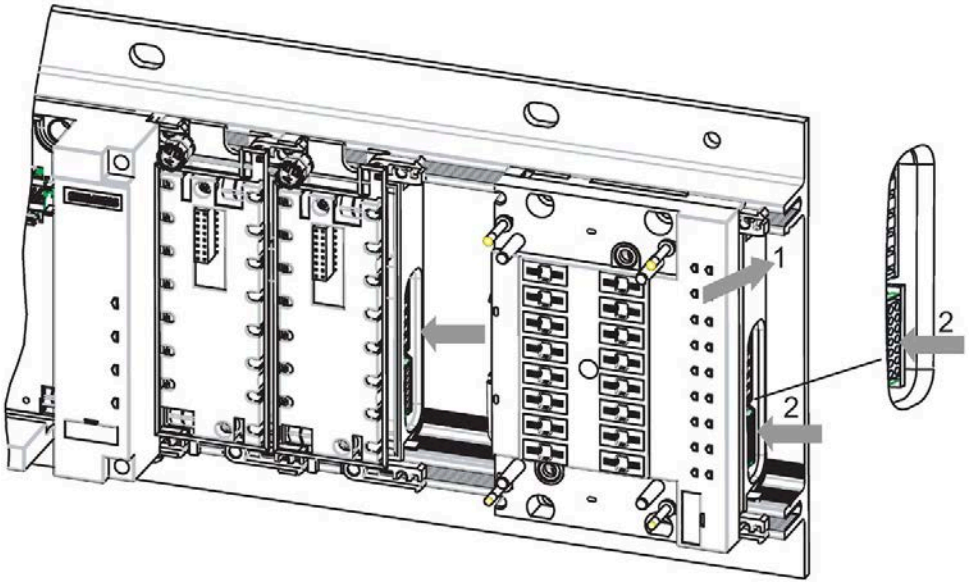


Figure 4-9 Mounting the pneumatic interface module on the rack

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.

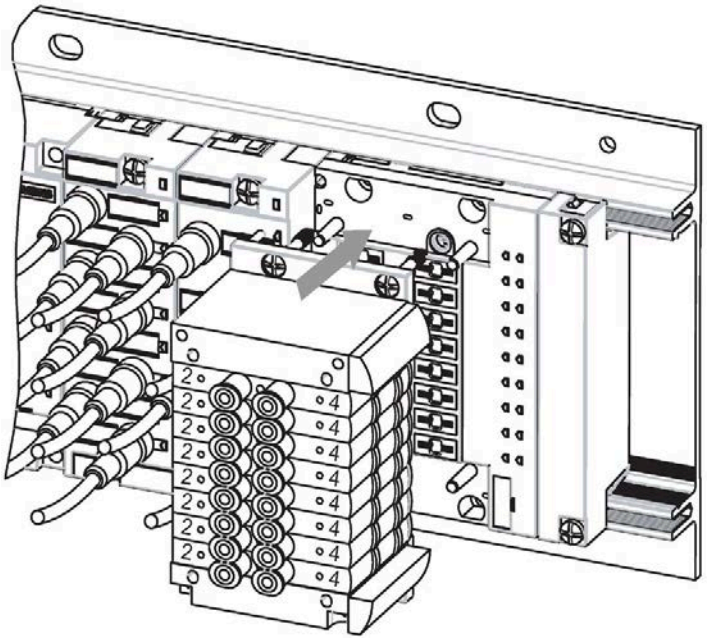


Figure 4-10 Mounting the FESTO valve terminal on the pneumatic interface module

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.

4.7 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.

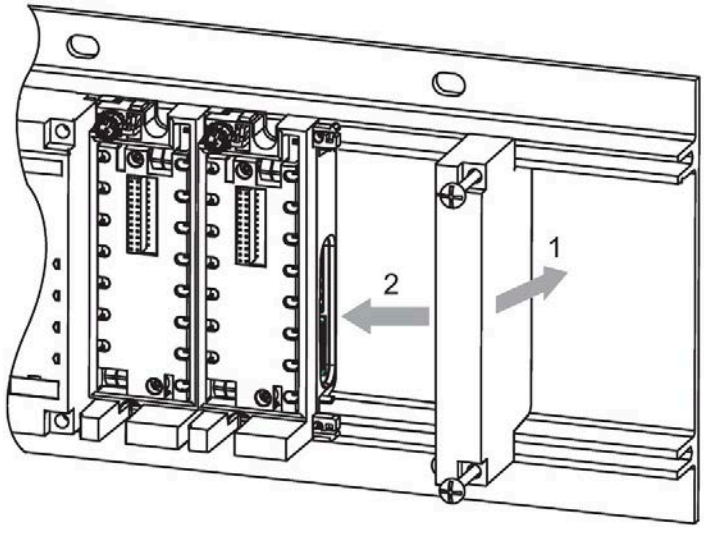


Figure 4-11 Mounting the terminating module

4.8 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

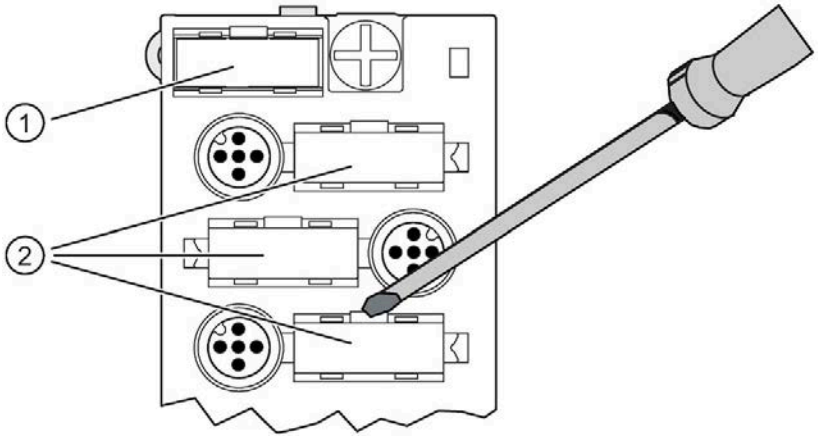
You may use module tags to identify the module class. The tags are available in blue, green, white and red.

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

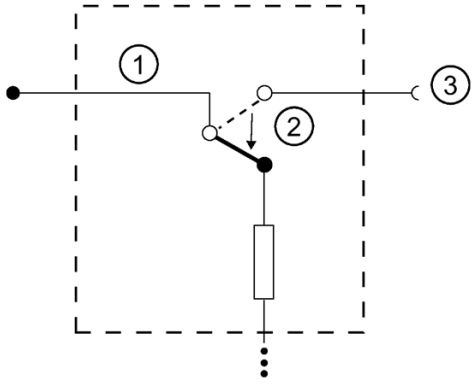
Figure 4-12 Replacing labels

4.9 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

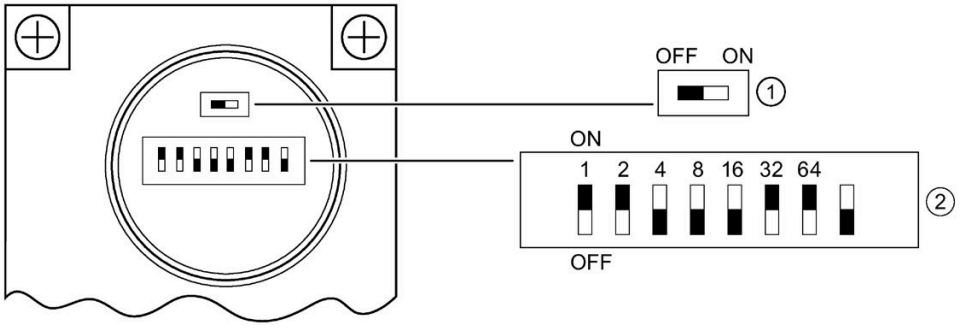
1. Remove the cap from the connection module.
2. Set the PROFIBUS DP address using the DIP switches (see the example below).
3. If this ET 200pro is the last node on PROFIBUS DP, enable the terminating resistor using the DIP switch.

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 141)

Connection 5

5.1 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 section 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 scenario

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

EMERGENCY STOP devices

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 startup after certain events

The table below shows what you have to observe when restarting a plant after certain events.

If ...	then ...
Startup after a voltage dip or power failure, Startup of the ET 200pro after an interruption of bus communication,	no dangerous operating states may occur. If necessary, "EMERGENCY STOP" must be forced!
Startup after engaging the "EMERGENCY STOP" device,	must not result in uncontrolled or undefined startup.

External fuses/switches

External fuses and switches must be installed so that they meet the standards for cable and device protection applicable to your application.

24 V DC supply

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

For ...	You must give heed to ...	
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 supply	Safety (electrical) extra-low voltage isolation (SELV/PELV)	
Loop-through of the supply voltage	Voltage drop with loop-through	

Protection against external electrical interference

The table below shows the measures you need to take to protect your system against electrical interference or faults.

For ...	Make sure that ...
All plants or systems in which the ET 200pro is integrated	the plant or system is grounded in compliance with EMC requirements in order to dissipate electromagnetic interferences.
Supply, signal and bus cables	the cable routing and installation is correct.
Signal and bus lines	a cable or conductor break does not result in undefined plant or system states.

See also

Commissioning ET 200pro (Page 141)

5.2 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).

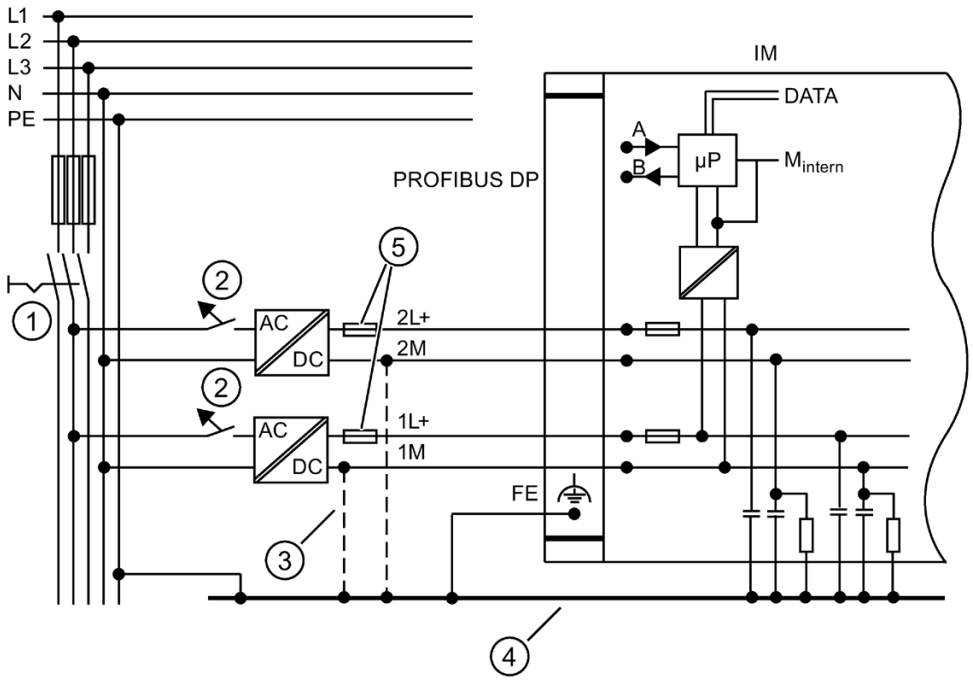
Components and protective measures

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.

5.3 Electrical Configuration of ET 200pro

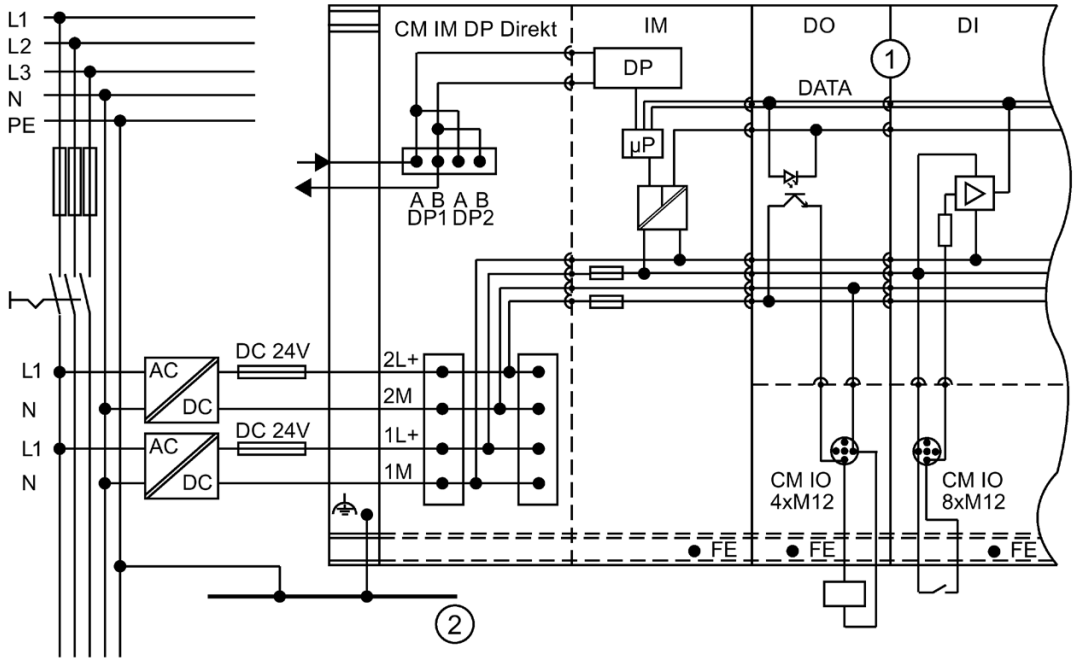
Electrical isolation

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.



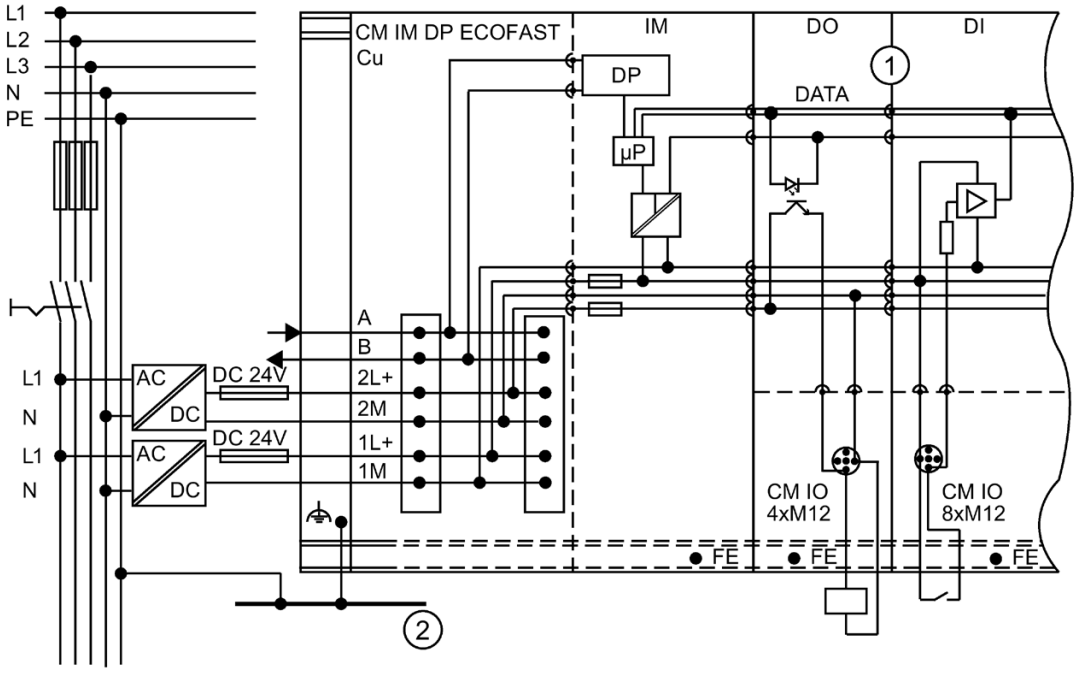
① Backplane bus

② Main ground line

Figure 5-1 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.



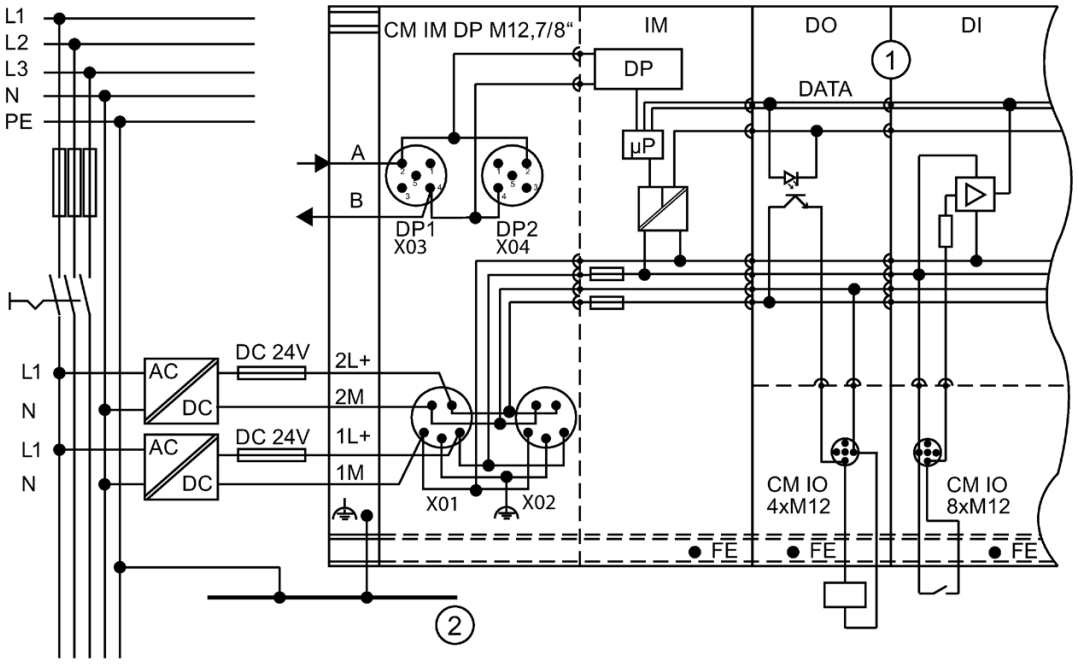
① Backplane bus

② Main ground line

Figure 5-2 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

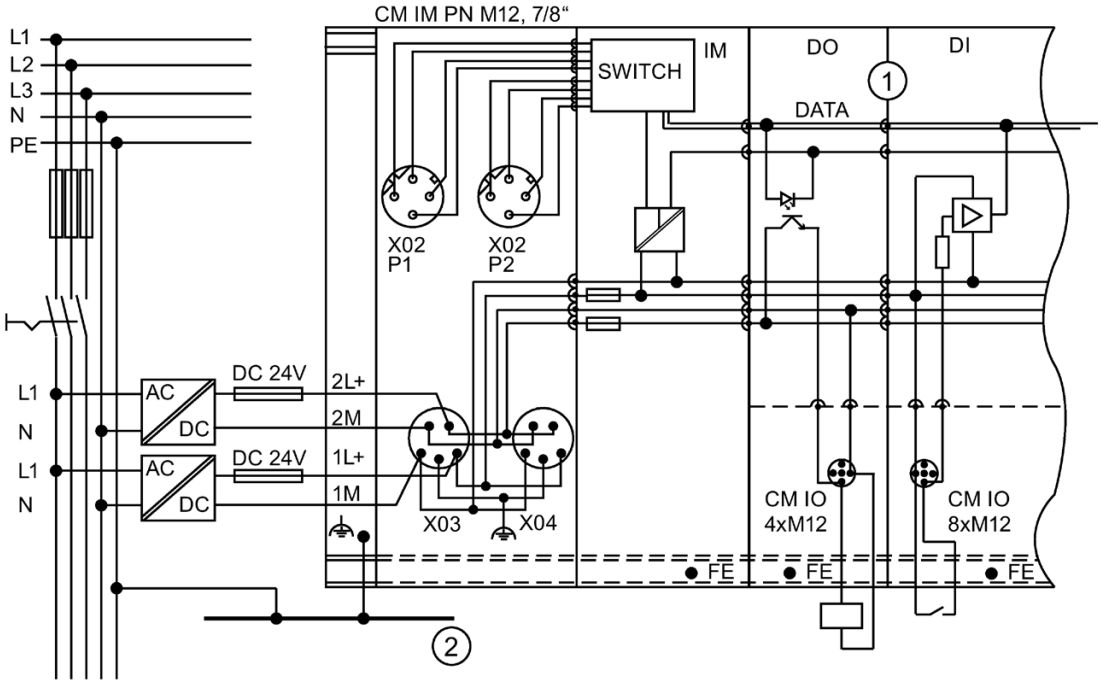
② Main ground line

Figure 5-3 ET 200pro configuration with CM IM DP M12, 7/8" connection module

ET 200pro configuration with CM IM PN M12, 7/8" (S) 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).

This diagram also applies to the CM IM PN M12, 7/8" S connection module on the IM 154-3 PN High Feature interface module (6ES7154-3AB00-0AB0).



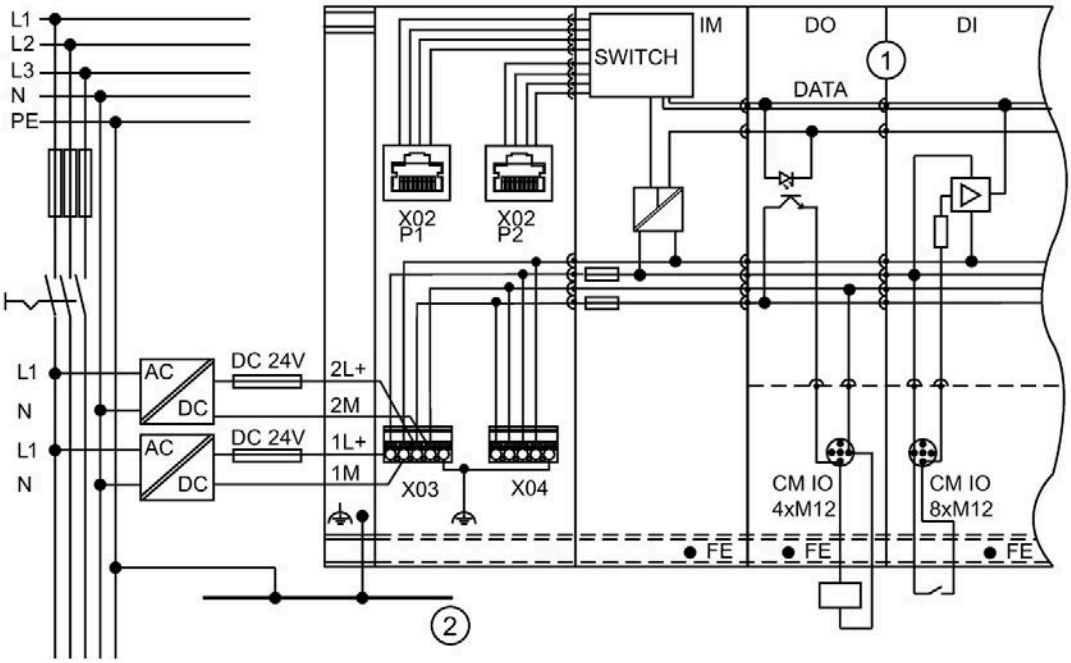
① Backplane bus

② Main ground line

Figure 5-4 ET 200pro configuration with CM IM PN M12, 7/8" (S) 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).



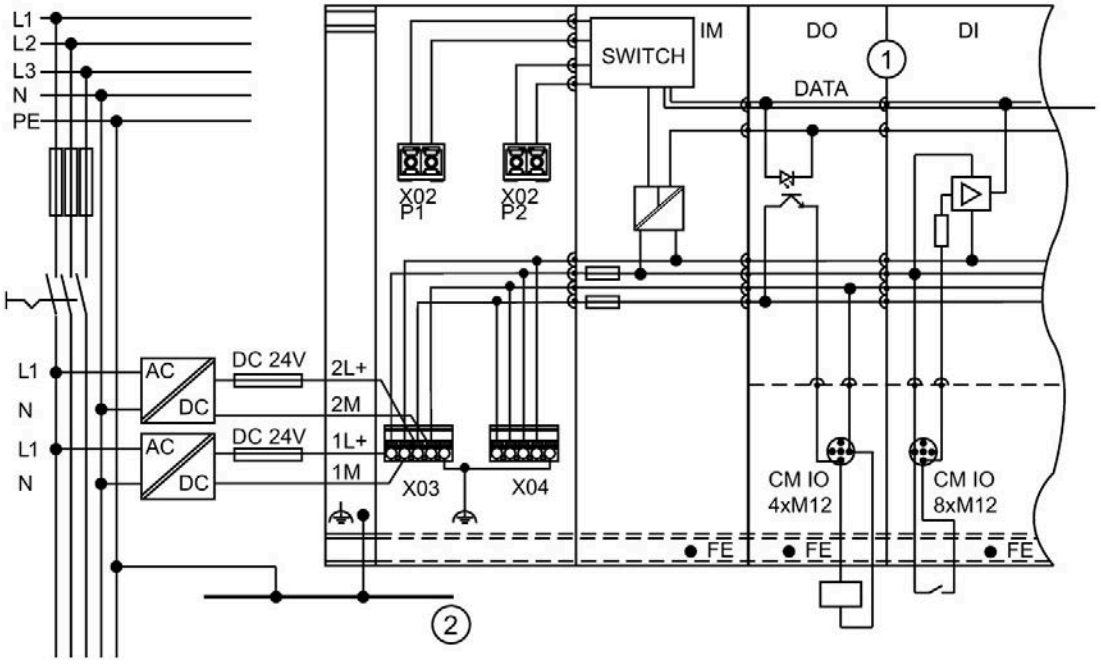
① Backplane bus

② Main ground line

Figure 5-5 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 5-6 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.

5.4 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.

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

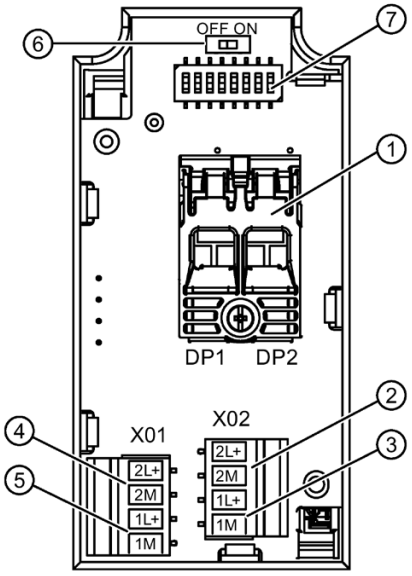
5.5.1 Requirements

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 442). 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 Cu 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).

Infeed			Loop-through (optional)		
PROFIBUS DP	**1L+ electronics/encoder supply**	**2L+ load voltage supply**	**PROFIBUS DP**	**1L+ electronics/encoder supply**	**2L+ load voltage supply**
PB Hybrid Standard Cable/PB Hybrid Robust Cable		2-wire cable	PB Hybrid Standard Cable/PB Hybrid Robust Cable		-
PROFIBUS ECOFAST Hybrid Cable/PROFIBUS ECOFAST Hybrid Cable GP			PROFIBUS ECOFAST Hybrid Cable/PROFIBUS ECOFAST Hybrid Cable GP		
PROFIBUS cable	4-wire cable		PROFIBUS cable	4-wire cable	
PROFIBUS cable	4-wire cable		PB Hybrid Standard Cable/PB Hybrid Robust Cable		2-wire cable
PROFIBUS cable	2-wire cable		PROFIBUS cable	2-wire cable	

See also

Preparing PROFIBUS DP Cables (Page 72)

Preparing PROFIBUS Hybrid Cables for the Connection at CM IM DP Direct (Page 73)

5.5.2 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.

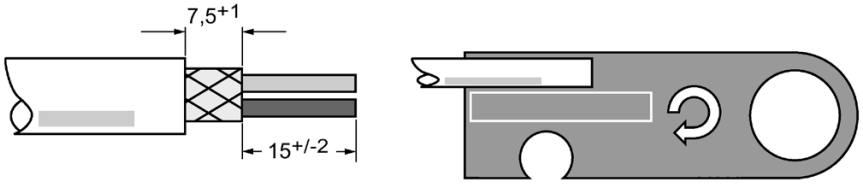


Figure 5-7 Stripping dimensions for the PROFIBUS DP cable

Result

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

See also

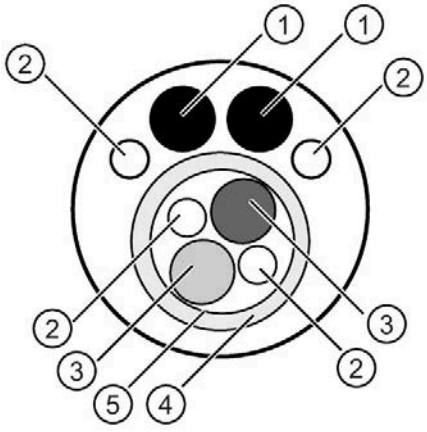
Mounting the Interface Module (Page 48)
Connecting PROFIBUS DP (Page 75)
Connecting the supply voltages (Page 76)

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

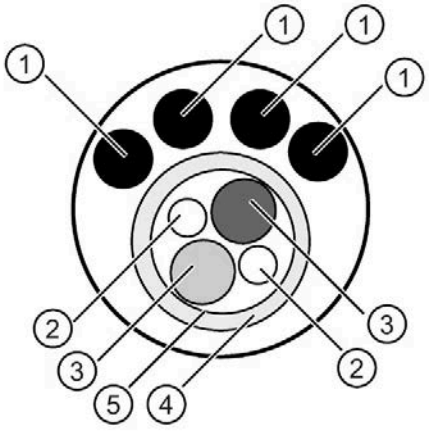
PROFIBUS Hybrid cables

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.

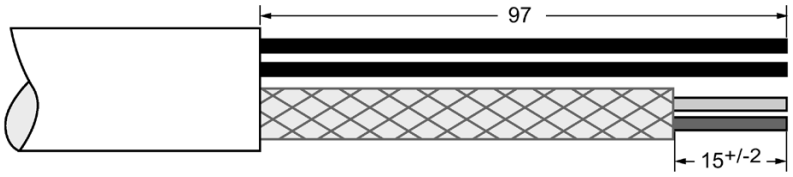


Figure 5-8 Stripping dimensions for PROFIBUS Hybrid cables

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 5-9 PROFIBUS Hybrid cable with heat-shrink tubing

Result

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

See also

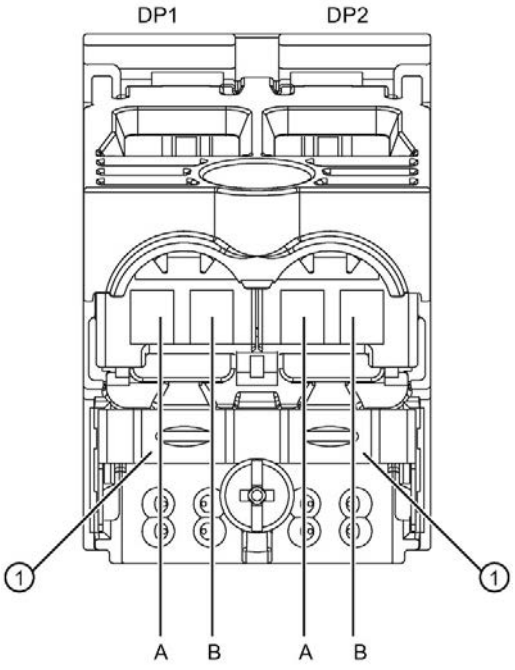
Connecting PROFIBUS DP (Page 75)

Connecting the supply voltages (Page 76)

5.5.4 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 5-10 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.

5.5.5 Connecting the supply voltages

Required tools

- Screwdriver, 3 mm

Requirements

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

Connecting supply voltages

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 to 0.7 N/m), terminate the supply cables on terminal X01 and the loop-through cables on terminal X02 (electronic/encoder supply 1L+, load voltage supply 2L+).

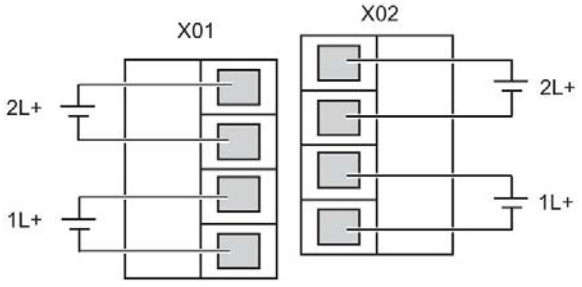


Figure 5-11 Connecting the supply voltage

See also

Terminating and installing the connection module (Page 77)

5.5.6 Terminating and installing the connection module

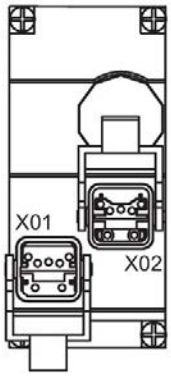
Terminating and installing the connection module

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.

5.6 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.

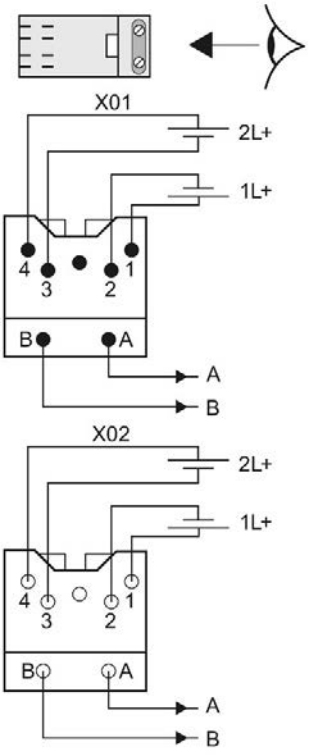
Required tools

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.

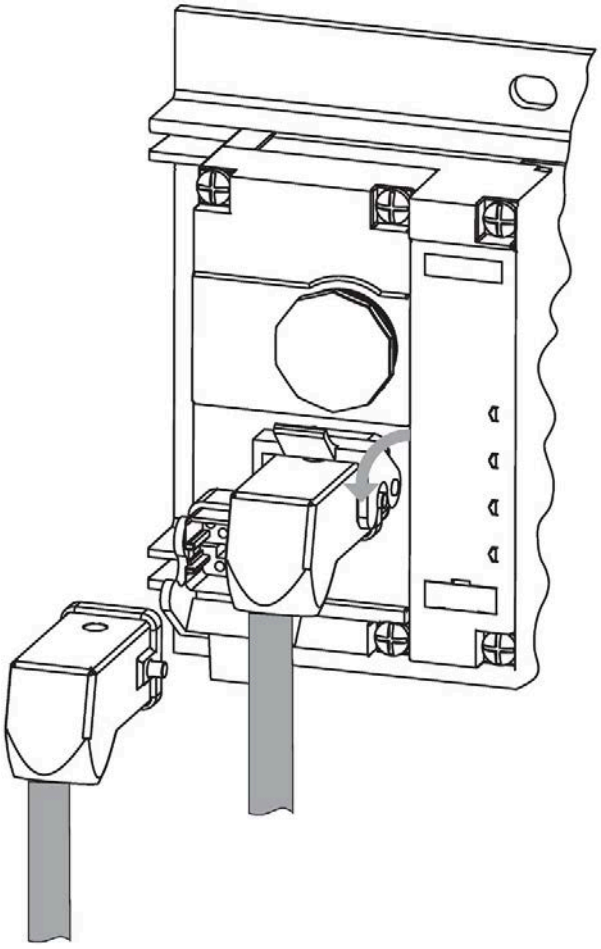


Figure 5-12 Connecting the ECOFAST cable connectors

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.

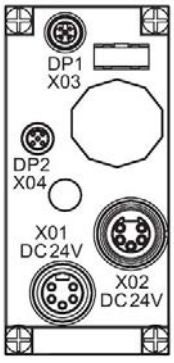
See also

Mounting the Interface Module (Page 48)

5.7 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.

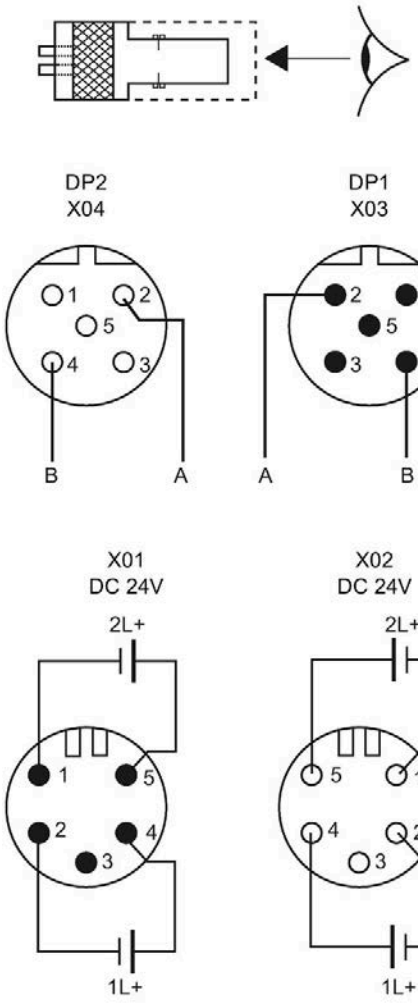
Required tools

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.

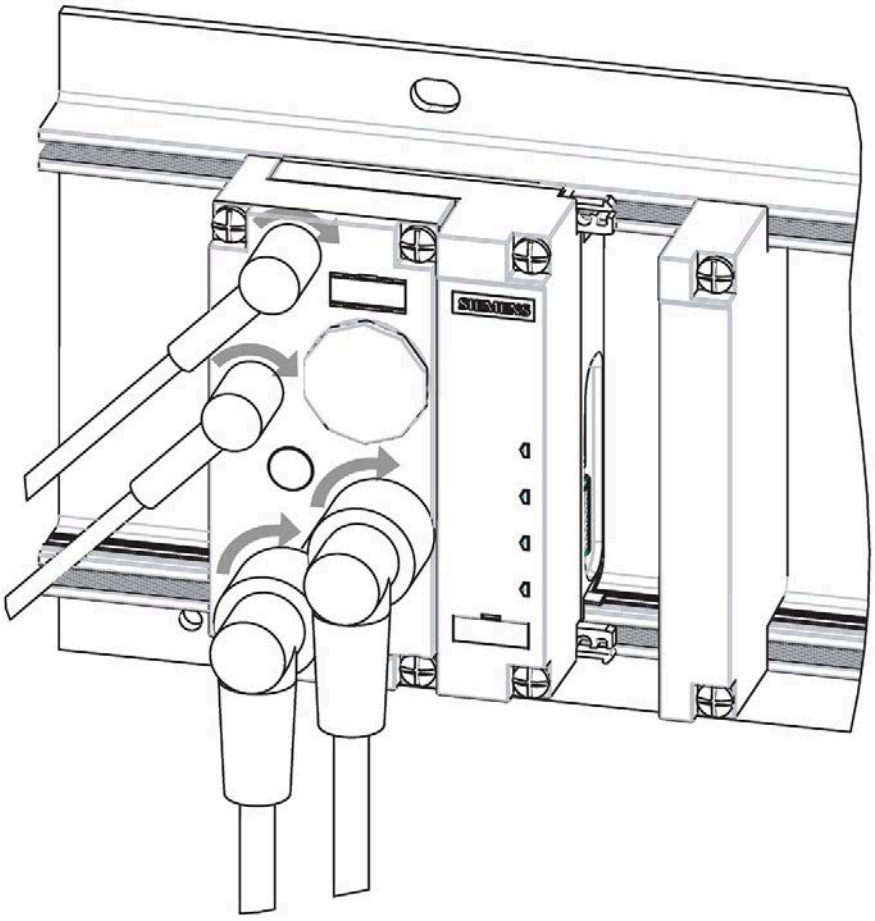
** We recommend that you connect the functional earth via the M12 thread (because it has a larger surface area than terminal 5).

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 48)

5.8 Connecting the PROFINET interface module to the CM IM PN M12, 7/8" (S) connection module

Introduction

Connect the supply voltages and PROFINET IO to the CM IM PN M12, 7/8" S or CM IM PN M12 7/8" connection module. The IM 154-3 High Feature and IM 154-4 PN High Feature interface modules are equipped with an internal PROFINET switch. This allows direct loop-through of PROFINET IO or the direct connection of an additional IO device (e.g. ET 200pro with IM 154-8 CPU).

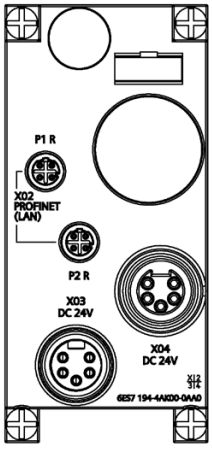


Figure 5-13 CM IM PN M12 7/8" S connection module for IM 154-3 PN High Feature

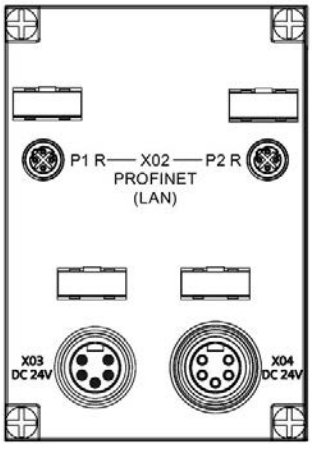


Figure 5-14 CM IM PN M12 7/8" connection module for IM 154-4 PN High Feature

CM IM PN M12 7/8" S and CM IM PN M12 7/8" pin assignment	
X02 P1 R	M12 circular socket (with female insert) for connecting PROFINET IO
X02 P2 R	M12 circular socket (with female insert) for connecting PROFINET IO
X03 24V DC	7/8" circular socket (with male insert) for feeding 1L+ electronics/encoder supply and 2L+ load voltage supply
X04 24V DC	7/8" circular socket (with female insert) for loop-through of 1L+ electronics/encoder supply and 2L+ load voltage supply

CAUTION

PROFINET

Modules with PROFINET interfaces may only be operated in LANs (Local Area Network) in which all nodes are equipped with SELV/PELV power supplies or protection systems of equal quality.

A data transfer terminal (modem, for example) is required to access the WAN (Wide Area Network) in order to ensure compliance with this safety standard.

Requirements

The IM 154-3 High Feature or IM 154-4 High Feature (including bus module) interface module and the corresponding connection module are mounted on the rack.

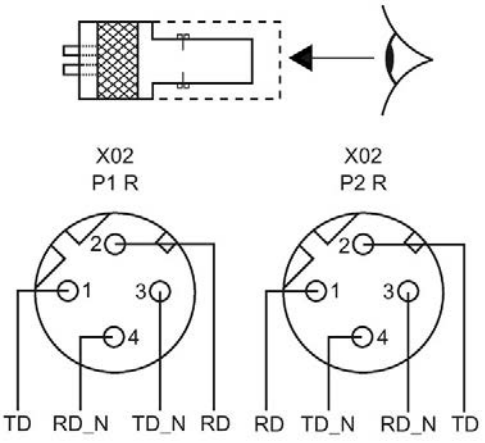
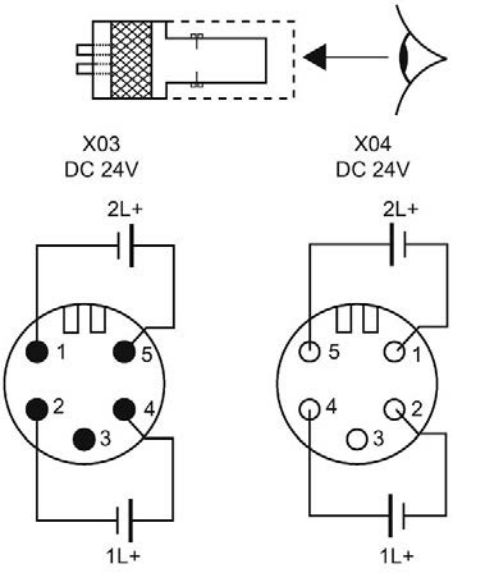
Required tools

- Screwdriver
- Stripping tool for wiring the M12 and 7/8" cable connectors, if you assemble the cables yourself.

Required accessories

- Prefabricated cable with M12 and 7/8" cable connectors. The cables are available in different lengths.
- If you are fabricating your own cables:
  - M12: 4-wire cable, shielded (bus cable) and M12 cable connector D-coded (PROFINET)
  - 7/8": 5-wire 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 R for connecting PROFINET</td><td>X02 P2 R 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 connector (supply voltages 1L+ and 2L+)</td></tr>
<tr><td rowspan="6"> 
</td><td colspan="3">X03 24V DC for infeed
X04 24V DC for loop-through</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 sockets on the 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).

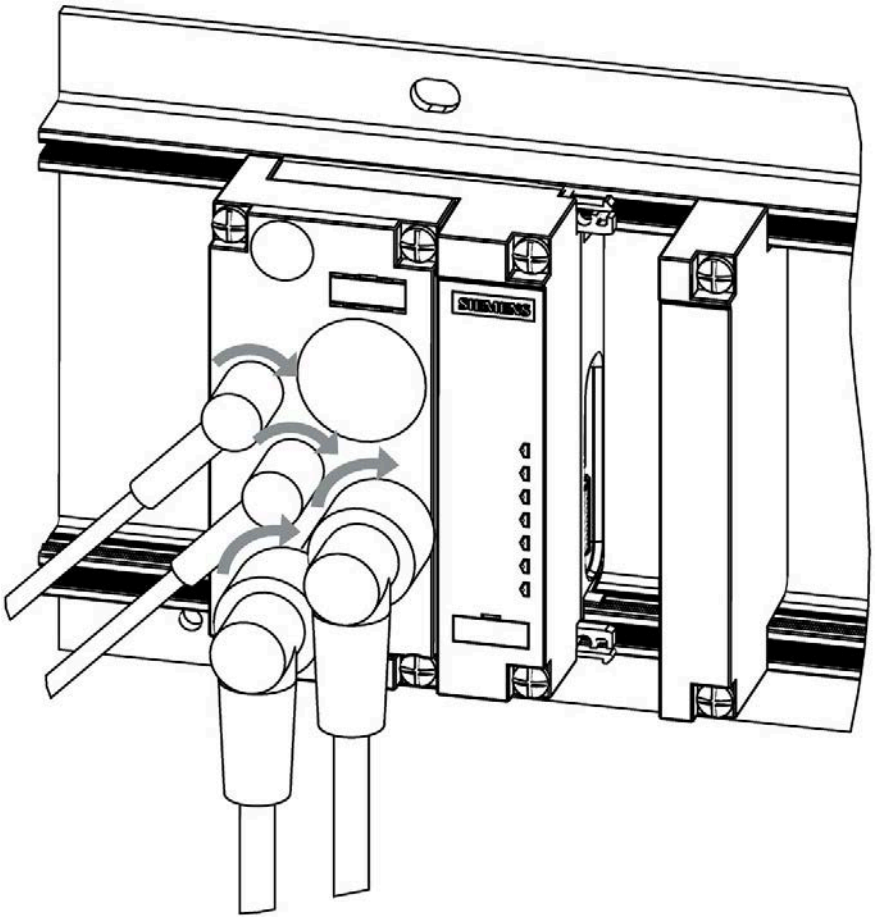


Figure 5-15 Connect the M12, 7/8" cable connector to the CM IM PN M12, 7/8" S

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

When you pull the M12 or 7/8" cable connector for loop-through, the following modules on the PROFINET IO will fail or no longer be supplied.

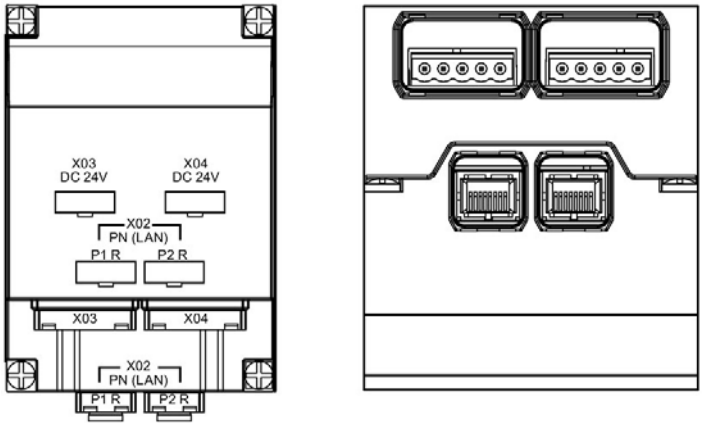
Covering unused sockets

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

5.9 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.

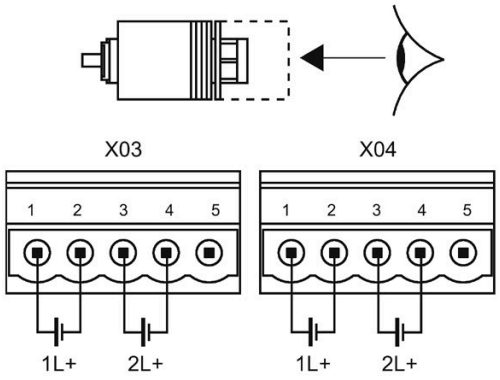
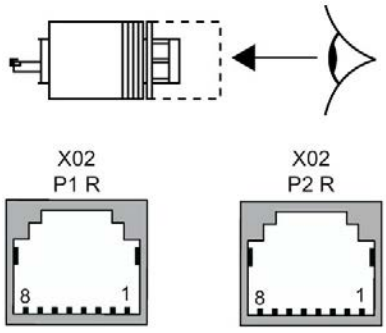
Required accessories

- 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

<table>
<tr><th>View of the push-pull cable connector</th><th>Terminal</th><th colspan="2">Assignment</th></tr>
<tr><td colspan="4">Push-pull cable connector (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">1L+ electronics/encoder supply</td></tr>
<tr><td>2</td><td colspan="2">Ground for electronics/encoder supply 1M</td></tr>
<tr><td>3</td><td colspan="2">2L+ load voltage supply</td></tr>
<tr><td>4</td><td colspan="2">Ground for load voltage supply 2M</td></tr>
<tr><td>5</td><td colspan="2">Functional earth</td></tr>
<tr><td colspan="4">Push-pull cable connector (RJ45)</td></tr>
<tr><td rowspan="9"> 
</td><td></td><td>X02 P1 R for connecting PROFINET</td><td>X02 P2 R for connecting PROFINET</td></tr>
<tr><td>1</td><td>Transmit Data+ TD</td><td>Receive Data+ RD</td></tr>
<tr><td>2</td><td>Transmit Data- TD_N</td><td>Receive Data- RD_N</td></tr>
<tr><td>3</td><td>Receive Data+ RD</td><td>Transmit Data+ TD</td></tr>
<tr><td>4</td><td colspan="2">Ground GND</td></tr>
<tr><td>5</td><td colspan="2">Ground GND</td></tr>
<tr><td>6</td><td>Receive Data- RD_N</td><td>Transmit Data- TD_N</td></tr>
<tr><td>7</td><td colspan="2">Ground GND</td></tr>
<tr><td>8</td><td colspan="2">Ground GND</td></tr>
</table>

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.

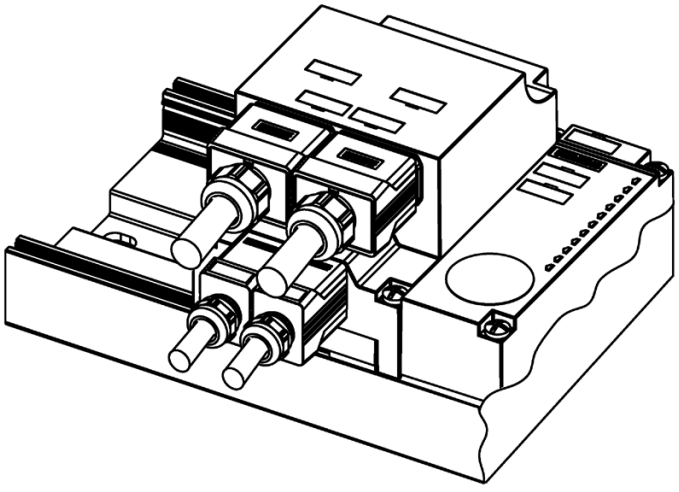


Figure 5-16 Connecting push-pull cable connector

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+ 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.

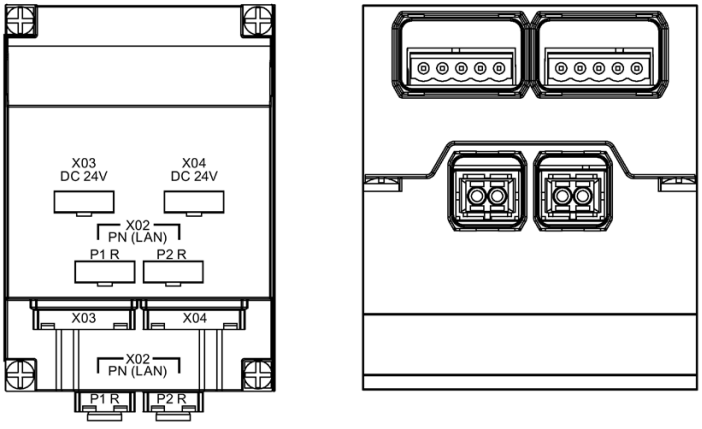
Covering unused sockets

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

5.10 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

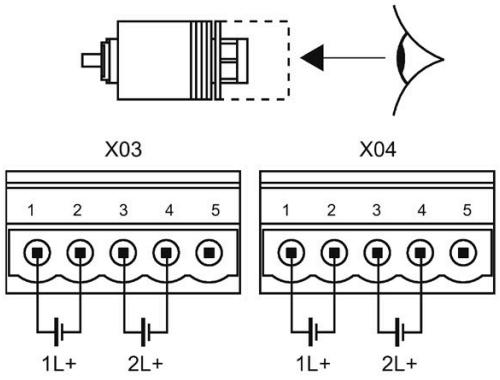
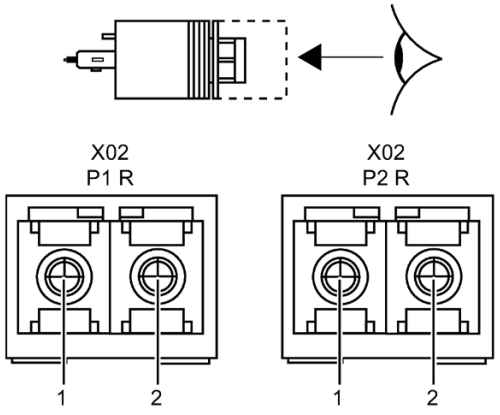
Refer also to the installation guidelines for fiber-optic cable in the *ET 200 Distributed I/O System* Manual or *SIMATIC NET - PROFIBUS Networks* Manual.

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 R for feeding PROFINET** **X02 P2 R for looping 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.

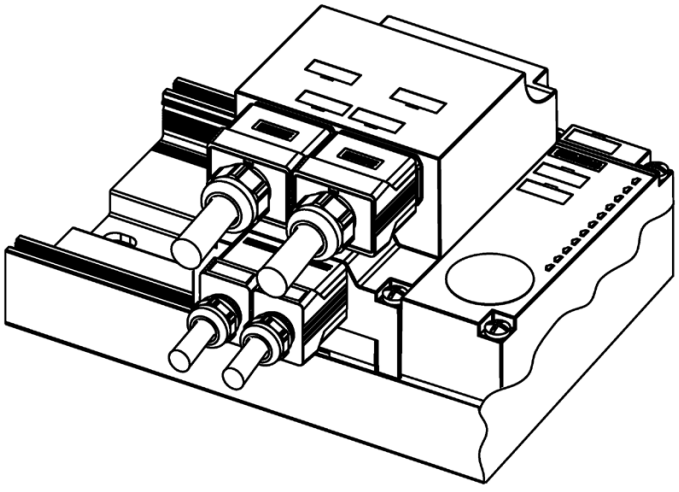


Figure 5-17 Connecting push-pull cable connector

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.

5.11 Wiring the Electronic Module using the Connection Module

5.11.1 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 442).

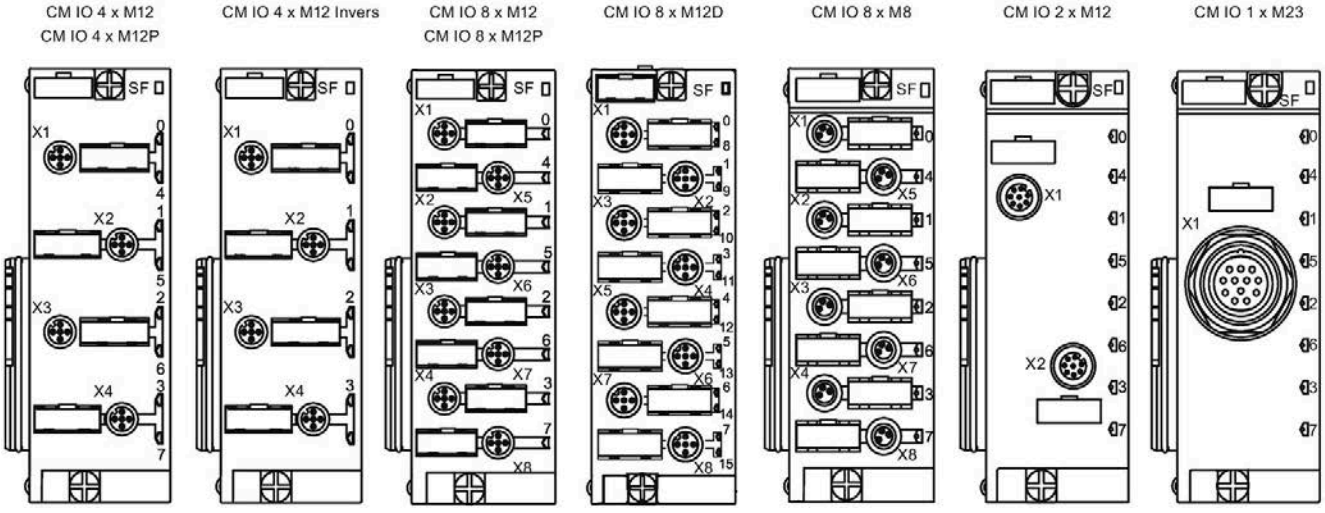


Figure 5-18 Sockets and LEDs of the connection modules

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	---

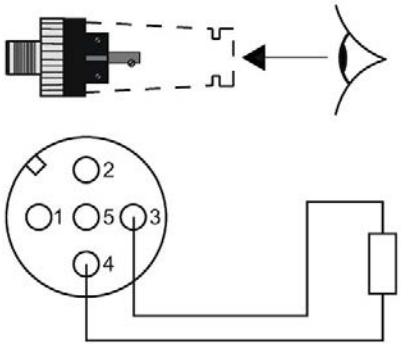
Accessories required for analog electronic modules

- 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

5.11.2 Pin assignment for the Digital Electronic Modules

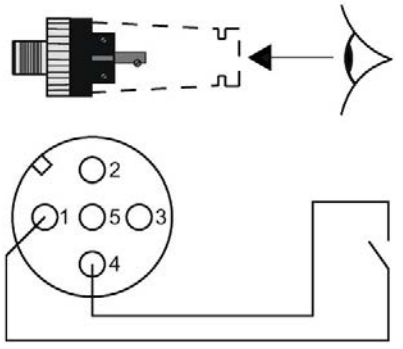
Pin assignment of CM IO 8 x M12, CM IO 8 x M12P connection module and 8 DO DC 24V/0.5A electronic module

Table 5- 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)

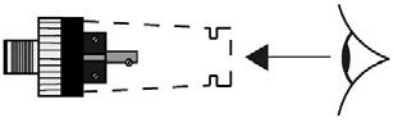
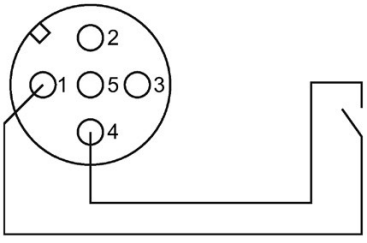
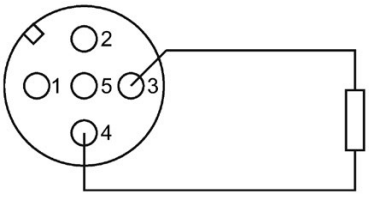
Pin assignment on the CM IO 8 x M12, CM IO 8 x M12P connection module and the 8 DI DC 24V, 8 DI DC 24V High Feature electronic module

Table 5- 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)

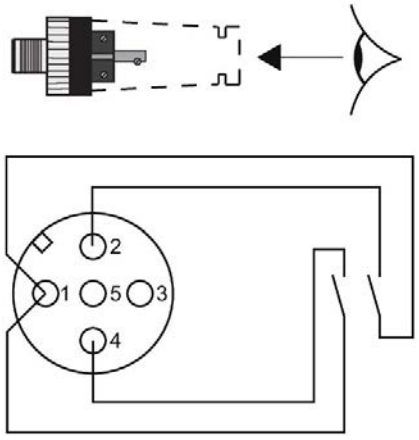
Pin assignment on CM IO 8 x M12, CM IO 8 x M12P connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

Table 5- 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)

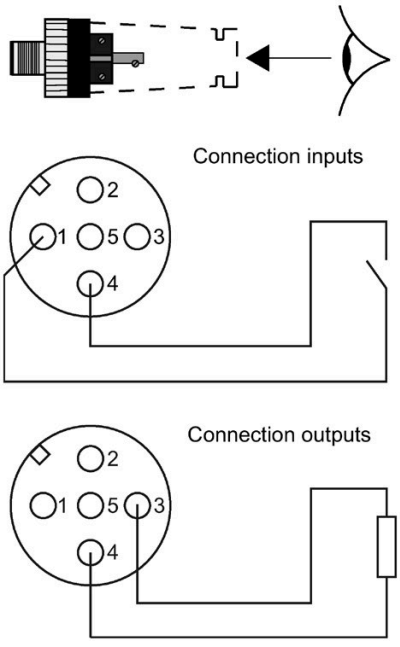
Pin assignment on the CM IO 8 x M12D connection module and the 16 DI DC 24V electronic module

Table 5- 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)

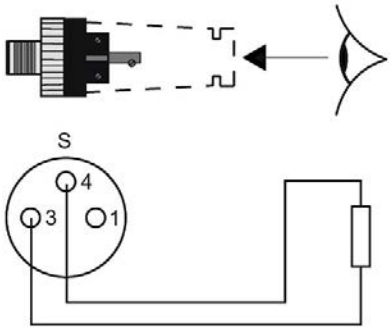
Pin assignment on CM IO 8 x M12D connection module and 4 DIO / 4 DO DC 24V/0,5A electronic module

Table 5- 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)

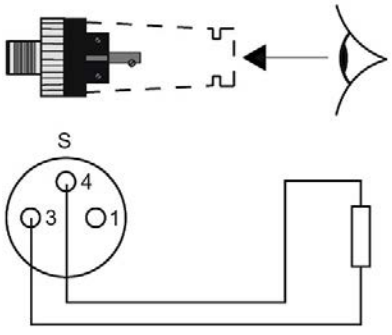
Pin assignment on the CM IO 8 x M8 connection module and the 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature electronic modules

Table 5- 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)

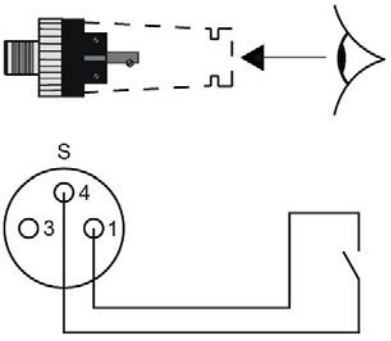
Pin assignment of CM IO 8 x M8 connection module and 8 DO DC 24V/0.5A electronic module

Table 5- 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)

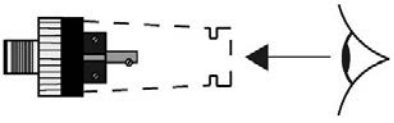
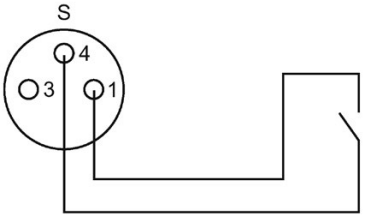
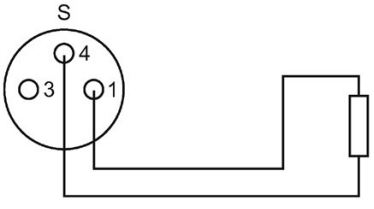
Pin assignment on the CM IO 8 x M8 connection module and the 8 DI DC 24V, 8 DI DC 24V High Feature electronic modules

Table 5- 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)

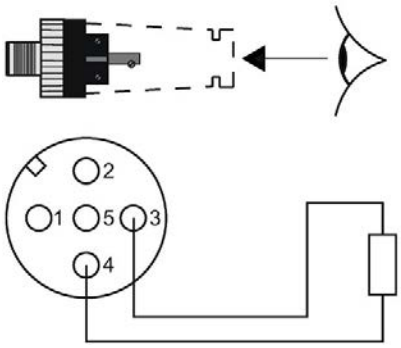
Pin assignment on CM IO 8 x M8 connection module and 4 DI / 4 DO DC 24V/0,5A electronic module

Table 5- 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)

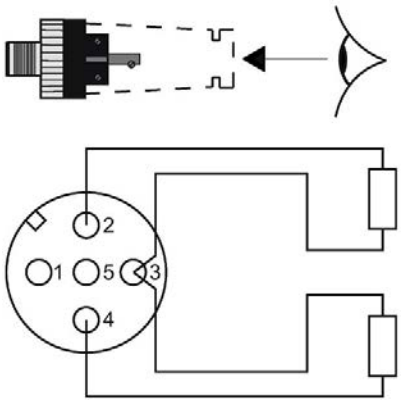
Pin assignment on the CM IO 4 x M12, CM IO 4 x M12P connection module and the 4 DO DC 24V/2.0A, 4 DO DC 24V/2.0A High Feature electronic modules

Table 5- 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)

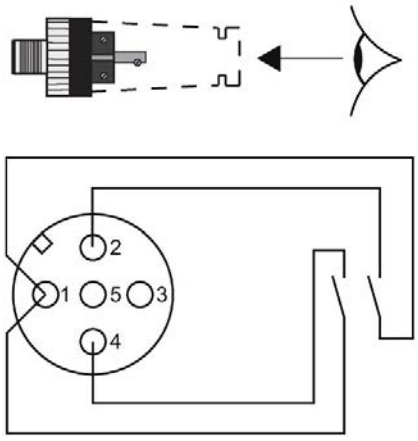
Pin assignment of CM IO 4 x M12, CM IO 4 x M12P connection module and electronic module 8 DO DC 24V/0.5A

Table 5- 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)

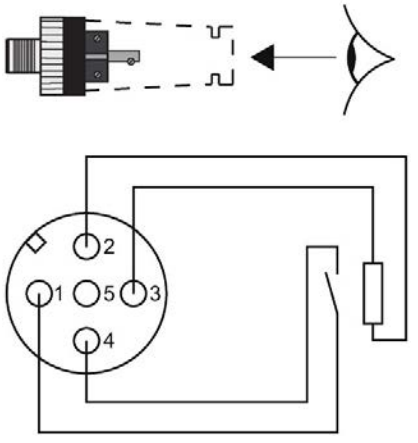
Pin assignment on the CM IO 4 x M12, CM IO 4 x M12P connection module and the 8 DI DC 24V, 8 DI DC 24V High Feature electronic modules

Table 5- 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)

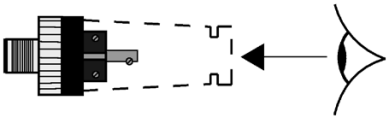
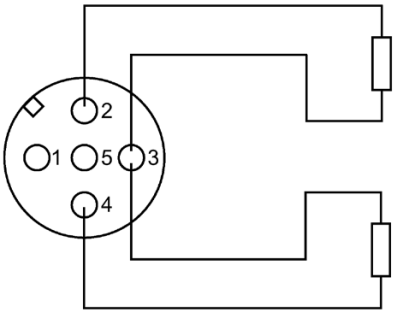
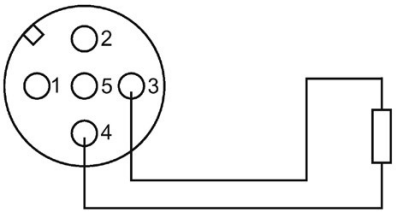
Pin assignment on CM IO 4 x M12, CM IO 4 x M12P connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

Table 5- 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 5- 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

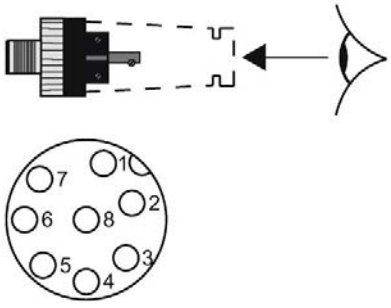
Connection of channel 1 (bit 1) and channel 3 (bit 3)

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.

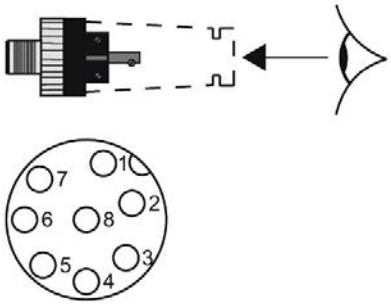
Pin assignment on the CM IO 2 x M12 connection module and the 4 DO DC 24V/2.0A, 8 DO DC 24V/0.5A electronic modules

Table 5- 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)

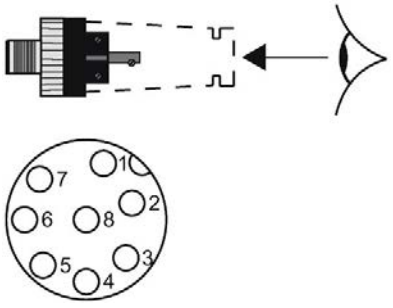
Pin assignment on the CM IO 2 x M12 connection module and the 8 DI DC 24V electronic module

Table 5- 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)

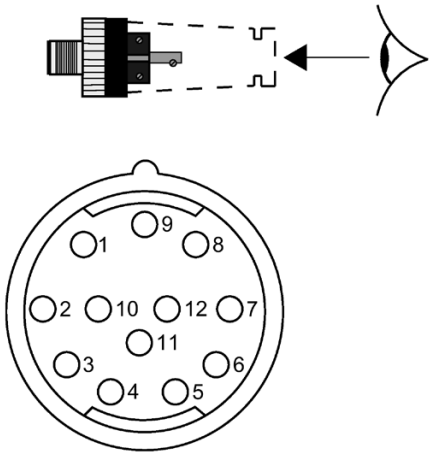
Pin assignment on CM IO 2 x M12 connection module and 4 DI / 4 DO DC 24V/0.5A electronic module

Table 5- 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)

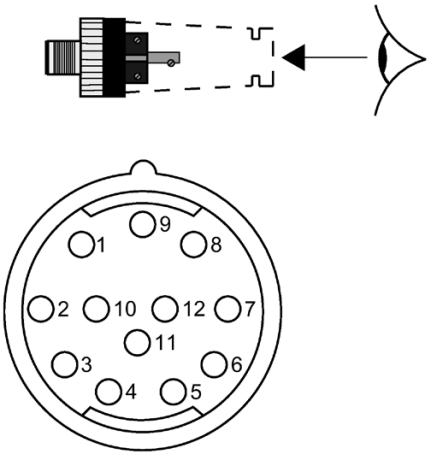
Pin assignment on the CM IO 1 x M23 connection module and the 4 DO DC 24V/2.0A electronic module

Table 5- 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)

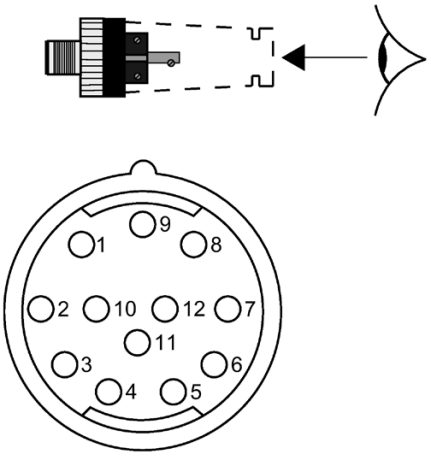
Pin assignment on the CM IO 1 x M23 connection module and the 8 DO DC 24V/0.5A electronic module

Table 5- 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)

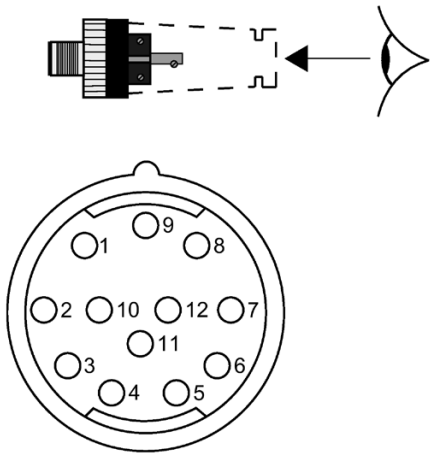
Pin assignment on the CM IO 1 x M23 connection module and the 8 DI DC 24V electronic module

Table 5- 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 5- 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)

5.11.3 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.

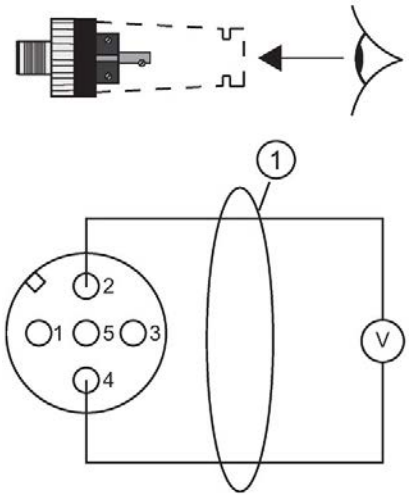
The connection module connects the cable shield with low impedance to the main ground line.

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 5- 22 Pin assignment of CM IO 4 x M12 with 4 AI U High Feature

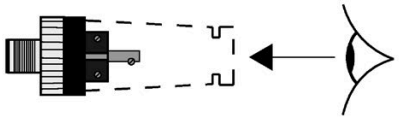
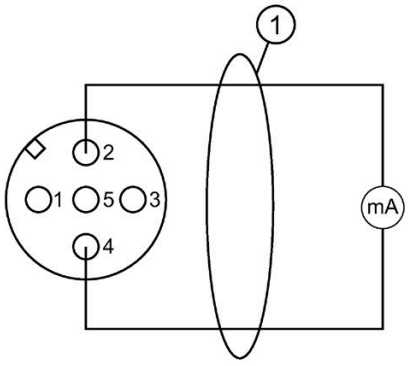
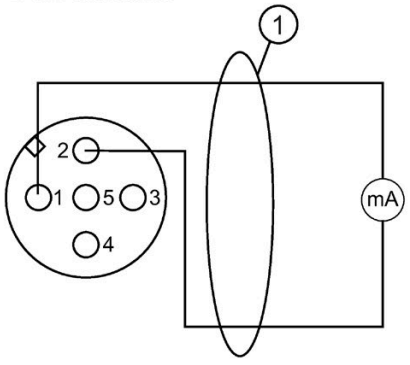
View of the coupler plug	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal DI_0+: Connector X1 Input signal U_1+: Connector X2 Input signal U_2+: Connector X3 Input signal U_3+: Connector X4
	3	Encoder supply ground 1M
	4	Input signal U_0-: Connector X1 Input signal U_1-: Connector 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 5- 23 Pin assignment of CM IO 4 x M12 with 4 AI I High Feature

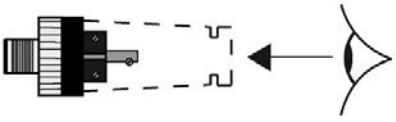
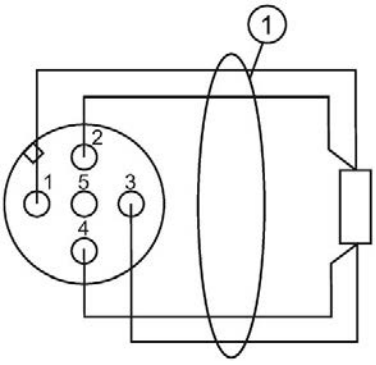
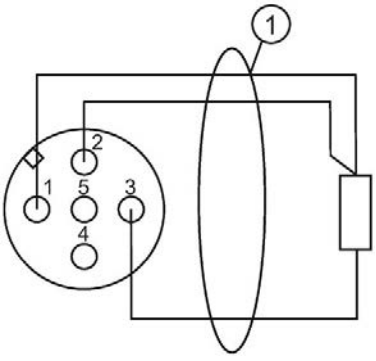
View of the coupler plug	Terminal	Assignment X1 to X4
	1	24V encoder supply U_S
	2	Input signal I_0+: Connector X1 Input signal I_1+: Connector X2 Input signal I_2+: Connector X3 Input signal I_3+: Connector X4
4-wire transducer	3	Encoder supply ground 1M
	4	Input signal I_0-: Connector X1 Input signal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

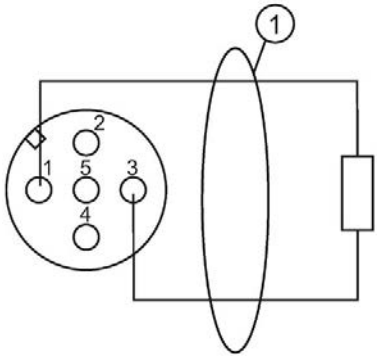
Pin assignment of CM IO 4 x M12 connection module and 4 AI RTD High Feature electronic module

Note

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

Table 5- 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)

View of the coupler plug	Terminal	Assignment X1 to X4
	**2-wire**	
	1	Measuring line M 0+: Connector X1 Measuring line M1+: Connector X2 Measuring line M2+: Connector X3 Measuring line M3+: Connector X4
	2	Not assigned
	3	Measuring line M 0-: Connector X1 Measuring line M1-: Connector X2 Measuring line M2-: Connector X3 Measuring line M3-: Connector X4
	4	Not assigned
	5	Functional earth (FE)
① Shielded copper cables		

Note

Coupler plug for RTD measurement

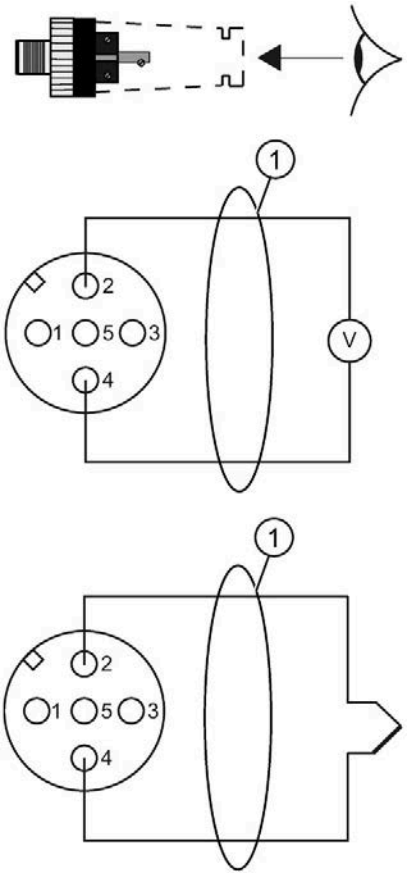
For RTD measurements, use a coupler plug with gold-plated contacts. Other materials can create contact resistance that can result in incorrect measured values.

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 5- 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

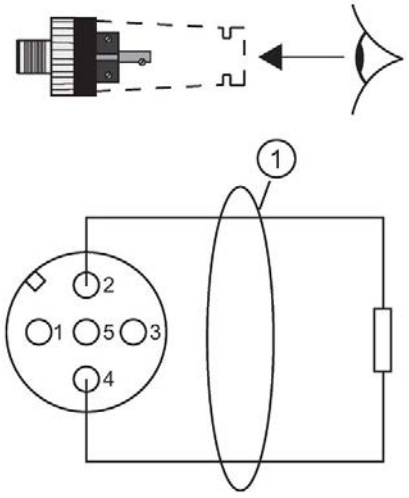
* If the M12 compensation connector is being used (see section 4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 386)), the Pt1000 resistance thermometer is already integrated. If an external Pt1000 is connected, α must equal 0.003851.

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 5- 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

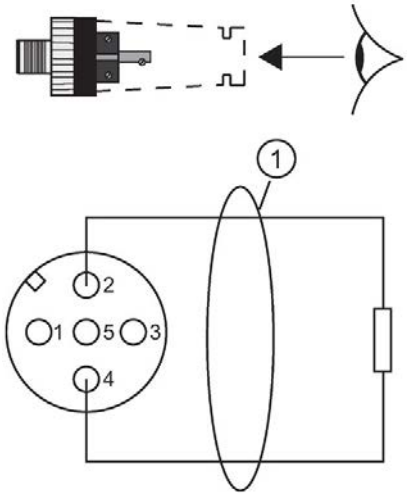
* Please note the changed pin assignment for the ET 200X. The use of actuators that have been wired for ET 200X could result in destruction of the actuator.

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 5- 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.

5.11.4 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).

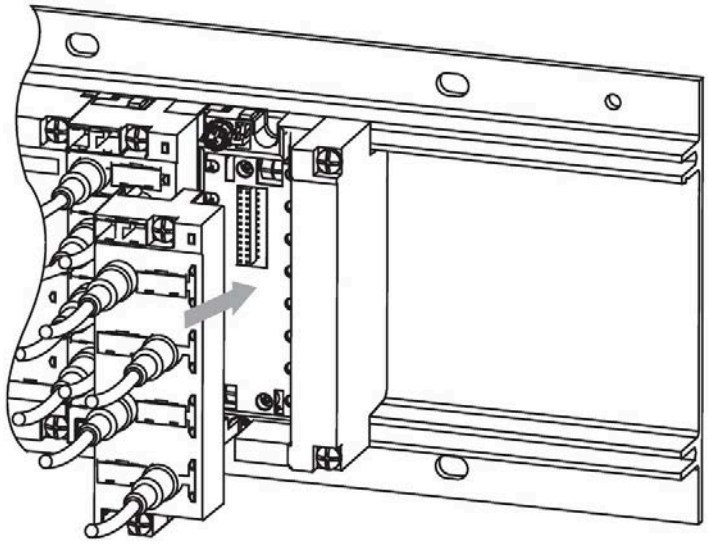


Figure 5-19 Connecting the connection module

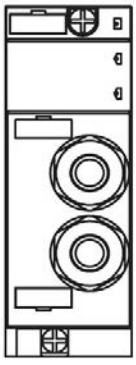
Sealing unused sockets

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

5.12 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 wire cross-sections for flexible Cu cables	Without end sleeve	0.14 to 2.5 mm^2
	With end sleeve	0.14 to 2.5 mm^2
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

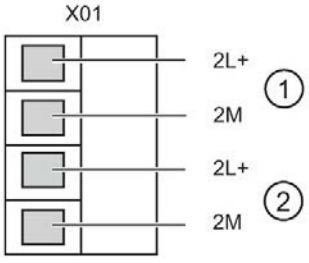
- Cables for feeding and looping through of the 2L+ load voltage supply:
  - 2-wire flexible Cu cable, conductor cross-section ≤ 2.5 mm^2
  - 4-wire shielded Cu cable, conductor cross-section, ≤ 2.5 mm^2
- M20 cable glands (included)

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.

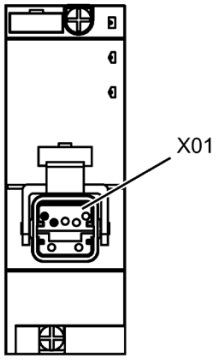
See also

PM-E power module (Page 312)

5.13 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.

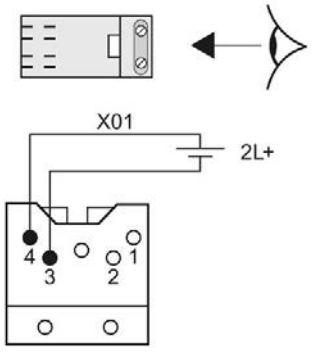
Required tools

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.

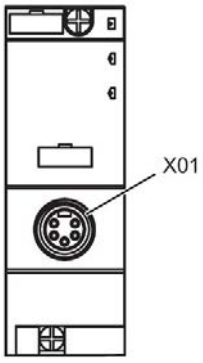
See also

PM-E power module (Page 312)

5.14 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.

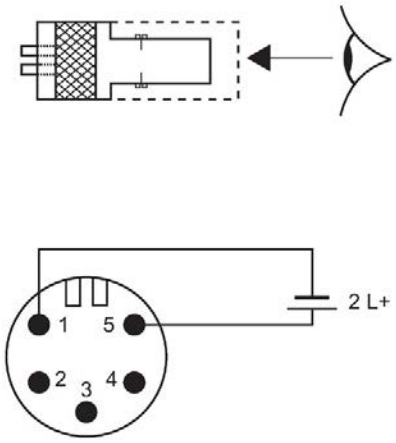
Required tools

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.

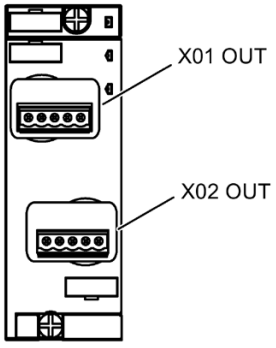
See also

PM-E power module (Page 312)

5.15 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.

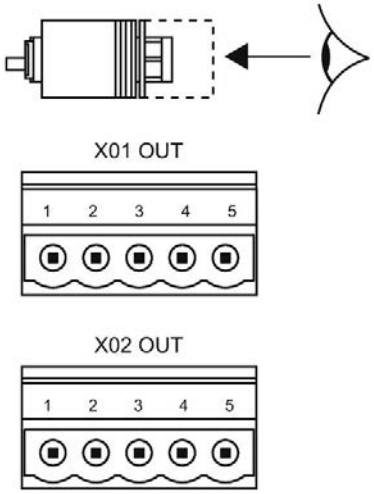
Required tools

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 317)

Configuring

6

6.1 PROFIBUS DP

6.1.1 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 139)

6.1.2 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 (https://support.industry.siemens.com/cs/ww/en/view/21221197)

- 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 128).

See also

Procedure when using the GSD file (Page 131)

Commissioning ET 200pro (Page 139)

6.1.3 Grouping electronic modules in the configuration

6.1.3.1 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.

6.1.3.2 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 128)

6.1.3.3 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.

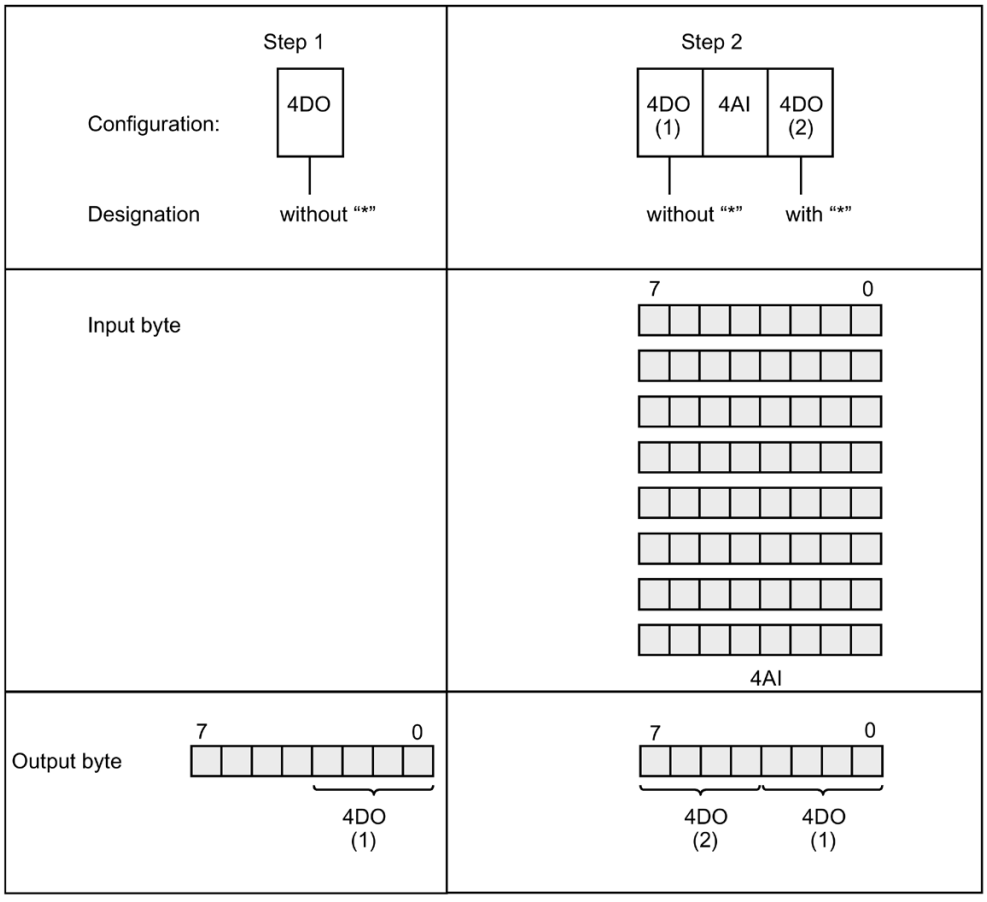


Figure 6-1 Grouping of digital output modules

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 129)

Example of a configuration (Page 133)

6.1.3.4 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:

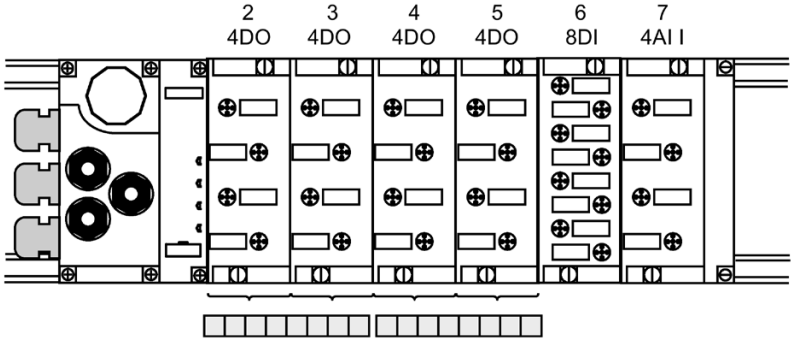


Figure 6-2 Example: Configuring an ET 200pro configuration

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 129)

Procedure when using the GSD file (Page 131)

6.2 PROFINET IO

6.2.1 Configuring in STEP 7

Introduction

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

Requirements

Interface module	Configuration software		Assignment of a name to the IO device
	STEP 7 (TIA Portal)	STEP 7	
IM 154-3 PN High Feature (6ES7154-3AB00-0AB0)	as of V14 SP1	as of V5.5 SP4 + HSP	See section Assigning device names to the I/O device (Page 135)
IM 154-4 PN High Feature (6ES7154-4AB10-0AB0)	All versions	as of V5.4 SP4 + HSP	

You can find the available HSPs for your configuration on the Internet (https://support.industry.siemens.com/cs/ww/en/view/23183356).

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 online help of STEP 7.

See also

Assigning device names to the I/O device (Page 135)
Commissioning ET 200pro (Page 141)

6.2.2 Configuring by Means of GSD File

Introduction

You can use the GSD file to configure ET 200pro in STEP 7. 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 (https://support.industry.siemens.com/cs/ww/en/view/21915937)

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 134).

See also

Commissioning ET 200pro (Page 141)

6.2.3 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 interface module.
2. In HW Config, open the "Properties" window, 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

The device name is stored internally 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 flashes on the selected IO device. If PROFINET IO is looped-through, both LINK LEDs flash.

Note

Flash test for interface module IM 154-3 PN High Feature

The LINK and RX/TX LEDs are combined as LED P1 or P2 with interface module IM 154-3 PN High Feature. LED P1 or P2 reacts like the LINK LED in the flash test.

6.2.4 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.

The PROFINET interface module has a maximum address space of 256 bytes for inputs and 256 bytes for outputs.

Asymmetry caused by swapping interrupts of digital output modules

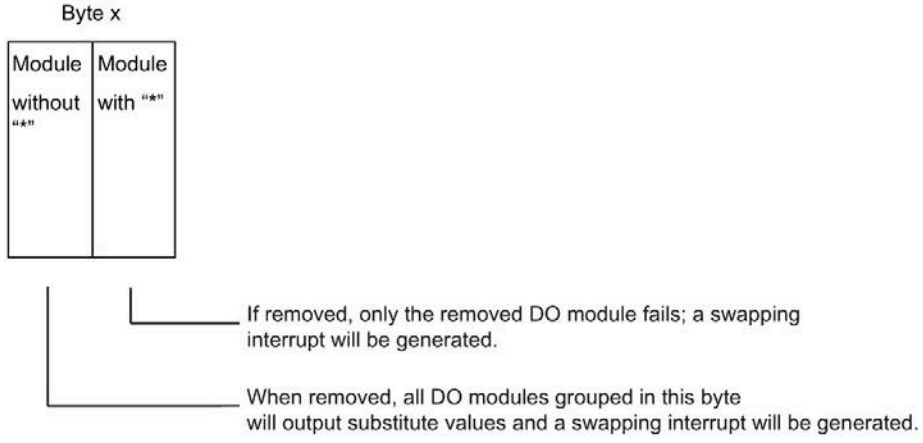


Figure 6-3 Asymmetry caused by swapping interrupts of digital output modules

Procedure

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

See also

Grouping Modules in Configuration Data (PROFIBUS DP) (Page 130)

6.2.5 Configuring port 1 and port 2

Introduction

The PROFINET interface module can diagnose 2 ports:

- X02 P1 and X02 P2.

Requirement

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

Configuring the ports in HW Config

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

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

  Select the fiber-optic cables used for "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

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

Commissioning 7

7.1 PROFIBUS DP

7.1.1 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 7- 1 Commissioning requirements

Actions	Reference
ET 200pro is mounted	Section Mounting (Page 38)
The PROFIBUS DP address is set on ET 200pro	Section Mounting (Page 38)
ET 200pro is wired	Section Connection (Page 59)
ET 200pro is configured	Section Configuring (Page 128)
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 128)

Configuring by Means of GSD File (Page 129)

7.1.2 Startup of ET 200pro

Principle of operation

The diagram below illustrates the startup routine of ET 200pro

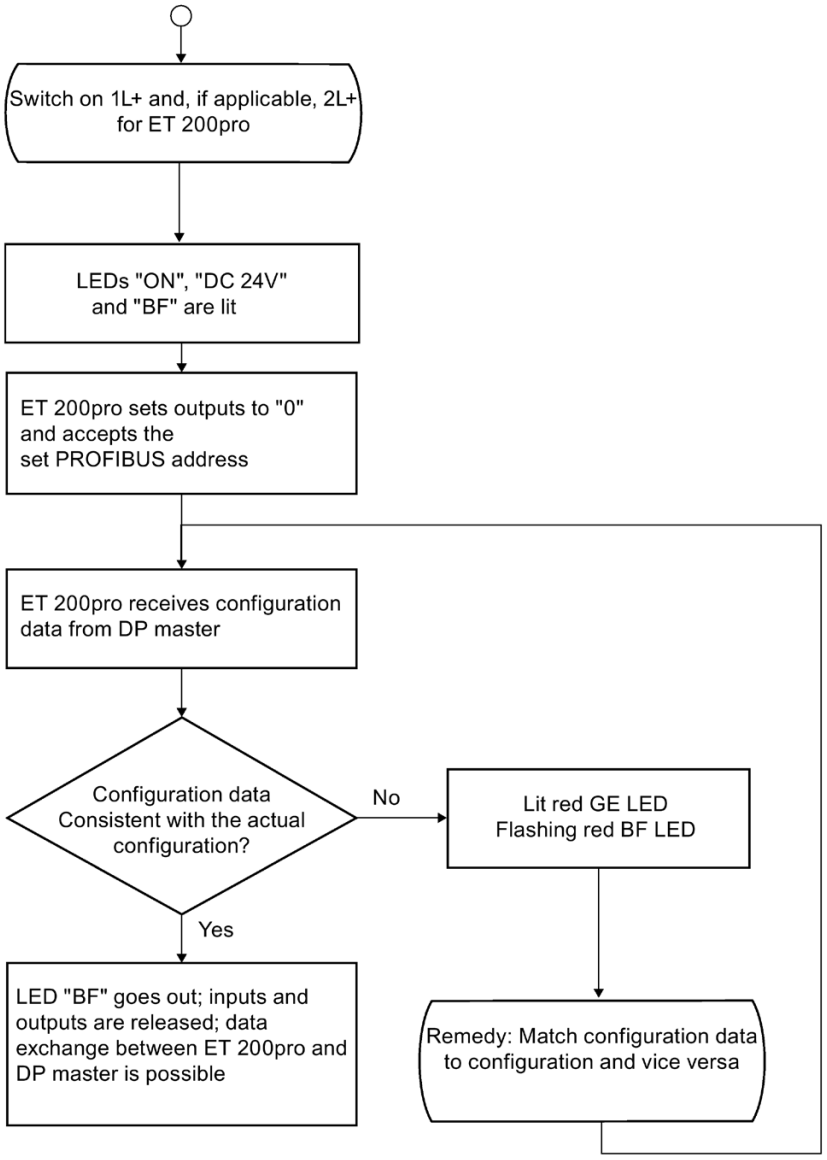


Figure 7-1 Startup of ET 200pro on PROFIBUS DP

7.2 PROFINET IO

7.2.1 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	Section Mounting (Page 38)
ET 200pro is wired	Section Connection (Page 59)
The SIMATIC Micro Memory Card is inserted	Section Maintenance and service (Page 143)
Assigning device names to the I/O device	Section Configuring (Page 128)
ET 200pro is configured	Section Configuring (Page 128)
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).

7.2.2 Startup of ET 200pro

Principle of operation

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

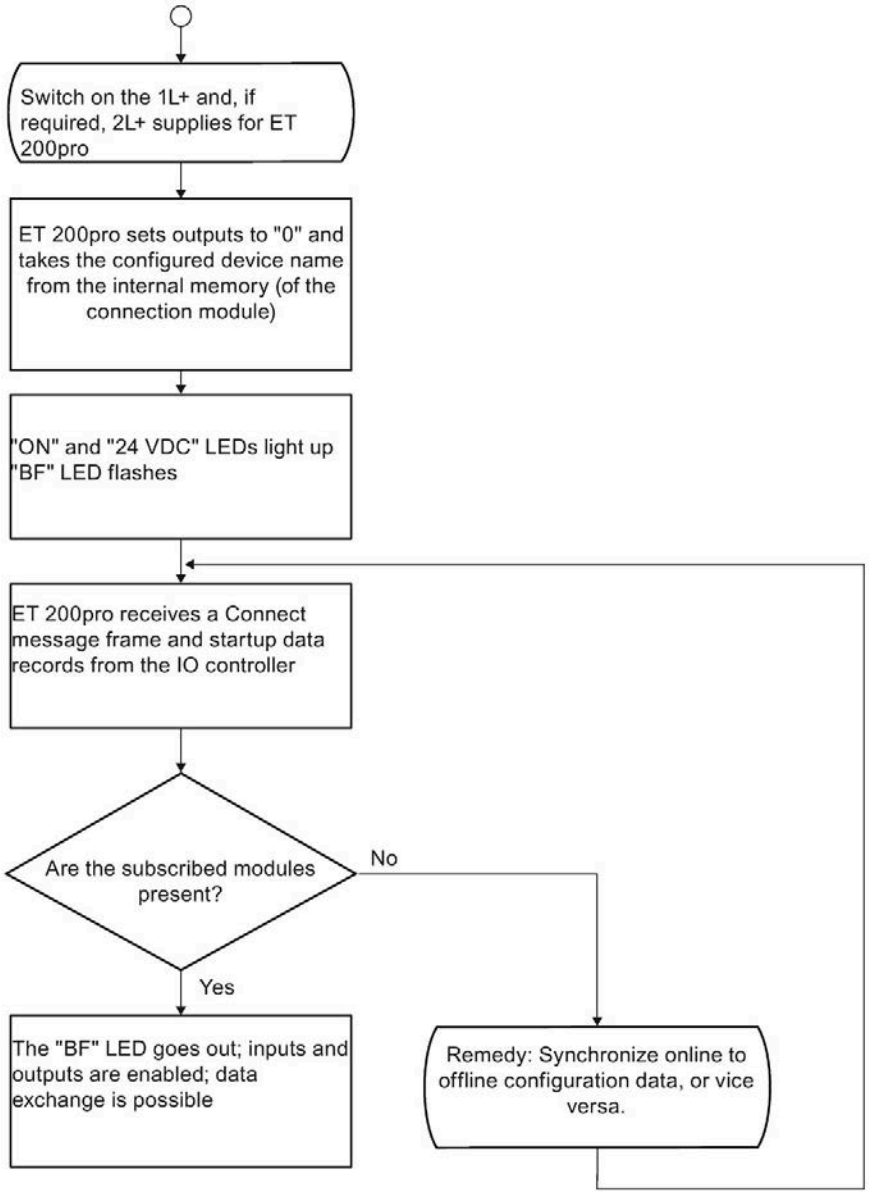


Figure 7-2 Startup of ET 200pro on PROFINET IO

Maintenance and service

8

8.1 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.

8.2 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.

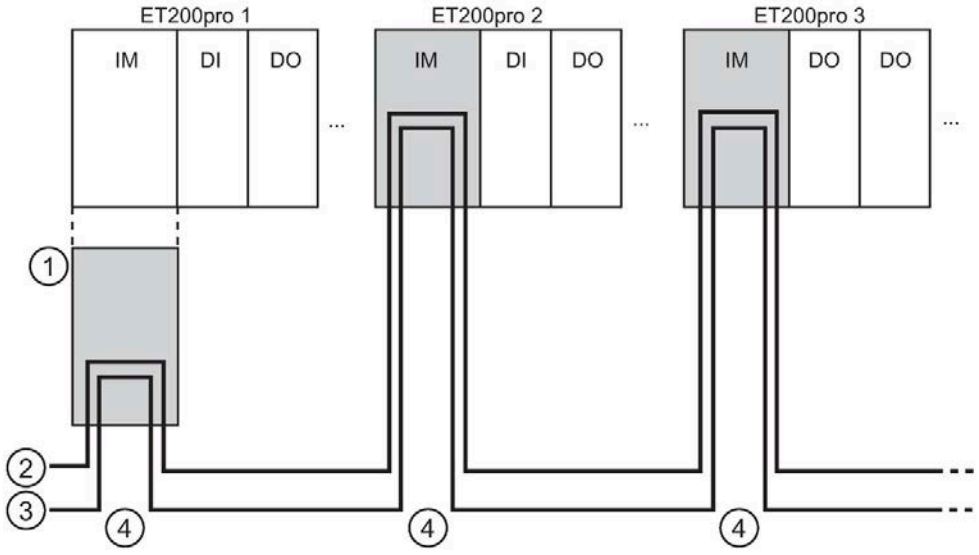
Required tools

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.

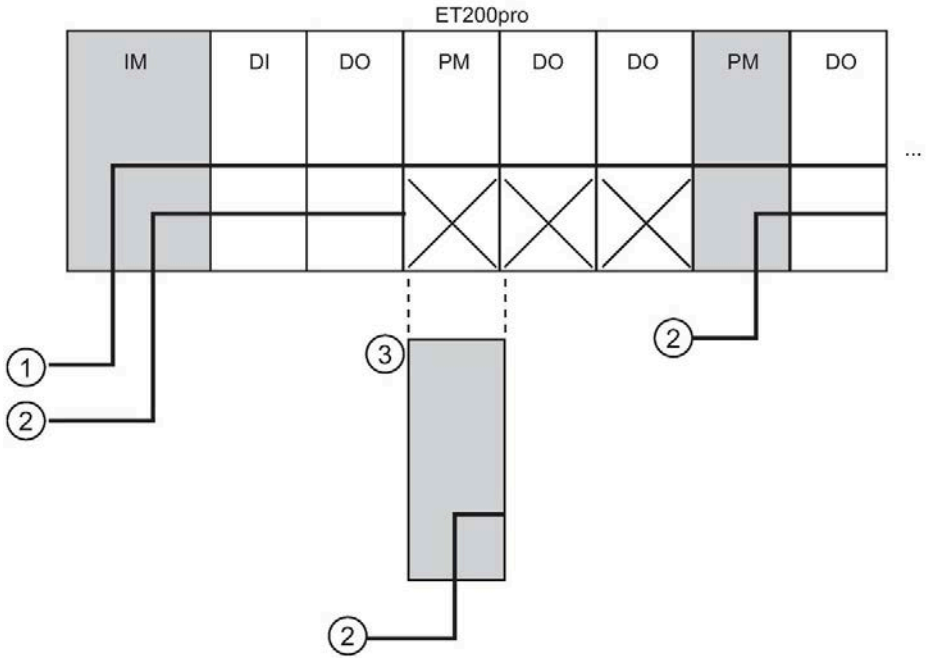


① The connection module is removed from the interface module.
② PROFIBUS DP
③ Suppl voltages 1L+, 2L+
④ PROFIBUS DP and the supply voltages are fed in and looped through.

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 146)

8.3 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.

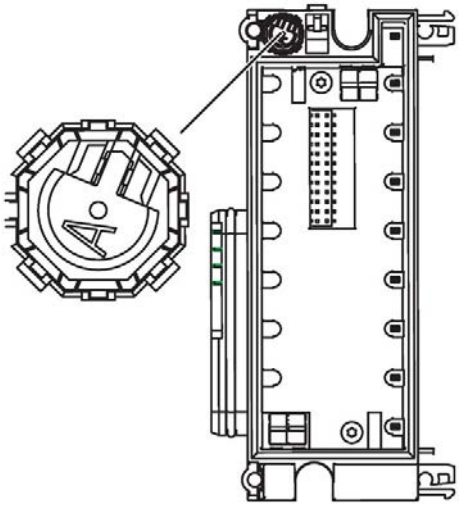


Figure 8-1 Removing the coding key

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 143)

8.4 Replacing an Interface / Power Module

Introduction

If the interface or power module is defective, you can replace it.

Requirements

- To replace the interface or power module, switch off the supply voltages 1L+ and 2L+ of the defective module.
- Pulling the connection module of the interface module leads to the failure of ET 200pro.
- Pulling the connection module of the power module leads to the failure of the associated potential group.

Note

PROFIBUS DP: Pulling the connection module for the interface module (CM IM)

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

NOTICE
PROFINET IO: Pulling the 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

- Phillips screwdriver, size 2
- Screwdriver, 3 mm

Replacing the interface or power module

1. Use the Phillips screwdriver to loosen the 4 or 2 screws on the front of the connection module.
2. Pull the connection module from the interface or power module.
3. Use the Phillips screwdriver to loosen the 2 screws on the front of the interface or power module (upper and lower right).
4. Pull the interface or power module from the bus module.
5. Mount the new interface or power module and the connection module.
6. Switch on the relevant power supplies.

8.5 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.

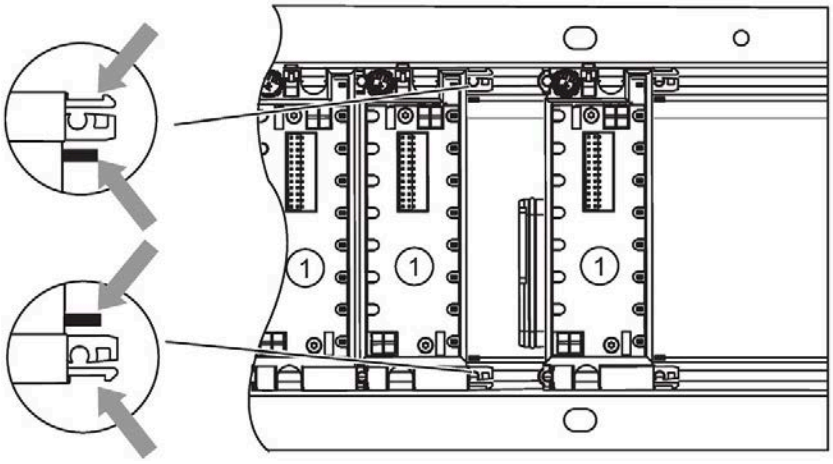


Figure 8-2 Replacing a bus module

① Bus modules

8.6 Replacing a Fuse in the Interface / Power Module

Introduction

Replaceable fuses for protecting the ET 200pro:

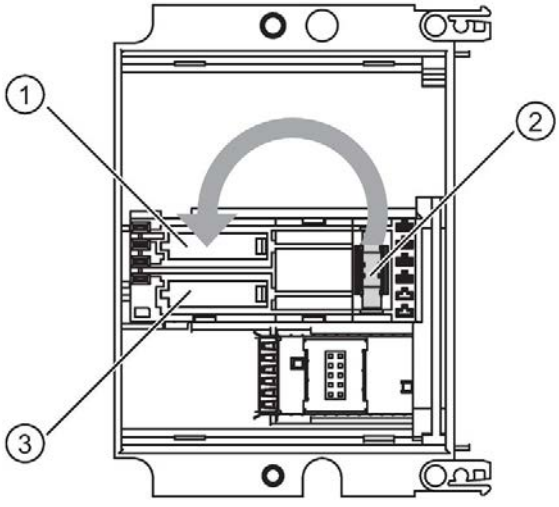
- Interface module:

  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 442)).

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.

8.7 Updating the interface module firmware

8.7.1 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 representative, or download it from the Internet at: Service & Support (http://support.industry.siemens.com)

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 for updating firmware does not depend on the interface module used.

8.7.2 Updating the firmware of an interface module

Introduction

It may be necessary to update firmware during operation (due to functional extensions, for example).
This section describes how to perform a firmware update on an interface module.

Requirements

- You have downloaded the necessary firmware files (*.UPD) and saved them in the file system of your programming device/PC.
- The interface module to be updated is available online.

Note

During a firmware update, all other modules of the station apply the configured substitute value behavior or are de-energized.

Performing a firmware update

1. Run *STEP 7* and switch to HW Config.
2. Open the station with the interface module to be updated.
3. Select the interface module.
4. Select the menu command **PLC > Update Firmware**.
5. The **Update firmware** dialog box opens. Click **Browse** to select the path to the firmware files (*.UPD).
6. After you have selected a file, the information in the lower fields of the **Update firmware** dialog box shows you the firmware file and version for the corresponding module(s).
7. Click the **Run** button. *STEP 7* checks whether the selected file can be interpreted by the interface module. When the check is positive, *STEP 7* loads the file. If this requires changing the mode of the interface module, dialogs will ask you to perform the relevant tasks. The interface module then updates the firmware automatically.
8. Use *STEP 7* (read the CPU diagnostics buffer) to verify that the interface module can start up with the new firmware. You can read out the current firmware version in the module status of the interface module.

Result

You have successfully updated the firmware version of your interface module.

Reference

For additional information on updating firmware, refer to the online help of STEP 7 or see:

- Firmware updates for ET 200pro interface modules (https://support.industry.siemens.com/cs/ww/en/ps/23705/dl)

Functions

9

9.1 PROFIBUS DP

9.1.1 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.

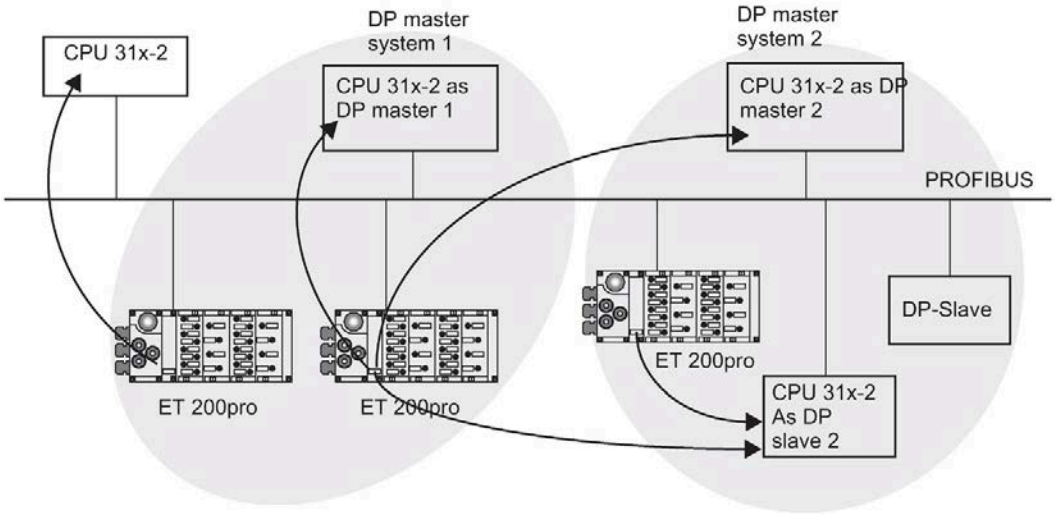


Figure 9-1 Example of data exchange

9.1.2 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 9- 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 9- 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 9- 3 Identification data

Identification data	Access	Default	Description
Identification data 0: Index 1 (data record 231)			
MANUFACTUREROR_ID	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)

Identification data	Access	Default	Description
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.

9.2 PROFINET IO

9.2.1 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 9- 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 9- 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

Identification data	Access	Default	Description
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.

9.3 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.

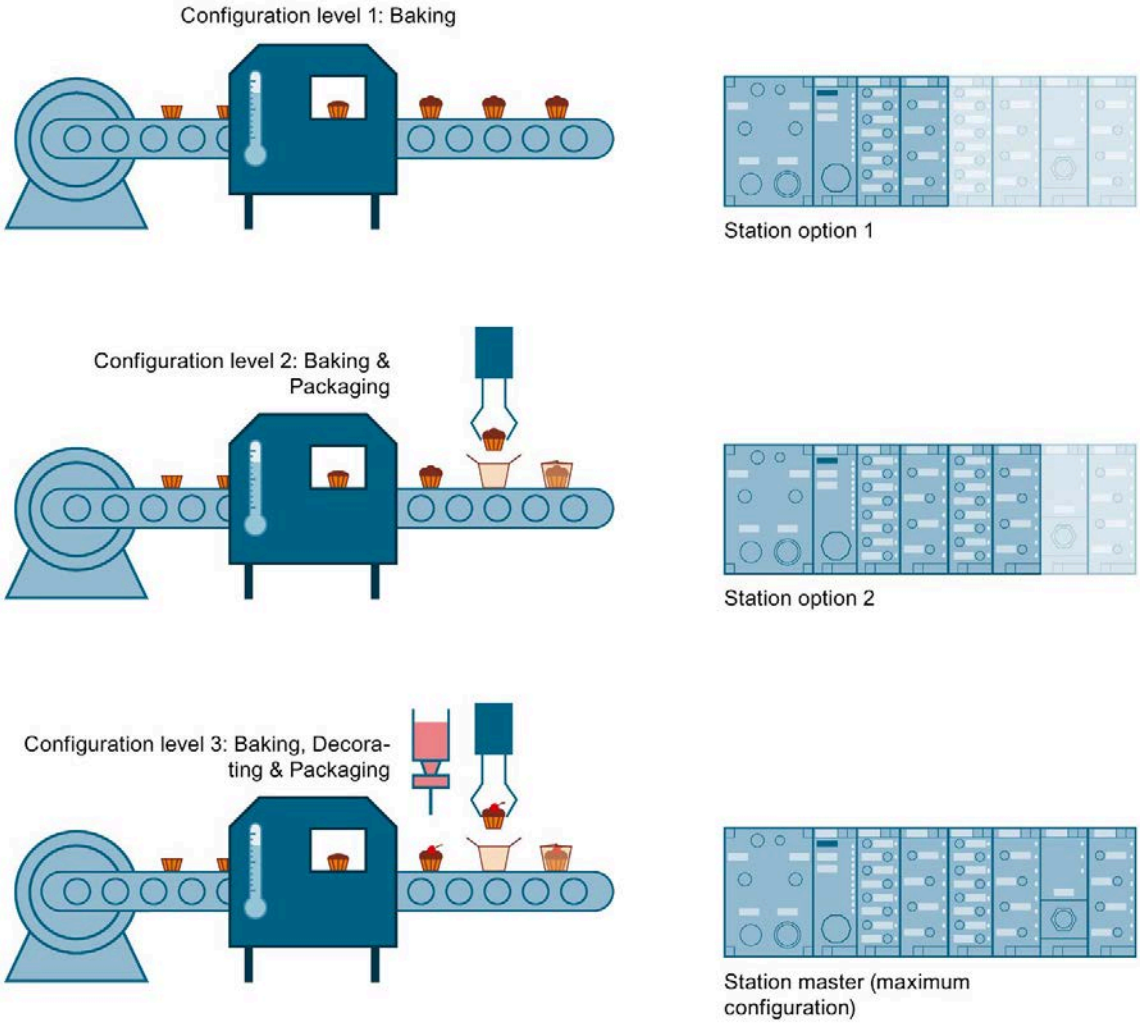


Figure 9-2 Different configuration levels of an application with the associated station options of the ET 200pro distributed I/O system

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

Library for configuration control

A library for configuration control is available on the Internet for download (https://support.industry.siemens.com/cs/#document/29430270?lc=en-WW). The library contains 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.

9.3.1 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 164)
2	Create control data record	Section Creating the control data record (Page 165)
3	Transfer control data record	Section Transferring the control data record in the start-up routine of the CPU (Page 170)

9.3.1.1 Configuring

Requirements

You have assigned the interface module to an IO controller in STEP 7.

They fulfill the following requirements for configuration:

Interface module	Configuration software		GSD file
	STEP 7 (TIA Portal)	STEP 7	
IM 154-3 PN High Feature	as of V14 SP1 + HSP227	as of V5.5 SP4 + HSP0265 V2.0	GSDML-Vx.y-siemens-et200pro-"Date in format yyyymmdd".xml (https://support.industry.siemens.com/cs/ww/en/view/21915937)
IM 154-4 PN High Feature (as of firmware version V7.1)	as of V13 SP1	as of V5.5 SP4 + HSP0265 V1.0	

Required steps

To configure the configuration control for the interface module, you must activate the "Enable configuration control" parameter.

Note

When you enable configuration control, the ET 200pro distributed I/O system requires control data record 196 from the user program.
The station will not run without a control data record.

9.3.1.2 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

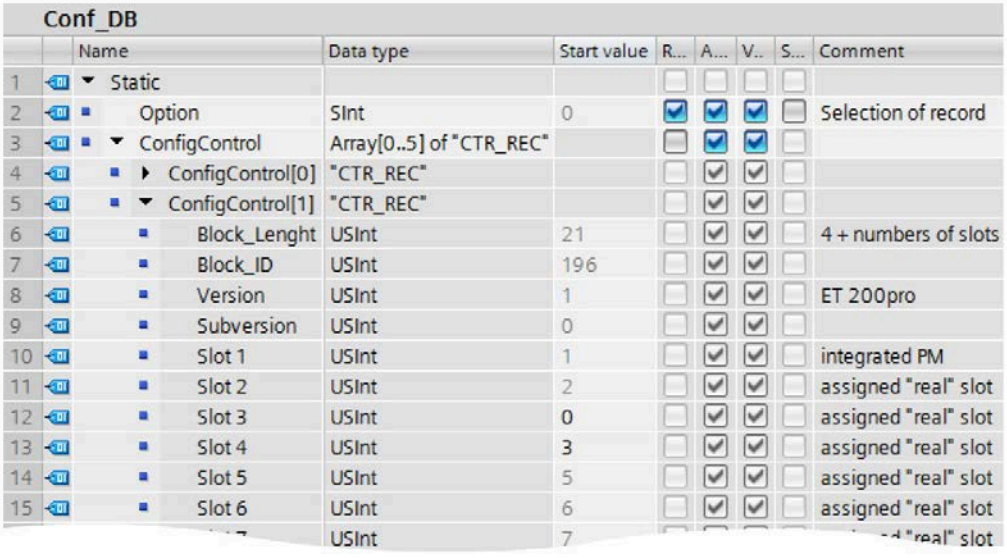
	Name	Data type	Default value	A...	V...	S..	Comment
1	Block_Lenght	USInt	21	☑	☑	☐	4 + numbers of slots
2	Block_ID	USInt	196	☑	☑	☐	
3	Version	USInt	1	☑	☑	☐	ET 200pro
4	Subversion	USInt	0	☑	☑	☐	
5	Slot 1	USInt	1	☑	☑	☐	integrated PM
6	Slot 2	USInt	2	☑	☑	☐	assigned "real" slot
7	Slot 3	USInt	3	☑	☑	☐	assigned "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 9-3 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 9-4 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 following table shows the possible slots for the various modules for an IM 154-X PN HF:

Table 9- 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 9- 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 9- 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 9- 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 9- 10 Error messages

Error code	Meaning
80B1H	Invalid length; the length information in data record 197 is not correct.
80B5H	Configuration control not configured
80B8H	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

9.3.1.3 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 167).

Error messages

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

Table 9- 11 Error messages

Error code	Meaning
80B1H	Impermissible length; the length information in data record 196 is incorrect.
80B5H	Configuration control not assigned parameters.
80B8H	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.

9.3.1.4 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.

9.3.1.5 Examples of configuration control

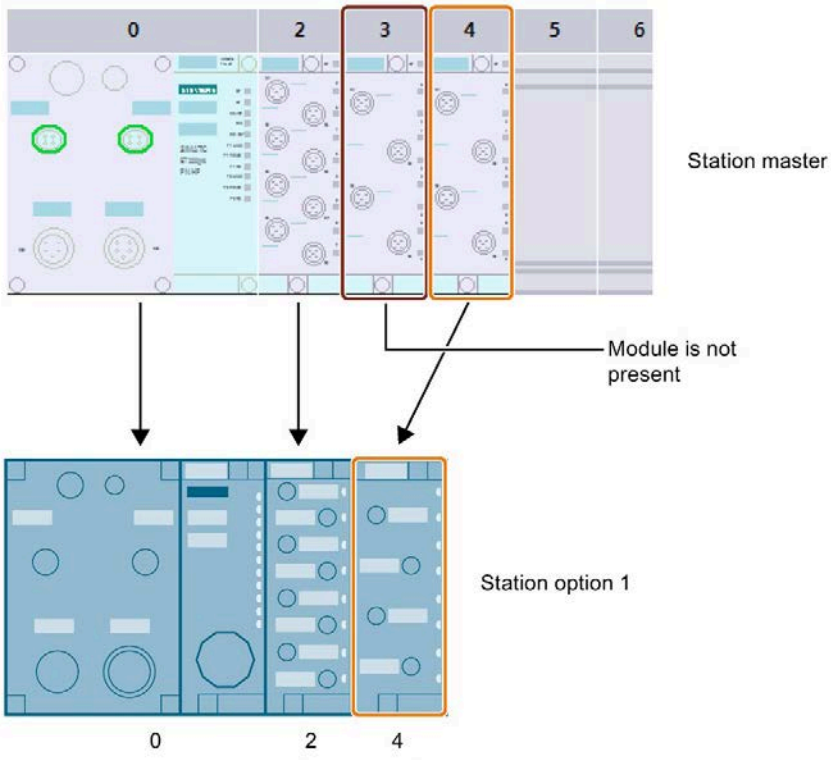
Below, a station master with one interface module and three I/O modules is configured in STEP 7.

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.

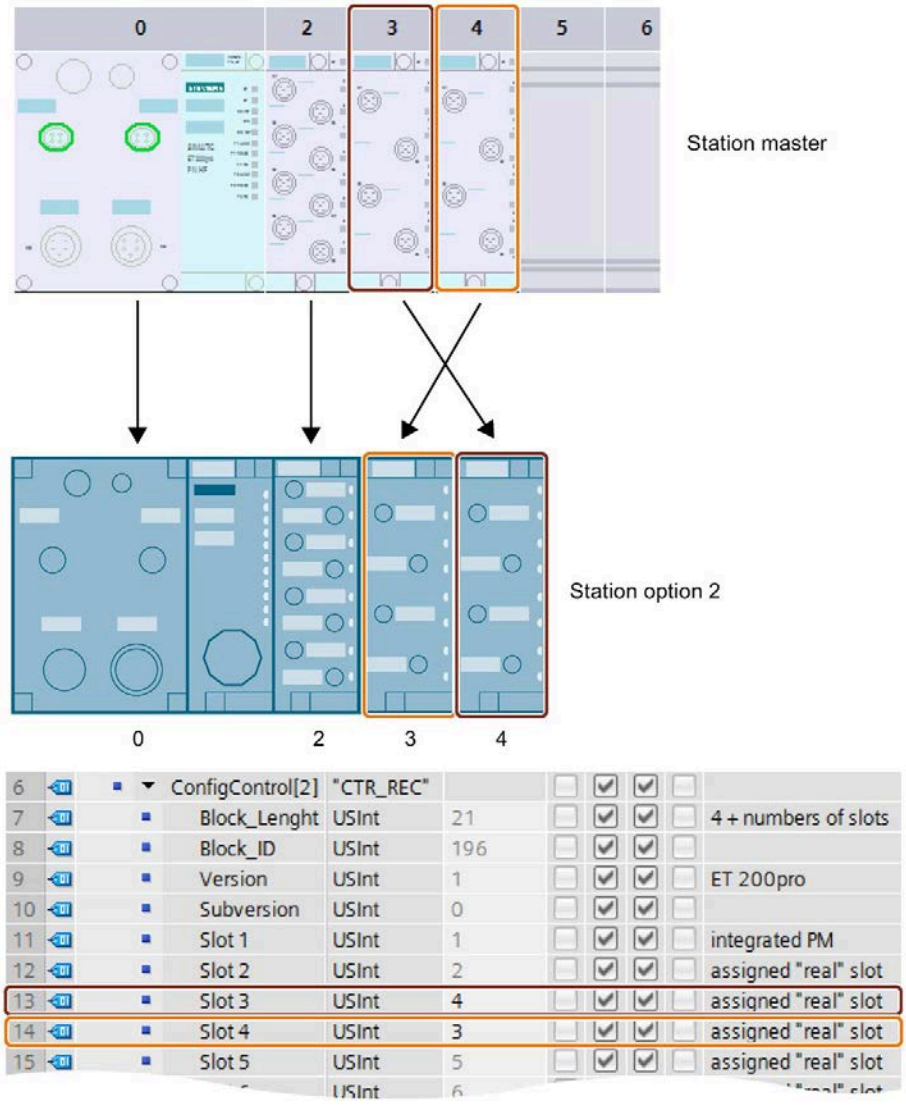


5			ConfigControl[1]	"CTR_REC"					
6			Block_Lenght	USInt	21				4 + numbers of slots
7			Block_ID	USInt	196				
8			Version	USInt	1				ET 200pro
9			Subversion	USInt	0				
10			Slot 1	USInt	1				integrated PM
11			Slot 2	USInt	2				assigned "real" slot
12			Slot 3	USInt	0				assigned "real" slot
13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

Figure 9-5 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

Figure 9-6 Example: Hardware configuration of station option 2 with the associated control data record in STEP 7

9.3.2 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 175)
2	Controlling and monitoring station options through the control interface	Section Controlling and monitoring station options (Page 177)

9.3.2.1 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.

9.3.2.2 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 9-7 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 9- 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 9- 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.

9.3.2.3 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).

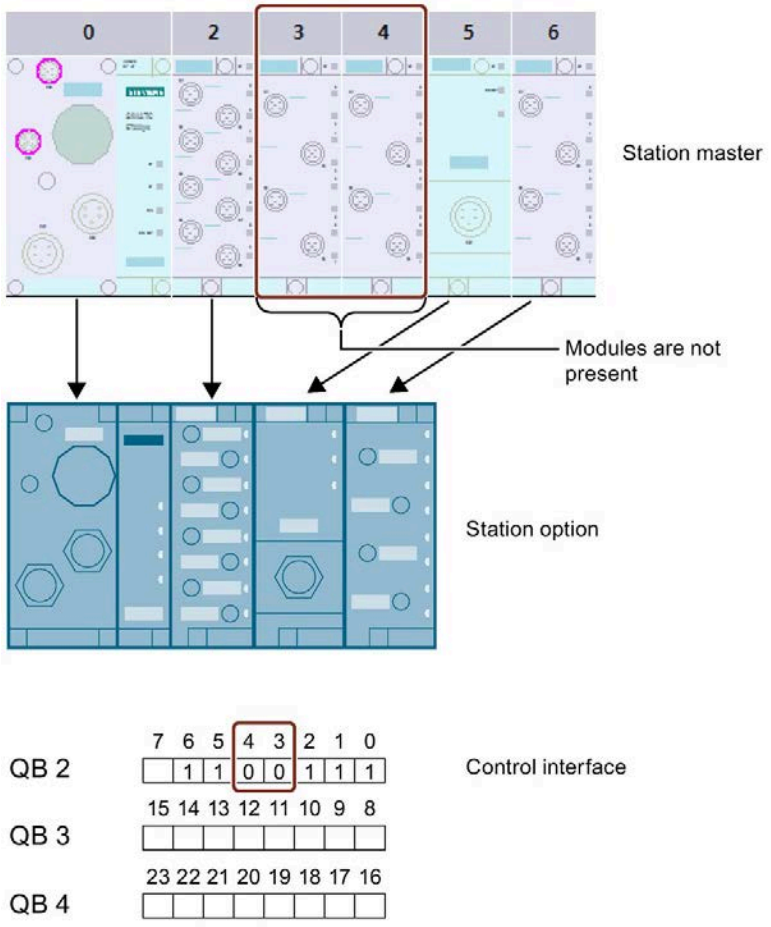


Figure 9-8 Example of the configuration control with an IM 154-2 DP HF

Alarm, error and system messages

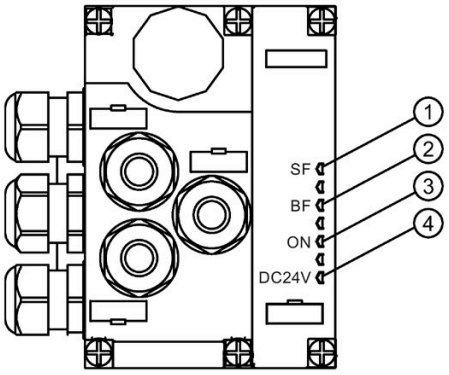
10

10.1 PROFIBUS DP

10.1.1 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 10- 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 184)

Evaluating interrupts (Page 187)

Channel-specific diagnostic data (Page 195)

10.1.2 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
```

10.1.3 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 181)

10.1.4 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.

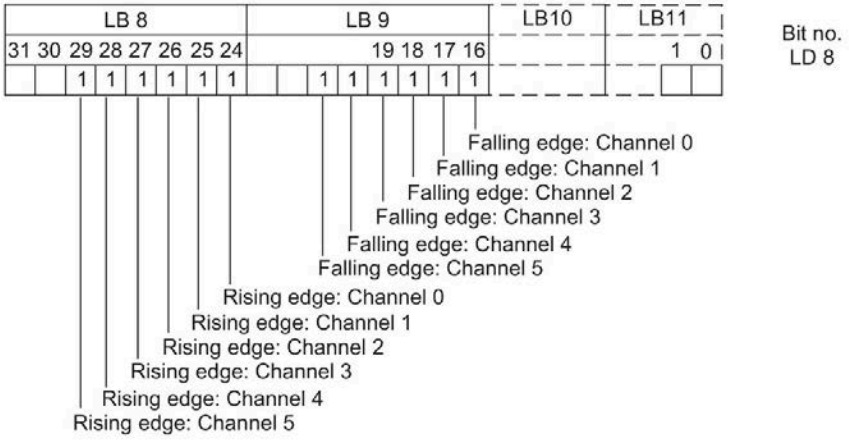


Figure 10-1 Interrupts of 8 DI DC 24V High Feature

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.

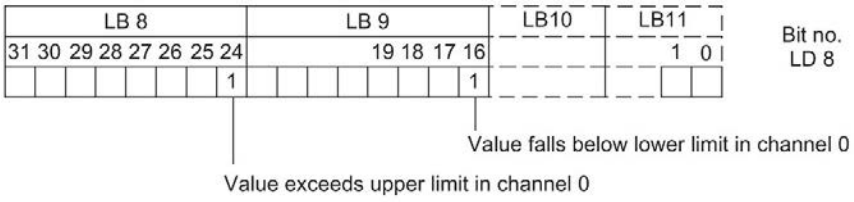


Figure 10-2 Interrupts for analog input modules

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.

10.1.5 Structure of slave diagnostic data

Structure of slave diagnostic data

The figure below illustrates the structure of slave diagnostics.

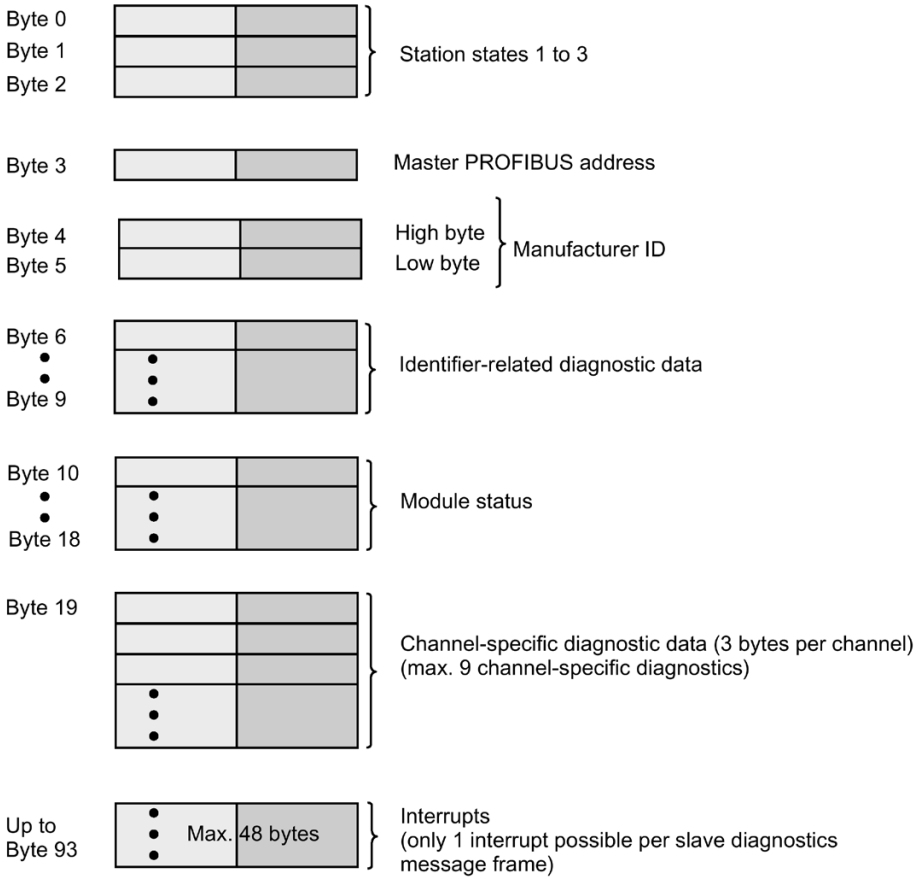


Figure 10-3 Structure of slave diagnostic data

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 191)
Master PROFIBUS address (Page 192)
Manufacturer ID (Page 193)
Identifier-related diagnostic data (Page 193)
Module status (Page 194)
Channel-specific diagnostic data (Page 195)
Interrupts (Page 198)

10.1.6 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.

Bit	Meaning	Cause/remedy
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).

10.1.7 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.

10.1.8 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
81H	18H	ET 200pro with IM154-1 DP
81H	19H	ET 200pro with IM154-2 DP High Feature

10.1.9 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:

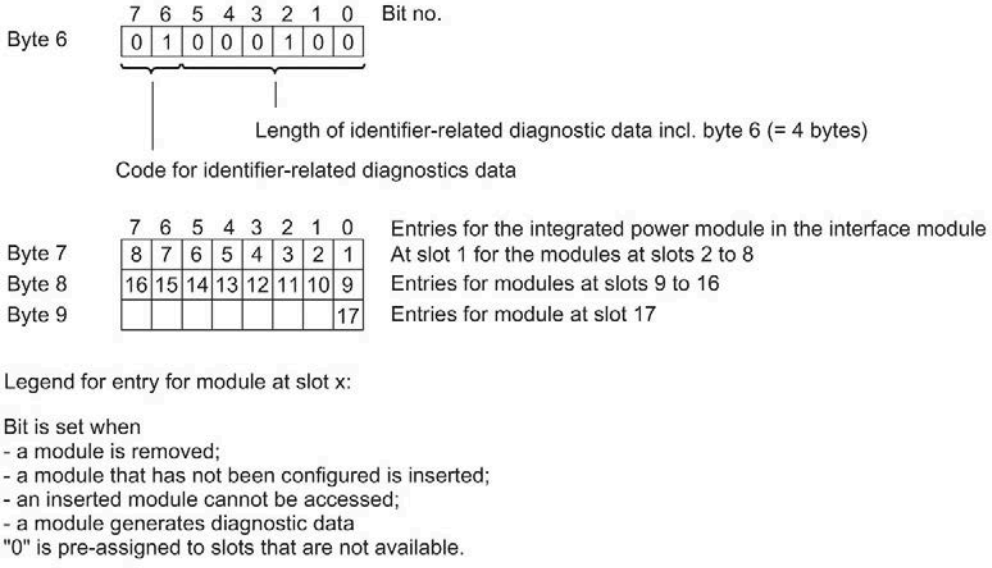


Figure 10-4 Structure of identifier-related diagnostic data

10.1.10 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:

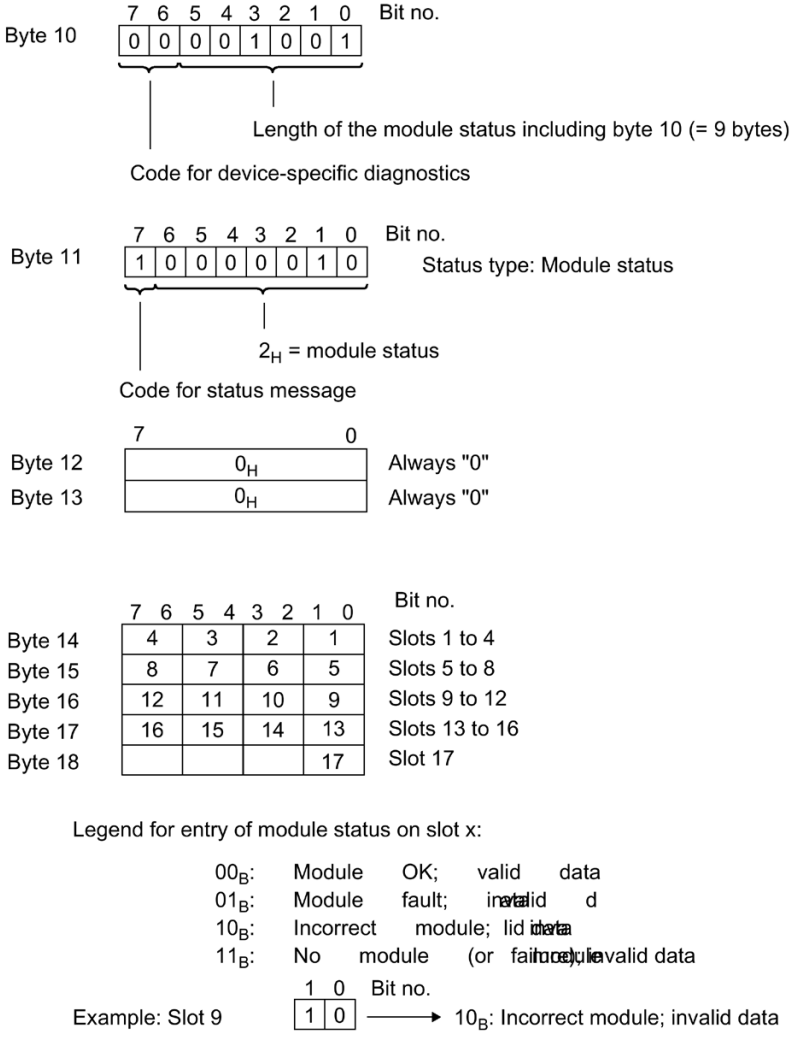


Figure 10-5 Module status

See also

Structure of interrupts (Page 199)

Diagnostics of faulty configuration states of ET 200pro (Page 205)

10.1.11 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.

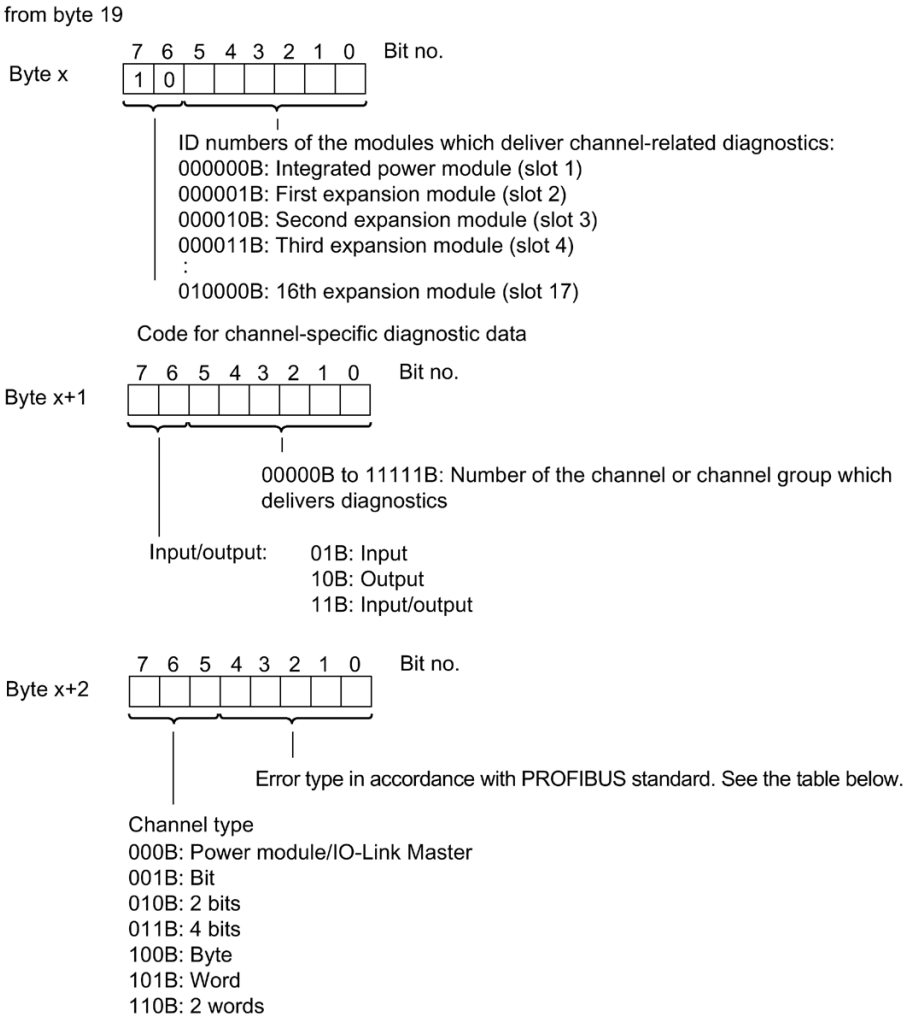


Figure 10-6 Structure of channel-specific diagnostic data

See also

LED display on the IM 154-1 DP and IM 154-2 DP High Feature interface modules (Page 181)

Error types for electronic modules (Page 217)

10.1.12 Error types for electronic modules

Error types and remedies

The table below shows the error types for electronic modules.

Table 10- 2 Error types for electronic modules

Error type		Error text	Meaning	Remedy
00001B	1D	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
00110B	6D	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
00111B	7D	Violation of upper limit	The value is above the overrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01000B	8D	Violation of lower limit	The value is below the underrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01001B	9D	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
10000B	16D	Parameter assignment error	Module not parameterized	Correct the parameters
10001B	17D	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
10101B	21D	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

Error type		Error text	Meaning	Remedy
10110B	22D	Process interrupt lost	ET 200pro failed to detect a process interrupt	Correction or coordination of the program, process, module
11010B	26B	External error	Error at encoder circuit	Correct the process wiring

10.1.13 Interrupts

10.1.13.1 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 199)

10.1.13.2 Structure of interrupts

Interrupt structure

Structure of the interrupt section for ET 200pro:

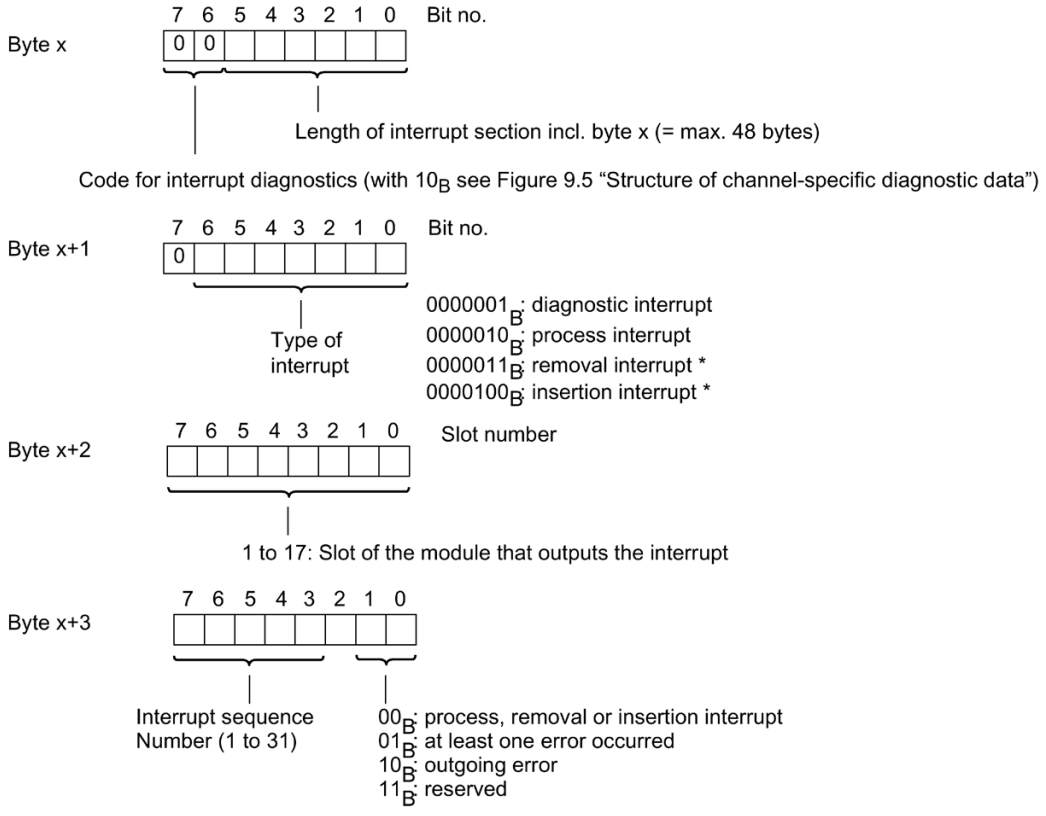
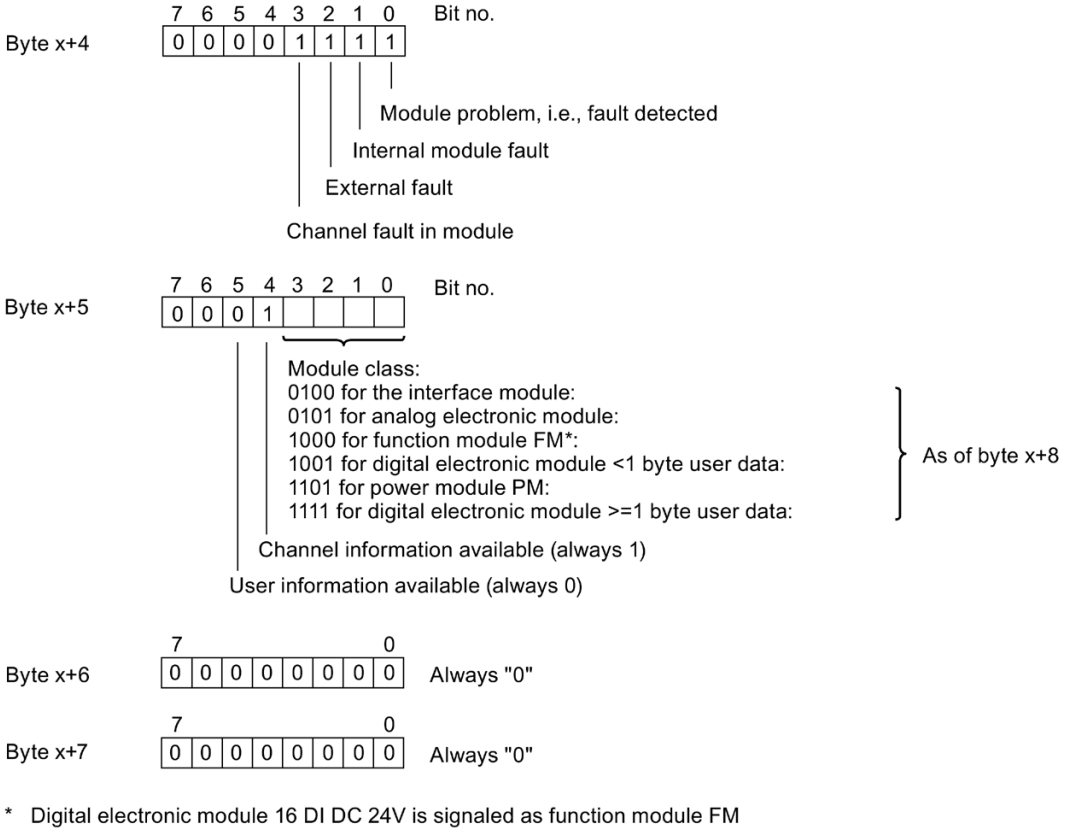


Figure 10-7 Structure of the interrupt status of the interrupt section

* 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 10-8 Structure of Bytes x+4 to x+7 for diagnostic interrupts

Diagnostic interrupt of the modules

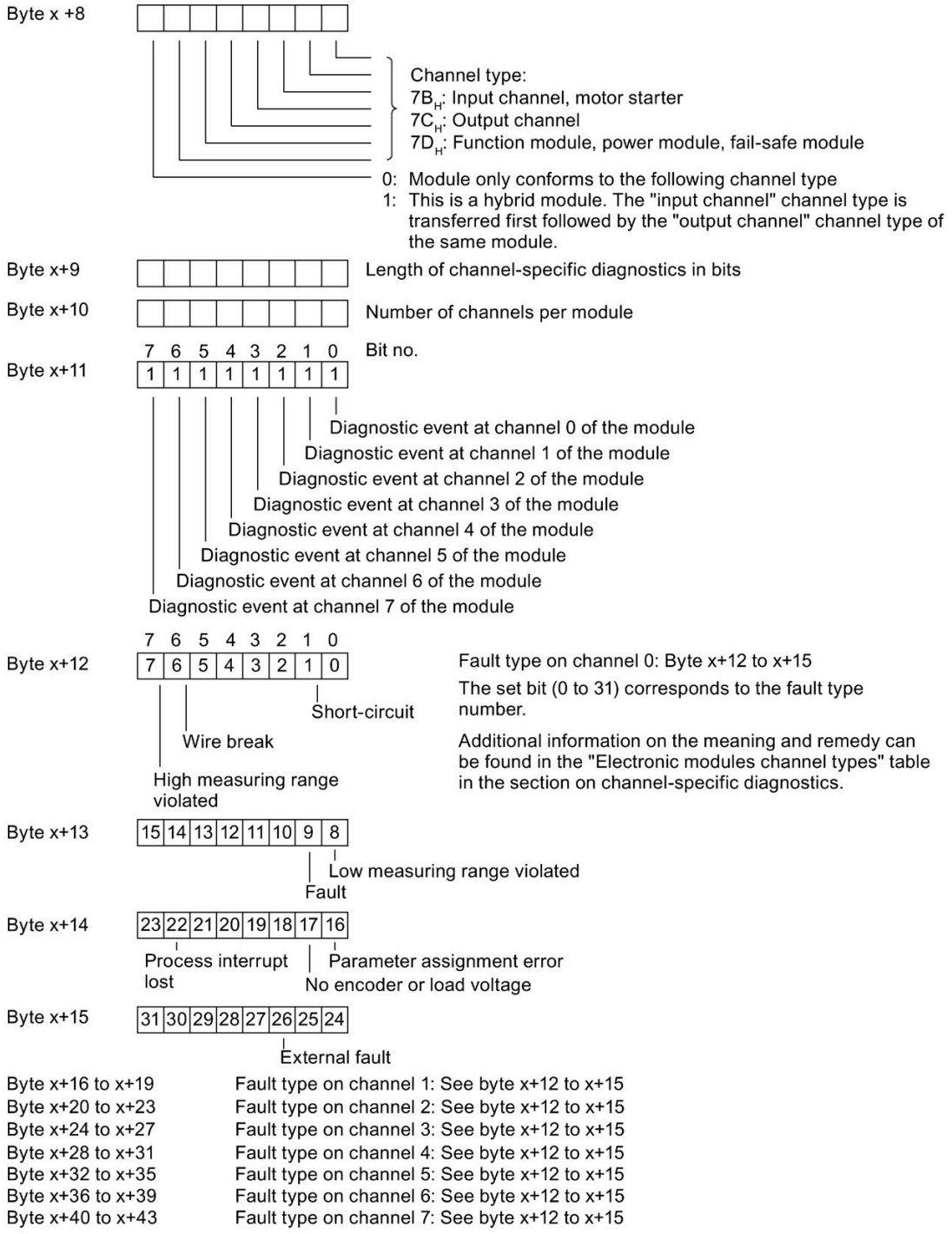


Figure 10-9 Structure of diagnostics interrupts, starting at Byte x+8

See also

Module status (Page 194)

Process interrupt of analog input modules (Page 204)

10.1.13.3 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.

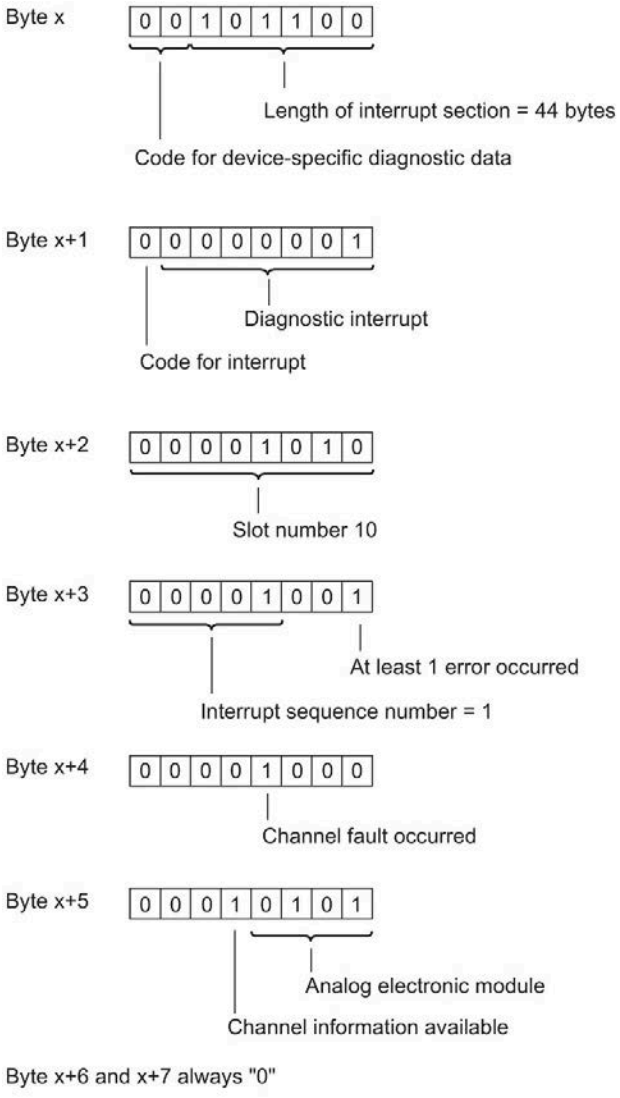


Figure 10-10 Example of a diagnostic interrupt

Example of a diagnostic interrupt (continued)

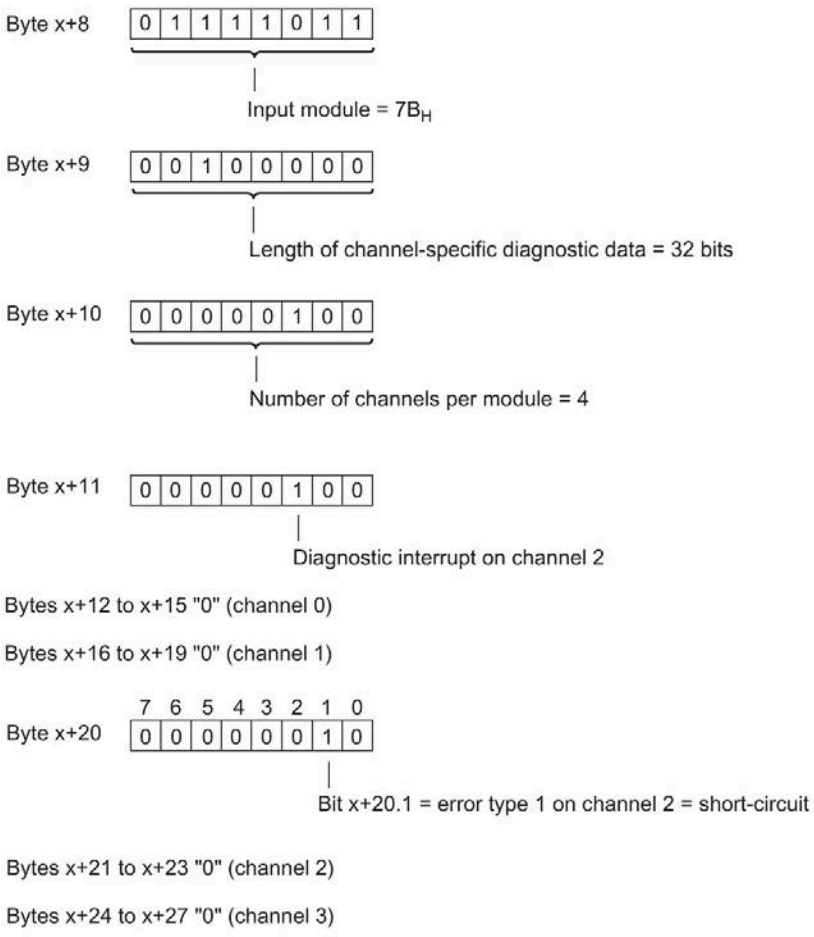
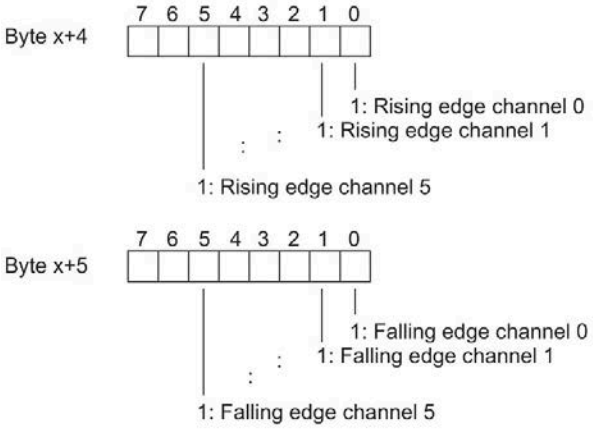


Figure 10-11 Example of a diagnostic interrupt (continued)

10.1.13.4 Process interrupt of digital input modules

Process interrupt of digital electronic module 8 DI DC 24V High Feature

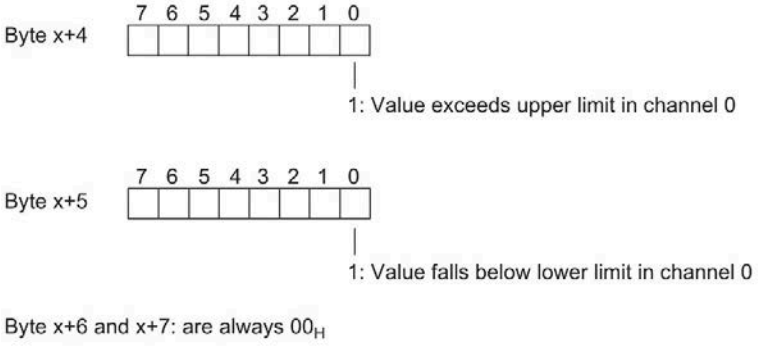


Byte x+6 and x+7: are always 00_H

Figure 10-12 Structure as of byte x+4 for process interrupt (8 DI DC 24V High Feature)

10.1.13.5 Process interrupt of analog input modules

Process interrupt of analog input modules



Byte x+6 and x+7: are always 00_H

Figure 10-13 Structure as of byte x+4 for process interrupt (analog input)

See also

Structure of interrupts (Page 199)

10.1.14 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 194)

10.1.15 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 205)

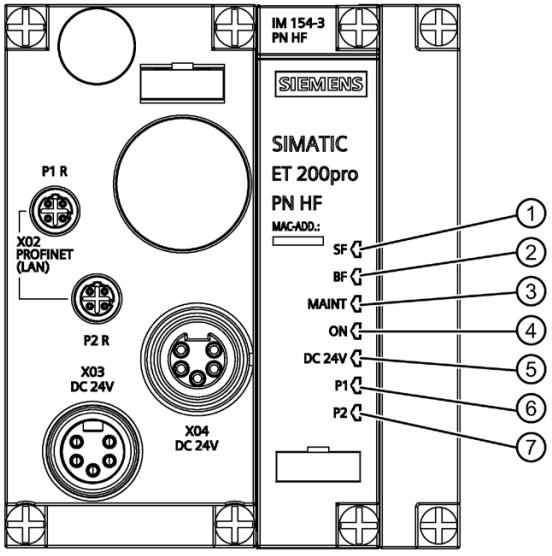
The DP slave still works and communicates, that is, it delivers diagnostics, reacts to I/O module events, and can process data records. The cause of the DP slave failure can be determined from the diagnostics.

10.2 PROFINET IO

10.2.1 LED display on interface module IM 154-3 PN High Feature (6ES7154-3AB00-0AB0)

LED display

The figure below shows the position and layout of the LED display on the IM 154-3 PN High Feature interface module (6ES7154-3AB00-0AB0) with the CM IM PN M12, 7/8" S 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: Connection to a switch or controller on port 1 (green LED)/ data exchange on port 1 (yellow LED)
⑦ P2: Connection to a switch or controller on port 2 (green LED)/ data exchange on port 2 (yellow LED)

Figure 10-14 LED display IM 154-3 PN High Feature

Status and error displays GE, BF, ON

Table 10- 3 Status and error displays of IM 154-3 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	-

*) not relevant

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 213)). An alarm message is generated in addition to the LED display.

Status display 24V DC

The green LED 24V DC 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.

Status displays P1/P2

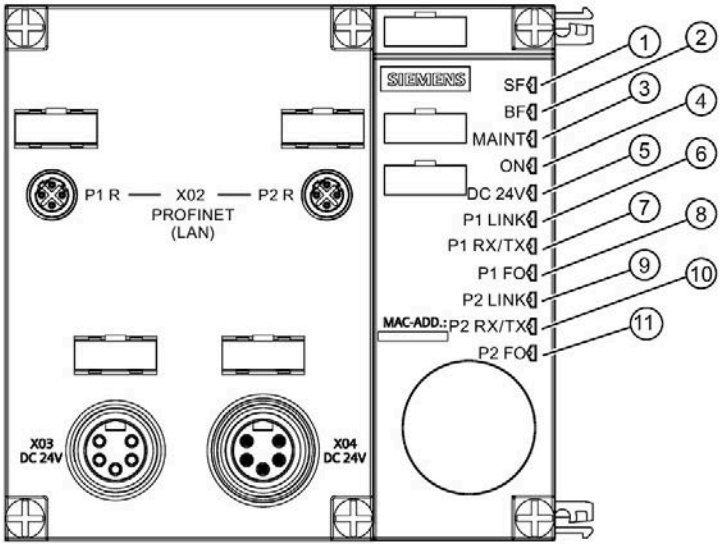
Table 10- 4 Status displays of the IM 154-3 PN High Feature on port 1 (P1) and port 2 (P2)

LEDs P1/P2	Meaning	Remedy
Off	No connection to the IO controller (no IO controller available on the network)	• Set uniform baud rate • Autonegotiation not successful
On (green)	There is a connection to the IO controller. Correct operation	-
Flashes (yellow)	Transmission/reception is in progress	-

10.2.2 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

Table 10- 5 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	-

*) not relevant

Status displays LINK, RX/TX, FO

Table 10- 6 Status displays of IM 154-4 PN High Feature on port 1 (P1) and port 2 (P2)

LEDs			Meaning	Remedy
P1 LINK / P2 LINK	**P1 RX/TX / P2 RX/TX**	**P1 FO / P2 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				

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 213)). 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.

10.2.3 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.

10.2.4 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.

10.2.5 Maintenance alarms

Introduction

The PROFINET interfaces of the PROFINET interface modules support the diagnostics and maintenance concept in PROFINET according to the IEC 61158-6-10 standard. The goal is to detect and eliminate potential problems as soon as possible.

Maintenance interrupts

The contents of the following table apply to:

- IM 154-3 PN High Feature with connection module CM IN PN M12, 7/8" S
- IM 154-4 PN High Feature with connection module CM IM PN PP Cu or CM IM PN M12, 7/8"

The PROFINET interface module signals the following to the higher-level diagnostics unit:

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

Maintenance interrupts IM 154-4 PN High Feature with CM IM PN PP FO connection module

For the IM154-4 PN High Feature, maintenance interrupts signal to the user when a fiber-optic cable must be checked or replaced. This depends on the increase in the attenuation value on the PROFINET interface.

The IM154-4 PN High Feature signals the following to the higher-level diagnostics unit:

Maintenance interrupts	Cause (limits POF cable)	Message/Meaning	LEDs
Level 1: Maintenance required	As of a system reserve < 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	As of a system reserve < 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.

System alarms in *STEP 7*

The maintenance information is generated in *STEP 7* with the following system alarms:

- Maintenance demanded – symbolized by a yellow wrench for each port.
- Maintenance required – symbolized by an orange wrench for each port.

10.2.6 Diagnostics in STEP 7

10.2.6.1 Reading out the diagnostic data

Options for reading out diagnostic data

Table 10- 7 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)

10.2.6.2 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 PROFINET interface modules:

Interface module	BlockVersion
IM 154-4 PN High Feature 6ES7154-4AB10-0AB0	W#16#0101
IM 154-3 PN High Feature 6ES7154-3AB00-0AB0	

Manufacturer-specific diagnostics in the User Structure Identifier (USI)

The following manufacturer-specific diagnostics are reported in the USI for the PROFINET interface modules.

- Interruption of the ET 200pro backplane bus: USI = W#16#0001
- Incorrect module combination: USI = W#16#0002

USI structure = W#16#0001

Table 10- 8 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 10- 9 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 217)

10.2.6.3 Error types for electronic modules

Error types and remedies

The table below shows the error types for electronic modules.

Table 10- 10 Error types for electronic modules

Error type		Error text	Meaning	Remedy
00001B	1D	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
00110B	6D	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
00111B	7D	Violation of upper limit	The value is above the overrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01000B	8D	Violation of lower limit	The value is below the underrange	• Correct the module/encoder tuning • Change the measuring range in the parameter assignment
01001B	9D	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
			• Short circuit to G (DI) • Short-circuit to G (DO) (only for digital electronic module 4 DI / 4 DO 24V DC/0.5A)	• Correct the process wiring • Check the encoder or actuator
10000B	16D	Parameter assignment error	Module not parameterized	Correct the parameters
10001B	17D	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

Error type		Error text	Meaning	Remedy
10101B	21D	Reference channel error	Measuring line for compensation interrupted	Correct the process wiring
			Data record DS2 incorrect	Check data record DS2
			Timeout with "Dynamic Ref. Temp."	Send DS2
10110B	22D	Process interrupt lost	ET 200pro failed to detect a process interrupt	Correction or coordination of the program, process, module
11010B	26B	External error	Error at encoder circuit	Correct the process wiring

See also

Channel-specific diagnostic data (Page 195)

Channel diagnostics (Page 215)

10.2.6.4 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 193)

Module status (Page 194)

10.2.6.5 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 ("*" "*")

10.2.6.6 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.

10.2.6.7 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.

10.2.6.8 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.

10.3 LED display on the power, electronic and pneumatic interface modules

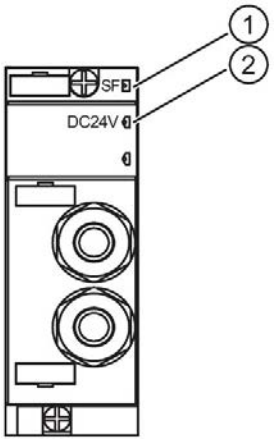
10.3.1 LED display on the PM-E power module

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 10- 11 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			

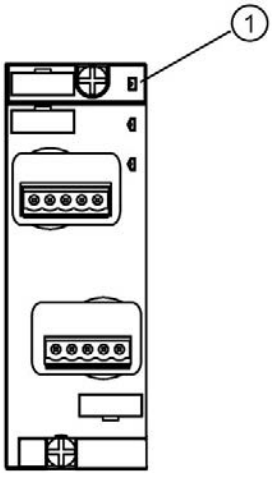
10.3.2 LED displays on the PM-O outgoing module

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 10- 12 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.

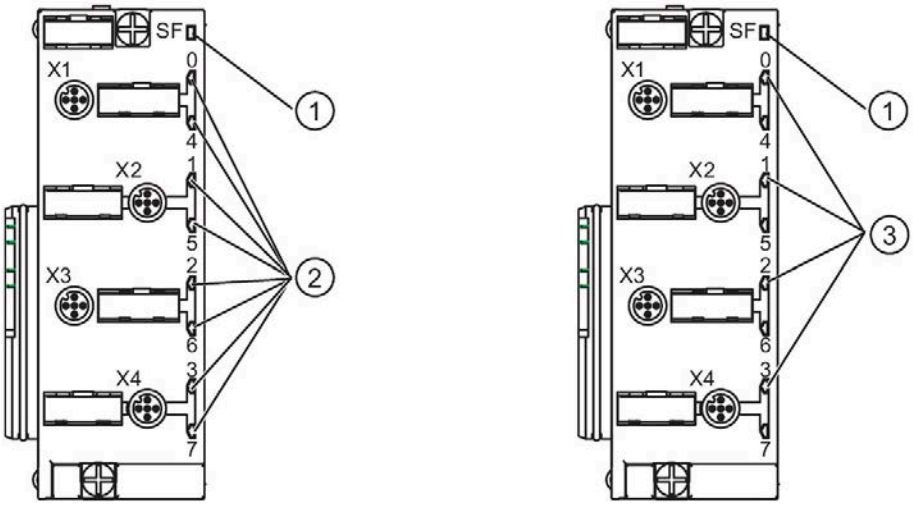
10.3.3 LED display at the electronic module

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)

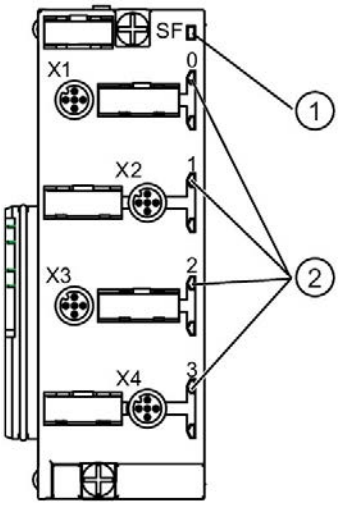
Status error/channel fault indicator for 8-channel digital High Feature electronic modules (green/red LEDs)

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.



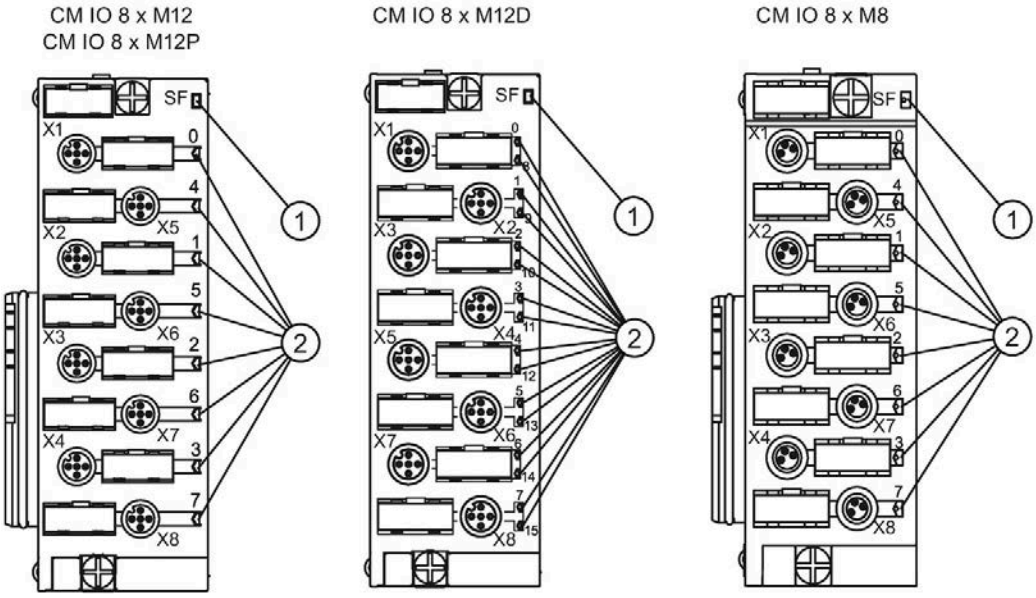
① GE: Group error (red LED)

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.

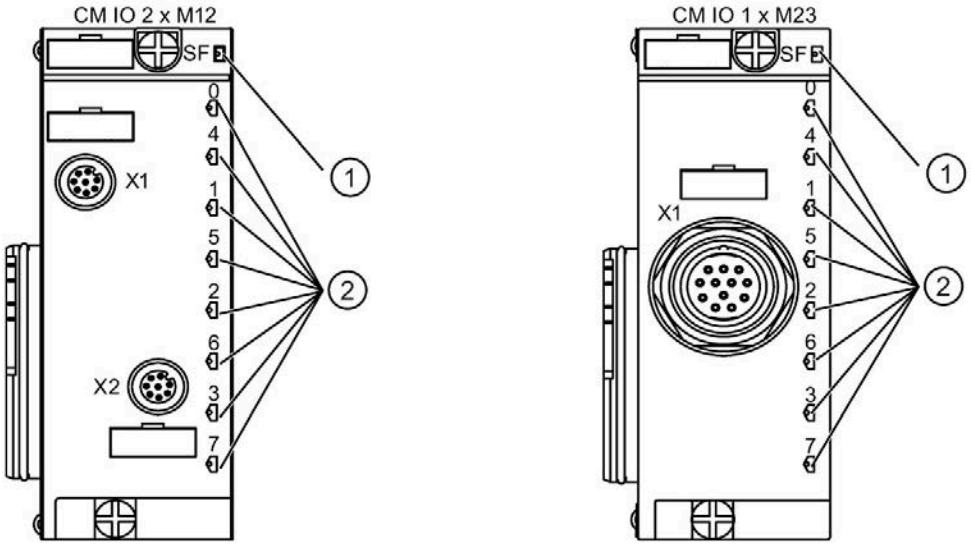


① GE: Group error (red LED)

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 10-15 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 10- 13 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.
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:	
On	---	Short-circuit	Check the wiring of the encoder supply or the outputs.

LEDs		Meaning	Remedy
GE	**Status and error displays**		
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 10- 14 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	---

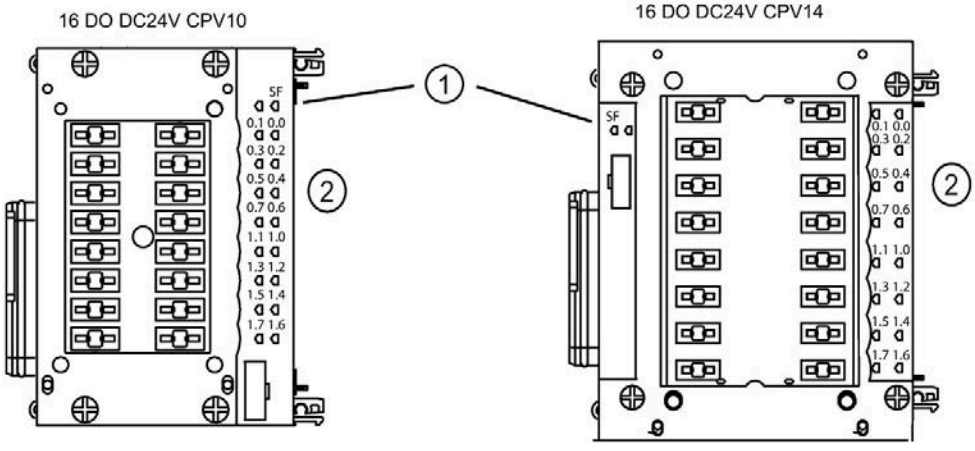
10.3.4 LED display on the electronic interface module

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 10- 15 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

11

11.1 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

The ET 200pro distributed I/O system meets the requirements and objectives of the following directives and conforms to the harmonized European standards (EN) published for programmable logic controllers in the official journals of the European Community:

- 2014/35/EU "Electrical equipment designed for use within certain voltage limits" (Low Voltage Directive)
- 2014/30/EU "Electromagnetic Compatibility" (EMC Guidelines)
- 2011/65/EU "Restriction of the use of certain hazardous substances in electrical and electronic equipment" (RoHS Guidelines)

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 SYS
P.O. Box 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 distributed I/O system ET 200pro meets the requirements of EN 61000-6-4 Generic standards – Emission standard for industrial environments.

Korea Certificate KCC-REM-S49-ET200

Note that this device corresponds to limit class A in terms of the emission of radio frequency interference. This device can be used in all areas, except residential areas.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Marking for the Eurasian Customs Union

EAC (Eurasian Conformity)

Customs Union of Russia, Belarus and Kazakhstan

Declaration of conformity with the technical requirements of the Customs Union (TR CU).

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

The ET 200pro distributed I/O system is designed for use in industrial areas. The following standards are met for this purpose:

- Requirements for emitted interference EN 61000-6-4: 2011
- Requirements for immunity to interference EN 61000-6-2: 2005

Use in mixed areas

Under certain circumstances, you can use the ET 200pro distributed I/O system in a mixed area. A mixed area is used for residential living and the accommodation of commercial enterprises which do not substantially disturb residential living.

If you use the ET 200pro distributed I/O system in a mixed area, you must ensure that radio interference emission complies with the limit classes of the technical standard EN 61000-6-3. Suitable measures for achieving these limits for use in a mixed area are, for example:

- Installation of the ET 200pro distributed I/O system in grounded control cabinets
- Use of filters in the supply lines.

In addition, an individual acceptance test is required.

Use in residential areas

Note

ET 200pro distributed I/O system not intended for use in residential areas

The ET 200pro distributed I/O system is not intended for use in residential areas. Using the ET 200pro distributed I/O system in residential areas may affect radio or television reception.

Marine approval

Classification societies:

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- CCS (China Classification Society)
- DNVGL (Det Norske Veritas / Germanischer Lloyd)
- KR (Korean Register of Shipping)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

11.2 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)		
• Asymmetric coupling	2 kV (supply line) 2 kV (signal/data line)	3
• 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

The following table shows the emitted interference of electromagnetic fields according to EN 55016 (measured at a distance of 10 m).

Table 11- 1 Emitted interference of electromagnetic fields

Frequency	Emitted interference
from 30 to 230 MHz	<40 dB (µV/m) Q
from 230 to 1000 MHz	<47 dB (µV/m) Q
from 1 GHz to 3 GHz	<66 dB (µV/m) P
from 3 GHz to 6 GHz	<70 dB (µV/m) P

11.3 Shipping and storage conditions

Transport and storage conditions

The ET 200pro distributed I/O system exceeds requirements in terms of transport and storage conditions according to IEC 61131-2. The following information applies to modules that are transported and/or stored in their original packaging.

Type of condition	Permitted range
Free fall	≤ 1 m
Temperature	From -40 °C to +70 °C
Temperature change	20 K/h
Air pressure	From 1140 to 660 hPa (corresponds to an elevation from 1000 to 3500 m)
Relative humidity	From 5 to 95%, without condensation

11.4 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	from 1140 to 795 hPa	Corresponds to an altitude of -1000 m to 2000 m
Concentration of pollutants	ANSI/ISA-71.04 severity level G1; G2; G3	-
* 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	Article number
IM 154-1 DP with terminating module	6ES7154-1AA01-0AB0
IM 154-2 DP High Feature with terminating module	6ES7154-2AA01-0AB0
IM 154-3 PN High Feature with terminating module	6ES7154-3AB00-0AB0
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 M12, 7/8" S	6ES7194-4AK00-0AA0
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
CM IO 8 x M12	6ES7194-4CB00-0AA0
CM IO 8 x M12P	6ES7194-4CB10-0AA0

Designation	Article number
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
8 DI DC 24V High Feature	6ES7141-4BF00-0AB0
8 DO DC 24V/0.5A	6ES7142-4BF00-0AA0
4 DO DC 24V/2.0A	6ES7142-4BD00-0AA0
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	6ES7144-4FF01-0AB0
4 AI I High Feature	6ES7144-4GF01-0AB0
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

11.5 Specifications for insulation tests, protection class, degree of protection, and rated voltage

Isolation

The isolation is designed in accordance with the requirements of EN 61131-2: 2007.

Note

In the case of modules with 24 V DC (SELV/PELV) supply voltage, galvanic isolations are tested with 707 V DC (type test).

You can find information on isolation with ET 200pro motor starters in the operating instructions for the ET 200pro motor starter on the Internet (http://support.automation.siemens.com/WW/view/en/22332388).

Protection class according to IEC 61131-2: 2007

The ET 200pro distributed I/O system fulfills protection class I and includes parts of protection class II and III. The 24 V components are part of protection class III.

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

11.6 Safety-related symbols for IP65/IP67 modules

The following table contains an explanation of the symbols located on your IP65/67 modules, their packaging or in the accompanying documentation.

Symbol	Meaning
	General warning sign **Caution/Notice** You must read the product documentation. The product documentation contains information about the type of potential hazard and enables you to recognize risks and implement countermeasures.
	The assigned safety symbols apply to devices **with Ex approval**. You must read the product documentation. The product documentation contains information about the type of potential hazard and enables you to recognize risks and implement countermeasures.
	Read the information provided by the product documentation. ISO 7010 M002
	Ensure the device is only installed by an electrically skilled person. IEC 60417 No. 6182
	Note that connected mains lines must be designed according to the expected minimum and maximum ambient temperature.
	Note that the device must be constructed and connected in accordance with EMC regulations.
	Note that a 230 V device can be exposed to electrical voltages which can be dangerous. ANSI Z535.2
	Note that a device of Protection Class III may only be supplied with a protective low voltage according to the standard SELV/PELV. IEC 60417-1-5180 "Class III equipment"
	Be aware that the device is only approved for the industrial field and only for indoor use.

Connection modules 12

12.1 Connection modules for interface modules with PROFIBUS DP

12.1.1 Connection module CM IM DP Direct for interface modules

Order number

6ES7194-4AC00-0AA0

Properties

Properties of the CM IM DP Direct connection module:

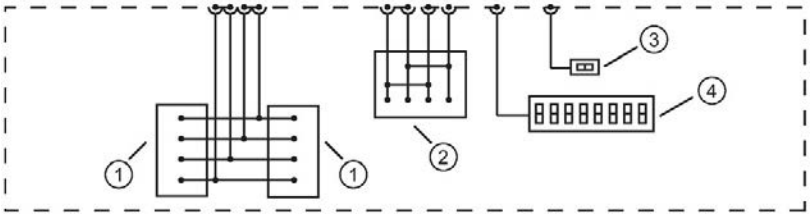
- Can be plugged in and attached with screws to the interface module
- The 1L+ and 2L+ supply voltages are connected via screw terminals, and PROFIBUS DP via insulation displacement terminals.
- You can loop through the power supplies and PROFIBUS DP using additional terminals.
- PROFIBUS DP address 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 273)

IM 154-2 DP High Feature interface module (Page 280)

12.1.2 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 273).

Block diagram

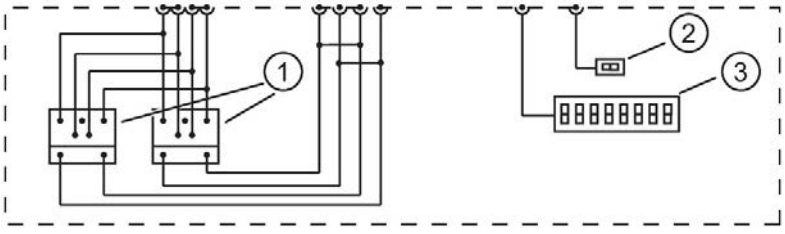


Figure 12-1 Block diagram of CM IM DP ECOFAST Cu for interface modules

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

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 273)

IM 154-2 DP High Feature interface module (Page 280)

12.1.3 CM IM DP M12 connection module, 7/8" for interface modules

Order number

6ES7194-4AD00-0AA0

Properties

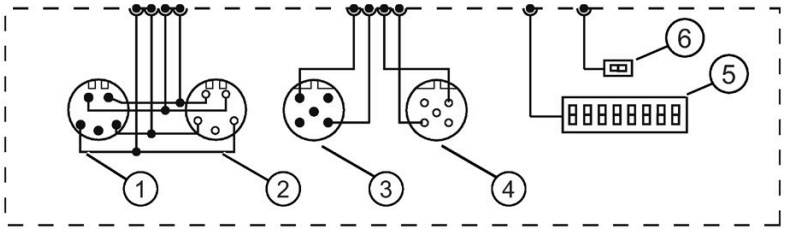
The CM IM DP M12, 7/8" connection module has the following properties:

- 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 section Interface modules (Page 273).

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. 440 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 273)

IM 154-2 DP High Feature interface module (Page 280)

12.2 Connection modules for the interface module with PROFINET IO

12.2.1 CM IM PN M12, 7/8" connection module for interface modules

Order number

6ES7194-4AJ00-0AA0

Properties

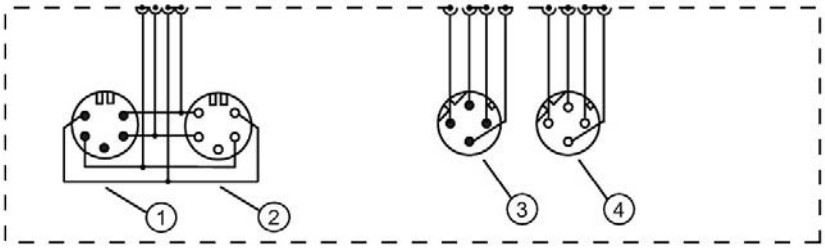
The CM IM PN M12, 7/8" connection module has the following properties:

- 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

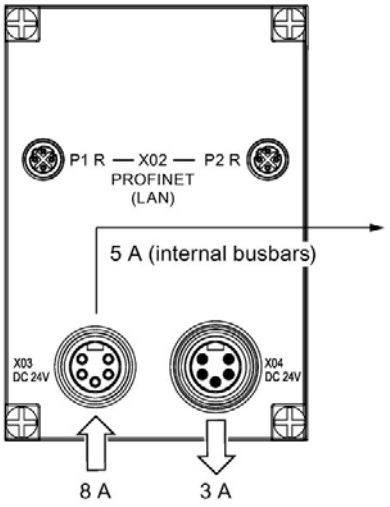
Feed current

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.



12.2.2 Connection module CM IM PN M12, 7/8" S for interface modules

Order number

6ES7194-4AK00-0AA0

Properties

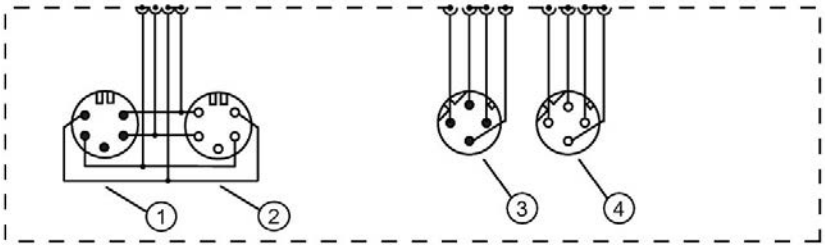
The CM IM PN M12, 7/8" S connection module has the following properties:

- Can be plugged in and attached with screws to the IM 154-3 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.
- 1 labeling strip

Pin assignment

You can find the pin assignment of CM IM PN M12, 7/8" in 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)	60 x 130 x 51
Weight	approx. 440 g
Currents	
Feed current	
• 1L+ electronics/encoder supply	Max. 8 A
• 2L+ load voltage supply	Max. 8 A

Note

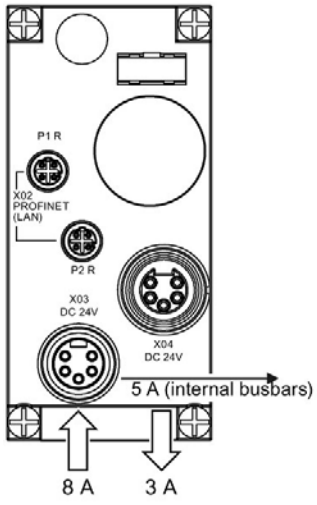
Feed current

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 154-3 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.



12.2.3 CM IM PN PP Cu connection module for interface module

Order number

6ES7194-4AF00-0AA0

Properties

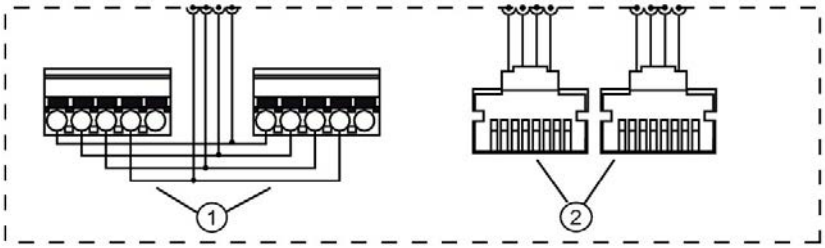
The CM IM PN PP Cu connection module has the following properties:

- 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 12-2 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

12.2.4 CM IM PN PP FO connection module for interface modules

Order number

6ES7194-4AG00-0AA0

Properties

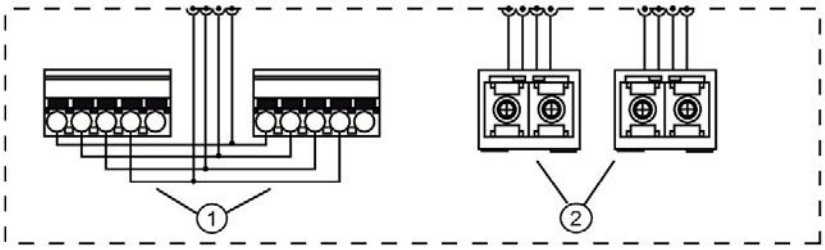
The CM IM PN PP FO connection module has the following properties:

- 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 12-3 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.

12.3 Connection modules for electronic modules

12.3.1 Connection module CM IO 4 x M12 for electronic modules

Order number

6ES7194-4CA00-0AA0

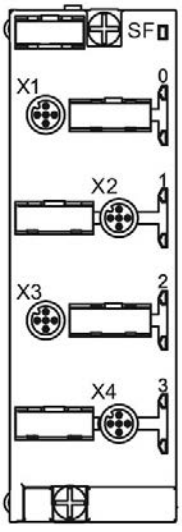
Properties

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.

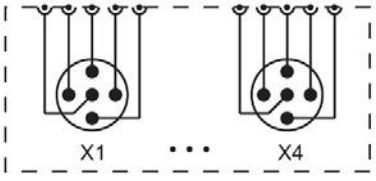


Figure 12-4 Block diagram, CM IO 4 x M12 connection module

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 321)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 326)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 335)
Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 341)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)
4 AI U High Feature analog electronic module (6ES7144-4FF01-0AB0) (Page 370)
4 AI I High Feature analog electronic module (6ES7144-4GF01-0AB0) (Page 375)
4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 386)
Analog electronic module 4 AI RTD High Feature (6ES7144-4JF00-0AB0) (Page 380)
Analog electronic module 4 AO U High Feature (6ES7145-4FF00-0AB0) (Page 392)
Analog electronic module 4 AO I High Feature (6ES7145-4GF00-0AB0) (Page 397)

12.3.2 CM IO 4 x M12P connection module for electronic modules

Order number

6ES7194-4CA10-0AA0

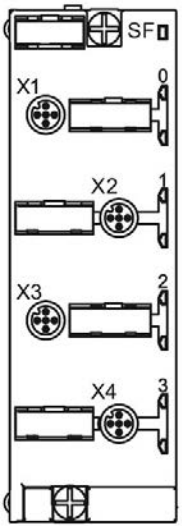
Properties

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.

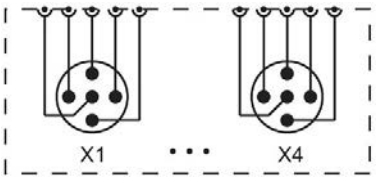


Figure 12-5 Block diagram, CM IO 4 x M12P connection module

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 321)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 326)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 335)
Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 341)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)

12.3.3 CM IO 4 x M12 Inverse connection module for electronic modules

Order number

6ES7194-4CA50-0AA0

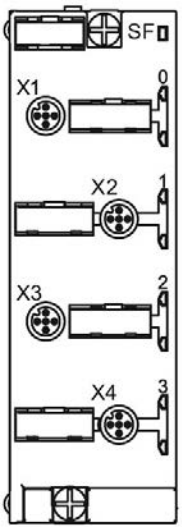
Properties

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.

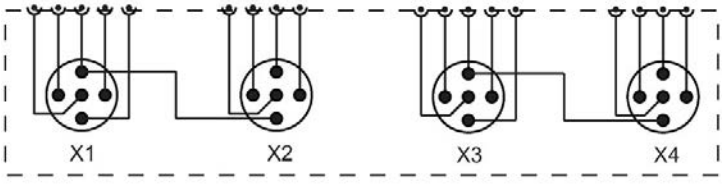


Figure 12-6 Block diagram of CM IO 4 x M12 Inverse connection module

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 335)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 341)

12.3.4 CM IO 8 x M12 connection module for electronic modules

Order number

6ES7194-4CB00-0AA0

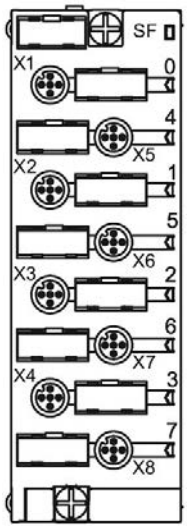
Properties

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.

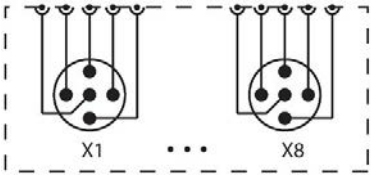


Figure 12-7 Block diagram, CM IO 8 x M12 connection module

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 321)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 326)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)

12.3.5 CM IO 8 x M12P connection module for electronic modules

Order number

6ES7194-4CB10-0AA0

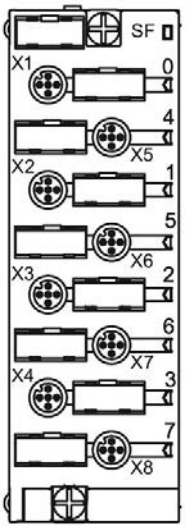
Properties

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.

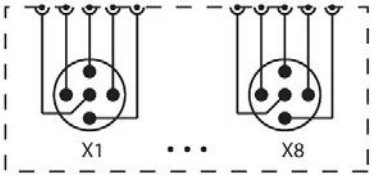


Figure 12-8 Block diagram, CM IO 8 x M12P connection module

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 321)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 326)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)

12.3.6 CM IO 8 x M12D connection module for electronic modules

Order number

6ES7194-4CB50-0AA0

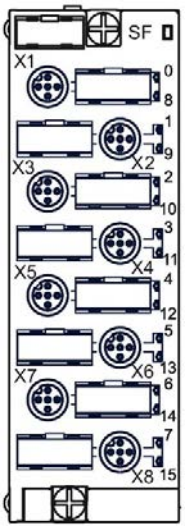
Properties

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.

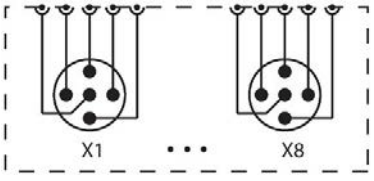


Figure 12-9 Block diagram, CM IO 8 x M12D connection module

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 331)
Digital electronic module 4 DIO / 4 DO DC 24V/0.5A (6ES7143-4BF00-0AA0) (Page 359)

12.3.7 CM IO 8 x M8 connection module for electronic modules

Order number

6ES7194-4EB00-0AA0

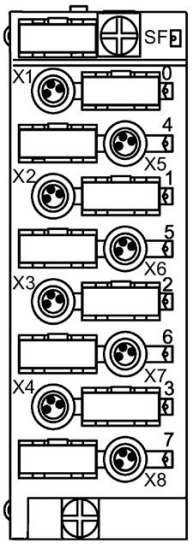
Properties

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.

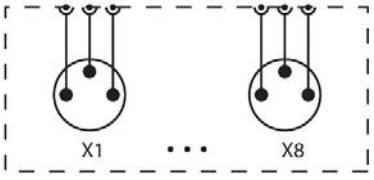


Figure 12-10 Block diagram CM IO 8 x M8

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 321)
Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 326)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 335)
Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 341)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)

12.3.8 CM IO 2 x M12 connection module for electronic modules

Order number

6ES7194-4FB00-0AA0

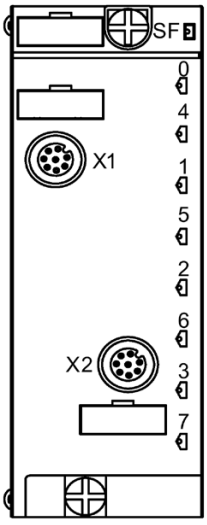
Properties

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.

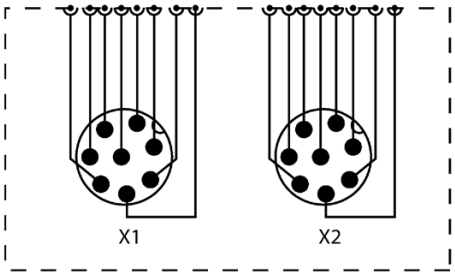


Figure 12-11 Block diagram CM IO 2 x M12

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 321)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 335)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)

12.3.9 CM IO 1 x M23 connection module for electronic modules

Order number

6ES7194-4FA00-0AA0

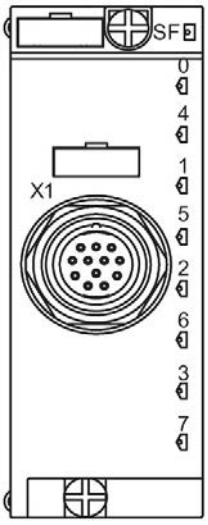
Properties

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.

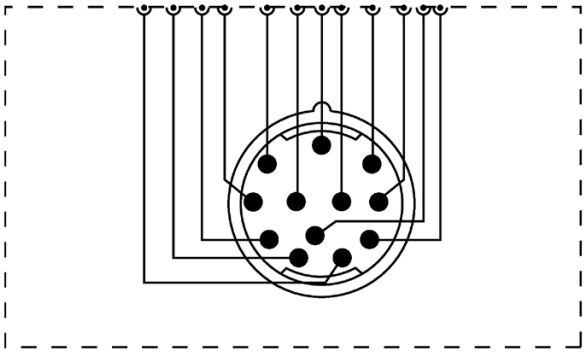


Figure 12-12 Block diagram CM IO 1 x M23

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 321)
Digital electronic module 4 DO DC 24V/2.0A (6ES7142-4BD00-0AA0) (Page 335)
Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)
Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0) (Page 352)

12.4 Connection modules for power modules

12.4.1 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:

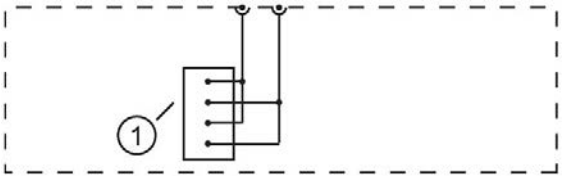
- Can be plugged in and attached with screws to the power module.
- Connecting the 2L+ load voltage supply using screw terminals.
- You can loop through the 2L+ load voltage supply via additional terminals
- 3 inscription labels

Pin assignment

For details on the pin assignment of CM PM Direct, refer to the chapter Power modules (Page 312).

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

12.4.2 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:

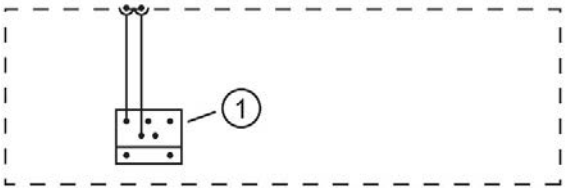
- Can be plugged in and attached with screws to the power module.
- Connecting the 2L+ load voltage supply using an ECOFAST cable connector.
- 2 inscription labels

Pin assignment

For details on the pin assignment of CM PM ECOFAST, refer to the chapter Power modules (Page 312).

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

12.4.3 CM PM-E 7/8" connection module for power modules

Order number

6ES7194-4BD00-0AA0

Properties

Properties of CM PM 7/8" connection module:

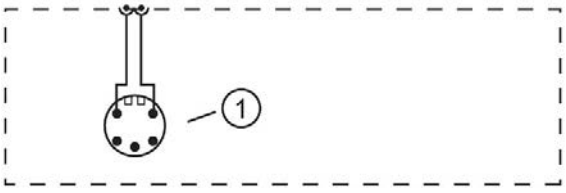
- Can be plugged in and attached with screws to the power module PM-E DC24V
- Connection of the 2L+ load voltage supply using a 7/8" connector
- 2 inscription labels

Pin assignment

For details on the pin assignment of CM PM 7/8", refer to the chapter Power modules (Page 312).

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

12.4.4 CM PM PP connection module for power modules

Order number

6ES7194-4BE00-0AA0

Properties

The CM PM PP connection module has the following properties:

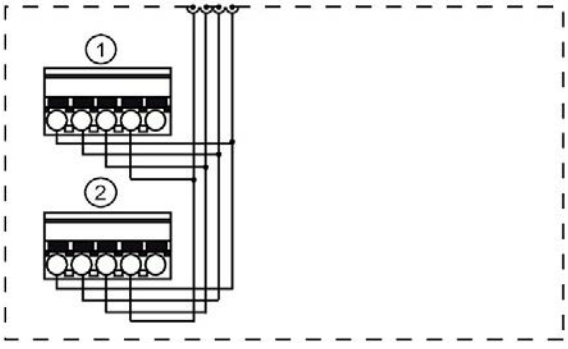
- Can be plugged in and attached with screws to the power module.
- Connecting the 1L+ electronic/encoder supply and the 2L+ load voltage supply using a push-pull cable connector. 2L+ is fed into the ET 200pro. 1L+ is only looped through from socket to socket.
- The 1L+ electronic/encoder supply and 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 312).

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

12.4.5 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:

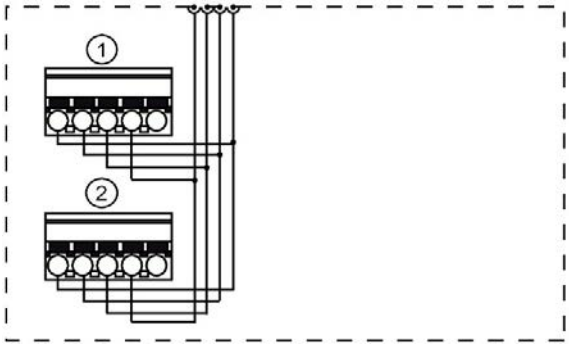
- Can be plugged in and attached with screws to the outgoing module.
- Connecting the 1L+ electronic/encoder supply and the 2L+ load voltage supply using a push-pull cable connector.
- 3 inscription labels

Pin assignment

For details on the pin assignment of CM PM-O PP, refer to the chapter Power modules (Page 312).

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 13

13.1 Interface modules for PROFIBUS DP

13.1.1 IM 154-1 DP interface module

Order number

6ES7154-1AA01-0AB0

Properties

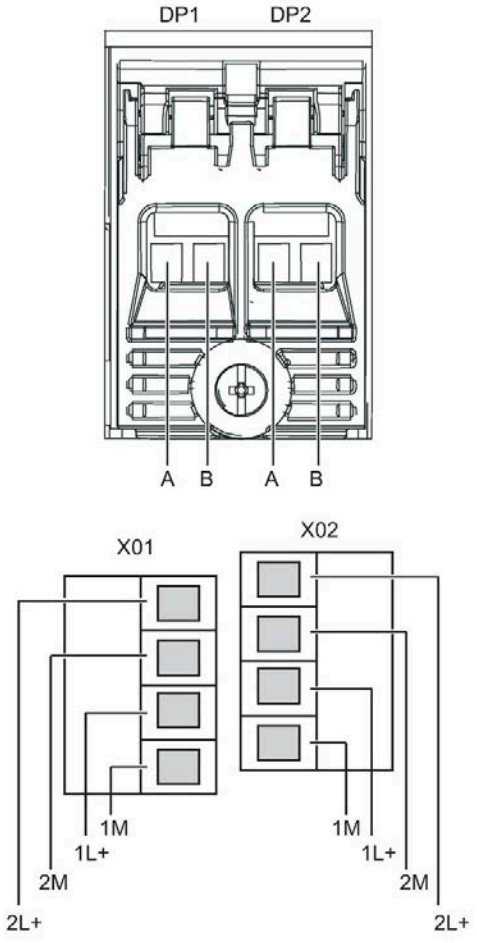
The IM 154-1 DP interface module has the following properties:

- 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.

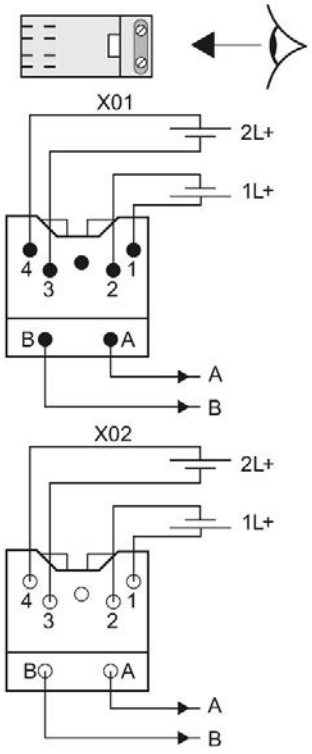
Compatibility with the predecessor module

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.

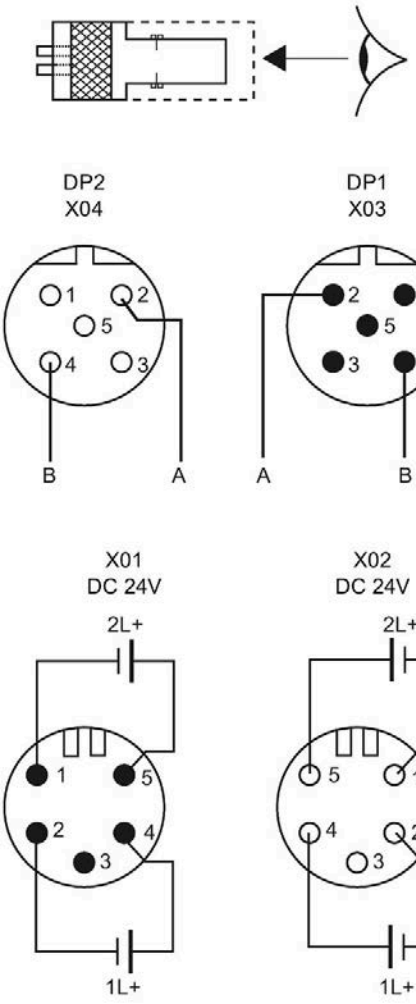
Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP Direct connection module

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

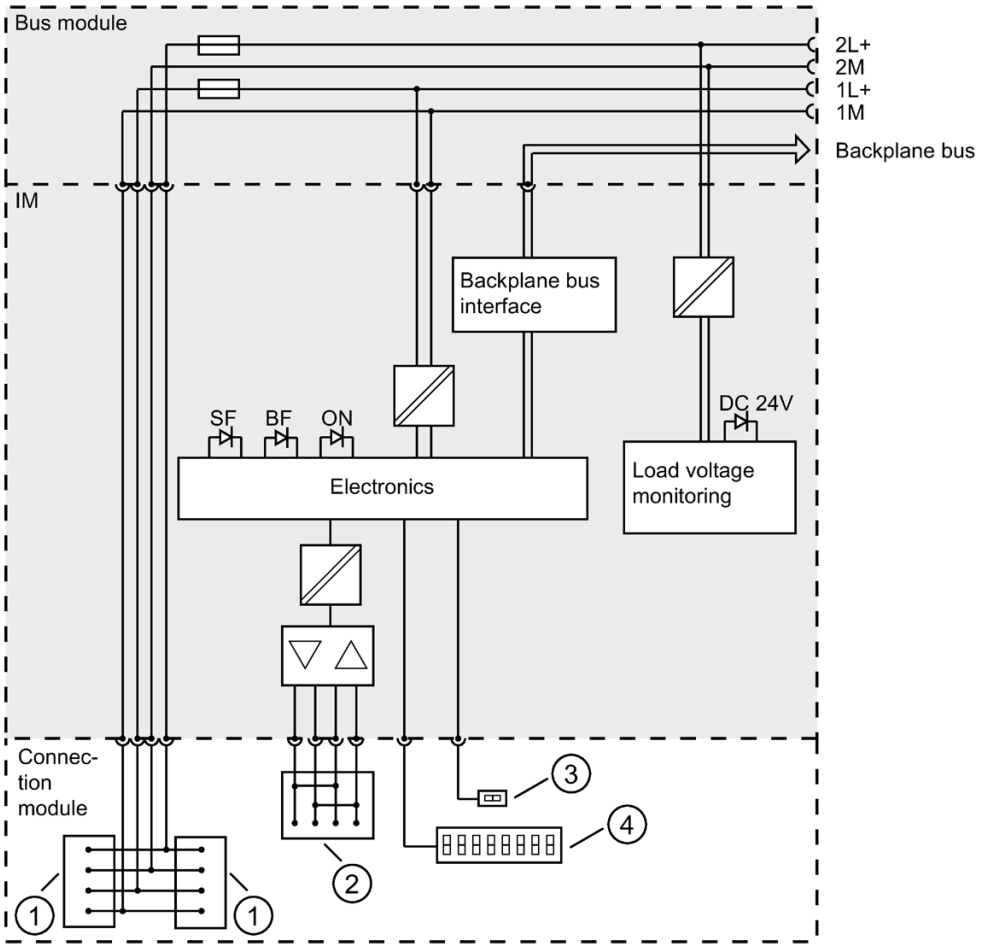
View of the M12 and 7/8" cable connectors	Terminal	Assignment
	**M12 cable connector for feeding DP1 X03**	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	M12 cable connector for looping DP2 X04	
	1	Supply 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 13-1 Block diagram IM 154-1 DP

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	90 × 130 × 60
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 section Parameter assignment dependencies (Page 289).

See also

Connection module CM IM DP Direct for interface modules (Page 239)

CM IM DP ECOFAST Cu connection module for interface modules (Page 241)

CM IM DP M12 connection module, 7/8" for interface modules (Page 242)

Electrical Configuration of ET 200pro (Page 63)

13.1.2 IM 154-2 DP High Feature interface module

Order number

6ES7154-2AA01-0AB0

Properties

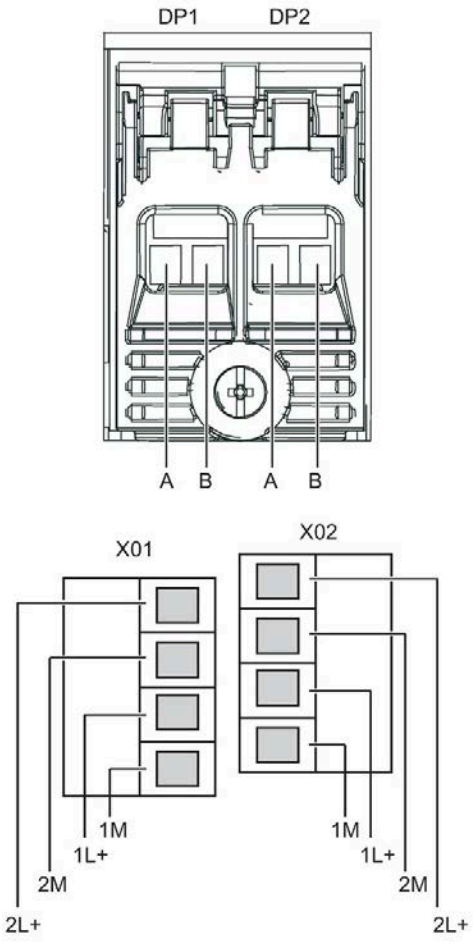
The IM 154-2 DP High Feature interface module has the following properties:

- 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.

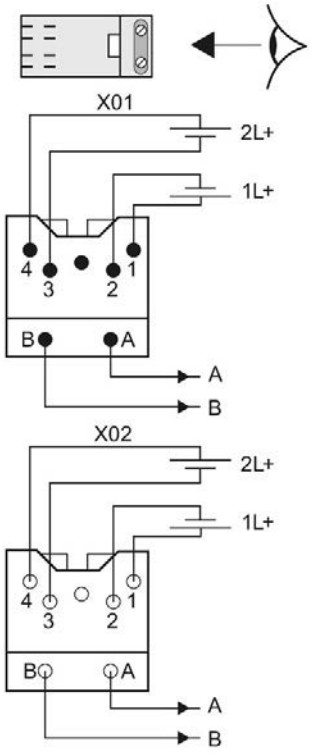
Compatibility with the predecessor module

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.

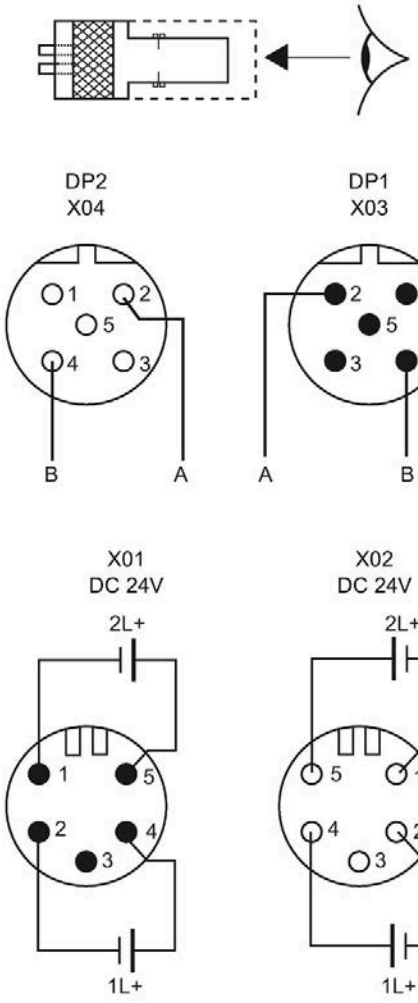
Pin assignment of PROFIBUS DP and voltage supplies on the CM IM DP Direct connection module

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

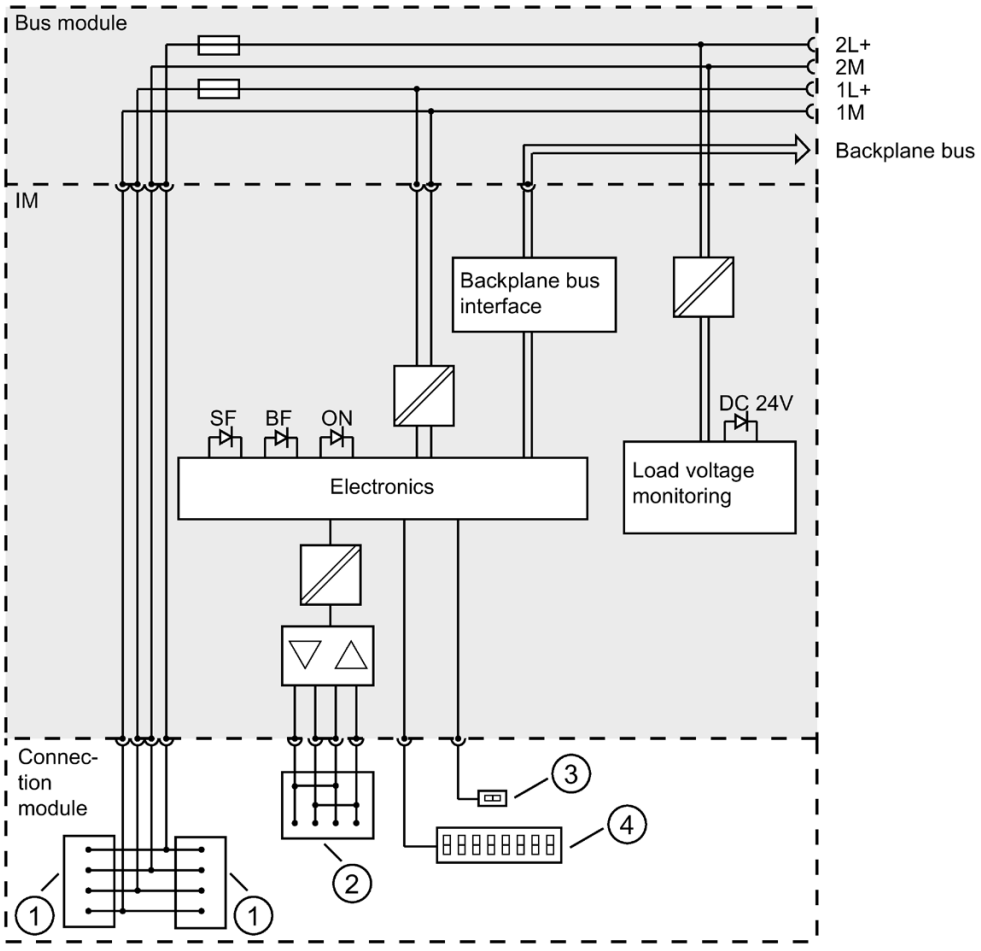
View of the M12 and 7/8" cable connectors	Terminal	Assignment
	**M12 cable connector for feeding DP1 X03**	
	1	Supply positive (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional earth
	Thread	Functional earth **
	M12 cable connector for looping DP2 X04	
	1	Supply 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 × 60
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
Status, interrupts, diagnostics	
Interrupts	Yes

Technical specifications	
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 section Parameter assignment dependencies (Page 289).

See also

Electrical Configuration of ET 200pro (Page 63)

Connection module CM IM DP Direct for interface modules (Page 239)

CM IM DP ECOFAST Cu connection module for interface modules (Page 241)

CM IM DP M12 connection module, 7/8" for interface modules (Page 242)

13.1.3 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

13.1.4 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.

13.1.5 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*.

13.2 Interface modules for PROFINET IO

13.2.1 Interface module IM 154-3 PN High Feature (6ES7154-3AB00-0AB0)

Order number

6ES7154-3AB00-0AB0

Properties

The IM 154-3 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 the 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.
- Saving the device name in the internal memory.
- Updating firmware online
- IM 154-3 PN High Feature has a maximum address space of 256 bytes for inputs and 256 bytes for outputs.
- Support of fail-safe modules.
- Supported Ethernet services:
  - ping, arp
  - Network diagnostics (SNMP)
- Supported PROFINET IO functions:
  - Isochronous real-time communication "high performance"
  - Prioritized startup
  - Device replacement without programming device
  - Changing IO devices during operation (changing partner ports)
  - Media redundancy
  - Shared device
- Interrupts
  - Diagnostic interrupts
  - Hardware interrupts
  - Swapping interrupts
  - Maintenance interrupts

- Configuration control (option handling)
- IM 154-3 PN High Feature supports operation with up to 16 electronic modules.
- The maximum mounting width is 1.2 m.
- Integrated power module for the 2L+ load voltage supply of ET 200pro.

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 performance":

  Topological configuration is required.

  Note

  IO controller as a sync master for IRT communication with the option "high performance"

  Operate the IO controller as a sync master by configuring the IRT communication with the "High performance" option.

  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 (https://support.industry.siemens.com/cs/ww/en/view/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

During startup of an IM 154-3 PN High Feature with "prioritized startup", the "Reset to factory settings" function must be performed twice to restore the factory settings for the module.

For additional information, refer to the STEP 7 online help and the PROFINET System Description (https://support.industry.siemens.com/cs/ww/en/view/19292127) manual.

Device replacement

ET 200pro IO devices can be replaced in a simple manner. You do not have to assign the device name with the programming device.
The ET 200pro distributed I/O system supports the following mechanisms for assigning device names for IO devices:

- Directly from the connection or interface module
- Via the topological configuration

Device replacement without topological configuration

The device name is stored on the connection module and the interface module. This is required for device replacement without topological configuration.

Storing the device name on the connection and interface module results in different scenarios for the assignment of the device name when the interface module is replaced:

Scenarios of the device name	Assignment of the device name
Device name in CM and IM = blank	MAC address (no device name)
Device name in CM = IM or IM = CM	Device name from CM
Device name in CM ≠ IM or IM ≠ CM	Device name from CM
Device name in CM = OK and in IM = blank	Device name from CM
Device name in IM = OK and in CM = blank	Device name from IM

Note

Resetting to factory settings

When restoring the factory settings, note that the device name of the IO device is deleted in the connection module as well as in the interface module.

Device replacement with topological configuration

The replaced IO device no longer receives a device name from the programming device but from the IO controller instead. The IO controller uses the configured topology and the neighborhood relationships determined by the IO devices. All devices involved must support the LLDP protocol (Link Layer Discovery Protocol). The configured desired topology must agree with the actual topology.

Note

Assignment of device names for topological configuration

You must restore the factory settings for IO devices that have already been used in a different configuration before using them again.

For additional information, refer to the STEP 7 online help and the PROFINET System Description (https://support.industry.siemens.com/cs/ww/en/view/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 (https://support.industry.siemens.com/cs/ww/en/view/19292127) Manual.

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 (https://support.industry.siemens.com/cs/ww/en/view/19292127) Manual.

Replacement case for IM 154-3 PN High Feature

If replacement is necessary, the factory settings of an IO device in operation must be restored using "Reset to factory settings".

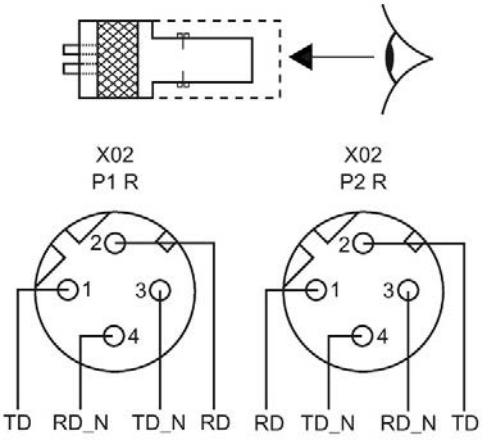
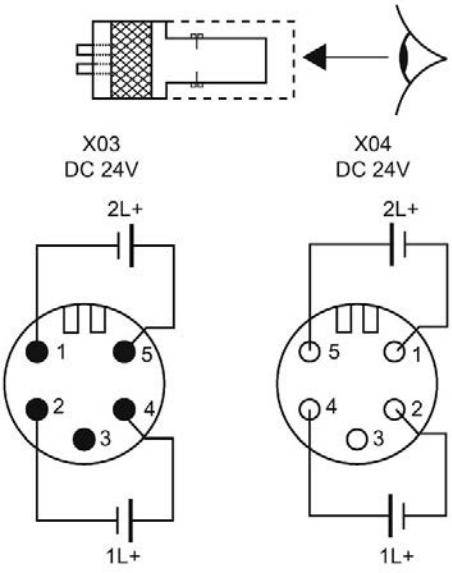
Resetting to factory settings

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.

Pin assignment of PROFINET IO and power supplies on the CM IM PN M12, 7/8" S connection module

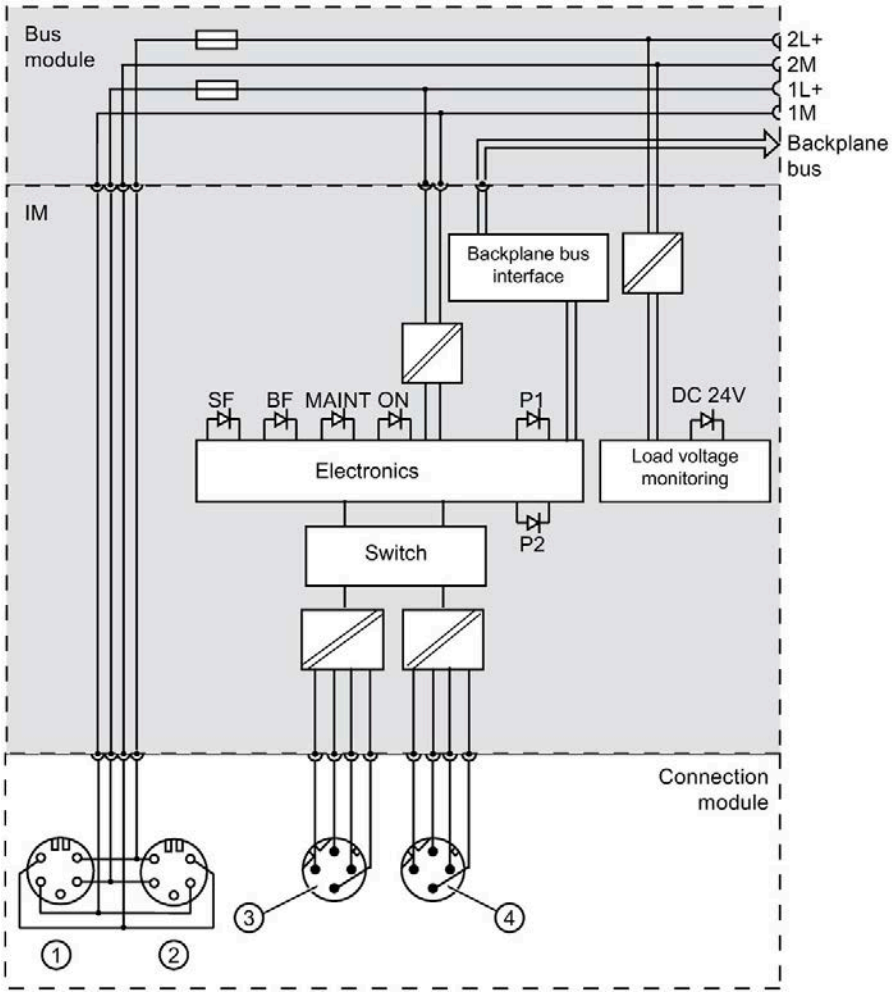
Note

If you deactivate the "Autonegotiation" function in STEP 7, you must observe the different assignment of the pins at X02 P1 R and P2 R.

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

Block diagram

The following figure shows the block diagram of the IM 154-3 PN High Feature interface module with the CM IM PN M12, 7/8" 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 13-2 IM 154-3 PN High Feature block diagram

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W × H × D (mm)	90 x 130 x 60
Weight	approx. 375 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; via replaceable fuses, for potential group
• Feed current 2L+	Max. 8 A; per ET 200pro
Current consumption	
From rated supply voltage (1L+)	typ. 250 mA
Power loss of the module	typ. 5 W
Insulation	
Insulation tested with	707 V DC (type test)

Technical specifications	
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 power / transmit/receive over mains	Green/yellow LED; one LED each for feed (P1) and loop-through (P2) of the PROFINET IO

13.2.2 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.
- Saving the device name in the internal memory.
- 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.
- The maximum mounting width is 1 m.
- 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	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 performance":

  Topological configuration is required.

  Note

  IO controller as a sync master for IRT communication with the option "high performance"

  Operate the IO controller as a sync master by configuring the IRT communication with the "High performance" option.

  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

During startup of an IM 154-4 PN High Feature with "prioritized startup", the "Reset to factory settings" function must be performed twice to restore the factory settings for the module.

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

ET 200pro IO devices can be replaced in a simple manner. You do not have to assign the device name with the programming device.
The ET 200pro distributed I/O system supports the following mechanisms for assigning device names for IO devices:

- Directly from the connection or interface module
- Via the topological configuration

Device replacement without topological configuration

The device name is stored on the connection module and the interface module. This is required for device replacement without topological configuration.

Storing the device name on the connection and interface module results in different scenarios for the assignment of the device name when the interface module is replaced:

Scenarios of the device name	Assignment of the device name
Device name in CM and IM = blank	MAC address (no device name)
Device name in CM = IM or IM = CM	Device name from CM
Device name in CM ≠ IM or IM ≠ CM	Device name from CM
Device name in CM = OK and in IM = blank	Device name from CM
Device name in IM = OK and in CM = blank	Device name from IM

Note

Resetting to factory settings

When restoring the factory settings, note that the device name of the IO device is deleted in the connection module as well as in the interface module.

Device replacement with topological configuration

The replaced IO device no longer receives a device name from the programming device but from the IO controller instead. The IO controller uses the configured topology and the neighborhood relationships determined by the IO devices. All devices involved must support the LLDP protocol (Link Layer Discovery Protocol). The configured desired topology must agree with the actual topology.

Note

Assignment of device names for topological configuration

You must restore the factory settings for IO devices that have already been used in a different configuration before using them again.

Note

The CM IM PN PP FO connection module does not have an internal memory, in other words a device cannot be replaced without a programming device or PC. You must assign the device name with STEP 7.

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

Replacement case for IM 154-4 PN High Feature

If replacement is necessary, the factory settings of an IO device in operation must be restored 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

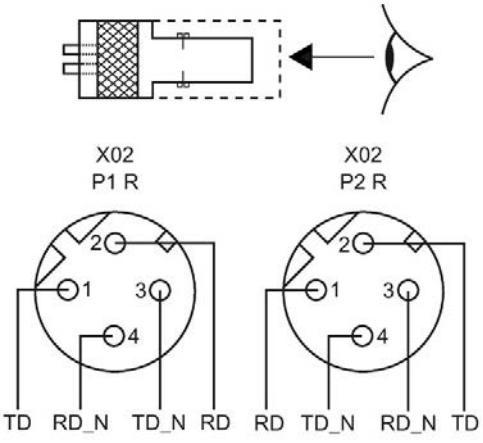
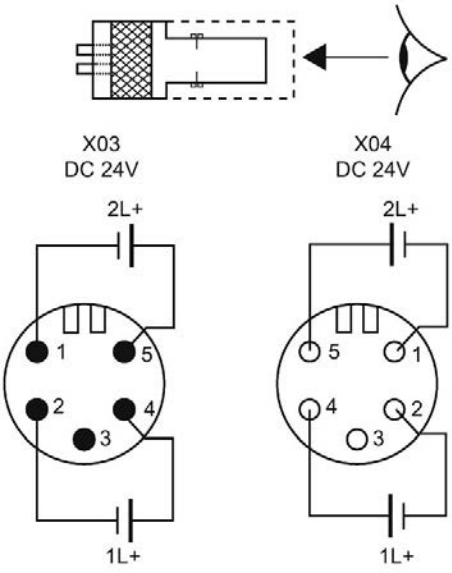
Resetting to factory settings

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.

Pin assignment of PROFINET IO and power supplies on the CM IM PN M12, 7/8" connection module

Note

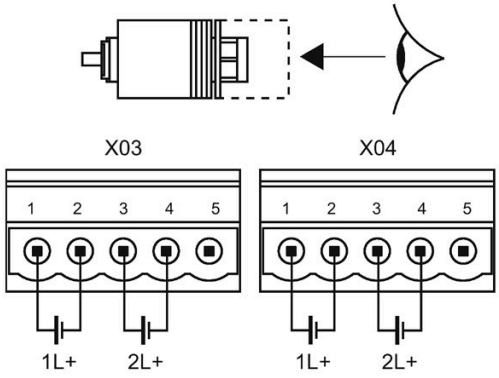
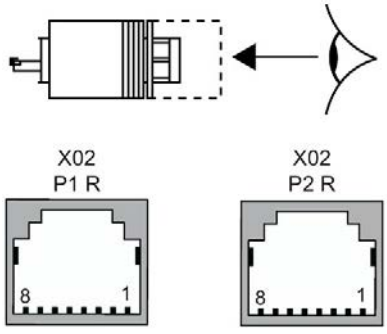
If you deactivate the "Autonegotiation" function in STEP 7, you must observe the different assignment of the pins at X02 P1 R and P2 R.

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

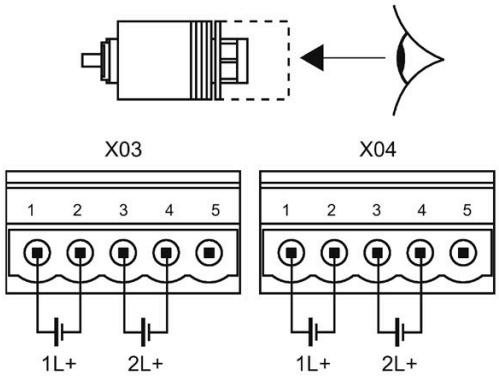
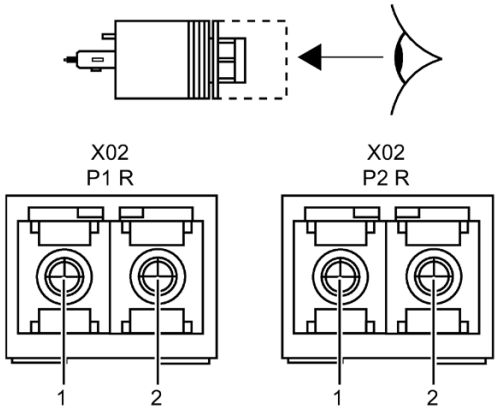
Pin assignment of PROFINET IO and supply voltages on the CM IM PN PP Cu connection module

Note

If you deactivate the "Autonegotiation" function in STEP 7, you must observe the different assignment of the pins at X02 P1 R and P2 R.

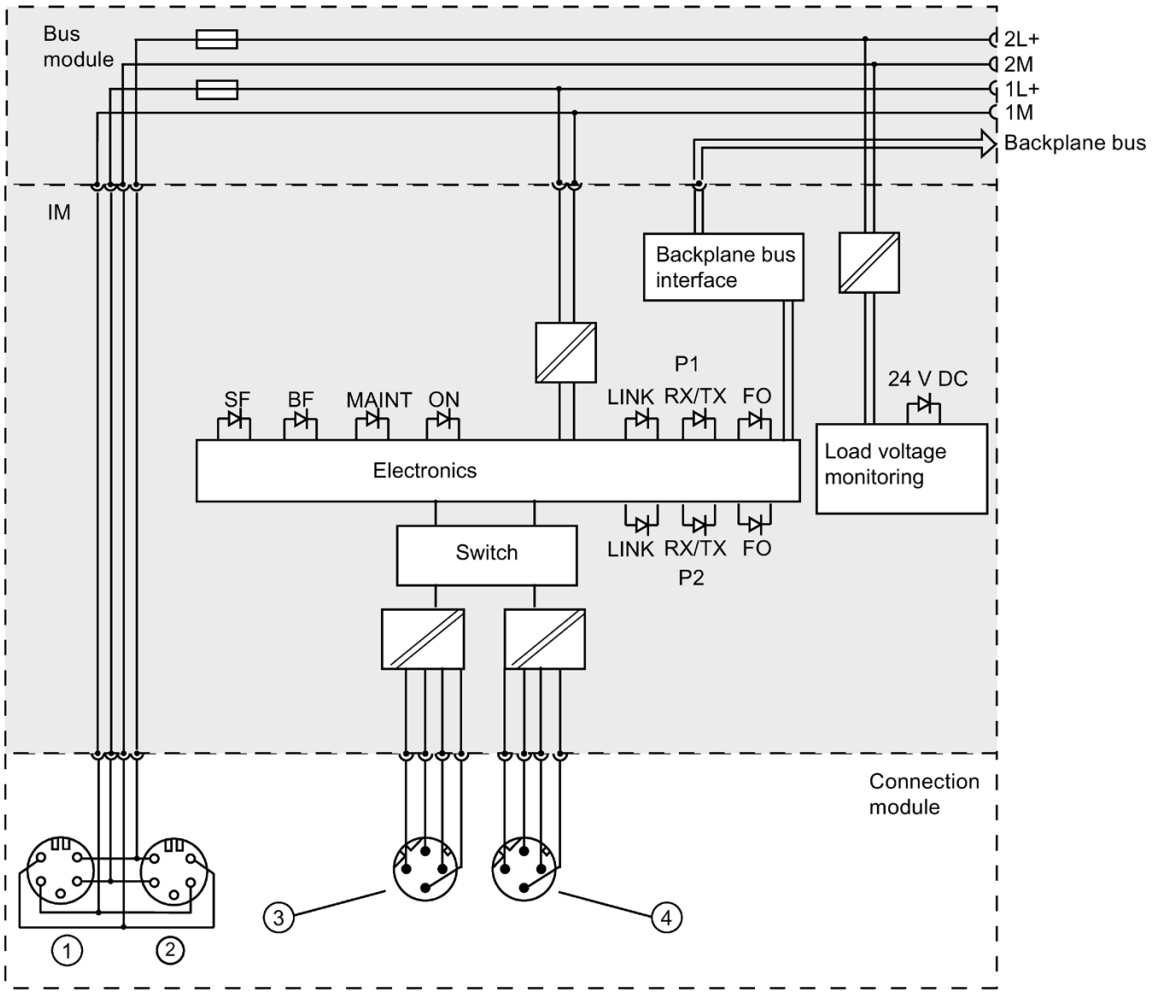
View of the push-pull cable connector	Terminal	Assignment	
Push-pull cable connector (1L+ and 2L+ supply voltages)			
	**X03 DC 24V for feeding** **X04 DC 24V for looping**		
	1	1L+ electronics/encoder supply	
	2	Ground for electronics/encoder supply 1M	
	3	2L+ load voltage supply	
	4	Ground for load voltage supply 2M	
	5	Functional earth (FE)	
Push-pull cable connector (RJ45)			
		**X02 P1 R for connecting PROFINET**	**X02 P2 R 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 P1 R for feeding PROFINET** **X02 P2 R for looping 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 13-3 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 • 100BASE-FX
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
Insulation	
Insulation tested with	707 V DC (type test)

Technical specifications	
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

13.2.3 Overview of parameters of the interface module

IM 154-3 PN High Feature and IM 154-4 PN High Feature parameters

You can find the representation and description of the parameters (interface, port 1, port 2) in the *STEP 7* online help.

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

13.2.4 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 161).

Power modules

14

14.1 PM-E power module

Order number

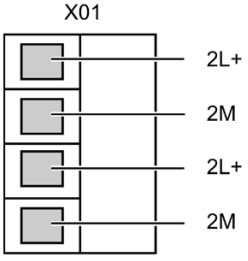
6ES7148-4CA00-0AA0

Properties

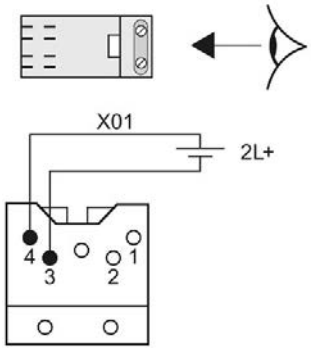
The PM-E power module has the following properties:

- 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 175)

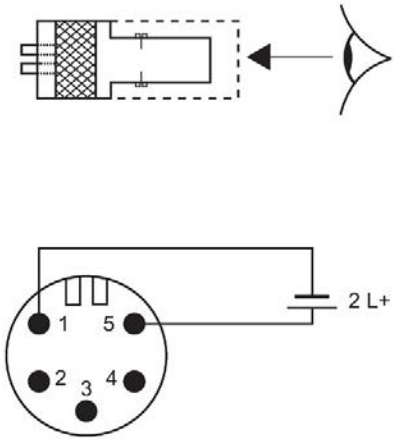
Pin assignment of the load voltage supply at connection module CM PM Direct

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)

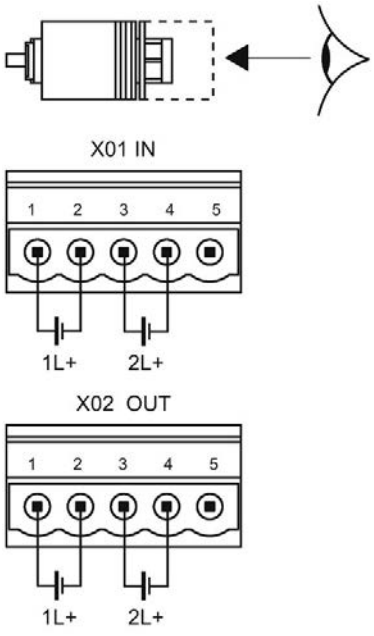
Pin assignment of the load voltage supply at connection module CM PM ECOFAST

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"

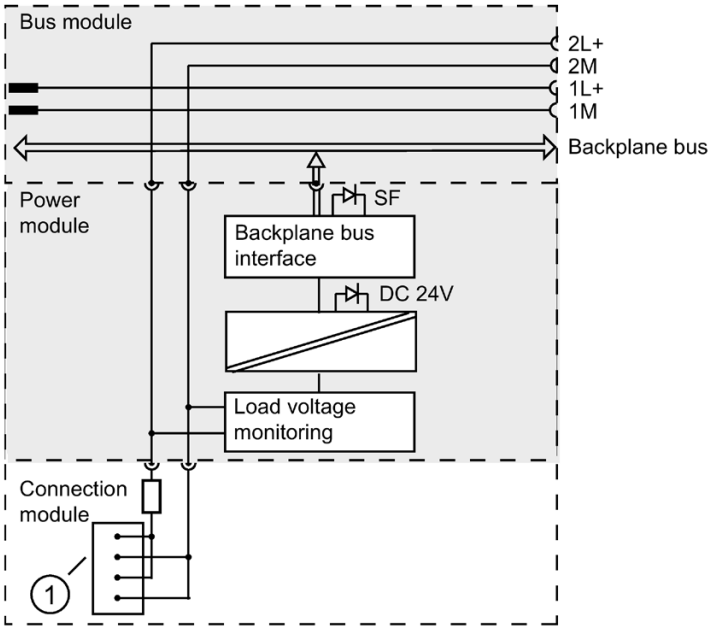
View of the 7/8" connector X01	Terminal	Designation
	**Feed for X01**	
	1	Ground for load voltage supply 2M
	2	Not assigned
	3	Not assigned
	4	Not assigned
	5	2L+ load voltage supply

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 14- 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 35)

Electrical Configuration of ET 200pro (Page 63)

Connecting the Power Module with the CM PM-E Direct Connection Module (Page 120)

Connecting the Power Module with the CM PM-E ECOFAST Connection Module (Page 122)

Connecting the Power Module with the CM PM-E 7/8" Connection Module (Page 124)

14.2 PM-O DC 2x24V outgoing module

Order number

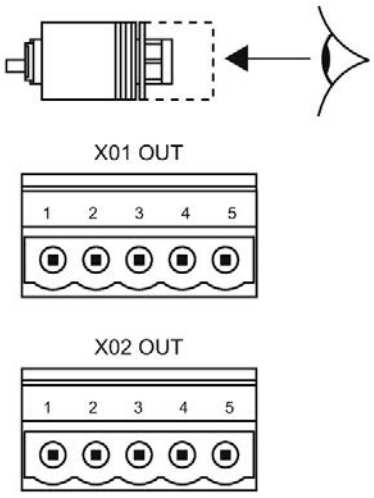
6ES7148-4CA60-0AA0

Properties

The PM-O DC 2x24V outgoing module has the following properties:

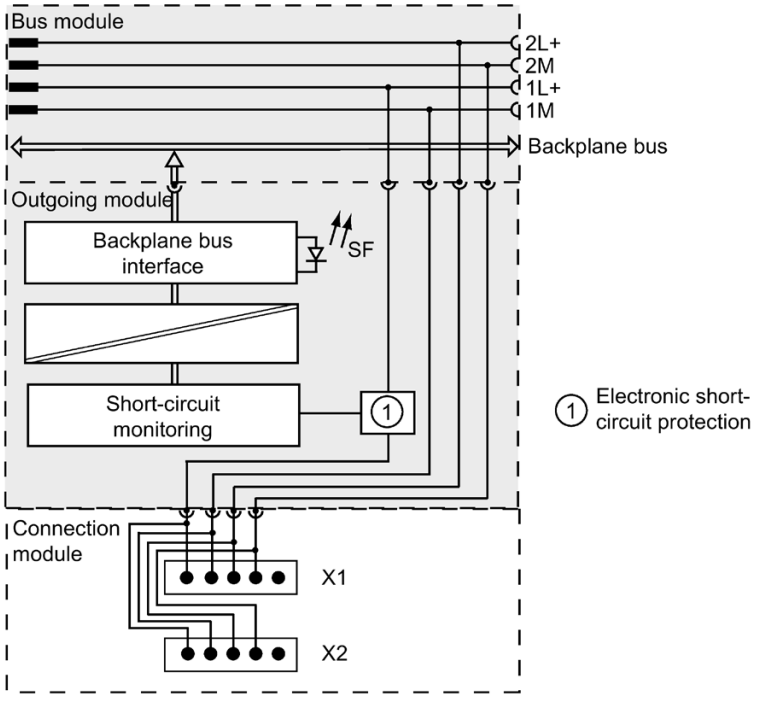
- Tapping the 1L+ electronics/encoder supply and the 2L+ load voltage supply using push-pull cable connectors.

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 36)

14.3 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

14.4 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 15

15.1 Digital electronic module 8 DI DC 24V (6ES7141-4BF00-0AA0)

Order number

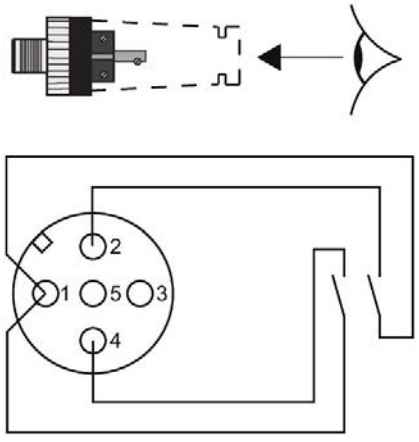
6ES7141-4BF00-0AA0

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

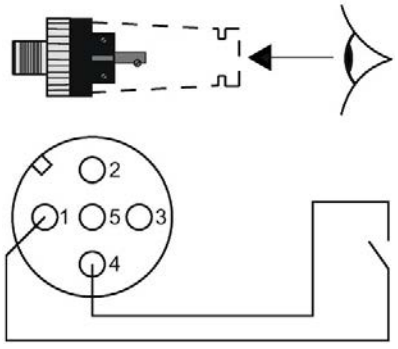
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

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)

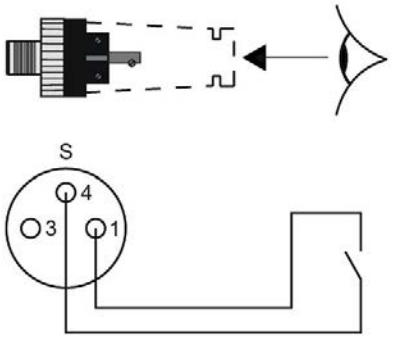
Pin assignment of connection modules CM IO 8 x M12 and CM IO 8 x M12P

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)

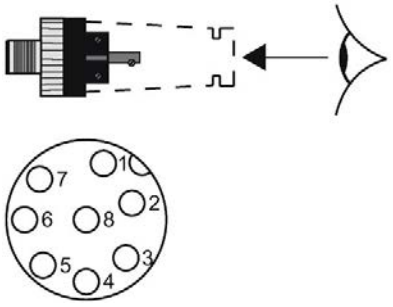
Pin assignment of connection module CM IO 8 x M8

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)

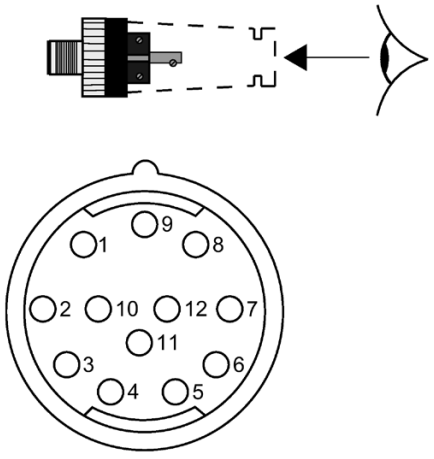
Pin assignment of connection module CM IO 2 x M12

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.

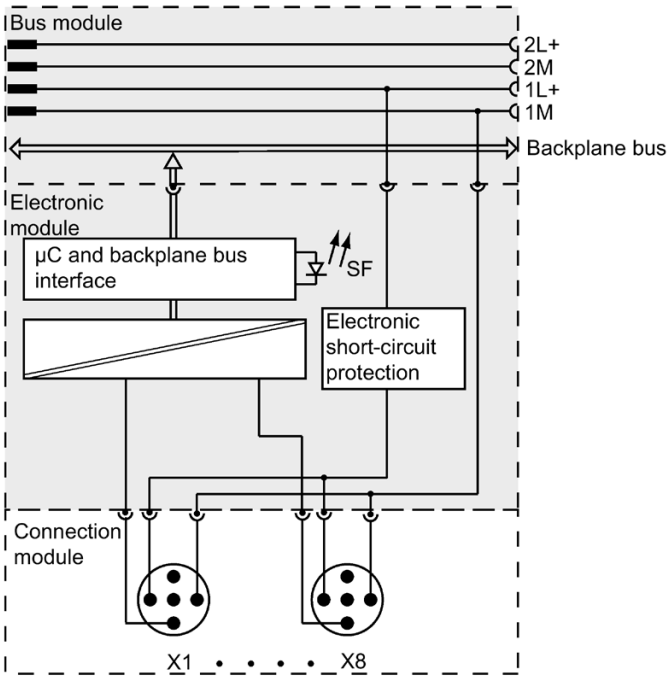


Figure 15-1 Block diagram 8 DI DC 24V

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

Technical specifications	
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
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 251)
CM IO 8 x M12 connection module for electronic modules (Page 256)
Response times of digital input modules (Page 487)

15.2 Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0)

Order number

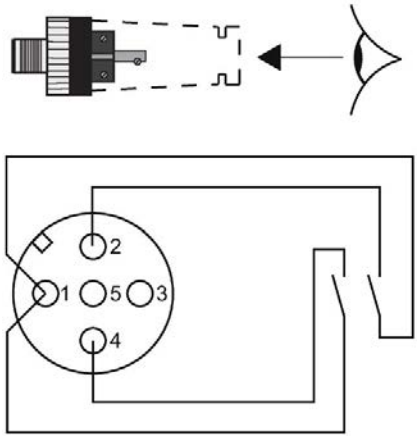
6ES7141-4BF00-0AB0

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

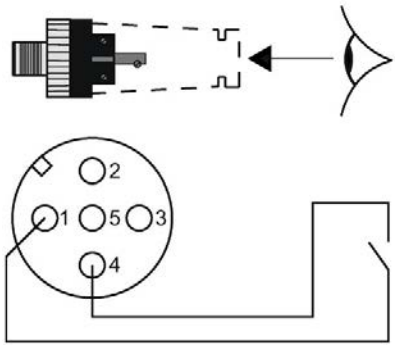
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

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)

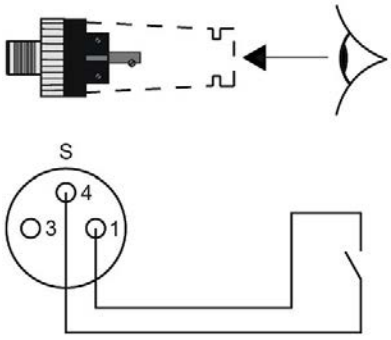
Pin assignment of connection modules CM IO 8 x M12 and CM IO 8 x M12P

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.

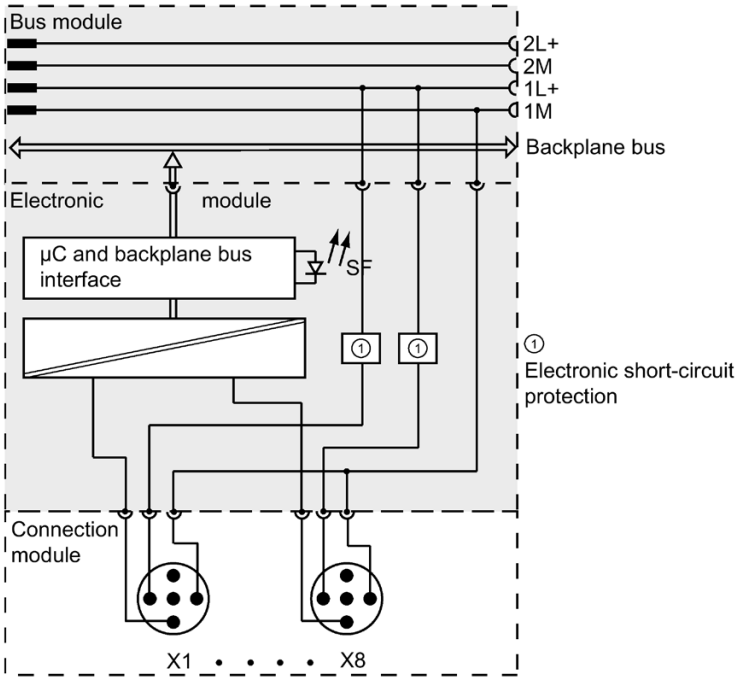


Figure 15-2 8 DI DC 24V High Feature block diagram

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
Monitoring for	
• Short-circuit	Yes; per channel
• Wire break	Input < 0.3 mA; per channel
Encoder supply	
Number of encoder supplies	8

Technical specifications	
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 251)
CM IO 8 x M12 connection module for electronic modules (Page 256)

15.3 Digital electronic module 16 DI DC 24V (6ES7141-4BH00-0AA0)

Order number

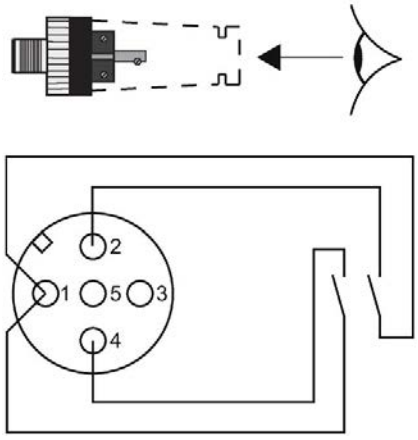
6ES7141-4BH00-0AA0

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.

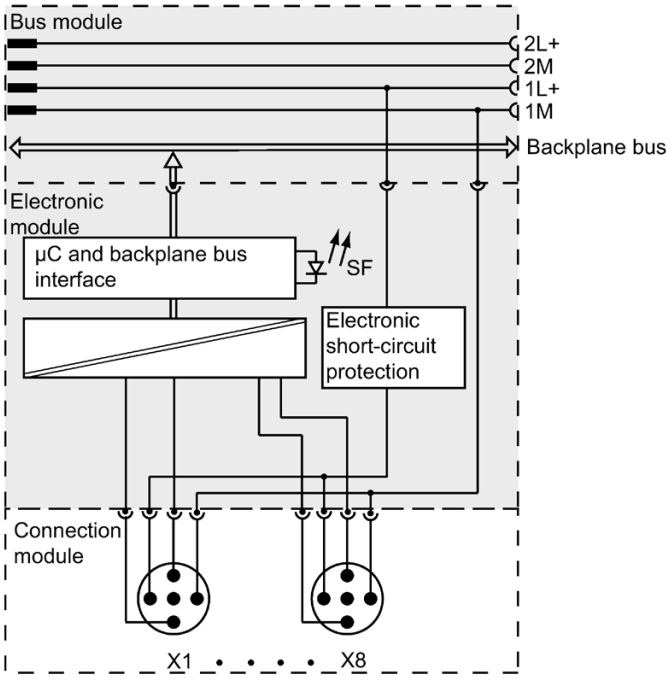


Figure 15-3 Block diagram 16 DI DC 24V

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 199).

See also

CM IO 8 x M12D connection module for electronic modules (Page 259)

15.4 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

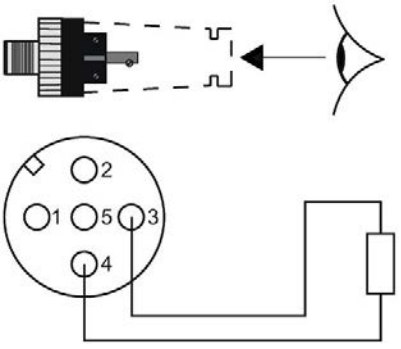
Note

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 256).

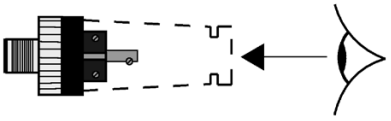
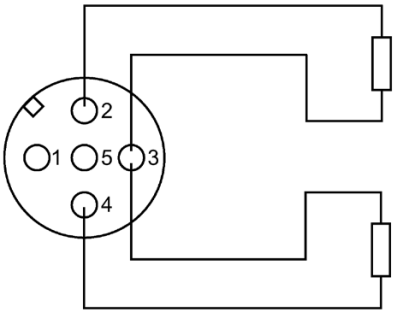
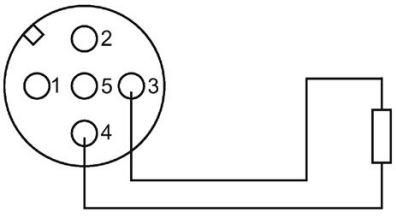
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

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

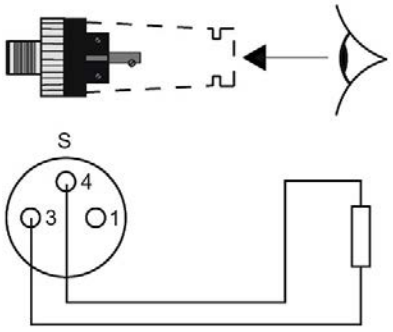
Connection of channel 1 (bit 1) and channel 3 (bit 3)

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.

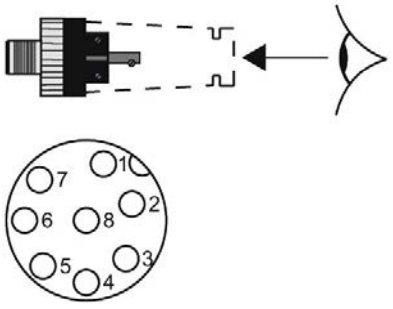
Pin assignment of connection module CM IO 8 x M8

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	

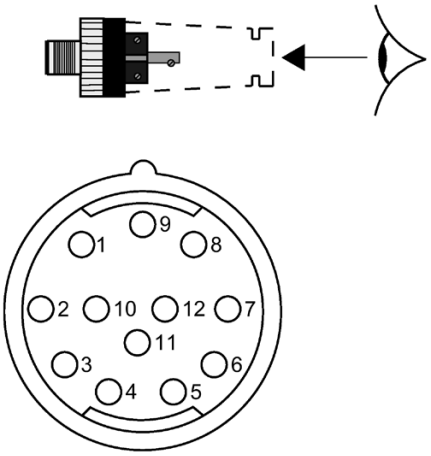
Pin assignment of connection module CM IO 2 x M12

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.

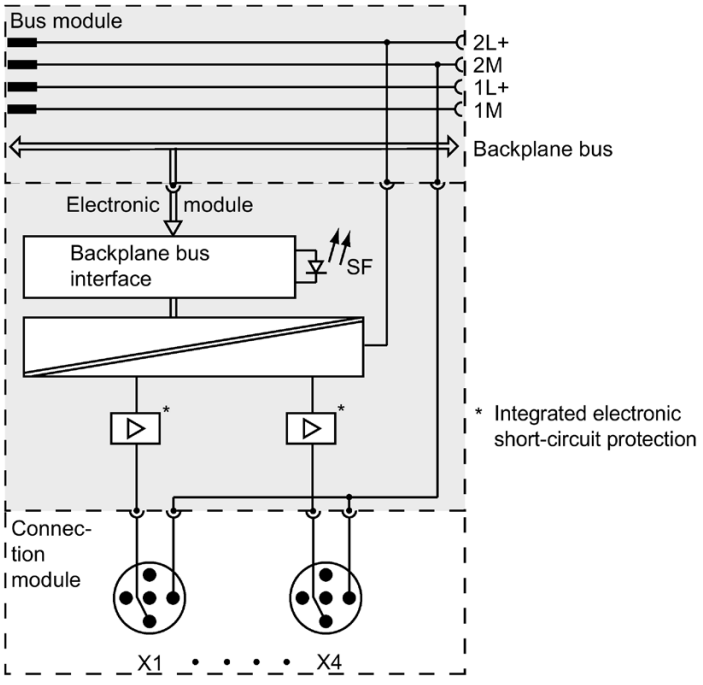


Figure 15-4 Block diagram 4 DO DC 24V

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 503)
Connection module CM IO 4 x M12 for electronic modules (Page 251)
CM IO 4 x M12 Inverse connection module for electronic modules (Page 254)
Response times for digital output and pneumatic interface modules (Page 487)

15.5 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

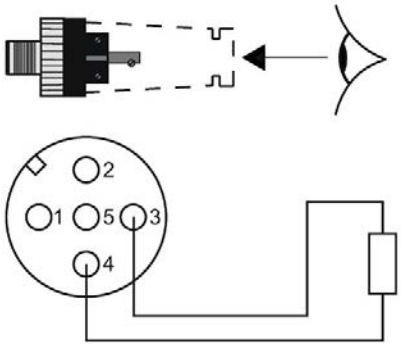
Note

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 503).

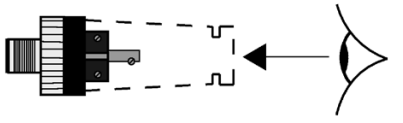
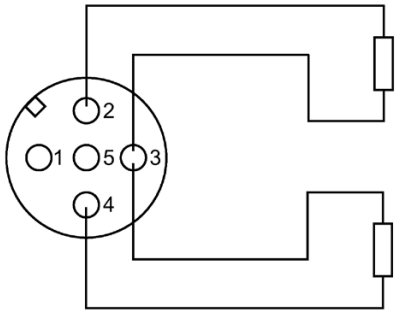
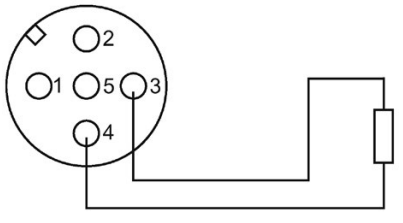
Pin assignment of connection modules CM IO 4 x M12 and CM IO 4 x M12P

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

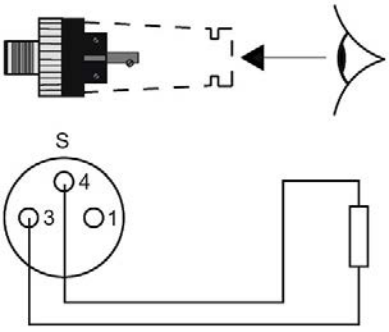
Connection of channel 1 (bit 1) and channel 3 (bit 3)

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.

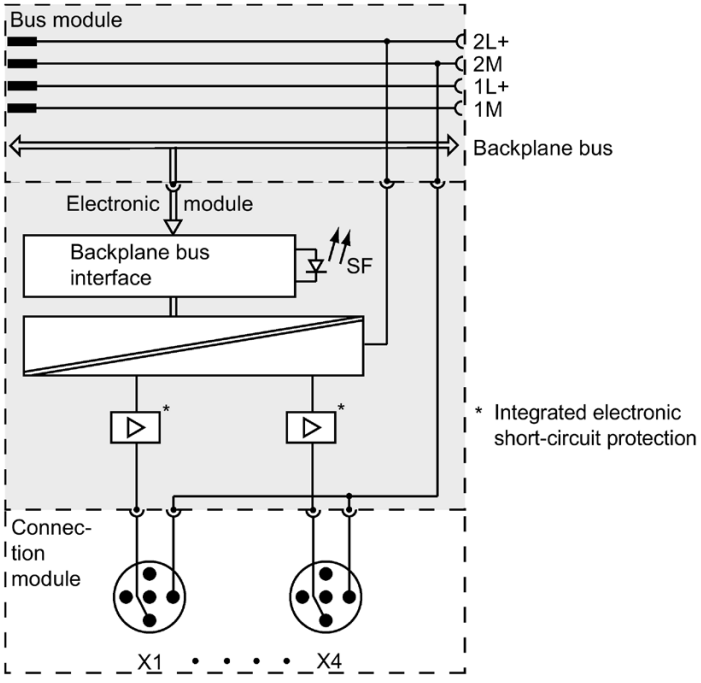


Figure 15-5 Block diagram of 4 DO DC 24V/2.0A High Feature

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
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	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 321)

CM IO 4 x M12 Inverse connection module for electronic modules (Page 254)

CM IO 8 x M12 connection module for electronic modules (Page 256)

15.6 Digital electronic module 8 DO DC 24V/0.5A (6ES71424BF00-0AA0)

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

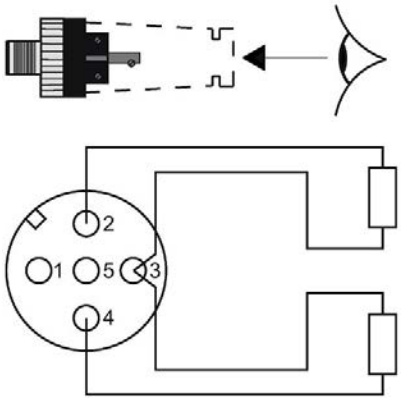
Note

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 503).

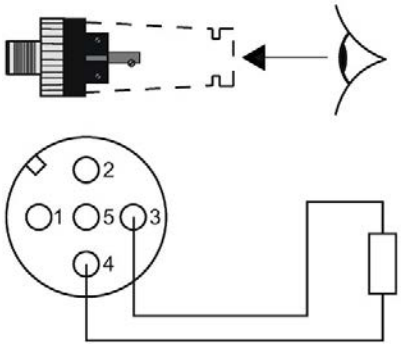
Pin assignment of connection modules CM IO 4x M12 and CM IO 4x M12P

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		

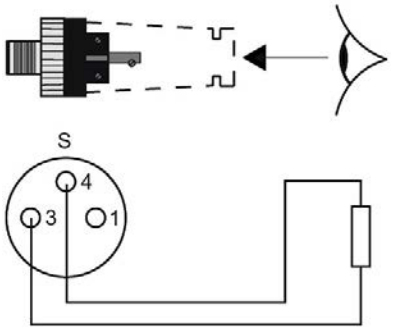
Pin assignment of connection modules CM IO 8 x M12 and CM IO 8 x M12P

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		

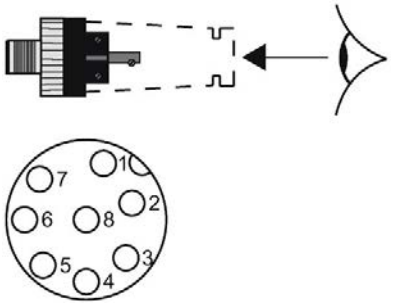
Pin assignment of connection module CM IO 8 x M8

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		

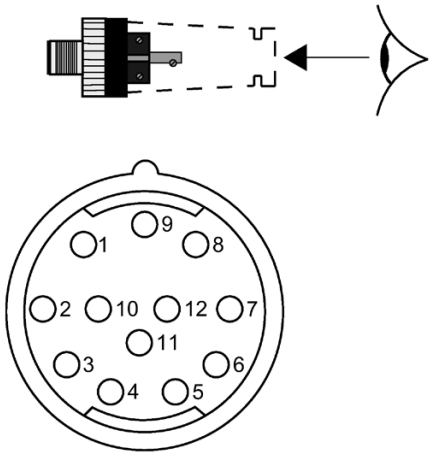
Pin assignment of connection module CM IO 2 x M12

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.

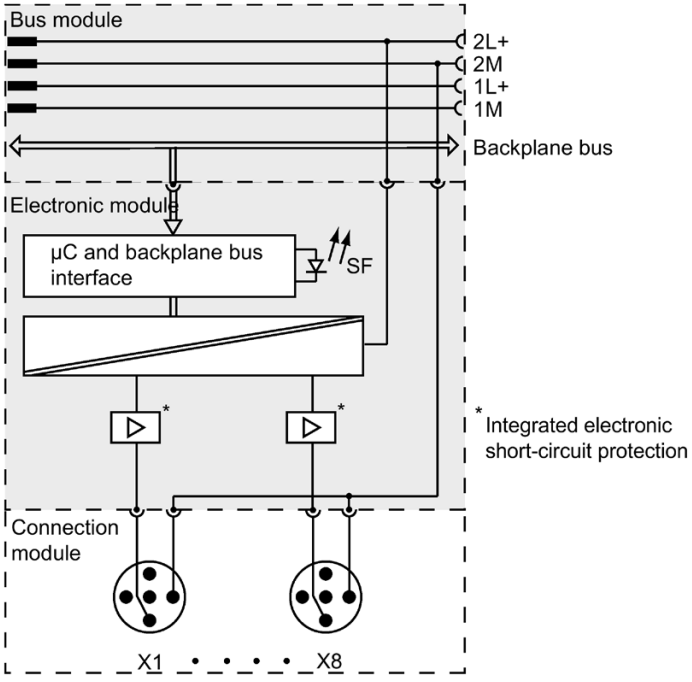


Figure 15-6 Block diagram 8 DO DC 24V/0.5A

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
Insulation	
Insulation tested	707 V DC (type test)

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

15.7 Digital electronic module 4 DI / 4 DO DC 24V/0.5A (6ES7143-4BF50-0AA0)

Order number

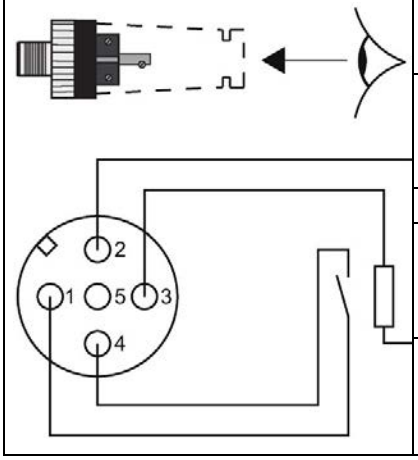
6ES7143-4BF50-0AA0

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

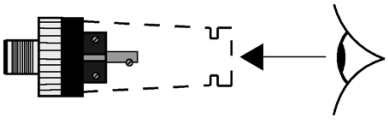
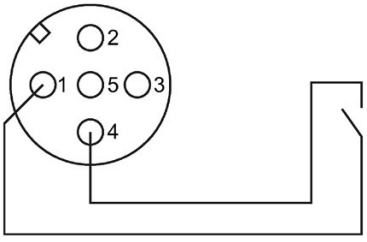
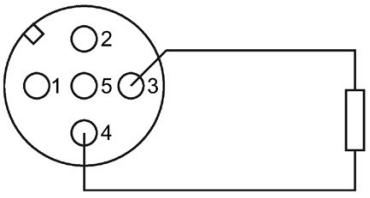
Pin assignment on connection modules CM IO 4 x M12 and CM IO 4 x M12P

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)

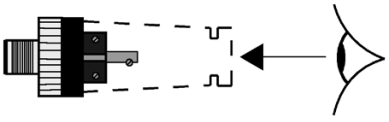
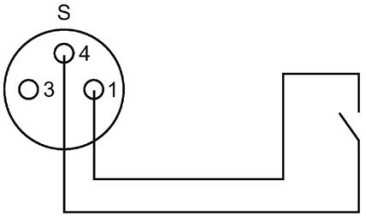
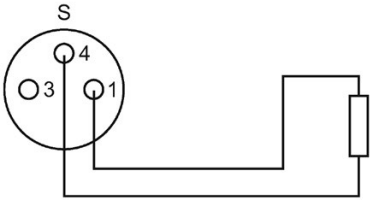
Pin assignment on connection modules CM IO 8 x M12 and CM IO 8 x M12P

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)

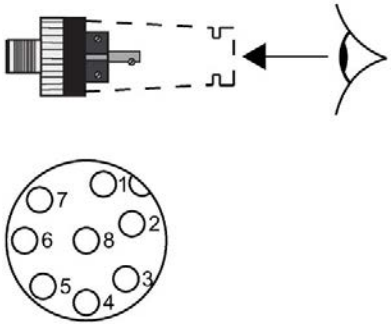
Pin assignment on the CM IO 8 x M8 connection module

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)

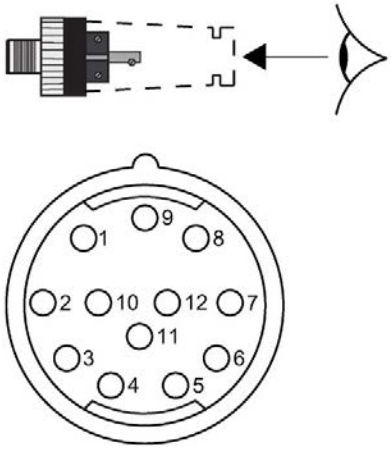
Pin assignment on the CM IO 2 x M12 connection module

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

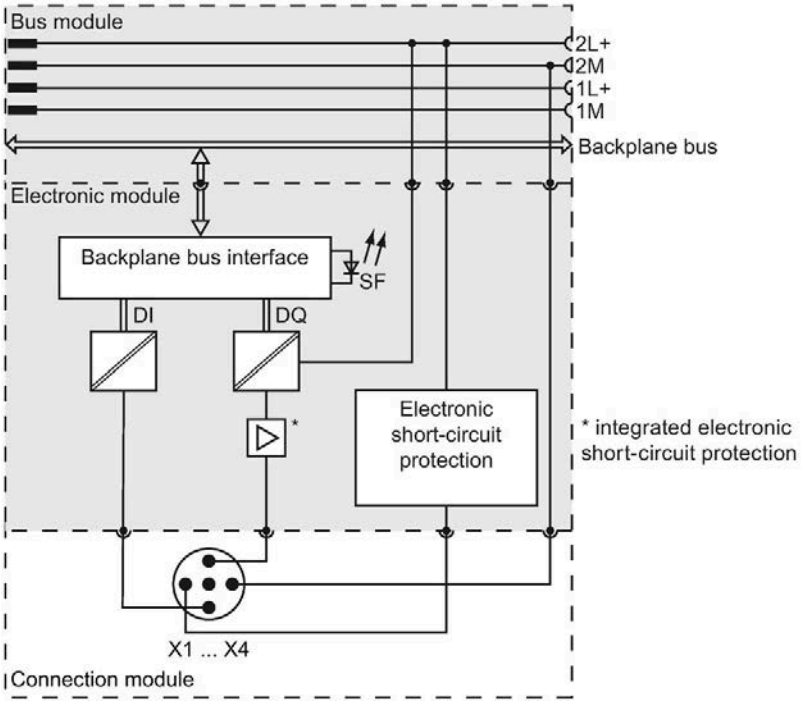


Figure 15-7 Block diagram 4 DI / 4 DO DC 24V/0.5A for CM IO 4 x M12

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)
Lamp load	Max. 5 W

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	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

15.8 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

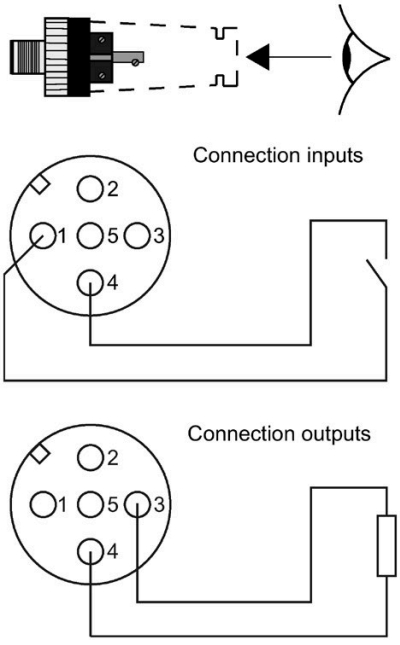
Note

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 503).

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.

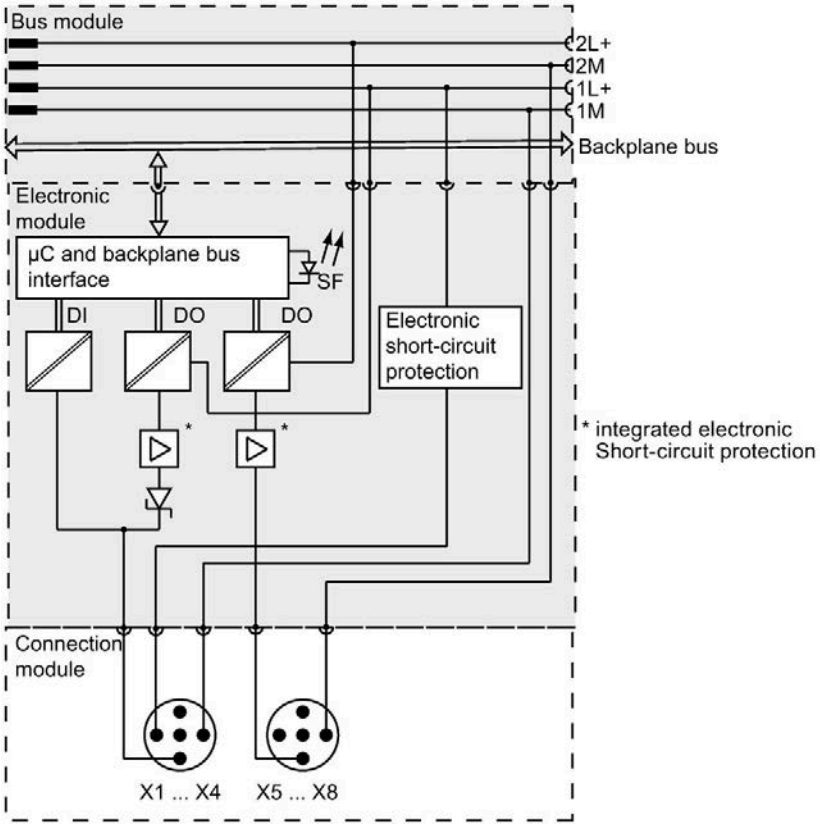


Figure 15-8 Block diagram 4 DIO / 4 DO DC 24V/0.5A

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
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)

Technical specifications	
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
Monitoring for	
• Short-circuit encoder supply	Yes
• Short-circuit at the output	Yes
Insulation	
Insulation tested	707 V DC (type test)

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; 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

15.9 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

Parameters	Value range	Default	Effective range
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

Parameters	Value range	Default	Effective range
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 367)

15.10 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 4DI/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 364)

Analog electronic modules

16

16.1 4 AI U High Feature analog electronic module (6ES7144-4FF01-0AB0)

Order number

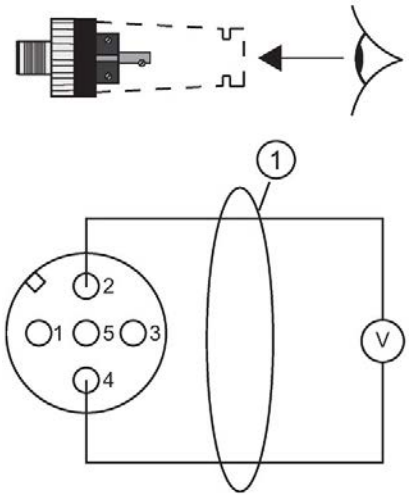
6ES7144-4FF01-0AB0

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 (depending on measuring range)
- Hardware interrupt on limit violation at channel 0
- permitted common mode voltage U_{CM}: 10 V AC_{SS}

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.

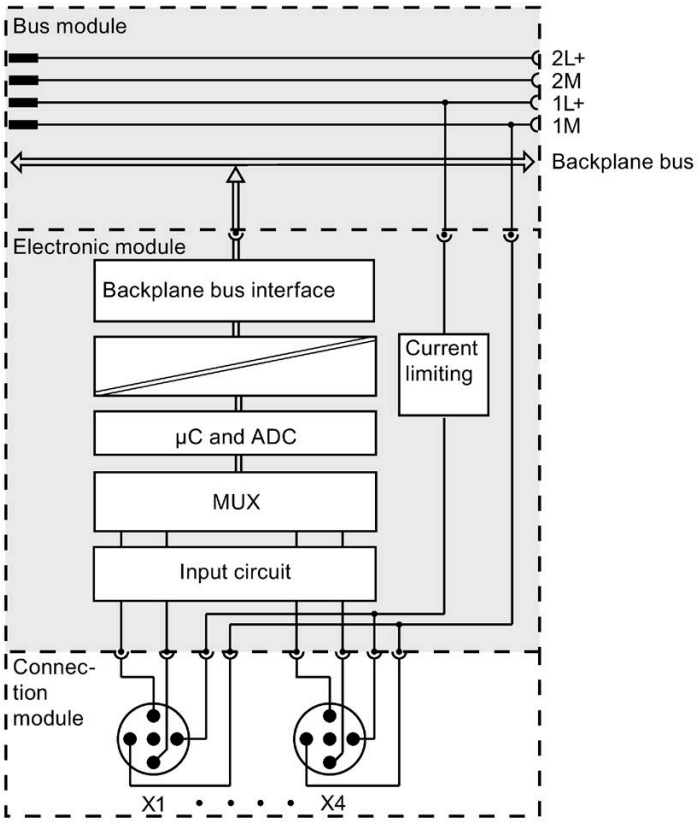


Figure 16-1 Block diagram 4 AI U High Feature

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. 12 mA
• From 1L+ electronics/encoder supply (no encoder connected)	Typ. 40 mA
Power loss of the module	Typ. 1.1 W
Analog inputs	
Number of 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				
• 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	16.67	50	60	3600
• Slow mode: Integration time in ms	-	20	16.7	-
• Slow mode: Conversion time in ms	-	66.7	66.7	-
• Fast mode: Integration time in ms	60	20	16.7	0.3
• Fast mode: Conversion time in ms	60.8	20.8	17.5	1.1
• 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 to 10 V/15 bit 1 to 5 V/15 bit			
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 (fast mode) min. 80 dB (slow mode)			
• Series-mode interference (signal value + peak value of interference < rated value of input range)	min. 40 dB (fast mode) min. 60 dB (slow mode)			

Technical specifications	
Crosstalk between inputs	max. -60 dB (at 3600 Hz) max. -70 dB (for all other modes)
Operational limit (across temperature range, referenced to input range)	±0.10% (positive temperature range) ±0.15% (negative temperature range)
Basic error limit (operational limit at 25 °C, referenced to input range)	±0.075%
Temperature error (referenced to input range)	±0.00075%/K (positive temperature range) ±0.0015%/K (negative temperature range)
Linearity error (referenced to input range)	±0.0075%
Repeat accuracy (in steady state at 25 °C, referenced to input range)	±0.004%
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})	10 V AC_{SS}

See also

Connection module CM IO 4 x M12 for electronic modules (Page 251)

Response times for analog input modules (Page 487)

16.2 4 AI I High Feature analog electronic module (6ES7144-4GF01-0AB0)

Order number

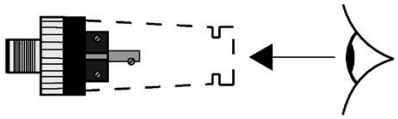
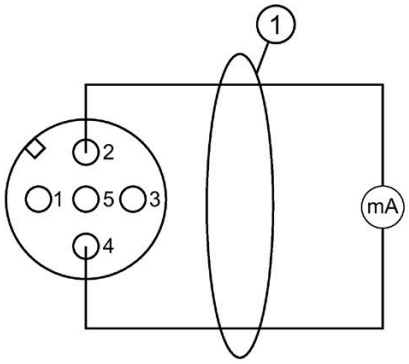
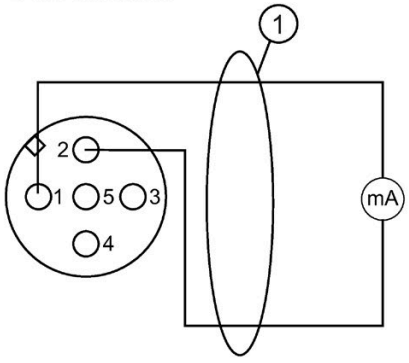
6ES7144-4GF01-0AB0

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 (depending on measuring range)
- Hardware interrupt on limit violation at channel 0
- permitted common mode voltage U_{CM}: 5 V AC_{SS} (voltage value: peak-peak)
- configurable from STEP 7 V5.5 SP4 or TIA Portal V13

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.

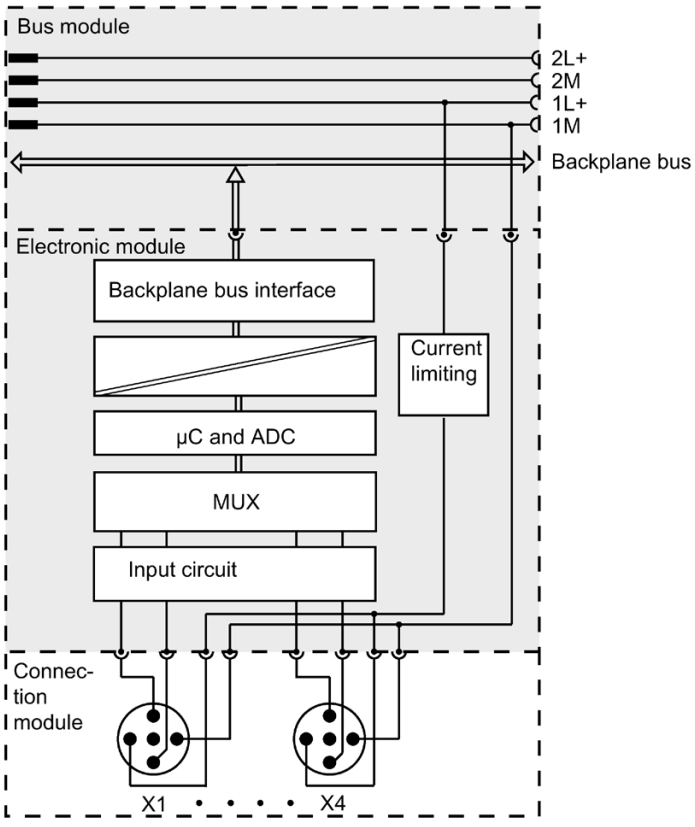


Figure 16-2 Block diagram, 4 AI I High Feature

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. 12 mA
• From electronics/encoder supply 1L+	Typ. 40 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		16.67	50	60	3600
• Slow mode: Integration time in ms		-	20	16.7	-
• Slow mode: Conversion time in ms		-	66.7	66.7	-
• Fast mode: Integration time in ms		60	20	16.7	0.3
• Fast mode: Conversion time in ms		60.8	20.8	17.5	1.1
• 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 4 to 20 mA/15 bit			
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 (fast mode) min. 80 dB (slow mode)			
• Series-mode interference (signal value + peak value of interference < rated value of input range)		min. 40 dB (fast mode) min. 60 dB (slow mode)			

Technical specifications	
Crosstalk between inputs	max. -60 dB (at 3600 Hz) max. -70 dB (for all other modes)
Operational limit (across temperature range, referenced to input range)	±0.10% (positive temperature range) ±0.15% (negative temperature range)
Basic error limit (operational limit at 25 °C, referenced to input range)	±0.075%
Temperature error (referenced to input range)	±0.00075%/K (positive temperature range) ±0.0015%/K (negative temperature range), max. ±0.002%/K
Linearity error (referenced to input range)	±0.0075%
Repeat accuracy (in steady state at 25 °C, referenced to input range)	±0.004%
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 at encoder supply	Yes; per module
• Short circuit at channel	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 251)

Response times for analog input modules (Page 487)

16.3 Analog electronic module 4 AI RTD High Feature (6ES7144-4JF00-0AB0)

Order number

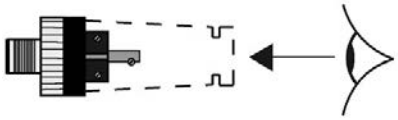
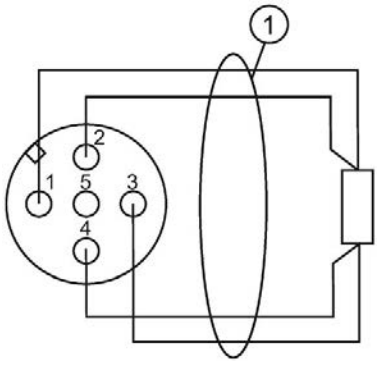
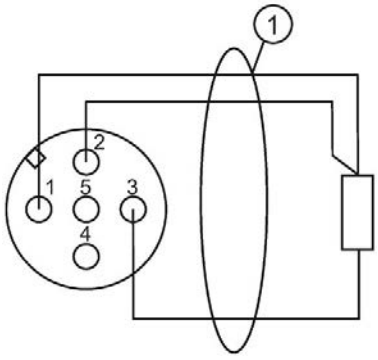
6ES7144-4JF00-0AB0

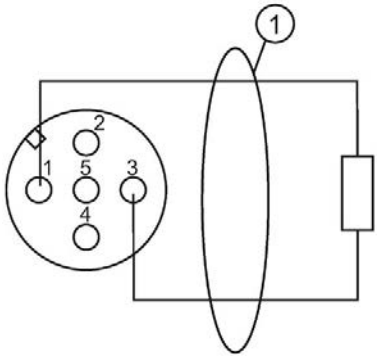
Properties

- 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)

View of circular connector	Terminal	Assignment X1 to X4
	**2-wire**	
	1	Measuring line M 0+: Connector X1 Measuring line M1+: Connector X2 Measuring line M2+: Connector X3 Measuring line M3+: Connector X4
	2	Not assigned
	3	Measuring line M 0-: Connector X1 Measuring line M1-: Connector X2 Measuring line M2-: Connector X3 Measuring line M3-: 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.

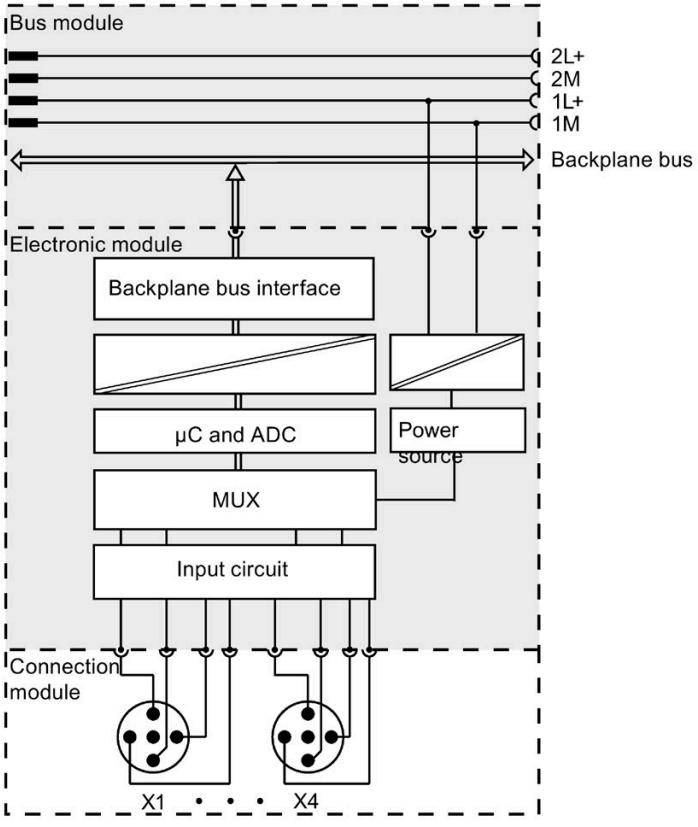


Figure 16-3 Block diagram 4 AI RTD High Feature

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	
Monitoring for			
• Wire break		Yes, between terminals 1 and 3	

Technical specifications	
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 251)

Response times for analog input modules (Page 487)

16.4 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 measuring range (as of functional status 2 with firmware V2.0.0 and activation via configuration)
- 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

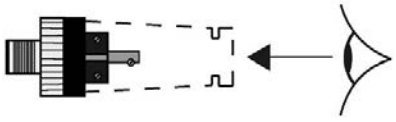
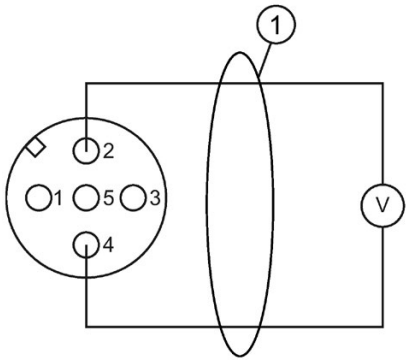
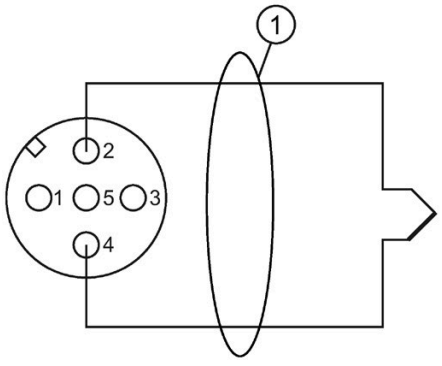
The electronic module needs an additional 40 ms for the wire break check. This time is independent of the number of channels that you have configured with wire break check.

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.

<table>
<tr><th>View of circular connector</th><th>Terminal</th><th>Assignment</th></tr>
<tr><td>  </td><td colspan="2"></td></tr>
<tr><td rowspan="6"> 
</td><td>Terminal</td><td>Assignment X1</td></tr>
<tr><td>1 *</td><td>Pt1000 resistance thermometer measuring line M+</td></tr>
<tr><td>2</td><td>Input signal M0+: Connector X1</td></tr>
<tr><td>3 *</td><td>Pt1000 resistance thermometer measuring line M-</td></tr>
<tr><td>4</td><td>Input signal M0-: Connector X1</td></tr>
<tr><td>5</td><td>Functional earth (FE)</td></tr>
<tr><td rowspan="6"> 
</td><td>Terminal</td><td>Assignment X2 to X4</td></tr>
<tr><td>1 *</td><td>Not assigned</td></tr>
<tr><td>2</td><td>Input signal M1+: Connector X2
Input signal M2+: Connector X3
Input signal M3+: Connector X4</td></tr>
<tr><td>3 *</td><td>Not assigned</td></tr>
<tr><td>4</td><td>Input signal M1-: Connector X2
Input signal M2-: Connector X3
Input signal M3-: Connector X4</td></tr>
<tr><td>5</td><td>Functional earth (FE)</td></tr>
<tr><td colspan="3">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).</td></tr>
</table>

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.

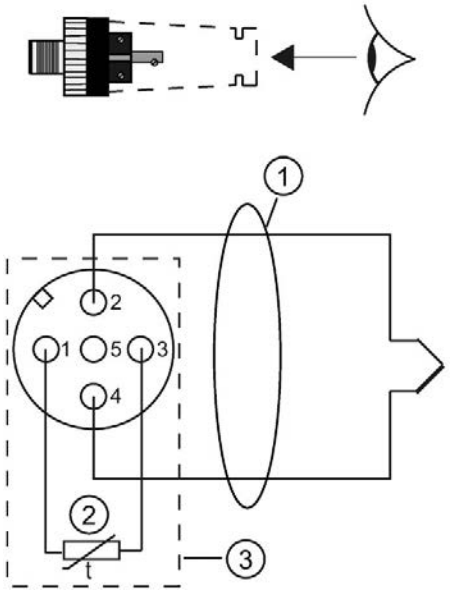
M12 compensation connectors need to be assembled after delivery. You can connect thermocouples via terminals 2 and 4 of M12 compensation connectors.

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 119)).

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.

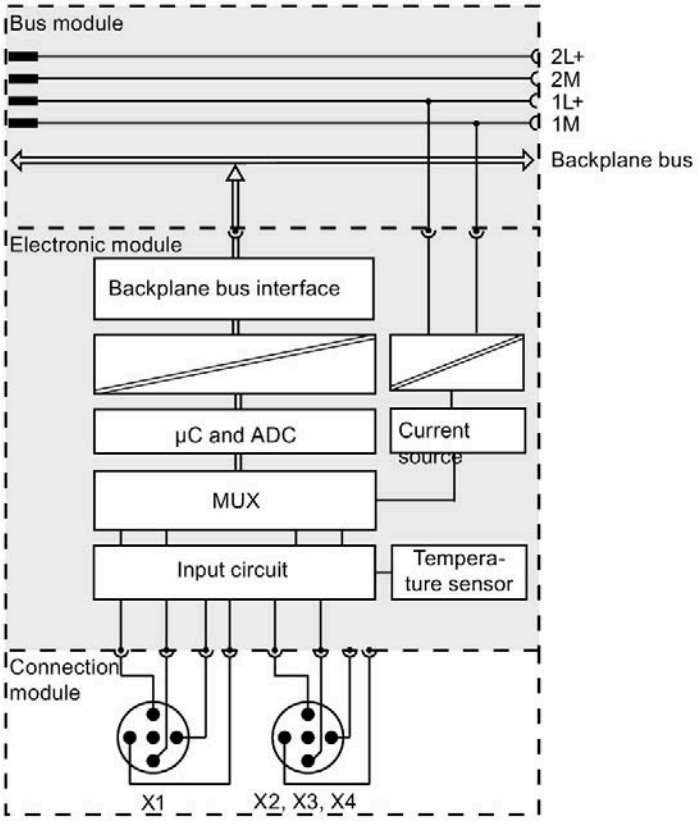


Figure 16-4 Block diagram 4 AI TC High Feature

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				
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%			

Technical specifications		
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	Yes	
• Underflow and overflow	Yes	
Insulation		
Insulation tested with	707 V DC (type test)	
Standards, approvals, certificates		
Suitable for applications according to AMS 2750	Yes; Declaration of Conformity, see online support entry 109757262	
Suitable for applications according to CQI-9	Yes; based on AMS 2750 E	
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 251)

Response times for analog input modules (Page 487)

16.5 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

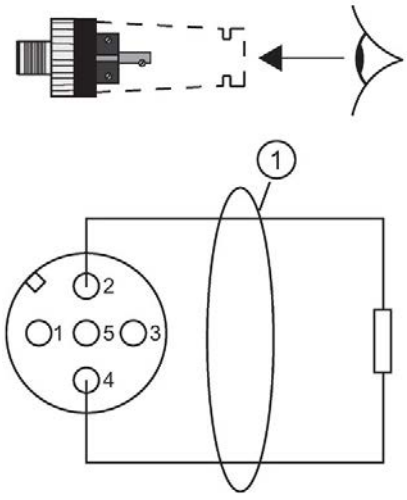
  0 V to 10 V, resolution 15 bit
- Outputs are electrically isolated from encoder voltage supply 1L+ and load voltage supply 2L+
- Diagnostics for encoder supply short-circuit to M per module
- Diagnostics for short-circuit at outputs per channel
- Output of substitute value

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.

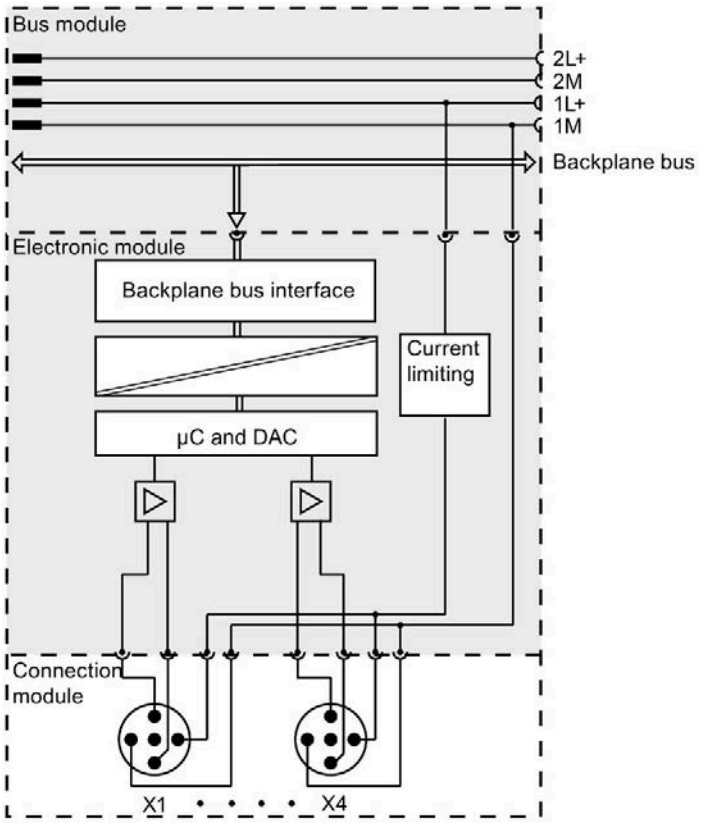


Figure 16-5 Block diagram of 4 AO U High Feature

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
Linearity error (referenced to output range)	±0.02% [1]
Repeat accuracy (in steady state at 25 °C, referenced to output range)	± 0.05%

Technical specifications	
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 251)

Response times for analog input modules (Page 487)

16.6 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

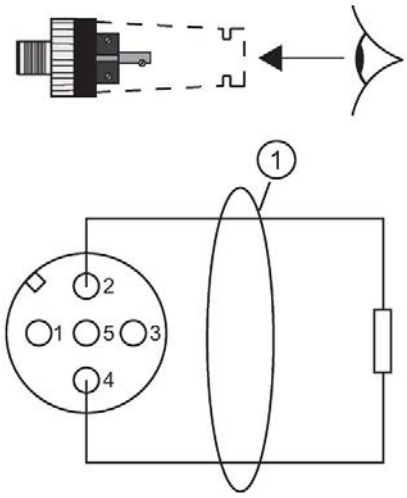
  0V to 20 mA, resolution 15 bit
- Outputs are electrically isolated from encoder voltage supply 1L+ and load voltage supply 2L+
- Diagnostics for encoder supply short-circuit to M per module
- Diagnostics for wire break per channel
- Output of substitute value

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.

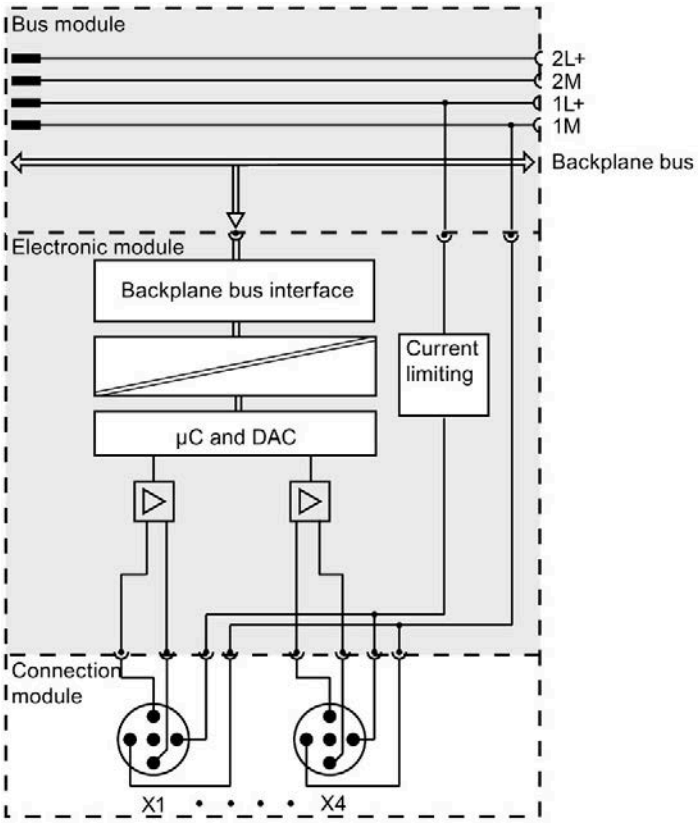


Figure 16-6 Block diagram of 4 AO I High Feature

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]
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%

Technical specifications	
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 251)

Response times for analog input modules (Page 487)

16.7 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
Operating mode[1]		• Slow mode • Fast mode	Slow mode	Modules
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-WMT) • Current (2-WMT)[2]	Current (4-WMT)	Channel
—	Measuring range	• 0 mA to 20 mA • 4 mA to 20 mA • ±20 mA	4 mA to 20 mA	Channel
Diagnostics short-circuit of the encoder supply to M[3]		• Disable • Enable	Disable	Module
Diagnostics short-circuit[4]		• Disable • Enable	Disable	Channel
Diagnostics wire break [4]		• 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] Further explanations in the following table.
[2] Restrictions for common mode voltage U_{CM}.
[3] The diagnostics function for the detection of a short-circuit of the encoder supply to M is enabled alongside the group diagnostics function.
[4] 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.

Operating mode for 4 AI U High Feature, 4 AI I High Feature analog input modules

Operating mode	Interference frequency suppression	Integration time	Conversion time
Slow mode	50 Hz 60 Hz	20 ms 16.667 ms	66.667 ms 66.667 ms
Fast mode	16.6 Hz 50 Hz 60 Hz 3600 Hz	60 ms 20 ms 16.667 ms 0.28 ms	60 ms 20.3 ms 17 ms 1 ms

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

Parameters	Value range	Default	Effective range
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
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

Parameters		Value range	Default	Effective range
4 AO U High Feature	**4 AO I High Feature**			
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 overshoot/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 409)

16.8 Overview of parameters of the analog electronic modules

Principle

The module can only detect a short-circuit of the encoder supply to ground when group diagnostics is enabled.

Diagnostics of short-circuit of the channel depends on the measuring range and is detected independently of the above-mentioned diagnostics.

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.

Operating mode for 4 AI U High Feature, 4 AI I High Feature analog input modules

In the operating mode "Fast mode", the conversion time is optimized.
In the operating mode "Slow mode", optimization applies to interference voltage suppression.

Measurement type/output type

With this parameter, you set the measurement type/output type, e.g. voltage. If you are not using a channel, you must 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

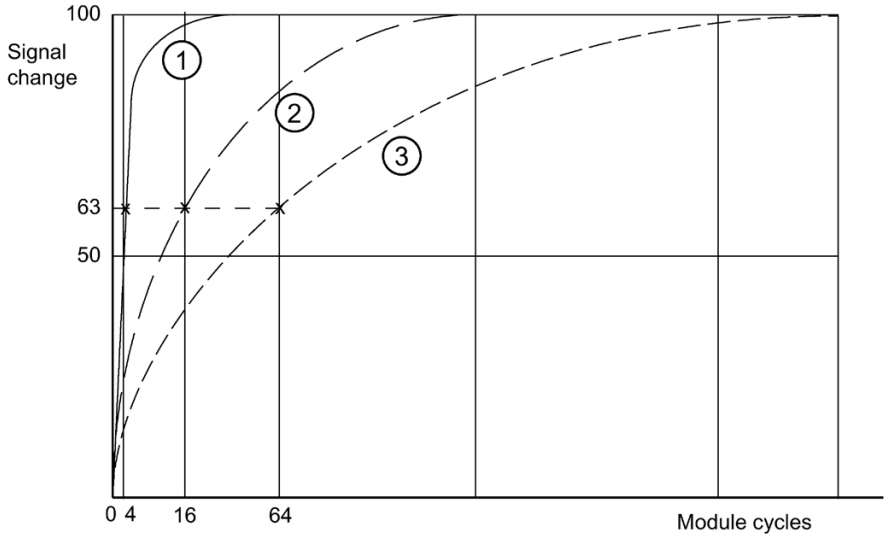
Smoothing of the analog values produces a reliable analog signal for further processing. The smoothing of analog values is useful when handling measured values with a slow rate of change, for example, temperature measurements.

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 to handle 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 alarm **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.

High limit

If the input value exceeds the set high limit and the hardware interrupt is enabled, the module triggers a hardware interrupt (limit interrupt).

Low limit

If the input value falls below the set low limit and the hardware interrupt is enabled, the module triggers a hardware interrupt (limit interrupt).

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 498)). 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 directly or using compensating lines to the CM IO 4 x M12 of the 4 AI TC High Feature (see example in the Appendix Connecting thermocouples to analog inputs (Page 498)).

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 498)).

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 additional information, see section Dynamic reference temperature for the 4 AI TC High Feature electronic module (Page 416). **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 498)).
Fix 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 possible value range is shown in the table *"Reference temperature" parameter for 4AI TC High Feature* in the section Parameter overview for analog electronic modules (Page 402). The configured reference junction temperature is valid for all the channels of the module for which you have selected this type of compensation. **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 498)).

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.

16.9 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 402).
- 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

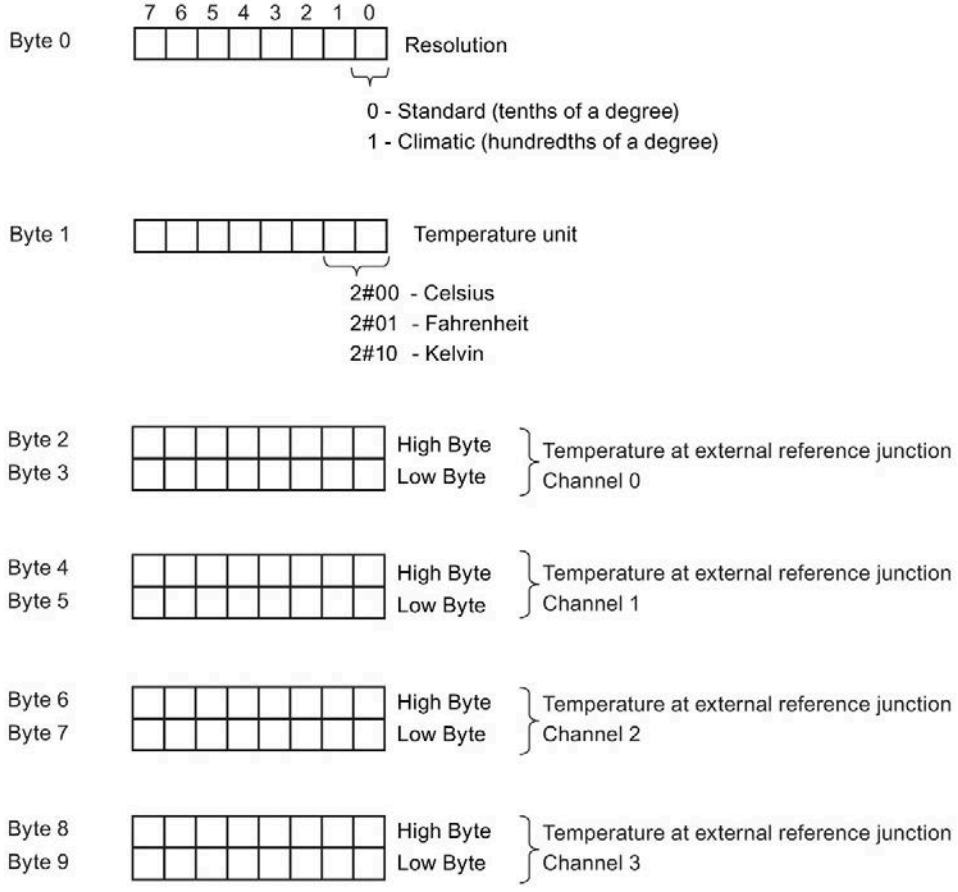


Figure 16-7 Data record DS2 structure

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).

16.10 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 16- 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 16- 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

16.11 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 0 to 10 V	Units		Range
	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	Hexadecimal	
> 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	Hexadecimal		Decimal	Hexadecimal	
> 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	Hexadecimal		Decimal	Hexadecimal	
> 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	Hexadecimal		Decimal	Hexadecimal	
> 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	Hexadecimal		Decimal	Hexadecimal	
> 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 16- 3

Type B in °C	Units		Type B in °F	Units		Type B in K	Units		Range
	Decimal	Hexadecimal		Decimal	Hexadecimal		Decimal	Hexadecimal	
> 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 16- 4

Type E in °C	Units		Type E in °F	Units		Type E in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexa-decimal		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 16- 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 16- 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 16- 7

Type L in °C	Units		Type L in °F	Units		Type L in K	Units		Range
	Decimal	Hexa-decimal		Decimal	Hexadec-imal		Decimal	Hexa-decimal	
> 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 16- 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 16- 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	Hexa-decimal		Decimal	Hexadec-imal		Decimal	Hexa-decimal	
> 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

16.12 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$_H$	

16.13 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

17

17.1 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 503).

Block diagram

The figure below shows the block diagram of the 16 DO DC 24V CPV10.

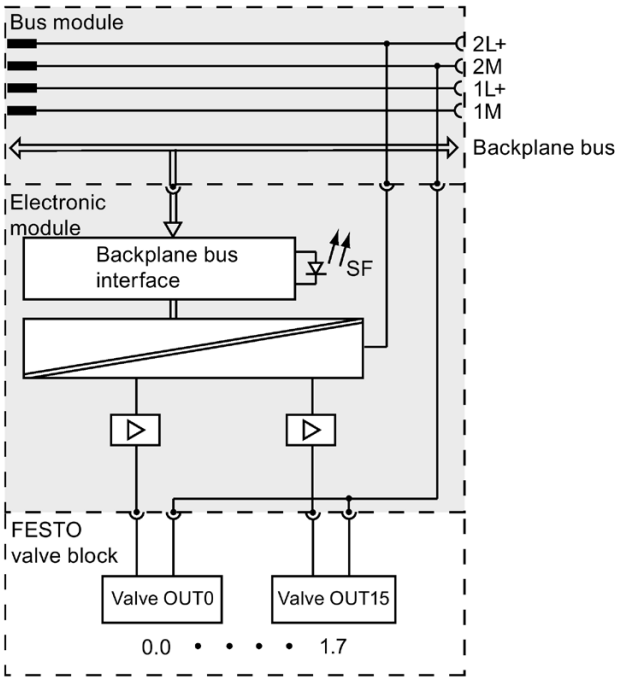


Figure 17-1 Block diagram 16 DO DC 24V CPV10

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.	

17.2 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 503).

Block diagram

The figure below shows the block diagram of the 16 DO DC 24V CPV14.

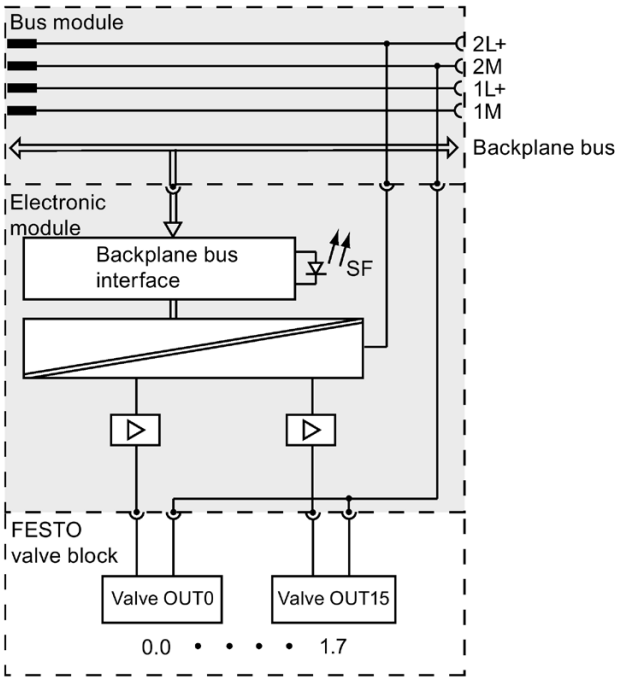


Figure 17-2 Block diagram 16 DO DC 24V CPV14

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

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	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.	

17.3 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
Interface module IM 154-3 PN High Feature with terminating module, 1 item	6ES7154-3AB00-0AB0
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 M12, 7/8" S, 1 item	6ES7194-4AK00-0AA0
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	6ES7144-4FF01-0AB0
4 AI I High Feature, 1 item	6ES7144-4GF01-0AB0
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

Designation	Order number
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
Prefabricated 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 Prefabricated with ECOFAST Hybrid Plug 180 at both ends fixed lengths, 1 item	0.5 m	6XV1830-7BH05
	1.0 m	6XV1830-7BH10
	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 Prefabricated with ECOFAST Hybrid Plug 180 at both ends Fixed lengths, 1 item:	0.5 m	6XV1860-3PH05
	1.0 m	6XV1860-3PH10
	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 Plug 180° (ECOFAST Cu) with female insert (Hanbrid connector) 5 items per package, 1 package		6GK1905-0CB00
PROFIBUS ECOFAST Hybrid Plug 180° (ECOFAST Cu) with male 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
PROFIBUS ECOFAST Hybrid Cable	20.0 m	6XV1830-7AN20
Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2	50.0 m	6XV1830-7AN50
Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	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 mm^2 Raw cable, sold by the meter		6XV1830-7AH10
PROFIBUS ECOFAST Hybrid Cable GP Trailing cable (PVC sheath) with 2 Cu cables shielded for PROFIBUS DP and 4 copper wires with 1.5 mm^2, with UL approval Raw cable, sold by the meter, min. order quantity 20 m Delivery unit max. 1000 m, 1 m		6XV1860-2P
PROFIBUS ECOFAST Hybrid Cable GP	50.0 m	6XV1860-4PN20
Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2, UL approval	50.0 m	6XV1860-4PN50
Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	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
Prefabricated cables and connectors:		
PROFIBUS M12 connecting cable Trailing-type cable, 2-wire • Prefabricated with PROFIBUS M12 connectors 180° at both ends, fixed length, 1 item:	0.3 m	6XV1830-3DE30
	0.5 m	6XV1830-3DE50
	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 • Prefabricated with PROFIBUS M12 angled connectors at both ends, fixed lengths, 1 item:	1.5 m	6XV1830-3DH15-0SB0*
	2.0 m	6XV1830-3DH20-0SB0*
	3.0 m	3RK1902-1NB30
	5.0 m	3RK1902-1NB50
	10.0 m	3RK1902-1NC10
	15.0 m	6XV1830-3DN15-0SB0*
PROFIBUS M12 connecting cable Trailing-type cable, 2-wire • Prefabricated with PROFIBUS M12 angled connector at one end (one end with pin, one end open), fixed lengths, 1 item:	3.0 m	3RK1902-1GB30
	5.0 m	3RK1902-1GB50
	10.0 m	3RK1902-1GC10
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm^2 • Prefabricated 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	6XV1822-5BH10
	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 mm^2 • Prefabricated with 7/8" angled connectors at both ends, fixed lengths, 1 item	1.5 m	6XV1822-5BH15-0SB0*
	2.0 m	6XV1822-5BH20-0SB0*
	3.0 m	3RK1902-3NB30
	5.0 m	3RK1902-3NB50
	10.0 m	3RK1902-3NC10
	15.0 m	6XV1822-5BN15-0SB0*
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm^2 • Prefabricated 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

Designation	Order number
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
• FC Trailing Cable	6XV1830-3EH10
• FC Food Cable (PE sheath)	6XV1830-0GH10
• FC Robust Cable (PUR sheath)	6XV1830-0JH10
• FC FRNC Cable (FRNC sheath)	6XV1830-0LH10
• FC Underground Cable	6XV1830-3FH10
• Festoon Cable GP (PVC sheath)	6XV1830-3GH10
• FC Flexible Cable GP (PUR sheath)	6XV1830-2K
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 terminating plug with male insert, 5-pin, B-coded 5 items	6GK1905-0CE00
M12 cover caps AS-Interface 10 items per package, 10 items	3RK1901-1KA00
M12 cover caps 10 items per package, 10 items	3RX9802-0AA00
7/8" cover caps 10 items per package, 1 item	6ES7194-3JA00-0AA0

* Order via Org. ID 10001539

Accessories, connection modules CM IM PN M12, 7/8" and CM IM PN M12, 7/8" S

Table A- 11 Accessories for CM IM PN M12, 7/8" and CM IM PN M12, 7/8" S interface modules, order numbers

Designation		Order number
Prefabricated cables and connectors:		
PROFINET M12 connecting cable trailing cable • Prefabricated with M12 connectors 180° at both ends, fixed lengths, 1 item:	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
PROFINET M12 connecting cable trailing cable • Prefabricated with M12 connectors at both ends, angled, fixed lengths, 1 item:	3.0 m	3RK1902-2NB30
	5.0 m	3RK1902-2NB50
	10.0 m	3RK1902-2NC10
PROFINET M12 connecting cable trailing cable • Prefabricated with M12 connectors at both ends, angled, fixed lengths, 1 item:	0.3 m	6XV1870-8GE30
	0.5 m	6XV1870-8GE50
	1.0 m	6XV1870-8GH10
	1.5 m	6XV1870-8GH15
	2.0 m	6XV1870-8GH20
	3.0 m	6XV1870-8GH30
	5.0 m	6XV1870-8GH50
	10.0 m	6XV1870-8GN10
	15.0 m	6XV1870-8GN15
PROFINET M12 connecting cable trailing cable • Prefabricated with M12 angled connector 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
PROFINET M12 connecting cable trailing cable • Prefabricated 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
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm^2 • Prefabricated 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	6XV1822-5BH10
	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

Designation		Order number
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Prefabricated with 7/8" angled connectors at both ends, fixed lengths, 1 item	1.5 m	6XV1822-5BH15-0SB0*
	2.0 m	6XV1822-5BH20-0SB0*
	3.0 m	3RK1902-3NB30
	5.0 m	3RK1902-3NB50
	10.0 m	3RK1902-3NC10
	15.0 m	6XV1822-5BN15-0SB0*
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Prefabricated 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 fast 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
• FC TP Marine Cable		6XV1840-4AH10
• FC TP Torsion Cable		6XV1870-2F
• FC TP Flexible Cable GP		6XV1870-2B
• FC TP FRNC Cable		6XV1871-2F
• FC TP Food Cable		6XV1871-2L
• FC TP Festoon Cable GP		6XV1871-2S
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

Designation	Order number
M12 cover caps AS-Interface 10 items per package, 10 items	3RK1901-1KA00
M12 cover caps 10 items per package, 10 items	3RX9802-0AA00
7/8" cover caps 10 items per package, 1 item	6ES7194-3JA00-0AA0

* Order via Org. ID 10001539

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
Prefabricated cables and connectors:	
Push-pull connecting cables for 1L+/2L+, preassembled	(on request)
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
Prefabricated cables and connectors:	
Push-pull connecting cables (1L+/2L+), preassembled	(on request)
Push-pull connecting cables for SC RJ, preassembled	
Raw cables and connectors:	
POF Standard Cable GP sold by the meter, min. order quantity 20 m, Delivery unit max. 500 m, 1 m	6XV1874-2A
POF Trailing Cable sold by the meter, min. order quantity 20 m, Delivery unit max. 500 m, 1 m	6XV1874-2B
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
Prefabricated cables and connectors:		
M12 connecting cable (PUR sheath), A-coded, max. 4 A • Prefabricated at both ends, 3 x 0.34 mm², fixed length, 1 item	1.5 m	3RK1902-4PB15-3AA0
M12 connecting cable (PUR sheath), A-coded, max. 4 A • Prefabricated with M12 angled connector at one end (one end with socket, one end open), 5 x 0.35 mm², fixed length, 1 item	1.5 m	3RK1902-4HB15-5AA0
	5 m	3RK1902-4HB50-5AA0
	10 m	3RK1902-4HC01-5AA0
M12 cover caps 10 items per package, 10 items		3RX9802-0AA00
M12 cover caps AS-Interface 10 items per package, 10 items		3RK1901-1KA00
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, screw terminal, max. 0.75 mm², A-coded, max. 4 A, 1 item		3RK1902-4BA00-5AA0

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 M12 connection module, order numbers

Designation	Order number
Prefabricated cables and connectors:	
M12 cover caps 10 items per package, 10 items	3RX9802-0AA00
M12 cover caps AS-Interface 10 items per package, 10 items	3RK1901-1KA00
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:	
Actuator/sensor distributor, 8-fold	(on request)
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
Prefabricated cables and connectors:		
PROFIBUS ECOFAST Hybrid Cable	1.5 m	6XV1830-7BH15
Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2	3.0 m	6XV1830-7BH30
	5.0 m	6XV1830-7BH50
	10.0 m	6XV1830-7BN10
Prefabricated with ECOFAST Hybrid Plug 180 at both ends fixed lengths, 1 item	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

Designation		Order number
PROFIBUS ECOFAST Hybrid Cable GP	1.5 m	6XV1860-3PH15
Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2	3.0 m	6XV1860-3PH30
	5.0 m	6XV1860-3PH50
	10.0 m	6XV1860-3PN10
Prefabricated with ECOFAST Hybrid Plug 180 at both ends	15.0 m	6XV1860-3PN15
Fixed lengths, 1 item:	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 Cable	20.0 m	6XV1830-7AN20
Trailing-type cable (PUR sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2	50.0 m	6XV1830-7AN50
	100.0 m	6XV1830-7AT10
Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	Sold by the meter	6XV1830-7AH10
PROFIBUS ECOFAST Hybrid Cable GP	20.0 m	6XV1860-4PN20
Trailing-type cable (PVC sheath) with 2 shielded Cu lines for PROFIBUS DP and 4 copper wires 1.5 mm^2, UL approval	50.0 m	6XV1860-4PN50
Raw cable Ring, 1 item For additional lengths, refer to Catalog IK PI	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
Prefabricated cables and connectors:		
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm2 • Prefabricated 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	6XV1822-5BH10
	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 • Prefabricated with 7/8" angled connectors at both ends, fixed lengths, 1 item	1.5 m	6XV1822-5BH15-0SB0*
	2.0 m	6XV1822-5BH20-0SB0*
	3.0 m	3RK1902-3NB30
	5.0 m	3RK1902-3NB50
	10.0 m	3RK1902-3NC10
	15.0 m	6XV1822-5BN15-0SB0*
7/8" connecting cable for power supply Trailing-type power cable, 5 x 1.5 mm² • Prefabricated 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

* Order via Org. ID 10001539

Accessories of CM PM PP connection module

Table A- 21 Order numbers of accessories of CM PM PP connection module

Designation	Order number
Prefabricated cables and connectors:	
Push-pull connecting cables for 1L+/2L+, prefabricated 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
Prefabricated cables and connectors:	
Push-pull connecting cables for 1L+/2L+, prefabricated 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

PROFINET IO

Technical book	Order numbers	Content
Automation with PROFINET - Industrial communication based on Industrial Ethernet	Commercial book number: ISBN 3-89578-244-0	This book provides an introduction to PROFINET technology

SIMATIC Manual Collection

Designation	Order number	Content
SIMATIC Manual Collection	6ES7998-8XC01-8YE0	Contains all SIMATIC manuals in electronic form

Technical Product Data – CD-ROM

Table A- 24

Designation	Order number	Content
Technical Product Data for Cax Applications	6ES7991-0CC00-0YX0	Contains the following technical product data for CAD/CAE systems: • Technical data according to ECAD component 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.

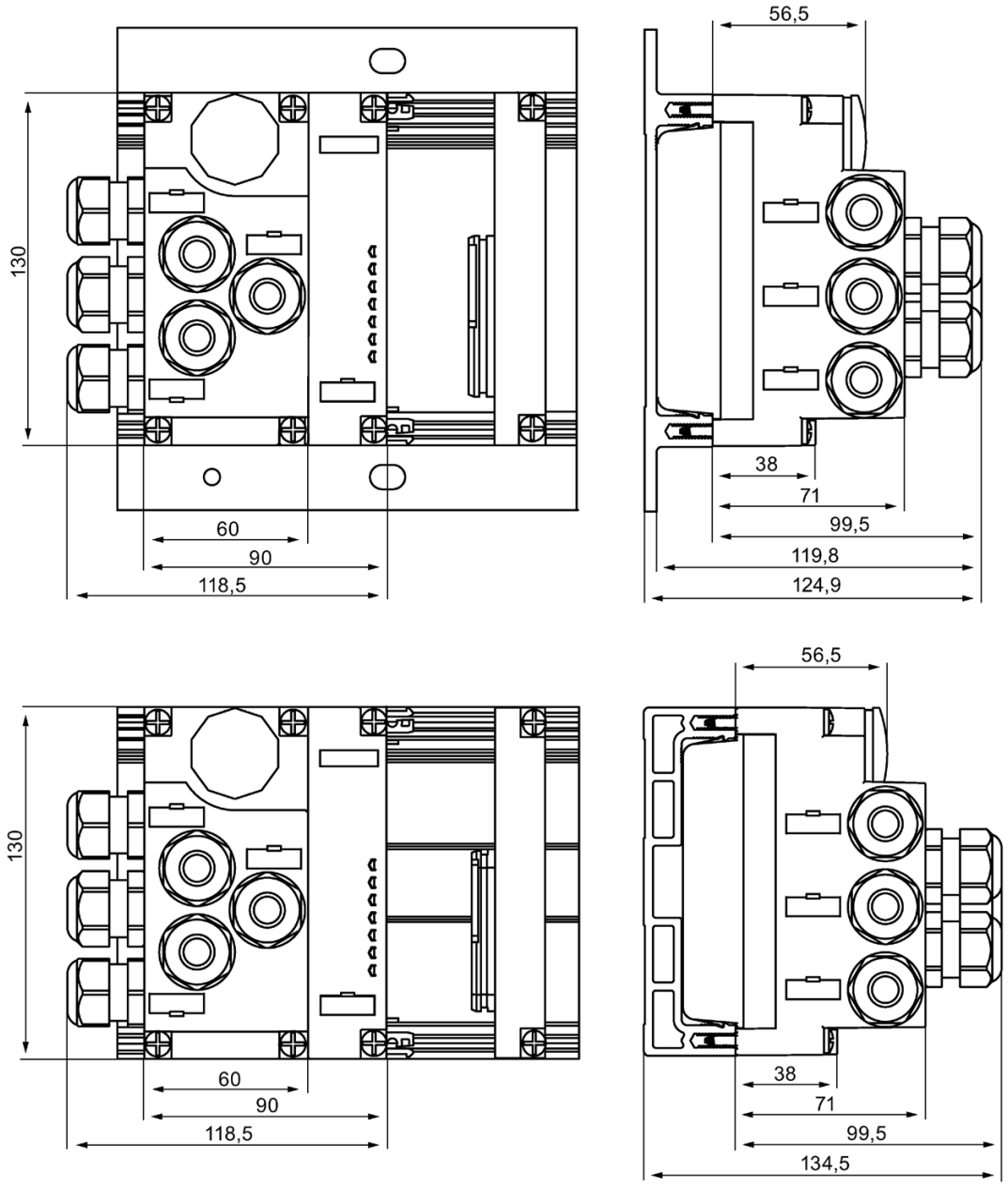


Figure A-1 Dimensional drawing of IM 154-1 DP/IM 154-2 DP High Feature interface module with CM IM DP Direct connection module

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.

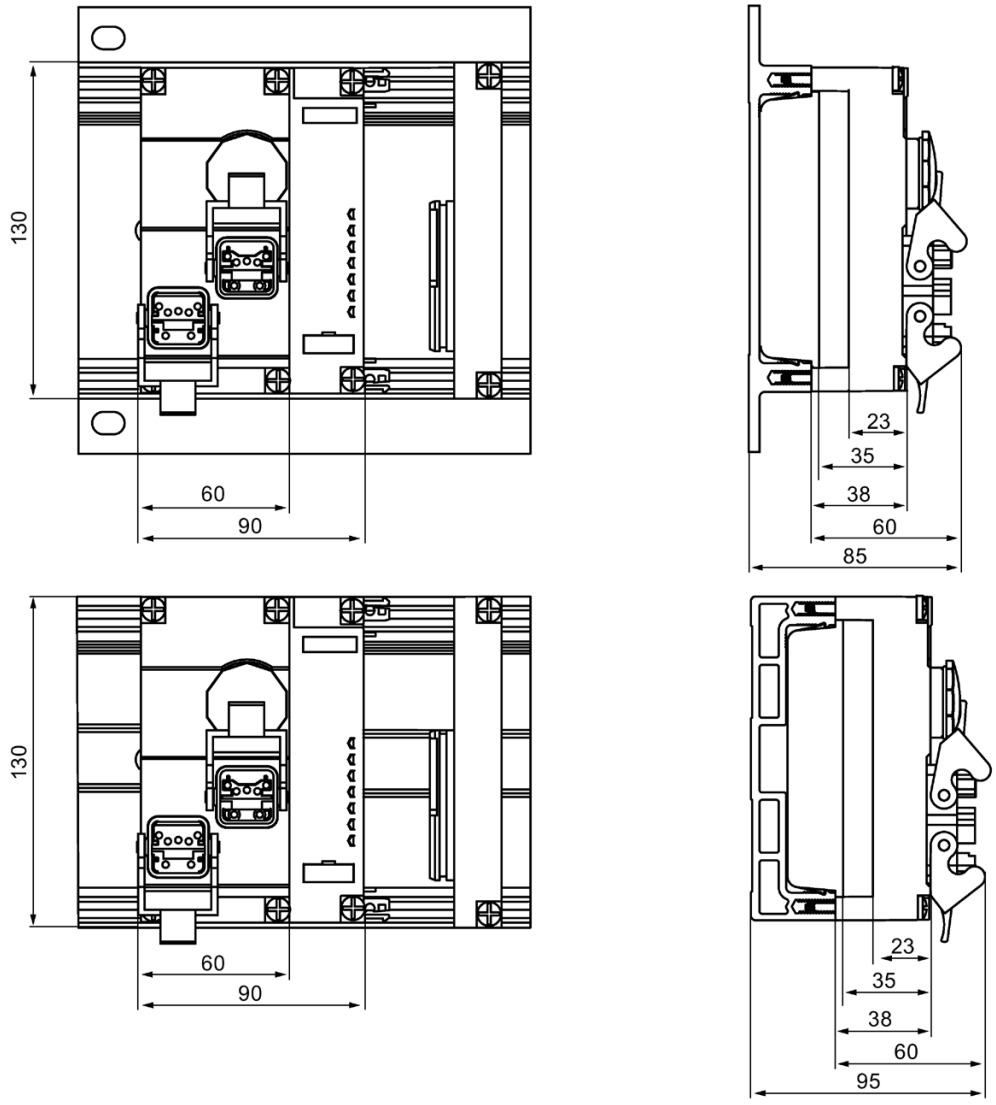


Figure A-2 Dimensional drawing of IM 154-2 DP High Feature interface module with CM IM DP ECOFAST Cu connection module

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.

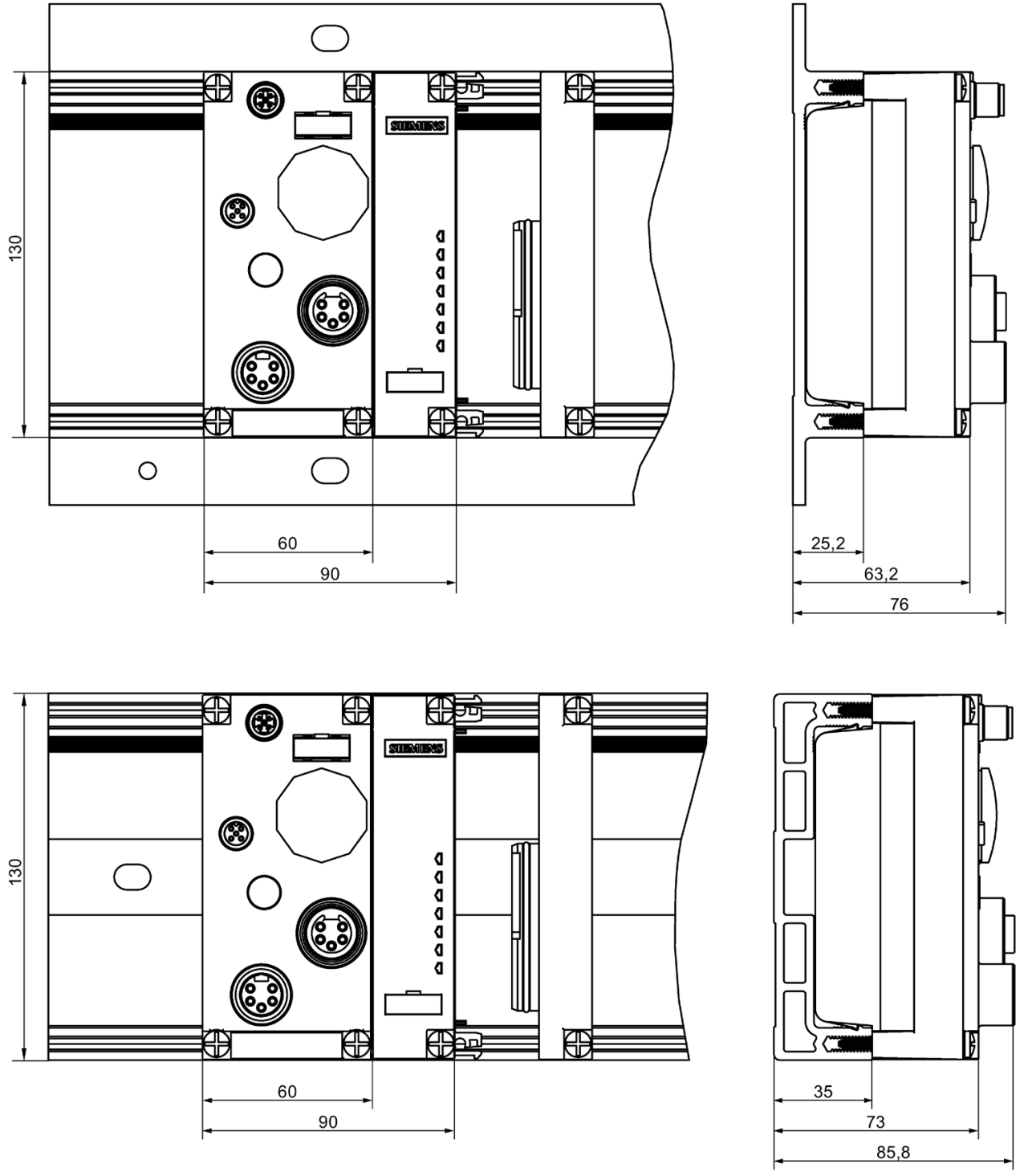


Figure A-3 Dimensional drawing of IM 154-2 DP High Feature interface module with CM IM DP M12, 7/8" connection module

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 rack; bottom: with compact rack.

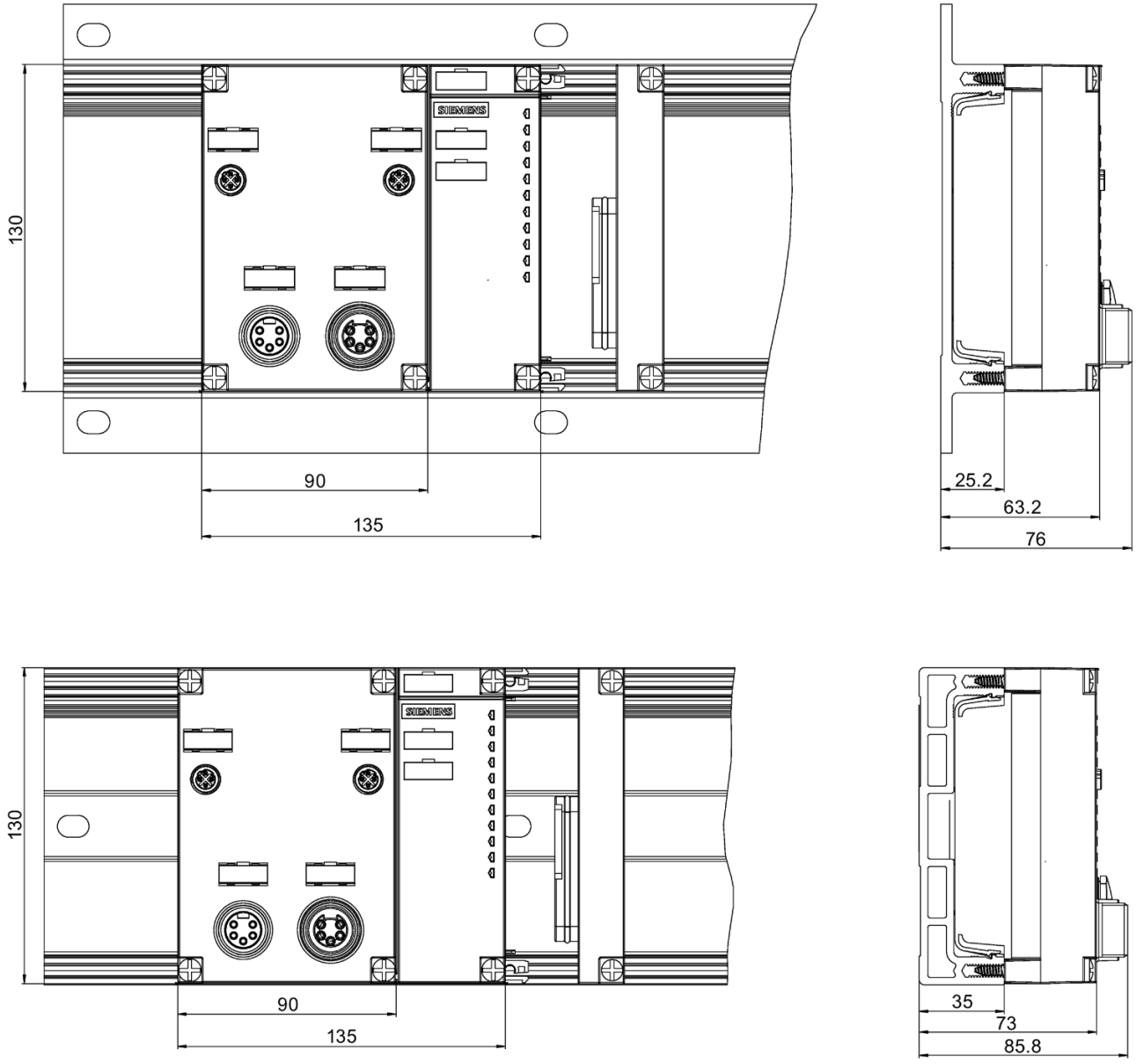


Figure A-4 IM 154-4 PN High Feature interface module with CM IM PN M12, 7/8" connection module

IM 154-4 PN High Feature interface module with CM IM PN PP Cu/CM IM PN PP FO connection module

Top: with narrow rack; bottom: with compact rack.

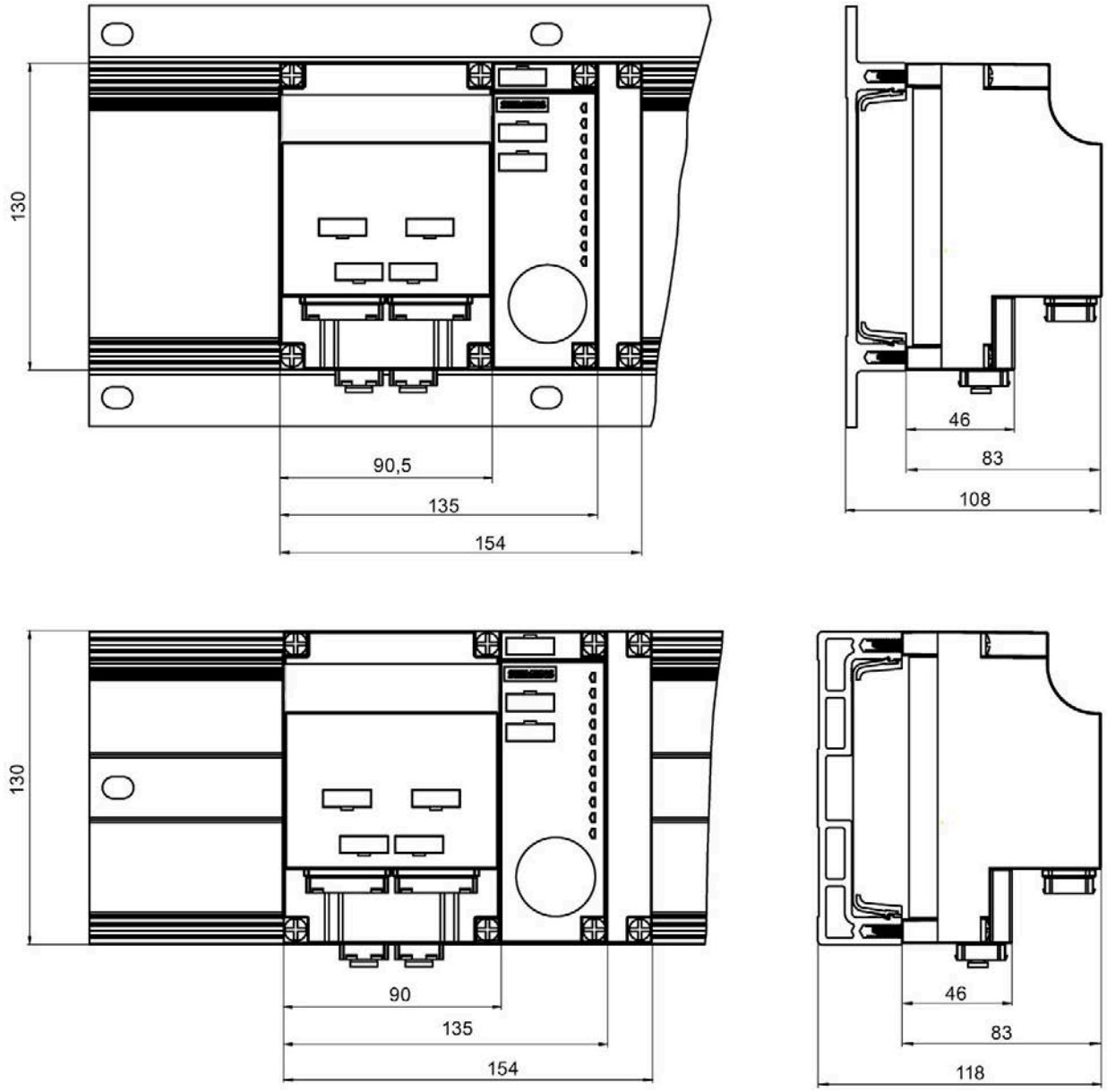


Figure A-5 IM 154-4 PN High Feature interface module with CM IM PN PP Cu/CM IM PN PP FO connection module

IM 154-3 PN High Feature interface module with CM IM PN M12, 7/8" S connection module

Top: with narrow rack; bottom: with compact rack.

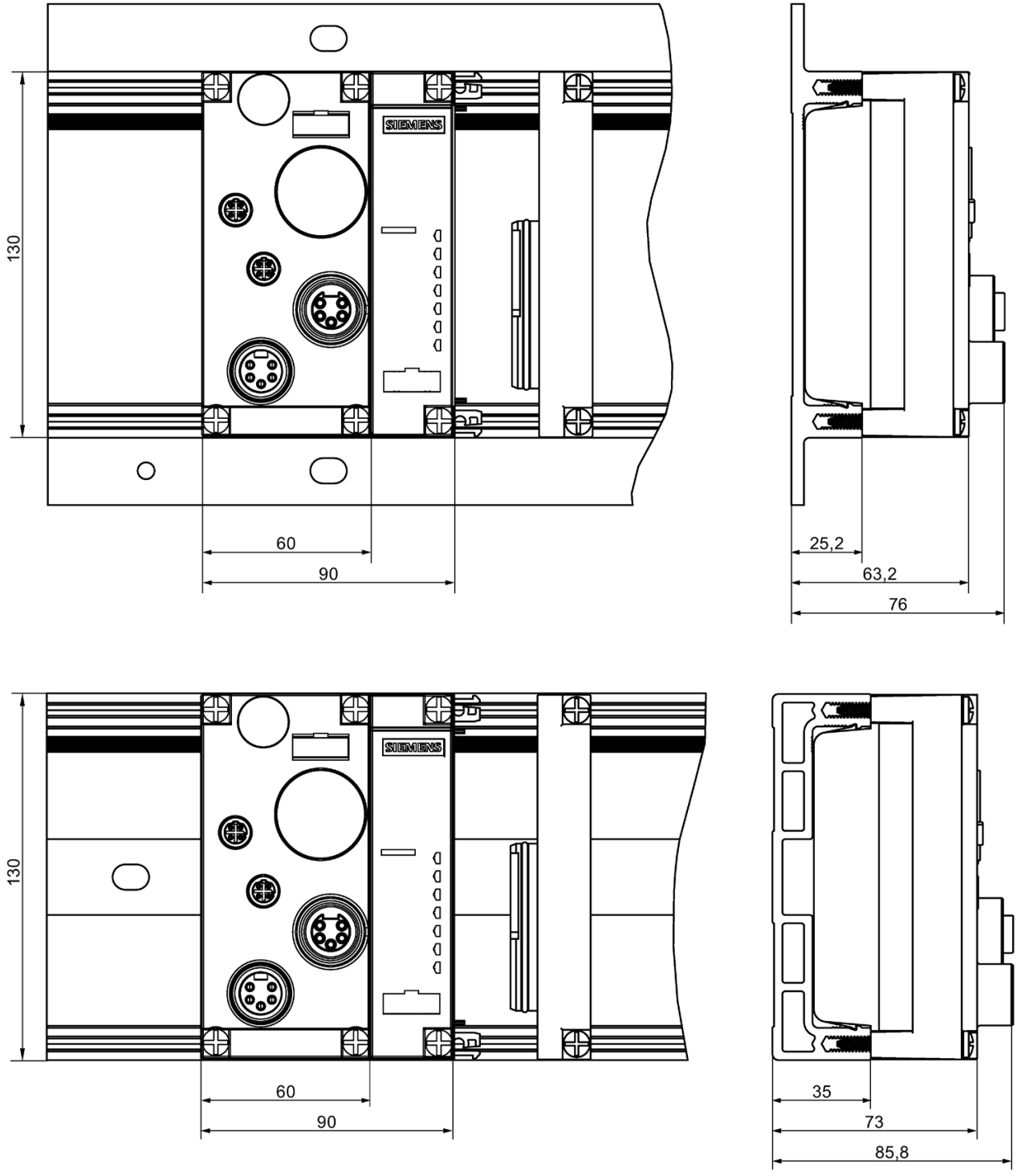


Figure A-6 IM 154-3 PN High Feature interface module with CM IM PN M12, 7/8" S connection module

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.

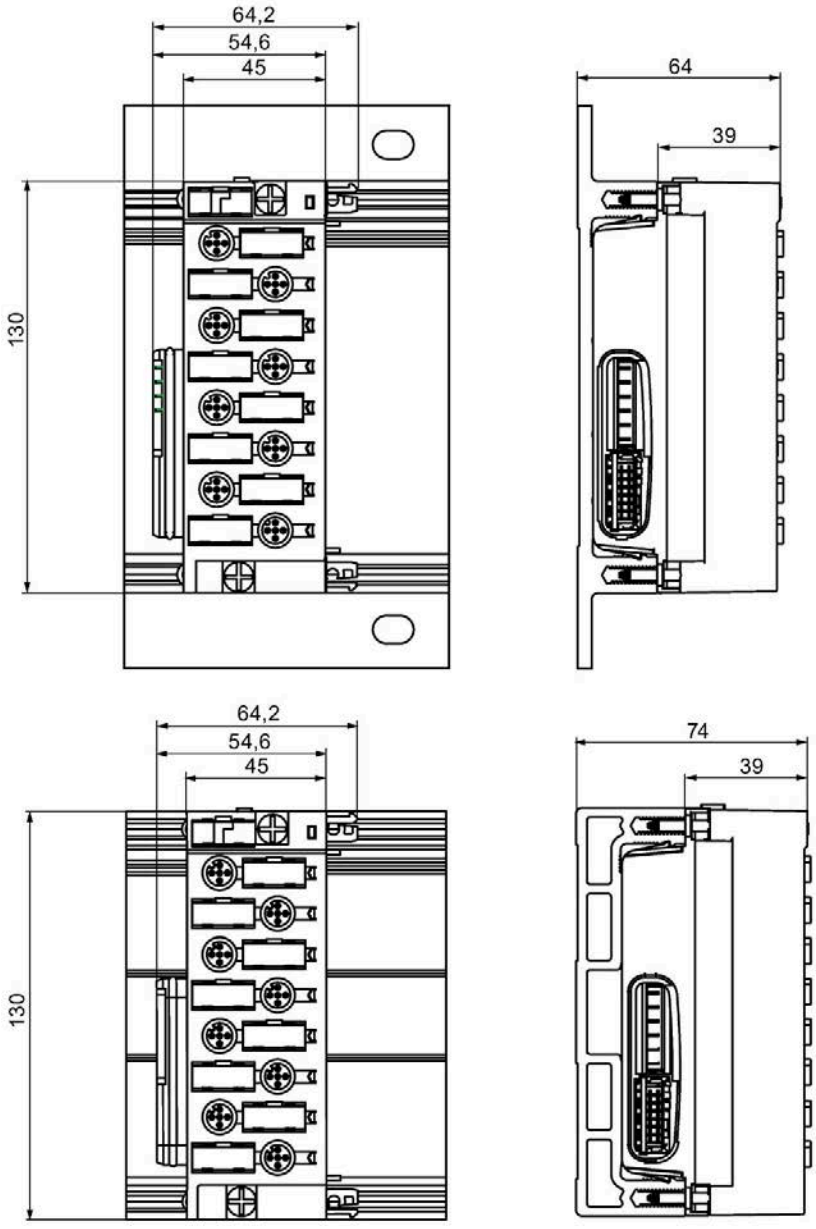


Figure A-7 Dimension drawing of an electronic module with CM IO 8 x M12 connection module

Electronic module with CM IO 2 x M12 connection module

Top: with narrow type rack; bottom: with compact type rack.

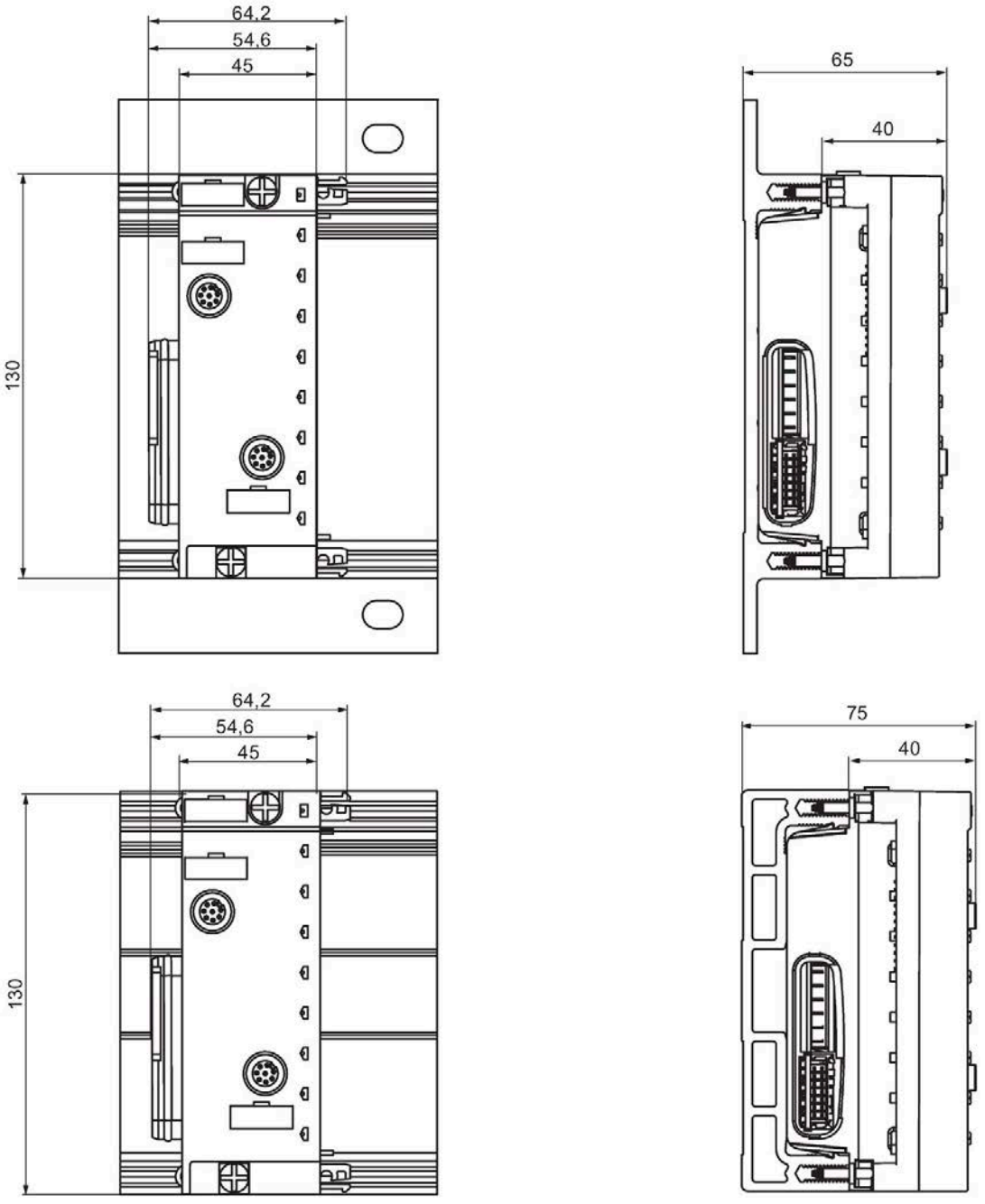


Figure A-8 Dimension drawing of electronic module with CM IO 2xM12 connection module

Electronic module with CM IO 1 x M23 connection module

Top: with narrow type rack; bottom: with compact type rack.

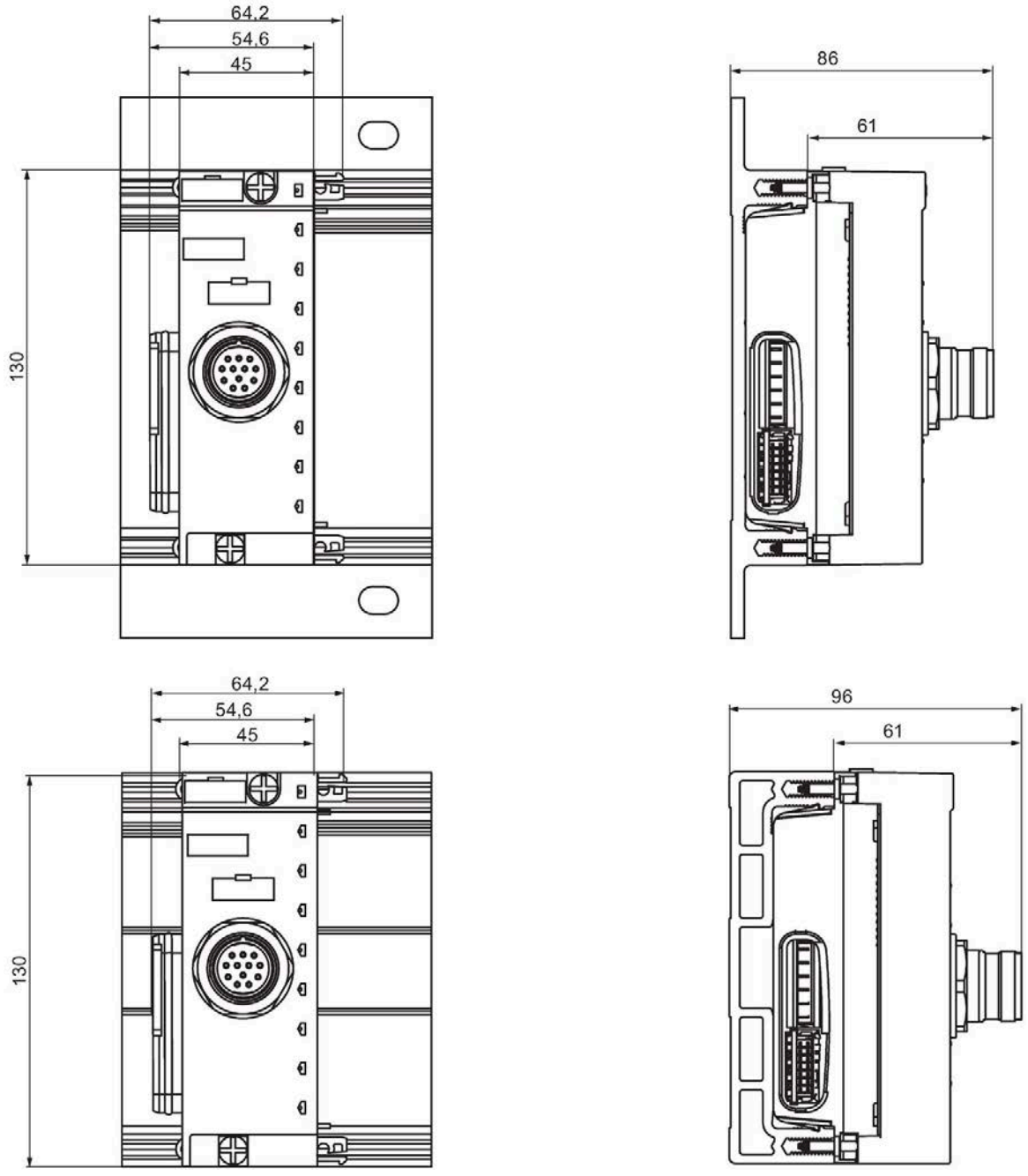
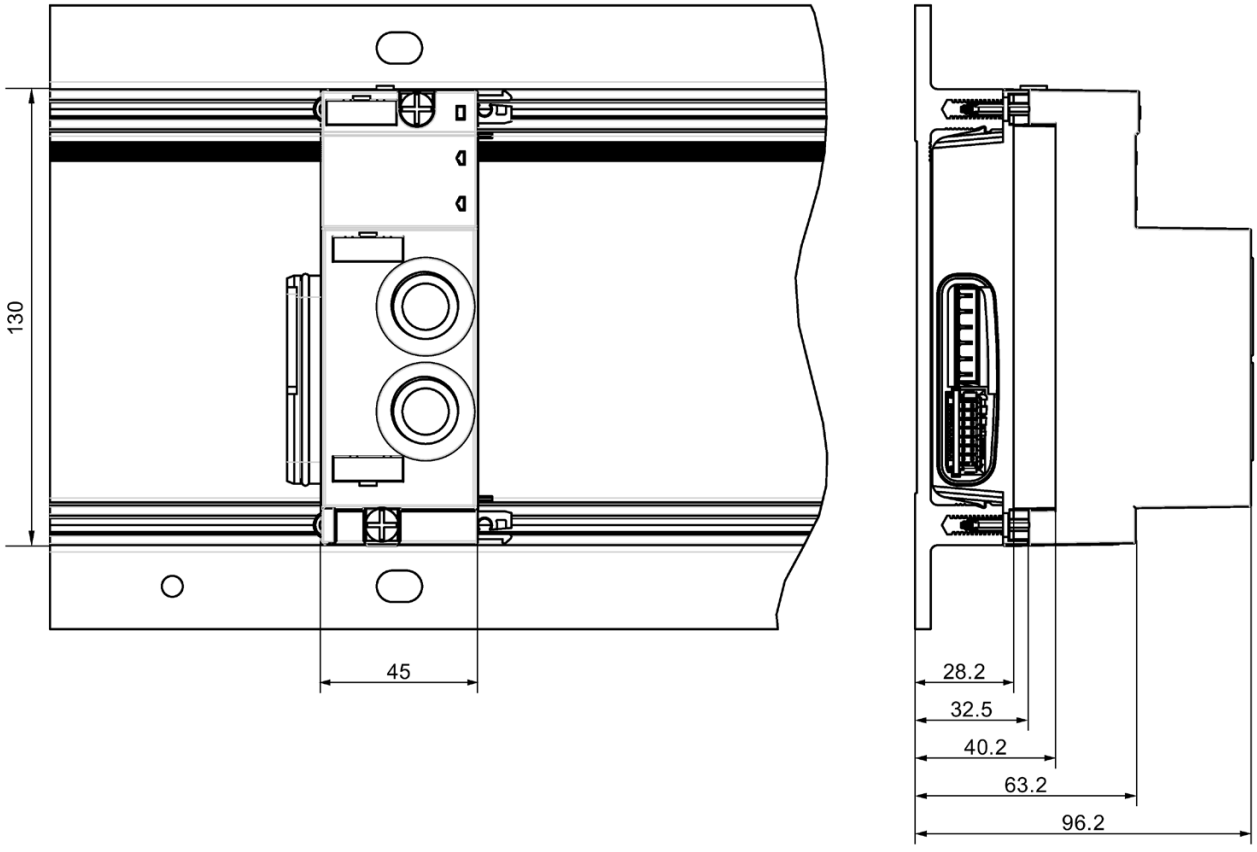


Figure A-9 Dimension drawing of electronic module with CM IO 1xM23 connection module

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.



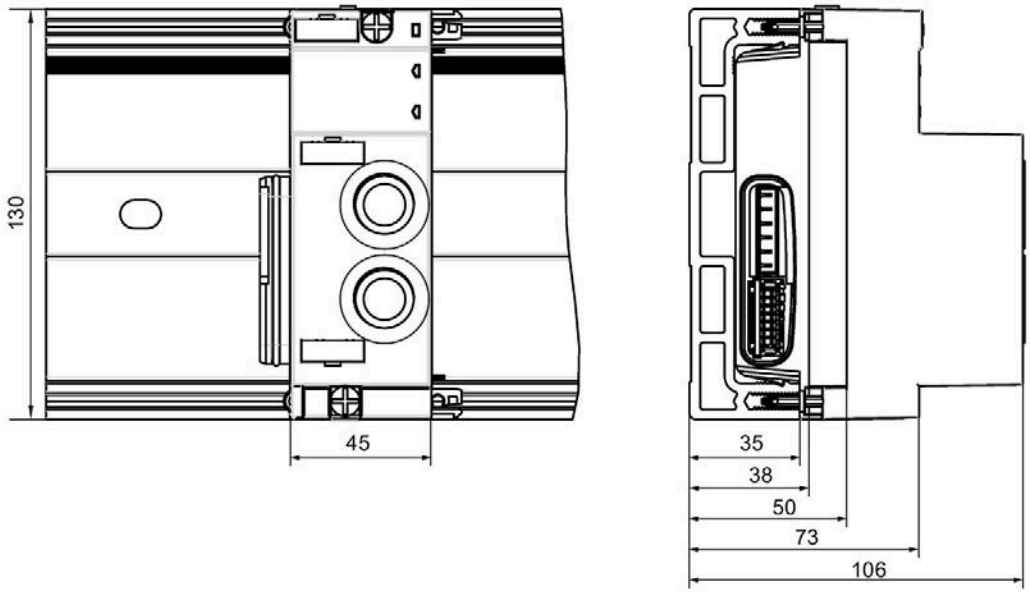
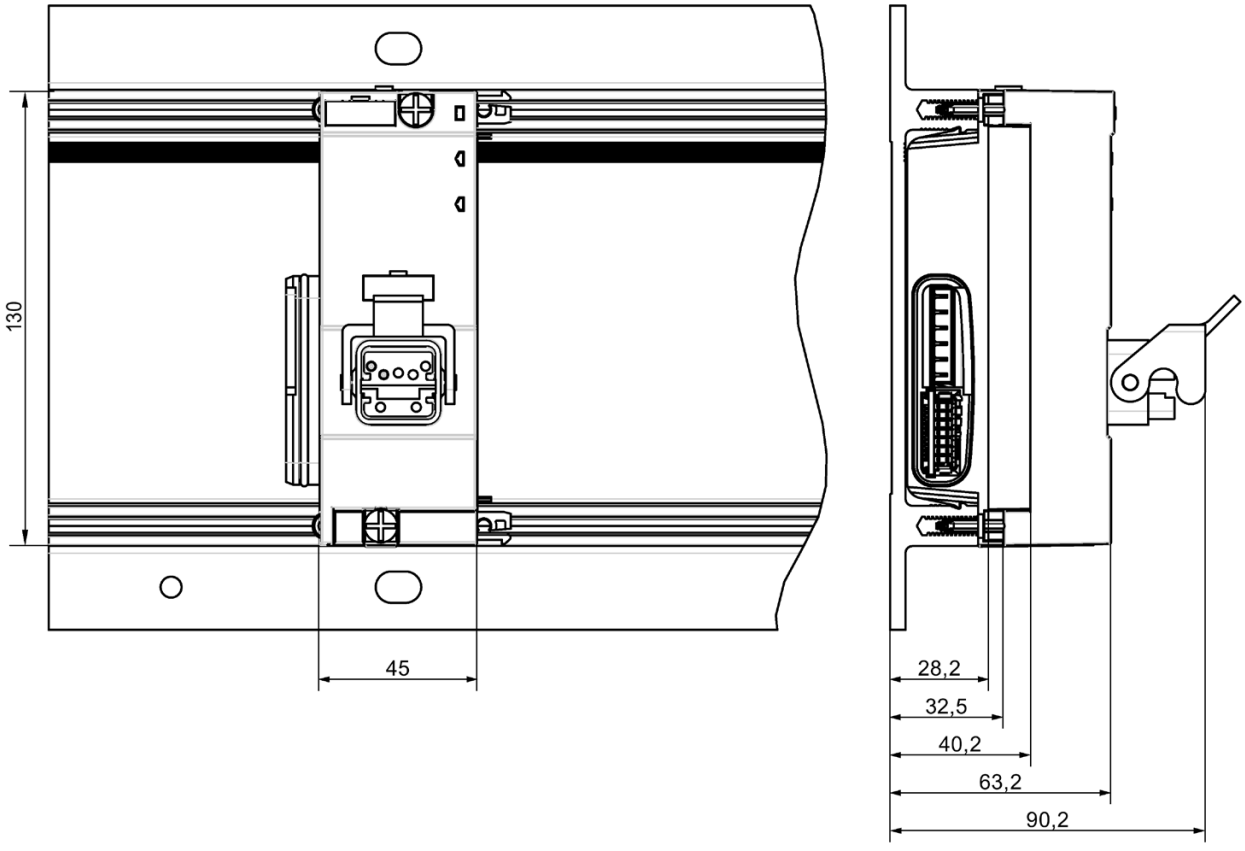


Figure A-10 Dimensional drawing of the power module with CM PM Direct connection module

PM-E power module with CM PM ECOFAST connection module

Top: With narrow type rack. Bottom: With compact type rack.



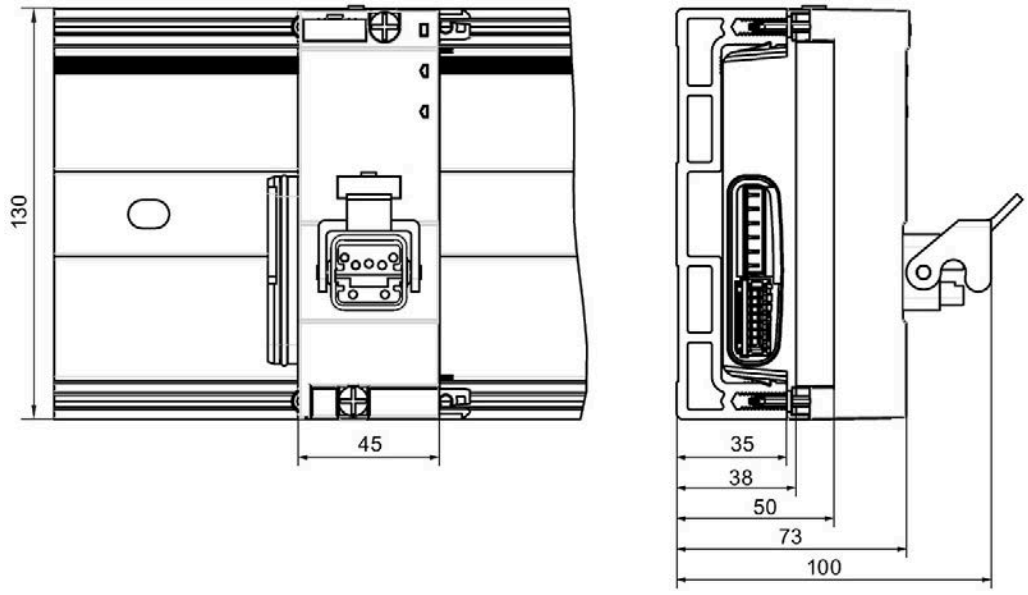
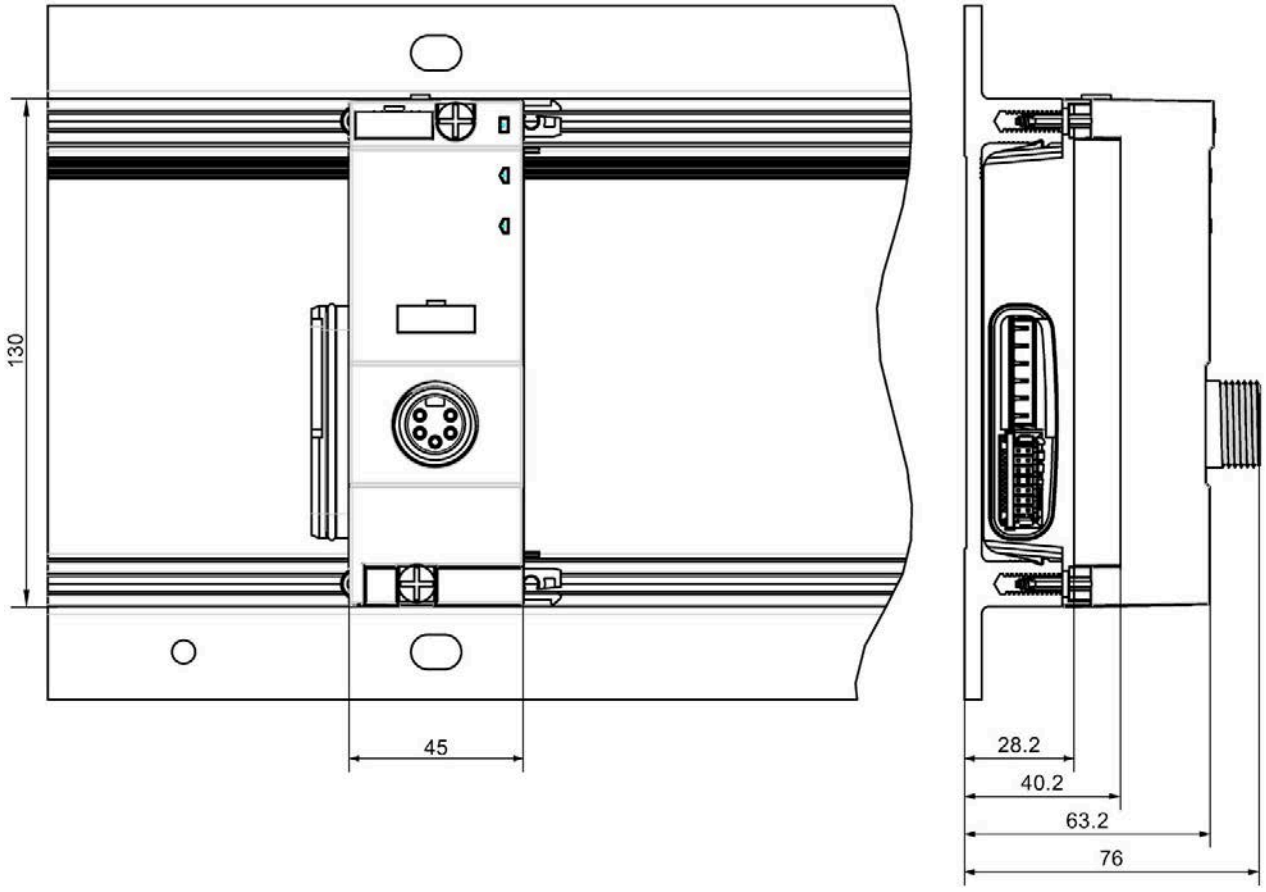


Figure A-11 Dimensional drawing of the power module with CM PM ECOFAST connection module

PM-E power module with CM PM 7/8" connection module

Top: With narrow type rack. Bottom: With compact type rack.



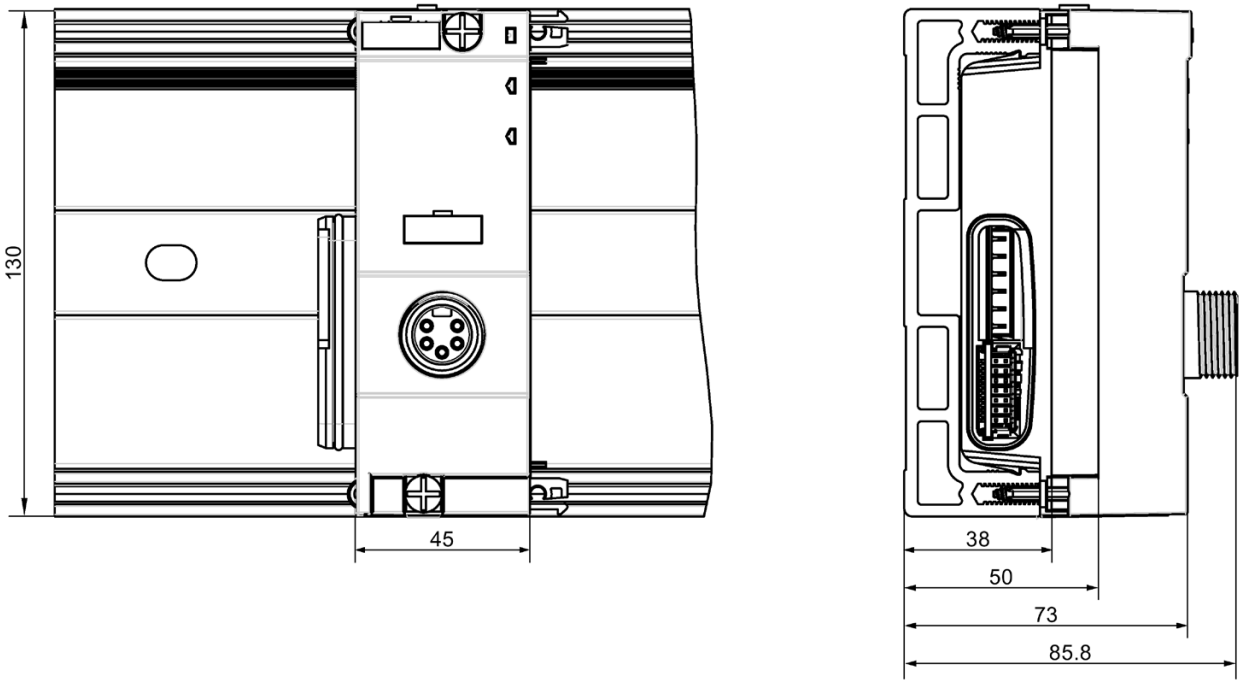


Figure A-12 Dimensional drawing of the power module with CM PM 7/8" connection module

PM-E power module with CM PM PP connection module

Top: With narrow type rack. Bottom: With compact type rack.

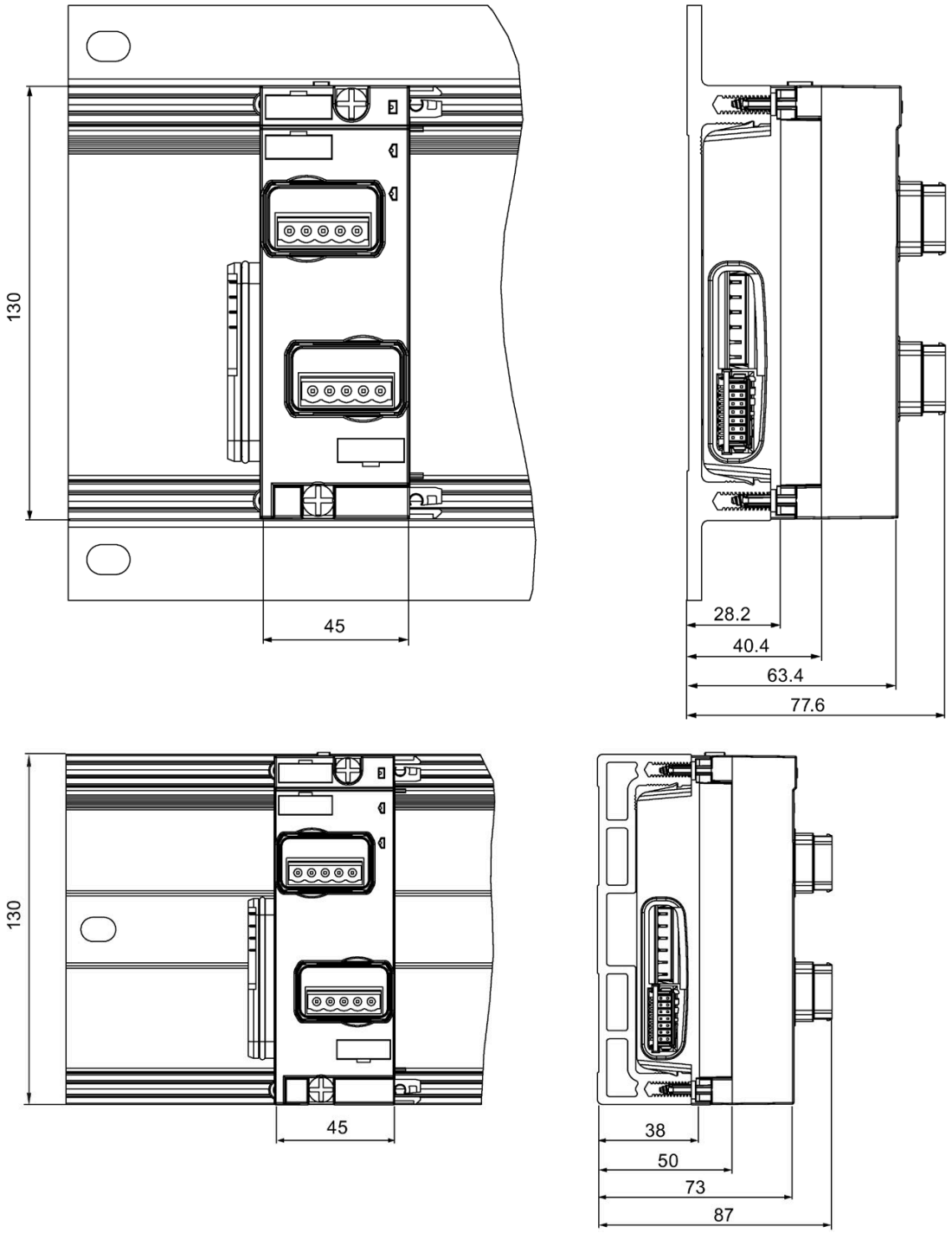


Figure A-13 Dimensional drawing of the power module with CM PM PP connection module

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.

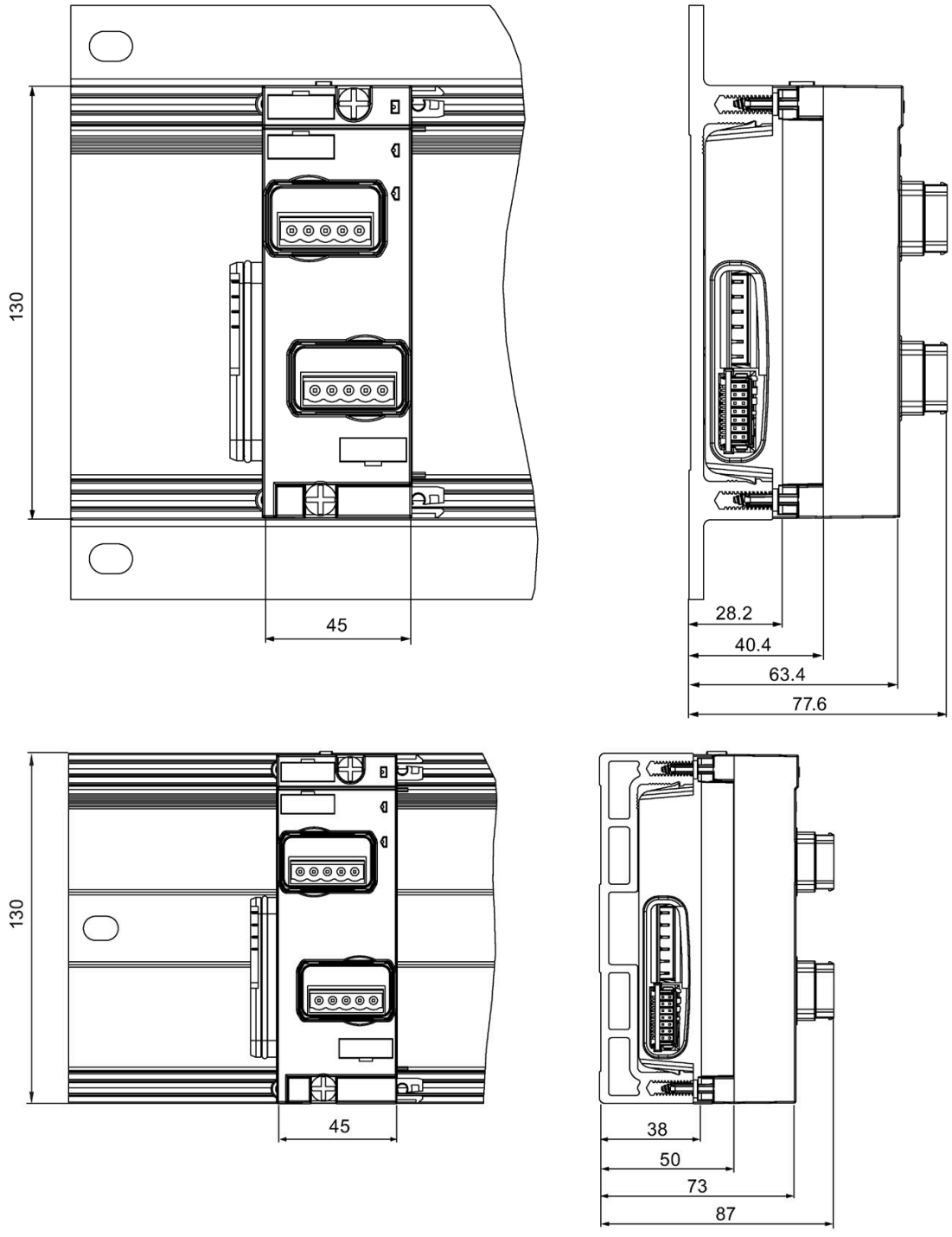


Figure A-14 Dimension drawing of the outgoing module with CM PM-O PP connection module

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.

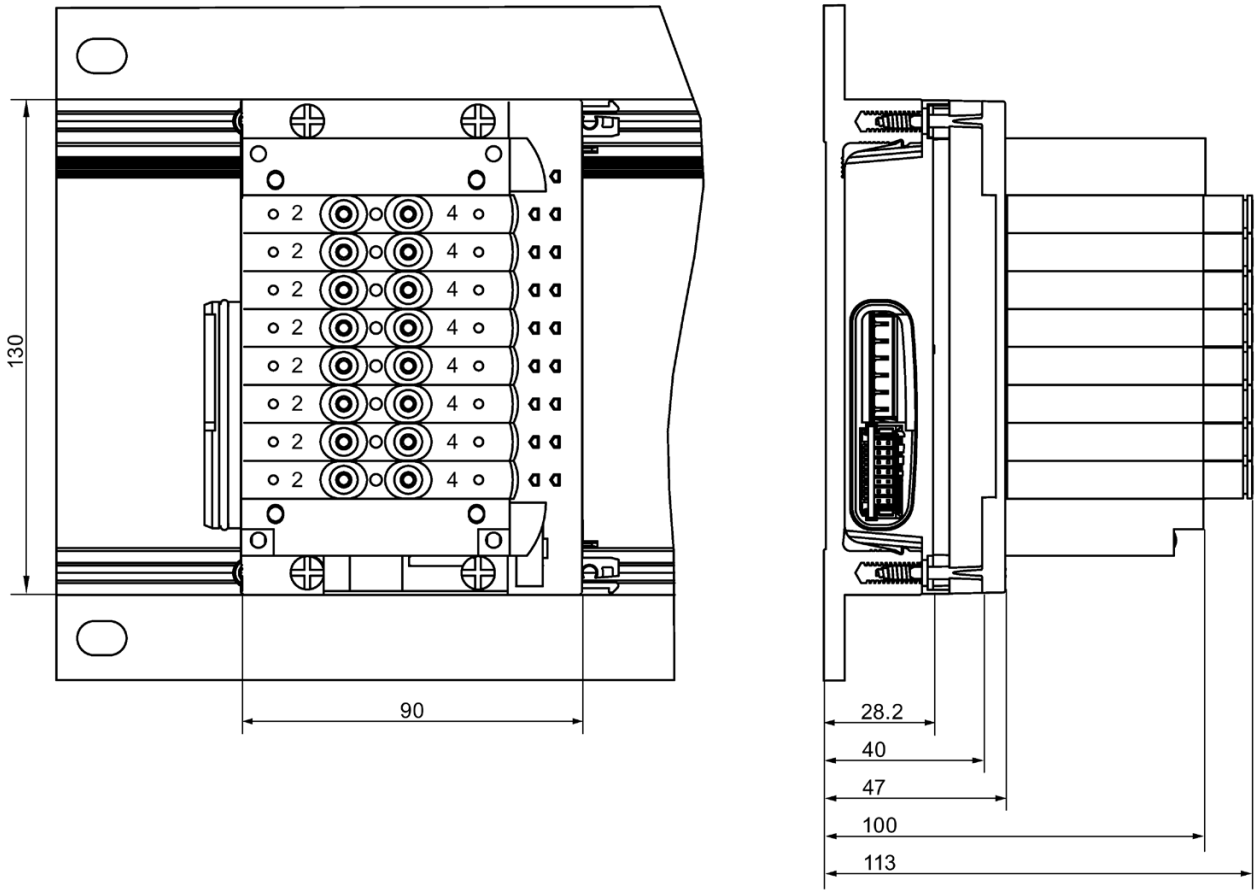


Figure A-15 Dimension drawing of 16 DO DC 24V CPV10 pneumatic interface module with FESTO valve terminal CPV10 on compact type rack

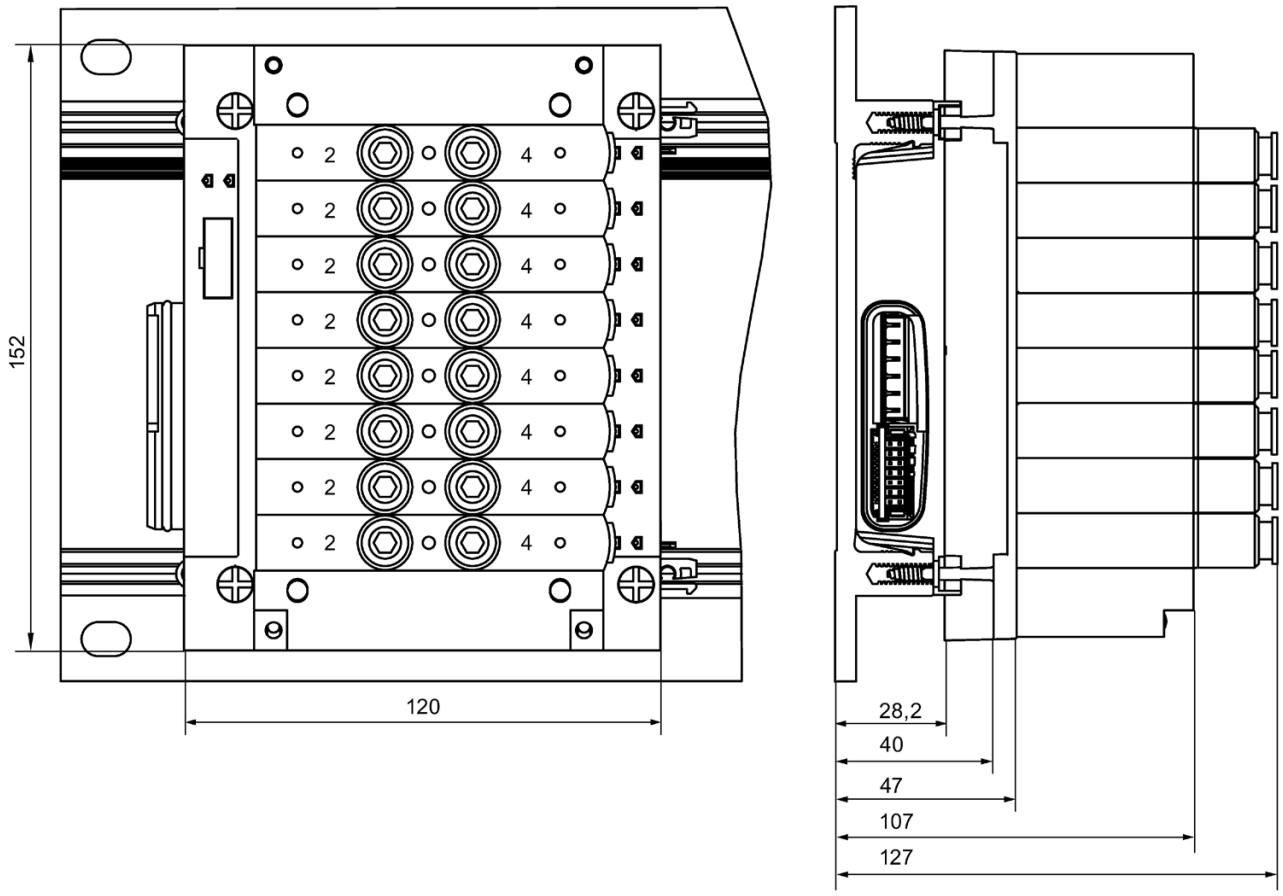


Figure A-16 Dimension drawing of 16 DO DC 24V CPV14 pneumatic interface module with FESTO valve terminal CPV14 on compact type rack

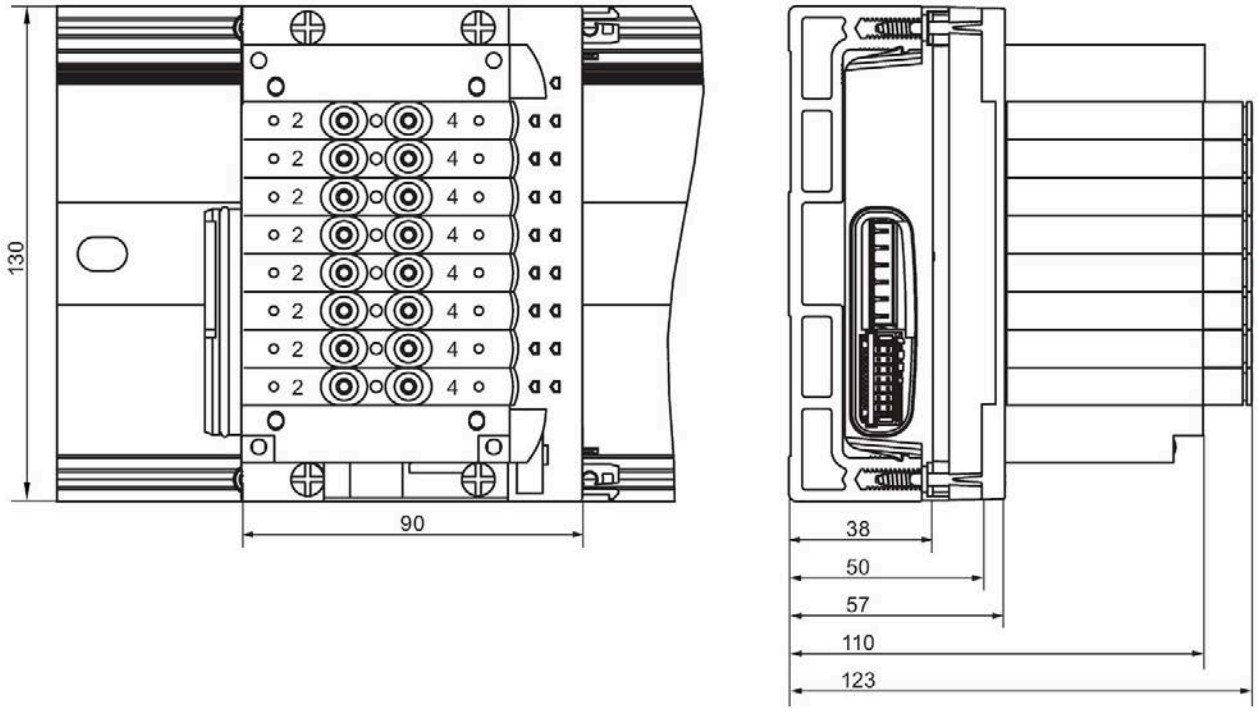


Figure A-17 Dimension drawing of 16 DO DC 24V CPV10 pneumatic interface module with FESTO valve terminal CPV10 on compact type rack

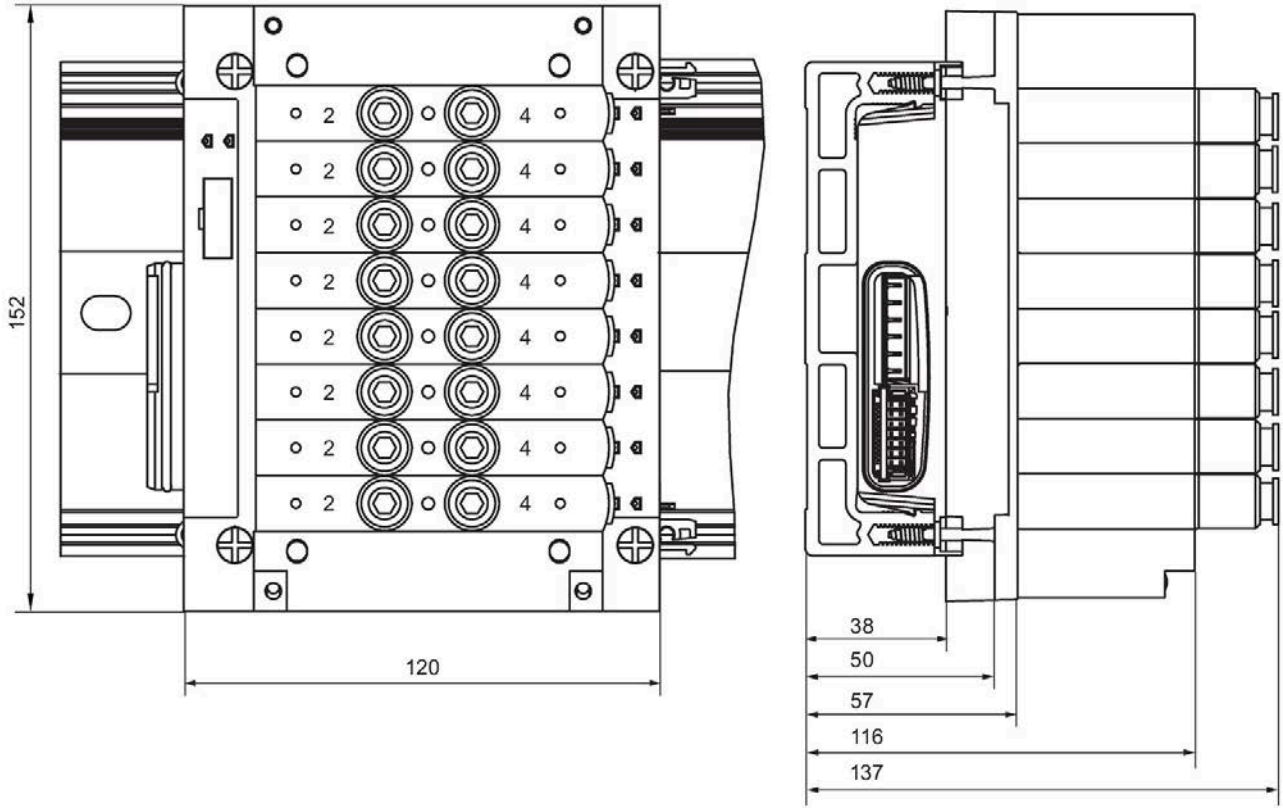


Figure A-18 Dimension drawing of 16 DO DC 24V CPV14 pneumatic interface module with FESTO valve terminal CPV14 on compact type rack

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.

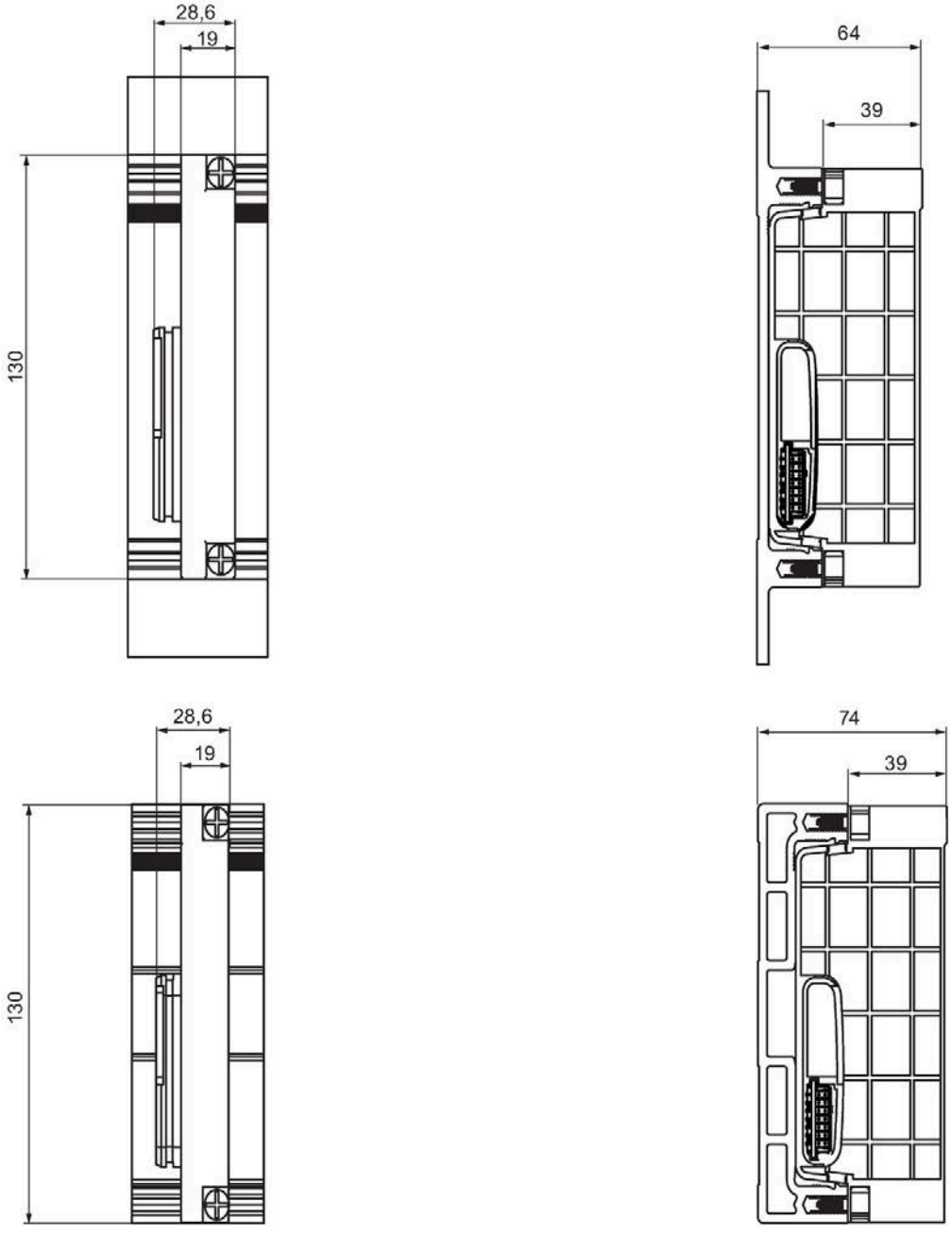
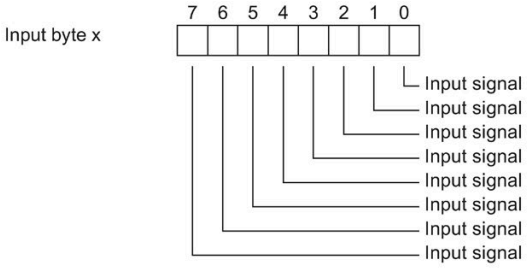


Figure A-19 Dimension drawing of terminating module

A.3 IO address space

A.3.1 Digital input modules

Address space for 8 DI DC 24V



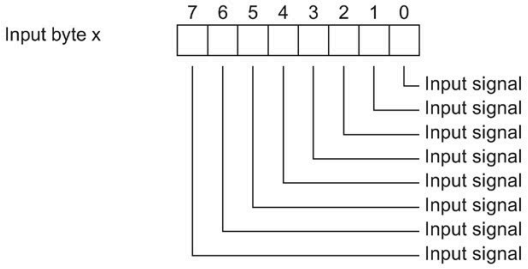
CM IO 8 x M8 CM IO 8 x M12 CM IO 8 x M12P	CM IO 4 x M12 CM IO 4 x M12P	Channel
X1 at terminal 4	X1 at terminal 4	0
X2 at terminal 4	X2 at terminal 4	1
X3 at terminal 4	X3 at terminal 4	2
X4 at terminal 4	X4 at terminal 4	3
X5 at terminal 4	X1 at terminal 2	4
X6 at terminal 4	X2 at terminal 2	5
X7 at 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-20 Address space for 8 DI DC 24V

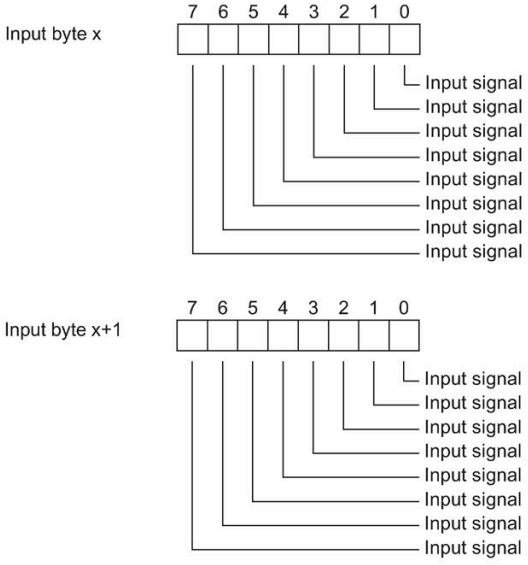
Address space for 8 DI DC 24V High Feature



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-21 Address space 8 DI DC 24V High Feature

Address space for 16 DI DC 24V



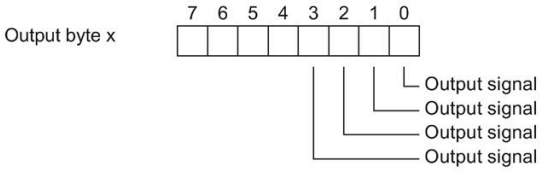
CM IO 8 x M12D	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3
X5 at terminal 4	4
X6 at terminal 4	5
X7 at terminal 4	6
X8 at terminal 4	7

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-22 Address space for 16 DI DC 24V

A.3.2 Digital output module

Address space for 4 DO DC 24V/0.2A



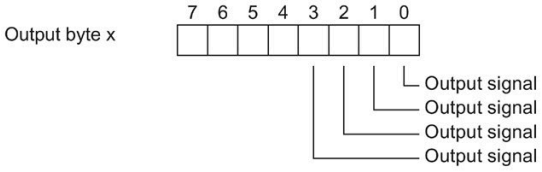
CM IO 4 x M12 CM IO 4 x M12P CM IO 4 x M12 Invers	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

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-23 Address space 4 DO DC 24V/0.2A

Address space for 4 DO DC 24V/0.2A High Feature

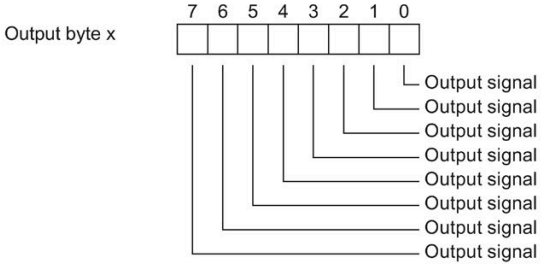


CM IO 4 x M12 CM IO 4 x M12P CM IO 4 x M12 Invers	Channel
X1 at terminal 4	0
X2 at terminal 4	1
X3 at terminal 4	2
X4 at terminal 4	3

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-24 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

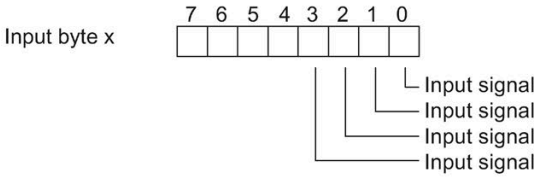
CM IO 1 x M23	Channel
X1 at terminal 1	0
X1 at terminal 2	1
X1 at terminal 3	2
X1 at terminal 4	3
X1 at terminal 5	4
X1 at terminal 6	5
X1 at terminal 7	6
X1 at terminal 8	7

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-25 Address space 8 DO DC 24V/0.5A

A.3.3 Digital input/output module

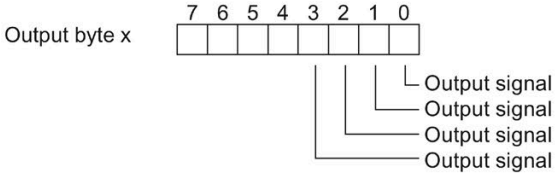
Address space for 4 DI / 4 DO DC 24V/0.5A



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-26 Address space 4 DI / 4 DO DC 24V/0.5A

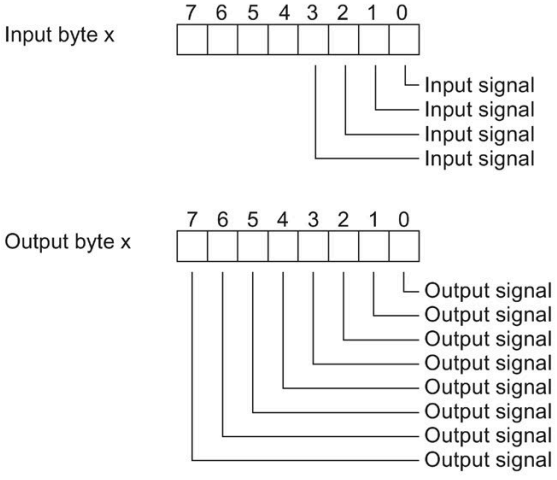
Note

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 130).

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-27 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

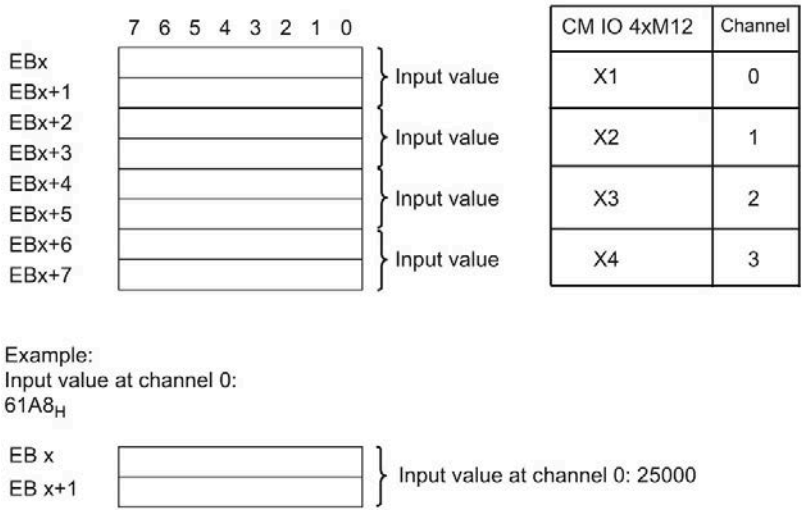


Figure A-28 Address range for 4 AI

A.3.5 Analog output module

Address range for 4 AI

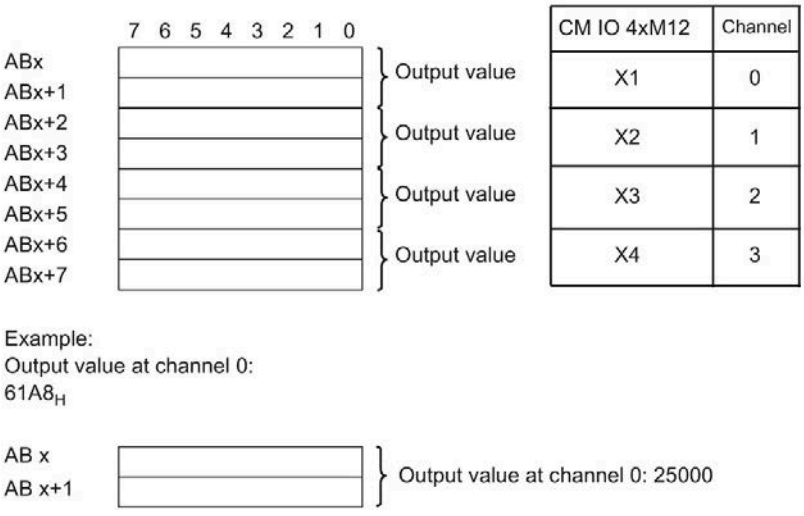


Figure A-29 Address range for 4 AI

A.3.6 Pneumatic interface module

Address range for pneumatic interface module

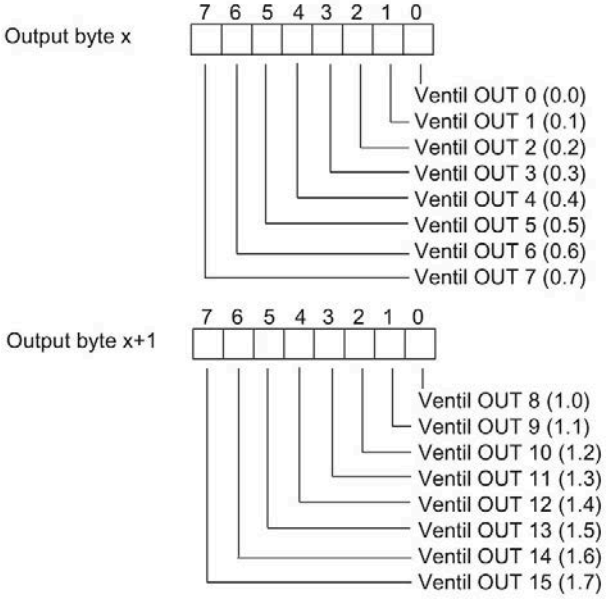


Figure A-30 Address range 16 DO DC24V

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

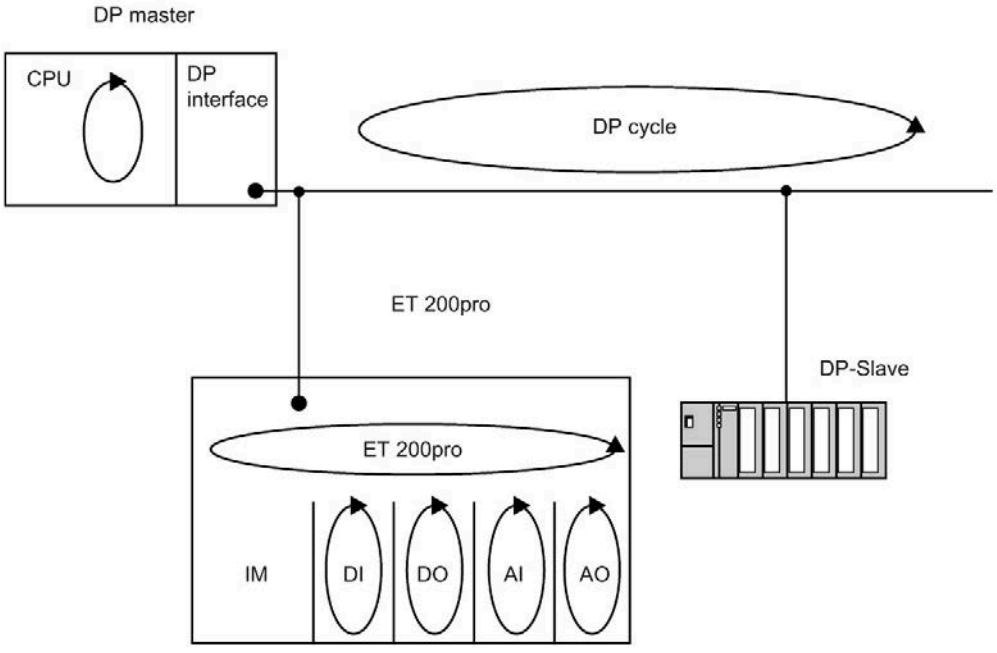


Figure A-31 Reaction times between the DP master and ET 200pro

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

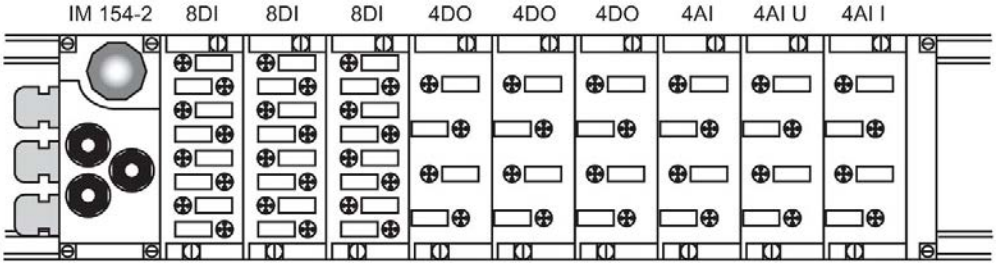


Figure A-32 Example of calculating the response time for IM 154-2 DP High Feature

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 321)

Digital electronic module 16 DI DC 24V (6ES7141-4BH00-0AA0) (Page 331)

Digital electronic module 8 DI DC 24V High Feature (6ES7141-4BF00-0AB0) (Page 326)

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 335)

Digital electronic module 4 DO DC 24V/2.0A High Feature (6ES7142-4BD00-0AB0) (Page 341)

Digital electronic module 8 DO DC 24V/0.5A (6ES7142-4BF00-0AA0) (Page 347)

Pneumatic interface module 16 DO DC 24V CPV10 (6ES7148-4EA00-0AA0) (Page 433)

Pneumatic interface module 16 DO DC 24V CPV14 (6ES7148-4EB00-0AA0) (Page 436)

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.

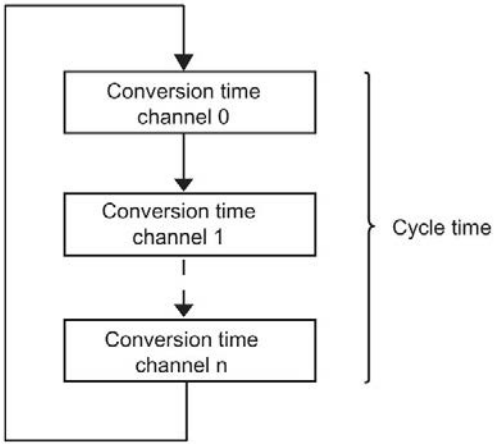


Figure A-33 Cycle time of analog input modules

Settling time

See *Smoothing*.

See also

4 AI U High Feature analog electronic module (6ES7144-4FF01-0AB0) (Page 370)

Analog electronic module 4 AI RTD High Feature (6ES7144-4JF00-0AB0) (Page 380)

4 AI I High Feature analog electronic module (6ES7144-4GF01-0AB0) (Page 375)

4 AI TC High Feature analog electronic module (6ES7144-4PF00-0AB0) (Page 386)

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.

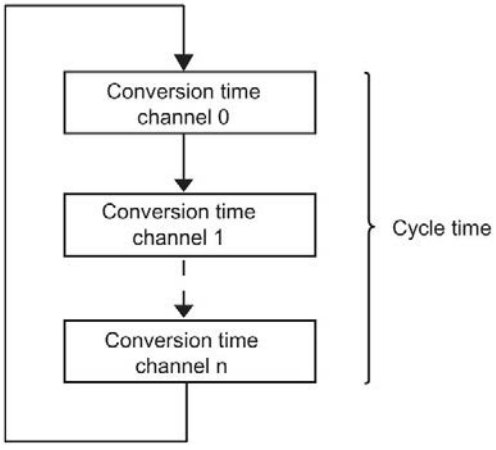


Figure A-34 Cycle time of analog output modules

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.

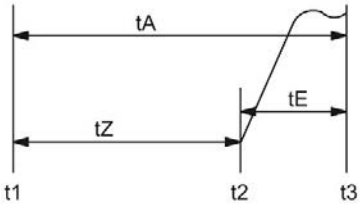


Figure A-35 Response time of an analog output channel

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

See also

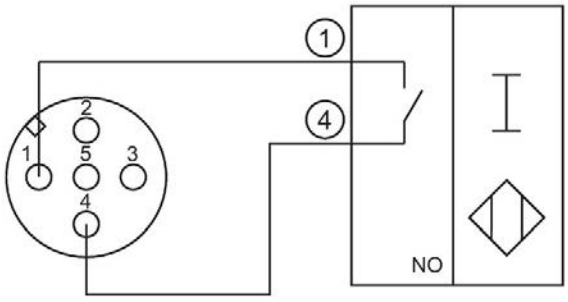
Analog electronic module 4 AO U High Feature (6ES7145-4FF00-0AB0) (Page 392)

Analog electronic module 4 AO I High Feature (6ES7145-4GF00-0AB0) (Page 397)

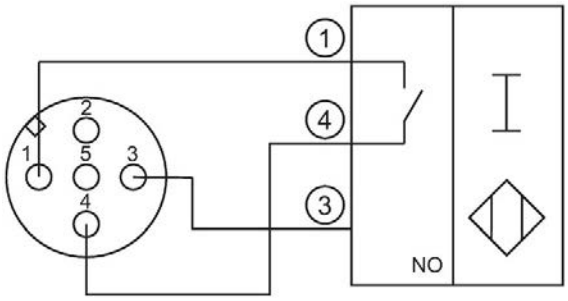
A.5 Connection examples

A.5.1 Connecting proximity switches to digital inputs

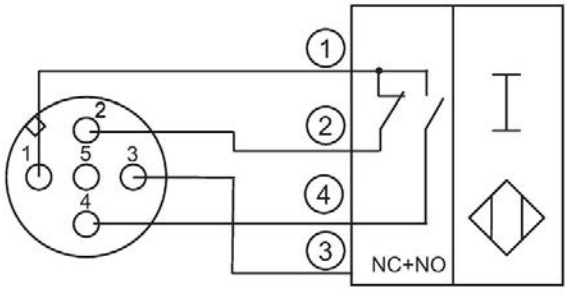
2-wire proximity switch



3-wire proximity switch



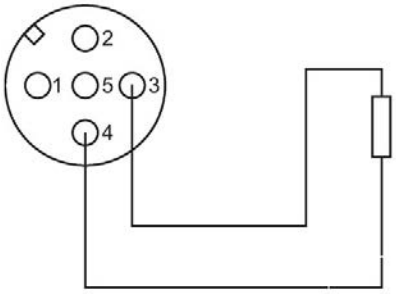
4-wire proximity switch



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

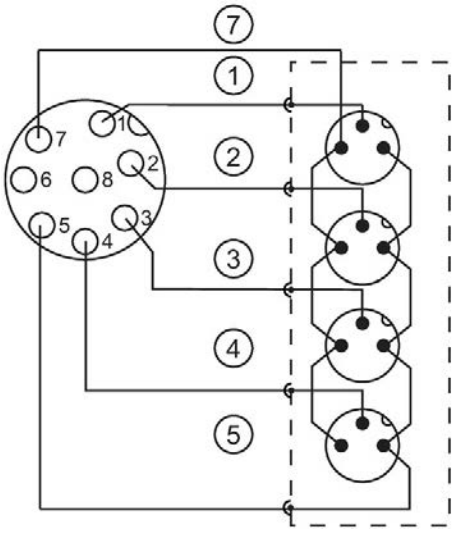


Figure A-36 Actuator/sensor distributor to digital inputs with connection module CM IO 2 x M12

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

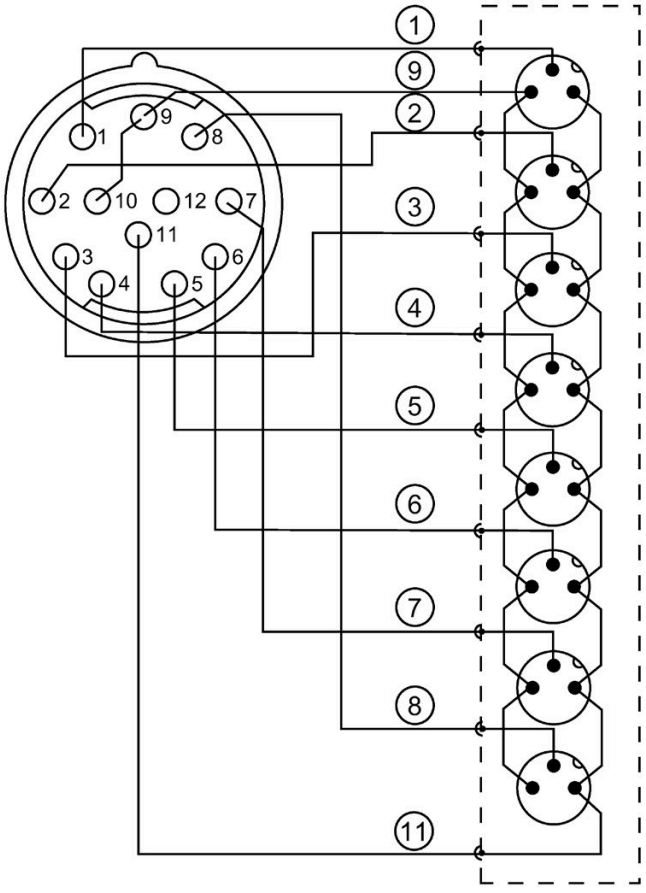


Figure A-37 Actuator/sensor distributor to digital inputs with connection module CM IO 1 x M23

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

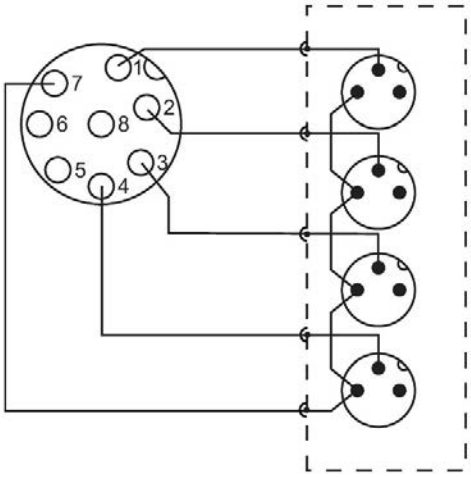


Figure A-38 Actuator/sensor distributor to digital outputs with connection module CM IO 2 x M12

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

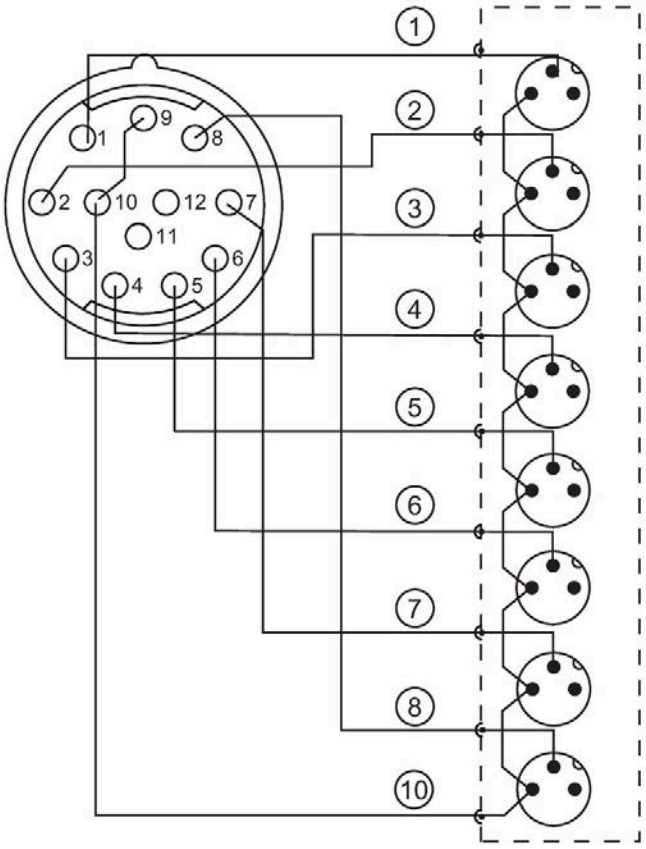
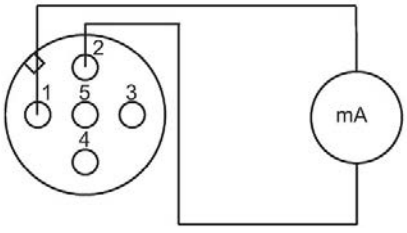


Figure A-39 Actuator/sensor distributor to digital outputs with connection module CM IO 1 x M23

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+.

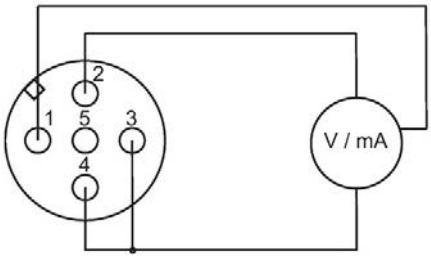
Current transmitter and voltage sensor as 4-wire transducer

3-wire

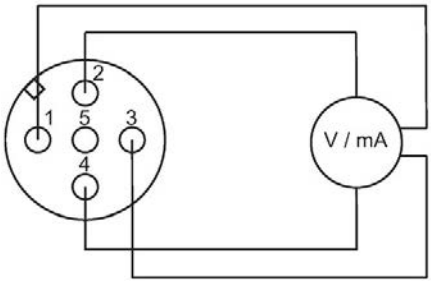
Note

Connecting a 3-wire unit

Provide for an external jumper 3/4, e.g. in the M12 connector or in the cable.



4-wire

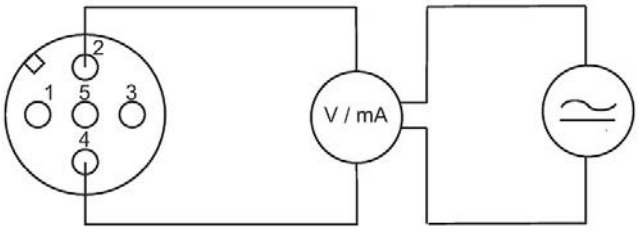


Voltage sensors and current transmitters as 4-wire transducer with external power supply

Note

Non-isolated transducers

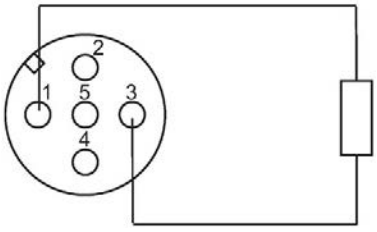
When wiring non-isolated transducers, always make sure to wire M to the correct terminal.



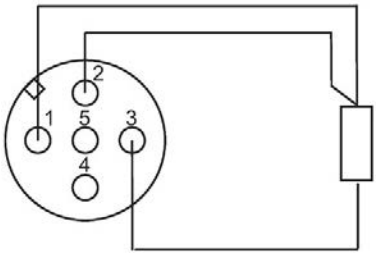
A.5.5 Connecting resistance thermometers to analog inputs

Connection example 4 AI RTD High Feature

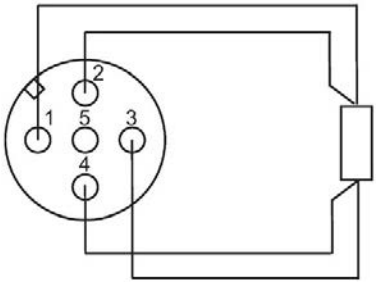
2-wire



3-wire



4-wire

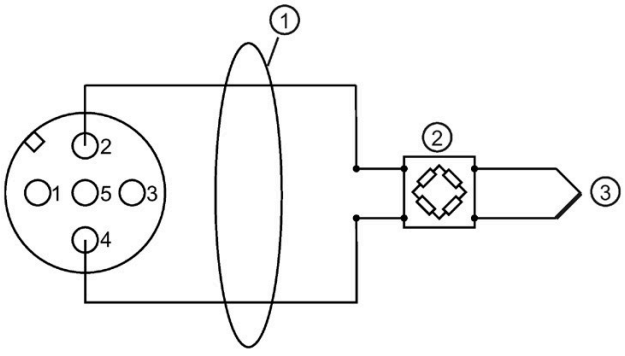


A.5.6 Connecting thermocouples to analog inputs

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.

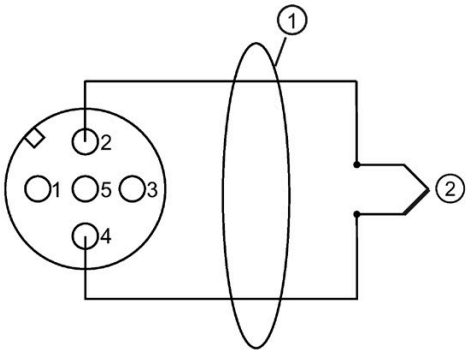
Connection example based on "No" compensation as the reference junction



① Copper cables
② E.g. compensating box (per channel); type B thermocouple does not need a compensating box
③ Thermocouple

Figure A-40 Connection example based on "No" compensation as the reference junction

Connection example based on "Internal" compensation or "Fixed ref. temp." as the reference junction

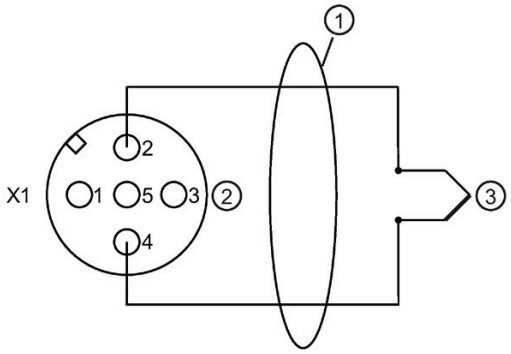


① Connecting the thermocouple directly or using compensating lines
② Thermocouple

Figure A-41 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)



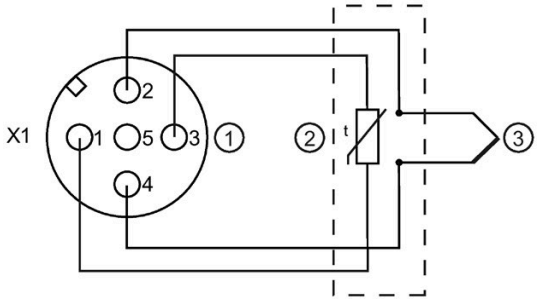
① Connecting the thermocouple directly or using compensating lines

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 386) 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 in the M12 compensation connector

- With external Pt1000 resistance thermometer



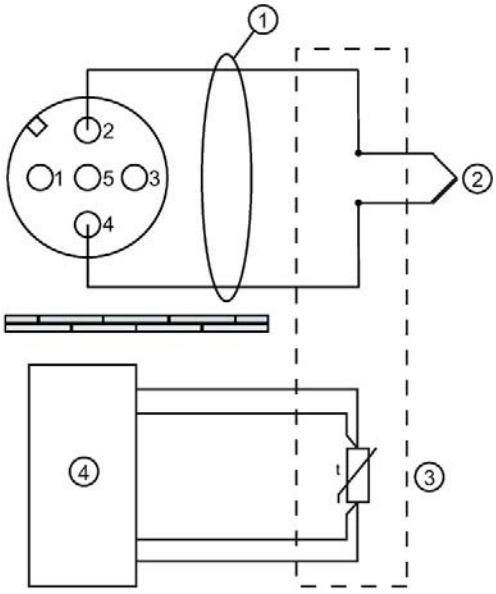
① M12 connector at circular socket connector X1 only

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-43 Connection example based on "RTD (0)" as the reference junction with external Pt1000

Connection example based on "Dynamic ref. temp." as the reference junction



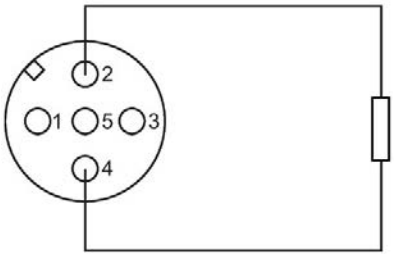
① Copper cables
② Thermocouple at 4 AI TC High Feature
③ E.g. Pt100 in the vicinity of the reference junction
④ Another station's RTD module

Figure A-44 Connection example based on "Dynamic ref. temp." as the reference junction

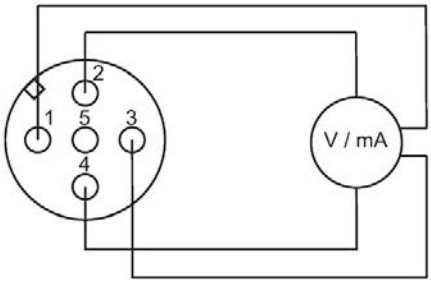
A.5.7 Connecting actuators to the analog inputs

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 perform a fail-safe shutdown of ET 200pro standard modules.

Through the displayed structure (with the safety shutdown device: e.g. 3SK1), all outputs of the connected ET 200pro standard output modules are switched to the safe OFF state. Safety class SIL2/Category 3 is reached.

Principle of operation

The higher-level safety shutdown device, e.g. 3SK1, disconnects the supply 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.

Block diagram

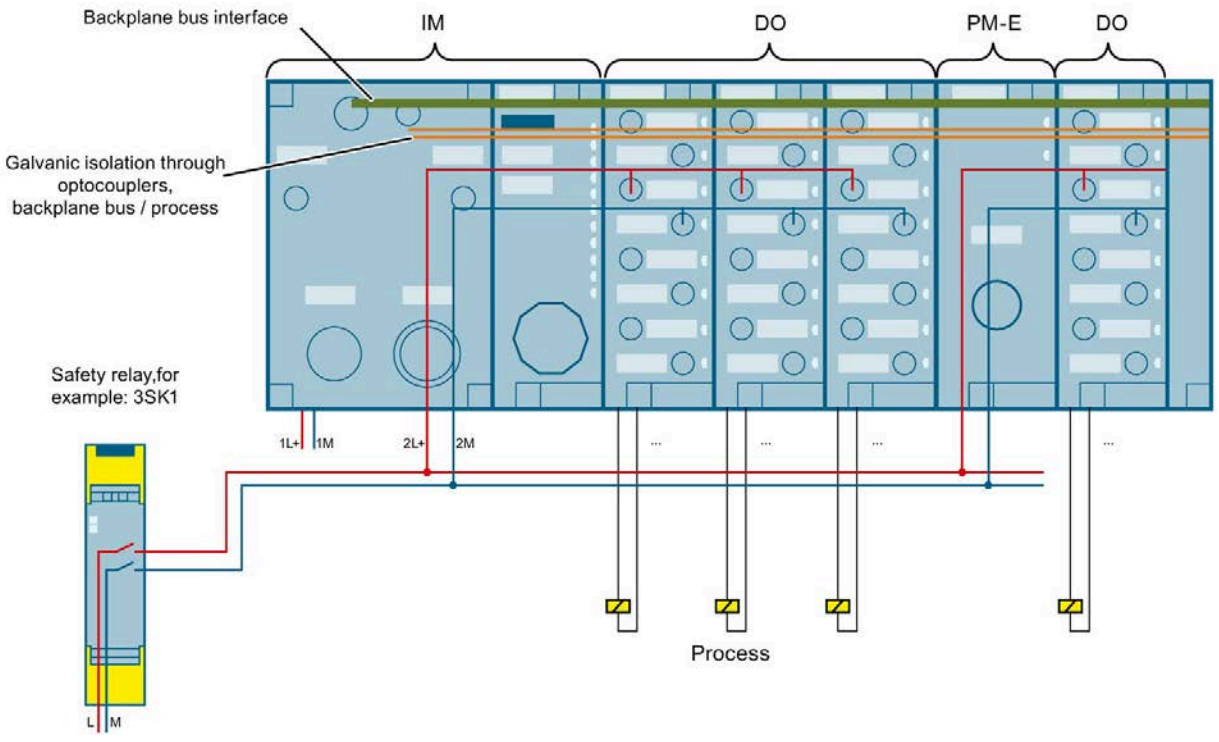


Figure A-45 Higher-level safety circuit with safety shutdown device

Note

Maintain safe electrical isolation for voltages higher than SELV/PELV.

Limits of the higher-level safety circuit

The standard modules of ET 200pro do not fulfill any safety functions. Safety functions are performed by the safety relay or the F-switch to bring the system into a safe state.
Adjust the operation inspection interval of the safety relay with relay output according to the safety class.
Take the following measures if energy that is not provided by the higher-level safety circuit is used to control the safety function.

Cover critical errors in the safety function that are not detected by the higher-level safety circuit (e.g. 3SK1, F-switch etc.) with suitable safety measures. The "diagnostics" must be performed indirectly via the controlled process.

Specifications for safety-relevant process data:

- Functionally safe
- Read via fail-safe inputs (e.g. F-DI)
- Fail-safe processing unit (e.g. F-CPU) for issuing commands
- Output through fail-safe outputs (e.g. F-DQ) to control the safety function

Requirements on the power supply

Operation requires a SELV/PELV power supply to limit overvoltages to L+ and M (24 V). This measure prevents possible errors from the power supply side at the same time.

Select the power supply according to the requirements of the respective operating instructions for the shutdown device or for the ET 200pro system.

You can find more information on safe SELV/PELV in the data sheets of the power supplies used.

F-switch PROFIsafe

Fail-safe shutdown (system-integrated solution, see section Placement of PM-O DC 2x24V Outgoing Module (Page 36)) is also possible with the F-Switch PROFIsafe electronic module (6ES7148-4FS00-0AB0).

The PROFIsafe fail-safe F-switch records the signal states of safety-related encoders and sends corresponding safety frames to the F-CPU. It is suitable for connecting frequency converters, motors, and output modules.

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

WARNING

Avoid extraneous contact to the output lines of the digital output module. For example, perform kink-proof installation in a pipe or cable duct. Adhere to the standard EN 60204-1 "Wiring outside enclosures".

FAQ

Read the latest information on safety-related shutdown in the FAQ (https://support.industry.siemens.com/cs/ww/en/view/39198632).

In this FAQ, you will find the SIMATIC standard modules that are suitable for safety-related shutdown.

Request German Technical Inspectorate report (Report no. SN94541T)

You can request copies of the German Technical Inspectorate report at the following address:

SIEMENS AG
Automation Technology
DI FA AS DH AMB 1
P.O. Box 1963
D-92209 Amberg, Germany

Glossary

Aggregate current

Accumulated current of all output channels of a digital output module.

Automation system

Programmable logic controller for the open-loop and closed-loop control of process chains of the process engineering industry and manufacturing technology. The automation system consists of different components and integrated system functions depending on the automation task.

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.

Basic conversion time

The basic conversion time is the time required to convert the analog value of an input signal to a digital value.

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

A physical connection between the bus device and the bus line.

Bus device

This device can send, receive or amplify data via the bus. It can be a DP master, DP slave, RS 485 repeater etc.

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

Systems with input and output modules that are configured on a distributed basis, far away from the CPU controlling them, e.g.

- ET 200AL, ET 200eco PN, ET 200M, ET 200MP, ET 200pro, ET 200S, ET 200 SP
- DP/AS-I Link, etc.

DP master

A → master which operates in compliance with IEC 61784-1: 2010 Ed3 CP 3/1 is referred to as DP master.

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 is referred to as DP slave.

DP standard

DP standard is the 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 IEC 61784-1: 2010 Ed3 CP 3/1.

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.

External lightning protection

External plant components at which galvanic coupling of lightning surges can occur. Corresponds with lightning protection zone 0_A and 0_B.

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.

Internal lightning protection

Shielding of buildings, rooms or devices Corresponds with lightning protection zone 1, 2 or 3.

IO-Link

IO-Link is a point-to-point connection to conventional and intelligent sensors/actuators by unshielded standard cables in proven 3-wire technology. IO-Link is downward compatible to all DI/DQ sensors/actuators. Switching status channel and data channel are designed in proven 24 V DC technology.

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.

LAN

Local area network. Interconnects computers within an enterprise. The LAN therefore has a limited geographical span and is solely available to a company or institution.

MAC address

Every PROFINET device is assigned a worldwide unique device identification before it leaves the factory. This 6-byte long device identification is the MAC address.

The MAC address is divided into:

- 3-byte manufacturer identification and
- 3-byte device identification (consecutive number).

The MAC address is generally shown on the front of the device, for example: 08-00-06-6B-80-C0

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 **E**xtra **L**ow **V**oltage = Protective extra low voltage with simple 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.

RoHS

EC Directive 2011/65/EU concerning the restriction of certain dangerous substances in electrical and electronic devices regulates the use of hazardous substances in devices and components. The English abbreviation RoHS (Restriction of the use of certain hazardous substances) is used to refer to this directive, as well as all related measures for implementing it into national legislation.

SELV

Safety Extra Low Voltage

Shared device

IO device that 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.

TIA Portal

Totally Integrated Automation Portal

The TIA Portal is the key to the full performance capability of Totally Integrated Automation. The software optimizes all operating, machine and process sequences.

WAN

Wide Area Network; extends beyond LAN limits and allows worldwide communication. Legal rights do not belong to the user, but to the provider of the WAN networks.

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