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SIMATIC

ET 200AL

ET 200AL distributed I/O system

System manual

Edition

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Answers for industry.

SIEMENS

SIMATIC

ET 200AL Distributed I/O system

System Manual

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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.

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Proper use of Siemens products

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 WARNING
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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.

Preface

Purpose of the documentation

This documentation provides you with important information on how to configure, install, wire and commission the SIMATIC ET 200AL distributed I/O system.

Changes compared to previous version

Compared to the previous version, this manual includes information on new modules, extended cable lengths, amendments to the technical specifications, and a description of the use of a Y-cable.

Basic knowledge required

A basic knowledge of automation technology is required to understand the documentation.

Validity of the documentation

This documentation is valid for SIMATIC ET 200AL distributed I/O system.

Conventions

Please observe notes labeled as follows:

Note

A note contains important information on the product described in the documentation and on the handling of the product to which particular attention should be paid.

Recycling and disposal

Due to their low pollutant content, the products are recyclable. For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Additional support

- For information on the Technical Support offering, please see the Appendix (Page 79).
- The range of technical documentation for the individual SIMATIC products and systems can be found on the Internet (<http://www.siemens.com/simatic-tech-doku-portal>).
- The online catalog and the ordering system are available on the Internet (<https://mall.industry.siemens.com>).

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

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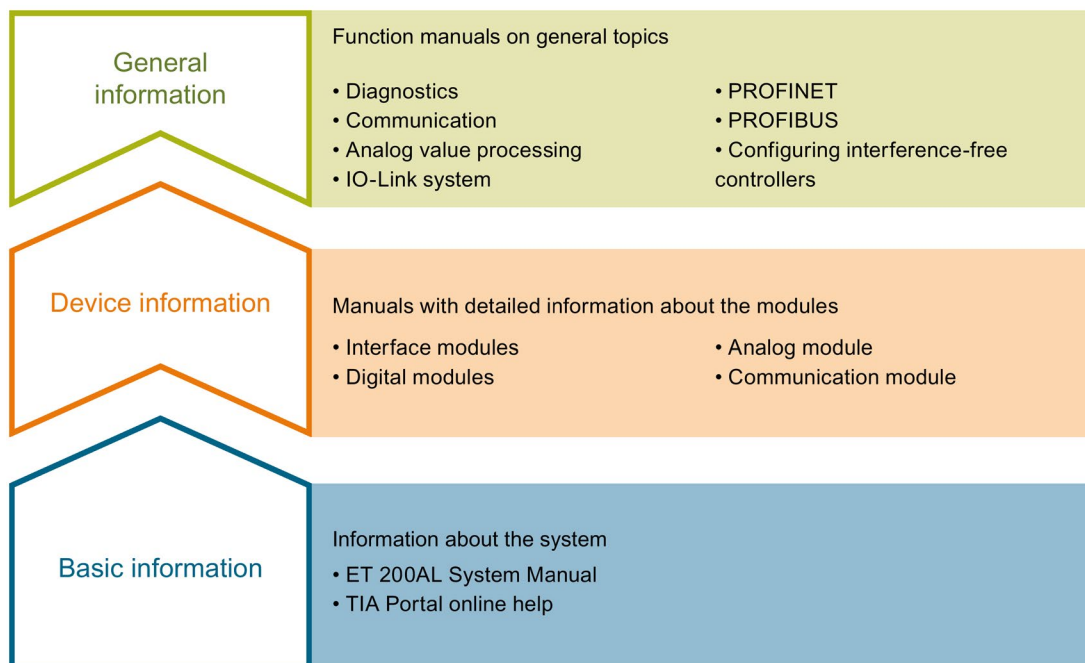
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Documentation guide

The documentation for the SIMATIC ET 200AL distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require.



Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200AL distributed I/O system. The STEP 7 online help supports you in the configuration and programming.

Device information

Product manuals contain a compact description of the module-specific information, such as properties, terminal diagrams, characteristics and technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200AL distributed I/O system, e.g. diagnostics, communication, Motion Control, Web server.

You can download the documentation free of charge from the Internet (<http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-et200/Pages/Default.aspx>).

Manual Collection ET 200AL

The Manual Collection contains the complete documentation on the SIMATIC ET 200AL distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (<http://support.automation.siemens.com/WW/view/en/95242965>).

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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.

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In doing so you can select:

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

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

Application examples

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

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

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).

This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet

(<http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool>).

System overview

2.1 What is the SIMATIC ET 200AL distributed I/O system?

SIMATIC ET 200AL

The SIMATIC ET 200AL distributed I/O system is a scalable and highly flexible, distributed I/O system for connecting process signals to a higher-level control system with a field bus.

Customer benefits of the system


<div data-bbox="145 840 571 898" style="background-color: #0070C0; color: white; padding: 2px;">Easy to use</div> <ul style="list-style-type: none"> • Easy wiring thanks to color-coded connectors • CAx compliant labeling of all interfaces • Fast, convenient configuration and commissioning with STEP 7 (TIA Portal) • Configuration can be adapted for future configurations through integrated configuration control 	<div data-bbox="603 702 1023 766" style="background-color: #0070C0; color: white; padding: 2px;">Compact design</div> <ul style="list-style-type: none"> • High IO quantities for module widths of 30 or 45 mm and up to 32 modules for each ET 200AL • High degree of protection IP65/IP67 • Suitable for temperatures of -25 °C to +55 °C and accelerations of up to 5 g 	<div data-bbox="1043 800 1482 857" style="background-color: #0070C0; color: white; padding: 2px;">Flexible mounting</div> <ul style="list-style-type: none"> • Easy mounting in all mounting positions - even in small spaces • Spatially separated mounting of the modules by means of a backplane bus designed as cable (= ET-Connection) • Flexible connection to PROFINET, PROFIBUS or integration in SIMATIC ET 200SP • Integration of sensors and actuators through M8 and M12 connection technology 	
<div data-bbox="145 1410 571 1468" style="background-color: #0070C0; color: white; padding: 2px;">Energy efficiency</div> <ul style="list-style-type: none"> • PROFIenergy as integrated function 			<div data-bbox="1043 1347 1482 1404" style="background-color: #0070C0; color: white; padding: 2px;">Communication standards</div> <ul style="list-style-type: none"> • PROFINET IO • PROFIBUS DP • IO-Link

Image 2-1 SIMATIC ET 200AL distributed I/O system - customer benefits

Area of application

The SIMATIC ET 200AL distributed I/O system is especially well suited for use in tight spaces, moving applications and for assembly and handling technology. Thanks to its scalable construction, you have the option to precisely customize its configuration to your on site needs.

The SIMATIC ET 200AL distributed I/O system features degree of protection IP65/IP67 and is suited to distributed use on a machine or assembly line.

Setup

The SIMATIC ET 200AL distributed I/O system is made up of the following components:

- Interface modules (PROFINET/PROFIBUS)
- Digital and analog I/O modules
- Communication module

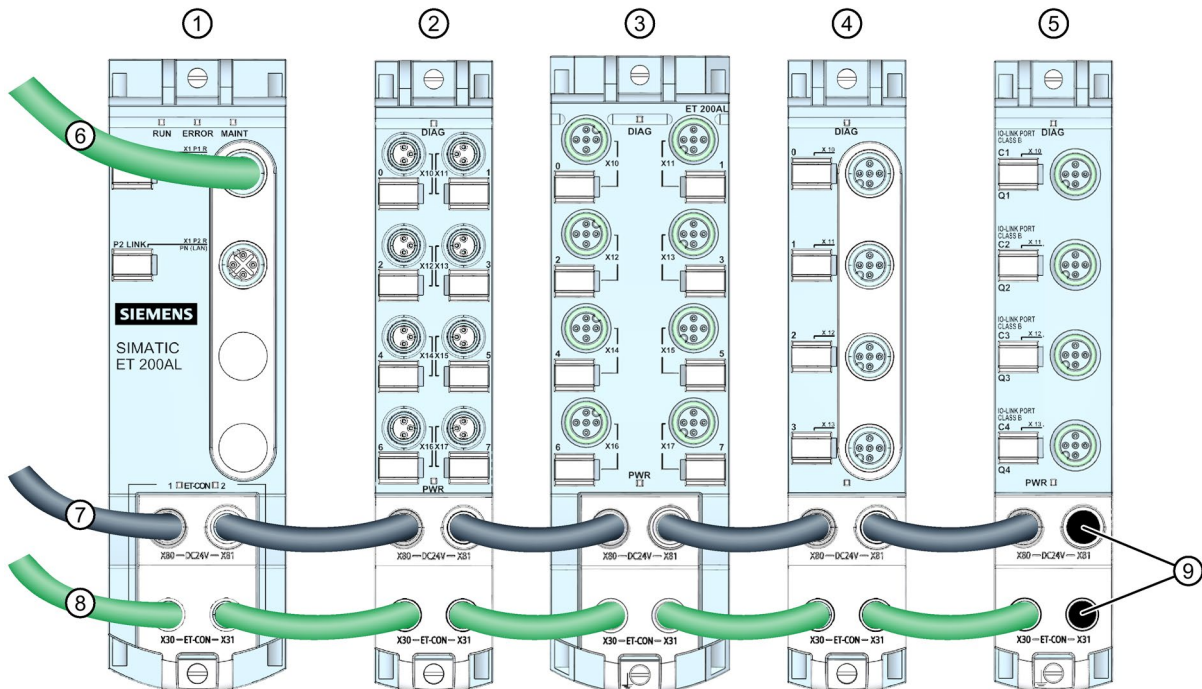
After an interface module you can configure 2 lines (ET-Connection), each with 16 modules.

Alternatively, you can configure a line with 16 I/O modules on the SIMATIC ET 200SP distributed I/O system with BaseUnit BU-Send and the BusAdapter BA-Send 1xFC.

The ET-Connection backplane bus is designed as a cable. This allows you to create spatial distances of up to 15 m between the modules.

Configuration example

The figure below shows a configuration example of the SIMATIC ET 200AL distributed I/O system with a PROFINET interface module.



- ① Interface module (PROFINET)
- ② Digital input/Digital output module
- ③ Digital output module
- ④ Analog input module
- ⑤ Communication module
- ⑥ PROFINET cable
- ⑦ Power supply cable
- ⑧ ET-Connection cable
- ⑨ Sealing caps


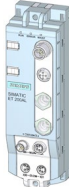
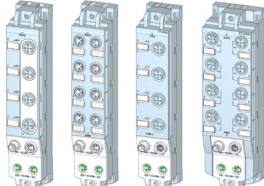
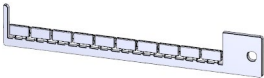


Image 2-2 Configuration example of the ET 200AL

2.2 Components

Components of the ET 200AL distributed I/O system

The following table shows and explains the function of the most important components of the ET 200AL distributed I/O system.

Table 2- 1 Components of the ET 200AL distributed I/O system

Components	Function	View
Interface module for PROFINET IO	<ul style="list-style-type: none"> The interface module connects the ET 200AL distributed I/O system with the IO controller Exchanges data with the I/O modules via ET-Connection 	
Interface module for PROFIBUS DP	<ul style="list-style-type: none"> The interface module connects the ET 200AL distributed I/O system with the DP master Exchanges data with the I/O modules via ET-Connection 	
I/O modules	<ul style="list-style-type: none"> The I/O modules form the interface to the process Recording and controlling the current process status via the connected sensors and actuators 	
Identification labels	<ul style="list-style-type: none"> The identification labels come with the module and can be machine printed Can be ordered separately 	
Bus cable and M8 connector for ET-Connection	<ul style="list-style-type: none"> The bus cable creates the bus connection between the modules 	
Power cable and M8 connector for power supply	<ul style="list-style-type: none"> The power cable provides power to the modules 	

Application planning

3.1 Hardware configuration

Mechanical maximum configuration

The following tables show the rules of the mechanical configuration. As soon as one of the following rules applies, the maximum configuration has been reached.

Table 3- 1 Maximum mechanical configuration - on ET 200AL interface module

Properties	Rule (max.)	
	Interface modules as of firmware version V1.0.0	Interface modules as of firmware version V1.0.1
Number of ET 200AL I/O modules in the configuration	32	
Number of ET-Connection outlets	2	
Number of I/O modules per ET-Connection outlet	16	
Spatial extension per ET-Connection line	160 m	240 m
Cable length between the modules	10 m	15 m

Table 3- 2 Maximum mechanical configuration - on ET 200SP with interface module

Properties	Rule (max.)	
	Interface modules as of firmware version V3.0.0	Interface modules as of firmware version V3.3.0
Number of ET 200AL I/O modules in the configuration	16	
Number of ET-Connection outlets	1	
Spatial extension ET-Connection line	160 m	240 m
Cable length between the modules	10 m	15 m

Table 3- 3 Maximum mechanical configuration - on ET 200SP with CPU

Properties	Rule (max.)
	CPUs with firmware version as of V2.0.0
Number of ET 200AL I/O modules in the configuration	16
Number of ET-Connection outlets	1
Spatial extension ET-Connection line	240 m
Cable length between the modules	15 m

Electrical maximum configuration

The number of usable I/O modules of a potential group is limited by the following points:

- Power requirements of the I/O modules
- Power requirements of the components supplied via these I/O modules

The maximum infeed current of the I/O modules is 4 A with 1L+ supply voltage (non-switched) and 2L+ load voltage (switched). When the maximum infeed current has been reached, you must open a new potential group.

Reference

You will find more information in the section Connecting cables for ET 200AL (Page 37).

3.2 Configuration variants with ET-Connection

3.2.1 ET 200AL with ET-Connection

Every ET 200AL interface module has 2 ET-Connection connections

From every ET-Connection, you have the option to set up a line with a maximum of 16 ET 200AL I/O modules.

ET-Connection1

The figure below shows a configuration in the IP65/IP67 environment with one ET-Connection line.

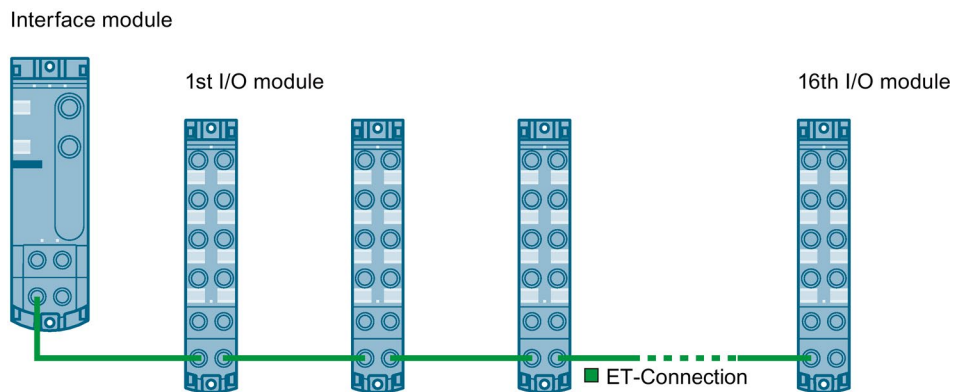


Image 3-1 ET 200AL with ET-Connection1

ET-Connection1 and ET-Connection2

The figure below shows a configuration in the IP65/IP67 environment with two ET-Connection lines

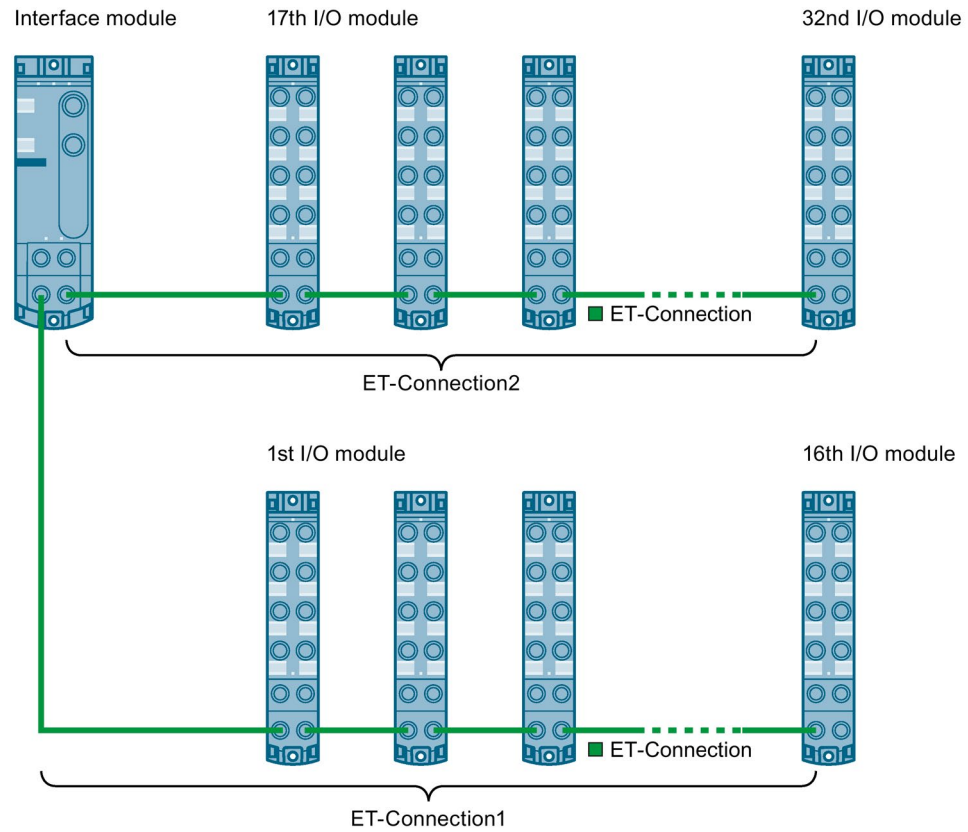


Image 3-2 ET 200AL with ET-Connection1 and ET-Connection2

3.2.2 Hybrid configuration ET 200AL/ET 200SP with ET-Connection

Hybrid configuration ET 200AL and ET 200SP

You have the option to integrate the I/O modules of the ET 200AL distributed I/O system (IP65/IP67) in a configuration of the ET 200SP distributed I/O system (IP20).

The figure below shows a combination of the modules of the ET 200AL and ET 200SP distributed I/O systems.

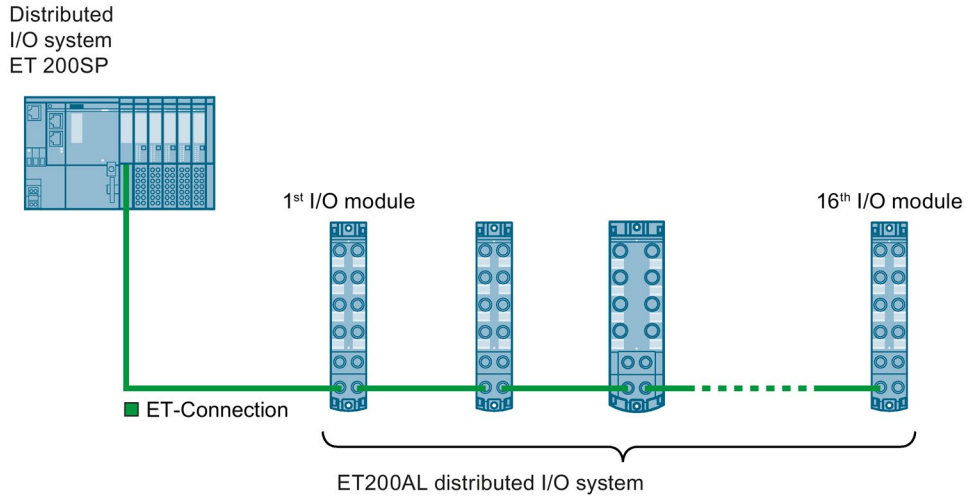


Image 3-3 Hybrid configuration ET 200SP and ET 200AL with ET-Connection

Requirement

For a hybrid configuration, you need at least the following components:

- Interface module
 - IM 155-6 PN HF (V3.0 or higher)
 - IM 155-6 PN ST (V3.1 or higher)
 - IM 155-6 DP HF (V3.0 or higher)

Note

Using 15 m cable

Keep in mind that you can only use cables with a cable length of 15 m between the modules in combination with interface modules as of firmware version V3.3.0.

- CPU
 - 1510SP-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
 - 1512SP-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
 - 1510SP F-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
 - 1512SP F-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
- BaseUnit BU-Send with BusAdapter BA-Send 1xFC
- ET-Connection cable pre-assembled on one side
- Power cable pre-assembled on one side

Rules

When putting together a hybrid configuration, you must observe the following rules:

- The bus length of the ET 200SP distributed I/O system is a maximum of 1 m (excluding interface module/CPU, including BU-Send, BA-Send 1xFC and server module).
- A maximum of 16 ET 200AL I/O modules can be connected to ET-Connection.
- The maximum length of the bus cable for ET-Connection between two modules is 15 m.

Procedure

Watch video sequence (<http://support.automation.siemens.com/WW/view/en/95886672>)

Proceed as follows to put together a multi-tier configuration:

1. Mount the BaseUnit BU-Send directly to the right of the ET 200SP interface module or the ET 200SP CPU.
2. Then install the other BaseUnits/I/O modules for the ET 200SP distributed I/O system and the server module.
3. Connect the bus cable for ET-Connection to the BusAdapter BA-Send 1xFC and install it on the BaseUnit BU-Send.

3.2 Configuration variants with ET-Connection

4. Fasten the BusAdapter BA-Send 1×FC with the BaseUnit BU-Send (1 screw with tightening torque of 0.2 Nm). Use a screwdriver with a 3 to 3.5 mm blade to do this.
5. Connect the other end of the bus cable for ET-Connection (with M8 connector) to the first ET 200AL I/O module (socket X30 ET-Connection IN).
6. Connect the supply voltage (24 V DC) to the ET 200AL I/O modules (X80 connector).

Note

Firmware update of an ET 200AL I/O module

When you perform a firmware update of an ET 200AL I/O module, then the ET-Connection is temporarily interrupted due to the restart of I/O module. All downstream ET 200AL I/O modules report a pull/plug interrupt.

Mounting

4.1 Basics

Introduction

All the modules of the ET 200AL distributed I/O system are designed for the degree of protection IP65/IP67. This means that you can directly mount this system in your plant.

Installation position

You can mount the ET 200AL distributed I/O system in any position.

Minimum clearances

At ambient temperatures of 50 °C or higher, please ensure that the module is mounted at a distance of least 1 cm from an adjacent module or another device.

Mounting rules

When mounting the modules, you do not need to following any special rules.

Note

Mounting of the modules

Mount the ET 200AL distributed I/O system only with disconnected supply voltages.

4.2 Mounting modules

Introduction

The modules of the ET 200AL distributed I/O system are designed for installation on a level, firm surface.

Thanks to the axisymmetrical drill holes in the modules, you have the option to fasten the modules on an aluminum profile using tee nuts.

The following images shows the aluminum profile on which you can mount the modules.

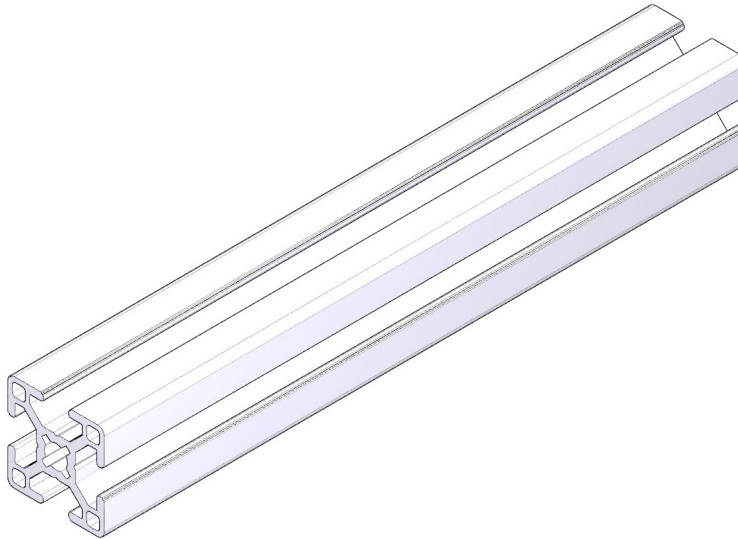


Image 4-1 Aluminum profile

Required tools

For installation, you need a screwdriver or an Allen wrench.

Required screws

The following table shows and explains the screw types required to mount the modules.

Table 4- 1 Recommended screws

Screw type	Explanation
Socket cap screw M4 according to ISO 1207/ISO 1580	The screw length must be at least 30 mm.
Hexagon socket head cap screw M4 according to DIN EN ISO 4762	If you need washers, use DIN EN ISO 7089/DIN EN ISO 7090 washers.

Drill holes of the modules

All modules of the ET 200AL distributed I/O system feature a uniform drill pattern.

- All module housings are axisymmetrical.
- The distance between the top and bottom drill hole is identical for all modules.

Mounting interface module and 45 mm I/O modules (front)

Watch video sequence (<http://support.automation.siemens.com/WW/view/en/95886672>)

The interface modules and the 45 mm I/O modules have an attachment point on top and on the bottom.

To mount an interface module or 45 mm I/O module, follow these steps:

1. Drill 2 fastening holes with 4.5 mm diameter at a distance of 149.6 mm.
2. Fasten the interface module or the 45 mm I/O module with the screws to both fastening points (tightening torque 1.2 Nm).

The figure below shows the dimensions for fastening the IM 157-1 PN interface module and the DQ 8x24VDC/2A 8xM12 45 mm I/O module.

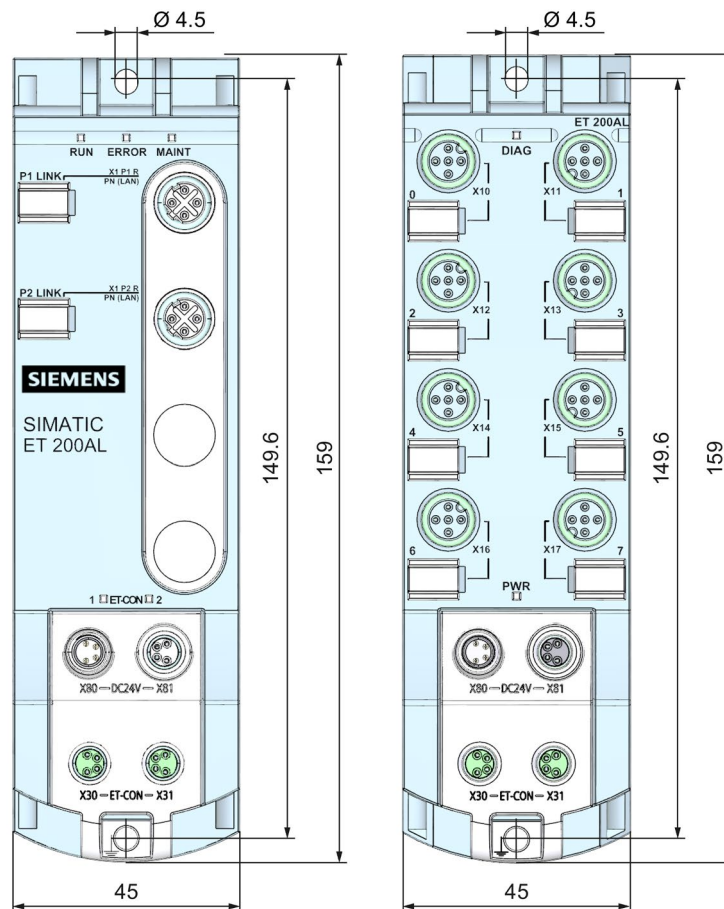


Image 4-2 Dimensions for mounting interface modules and 45 mm I/O modules

Mounting 30 mm I/O modules (front or side)

Watch video sequence (<http://support.automation.siemens.com/WW/view/en/95886672>)

The 30 mm I/O modules have an attachment point on top and on the bottom. You also have the option of fastening the 30 mm I/O modules at the side. When fastening them at the side, you must use the supplied spacers.

To mount a 30 mm I/O module, follow these steps:

1. Drill 2 fastening holes with 4.5 mm diameter at a distance of 149.6 mm.
2. Use the supplied spacers for side fastening of the I/O module on the top and bottom (on one side adjacent to the fastening surface).
3. Fasten the I/O module with the screws to both fastening points (tightening torque 1.2 Nm).

The figure below shows the dimensions for fastening the 30 mm I/O modules using the example of the DIQ 4+DQ 4x24VDC/0.5A 8xM8 I/O module.

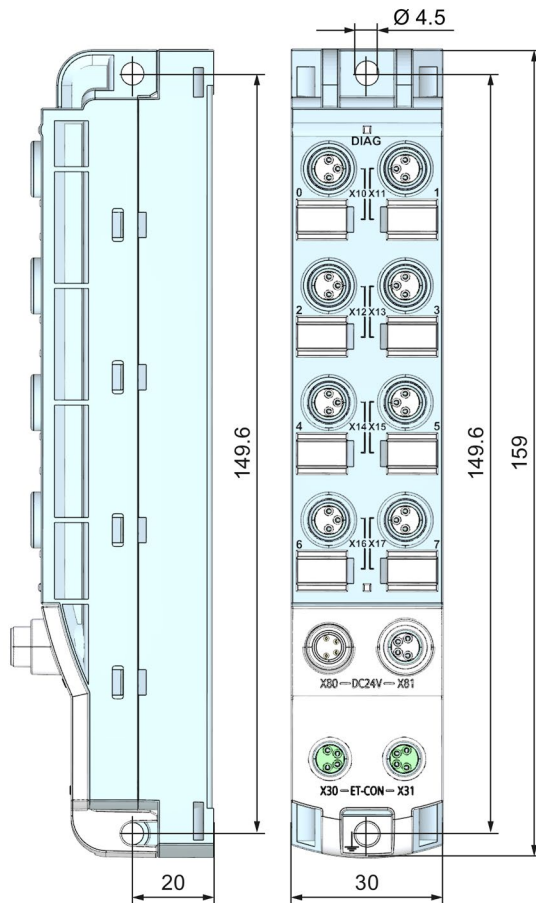


Image 4-3 Dimensions for mounting 30 mm I/O modules

Fastening for cable ties

All module of the ET 200AL distributed I/O system have an integrated attachment point for cable ties. The attachment points are found on all four corners of the modules.

The figure below shows the top left attachment point for 2.5 mm wide cable ties for fastening the cables.

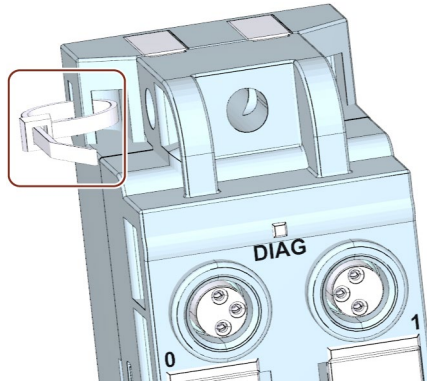


Image 4-4 Top left attachment point for cable ties

Connecting

5.1 Rules and regulations for operation

Introduction

Depending on the area of application, the ET 200AL distributed I/O system, as a component of plants and systems, requires that special rules and specifications be followed.

This section gives an overview of the most important rules to be followed for integration of the ET 200AL distributed I/O system in a plant or in a system.

Specific application

Follow the safety and accident prevention regulations applicable to specific applications, e.g. the machinery directive.

EMERGENCY-STOP device

EMERGENCY-STOP devices according to IEC 60204 (corresponds to DIN VDE 113) must remain in effect in all operating modes of the plant or system.

Excluding hazardous system conditions

Hazardous operating states must not occur in the following situations:

- When the plant restarts after a voltage drop or power outage.
- When the ET 200AL distributed I/O system restarts after interruption of bus communication.

If necessary, EMERGENCY STOP must be forced!

An uncontrolled or undefined startup is not permitted after the "EMERGENCY STOP" is unlocked.

Cables and wires

Make sure that the cables used (incl. connectors) are approved for a continuous operating temperature of at least 70 °C.

Line voltage

The following section describes what you need to pay attention to with respect to the line voltage (you will find additional information in the section Information on insulation, protection class, degree of protection, and rated voltage (Page 68)):

- For stationary plants or systems without an all-pole line disconnecter, there must be a disconnecter unit (all-pole) fitted in the building installation.
- For load current supplies, the configured rated voltage range must correspond to the local line voltage.
- For all power circuits of the ET 200AL distributed I/O system, the fluctuation/deviation of the line voltage from the rated value must be within the permitted tolerance.

24 V DC supply

Below there is a description of what you need to pay attention to with 24 V DC supply:

- For buildings:
If there is a danger due to overvoltages, you must take lightning protection measures for external lightning protection (e.g. lightning protection elements).
- With 24 V DC supply lines and signal lines:
If there is a danger due to overvoltages, you must take lightning protection measures for internal lightning protection (e.g. lightning protection elements. You will find additional information in the Designing interference-free controllers (<http://support.automation.siemens.com/WW/view/en/59193566>) function manual).
- For 24 V DC supply:
Ensure that there is a safe (electrical) separation of low voltage (SELV/PELV) according to IEC 60364-4-41.
You must secure all feeding supply voltages with a UL/IEC approved fuse 24 V DC/4 A (trigger characteristic type B or C).

Protection against outside electrical influences

Below is a description of what you must pay attention to in terms of protection against electrical impacts and/or faults:

- For all plants or systems in which the ET 200AL distributed I/O system is integrated, you must ensure that the equipment or system is functionally grounded to discharge electromagnetic interference.
- For supply, signal and bus cables, you must ensure that the cable routing and installation is correct.
- For signal and bus cables, you must ensure that a wire/cable breakage or a cross-wire does not lead to undefined states of the plant or system.

Reference

Additional information can be found in the function manual Designing interference-free controllers (<http://support.automation.siemens.com/WW/view/en/59193566>).

5.2 Operation of the ET 200AL on grounded/non-grounded infeed

Introduction

Information is provided below on the overall configuration of an ET 200AL distributed I/O system on a grounded incoming supply (TN-S network). The specific subjects discussed are:

- Disconnecting devices, short-circuit and overload protection to IEC 60364 (corresponding to DIN VDE 0100) and IEC 60204 (corresponding to DIN VDE 0113)
- Load current supplies and load circuits
- Supply voltages of the ET 200AL distributed I/O system

Grounded infeed

In grounded incoming supplies, the neutral conductor of the supply system is grounded. A simple ground fault between a live conductor and ground or a grounded section of the plant causes the protective devices to trip.

Supply voltages

Two supply voltages are available for the ET 200AL distributed I/O system.

- 1L+: Supply voltage (non-switched)
- 2L+: Load voltage (switched)

Secure electrical separation (SELV/PELV according to IEC 60364-4-41)

Mains devices/power supply modules with secure electrical separation are required for the operation of the ET 200AL distributed I/O system. This protection is designated as SELV (Safety Extra Low Voltage)/PELV (Protective Extra Low Voltage) according to IEC 60364-4-41.

Configuring ET 200AL with grounded reference potential

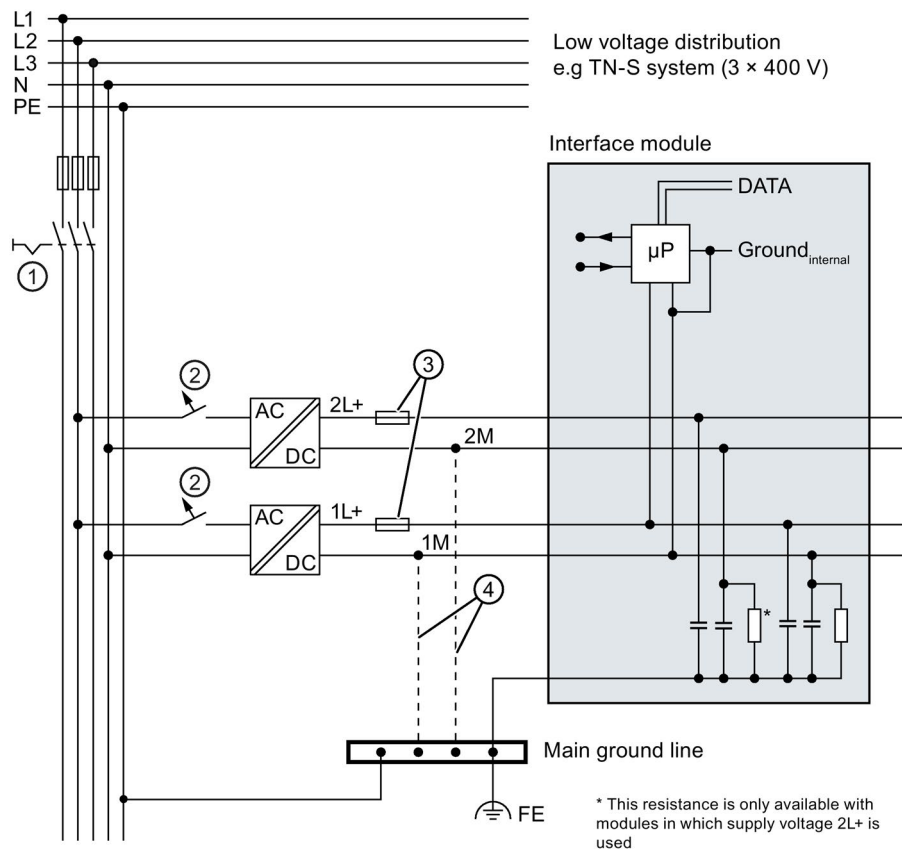
When configuring the ET 200AL distributed I/O system with grounded reference potential, occurring interference currents are discharged into functional earth. The connections must be externally connected (connection between 1M and FE).

Configuring ET 200AL with ungrounded reference potential

When configuring the ET 200AL distributed I/O system with non-grounded reference potential, occurring interference currents are discharged via an internal RC network to functional earth (no external connection between 1M and FE).

ET 200AL in the overall configuration

The figure below shows the ET 200AL distributed I/O system in the complete electrical configuration using the example of an interface module.



- ① Main switch
- ② Short-circuit and overvoltage protection
- ③ Fuses for cable protection (automatic circuit breaker for 4 A)
- ④ When configuring the ET 200AL distributed I/O system with non-grounded reference potential, no connection is made between 1M, 2M and FE.

Image 5-1 Electrical configuration

Components and protective measures

Various components and protective measures are stipulated for setting up a complete plant. The types of components and the degree to which the protective measures are mandatory depend on the IEC regulation that applies to your plant setup.

The following table shows the components of the electrical configuration with reference to the previous figure and compares the IEC regulations.

Table 5- 1 Components of electrical configuration

	Reference to illustration	IEC 60364 (DIN VDE 0100)	IEC 60204 (DIN VDE 0113)
Disconnection element for controller, sensors, and actuators	①	Main switch	Disconnecter
Short-circuit / overload protection	②	Single-pole protection of circuits Secure all incoming supply cables with a circuit breaker (24 V DC/4 A).	Secure with one pole with a grounded secondary circuit
Cable protection	③	Protection of cables and wires against overcurrent	-

Insulation monitoring

In the following situations, you must provide insulation monitoring.

- When configuring the ET 200AL distributed I/O system with non-grounded reference potential
- When hazardous system conditions may occur due to errors

5.3 Electrical configuration of the ET 200AL

Electrical isolation

When electrically configuring the ET 200AL distributed I/O system, there is electrical isolation between:

- Load voltage 2L+ and all other switching parts
- Communication interfaces (PROFINET/PROFIBUS) of the interface modules and all other switching parts
- ET-Connection and all other switching parts

The following images show the potential conditions of the modules of the ET 200AL distributed I/O system.

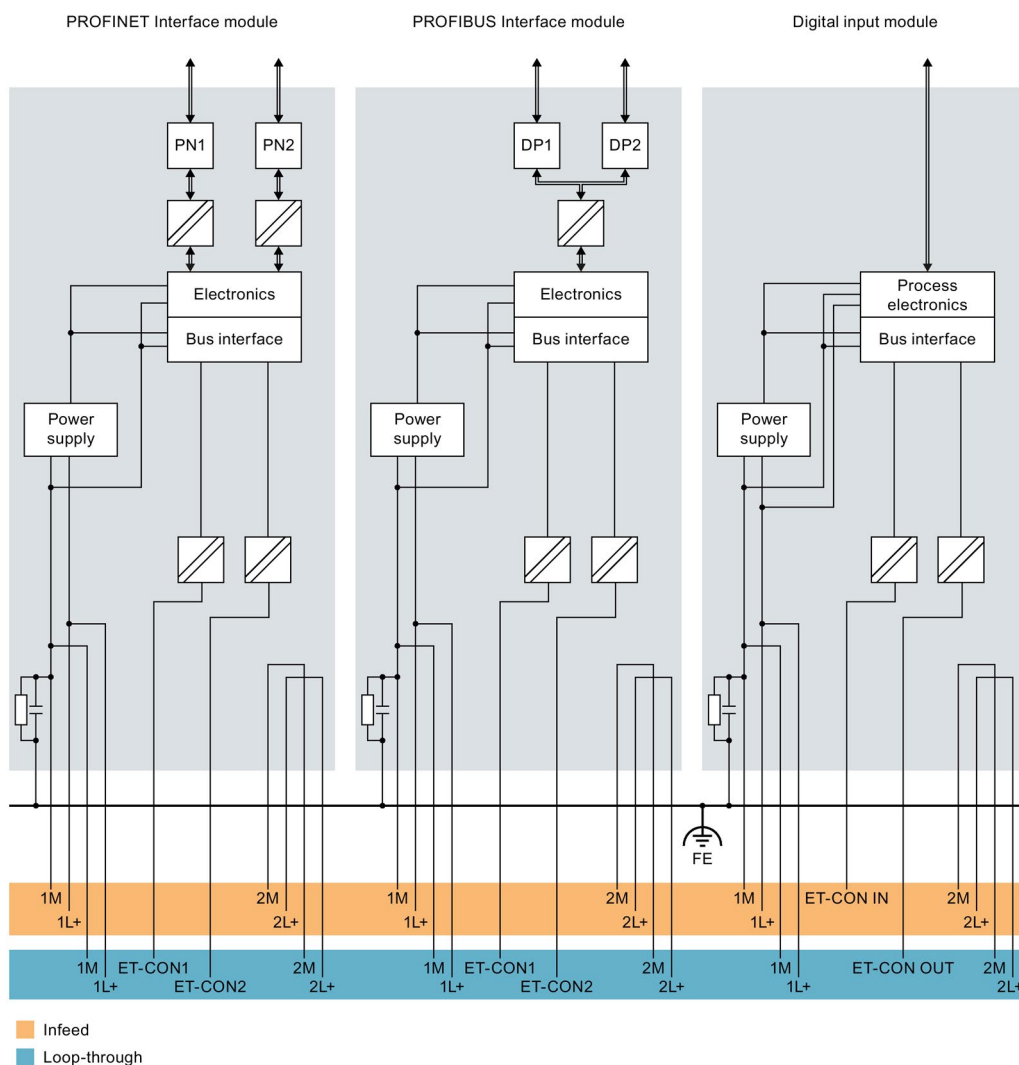


Image 5-2 Potential conditions of the ET 200AL distributed I/O system (Part 1)

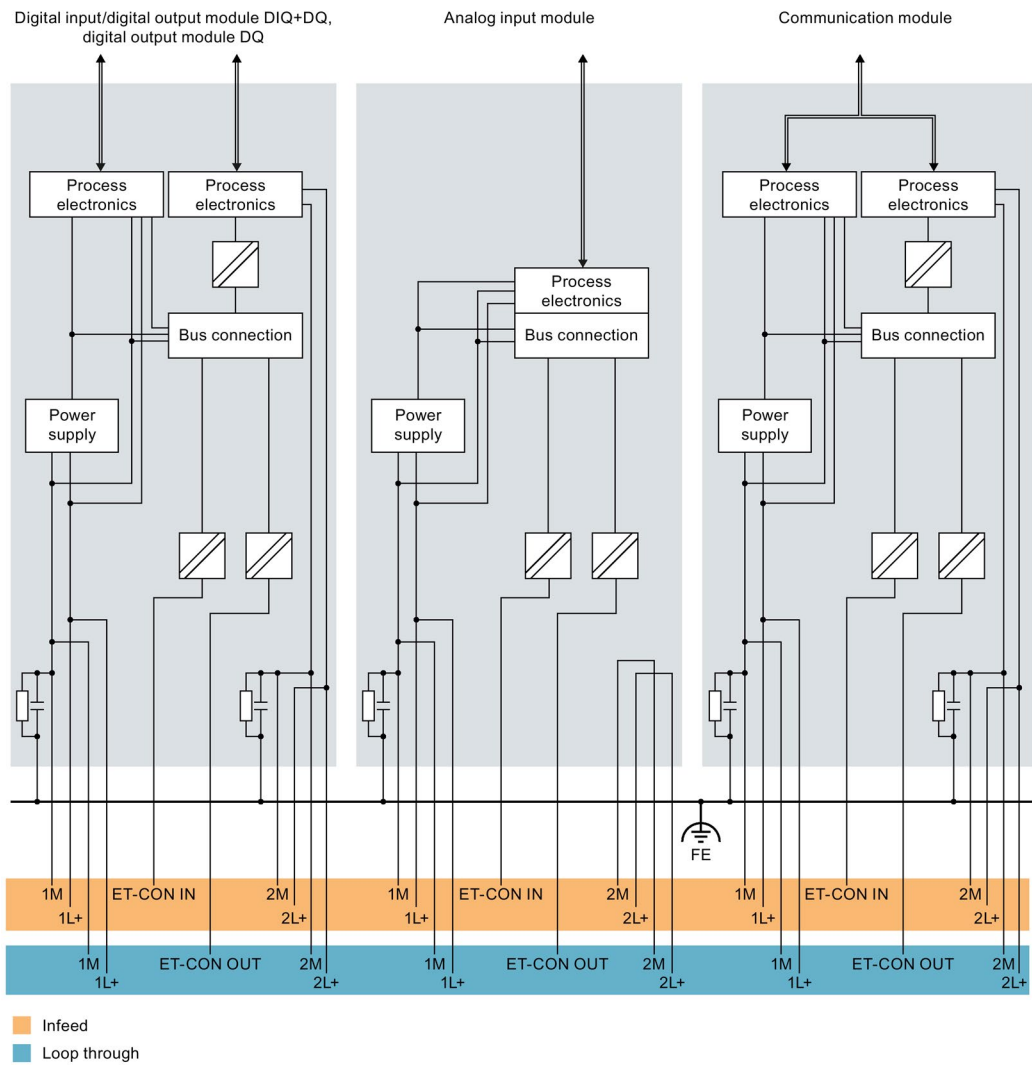


Image 5-3 Potential conditions of the ET 200AL distributed I/O system (Part 2)

Connection of a digital output with a digital input

⚠ WARNING

Pay attention to the potential group

When a digital output is connected to a digital input, pay attention to the potential groups. Depending on the configuration, 1M and 2M may then be connected, resulting in elimination of the electrical isolation between 1L+ and 2L+. The possible compensating currents can destroy the digital module.

Cable protection

According to IEC 60364, cable protection is required, i.e. you must always secure the incoming lines externally.

You must secure all incoming supply voltages with a UL/IEC approved 24 V DC/4 A fuse (trigger characteristic type B or C).

Power supply of the configuration

Two voltage groups are available for the distributed I/O system ET 200AL: 1L+ (supply voltage) and 2L+ (load voltage)

A second infeed may be needed to supply all the modules of a configuration with the required voltage. Renewed voltage supply of 1L+ and 2L+ can be necessary to configure different potential groups or because the voltage is not sufficient for all modules due to the voltage drop. Create a power balance for the selection of the infeed point of the voltage.

Note

Turning 1L+ and 2L+ on and off

In contrast to the 2L+ load voltage, the 1L+ supply voltage may not be turned on and off in operation.

The figure below shows a configuration with a new voltage infeed for the modules. The different potential groups have a gray background.

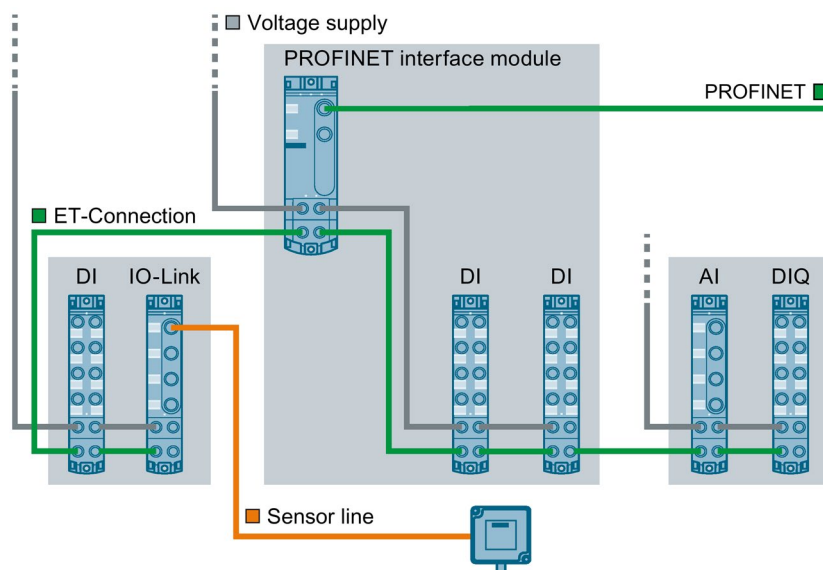


Image 5-4 Wiring of the power supply

Reference

You will find additional information on electrical configuration and the voltage drop in the section Connecting cables for ET 200AL (Page 37).

5.4 Connecting ET 200AL to functional earth

Introduction

You must connect the distributed I/O system ET 200AL to functional earth (FE)

What is functional earth?

All ET 200AL modules feature a functional earth connection. This connection is used to suppress interference sensitivity, but not for protection purposes. With the functional earth connection, you create an electrical connection directly to a point of your system or shielding. This discharges the EMC interference directly into the earth. By discharging the EMC interference, the interference safety of the entire module is increased.

The figure below shows the symbol with which the functional earth connection is identified on the ET 200AL modules.

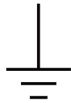


Image 5-5 Functional earth

5.4.1 Mounting ET 200AL modules on conductive substrate

Requirement

Conductive substrate for mounting of the module

Required tools

To connect to functional earth, you need the following tools:

- Screwdriver

Required accessories:

To connect to functional earth, you need the following accessories:

- 2 x M4 fastening screws.

Mounting

To connect modules of the ET 200AL distributed I/O system to functional earth with a conductive mounting substrate, proceed as follows:

1. Drill two fastening holes.
2. Screw the module with the M4 fastening screws using a torque of 1.2 Nm.

Note

Earthing with conductive mounting substrate

When you fasten a module of the ET 200AL distributed I/O system on a conductive, grounded substrate, the bottom fastening screw provides a conductive connection to the ground potential.

Ensure that there is a low-impedance connection between the module and conductive underground as well as between the conductive underground and functional earth.

Reference

You will find more information on installing the modules in the section Mounting modules (Page 22).

5.4.2 Mounting ET 200AL modules on non-conductive substrate

Requirement

Conductive substrate for mounting of the module

Required tools

To connect to functional earth, you need the following tools:

- Screwdriver
- Stripping tool
- Crimp tool

Required accessories:

To connect to functional earth on a non-conductive fastening substrate, you need the following accessories:

- 2 x M4 fastening screws.
- Cable lug suitable for M4 screws
- Grounding cable (braided copper cable) with a minimum cross section of 4 mm²

Mounting

To connect modules of the ET 200AL distributed I/O system to functional earth, proceed as follows:

1. Drill two fastening holes.
2. Strip the grounding cable.
3. Fasten the cable lug to the grounding cable.
4. Screw the module and the cable lug with the M4 fastening screws using a torque of 1.2 Nm.

The figure below shows how to connect functional earth using the example of the IM 157-1 PN interface module.

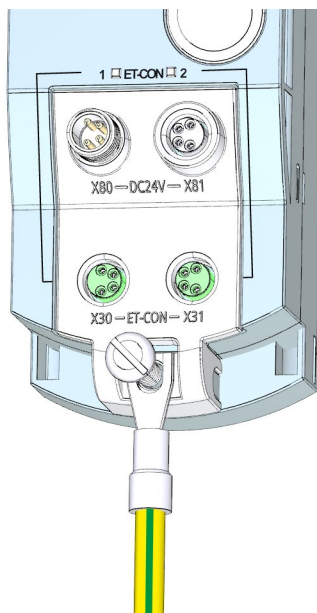


Image 5-6 Connecting the functional earth

Note

Earthing with non-conductive mounting substrate

Make sure there is a low-impedance connection between the module and the functional earth.

Reference

You will find more information on installing the modules in the section Mounting modules (Page 22).

5.5 Connecting cables for ET 200AL

Impact of cable length on the supply voltage

When wiring your configuration, you must take into account the impact of the cable length on the supply voltage of the ET 200AL distributed I/O system.

CAUTION

Pay attention to maximum incoming currents

For each power supply (1L+, 2L+), you can feed in a maximum of 4A.

If you exceed the maximum incoming currents and do not comply with the required cable cross sections, an increased incoming current could lead to overheating of the cable insulation and the contacts. This could result in damage to the modules.

The figure below shows the voltage drop depending on the cable length for 4 current strengths, using the example of a copper cable with $\varnothing 0.5 \text{ mm}^2$.

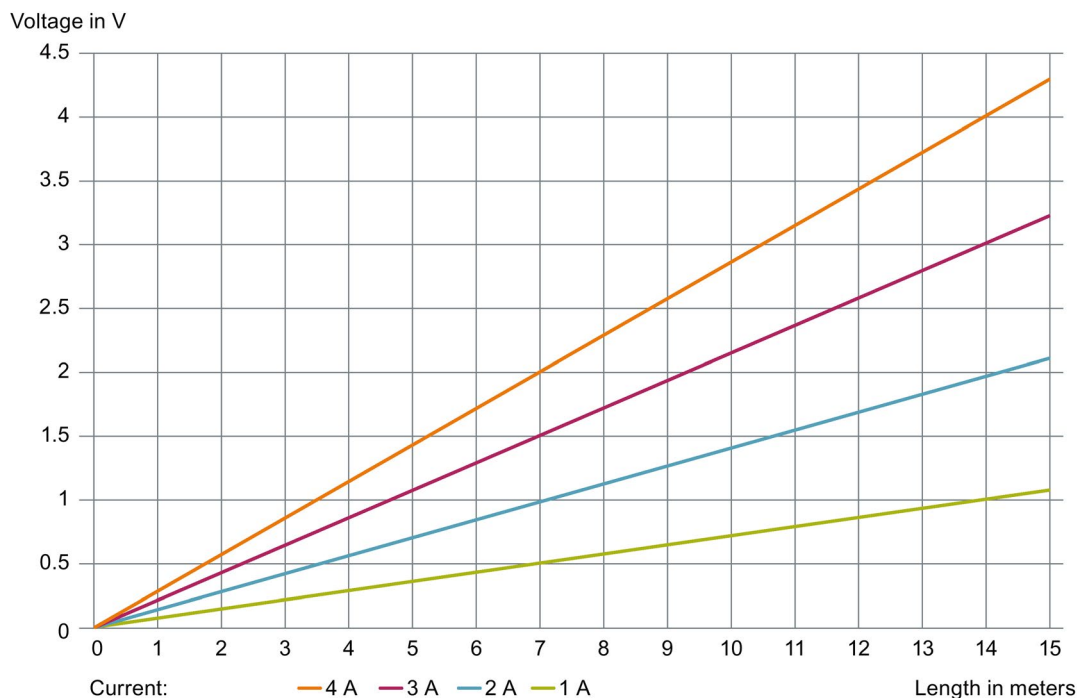


Image 5-7 Voltage drop with a cable cross-section of 0.5 mm^2

To estimate the voltage drop in your ET 200AL distributed I/O system, you must add the voltage drops of the different cables. For every module used, you must add an additional voltage drop of around 0.1 V.

Example

If you have a 7 m power supply cable with $\varnothing 0.5 \text{ mm}^2$, the voltage drop is around 1.5 V with a load of 3 A.

5.6 Wiring

Connection

Connect all cables to the front side of the modules:

- Supply voltage and ET-Connection to the 4-pole M8 round sockets and M8 round connectors
- Signal lines to the 4-pole M8 or 4/5 pole M12 round sockets
- Fieldbus lines to the 4/5 pole M12 round sockets and M12 round connectors

Note

Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

Requirement

Wire the modules with the supply voltage off.

Required tools

If you are not using pre-assembled cables, you need the following tools:

- Stripping tool
- Screwdriver to wire the connection plugs
- Stripping Tool for ET-Connection

Required accessories when connecting the supply voltage

You need the following accessories:

- Cables
 - pre-assembled power cable, M8, 4-pole, or
 - flexible 4-wire copper cable (wire cross section: 0.25 to 0.5 mm²)
- 4-pole M8 connection plug

Accessories required for the connection of ET-Connection

You need the following accessories:

- ET-Connection cables
- 4-pole M8 connection plug

Note

ET-Connection cables

When connecting ET-Connection **use only** the offered cables.

Connecting M8 connectors

To connect M8 connectors, proceed as follows:

1. Insert the connector in the appropriate round socket on the module.
Make sure that there is proper locking between the connector and socket.
2. Tighten the connector using the knurled screw with a torque of 0.4 Nm.

The figure below shows the connection of the M8 connectors, using the example of the DIQ 4+DQ 4x24VDC/0.5A 8xM8 digital input/digital output module.

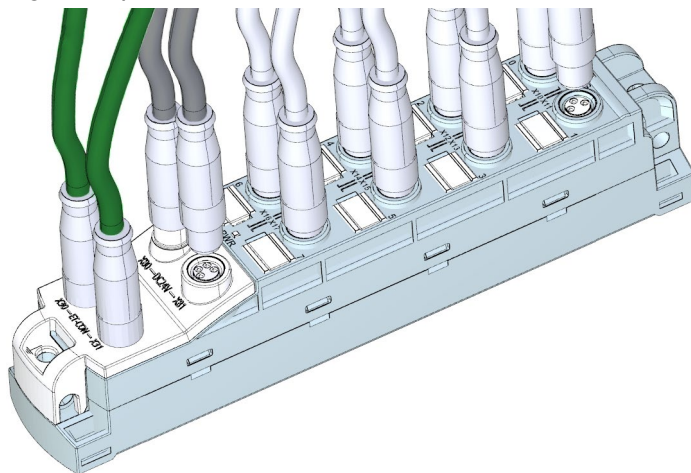


Image 5-8 Connecting M8 connectors

Connecting M12 connectors

To connect M12 connectors, proceed as follows:

1. Insert the connector in the appropriate round socket on the module.
Make sure that there is proper locking between the connector and socket (nut and spring).
2. Tighten the connector using the knurled screw with a torque of 1 Nm.

The figure below shows the connection of the M12 connectors, using the example of the analog input module AI 4xU/I/RTD 4xM12.

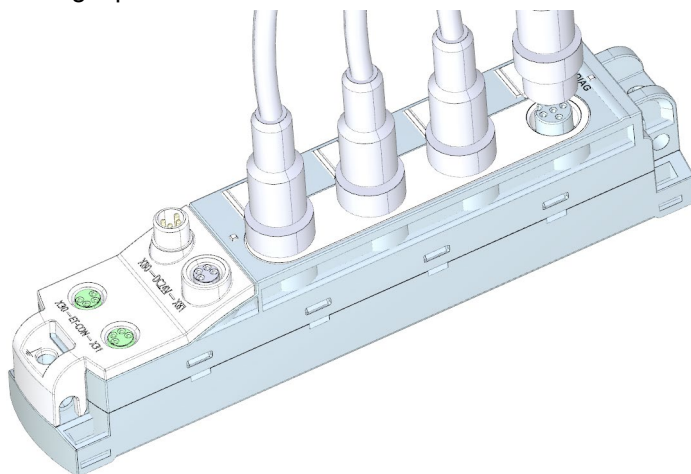


Image 5-9 Connecting M12 connectors

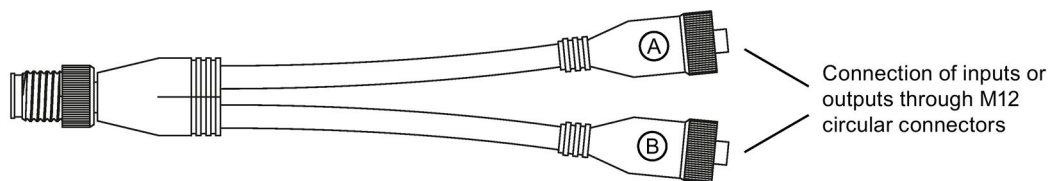
Pin assignment of the sockets

The pin assignment of the sockets can be found in the manuals for the interface modules (<http://support.automation.siemens.com/WW/view/en/89013662>) and I/O modules (<http://support.automation.siemens.com/WW/view/en/89013554>) in the section on Pin assignment and on the side surface of the module.

Y-cable

The Y-cable allows you to connect two actuators or sensors to the inputs or outputs.

The use of a Y-cable is particularly recommended when two channels are occupied for each socket of an I/O device. The Y-cable distributes the channels to two circular connectors.



The figure below shows the wiring of the Y-cable.

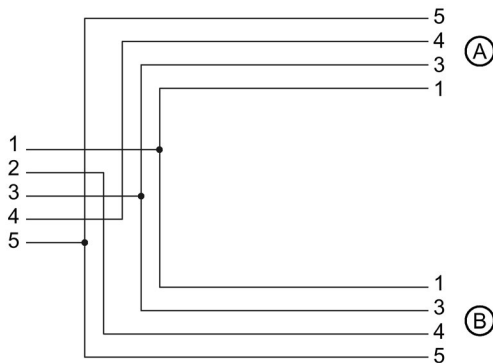


Image 5-10 Wiring of the Y-cable

Sealing of unused sockets

To ensure IP65 or IP67 degree of protection, seal off all unused sockets with sealing caps.

Article numbers for accessories/spare parts.

You will find the article numbers in the Appendix in section Accessories/spare parts (Page 70).

5.7 ET 200AL marking

5.7.1 Factory markings

Introduction

For better orientation, the ET 200AL distributed I/O system is identified using various markings which will help you when configuring and connecting the modules.

Marking of the interfaces

The interfaces of the modules are factory-labeled.

The table below shows the labeling of the interfaces.

Table 5- 2 Interface labeling

interface	Labeling
PROFINET IO interfaces	X1 P1 R and X1 P2 R
PROFIBUS DP interfaces	X1 DP1 and X1 DP2
I/O input and output interfaces	X10 through X17
ET-Connection interfaces (interface modules)	X30 (ET-CON1) and X31 (ET-CON2)
ET-Connection interfaces (I/O modules)	X30 (ET-CON IN) and X31 (ET-CON OUT)
Power supply interfaces	X80 (IN) and X81 (OUT)

Note

Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

NOTICE

ET-Connection/supply voltage

Observe the correct wiring of the M8 sockets for ET-Connection and the supply voltage.

Mixing up the ET-Connection connectors and the connectors for the supply voltage can destroy the module.

Pin assignment

The pin assignments of the various interfaces are lasered at the factory, on the side of every module.

5.7.2 Optional markings

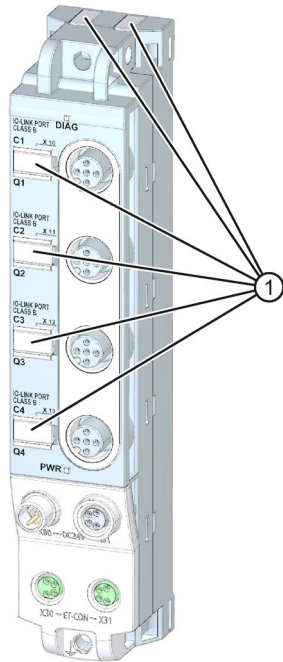
Introduction

In addition to the factory markings, there are also optional possibilities for labeling and/or identifying interfaces and modules on the ET 200AL distributed I/O system.

Identification label

The identification labels come with each module as strips and can be machine-printed. A strip has 10 identification labels measuring 10 x 5 mm in the color RAL9016. The identification labels can be inserted into every module at the points provided. The identification labels are used for channel, module and slot labeling.

The figure below shows all points where you can use the identification labels using the example of the IO-Link Master CM 4xIO-Link 4xM12 communication module.



① Identification labels

Image 5-11 Optional marking

5.7.3 Mounting identification labels

Introduction

This section describes how to mount or remove identification labels.

Required tools

You need a screwdriver with 3 mm blade width (only to remove identification labels).

Mounting procedure

To mount an identification label, proceed as follows:

1. Print the identification label using commercially available marking systems.
2. Press the identification label out of its holder.
3. Stick the identification labels into the cutouts provided, as shown in the figure *Optional marking* (Page 42).

Mounting the identification labels is the same for all modules.

Removal procedure

To remove an identification label, proceed as follows:

1. Carefully use a screwdriver to pull out the identification label.

Removing identification labels is the same for all modules.

Configuring

Introduction

You configure and assign parameters for the ET 200AL distributed I/O system (interface modules and I/O modules) using STEP 7 or the configuration software of another manufacturer.

Requirements

Table 6- 1 Configuration software and requirements

Configuration software	Requirements	Installation information
STEP 7 (TIA Portal) V13 SP1 or higher for modules: <ul style="list-style-type: none"> DI 8x24VDC 4xM12 DI 16x24VDC 8xM12: 	<ul style="list-style-type: none"> PROFINET IO, PROFIBUS DP: as of Support Package HSP 0155 	STEP 7 online help
STEP 7 (TIA Portal) V13 SP1 or higher for modules: <ul style="list-style-type: none"> DIQ 4+DQ 4x24VDC/0.5A 4xM12 DQ 8x24VDC/2A 8xM12 	<ul style="list-style-type: none"> PROFINET IO, PROFIBUS DP: as of Support Package HSP 0156 	
STEP 7 (TIA Portal) V13 SP1 or higher for modules: <ul style="list-style-type: none"> IM 157-1 PN IM 157-1 DP DI 8x24VDC 8xM8 DIQ 4+DQ 4x24VDC/0.5A 8xM8 AI 4xU/I/RTD 4xM12 CM 4xIO-Link 4xM12 	<ul style="list-style-type: none"> none, integrated in STEP 7 	
STEP 7 V5.5 SP4 or higher	<ul style="list-style-type: none"> PROFINET IO, PROFIBUS DP: as of Support Package HSP 0260 	Manufacturer documentation
STEP 7 (TIA Portal) as of V13 Update 3	<ul style="list-style-type: none"> PROFINET IO GSD file: GSDML-Vx.y-Siemens-ET200AL-"Date in format yyyyymmdd".xml (http://support.automation.siemens.com/WW/view/en/19698639/130000) for example: GSDML-V2.31-Siemens-ET200AL-20140507.xml PROFIBUS DP GSD file: siem81A9.gsg (http://support.automation.siemens.com/WW/view/en/10805317/133100) 	
Software of third-party manufacturer		

Configuring the ET 200AL distributed I/O system

See the STEP 7 online help or the documentation of the manufacturer of the configuration software.

Configuration - PROFINET maximum configuration

Each of the connections for ET-Connection occupies a slot in the configuration. The slots for ET-Connection1 and ET-Connection2 are specified statically in the PROFINET GSD file. ET-Connection1 is permanently on slot 1 and ET-Connection2 on slot 18.

The fixed slot assignment of ET-Connection1 and ET-Connection2 offers you the following advantages:

- You can expand ET-Connection1 and ET-Connection2 without a high workload
- Transparency in configuration control
- Simplification of diagnostics alarms and troubleshooting

The figure below shows the maximum configuration with modules of the ET 200AL distributed I/O system.

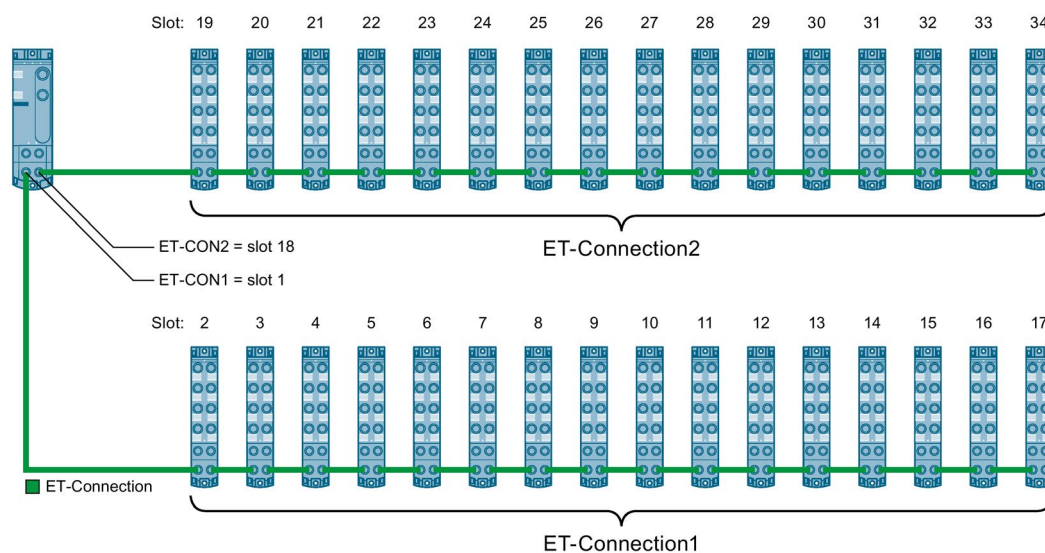


Image 6-1 PROFINET maximum configuration

Reference

You will find more information on this topic in the IM 157-1 PN interface module (<http://support.automation.siemens.com/WW/view/en/89254863>) manual in the section "Configuration control (option handling)".

Configuration - PROFIBUS maximum configuration

Each of the connections for ET-Connection occupies a slot in the configuration. The slot for ET-Connection1 is statically defined in the PROFIBUS GSD file. ET-Connection1 is always permanently installed in slot 1. Always place the topology module for ET-Connection2 on slot 18. You do not need to fill slots in the configuration for ET-Connection1 with dummy modules.

The fixed slot assignment of ET-Connection1 and ET-Connection2 offers you the following advantages:

- You can expand ET-Connection1 and ET-Connection2 without a high workload; for ET-Connection1 you need to remove the placeholder, the I/O module is placeable (no placeholders are needed for ET-Connection2)
- You cannot configure more modules on ET-Connection1 or ET-Connection2 than are allowed.
- Transparency in configuration control
- Simplification of diagnostics alarms and troubleshooting

The figure below shows the maximum configuration with modules of the ET 200AL distributed I/O system.

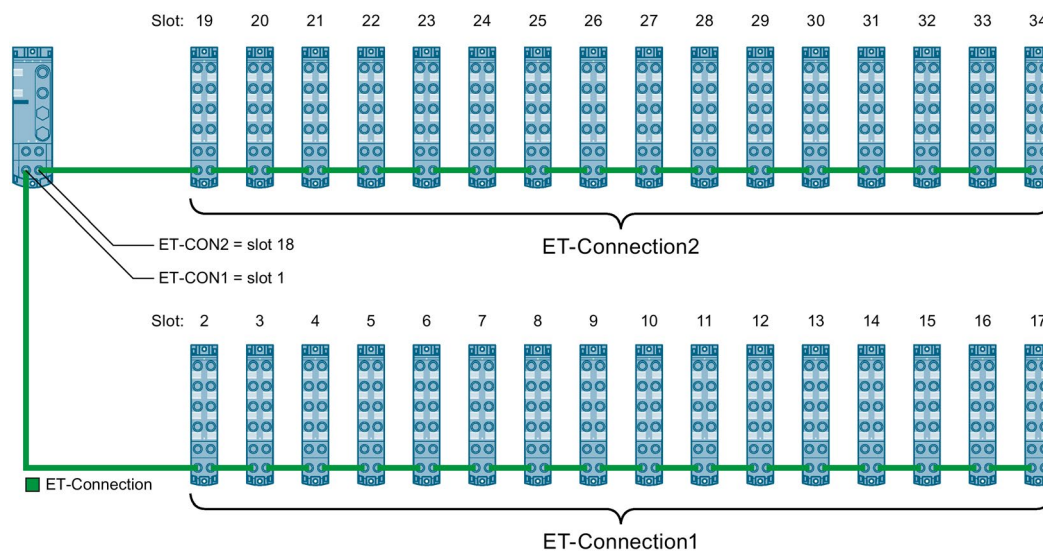


Image 6-2 PROFIBUS maximum configuration

Reference

You will find more information on this topic in the IM 157-1 PN interface module (<http://support.automation.siemens.com/WW/view/en/89255073>) manual in the section "Configuration control (option handling)".

Commissioning

7.1 PROFINET IO

7.1.1 Commissioning ET 200AL on PROFINET IO

Introduction

The commissioning of your distributed I/O system depends on the system configuration. The following procedure describes the commissioning of the ET 200AL distributed I/O system on an IO controller.

Requirements for the ET 200AL distributed I/O system on the PROFINET IO

Note

Performing tests

You must ensure the safety of your plant. You therefore need to perform a complete functional test and the necessary safety checks before the final commissioning of a plant.

Also plan the tests to include any possible foreseeable errors. This will allow you to prevent people or plants from being placed in danger during operation.

Procedure

The following table shows the chapters/documents in which the required actions are described.

Table 7- 1 Requirements for the ET 200AL distributed I/O system on the PROFINET IO

Step	Procedure	See...
1	Mounting the ET 200AL interface module	Section Mounting (Page 21)
2	Wiring the ET 200AL interface module	Section Connecting (Page 26)
3	Configuring the ET 200AL interface module	Section Configuring (Page 44)
4	Turning on the supply voltage for the ET 200AL interface module	IM 157-1 PN interface module (http://support.automation.siemens.com/WW/view/en/89254863) manual
5	ET 200AL interface module automatically switches to RUN mode	-

Reference

You can find additional information on assigning the PROFINET IO parameters in the PROFINET with STEP 7 V13 (<http://support.automation.siemens.com/WW/view/en/49948856>) function manual.

7.1.2 Startup on PROFINET IO

Principle of operation

The figure below schematically shows the startup of the ET 200AL distributed I/O system on the PROFINET IO (= IO device) as a flow chart.

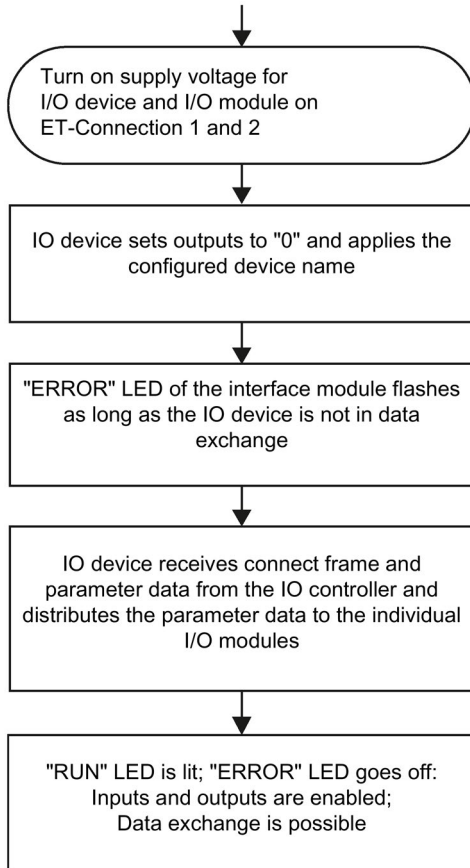


Image 7-1 Startup of the ET 200AL distributed I/O system on the PROFINET IO

The figure below schematically shows the startup of an ET 200AL I/O module after an ET 200AL PROFINET interface module.

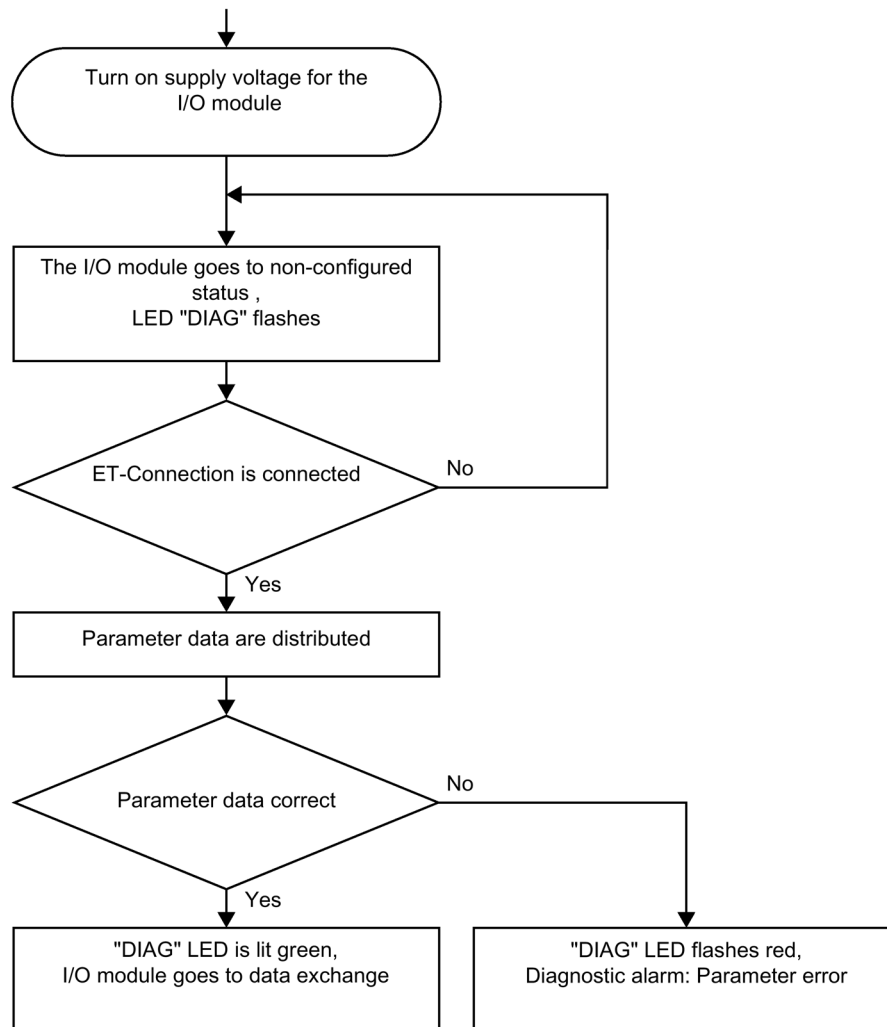


Image 7-2 Startup of the ET 200AL I/O module

7.1.3 PROFlenergy

PROFlenergy (for PROFINET) makes it possible to reduce the energy consumption of the device using the PROFlenergy command during production downtime.

Additional information

You will find more information on the Internet (<http://www.profibus.com>) under Common Application Profile PROFlenergy; Technical Specification for PROFINET; as well as in the following documentation:

- IM 157-1 PN interface module (<http://support.automation.siemens.com/WW/view/en/89254863>) manual
- I/O modules (<http://support.automation.siemens.com/WW/view/en/89013554>) manuals
- PROFINET System Description (<http://support.automation.siemens.com/WW/view/en/19292127>) system manual
- PROFINET with STEP 7 V13 (<http://support.automation.siemens.com/WW/view/en/49948856>), function manual, section: Saving energy with PROFlenergy
- Example of an application (<http://support.automation.siemens.com/WW/view/en/41986454>)
- You can find additional information on the PROFlenergy FBs ("PE_START_END" - FB 815, "PE_CMD" - FB 816) in the online help for STEP 7 V5.5 as of SP2, Help on system functions/function blocks.

7.2 PROFIBUS DP

7.2.1 Commissioning ET 200AL on PROFIBUS DP

Introduction

The commissioning of your distributed I/O system depends on the system configuration. The following procedure describes the commissioning of the ET 200AL distributed I/O system on a DP master.

Requirements for the ET 200AL distributed I/O system on a PROFIBUS DP

Note

Performing tests

You must ensure the safety of your plant. You therefore need to perform a complete functional test and the necessary safety checks before the final commissioning of a plant.

Also plan the tests to include any possible foreseeable errors. This helps to avoid endangering persons or equipment during operation.

Procedure

The following table shows the chapters/documents in which the required actions are described.

Table 7- 2 Requirements for the ET 200AL distributed I/O system on a PROFIBUS DP

Step	Procedure	See...
1	Mounting the ET 200AL interface module	Section Mounting (Page 21)
2	Setting the PROFIBUS DP address on the ET 200AL PROFIBUS interface module	IM 157-1 DP interface module (http://support.automation.siemens.com/WW/view/en/89255073) manual, section Setting the PROFIBUS DP address and terminating resistor
3	Wiring the ET 200AL interface module	Section Connecting (Page 26)
4	Configuring the ET 200AL interface module	Section Configuring (Page 44)
5	Turning on the supply voltage for the ET 200AL interface module	IM 157-1 DP interface module (http://support.automation.siemens.com/WW/view/en/89255073) manual
6	ET 200AL interface module automatically switches to RUN mode	-

7.2.2 Startup on PROFIBUS DP

Principle of operation

The figure below schematically shows the startup of the ET 200AL distributed I/O system on the PROFIBUS DP (= DP slave) as a flow chart.

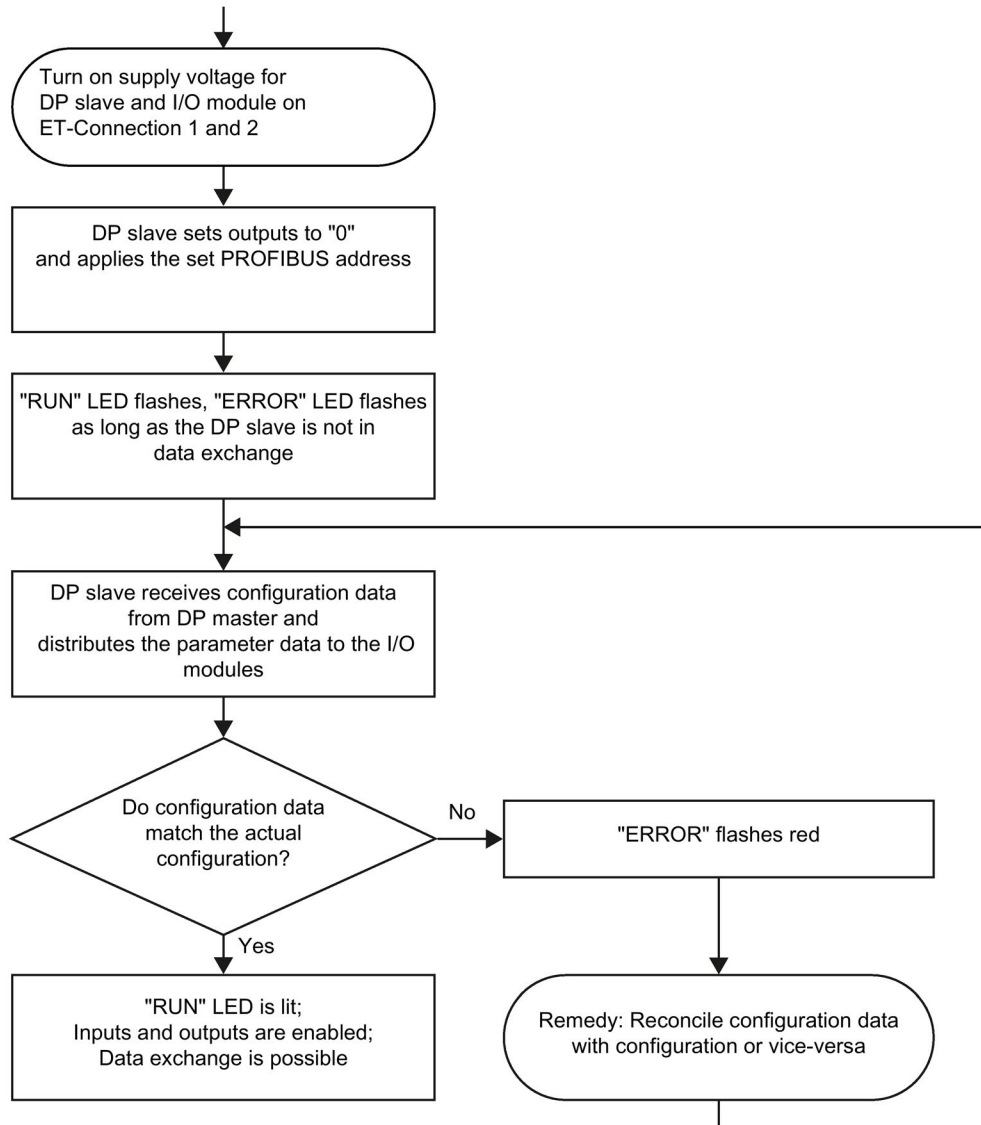


Image 7-3 Startup of the ET 200AL distributed I/O system on PROFIBUS DP

The figure below schematically shows the startup of an ET 200AL I/O module after an ET 200AL PROFIBUS interface module as flow chart.

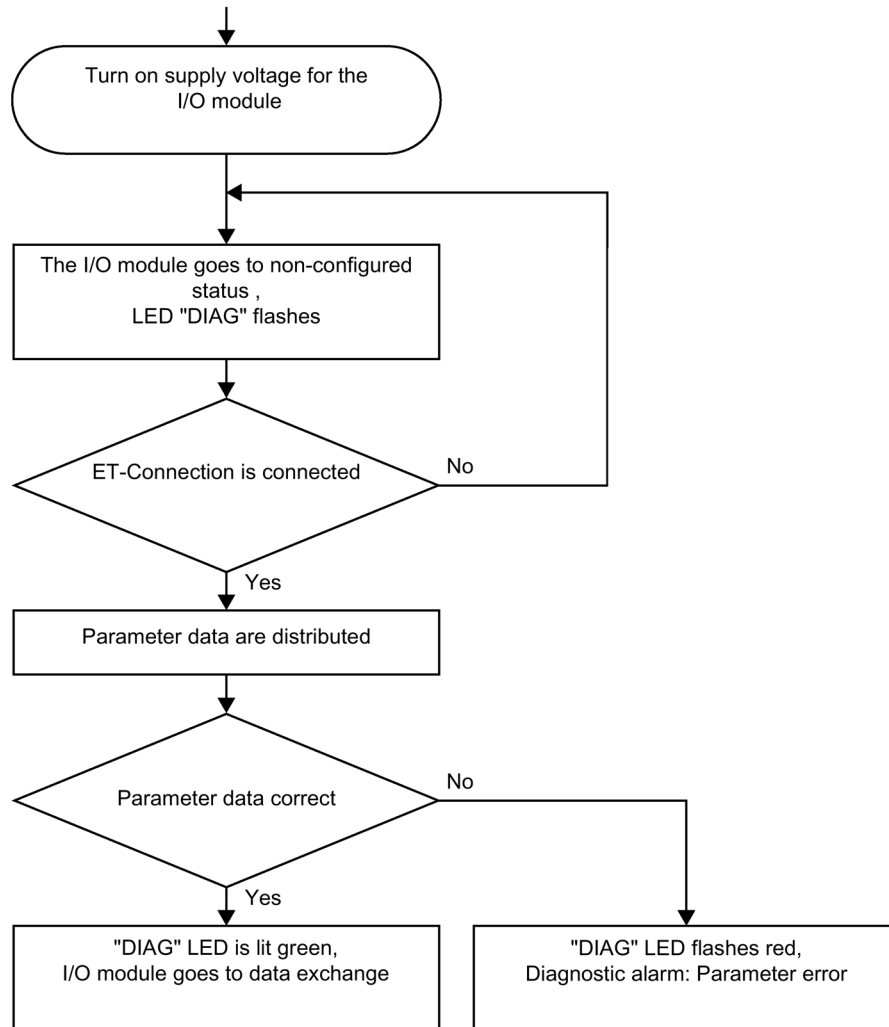


Image 7-4 Startup of an ET 200AL I/O module

7.3 Identification and maintenance data

7.3.1 Reading out and entering I&M data

Introduction

Identification data I&M is information that is saved either as read-only (I data) or read/write (M data) on the interface module.

Identification data (I&M0): Manufacturer information on the module that is read-only and in some cases is also printed on the module housing, for example, article number, serial number and firmware version.

Maintenance data (I&M1, 2, 3): Plant-dependent information, e.g. installation location. Maintenance data is created during configuration and written to the module.

All modules of the ET 200AL distributed I/O system support identification data (I&M0 to I&M3).

The I&M identification data supports you in the following activities:

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

With the I&M identification data, you have the option of clearly identifying modules online.

In STEP 7, the identification data is displayed in the "Module status - IM 157" and "Properties..." tabs (see STEP 7 online help).

Options for reading out I&M data

You have the following options for reading the I&M data:

- Via the user program
- Via STEP 7 or HMI devices

Procedure for reading I&M data by means of the user program

To read the I&M data of the interface module in the user program, use the instruction "RDREC".

Procedure for reading the I&M data using STEP 7

Requirement: There must be an online connection to the interface module.

1. In the project navigation, under "Distributed I/O", select the I/O device or the DP slave, e.g. "IM 157-1 PN".
2. Select: **IO device/DP slave > Online & Diagnostics > Identification & Maintenance.**

Procedure for input of maintenance data using STEP 7

The default module name is assigned by STEP 7. You have the option to enter the following data:

- Plant designation (I&M1)
- Location identifier (I&M1)
- Installation date (I&M2)
- Additional information (I&M3)
- Signature (I&M4), only for PROFINET

To enter the data, follow these steps:

1. In the device view of the STEP 7 hardware network editor, select the interface module, for example.
2. In the properties under "General", select the "Identification & Maintenance" area and enter the data.

During the loading of the hardware configuration, the I&M data are also loaded.

Reference

You can find additional information on I&M data of the ET 200SP (mixed configuration) in the ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/ww/en/view/58649293>) system manual.

7.3.2 Data record structure for I&M data

Reading I&M data records (distributed via PROFINET IO)

You can directly access specific identification data by selecting **Read data record** ("RDREC" instruction). You obtain the corresponding part of the identification data under the associated data record index.

The following table shows the principle behind the structure of data records.

Table 7- 3 Basic structure of data records with I&M identification data

Contents	Length (bytes)	Coding (hex)
Header information		
BlockType	2	I&M0: 0020 _H I&M1: 0021 _H I&M2: 0022 _H I&M3: 0023 _H I&M4: 0024 _H
BlockLength	2	I&M0: 0038 _H I&M1: 0038 _H I&M2: 0012 _H I&M3: 0038 _H I&M4: 0038 _H
BlockVersionHigh	1	01
BlockVersionLow	1	00
Identification data		
Identification data (see table below)	54 54 16 54 54	I&M0/Index AFF0 _H I&M1/Index AFF1 _H I&M2/Index AFF2 _H I&M3/Index AFF3 _H I&M4/Index AFF4 _H

The following table shows the structure of data records for I&M identification data.

Table 7- 4 Data record structure for I&M identification data

Identification data	Access	Default	Explanation
Identification data 0: (data record index AFF0 hex)			
VendorIDHigh	read (1 byte)	00 _H	This is where the name of the manufacturer is stored (42 _D = SIEMENS AG).
VendorIDLow	read (1 byte)	2A _H	
Order_ID	read (20 bytes)	6ES7157-1AB00-0AB0	Order number of the module (e.g. of PROFINET interface module)
IM_SERIAL_NUMBER	read (16 bytes)	-	Serial number (device-specific)
IM_HARDWARE_REVISION	read (2 bytes)	1	Corresponding hardware version
IM_SOFTWARE_REVISION	read	Firmware version	Provides information about the firmware version of the module
• SWRevisionPrefix	(1 byte)	V	
• IM_SWRevision_Functional_Enhancement	(1 byte)	00 - FF _H	
• IM_SWRevision_Bug_Fix	(1 byte)	00 - FF _H	
• IM_SWRevision_Internal_Change	(1 byte)	00 - FF _H	
IM_REVISION_COUNTER	read (2 bytes)	0000 _H	provides information about configured changes on the module (not used)
IM_PROFILE_ID	read (2 bytes)	0000 _H	Generic device

Identification data	Access	Default	Explanation
IM_PROFILE_SPECIFIC_TYPE	read (2 bytes)	0005 _H	Interface modules
IM_VERSION	read	0101 _H	provides information about the version of the identification data (0101 _H = Version 1.1)
• IM_Version_Major	(1 byte)		
• IM_Version_Minor	(1 byte)		
IM_SUPPORTED	read (2 bytes)	001E _H	provides information about the existing identification data (I&M1 though I&M4)
Maintenance data 1: (data record index AFF1 hex)			
IM_TAG_FUNCTION	Read/write (32 bytes)	-	Enter an identifier for the module here, that is unique plant-wide.
IM_TAG_LOCATION	Read/write (22 bytes)	-	Enter the installation location of the module here.
Maintenance data 2: (data record index AFF2 hex)			
IM_DATE	Read/write (16 bytes)	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 bytes)	-	Enter a comment describing the module.

Reading I&M data records with data record 255 (distributed via PROFIBUS DP)

The modules support standardized access to identification data using DR 255 (index 65000 to 65003). For additional information on the DR 255 data structure, refer to the specifications of the Profile Guideline - Order No. 3.502.

Maintenance

8.1 Replacing modules

Replacing modules

Replacing a module is not permitted during ongoing operation.

 **WARNING**

Material damage can occur

If you remove/insert modules with the power connected, this can lead to undefined states in your system.

Material damage to the ET 200AL distributed I/O system may occur as a result.

Only remove or replace modules when the power is disconnected.

Always comply with the required standards and safety guidelines when configuring a system.

 **WARNING**

Mixing up ET-Connection1 and ET-Connection2

When connecting the modules, always ensure that they are properly connected.

If you mix up the lines for ET-Connection1 and ET-Connection2 when connecting the modules, this can lead to undefined states in your system.

Behavior of ET-Connection

During ongoing operation, a module replacement may be necessary, e.g. because the module is defective. If an I/O module fails in an ET-Connection line, the line remains active up to the failed I/O module. After replacing the I/O module, the ET-Connection line starts up by itself.

Procedure

To replace a module, proceed as follows:

1. Disconnect the supply voltage to the module to be replaced.
2. Completely remove all cables connected to the module.
3. Completely remove the fixing screws of the module
4. Replace the module.

Note

"New" module

The removed module may only be replaced by a module of the same type.

5. Fasten the module with a torque of 1.2 Nm.
6. Connect all cables.
7. Turn the supply voltage on.

WARNING

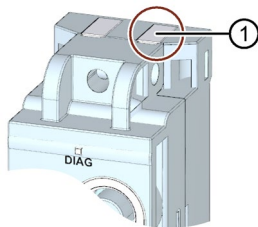
Pay attention to the slot number of the module

If you mix up the ET 200AL I/O modules when connecting them, this can cause personal injury and damage to the machine.

The ET 200AL distributed I/O system cannot distinguish between modules of the same type during the actual/target comparison.

We recommend that you clearly label the ET 200AL I/O modules with the slot number.

The figure below shows a recommendation for labeling the ET 200AL I/O modules with the slot number.



- ① Recommendation for labeling the slot number

Image 8-1 Slot number

Result

The disconnected I/O module and all downstream I/O modules start up again by themselves.

8.2 Firmware update

Introduction

During operation, it can become necessary to update the firmware (e.g. for function extensions).

Firmware updates are used to update the firmware of the interface module and I/O modules.

Note

Temporary bus interruption

When an I/O module is restarted after the firmware update, the data exchange on the ET-Connection is interrupted briefly. All downstream I/O modules fail briefly.

Options for the firmware update

There are two ways to perform a firmware update:

- Online with STEP 7, V5.5 or higher
- Online with STEP 7, TIA Portal V13 or higher

Reference

You can find additional information on the procedure in the FAQs on the Internet (<http://support.automation.siemens.com/WW/view/en/88778936>) and in the online help for STEP 7.

8.3 Cleaning modules

When wired, ET 200AL modules comply with degree of protection IP65/IP67 and do not require any cleaning. If you do have to clean the modules, then use a dry or damp cloth. Please take care to comply with degree of protection IP65/67 when cleaning with liquids.

Technical specifications

Introduction

The technical specifications of the system are found in this section:

- The standards and test values that the ET 200AL distributed I/O system complies with and fulfills.
- The test criteria according to which the ET 200AL distributed I/O system was tested.

Technical specifications for the modules

The technical data of the individual modules can be found in the modules' manuals. If there are discrepancies between the statements in this document and the product manuals, the statements in the product manuals take priority.

Reference

The certificates of the markings and authorizations can be found on the Internet under Service & Support (<http://www.siemens.com/automation/service&support>).

9.1 Standards and authorizations

Currently valid markings and authorizations

Note**Details on the components of the ET 200AL distributed I/O system**

The currently valid markings and approvals are printed on the components of the ET 200AL distributed I/O system.

CE mark



The ET 200AL distributed I/O system fulfills the requirements and protection targets of the following directives and complies with the harmonized European standards (ES) which have been promulgated for programmable logic controllers in the official gazettes of the European Community:

- 2004/108/EC "Electromagnetic Compatibility" (EMC directive)
or
- 2014/30/EU "Electromagnetic Compatibility" (EMC directive)

The EC declarations of conformity are available to the responsible authorities at:

Siemens AG
Digital Factory

Factory Automation
DF FA AS DH AMB
Postfach 1963
D-92209 Amberg

These are also available for download on the Customer Support Internet pages, under the keyword "Declaration of Conformity".

UL approval



Underwriters Laboratories Inc. in accordance with

- UL 61010-2-201
- CSA C22.2 No. 142 (Process Control Equipment)
- UL50, enclosure type 4X, indoor use only, water-tight (available soon)

RCM (C-Tick) Declaration of conformity for Australia/New Zealand



The ET 200AL distributed I/O system fulfills the requirements of the standards:

- AS/NZS 61000.6.4
- IEC 61000-6-4.

Korea Certificate KCC-REM-S49-ET200



Please note that this device corresponds to limit class A with regard to the emission of radio 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 61131-2

The ET 200AL distributed I/O system meets the requirements and criteria of standard IEC 61131-2, excluding the requirements mentioned in section 11 to 14 (programmable logic controllers, part 2: Equipment requirements and tests).

IEC 61010-2-201

The ET 200AL distributed I/O system fulfills the requirements and criteria of standard IEC 61010-2-201.

PROFINET standard

The interface module IM 157-1 PN based on standard IEC 61158 Type 10.

PROFIBUS standard

The interface module IM 157-1 DP based on standard IEC 61158 Type 3.

Marine approval (available soon)

Classification societies:

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

IO-Link standard

The communication module CM 4xIO-Link 4xM12 based on standard IEC 61131-9.

Industrial use

SIMATIC products are designed for industrial applications.

The table below shows the standards applicable for industrial applications.

Table 9- 1 Standard for industrial applications

Area of application	Interference emission requirements	Interference immunity requirements
Industry	EN 61000-6-4:2007 + A1:2011	EN 61000-6-2:2005

Use in residential areas

If you use the ET 200AL distributed I/O system in residential areas, you must comply with limit value class B according to EN 55011.

Note

Use in residential areas

The ET 200AL is intended for use in industrial areas; use in residential areas may have an impact on radio/TV reception.

Suitable measures to achieve the radio interference degree of limit value class B include, for example:

- Installation of the ET 200AL distributed I/O system in grounded control cabinets/control boxes
- Use of filters in supply cables

9.2 Electromagnetic compatibility

Definition

Electromagnetic compatibility is the ability of an electrical apparatus to function in a satisfactory manner in its electromagnetic environment without affecting this environment.

An I/O device of the ET 200AL distributed I/O system fulfills the requirements of the EMC law of the European Union. The requirement for this is that an I/O device of the ET 200AL distributed I/O system meets the specifications and guidelines for electrical configuration.

Pulse-shaped disturbance variables

The table below shows the electromagnetic compatibility of the distributed I/O systems compared to pulse-shaped disturbance variables.

Table 9- 2 Pulse-shaped disturbance variables

Pulse-shaped disturbance variable	Tested with	Corresponds to degree of severity
Electrostatic discharge according to IEC 61000-4-2.	Air discharge: ± 8 kV	3
	Contact discharge: ± 4 kV	2
Burst pulses (rapid transient disturbance values) according to IEC 61000-4-4.	± 2 kV (power supply cable)	3
	± 2 kV (PROFIBUS-/PROFINET line)	4
	± 1 kV (signal line <30 m)	3
	± 1 kV (ET-Connection)	3
High-energy surge according to IEC 61000-4-5.		
<ul style="list-style-type: none"> Asymmetrical coupling 	± 2 kV (24 V DC supply cable) with protective element	3
	± 0.5 kV (24 V DC supply cable) without protective element	1
	± 2 kV (PROFIBUS-/PROFINET line) without protective element	3
<ul style="list-style-type: none"> Symmetrical coupling 	± 1 kV (24 V DC supply cable) with protective element	3
	± 0.5 kV (24 V DC supply cable) without protective element	2

Sinusoidal disturbance variables

The following tables show the electromagnetic compatibility of the distributed I/O systems to sinusoidal disturbance variables.

Table 9- 3 RF radiation

RF radiation according to IEC 61000-4-3 Electromagnetic RF field, amplitude modulated		Corresponds to degree of severity
80 to 1000 MHz	10 V/m	3
1.4 to 2 GHz	3 V/m	2
2 to 2.7 GHz	1 V/m	1
80% AM (1 kHz)		

Table 9- 4 RF coupling (signal and supply cables)

RF coupling according to IEC 61000-4-6.		Corresponds to degree of severity
0.15 to 80 MHz	10 V _{rms} unmodulated 80% AM (1 kHz) 150 Ω source impedance	3
10 V _{rms} unmodulated		
80% AM (1 kHz)		
150 Ω source impedance		

Emission of radio frequency interference

The following table shows the interference emission of electromagnetic fields according to 55016: Limit value class A, group 1 (measured at 10 m distance).

Table 9- 5 Interference emission of electromagnetic fields

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

24 V supply connection

The following table shows measurement ranges for low voltage according to EN 55016.

Table 9- 6 Interference emission of electromagnetic fields

Frequency	Interference emission
0.15 MHz to 0.5 MHz	79 dB (μV) Q
	66 dB (μV) M
0.5 MHz to 30 MHz	73 dB (μV) Q
	60 dB (μV) M

9.3 Transport and storage conditions

Transport and storage conditions

The modules of the ET 200AL distributed I/O system exceed the requirements of IEC 61131-2 with respect to transport and storage conditions. The following table shows the conditions that apply to modules which are transported or stored in their original packaging.

Table 9- 7 Transport and storage conditions

Type of condition	Permissible range
Free fall	≤0.3 m
Temperature	-40 °C to +70 °C
Temperature variation	20 K/h
Barometric pressure	1080 to 660 hPa (corresponds to a height of-1000 to 3500 m)
Relative humidity	from 5 to 95%

9.4 Mechanical and climatic ambient conditions

Operating conditions

The ET 200AL distributed I/O system is suitable for use in weather-proof, fixed locations. The conditions of use exceed the requirements pursuant to IEC 60721-3-3:

- Class 3M3 (mechanical requirements)
- Class 3K3 (climatic requirements)

Mechanical ambient conditions

The following table shows the mechanical ambient conditions, listed in sinusoid vibrations.

Table 9- 8 Mechanical ambient conditions

Frequency band	Tested
$5 \leq f \leq 8 \text{ Hz}$	15 mm amplitude
$8 \leq f \leq 150 \text{ Hz}$	5 g constant acceleration

Tests of mechanical ambient conditions

The following table shows the type and scope of the tests on mechanical ambient conditions.

Table 9- 9 Tests of mechanical ambient conditions

Condition tested	Test standard	Values
Vibrations	Vibration test according to IEC 60068-2-6.	Type of oscillation: Frequency sweeps with a rate of change of 1 octave/minute. 5 to 9.1 Hz, constant amplitude 15 mm 9.1 Hz to 150 Hz, constant acceleration 5 g Duration of oscillation: 10 frequency sweeps per axis at each of three vertically aligned 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 shocks each in \pm direction in each of the 3 axes vertical to one another

Climatic ambient conditions

The following table shows the type and scope of the tests on climatic ambient conditions.

Table 9- 10 Climatic ambient conditions

Ambient conditions	Fields of application	Comments
Temperature	-25 °C to 55 °C	All installation positions
Temperature variation	10 K/h	-
Relative humidity	From 5 to 100%	With condensation
Barometric pressure	1080 hPa to 795 hPa	Corresponds to a height of -1000 to 2000 m
Concentration of pollutants	SO ₂ : < 0.5 ppm; rel. humidity < 60%, no condensation H ₂ S: < 0.1 ppm; rel. humidity < 60%, no condensation	-

9.5 Details on insulation, protection class, degree of protection and rated voltage

Insulation

The insulation is designed in compliance with the requirements of IEC 61010-2-201.

Pollution degree/overvoltage category pursuant to IEC 61010-2-201

- Pollution degree 2
- Overvoltage category II

Pollution class according to IEC 61010-2-201

- Protection class III

Degree of protection IP65 and IP67

Degree of protection IP65 and IP67 according to IEC 60529 for all modules of the ET 200AL distributed I/O system:

- 1. Code number: Dust-proof and complete protection from contact
- 2. Code number: Protection from water
 - IP65: Protection from water jets from any angle (The water may not have any damaging effect)
 - IP67: Protection against temporary submersion (The water must not enter the enclosure in harmful quantities)

Rated voltage for operation

The following table shows the rated voltage and the corresponding tolerance with which the ET 200AL distributed I/O system operates.

Table 9- 11 Rated voltage for operation

Rated voltage (SELV/PELV)	Tolerance range
24 V DC	20.4 V to 28.8 V DC

Dimension drawings

2 module widths are available with the distributed I/O system.

The figure below shows the height and width of the modules. The depth of the modules ranges from 40 mm to 46 mm. Detailed information on the dimensions of the individual modules can be found in the manuals for the Interface modules (<http://support.automation.siemens.com/WW/view/en/89013662>) and I/O modules (<http://support.automation.siemens.com/WW/view/en/89013554>) in the section "Dimension drawing".

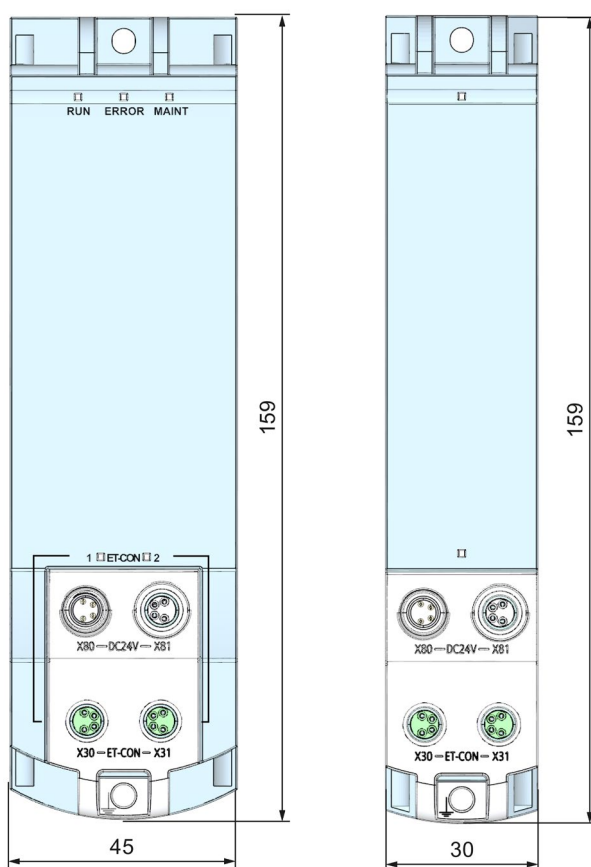


Image A-1 Module dimension drawings (front view)

Accessories/spare parts

B.1 Accessories/spare parts

Accessories for the ET 200AL distributed I/O system

Table B- 1 Accessories for ET-Connection

Designation	Length	Article number
Bus cable for ET-Connection M8, pre-assembled on both sides with 2 x M8 connectors, 4-pole, shielded	0.19 m	6ES7194-2LH02-0AA0
	0.3 m	6ES7194-2LH03-0AA0
	1.0 m	6ES7194-2LH10-0AA0
	2.0 m	6ES7194-2LH20-0AA0
	5.0 m	6ES7194-2LH50-0AA0
	10.0 m	6ES7194-2LN10-0AA0
	15.0 m	6ES7194-2LN15-0AA0
Bus cable for ET-Connection M8, pre-assembled on both sides with 2 x M8 connectors, angled, 4-pole, shielded	0.3 m	6ES7194-2LH03-0AB0
	1.0 m	6ES7194-2LH10-0AB0
	2.0 m	6ES7194-2LH20-0AB0
	5.0 m	6ES7194-2LH50-0AB0
	10.0 m	6ES7194-2LN10-0AB0
	15.0 m	6ES7194-2LN15-0AB0
Bus cable for ET-Connection M8, pre-assembled on one side with 1 x M8 connector, 4-pole, shielded	2.0 m	6ES7194-2LH20-0AC0
	5.0 m	6ES7194-2LH50-0AC0
	10.0 m	6ES7194-2LN10-0AC0
	15.0 m	6ES7194-2LN15-0AC0
M8 connector for ET-Connection, 4-pole, shielded		6ES7194-2AB00-0AA0

Table B- 2 Accessories for power supply

Designation	Length	Article number
Power cable M8, pre-assembled on both sides with M8 connector and M8 socket, 4-pole	0.19 m	6ES7194-2LH02-1AA0
	0.3 m	6ES7194-2LH03-1AA0
	1.0 m	6ES7194-2LH10-1AA0
	2.0 m	6ES7194-2LH20-1AA0
	5.0 m	6ES7194-2LH50-1AA0
	10.0 m	6ES7194-2LN10-1AA0
	15.0 m	6ES7194-2LN15-1AA0
Power cable M8, pre-assembled on both sides with angled M8 connector and angled M8 socket, 4-pole	0.3 m	6ES7194-2LH03-1AB0
	1.0 m	6ES7194-2LH10-1AB0
	2.0 m	6ES7194-2LH20-1AB0
	5.0 m	6ES7194-2LH50-1AB0
	10.0 m	6ES7194-2LN10-1AB0
	15.0 m	6ES7194-2LN15-1AB0
Power cable M8, pre-assembled on one side with M8 socket, 4-pole	2.0 m	6ES7194-2LH20-1AC0
	5.0 m	6ES7194-2LH50-1AC0
	10.0 m	6ES7194-2LN10-1AC0
	15.0 m	6ES7194-2LN15-1AC0
M8 power connector, pin insert, 4-pole		6ES7194-2AA00-0AA0
M8 power connector, female insert, 4-pole		6ES7194-2AC00-0AA0

Table B- 3 M12 connector

Designation		Article number
Non-preassembled connectors for X1 DP1 (pin)		
PROFIBUS M12 plug connector 180° with female insert		6GK1905-0EB00
PROFIBUS M12 plug connector FastConnect 180° with female insert		6GK1905-0EB10
PROFIBUS M12 plug connector, angled with female insert		3RK1902-1DA00
Non-preassembled connectors for X1 DP2 (socket)		
PROFIBUS M12 plug connector 180° with pin insert		6GK1905-0EA00
PROFIBUS M12 plug connector FastConnect 180° with pin insert		6GK1905-0EA10
PROFIBUS M12 plug connector angled with pin insert		3RK1902-1BA00
Non-preassembled connectors for X1 P1R PN (LAN) and X1 P2R PN (LAN) socket		
PROFINET M12 plug connector d-coded with FastConnect connection technology, 180	1 unit/ pack	6GK1901-0DB10-6AA0
	8 units/ pack	6GK1901-0DB10-6AA8
PROFINET M12 plug connector, D-coded with fast connect technology 180°	1 unit/ pack	6GK1901-0DB20-6AA0
	8 units/ pack	6GK1901-0DB20-6AA8
PROFINET M12 plug connector, D-coded, angled		3RK1902-2DA00

Table B- 4 Non-preassembled cable M12

Designation	Article number
Non-preassembled cable for X1 DP1 and X1 DP2	
PROFIBUS FC Cable	
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)	6XV1831-2K
Non-preassembled connectors for X1 P1R PN (LAN) and X1 P2R PN (LAN)	
PROFIBUS FC Cable	
FC 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 (PVC sheath)	6XV1870-2B
FC TP FRNC Cable	6XV1871-2F
FC TP Food Cable (PE sheath)	6XV1871-2L
FC TP Festoon Cable GP (PVC sheath)	6XV1871-2S

Table B- 5 Pre-assembled cable M12

Designation	Article number	
Pre-assembled cable for X1 DP1 and X1 DP2		
PROFIBUS M12 connecting cable, trailing cable, pre-assembled on both sides with PROFIBUS M12 connectors, 180° (one side socket, one side pin)	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

Designation		Article number
PROFIBUS M12 connecting cable, trailing cable, pre-assembled on both sides with PROFIBUS M12 connectors, angled (one side socket, one side pin)	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
Pre-assembled cable for X1 P1R PN (LAN) and X1 P2R PN (LAN)		
PROFINET M12 connecting cable, trailing cable, pre-assembled on both sides with M12 connectors 180° (pin)	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, pre-assembled on both sides with M12 connectors, angled (pin)	0.3 m	6XV1870-8AE30-0SB0
	0.5 m	6XV1870-8AE50-0SB0
	1.0 m	6XV1870-8AH10-0SB0
	1.5 m	6XV1870-8AH15-0SB0
	2.0 m	6XV1870-8AH20-0SB0
	3.0 m	3RK1902-2NB30
	5.0 m	3RK1902-2NB50
	10.0 m	3RK1902-2NC10
	15.0 m	6XV1870-8AN15-0SB0
PROFINET M12 connecting cable, trailing cable, pre-assembled on both sides with PROFIBUS M12 connectors, angled (one side socket, one side pin)	3.0 m	3RK1902-2HB30
	5.0 m	3RK1902-2HB50
	10.0 m	3RK1902-2HC10
PROFINET M12 connecting cable, trailing cable, pre-assembled on one side with M12 connectors 180° (pin), other side with RJ45 plug 145°	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

Table B- 6 Additional accessories

Designation	Article number
Identification labels 10 x 5 mm RAL9016, composed of 200 labels on frames, per frame 40 labels	6ES7194-2BA00-0AA0
Sealing cap M8 for modules IP67	3RK1901-1PN00
Sealing cap M12 for modules IP67	3RX9802-0AA00
Bus connection plug PROFIBUS M12, pin insert, 5 units	6GK1905-0EC00
Stripping Tool for ET-Connection	6ES7194-2KA00-0AA0
Stripping Tool for PROFINET	6GK1901-1GA00
Stripping Tool for PROFIBUS	6GK1905-6AA00

Online catalog

Other article numbers for the ET 200AL distributed I/O system can be found on the Internet (<http://mall.automation.siemens.com>) in the online catalog and the online order system.

B.2 Cables

Cables for ET-Connection

The cables for ET-Connection are available in the following versions and lengths:

- Bus cable (4-wire), pre-assembled on both sides with 2 M8 connectors, 4-pole, shielded
 - available lengths: 0.19 m, 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m
- Bus cable (4-wire), pre-assembled on both sides with 2 M8 connectors, angled, 4-pole, shielded
 - available lengths: 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m
- Bus cable (4-wire), pre-assembled on one side 1x M8 connector, 4-pole, shielded
 - available lengths: 2 m, 5 m, 10 m, 15 m

The following table shows the technical properties of the bus cable ET-Connection.

Table B- 7 Cables for ET-Connection

General information	
Product type designation	BUS CABLE ET-CONNECTION
Function	To connect ET-CONNECTION devices with degree of protection IP65/IP67
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	2Y(ST)CY 1x4x0.5/1.0-100-GN
Number of electrical wires	4
Design of shielding	Overlapped aluminum-lined sheet, coated with shielding made of tin plated copper wires
Outside diameter of the inner conductor	0.5 mm
Outside diameter of the wire insulation	1.0 mm
Outside diameter of the cable sheath	5 mm
Number of bending cycles	1000000*; suitable as trailing chain for 1 million bending cycles with a bending radius of 100 mm, a velocity of 4 m/s ² and an acceleration of 4 m/s ²
Permissible bending radius	
One time bending, min.	20 mm
Multiple bending, min.	40 mm
Constant bending	100 mm
Color of the cable sheath	Green
Color of the wire insulation of the data wires	White, yellow, blue, orange
Weight per length	34 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet 90° cable outlet (with angled connectors)
Number of connectors	1 or 2
Connector housing material	Metal
Wire insulation material	PE
Cable sheath material	PVC
Material property halogen free	No
Material property silicon free	Yes

* = Applies to cable lengths up to 10 meters.

Cables for power supply

The cables for the power supply are available in the following versions and lengths:

- Power cable (4-wire), pre-assembled on both sides with a 4-pole M8 pin connector/socket connector
 - available lengths: 0.19 m, 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m
- Power cable (4-wire), pre-assembled on both sides with a 4-pole M8 pin connector/socket connector, angled
 - available lengths: 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m
- Power cable (4-wire), pre-assembled on one side with 1x M8 socket connector
 - available lengths: 2 m, 5 m, 10 m, 15 m

The following table shows the technical properties of the power supply cable

Table B- 8 Cables for power supply

General information	
Product type designation	POWER CABLE M8
Function	For connection of ET 200AL for 24 V DC power supply
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	4 Li9Y 0.50
Number of electrical wires	4
Outside diameter of the inner conductor	0.8 mm
Outside diameter of the wire insulation	1.46 mm
Outside diameter of the cable sheath	5.2 mm
Number of bending cycles	2500000; trailing-chain suitable for 2.5 million bending cycles with a bending radius of 52 mm, a velocity of 3 m/s ² and an acceleration of 10 m/s ²
Permissible bending radius	
One time bending, min.	26 mm
Multiple bending, min.	52 mm
Constant bending	52 mm
Color of the cable sheath	gray

General information	
Color of the wire insulation of the power wires	White, brown, blue black
Weight per length	44 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet 90° cable outlet (with angled connectors)
Number of connectors	1 or 2
Connector housing material	Plastic
Wire insulation material	PP
Cable sheath material	PVC
Material property silicon free	Yes

B.3 Pin assignment and core color

Pin assignment of the sockets for ET-Connection

The tables below shows the pin assignments of the 2 sockets for the connection of ET-Connection.

Table B- 9 Pin assignment for ET-Connection (interface modules)

Pin	Assignment		Assignment of the core color of the bus cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection1)	X31 socket (ET-Connection2)		X30	X31
1	RXP	RXP	yellow		
2	TXP	TXP	white		
3	TXN	TXN	blue		
4	RXN	RXN	orange		
Shielding	Functional earth FE		-		

Table B- 10 Pin assignment for ET-Connection (I/O modules)

Pin	Assignment		Assignment of the core color of the bus cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection IN)	X31 socket (ET-Connection OUT)		X30	X31
1	TXP	RXP	yellow		
2	RXP	TXP	white		
3	RXN	TXN	blue		
4	TXN	RXN	orange		
Shielding	Functional earth FE		-		

Pin assignment of the connector for infeed of the supply voltage

The table below shows the pin assignment for infeed of the supply voltage.

Table B- 11 Pin assignment of the supply voltage connector

Pin	Assignment	Assignment of the core color of the power cable	Front view of the connector
	X80 connector (power input)		
1	Supply voltage 1L+ (non-switched)	brown	
2	Ground 2M (switched)	white	
3	Ground 1M (non-switched)	blue	
4	Load voltage 2L+ (switched)	black	

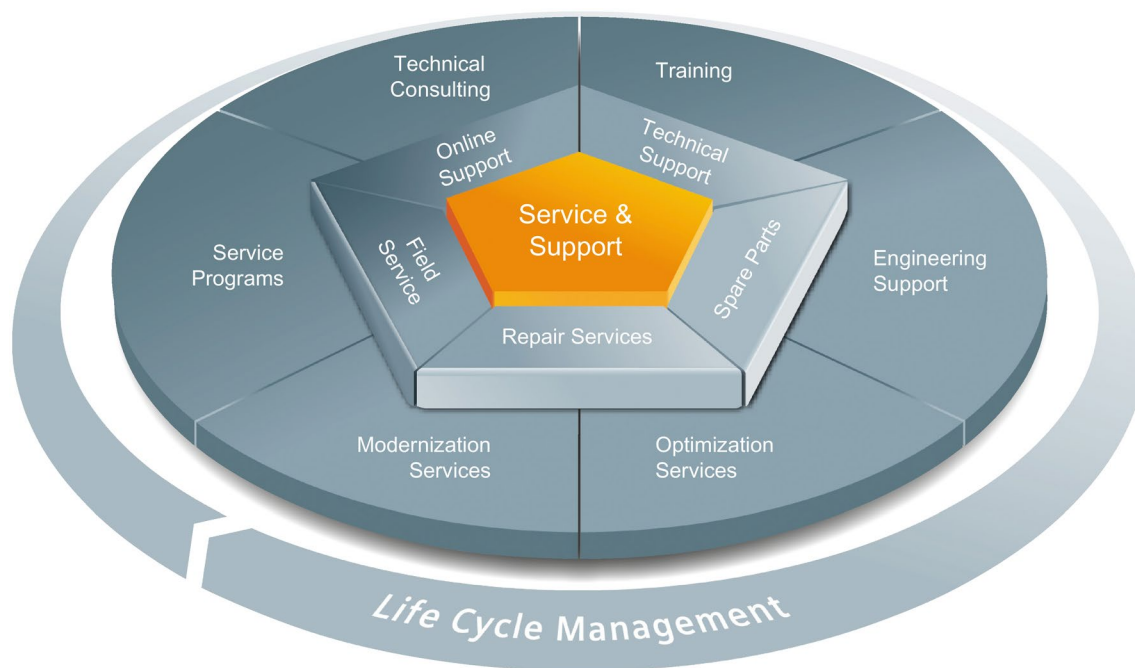
Pin assignment of the socket for loop-through of the supply voltage

The table below shows the pin assignment for loop-through of the supply voltage.

Table B- 12 Pin assignment of the supply voltage socket

Pin	Assignment	Assignment of the core color of the power cable	Front view of the socket
	X81 Socket (power output)		
1	Supply voltage 1L+ (non-switched)	brown	
2	Ground 2M (switched)	white	
3	Ground 1M (non-switched)	blue	
4	Load voltage 2L+ (switched)	black	

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Glossary

Bus

A common transfer route to which all devices are connected; it has two defined ends.

Configuration

Systematic arrangement of individual modules (design).

Connection plug

Physical connection between device and cable.

Device

Device that can send, receive or amplify data via the bus, e.g. IO device via PROFINET IO.

Diagnostics

Monitoring functions for the detection, localization, classification, display, and further evaluation of errors, faults, and alarms. They run automatically while the system is in operation. This increases the availability of systems by reducing commissioning times and downtimes.

Distributed I/O system

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

ET-Connection

Backplane bus through which a connection is made. This allows bus participants to be installed several meters from each other.

Firmware update

Upgrade of firmware for modules (interface modules, I/O modules etc.), e.g. after functional enhancements, to the newest firmware version (update).

Ground

Conductive earth whose electrical potential can be set equal to zero at any point.

All interconnected, inactive parts of a piece of equipment that cannot accept any dangerous contact voltage, even in the event of a fault.

Ground

Conductive earth whose electrical potential can be set equal to zero at any point.

All interconnected, inactive parts of a piece of equipment that cannot accept any dangerous contact voltage, even in the event of a fault.

GSD file

As a generic station description, this file in XML format has all the properties of a PROFINET or PROFIBUS device that are required for its configuration.

I/O modules

All modules that can be operated with a CPU or an interface module.

Identification data

Information that is saved in modules and that supports the user in checking the plant configuration and locating hardware changes.

Interface module

Module in the distributed I/O system. The interface module connects the distributed I/O system via a field bus with the CPU (I/O) controller and prepared the data for the/from the I/O modules.

Parameter assignment

Parameter assignment is the transfer of parameters from the IO controller to the IO device.

PELV

Protective **Extra Low Voltage** = protective extra-low voltage

PROFINET

PROcess Field NETwork, open Industrial Ethernet standard, which continues PROFIBUS and Industrial Ethernet. A cross-manufacturer communication, automation and engineering model, defined as an automation standard by PROFIBUS International e.V.

PROFINET IO controller

Device used to address connected I/O devices (e.g. distributed I/O systems). This means that: The IO controller exchanges input and output signals with assigned I/O devices. The IO controller often corresponds with the CPU in which the automation program is running.

PROFINET IO device

Distributed field device that can be assigned to one or more IO controllers (e.g. distributed I/O system, valve terminals, frequency converters, switches).

PROFINET IO

Communication concept for the realization of modular, distributed applications in the framework of PROFINET.

Reference potential

Potential from which the voltages of the circuits involved are observed and/or measured.

SELV

Safety Extra Low Voltage = Safety extra-low voltage

TIA Portal

Totally Integrated Automation Portal

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

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