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SIMATIC

ET 200pro distributed I/O EtherNet/IP interface module

Manual

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Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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

Qualified Personnel

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

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Disclaimer of Liability

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

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Preface

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1.1 Preface

Trademarks

This manual references technologies whose names are trademarked by ODVA, the Open DeviceNet Vendors Association. The ODVA technologies referenced in this manual include:

- EtherNet/IP™
- CIP™ (Common Industrial Protocol)
- QuickConnect™

For more information on ODVA and its trademarked technologies, visit the ODVA website (http://www.odva.org).

Purpose of the manual

The information in this manual is intended to enable you to operate the ET 200pro EtherNet/IP interface module on EtherNet/IP.

Required level of knowledge

You require knowledge of the automation engineering field in order to use the material in this manual.

Scope of the manual

This manual is valid for the ET 200pro EtherNet/IP module. Appendix A provides order information.

This manual contains a description of the components that were valid at the time the manual was published. Information about new components and new versions of components is released in Product Information bulletins available on the Siemens Industry Online Support (https://support.industry.siemens.com) website.

Certifications, Marks, and Standards

The ET 200pro EtherNet/IP module complies with EtherNet/IP Specification CIP Networks Library Volume 2: EtherNet/IP Adaption of CIP, Edition 1.22.

See the "General technical specifications (Page 75)" chapter for a full description of all applicable certifications, marks, and standards.

Relevant manuals

The disk that shipped with your ET 200pro EtherNet/IP module includes the following manuals:

- ET 200pro EtherNet/IP interface module System Manual (this manual)
- ET 200pro distributed I/O System Operating Instructions
- EIP ET200 Configuration Tool User Reference Guide

The ET 200pro Motor starters Manual is also relevant to the ET 200pro system. It can be found on the Siemens Industry Online Support (https://support.industry.siemens.com) website:

Software

The disk that shipped with your ET 200pro EtherNet/IP module also includes the EIP ET200 Configuration Tool software. This software is required to configure the ET 200pro EtherNet/IP module.

Service and support on the internet

In addition to the documentation described above, Siemens offers technical expertise on the following websites:

Siemens Industry Online Support (https://support.industry.siemens.com) website

Automation / partner (http://www.siemens.com/automation/partner) website

Contact your Siemens distributor or sales office for:

- answers to technical questions
- training
- ordering SIMATIC products

Recycling and disposal

The ET 200pro EtherNet/IP module is recyclable because it is low in contaminants. Contact a certified electronic waste disposal company to recycle and dispose of your old equipment in an environmentally-friendly manner.

1.2 Security information

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

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

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (http://support.industry.siemens.com).

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

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

Product overview

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2.1 What are distributed I/O systems?

When you first set up your system, the inputs and outputs for the process are often located centrally within the programmable logic controller (PLC).

If inputs and outputs are distant from the PLC, the following problems might occur:

- difficulty physically tracing long cable runs between connection points
- electromagnetic interference might degrade the signal and impair data reliability

Using a distributed I/O system solves these problems and provides the following benefits:

- The PLC is located centrally
- The I/O system's inputs and outputs operate locally on a distributed basis
- The high-performance ET 200pro system ensures that the PLC and I/O systems communicate smoothly

2.2 What is the ET 200pro distributed I/O system?

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

Fields of application

Because of its robust design and degrees of protection, the ET 200pro EtherNet/IP module is particularly suitable for use in rugged industrial environments. The ET 200pro EtherNet/IP module is protected from foreign bodies and water. The module does not require an additional enclosure.

Area of application

With the ET 200pro system, you can connect virtually any number of I/O modules in any combination next to the interface module. This means that you can adjust the configuration to suit local requirements.

Configuration

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

- An interface module that transfers data to the EtherNet/IP master
- Up to 16 electronic modules with maximum 1 m total width (without rack)
- Connection modules in various designs for
  - ET 200pro EtherNet/IP module
  - Supply voltages
  - Inputs and outputs
- Pneumatic interface modules for linking of FESTO valve terminals

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

The convenient handling features of ET 200pro EtherNet/IP module ensure quick commissioning and easy maintenance.

Terminal modules and electronic modules

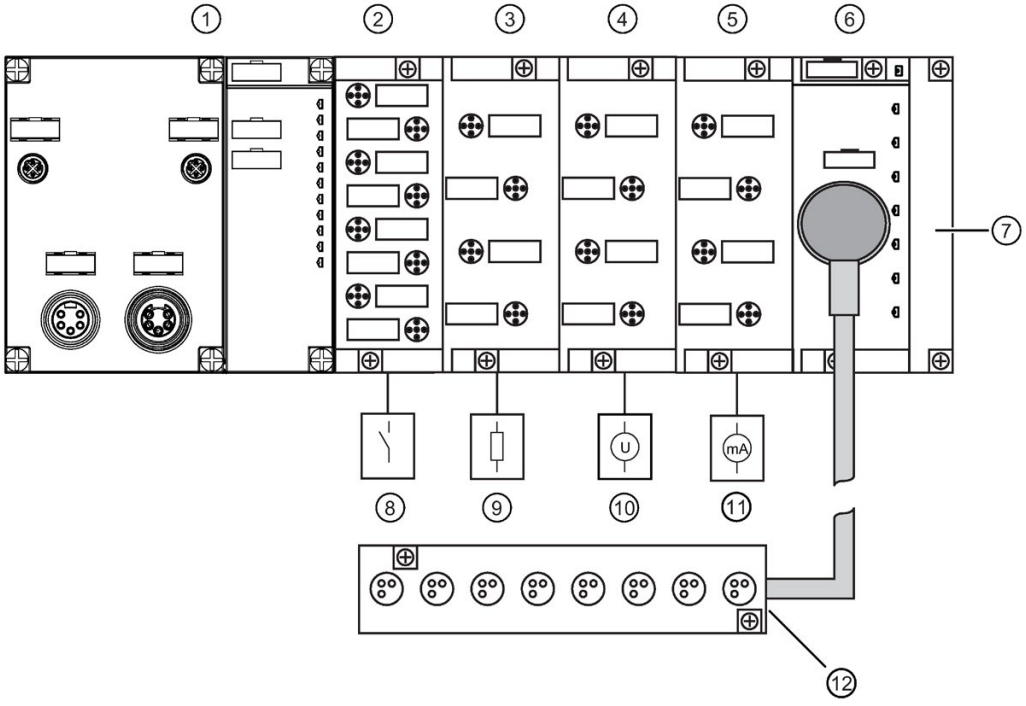
The ET 200pro distributed I/O system consists primarily of various passive connection modules to which you connect the electronic modules and motor starters.

The ET 200pro EtherNet/IP module enables the ET 200pro distributed I/O system to be connected to the EtherNet/IP network.

Example configuration with electronic modules

You can equip the ET 200pro EtherNet/IP module with electronic modules up to the maximum configuration. Between an interface module and a terminating module, you can adapt the electronic modules to your application in whatever configuration you require.

The following image illustrates an example configuration of the ET 200pro distributed I/O system:

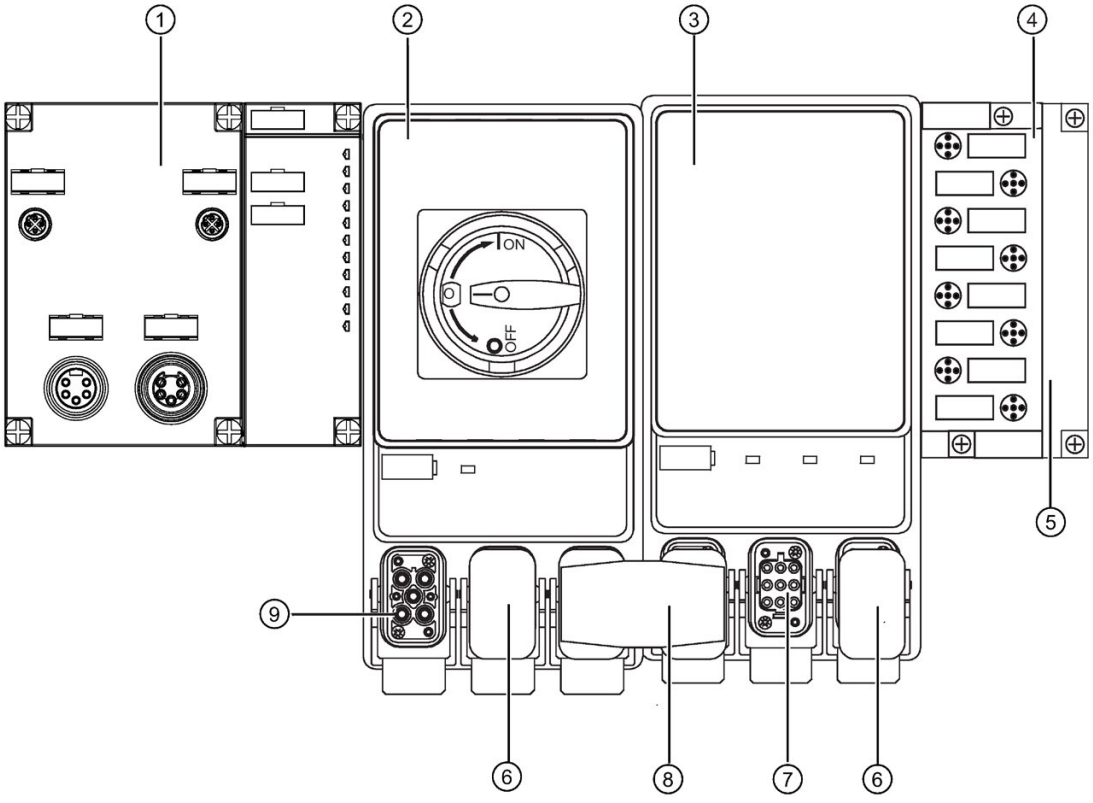


① ET 200pro EtherNet/IP interface module (with connection module)
② 8 DI DC 24V
③ 4 DO DC 24V/2.0A
④ 4 AI U HF
⑤ 4 AI I HF
⑥ 8 DI DC 24V
⑦ Terminating module
⑧ 8 x switches, sensors
⑨ 4/8 x load
⑩ 4 x voltage measurement
⑪ 4 x current measurement for 2-/4-wire measuring transducer
⑫ Actuator/sensor distributor

Example configuration with electronic module and motor starter

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

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



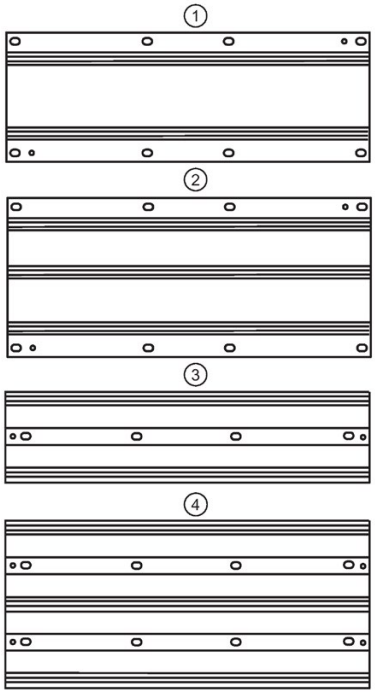
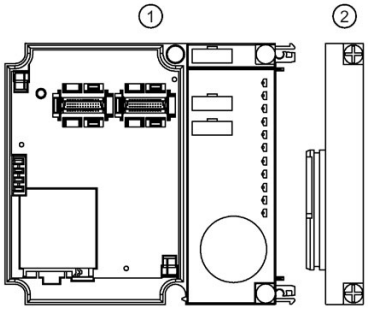
①	ET 200pro EtherNet/IP interface module (with connection module)
②	Repair switch module
③	DSe; Standard
④	8 DI DC 24 V
⑤	Terminating module
⑥	Cap
⑦	Motor connection
⑧	Power jumper plug
⑨	Infeed

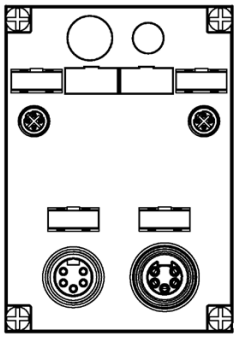
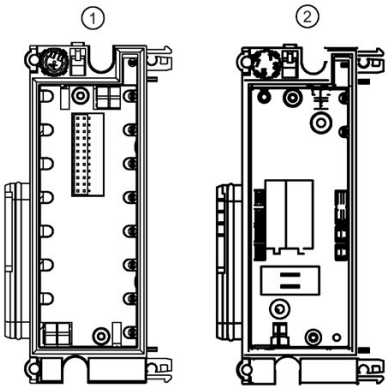
See also

Standards and approvals (Page 75)

2.3 Components of the ET200pro distributed I/O system

The table below lists components of an ET 200pro system:

Component	Function	View
Rack	You mount the ET 200pro on a rack. Four versions with different lengths are available: Rack, narrow ① Rack, wide ② Rack, compact narrow ③ Rack, compact wide ④	
Interface module for EtherNet/IP with bus module and terminating module	The interface module connects the ET 200pro with the EtherNet/IP master and prepares the data for the electronic modules. The unit is delivered with the terminating module ②, and the interface module ① is already mounted on the bus module. • The bus module is the mechanical and electrical connection element between the various ET 200pro modules. • The terminating module terminates the ET 200pro backplane bus. • The ET 200pro EtherNet/IP interface module (ZNX:EIP200PRO) is also available for EtherNet/IP.	

Component	Function	View
Connection module for the ET 200pro EtherNet/IP interface module	The connection module is mounted on the interface module. It is used to connect EtherNet/IP, the electronic encoder, and load voltage supplies. The following connection module is available for EtherNet/IP: • CM IM M12, 7/8" (ZNX:ET200PROCM1)	
Power module with bus module and outgoing module	① The power module provides a new potential group for the 2L+ load voltage supply. The unit is shipped with the power module mounted on the bus module. ② The outgoing module enables the 1L+ electronics/encoder supply and the 2L+ load voltage supply to be tapped.	

2.4 The ET 200pro EtherNet/IP interface module

ET 200pro EtherNet/IP interface module package

The ET 200pro EtherNet/IP interface module package includes the following components:

- Interface module and terminating module (ET 200pro EtherNet/IP)
- Companion disk with:
  - EIP ET200 Configuration Tool software
  - EIP ET200 Configuration Tool User Reference Guide
  - This ET 200pro EtherNet/IP interface module manual

Order number

The order number for this package is: ZNX:EIP200PRO.

ET 200pro EtherNet/IP interface module features

The ET 200pro EtherNet/IP module is a communications adapter for interfacing with an ET 200pro distributed I/O system. The module provides connectivity between an EtherNet/IP network and ET 200pro power and I/O modules. The ET 200pro EtherNet/IP module includes the following features:

- It prepares the data for electronic modules and motor starters.
- It supplies the backplane bus.
- The maximum address space is 255 bytes for inputs and 255 bytes for outputs.
- A maximum of 16 modules can be operated with the interface module.
- The maximum width of the station is 1 m.
- The maximum parameter length for the entire station is 237 bytes.
- You can group modules within one byte (packing).
- Device Level Ring (DLR) operation is supported.

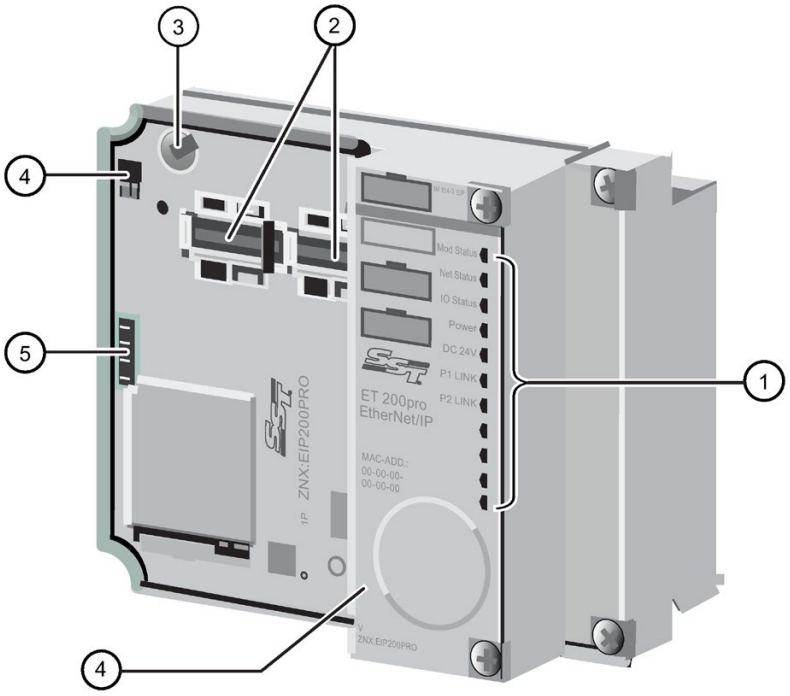
Note

Operating with ungrounded reference potential

An internal RC circuit discharges any interference currents to protective ground when you operate the ET 200pro EtherNet/IP module with ungrounded reference potential and when 1M and FE are not interconnected.

The connection between 1M and FE is not applicable in a configuration with ungrounded reference potential.

The following illustration highlights the hardware features of the ET 200pro EtherNet/IP module:



①	Status LEDs
②	Connection module interface
③	Coding element
④	Ground connections
⑤	Power connection

I/O features

The ET 200pro EtherNet/IP module supports the following I/O features:

- Up to 16 modules per ET 200pro EtherNet/IP module
- Electronic module parameterization
- Electronic module diagnostics
- Provides support for a subset of ET 200pro modules

2.5 Features and benefits of the ET 200pro EtherNet/IP module

The following table lists the features and benefits of the ET 200pro EtherNet/IP module:

Features	Benefits
Structure	
Finely-graduated modular design: • 4/8/16 channel electronic modules • Power modules • Integrated motor starters	• Function-oriented, cost-optimized station design • Considerable reduction in outlay for configuration and documentation • Space savings due to arbitrary arrangement of the modules
Extensive range of electronic modules	Broad area of application
Communication capacity, system-integrated motor starter: direct and reversing starter to 7.5 kW	PLC inputs and outputs, terminal blocks, circuit breakers and contactors in a plug-in module save space and the effort involved in wiring
Permanent wiring due to the separation of the connection module and electronic components	• Prewiring possible • Module replacement during operation of the ET 200pro EtherNet/IP module ("hot swapping")
DLR media redundancy	Ring structures with Device Level Ring (DLR) support
Individual connection of power modules to common potential	• Individual formation of potential groups • Simple load interruption
Robust structure for rough industrial conditions (10 g vibration resistance)	High operating reliability when mounted directly on the machine, high availability
Connection system	
Integrated voltage buses	Reduced effort required for wiring
Power bus up to 25 A for motor starters	Minimization of wiring in 400 V range
M8, M12, and M23 connections	A change in terminal connection method is not necessary
• 2- and 3-wire connection, or • 2-, 3- and 4-wire connection	Optimal selection on grounds of space and cost
IP65, IP66, and IP67 connection modules	A change in connection method is not necessary
Automatic coding of the I/O modules	Quick and reliable module replacement
Large label plate	Adequate space for clear identification
With motor starters up to safety category 4 in accordance with EN 954-1	Saves money on costly safety equipment

2.6 What is Device Level Ring (DLR)?

A Device Level Ring (DLR) network is a single-fault-tolerant ring network that is intended for the interconnection of automation devices without the need for more switches. This topology is also implemented at the device level. The ring topology offers the following advantages:

- Media redundancy
- Fast-network fault detection and reconfiguration
- Resiliency of a single fault-tolerant network
- Easy implementation without more hardware requirements
- Enhanced machine availability

DLR network

The DLR network includes at least one node configured to be a ring supervisor, and any number of normal ring nodes utilizing embedded switch technology. Ring nodes can be either Beacon-based or Announce-based.

The ZNX:EIP200PRO is a Beacon-based ring node and processes the Beacon frames sent by the ring supervisor. When a fault occurs on the DLR network, the ring nodes reconfigure themselves and re-learn the network topology. Additionally, ring nodes can report fault locations to the active ring supervisor.

For more information about Beacon- and Announce-based ring nodes, see ODVA publication, EtherNet/IP Adaptation of CIP, Vol2_1.22, chapter 9-5 Device Level Ring Protocol.

NOTICE
Important • Depending on your network architecture, DLR topology limitations can exist. Make sure to validate your DLR topology within the larger network before you use it in production. • Do not connect non-DLR devices directly to the network. Non-DLR devices must be connected to the network through secondary devices (for example, an EtherNet network tap) • In a DLR network, you must configure at least one of the supervisor-capable devices as the ring supervisor before physically closing the ring. A backup supervisor is recommended in case of a supervisor fault. • Run all nodes on the DLR network at 100 Mbps and in full-duplex mode. These configuration values provide the best performance. Otherwise, run all nodes in Auto-Negotiate. Do not use Auto-Negotiate on one node and then force the baud rate on the next node linked to it. • Devices running at 10 Mbps should be connected through a network tap using the device port. If you connect a 10 Mbps device directly to the network, instead of through a tap, the linear or DLR network traffic slows to 10 Mbps. Additionally, if the 10 Mbps device is connected to the network without a network tap, network recovery times are significantly impacted.

The ET 200pro EtherNet/IP module 3

3.1 ET 200pro EtherNet/IP module hardware

Hardware configuration

You can operate your ET 200pro EtherNet/IP module in automatic configuration mode, or you can use the EIP ET200 Configuration Tool software to operate in user configured mode.

The software and associated User Reference Guide can be found on the companion disk that shipped with your module, or downloaded from the Siemens Industry Online Support (https://support.automation.siemens.com/cs/?lc=en-US) website.

LED status indicators

The ET 200pro EtherNet/IP module has three bi-color LEDs that provide diagnostic information about the current state of the device and provide an indication of any faults. The LEDs conform to the behaviors defined in the ODVA EtherNet/IP Adaptation of CIP Adapter Specification for the Module Status and Network Status LEDs, and in this manual for I/O Status LEDs.

LED status indicator: Module Status LED

The bi-color Module Status LED indicates the current state of the ET 200pro EtherNet/IP module, as described in the following table:

State	Description
Off	No power applied to device.
Flashing green	• Device has not been configured. • Invalid parameter data. • Mod Status flashing green and Net Status Off - waiting for IP address from DHCP or BOOTP.
Green	Device has initialized successfully and no errors were detected.
Flashing red	Recoverable fault. Device needs commissioning due to configuration error: • Invalid parameter data • Invalid slot configuration data.
Red	Unrecoverable fault detected: hardware failure.

LED status indicator: Network Status LED

The bi-color Network Status LED indicates the current state of the ET 200pro EtherNet/IP communications link, as described in the following table:

State	Description
Off	• Device is powered off, or is powered on but does not have an IP address. • May be waiting for IP address if in DHCP/BOOTP mode.
Flashing green	No connection - an IP address is configured, but no CIP connections are established.
Green	Connected.
Flashing red	One or more CIP connections have timed out.
Red	Duplicate IP address detected.

LED status indicator: I/O Status LED

The bi-color I/O Status LED provides diagnostic information about the current state of the I/O under the control of the ET 200pro EtherNet/IP module, as described in the following table:

State	Description
Off	• All outputs and inputs are inactive. • Configuration errors prevent enabling of inputs/outputs. • No connection. • Device not powered.
Green	Device online with connections established (normal operation, RUN mode).
Flashing green	• Device online with connections established (normal operation, IDLE mode). • Firmware update in progress.
Flashing red	One or more outputs or inputs are faulted when I/O is active.

3.2 Operation

The ET 200pro EtherNet/IP interface module is capable of operating out of the box in Automatic Configuration mode without any special configuration software. Automatic Configuration mode is the default mode.

However, to take full advantage of advanced diagnostics and features, you can operate in User-configured mode by using the EIP ET200 Configuration Tool software.

You can access the Configuration Tool software and associated User Reference Guide in one of two places:

- on the companion disk that shipped with your ET 200pro EtherNet/IP interface module
- on the Siemens Industry Online Support website (https://support.automation.siemens.com/cs/?lc=en-US)

Automatic Configuration mode

When operating in Automatic Configuration mode, the ET 200pro EtherNet/IP module configures its I/O sizes, I/O module parameterization data, and configuration data according to the combination of ET 200pro modules present at power-up or reset. In Automatic Configuration mode:

- Electronic module parameter data cannot be specified. The modules use the default parameters. You must make certain that the default parameters for the modules satisfy your application requirements.
- I/O configuration cannot be verified. The ET 200pro EtherNet/IP module verifies the configuration by examining I/O sizes.

Note that the ET 200pro EtherNet/IP module is unable to differentiate modules of similar configuration types (for example, a 2 A discrete output module as compared to a 0.5 A discrete output module):

- The I/O data format is defined by the combination of modules installed
- I/O module grouping is enabled
- The I/O status byte is enabled

Note

Motor starters require User-configured mode.

User-configured mode

When operating in User-configured mode, the ET 200pro EtherNet/IP module I/O sizes, I/O module parameterization data, and I/O configuration data are stored in nonvolatile memory and accessed via the Slot Object. In User-configured mode:

- You can modify electronic module parameter data, allowing access to more advanced configuration options and diagnostics.
- I/O configuration is verified. Mismatching I/O configurations result in an error.

Note that the ET 200pro EtherNet/IP module is unable to differentiate modules of similar configuration types (for example, a 2 A discrete output module as compared to a 0.5 A discrete output module).

- You can set Slot Object instance attributes (as long as there are no open I/O connections).
- You define the I/O data format by the combination of modules you configure.
- I/O module grouping is available, but you must define it by your configuration selections.

Changes to configuration data

Changes to user configuration data take effect immediately after download without resetting the device.

Changes to user configuration data are stored in nonvolatile memory immediately (before the explicit message response is sent).

Setting the IP address

DHCP is the factory default. When the ET 200pro EtherNet/IP module is using DHCP, you can set IP addresses by using Microsoft Windows and Linux DHCP/BOOTP servers. There are several free servers for Microsoft Windows available for download from the Internet. Use discretion when downloading software from the Internet.

After you set the IP address with DHCP, you can use the EIP ET200 Configuration Tool to set a permanent IP address and turn off DHCP. See the "EIP ET200 Configuration Tool User Reference Guide" for detailed instructions.

I/O status byte

The Adapter Object IO_StatusEnable attribute allows you to enable or disable the generation of an additional I/O status byte to detect faults in the ET 200pro EtherNet/IP. If the IO_StatusEnable attribute is TRUE (1), an additional status byte is placed at the beginning of the input data packet, prior to any electronic module data. In the event of a fault, the status byte is set to 1, and the I/O status LED flashes red while I/O is active.

If the IO_StatusEnable attribute is FALSE (0), the input data packet contains only electronic module data as configured.

Module grouping

The ET 200pro EtherNet/IP module supports grouping electronic module data to enable more efficient data transfer and use of address space. Electronic module data is always grouped in Automatic Configuration mode. See the topic "Configuring the ET 200pro EtherNet/IP module" for details about grouping module data.

Reset behavior

When the ET 200pro EtherNet/IP module is reset, the outputs are deactivated during the short period that the reset is in progress. The unit can be reset in the following ways:

- By cycling of primary device 24 VDC power of the primary device.
- By using the reset function in the EIP ET200 Configuration Tool.
- By sending an explicit EtherNet/IP Reset service message to instance 1 of the Identity Object with service data of 0, 1, or 2. If service data 1 is sent, on reset the module returns to factory default state and any user configuration is lost. If service data 2 is sent, the module returns to the factory default state, but the IP address is maintained.

Note

When network power is removed (or if an I/O connection times out or is lost), outputs go to their configured "substitute" value according to how the parameter is set for each I/O module. The "default" substitute value, which is in effect in Automatic Configuration mode, is to turn off or to zero outputs. Consult the documentation for your specific I/O module for details. To set a non-default substitute value, you must use User-configured mode.

3.3 Parameters for the ET 200pro EtherNet/IP module

Parameter assignment

Parameters for the ET 200pro EtherNet/IP module are set by using the EIP ET200 Configuration Tool software. After loading new parameters into the interface module, the parameters take effect immediately.

The following table describes the parameters of the ET 200pro EtherNet/IP interface module as they appear in the Configuration Tool:

Parameter	Value range	Default
Operation for ref. <> actual conf.	enable disable	disable
Identifier-related diagnostics	enable disable	enable
Submodule status	enable disable	enable
Channel-related diagnostics	enable disable	enable
Option handling	not currently supported	

Parameter description

Operation for ref. <> actual conf.

If this parameter is enabled and:

- You hot-swap an electronic module, this will not cause a failure of the ET 200pro station
- The preset and actual configurations do not match, ET 200pro can still exchange data with the PLC

If this parameter is disabled and:

- You hot-swap an electronic module, this will cause a failure of the ET 200pro station
- The preset and actual configurations do not match, ET 200pro cannot exchange data with the PLC

Identifier-related diagnostics

This parameter has no effect for the ET 200pro EtherNet/IP module. All of the diagnostic data is always available through the Adapter Object.

Submodule status

This parameter has no effect for the ET 200pro EtherNet/IP module. All of the diagnostic data is always available through the Adapter Object.

Channel-related diagnostics

This parameter has no effect for the ET 200pro EtherNet/IP module. All of the diagnostic data is always available through the Adapter Object.

Option handling

This parameter is not currently supported.

3.4 Faults

Configuration faults

Faults in the electronic module configuration and parameterization data are handled slightly differently depending on when they are detected.

Regardless of the detection time, the following occur:

- The Adapter Object AdapterStatus attribute indicates the appropriate code.
- The Identity Object Status attribute indicates a minor recoverable fault.

When the fault is detected at power-up or as a result of a hot swap when no I/O connections are open:

- An attempt to open I/O connections results in a Device State Conflict error.

A fault detected as a result of a hot-swap when one or more I/O connections are open result in the following behavior:

- If the IO_StatusEnable attribute is TRUE, a fault is indicated in the I/O Status byte at the beginning of the input data packet.
- Output data from the scanner is ignored.
- Any attempt to allocate I/O connections is rejected by the device.

You can recover from the configuration fault by:

- Installing or removing I/O modules to make the actual configuration match the user-defined configuration; and/or
- Changing the configuration data to match the actual configuration.

The I/O configuration is reapplied immediately after a configuration download from the EIP ET200 Configuration Tool, and at module startup.

Electronic module faults

When an I/O connection is active, faults in electronic modules are reportedas follows:

- If the IO_StatusEnable attribute is TRUE, a fault is indicated in the I/O Status byte at the beginning of the input data packet.
- The appropriate Slot Object instance SlotStatus attribute and Channel<n>Status attribute(s) indicate the nature of the fault.
- The I/O status LED state is flashing red when I/O is active.

Module hot swap

The ET 200pro distributed I/O system supports removing and inserting one electronic module (one gap) while the device is active on the network without removing power.

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

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

Hot-swapping electronic modules in RUN state is supported only if the "Operation in setpoint <> actual configuration" parameter is enabled for the ET 200pro EtherNet/IP module.

To perform the hot-swap, you will need a size 2 cross-tip (or Phillips) screwdriver and pointed pliers.

To replace an electronic module, follow these steps:

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

To change from one type of electronic module to another, follow these steps:

1. Using the screwdriver, remove the two screws from the front of the connection module from the right side top and bottom.
2. Remove the connection module next to the electronic module from the bus module.
3. While pressing the interlock button on the top of the electronic module, pull the connection module upwards and out of the electronic module.
4. Use the pointed pliers to remove one half of the coding key from the connection module (top right).
5. Insert the appropriate connection module into the replacement electronic module.

6. Insert the connection module with the electronic module into the bus module and screw it down.
7. Change the configuration using the EIP ET200 Configuration Tool and download it to the EtherNet/IP master device.

WARNING

Changing the coding

Changing the coding might result in a mismatch between the ET 200pro EtherNet/IP module and the connection module. This mismatch might cause unexpected machine or process operation which could result in serious personal injury and/or property damage.

WARNING

Deactivate outputs before removing connection modules

Removing connection modules might cause unexpected machine or process operation and result in serious personal injury, damage to the ET 200pro, and damage to other property.

Communication faults

If you are unable to communicate with the ET 200pro EtherNet/IP module, ensure that you have completed the following:

- Check that the appropriate link LED, P1 or P2, is green. If it is off, check the cabling to the network switch. The link LED must be on before proceeding to the next step.
- If the Network Status LED is off, the IP address is not set. If the module is using DHCP (factory default), check that the DHCP server is set up and running correctly. The Network Status LED must be flashing green before proceeding to the next step.
- Perform a List Identity from the EIP ET200 Configuration Tool.
- Ensure that the IP address is unique on the network.
- Ensure that the IP address of the communication partner is on the same IP subnet.

3.5 Troubleshooting

The following sections describe some typical problems and how to address them.

Unable to communicate with the device

See the "Communication faults" section of the previous topic "Faults".

All of the LEDs are off

It is necessary to provide module power via the power terminals on the front of the ET 200pro EtherNet/IP module The module does not attempt to initialize until power is applied to the 24 VDC terminals.

Module Status LED is solid red

If a major unrecoverable fault occurs, the device ceases all communication on the network and the Module Status LED will be solid red. This condition could occur due to a hardware failure that prevents proper operation of the device. Replace the interface module, or contact your Siemens representative.

Module Status LED is flashing red

If the Module Status LED is flashing red, this is most likely due to a configuration error. In automatic configuration mode, this may be due to a module hot swap in which an incorrect module was used in place of the previous module or a new module has not been inserted. In user configured mode, this may indicate that an invalid Adapter parameter combination has been specified or the configuration specified by the module does not match the actual configuration currently connected to the ET 200pro EtherNet/IP module.

Module Status LED is flashing green

The module configuration is correct, but an invalid parameter combination has been assigned for either the ET 200pro EtherNet/IP module or one or more other modules.

Network Status LED is solid red

The device fails the duplicate MAC ID check sequence during power-up due to a conflicting node ID.

To recover, perform one of the following steps:

- If the ET 200pro EtherNet/IP module is using DHCP, change the IP address at the DHCP server and power cycle the module.
- If you are using a configured IP address, modify one of the IP addresses with the EIP ET200 Configuration Tool. You may have to disconnect one of the conflicting devices from the network first.

Network Status LED flashing red

If the Network Status LED is flashing red, one or more I/O connections are in the time-out state. This can be caused by the controller stopping I/O without closing the connection or by a break in EtherNet communications.

I/O Status LED flashing red

If the I/O Status LED is flashing red, one or more of the inputs/outputs are faulted when I/O is active. This only occurs if an I/O connection is open (Network Status LED is solid green). This may be caused by a diagnostic alarm due to a short circuit on an output module, a missing module due to hot swapping, or a missing terminating module.

See also

Faults (Page 25)

3.6 Replacing a faulty ET 200pro EtherNet/IP module

When you download a new configurations or new network parameters to the ET 200pro EtherNet/IP module, the data is stored in internal flash memory.

Replacement procedure

Follow this procedure to replace the ET 200pro EtherNet/IP module:

1. Using the EIP ET200 Configuration Tool, upload the current configuration.
2. Replace the ET 200pro EtherNet/IP module.
3. Power up the replacement module.
4. Restore the connections.
5. Download the configuration to the module.

You can now use the replacement module.

Note

If you are not also replacing the connection module, you can skip steps 1 and 5 above because your data is stored in the connection module flash memory.

3.7 Device profile: supported CIP objects

3.7.1 Identity Object

The following information applies to the Identity Object for the ET 200pro EtherNet/IP interface module.

Class code 0x01
Class attributes 1, 2, 3
Number of instances 1

Instance 1 attributes for Identity Object

Attribute ID	Access rule	Name	Data type	Data value
1	Get	Vendor	UINT	0008_H
2	Get	Device Type	UINT	$000C_H$
3	Get	Product Code	UINT	$23A_H$
4	Get	Revision Major Revision Minor Revision	Struct of: USINT USINT	 Depending on the firmware
5	Get	Status	WORD	Defined in the Device_Status definitions table below
6	Get	Serial Number	UDINT	Unique 32-bit number
7	Get	Product Name String Length ASCII String	Struct of: USINT STRING	 15 EIP200PRO Adapter

Device_Status definitions for Identity Object

Bit(s)	Called	Definition
0	Owned	0 = not owned 1 = the device has an owner
1	Reserved	Always 0
2	Configured	0 = "out-of-box" configuration 1 = configuration modified (not including communications)
3	Reserved	Always 0
4, 5, 6, 7	Extended Device Status	Defined in the "Extended device status description" table below
8	Minor recoverable fault	Minor configuration fault
9	Minor unrecoverable fault	Minor device fault (unrecoverable)
10	Major recoverable fault	Major configuration fault
11	Major unrecoverable fault	Major device fault (unrecoverable)
12, 13	Reserved	Always 0
14, 15	Reserved	Always 0

Extended device status description

Bit(s)	Called	Definition
0	Owned	TRUE indicates the device (or an object within the device) has an owner.
1		Reserved, shall be 0.
2	Configured	TRUE indicates the application of the device has been configured to do something different than the "out-of-box" default. This shall not include configuration of the communications.
3		Reserved, shall be 0.
4 - 7	Extended Device Status	See "Extended Device Status - Bits 4-7" table below.
8	Minor Recoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be recoverable. The problem does not cause the device to go into one of the faulted states. See Note regarding Behavior below.
9	Minor Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be unrecoverable. The problem does not cause the device to go into one of the faulted states. See Note regarding Behavior below.
10	Major Recoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the "Major Recoverable Fault" state. See Note regarding Behavior below.
11	Major Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the "Major Unrecoverable Fault" state. See Note regarding Behavior below.
12-15		Reserved, shall be 0.

Extended Device Status - Bits 4-7

Bits 4-7	Extended Device Status Description
0 0 0 0	Self-testing or Unknown.
0 0 0 1	Firmware update in progress.
0 0 1 0	At least one faulted I/O connection.
0 0 1 1	No I/O connections established.
0 1 0 0	Nonvolatile configuration bad.
0 1 0 1	Major fault - either bit 10 or bit 11 is true (1).
0 1 1 0	At least one I/O connection in run mode.
0 1 1 1	At least one I/O connection established, all in idle mode.
1 0 0 0 1 0 0 1	Reserved, shall be 0.
1 0 1 0 thru 1 1 1 1	Vendor/product specific.

Note

Behavior after a fault

A device may not be able to communicate in the Major Unrecoverable Fault state. Therefore, it might not be able to report a Major Unrecoverable Fault. It will not process a Reset service. The only exit from a Major Unrecoverable Fault is to cycle power.

Common services for Identity Object

Service code	Implemented for		Service name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x05	Yes	Yes	Reset
0x01	Yes	Yes	Get_Attributes_All

3.7.2 Assembly Object

The following information applies to the Assembly Object for the ET 200pro EtherNet/IP module.

Class code	0x04
Class attributes	1, 2, 3
Number of instances	4

Class attributes for Assembly Object

Attribute ID	Access rule	Description	Data type	Default value
1	Get	Revision of this object	UINT	0x0002
2	Get	Maximum instance	UINT	0x0069
3	Get	Number of instances	UINT	0x0004

Instance attributes for Assembly Object:

Instance 101 (65_{hex}): Input Assembly

Attribute ID	Access rule	Description	Data type	Default value
3	Get	Input Data	ARRAY of BYTE	---

Instance 102 (66_{hex}): Output Assembly

Attribute ID	Access rule	Description	Data type	Default value
3	Set	Output Data	ARRAY of BYTE	---

Instance 103 (67_{hex}): Config Assembly

Attribute ID	Access rule	Description	Data type	Default value
3	Get	Configuration data	ARRAY of BYTE	---

Instance 198 ($C6_{hex}$): Input Only

This instance is used to establish a connection when no outputs are to be addressed or when inputs, which are already being used in an exclusive owner connection, are to be interrogated. The data length of this instance is always zero.

Instance 199 ($C7_{hex}$)

This instance is used to establish a connection based on an existing exclusive owner connection. The new connection also has the same transmission parameters as the exclusive owner connection. When the exclusive owner connection is cleared, this connection, too, is automatically cleared. The data length of this instance is always zero.

Common services for Assembly Object

Service code	Service available		Service name	Description
	Class	Instance		
0x0E	Yes	Yes	Get_Attribute_Single	Supplies contents of the appropriate attribute
0x10	No	Yes	Set_Attribute_Single	Modifies an attribute value

3.7.3 Connection Manager Object

The following information applies to the Connection Manager Object for the ET 200pro EtherNet/IP module.

Class code 0x06
Class attributes 1, 2, 3
Number of instances 1

Instance 1 attributes for Connection Manager Object

Attribute ID	Need in implem	Access rule	NV	Name	Data type	Description
1	Optional	Set [1]	V	Open Requests	UINT	Number of Forward Open service requests received.
2	Optional	Set [1]	V	Open Format Rejects	UINT	Number of Forward Open service requests which were rejected due to bad format.
3	Optional	Set [1]	V	Open Resource Rejects	UINT	Number of Forward Open service requests which were rejected due to lack of resources.
4	Optional	Set [1]	V	Open Other Rejects	UINT	Number of Forward Open service requests which were rejected for reasons other than bad format or lack of resources.
5	Optional	Set [1]	V	Close Requests	UINT	Number of Forward Close service requests received.
6	Optional	Set [1]	V	Close Format Requests	UINT	Number of Forward Close service requests which were rejected due to bad format.
7	Optional	Set [1]	V	Close Other Requests	UINT	Number of Forward Close service requests which were rejected for reasons other than bad format.
8	Optional	Set [1]	V	Close Timeout	UINT	Total number of connection timeouts that have occurred in connections controlled by this Connection Manager.

[1] A device may reject a Set request to this attribute using General Status Code 0x09 (Invalid Attribute Value) if the attribute value sent is not zero.

Common services for Connection Manager Object

Service code	Implemented for		Service name
	Class	Instance	
0x01	Yes	Yes	Get_Attributes_All
0x0E	Yes	Yes	Set_Attribute_Single

3.7.4 TCP/IP Interface Object

The TCP/IP Interface Object provides the mechanism to configure the ET 200pro EtherNet/IP TCP/IP network interface. Examples of configurable items include the device's IP address, network mask, gateway address, and host name.

Class attributes 1, 2, 3
Class services 0x1, 0xE, 0x10
Instance attributes 1, 2, 3, 4, 5, 6, 12, 13
Instance services 0x1, 0xE, 0x10

Class attributes for TCP/IP Interface Object

Attribute ID	Access rule	Description	Data type	Default value
1	Get	Revision	UINT	0x0001
2	Get	Maximum number of instances	UINT	0x0001
3	Get	Number of instances	UINT	0x0001

Instance attributes for TCP/IP Interface Object

Attribute ID	Access rule	Description	Data type	Default value	Semantics of values
1	Get	Interface status (Status)	DWORD	0x00000002	See table below: "Table for Interface status, attribute 1"
2	Get	Interface capability flags (Configuration Capability)	DWORD	0x00000015	Bit 0: BOOTP Client (false) Bit 1: DNS Client (true) Bit 2: DHCP Client (true) Bit 3: DHCP-DNS Update (false = device is not capable of sending its host name in the DHCP request) Bit 4: Configuration Settable (true = Interface control flags are settable, see attribute 3) Bit 5-31: reserved
3	Set	Interface control flags (Configuration Control)	DWORD	0x00000000	Bit 0-3: Startup Configuration (0 – as stored in flash, 1 = via BOOTP, 2 = via DHCP, 3-15 = reserved) Bit 4: DNS Enable (false)

Attribute ID	Access rule	Description	Data type	Default value	Semantics of values
4	Get	Path to physical link object	STRUCT of:		Identifies the object associated with underlying physical communication object.
		Size of path	UINT	0x0002	Number of 16 bit words in path.
		Logical segments identifying the physical link	Padded EPATH	Class: = 0xF6 Instance = 1	Path address of the internal port of the embedded switch.
5	Set	TCP/IP network interface configuration	STRUCT of:		Contains parameters required to operate as a TCP/IP node. In order to prevent incomplete or incompatible configuration, the parameters cannot be set individually. The user should first Get this attribute, change the desired parameters, then Set the attribute.
		IP address	UDINT	Device's IP address	Value of 0 indicates no IP address has been configured. Otherwise a valid Class A, B, or C address shall be set and shall not be set to the loopback address (127.0.0.1).
		Network mask	UDINT	Device's network mask	Value of 0 indicates no network mask address has been configured.
		Gateway address	UDINT	Default gateway address	Value of 0 indicates no IP address has been configured. Otherwise a valid Class A, B, or C address shall be set and shall not be set to the loopback address (127.0.0.1).
		Primary name server	UDINT	0x00000000	Value of 0 indicates no name server address has been configured. Otherwise a valid A, B, or C address shall be set.
		Secondary name server	UDINT	0x00000000	Value of 0 indicates no secondary name server address has been configured. Otherwise a valid A, B, or C address shall be set.

Attribute ID	Access rule	Description	Data type	Default value	Semantics of values
		Domain name	STRING	0x0000 (length = 0, empty STRING)	ASCII characters. Maximum length is 48 characters. Shall be padded to an even number of characters (pad not included in length). A length of 0 indicates no domain name is configured.
6	Set	Host name	STRING	0x00E (length = 14) plus hex equivalent of "br+MAC" (2+12 digits)	ASCII characters. Maximum length is 48 characters. Padded to an even number of characters (pad not included in length). A length of 0 indicates no host name is configured.
12	Set	Ethernet/IP QuickConnect	BOOL	0	0 = disabled 1 = enabled
13	Set	Encapsulation Inactivity Timeout	UINT	120	0 = disabled 1-3600 = timeout in seconds

Table for "Interface status", Attribute 1

Bit(s):	Called:	Definition	
0 - 3	Interface Configuration Status	Indicates the status of the Interface Configuration attribute.	0 = The Interface Configuration attribute has not been configured 1 = The Interface Configuration attribute contains valid configuration obtained from BOOTP, DHCP, or non-volatile storage. 2 = The Interface Configuration attribute contains valid configuration, obtained from hardware settings (for example, pushwheel, thumbwheel, etc.) 3 - 15 = Reserved for future use
4	Mcast Pending	Indicates a pending configuration change in the TTL Value and/or McastConfig attributes. This bit is set when either the TTL Value or McastConfig attribute is set, and cleared the next time the device starts.	
5 - 31	Reserved	Reserved for future use and set to zero.	

Common services for TCP/IP Interface Object

Service code	Service available		Service name	Description
	Class	Instance		
0x01	Yes	Yes	Get_Attribute_All	Supplies contents of all attributes
0x0E	Yes	Yes	Get_Attribute_Single	Supplies contents of the appropriate attribute
0x10	No	Yes	Set_Attribute_Single	Modifies an attribute value

3.7.5 EtherNet Link Object

The EtherNet Link Object maintains link-specific counters and status information for an IEEE 802.3 communications interface. The ET 200pro EtherNet/IP has an embedded 2-port switch and has one instance of the EtherNet Link Object for the internally accessible interface.

Values set in Instance 1 Attribute 6 apply to both ports.

Class attributes 1, 2, 3
Class services 0x1, 0xE, 0x10
Instance attributes 1, 2, 3, 4, 5, 6, 7, 8, 10, 11
Instance services 0x1, 0xE, 0x10
Number of instances 2

Class attributes for EtherNet Link Object

Attribute ID	Access rule	Name	Description	Data type	Semantics of values
1	Get	Revision	Revision of this object	UINT	1 = the minimum value. ≥ 2 = if instance attribute 6 is implemented. 3 = the maximum value.
2	Get	Max Instance	Maximum instance number of an object currently created in this class level of the device	UINT	The largest instance number of a created object at this class hierarchy level.
3	Get	Number of Instances	Number of object instances currently created at this class level of the device	UINT	The number of object instances at this class hierarchy level.

Instance 1 attributes for EtherNet Link Object

Attribute ID	Access rule	Name	Description	Data type	Semantics of values
1	Get	Interface Speed	Interface speed currently in use	UDINT	Speed in Mbps (10, 100, etc.).
2	Get	Interface Flags	Interface status flags	DWORD	Bit map of interface flags. See Table "Interface Flags attribute" below.
3	Get	Physical Address	MAC layer address	ARRAY of 6 USINTs	MAC layer address in the format "XX-XX-XX-XX-XX-XX."
4	Get	Interface counters	Relevant to the receipt of packets	STRUCT of:	See section "Interface Counters" below.
5	Get	Media counters	Media-specific counters	STRUCT of:	See section "Media Counters" below.
6	Set	Interface Control	Configuration for physical interface	STRUCT of:	See section "Interface Control" below.
		Control Bits	Interface Control Bits	WORD	----
		Forced Interface Speed	Speed at which the interface shall be forced to operate	UINT	Speed in Mbps (10, 100, etc.).
7	Get	Interface Type	Type of interface: twisted pair, fiber, internal, etc.	USINT	----
8	Get	Interface State	Current state of the interface: operational, disabled, etc.	USINT	----
10	Get	Interface Label	Human readable identification	SHORT_ STRING	----

Attribute ID	Access rule	Name	Description	Data type	Semantics of values
11	Get	Interface Capability	Indication of capabilities of the interface	STRUCT of:	----
		Capability Bits	Interface capabilities, other than speed/duplex	DWORD	Bit map
		Speed/Duplex Options	Indicates speed/duplex pairs supported in the Interface Control attribute	STRUCT of:	----
			Speed/Duplex Array Count	USINT	Number of Elements
			Speed/Duplex Array	ARRAY of STRUCT of:	----
			Interface Speed	USINT	Semantics are the same as for the Forced Interface Speed in the Interface Control attribute: speed in Mbps.
			Interface Duplex Mode	USINT	0 = half duplex 1 = full duplex 2-255 = Reserved

Interface Flags attribute

Bit(s):	Called:	Definition
0	Link Status	Indicates whether the IEEE 802.3 communications interface is connected to an active network: 0 = inactive link. 1 = active link. The determination of link status is implementation specific.
1	Half/Full Duplex	Indicates the duplex mode currently in use: 0 = interface is running half duplex. 1 = interface is running full duplex. Note that if the Link Status flag is 0, the value of the half/full duplex flag is indeterminate.
2 - 4	Negotiation Status	Indicates the status of link autonegotiation: 0 = autonegotiation in progress. 1 = autonegotiation and speed detection failed. Using default values for speed and duplex. 2 = autonegotiation failed but detected speed. Duplex was faulted. 3 = successfully negotiated speed and duplex. 4 = autonegotiation not attempted. Forced speed and duplex.
5	Manual Setting Requires Reset	0 = interface can activate changes to link parameters (autonegotiate, duplex mode, interface speed) automatically. 1 = device requires a Reset service be issued to its Identity Object in order for the changes to take effect.
6	Local Hardware Fault	0 = interface detects no local hardware fault. 1 = local hardware fault detected.
7 - 31	Reserved	Set to 0.

Interface Counters (STRUCT of):

Name	Data Type	Description of Attribute
In Octets	UDINT	Octets received on the interface
In Ucast Packets	UDINT	Unicast packets received on the interface
In NUcast Packets	UDINT	Non-unicast packets received on the interface
In Discards	UDINT	Inbound packets received on the interface but discarded
In Errors	UDINT	Inbound packets that contain errors (does not include In Discards)
In Unknown Protos	UDINT	Inbound packets with unknown protocol
Out Octets	UDINT	Octets sent on the interface
Out Ucast Packets	UDINT	Unicast packets sent on the interface
Out NUcast Packets	UDINT	Non-unicast packets sent on the interface
Out Discards	UDINT	Outbound packets discarded
Out Errors	UDINT	Outbound packets that contain errors

Media Counters (STRUCT of):

Name	Data Type	Description of Attribute
Alignment Errors	UDINT	Frames received that are not an integral number of octets in length
FCS Errors	UDINT	Frames received that do not pass the FCS check
Single Collisions	UDINT	Successfully transmitted frames which experienced exactly one collision
Multiple Collisions	UDINT	Successfully transmitted frames which experienced more than one collision
SQE Test Errors	UDINT	Number of times SQE test error message is generated
Deferred Transmission	UDINT	Frames for which first transmission attempt is delayed because the medium is busy
Late Collisions	UDINT	Number of times a collision is detected later than 512 bit-times into the transmission of a packet
Excessive Collisions	UDINT	Frames for which transmission fails due to excessive collisions.
MAC Transmit Errors	UDINT	Frames for which transmission fails due to an internal MAC sublayer transmit error.
Carrier Sense Errors	UDINT	Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Frame Too Long	UDINT	Frames received that exceed the maximum permitted frame size
MAC Receive Errors	UDINT	Frames for which reception on an interface fails due to an internal MAC sublayer receive error

Interface Control attribute

The Interface Control attribute is a structure consisting of Forced Interface Speed and Control Bits.

If the autonegotiate bit is 0, the Forced Interface Speed bits indicate the speed at which the interface operates. Speed is specified in megabits per second; for example, for 10 Mbps EtherNet, the Interface Speed is 10. Interfaces not supporting the requested speed return 0x09 (Invalid Attribute Value). If autonegotiation is enabled, attempting to set the Forced Interface Speed results in a response of 0x0C (Object State Conflict).

Control Bits operate as follows:

Bit(s)	Called:	Definition
0	Autonegotiate	0 = 802.3 link autonegotiation is disabled. 1 = autonegotiation is enabled. If autonegotiation is disabled, the device uses the settings indicated by the Forced Duplex Mode and Forced Interface Speed bits.
1	Forced Duplex Mode	If the Autonegotiate bit is 0, the Forced Duplex Mode bit indicates whether the interface operates in full or half duplex mode. 0 = half duplex. 1 = full duplex. Interfaces not supporting the requested duplex return 0x09 (Invalid Attribute Value). If autonegotiation is enabled, attempting to set the Forced Duplex Mode bits results in a response of 0x0C (Object State Conflict).

Interface Capability

The Interface Capability attribute indicates the set of capabilities for the interface. The attribute is a structure with two main elements: Capability Bits and Speed/Duplex Options.

Bit(s)	Called:	Definition
0	Manual Setting Requires Reset	Indicates whether or not the device requires a reset to apply changes made to the Interface Control attribute (#6). 0 = Indicates the device automatically applies changes made to the Interface Control attribute (#6) and does not require a reset for changes to take effect. This is the value this bit has when the Interface Control attribute (#6) is not implemented. 1 = Indicates the device does not automatically apply changes made to the Interface Control attribute (#6) and, requires a reset in order for changes to take effect. Note: this bit is also replicated in the Interface Flags attribute (#2) to retain backwards compatibility with previous object revisions.
1	Auto Negotiate	0 = Indicates the interface does not support link auto-negotiation. 1 = Indicates the interface supports link auto-negotiation.
2	Auto-MDIX	0 = Indicates the interfaces does not support auto MDIX operation. 1 = Indicates the interface supports auto MDIX operation.
3	Manual Speed/Duplex	0 = Indicates the interface does not support manual setting of speed/duplex. The Interface control attribute (#6) is not supported. 1 = Indicates the interface supports manual setting of speed/duplex via the Interface Control attribute (#6).
4-31	Reserved	Set to 0

Common services for EtherNet Link Object

Service code	Need in implementation		Service name	Description
	Class	Instance		
0x01	Optional	Optional	Get_Attribute_All	Supplies contents of all attributes.
0x0E	Conditional	Required	Get_Attribute_Single	Supplies contents of the appropriate attribute.
0x10	N/A	Conditional	Set_Attribute_Single	Modifies a single attribute.

3.7.6 Device Level Ring (DLR) Object

Device Level Ring (DLR) Object

The Device Level Ring (DLR) Object provides the configuration and status information interface for the DLR protocol. The DLR protocol is a layer 2 protocol that enables the use of an Ethernet ring topology.

Class Code	0x47
Class attributes	1, 2, 3
Class services	0x1, 0xE
Instance attributes	1, 2, 10, 12
Instance services	0x1, 0xE
Number of Instances	1

Class attributes

Attribute ID	Access rule	Name	Description	Data type	Default value
1	Get	Revision	Revision of this object[1]	UINT	0x0001
2 to 7	These class attributes are optional and are described in Volume 1, Chapter 4 of the CIP Common specifications.				

[1] Conditional: Required if the Revision value is greater than 1.

Instance attributes

Attribute ID	Access rule	Name	Data type	Description of Attribute	Semantics of values
1	Get required	Network Topology	USINT	Current network topology mode	0 - indicates "Linear" 1 - indicates "Ring"
2	Get Required	Network Status	USINT	Current status of network	0 - indicates “Normal” 1 - indicates “Ring Fault” 2[1] - indicates “Unexpected Loop Detected” 3 - indicates “Partial Network Fault” 4 - indicates “Rapid Fault/Restore Cycle”
10	Get Required	Active Supervisor Address	STRUCT of:	IP and/or MAC address of the active ring supervisor	---
			UDINT	Supervisor IP Address	A value of 0 indicates no IP Address has been configured for the device
			ARRAY of 6 USINTs	Supervisor MAC Address	Ethernet MAC address
12	Get Required	Capability Flags	DWORD	Describes the DLR capabilities of the device	---

[1] If the device is capable of detecting reception of frames that it sent, it shall report the “Unexpected Loop Detected” value. Not supported by EtherNet/IP ET 200pro.

3.7.7 Quality of Service (QoS)

Quality of Service (QoS) is a general term that is applied to mechanisms used to treat traffic streams with different relative priorities or other delivery characteristics. Standard QoS mechanisms include IEEE 802.1D/Q (Ethernet frame priority) and Differentiated Services (DiffServ) in the TCP/IP protocol suite.

The QoS Object provides a means to configure certain QoS-related behaviors in EtherNet/IP devices.

Class Code	0x48
Class attributes	1, 2, 3
Class services	0x1, 0xE
Instance attributes	4, 5, 6, 7, 8
Instance services	0x1, 0xE, 0x10
Number of Instances	1

Class attributes

The QoS object supports the following class attributes:

Attribute ID	Access rule	Description	Data type	Default value
1	Get	Revision	UINT	0x0001
2	Get	Maximum number of instances	UINT	0x0001
3	Get	Number of instances	UINT	0x0001

Instance attributes

Attribute ID	Access rule	Name	Data type	Description of Attribute	Semantics of values
4	Set	DSCP Urgent	USINT	DSCP value for CTP transport class 0/1 priority messages	
5	Set	DSCP Schedule	USINT	DSCP value for CIP transport class 0/1 Scheduled priority messages	
6	Set	DSCP High	USINT	DSCP value for CIP transport class 0/1 High priority messages	
7	Set	DSCP Low	USINT	DSCP value for CIP transport class 0/1 low priority messages	
8	Set	DSCP Explicit	USINT	DSCP value for CIP explicit messages (transport class 2/3 and UCMM) and all other EtherNet/IP encapsulation messages	

Note

A change to the value of the above attributes takes effect the next time the device restarts.

Common Services

The QoS object provides the following common services:

Service code	Need in Implementation		Service Name	Description of Service
	Class	Instance		
0x01	Optional	N/A	Get_attributes_All	See Volume 1, Appendix A
0x0E	Conditional[1]	Required	Get_Attribute_Single	See Volume 1, Appendix A
0x10	N/A	Required	Set_Attribute_Single	See Volume 1, appendix A

[1] Required if any class attributes are implemented.

3.8 Device profile: vendor-specific objects

3.8.1 Adapter Object

The Adapter Object provides the external configuration and monitoring interface to the ET 200pro EtherNet/IP.

Class code 0x64
Class attributes No attributes are supported for the Adapter Object at the class level.
Number of instances 1

Instance 1 attributes of the Adapter Object

Attribute ID	Access rule	Name	Data type	Data value
1	Get	AdapterStatus	USINT	Adapter Status (see AdapterStatus details table).
2	Get	InputSize	USINT	Currently configured input assembly size.
3	Get	OutputSize	USINT	Currently configured output assembly size.
4	Get/Set [2]	AutoConfig	BOOL	Automatic Configuration mode 1: Automatic configuration: the rack self-configures based on the modules installed (factory default). 0: Manual configuration: the rack configuration is stored in nonvolatile memory.
5	Get	ConfigChanged	BOOL	True if manual configuration changes have been made but have not taken effect.
6	Get	Diagnostic String	Array of USINT [65]	An array of USINT containing slot diagnostics. The first byte of the array indicates the number of valid diagnostic bytes within the array (the remaining bytes within the array can be ignored).
7	Get	ConfiguredSlots	USINT	Indicates the number of configured slot objects.
8	Get/Set [2]	HeadParameters	Array of USINT [19]	Configuration information for the adapter module.
9	Get/Set [2]	IO_StatusEnable	BOOL	Enables the generation of an I/O status byte at the beginning of the input data I/O packet. Factory default = enabled.
10	Get/Set [2]	HeadParamByte1	USINT	Parameter bytes for electronic module and adapter module behavior.
11	Get/Set [2]	HeadParamByte2	USINT	
12	Get/Set [2]	HeadParamByte3	USINT	
13	Get/Set [2]	HeadParamByte4	USINT	
14	Get/Set [2]	HeadParamByte5	USINT	
15	Get/Set [2]	HeadParamByte6	USINT	
16	Get/Set [2]	HeadParamByte7	USINT	

Attribute ID	Access rule	Name	Data type	Data value
17	Get/Set [2]	HeadParamByte8	USINT	
18	Get/Set [2]	HeadParamByte9	USINT	
19	Get/Set [2]	HeadParamByte10	USINT	
20	Get/Set [2]	HeadParamByte11	USINT	
21	Get/Set [2]	HeadParamByte12	USINT	
22	Get/Set [2]	HeadParamByte13	USINT	
23	Get/Set [2]	HeadParamByte14	USINT	
24	Get/Set [2]	HeadParamByte15	USINT	
25	Get/Set [2]	HeadParamByte16	USINT	
26	Get/Set [2]	HeadParamByte17	USINT	
27	Get/Set [2]	HeadParamByte18	USINT	
28	Get/Set [2]	HeadParamByte19	USINT	
29	Reserved			
30	Reserved			
31	Reserved			
32	Get	Firmware version String Length ASCII String	Struct of: USINT STRING	Firmware version
33	Get	Serial Number String Length ASCII String	Struct of: USINT STRING	Serial number

[1] Length of data [...] array does not include data.

[2] When an I/O connection is open: setting this attribute returns Device_State_Conflict.

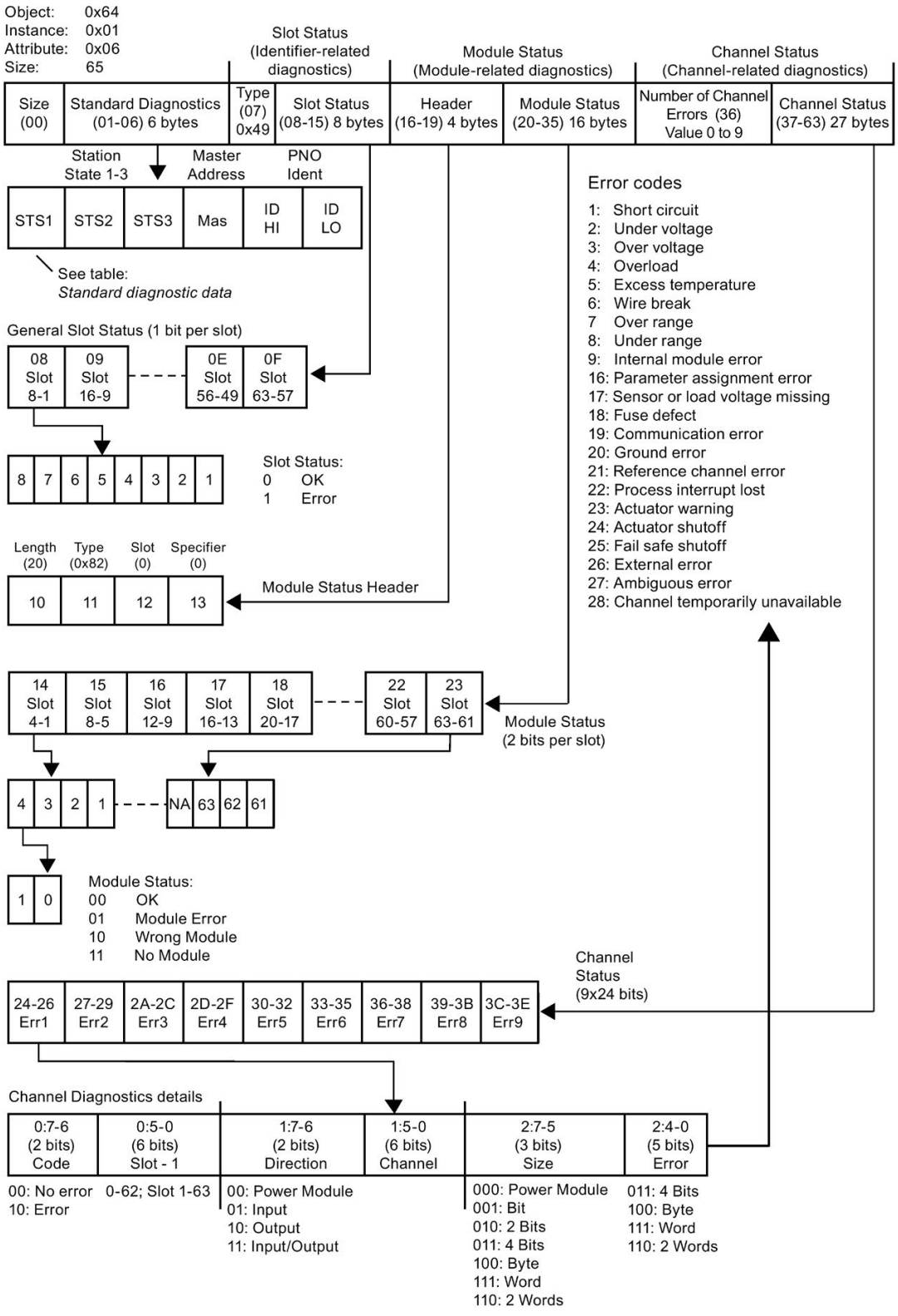
Attribute 1 [AdapterStatus] details

Object	0x64
Instance	0x01
Attribute	0x06
Size	65

The AdapterStatus attribute reports the status of the ET 200pro EtherNet/IP and electronic modules:

Bit(s)	Name	Description
0		Reserved
1	Parameters rejected	One or more modules rejected the parameters specified by its slot object.
2	Configuration rejected	One or more modules rejected the configuration byte specified by its slot object.
3	Electronic module diagnostics	One or more modules is reporting an error.
4 - 7		Reserved

ET 200pro EtherNet/IP module Attribute 6 [Diagnostic String] details



Adapter Object: Standard diagnostic data

Byte 0	Station state 1
Byte 1	Station state 2
Byte 2	Station state 3
Byte 3	Master address
Byte 4	Ident number (low)
Byte 5	Ident number (high)

The structure of the standard diagnostic data is as follows:

Byte	Bit(s)	Description
0	0, 1	Not used
	2	CfgFault: configuration data mismatch
	3	ExtDiag: extended Diagnostic data available and valid
	4 - 7	Not used
1	0	Not used
	1	Bus error or > 16 modules
	2 - 7	Not used
2	0 - 6	Not used
	7	ExtDiagOverflow: extended diagnostic data overflow
3, 4, 5		Not used

Attribute 9 [IO_StatusEnable] details

The IO_StatusEnable attribute enables/disables the generation of a single I/O status byte at the beginning of the input data I/O packet. This status byte indicates if any faults have occurred which would result in invalid data. The default value for Attribute 9 is enabled (1).

The format of the I/O status byte is shown below:

7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	Fault

Attributes 10-28 [HeadParamByte(n)] details

The HeadParamByte attributes provide single byte (USINT) access to the elements of the HeadParameters attribute (attribute 8) for access via tools not supporting complex data type representation. Modification of the HeadParameters will affect all the corresponding HeadParamByte attributes and vice versa.

Common services for the Adapter Object

Service code	Implemented for		Service name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

3.8.2 Slot Object

The following information applies to the Slot Object for the ET 200pro EtherNet/IP module. The Slot Object provides the external configuration and monitoring interface to the I/O module in one slot. One instance of this object exists for each available slot.

Class code 0x65
Class attributes No attributes are supported for the Slot Object at the class level.
Number of instances 63

Instance attributes of the Slot Object

Attribute ID	Access rule	Name	Data type	Data value
1	Get / Set[1,2]	ModuleReference	UINT	For Configuration Tool use.
2	Get / Set[1,2]	ParameterSize	USINT	Number of parameter bytes required by this slot (max. 32).
3	Get / Set[1,2]	Parameters	Array of USINT	Parameter bytes for this slot: array size is set by Attribute 2.
4	Get / Set[1,2]	ConfigByte	USINT	Configuration byte for this slot.
5	Get	SlotStatus	USINT	Slot status code (see Attribute 5 table).
6	Get	Channel0Status	USINT	Channel Status code (see Attribute 6-13 table).
7	Get	Channel1Status	USINT	
8	Get	Channel2Status	USINT	
9	Get	Channel3Status	USINT	
10	Get	Channel4Status	USINT	
11	Get	Channel5Status	USINT	
12	Get	Channel6Status	USINT	
13	Get	Channel7Status	USINT	

Attribute ID	Access rule	Name	Data type	Data value
14	Get	Channel0Type	USINT	Channel Type code (see Attribute 14-21 table). The Channel Type code is zero if the corresponding Channel Status code is zero.
15	Get	Channel1Type	USINT	
16	Get	Channel2Type	USINT	
17	Get	Channel3Type	USINT	
18	Get	Channel4Type	USINT	
19	Get	Channel5Type	USINT	
20	Get	Channel6Type	USINT	
21	Get	Channel7Type	USINT	
22	Get / Set[1,2]	ParamByte1	USINT	Parameter bytes for this slot: Number actually used is set by Attribute 2.
23	Get / Set[1,2]	ParamByte2	USINT	
24	Get / Set[1,2]	ParamByte3	USINT	
25	Get / Set[1,2]	ParamByte4	USINT	
26	Get / Set[1,2]	ParamByte5	USINT	
27	Get / Set[1,2]	ParamByte6	USINT	
28	Get / Set[1,2]	ParamByte7	USINT	
29	Get / Set[1,2]	ParamByte8	USINT	
30	Get / Set[1,2]	ParamByte9	USINT	
31	Get / Set[1,2]	ParamByte10	USINT	
32	Get / Set[1,2]	ParamByte11	USINT	
33	Get / Set[1,2]	ParamByte12	USINT	
34	Get / Set[1,2]	ParamByte13	USINT	
35	Get / Set[1,2]	ParamByte14	USINT	
36	Get / Set[1,2]	ParamByte15	USINT	
37	Get / Set[1,2]	ParamByte16	USINT	
38	Get / Set[1,2]	ParamByte17	USINT	
39	Get / Set[1,2]	ParamByte18	USINT	
40	Get / Set[1,2]	ParamByte19	USINT	
41	Get / Set[1,2]	ParamByte20	USINT	
42	Get / Set[1,2]	ParamByte21	USINT	
43	Get / Set[1,2]	ParamByte22	USINT	
44	Get / Set[1,2]	ParamByte23	USINT	
45	Get / Set[1,2]	ParamByte24	USINT	
46	Get / Set[1,2]	ParamByte25	USINT	
47	Get / Set[1,2]	ParamByte26	USINT	
48	Get / Set[1,2]	ParamByte27	USINT	

Attribute ID	Access rule	Name	Data type	Data value
49	Get / Set[1,2]	ParamByte28	USINT	
50	Get / Set[1,2]	ParamByte29	USINT	
51	Get / Set[1,2]	ParamByte30	USINT	
52	Get / Set[1,2]	ParamByte31	USINT	
53	Get / Set[1,2]	ParamByte32	USINT	

1 When Adapter Object AutoConfig attribute is true: These attributes reflect the nonvolatile configuration parameters and are not used by the Adapter.

2 When an I/O connection is open, setting this attribute returns Device_State_Conflict.

Attribute 5 [SlotStatus] details

The SlotStatus attribute, listed in the table below, reports the operating status of the module installed:

Status code	Text	Description
0	OK	Module is operating normally.
1	Module error	
2	Wrong module	
3	No module	Slot is empty - no module installed.
4 - 255		Reserved

Attribute 6-13 [Channel<n>Status] details

The Channel<n>Status attributes, listed in the following table, report the operating status of each channel in the module:

Status code	Text
1	Short circuit
2	Under voltage
3	Over voltage
4	Overload
5	Excess temperature
6	Wire break
7	Over range
8	Under range
9	Internal module error
16	Parameter assignment error
17	Sensor or load voltage missing
18	Fuse defect
19	Communication error
20	Ground error
21	Reference channel error
22	Process interrupt lost
23	Actuator warning
24	Actuator shutoff
25	Fail-safe shutoff
26	External error
27	Ambiguous error
28	Channel temporarily unavailable

Attribute 14-21 [Channel<n>Type] details

The Channel<n>Type attributes, listed in the following table, provide additional detail when the corresponding Channel<n>Status is reporting an error.

Status code	Text	Description
0	N/A	Reported when corresponding Channel<n>Status is reporting "No error"
1	Bit	1-bit channel
2	2 Bit	2-bit channel
3	4 Bit	4-bit channel
4	Byte	8-bit channel
5	Word	16-bit channel
6	2 Word	32-bit channel
7 - 255		Reserved

Attribute 22-53 [ParamByte(n)] details

The ParamByte attributes provide single byte (USINT) access to the first 32 elements of the Parameters attribute (Attribute 3) for access via tools not supporting complex data type representation. Modification of the Parameters attribute will affect all the corresponding ParamByte attributes and vice versa. The EIP200pro EtherNet/IP Adapter limits the slot object's ParameterSize attribute to a maximum value of 32.

Common services for the Slot Object

Service code	Implemented for		Service name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

3.9 Technical specifications

SIMATIC interface module ET 200pro EtherNet/IP interface module: 2 EtherNet ports with M12 connectors; up to 1 m width connectable to a maximum of 16 power, electronic, or motor starter modules.

SUPPLY VOLTAGE	
Rated	24 V
Lower limit	20.4 V
Upper limit	28.8 V
INPUT CURRENT	
From supply voltage 1L+, max.	400 mA (dependent on connection module, typ.
POWER LOSSES	
Power loss, typ.	6 W
ADDRESS AREA	
Addressing volume	
Outputs	255 bytes
Inputs	255 bytes
INTERFACES	
Supports protocol for EtherNet/IP	
Automatic detection of transmission speed	Yes
Transmission rate, max.	100 Mbps
M12 (2 ports)	Yes
PROTOCOLS	
Supports protocol for EtherNet/IP	Yes
INTERRUPTS/DIAGNOSTICS/STATUS INFORMATION	
Diagnoses	
Diagnostic functions	Yes
Diagnostics indication LED	
Module Status, Network Status, and I/O Status LEDs	Yes
Monitoring 24 V voltage supply ON (green)	Yes
24 VDC power LED	Yes
Connection to network P1 LINK (green)	Yes
Connection to network P2 LINK (green)	Yes
GALVANIC ISOLATION	
Between backplane bus and electronics	No
Between supply voltage and electronics	Yes
Between EtherNet and electronics	Yes

DIMENSIONS	
Width	135 mm
Height	130 mm
Depth	59.3 mm
WEIGHT	
Weight, approx.	490 g

Installing, mounting, and connecting 4

4.1 Installing

Simple installation

The ET 200pro distributed I/O system is designed for simple installation. The wide range of products available for the ET 200pro system give you many options for configuring your application.

Installation position

The preferred installation position for the ET 200pro EtherNet/IP module is horizontal on a vertical wall. Any other installation position is also possible.

Installing on a rack

You can preassemble your ET 200pro modules on a narrow or wide rack before you install the rack on your site.

For details on rack installation, see the "Rack" chapter of the SIMATIC ET 200pro distributed I/O system Operating Instructions manual. You can access the manual on the companion disk that shipped with your product. You can also access the manual on the Siemens Industry Online Support (https://support.automation.siemens.com/cs/?lc=en-US) website.

4.2 Mounting

The ET 200pro EtherNet/IP interface module connects the ET 200pro system with EtherNet I/O and supplies power to the electronic modules.

Mounting details

For details on mounting the ET 200pro EtherNet/IP module and other components of the ET 200pro system, see the "Mounting" chapter of the "SIMATIC ET 200pro distributed I/O system Operating Instructions" manual. You can access the manual on the companion disk that shipped with your product. You can also access the manual on the Siemens Industry Online Support (https://support.automation.siemens.com/cs/?lc=en-US) website.

4.3 Connecting

There are connection guidelines that you must follow to ensure safe operation of the ET 200pro EtherNet/IP module and the ET 200pro system.

Connection details

For details on connecting the ET 200pro EtherNet/IP module and other components of the ET 200pro system, see the "Connection" chapter of the "SIMATIC ET 200pro distributed I/O system Operating Instructions" manual. You can access the manual on the companion disk that shipped with your product. You can also access the manual on the Siemens Industry Online Support (https://support.automation.siemens.com/cs/?lc=en-US) website.

Commissioning 5

5.1 Configuring the ET 200pro EtherNet/IP module

Use the EIP ET200 Configuration Tool to configure the ET 200pro EtherNet/IP module. Refer to the "EIP ET200 Configuration Tool User Reference Guide" for complete instructions.

5.2 Setting the IP address

DHCP is the factory default. When the ET 200pro EtherNet/IP module is using DHCP, you can set IP addresses by using Microsoft Windows and Linux DHCP/BOOTP servers. There are several free servers for Microsoft Windows available for download from the Internet. Use discretion when downloading software from the Internet.

After you set the IP address with DHCP, you can then use the EIP ET200 Configuration Tool to set a permanent IP address and turn off DHCP. See the "EIP ET200 Configuration Tool User Reference Guide" for detailed instructions.

5.3 Grouping electronic modules

Introduction

Grouping modules allows you to make better use of the available address range of the ET 200pro EtherNet/IP module and reduce the data exchange between the ET 200pro and the EtherNet/IP master.

You can achieve these benefits by grouping two digital output modules within one byte in the output area of the process image. Arrange the electronic modules systematically and label them accordingly.

The two digital output modules that you group must be of the same module type. You can insert other modules between the two modules that you have grouped.

You can use no more than 8 channels (1 byte) in total for grouping. The ET 200pro EtherNet/IP module has a maximum address space of 255 bytes for inputs and 255 bytes for outputs.

Configuration

The ET 200pro system has address space of up to 255 bytes for inputs and 255 bytes for outputs. To better exploit the available address space of the scanner and reduce data transfer between the ET 200pro and the scanner, you can group several electronic modules/load feeders in a single byte in the input or output area of the process image. This is achieved by the systematic arrangement and designation of the ET 200pro electronic modules.

In Appendix C, you will find a table describing the address space required for the individual modules.

Procedure for groupable modules

1. In the hardware catalog of your configuration software, you can recognize groupable modules by the fact that they are available in duplicate. The modules differ from each other only by a " * " in the designation.
2. Configure the ET 200pro setup, adhering to the following rules:
   – The modules that you can group in a single byte must be of the same module type.
   – There can be a total of no more than 8 channels (1 byte).
3. From the Configuration Tool hardware catalog, select a module without the " * " designation.
   – Result: You open a byte and store the first module there.
4. From the Configuration Tool hardware catalog, select a module with the " * " designation.
   – Result: In the open byte, you store additional modules until all the bits are occupied.
5. If a byte is filled, you must configure a module again (that is, open a new byte for a module without the " * ").

Note

The EIP ET200 Configuration Tool does not check whether the modules have been grouped correctly. If you configure more than 8 channels in one byte, the modules that exceed the byte limit are reported as being incorrectly configured in the diagnosis:

Module status → 10_B: Incorrect module; invalid user data

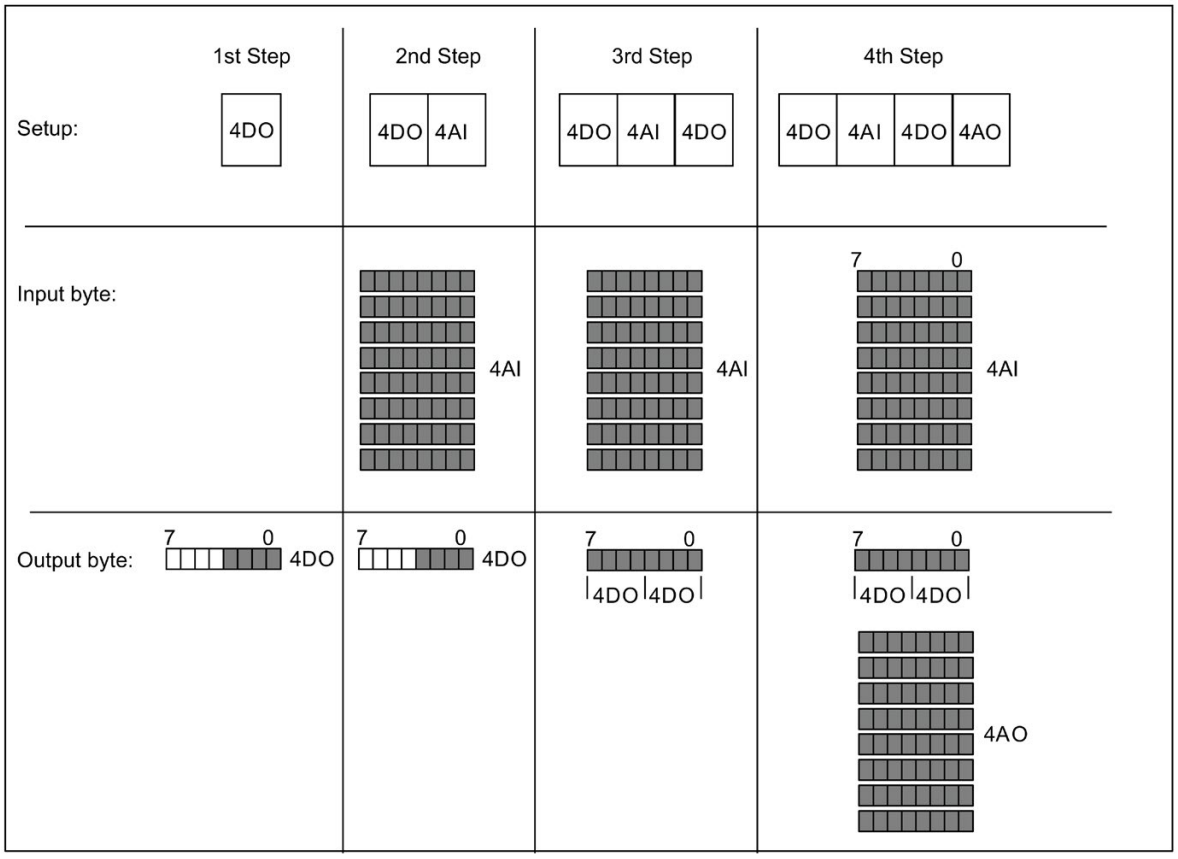
These modules are not addressed.

Note

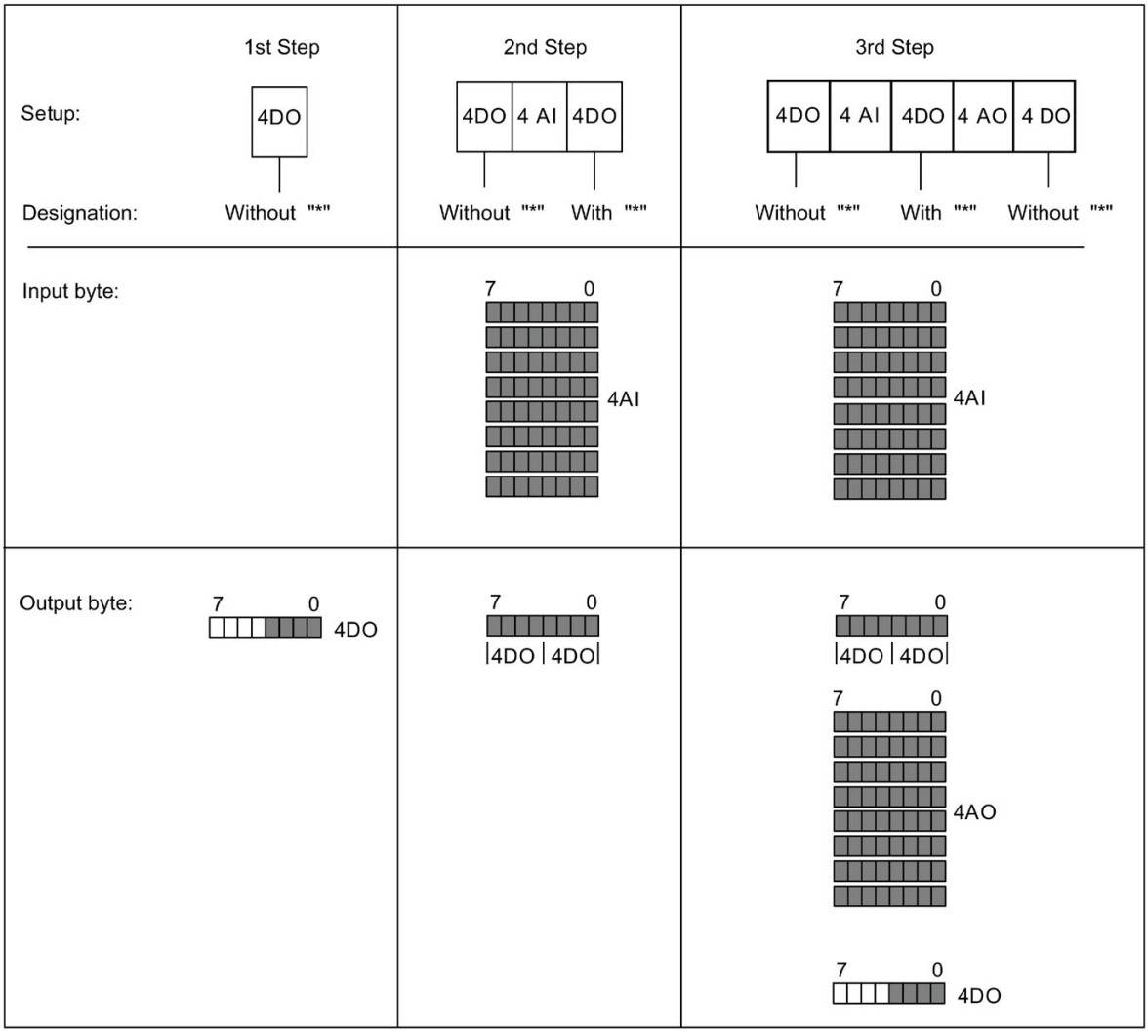
ET 200pro assembles data on byte boundaries. Some scanners may only provide access to this data on word boundaries. You should organize your ET 200pro modules to conform to the scanner's restrictions. For example, configure the grouping of digital modules so that an analog module will occupy bytes 0 to 3 or 4 to 7. In this way, the analog modules will begin on even-byte boundaries to avoid an analog value being split between two words.

Examples of possible configurations are illustrated as follows:

Grouping modules in Automatic Configuration (default) mode



Grouping modules in User-configured mode



No grouping

If you do not want to group your digital output modules in a single byte, use only modules without the " * " designation in the Configuration Tool hardware catalog. Each electronic module will then occupy one byte in the process image.

5.4 Commissioning and startup

You commission the automation system according to your plant configuration. The procedure outlined below only describes the commissioning of ET 200pro connected to an EtherNet/IP master.

Requirements of ET 200pro on EtherNet/IP

References to chapters in the following table are to the "SIMATIC ET 200pro distributed I/O system Operating Instructions" manual. You can access the manual on the companion disk that shipped with your product. You can also access the manual on the Siemens Industry Online Support (https://support.automation.siemens.com/cs/?lc=en-US) website.

For I/O controller actions, reference the manual that shipped with your I/O controller.

Actions	Reference
ET 200pro is mounted	Chapter "Mounting"
ET 200pro is wired	Chapter "Wiring"
Device names are assigned to the I/O device	Chapter "Configuring"
ET 200pro is configured	Chapter "Configuring"
Supply voltage to the I/O controller is switched on	I/O controller manual
I/O controller is in RUN	I/O controller manual

Commissioning the ET 200pro system

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

Note

Changes to the backplane bus

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

Commissioning the ET 200pro EtherNet/IP

1. Switch on the supply voltage for the module
2. Switch on the supply voltage for the load as necessary

5.5 Using QuickConnect

5.5.1 QuickConnect overview

What is QuickConnect™?

QuickConnect technology enables EtherNet/IP devices to quickly power up and join an EtherNet/IP network. Examples of typical implementations might include the following:

- A robotic application where a robot arm quickly exchanges tools to switch tasks.
- A pallet application where a large frame consisting of many I/O modules moves down an assembly line and connects to different controllers at different locations on the line.

Connection time

The ET200pro EtherNet/IP interface module is a Class B QuickConnect target device. Therefore, the module is able to power up, send the first gratuitous ARP packet, and be ready to accept a TCP connection in 1100 ms seconds or less.

Advantages of using QuickConnect

QuickConnect accelerates the startup of distributed I/O devices. It shortens the time that the respective configured distributed I/O devices require in order to reach the cyclic user data exchange in the following cases:

- After distributed I/O devices have been activated.
- After the supply voltage has returned.
- After a station has returned.

Using QuickConnect reduces waiting times between the scheduled processes of a restart. This enables greater throughput in production by accelerating the production process using removable I/O devices.

Architecture

A QuickConnect system consists of two sides: a controller side and a tool side.

The controller side might include some of the following components:

- Robot with a tool-changing coupler
- Robot controller
- Managed switch
- EtherNet/IP communication modules
- EtherNet/IP network
- EtherNet/IP-based I/O devices

The tool side typically consists of multiple tools that include these components:

- A tool-changing coupler
- EtherNet/IP network
- EtherNet/IP-based I/O devices with QuickConnect capability

5.5.2 Guidelines for using QuickConnect on your network

QuickConnect and the EIP ET200 Configuration Tool

Use the EIP ET200 Configuration Tool to enable QuickConnect, to turn off autonegotiation, and to set a fixed baud rate and duplex.

Note that if QuickConnect is turned on in the ET 200pro EtherNet/IP module, you should not use the ET 200pro EtherNet/IP Configuration Tool to perform a firmware update because the self-checks are turned off in that mode.

Requirements

An EtherNet/IP QuickConnect system requires an electrical lock signal. The electrical lock signal indicates that the tool changer has applied power to the tool. This is a hard-wired signal that must be implemented by the system builder. This signal must run from the tool changer back to the control system and must be connected to a digital input module. This signal is the event that starts the QuickConnect sequence.

QuickConnect system guidelines

The following guidelines are required in order to enable setup with QuickConnect:

System component	Guidelines
Tool side devices	• Use a preconfigured, static IP address for the devices. This removes DHCP/BOOTP cycle time. • Configure the devices for 100 Mbps, full-duplex operation in both the switch and the end-node device. • Configure the devices to not autonegotiate and to not use Auto-MDIX. • Use straight-through EtherNet/IP cables on the devices. • Connect the devices in a linear topology. Ring topology is not supported.
Switches	• Make sure an EtherNet/IP managed switch on the controller side remains powered on at all times. Only the tool side is subject to power cycling. This is important so that the switch does not block communication to and from devices.
Data	• I/O data sizes must remain the same when nodes on a new device use the same IP address. If the I/O sizes are different, then the nodes need unique IP addresses.
Communication	• A QuickConnect I/O device issues a gratuitous ARP message announcing its presence on the network. The module continues to issue the gratuitous ARP message every 25 ms for a maximum of 40 times (1 second) until an I/O connection is established. • The module issues a TCP close when it receives a forward close message. Otherwise, connections may stay open for several seconds before they time out.
Controllers	• Upon receiving the electrical lock signal, the controller waits for a module-specific delay period and then uninhibits the QuickConnect module to open an I/O connection. • The controller knows the device startup time. You might need to alter the power-up time to delay the connection establishment procedure by that amount of time.

QuickConnect sequence

Using a robot system as an example:

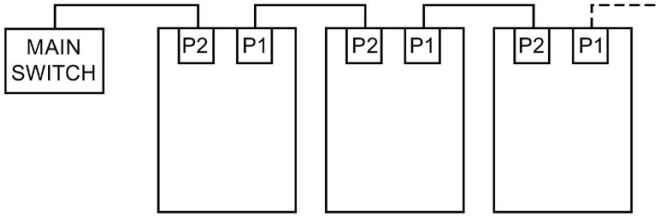
1. The controller inhibits current connections to QuickConnect modules, and the robot arm physically disengages the current tool.
2. The robot arm physically attaches a new QuickConnect module.
3. The new QuickConnect module powers up.
4. The controller acknowledges a successful attachment to a new tool via an electrical lock signal.
5. Upon receiving the electrical lock signal, the controller waits for the devices to start up before uninhibiting a new set of I/O connections and then connects to the new QuickConnect module.
6. When all connections are established, the robot is ready for operation.

Procedures for using QuickConnect

Port parameter	Setting
Negotiation	Off
Rate	100 Mbps
Duplex	Full
Auto-MDIX	Off

To enable the use of QuickConnect, perform the following steps:

1. Connect the ET 200pro EtherNet/IP module to a managed switch with the switch port set to autonegotiation off and auto crossover (auto-MDIX) off, with the same fixed baud rate and duplex as the device. You can use an EtherNet straight-through cable (1:1) by connecting to Port 2 on the ET 200pro EtherNet/IP module because Port 2 is crossed over internally. (A connection to Port 1 on the ET 200pro EtherNet/IP module would require a crossover cable). Another option is to have more than one ET 200pro module set up this way and connect them in a daisy chain with Port 2 of one device connected to Port 1 of the other. This can be done with straight-through cables.



2. Use the EIP ET200 Configuration Tool, turn autonegotiation off and set a fixed baud rate and duplex.
3. Turn on QuickConnect with the Configuration Tool.

Wiring rules for disabled autonegotiation

With auto crossover (MDIX) turned off, the ET 200pro EtherNet/IP ports are set as follows:

- Port 1 - normal (straight-through) pin assignment
- Port 2 - crossed over pin assignment

Crossed over pin assignment means that the pin assignment for the ports for sending and receiving between devices is exchanged internally.

5.5.3 Replacing a faulty QuickConnect Adapter

In case of QuickConnect failure, follow this process to replace both the ET 200pro EtherNet/IP module and the connection module:

1. Prepare and mount the replacement modules.
2. Power up the replacement devices.
3. Configure the replacement module's IP address using DHCP, or set a fixed IP address with the EIP ET200 Configuration Tool.
4. Use the Configuration Tool to turn off autonegotiation, set a fixed baud rate and duplex, and turn QuickConnect on as described in the topic "Guidelines for using QuickConnect on your network".

The replacement module is now ready for QuickConnect power-up.

Note

If you are replacing only the ET200pro EtherNet/IP module and are not also replacing the connection module, you can skip steps 3 and 4 above because the configuration and network data is stored in the connection module's flash memory.

5.5.4 Troubleshooting and optimization

Delayed connection time

Many factors can cause the controller connection time to be slower than expected. These factors include the following:

- RPI (I/O cycle time)
- Time slice percentage
- Timer set in the application logic
- EtherNet/IP traffic
- Controller task load

If you cannot achieve optimum connection time with the recommended settings, you may need to evaluate alternate EtherNet/IP configurations or controller requirements.

Timing errors

Once you initially configure your system, you should test whether the connection timing is within your required timeframe. A QuickConnect I/O device issues a gratuitous ARP message on the network every 25 ms for a maximum of 40 times (1 second) until an I/O connection is established. If you experience periodic missed connections, it is recommended that you:

- Analyze network traffic for the root cause.
- Extend the timer in your application logic to allow more startup time if necessary.

5.6 Firmware updates

You perform firmware updates by using the EIP ET200 Configuration Tool and EtherNet/IP. See the Configuration Tool User Reference Guide for detailed instructions.

Note

If QuickConnect is turned on in the ET 200pro EtherNet/IP module, you should not perform a firmware update with the Configuration Tool because the self-checks are turned off in that mode.

General technical specifications

6

6.1 Standards and approvals

Contents of general technical specifications:

- The standards and test values which the ET 200pro distributed I/O system complies with/satisfies
- The test criteria used to test the ET 200pro distributed I/O system

Note

Information on the nameplate

You will find the current markings and approvals on the nameplate of the respective product.

CE approval

The ET 200pro distributed I/O system meets the requirements and protective objectives of the following EC directives, and satisfies the Harmonized European Standards (EN) for Programmable Logic Controllers which were published in the official pamphlets of the European Community:

- 2006/95/EC "Electrical Equipment Designed for Use within Certain Voltage Limits" (Low Voltage Directive)
- 2004/108/EC "Electromagnetic Compatibility Directive" (EMC Directive)

The EC Declarations of Conformity are made available to the relevant authorities at the following address:

Siemens AG
Automation and Drives
I IA AS R&D ST DH A
Postfach 1963
D-92209 Amberg, Germany

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

Approval

Underwriters Laboratories Inc. acc. to

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)

Note

For the pneumatic interface module, no cULus approval has been applied for.

NEMA classification of ET 200pro (for the US market)

The ET 200pro distributed I/O system conforms to the NEMA classification: Enclosure rating type: 4X indoor use only.

Marking for Australia and New Zealand

The ET 200pro distributed I/O system satisfies the requirements of the AS/NZS CISPR 16 standard.

IEC 61131

The ET 200pro distributed I/O system satisfies the requirements and criteria of IEC 61131-2 (Programmable Logic Controllers, Part 2: Equipment Requirements and Tests).

EtherNet/IP standard

The ET 200pro EtherNet/IP module complies with EtherNet/IP Specification CIP Networks Library Volume 2: EtherNet/IP Adaption of CIP, Edition 1.12.

Use in industrial environments

SIMATIC products are designed for use in industrial applications.

Area of application	Interference emission requirement	Interference immunity requirement
Industry	EN 61000-6-4: 2007	EN 61000-6-2: 2005

Use in residential areas

Note

The ET 200pro distributed I/O system is intended for use in industrial environments; when used in residential areas, it can affect radio/television reception.

If you use the ET 200pro in residential areas, you must ensure observance of the Class B radio interference limit in accordance with EN 55011 regarding the emission of radio interferences.

Suitable measures for achieving the required Class B radio interference level include, for example:

- Installation of ET 200pro in grounded control cabinets/control boxes
- Use of filters in the supply lines

6.2 Electromagnetic compatibility

Definition

Electromagnetic compatibility refers to the capability of electrical equipment of reliably performing its dedicated function in an electromagnetic environment, without causing interference in the same environment.

The ET 200pro distributed I/O system meets all requirements of EMC legislation for the European market. This requires that the ET 200pro distributed I/O system complies with the requirements and guidelines for electrical installation.

Pulse-shaped interference

The following table shows the electromagnetic compatibility of the ET 200pro distributed I/O system relative to pulse-shaped interference.

Pulse-shaped interference	Tested with	Corresponds to degree of severity
Electrostatic discharge according to IEC 61000-4-2.	8 kV 6 kV	3 (air discharge) 3 (contact discharge)
Burst pulses (high-speed transient interference) according to IEC 61000-4-4.	2 kV (supply line) 2 kV (signal line)	3 3
High-energy single pulse (surge) according to IEC 61000-4-5 Only with lightning protection elements		3
• Asymmetric coupling	2 kV (supply line) 2 kV (signal/data line)	
• Symmetric coupling	1 kV (supply line) 1 kV (signal/data line)	

Sinusoidal interference

The table below shows the electromagnetic compatibility of the ET 200pro distributed I/O device with respect to sinusoidal interference.

HF interference according to IEC 61000-4-3 Electromagnetic HF field	HF coupling according to IEC 61000-4-6
Amplitude modulated	
80 to 1000 MHz; 1.4 to 2 GHz	0.15 to 80 MHz
10 V/m 80% AM (1 kHz)	10 V_{rms} unmodulated
2 to 2.7 GHz	80% AM (1 kHz)
1 V/m at 80% AM (1 kHz)	150 Ω source impedance

Emission of radio interference

Interference emission of electromagnetic fields in accordance with EN 55016: Limit Value Class A, Group 1 (measured at a distance of 10 m).

Frequency	Emitted interference
from 30 to 230 MHz	< 40 dB (µV/m)Q
from 230 to 1000 MHz	< 47 dB (µV/m)Q

6.3 Shipping and storage conditions

Shipping and storage conditions

The ET 200pro distributed I/O system surpasses the IEC 61131-2 requirements for shipping and storage conditions. The specifications below apply to modules that are transported and stored in their original packaging.

Type of condition	Permissible range
Free fall	≤ 1 m
Temperature	–40 °C to +70 °C
Temperature change	20 K/h
Barometric pressure	1080 hPa to 660 hPa (corresponds to an altitude of -1000 m to 3500 m)
Relative humidity	5% to 95%, without condensation

6.4 Mechanical and climatic environmental conditions

Climatic environmental conditions

The following climatic environmental conditions apply (indoor use only):

Environmental requirements	Areas of application	Remarks
Temperature	0 °C to 55 °C *	All mounting positions
Temperature change	10 K/h	-
Relative humidity	5% to 100%	with condensation
Barometric pressure	1080 hPa to 795 hPa	Corresponds to an altitude of -1000 m to 2000 m
Concentration of pollutants	SO_2: <0.5 ppm; RH < 60%, no condensation H_2S: <0.1 ppm; RH < 60%, no condensation	-
* The FESTO CPV10 and CPV14 valve terminals deviate from the specified operating temperature range of 0 to 55 °C. For the temperature operating range of FESTO valve terminals, refer to the corresponding FESTO Operating Manuals.		

Modules for use in the -25 °C to 55 °C temperature range

The following modules support operation in the -25 °C to 55 °C temperature range (indoor use only):

Designation	Order number
IM 154-3 PN High Feature with terminating module	ZNX:EIP200PRO
CM IM M12, 7/8"	ZNX:EIP200PROCM1
PM-E DC 24V	6ES7148-4CA00-0AA0
PM-O DC 2x24V	6ES7148-4CA60-0AA0
CM PM Direct	6ES7194-4BC00-0AA0
CM PM ECOFAST	6ES7194-4BA00-0AA0
CM PM 7/8"	6ES7194-4BD00-0AA0
CM PM PP	6ES7194-4BE00-0AA0
CM PM-O PP	6ES7194-4BH00-0AA0
CM IO 4 x M12	6ES7194-4CA00-0AA0
CM IO 4 x M12P	6ES7194-4CA10-0AA0
CM IO 4 x M12 Inverse	6ES7194-4CA50-0AA0
CM IO 8 x M12	6ES7194-4CB00-0AA0
CM IO 8 x M12P	6ES7194-4CB10-0AA0
CM IO 8 x M12D	6ES7194-4CB50-0AA0
CM IO 8 x M8	6ES7194-4EB00-0AA0
CM IO 2 x M12	6ES7194-4FB00-0AA0
CM IO 1 x M23	6ES7194-4FA00-0AA0
8 DI DC 24V	6ES7141-4BF00-0AA0
16 DI DC 24V	6ES7141-4BH00-0AA0
4 DO DC 24V/2.0A	6ES7142-4BD00-0AA0
8 DO DC 24V/0.5A	6ES7142-4BF00-0AA0
8 DI DC 24V High Feature	6ES7141-4BF00-0AB0
4 DO DC 24V/2.0A High Feature	6ES7142-4BD00-0AB0
4 DI / 4 DO DC 24V/0.5A	6ES7143-4BF50-0AA0
4 DIO / 4 DO DC 24V/0.5A	6ES7143-4BF00-0AA0
4 AI U High Feature	6ES7144-4FF00-0AB0
4 AI U High Feature	6ES7144-4FF01-0AB0
4 AI I High Feature	6ES7144-4GF00-0AB0
4 AI I High Feature	6ES7144-4GF01-0AB0
4 AI RTD High Feature	6ES7144-4JF00-0AB0
4 AI TC High Feature	6ES7144-4PF00-0AB0
4 AO U High Feature	6ES7145-4FF00-0AB0
4 AO I High Feature	6ES7145-4GF00-0AB0

Mechanical environmental conditions

The table below shows the mechanical environmental conditions in the form of sinusoidal oscillation.

Modules	Frequency range	Continuous	Infrequent
Interface, electronic, and connection modules; Pneumatic interface modules with FESTO valve terminals	5 ≤ f ≤ 8 Hz	15 mm amplitude	-
	8 ≤ f ≤ 150 Hz	5 g constant acceleration	10 g constant acceleration

Testing mechanical environmental conditions

The table below provides information about the type and scope of mechanical environmental condition tests.

Condition tested	Test standard	Interface, electronic, and connection modules; Pneumatic interface modules with FESTO valve terminals
Vibrations	Vibration test according to IEC 60068-2-6	Type of vibration: Frequency sweeps with a rate of change of 1 octave/minute. 5 Hz ≤ f ≤ 12 Hz, constant amplitude 15 mm 12 Hz ≤ f ≤ 150 Hz, constant acceleration 10 g Duration of vibration: 10 frequency sweeps per axis in each of three perpendicular axes
Shock	Shock, tested according to IEC 60068-2-27	Type of shock: half-sine Shock intensity: 30 g peak value, 18 ms duration Direction of shock: 3 shock tests in +/- direction in each of the 3 perpendicular axes
Continuous shock	Shock, tested according to IEC 60068-29	Type of shock: half-sine Shock intensity: 25 g peak value, 6 ms duration Direction of shock: 1000 shock tests in +/- direction at each of the 3 perpendicular axes

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

Test voltage

The proof of dielectric strength is provided in a type test with the following test voltage according to IEC 61131-2:

Circuits with rated voltage V_e against other circuits or ground	Test voltage
< 50 V	500 VDC
< 150 V	2500 VDC
< 250 V	4000 VDC

Pollution degree/overvoltage category according to IEC 61131-2

- Pollution degree 2
- Overvoltage category
  - At V_r = 24 VDC: II

Degree of protection IP65

Degree of protection according to IEC 60529

- Protection against the ingress of dust and full touch protection
- Water projected by a nozzle against the enclosure from any direction shall have no harmful effect.

Degrees of protection IP66 and IP67

Degree of protection according to IEC 60529

- Protection against the ingress of dust and full touch protection
- IP66: Water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities.
- IP67: Protection against water when enclosure is immersed at specified pressures over a specified time period (water must not enter the enclosure in any harmful amount)

Rated voltage for operation

The ET 200pro distributed I/O system operates at the following rated voltage and corresponding tolerance:

Rated voltage	Tolerance range
24 VDC	20.4 VDC to 28.8 VDC

Order number

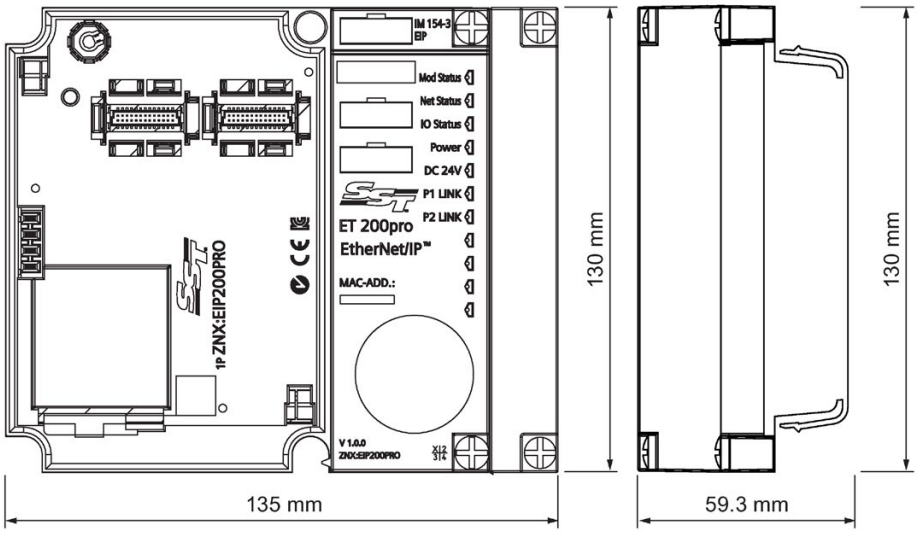
A

Designation	Order number
ET 200pro EtherNet/IP interface module package	ZNX:EIP200PRO
CM IM M12, 7/8" connection module	ZNX:ET200PROCM1

Dimension drawing

B

ET 200pro EtherNet/IP interface module front and side views



Address area

C

Address area of the modules

The following table shows the address area for ET 200pro digital input and output modules:

Module	Address space of the inputs		Address space of the outputs	
	Without grouping	With grouping[1]	Without grouping	With grouping[1]
Digital input modules	1 byte (8 DI)	---	---	---
	2 bytes (16 DI)			
Digital output modules	---	---	1 byte (4 DO)	4 bits (4 DO)
			1 byte (8 DO)	---
Digital input/output modules	1 byte (4 DI)	4 bits (4 DI)	1 byte (4 DO)	4 bits (4 DO)
Analog input modules	4 bytes		---	---
Analog output modules	---	---	4 bytes	
Direct-on-line starter	1 byte	4 bits	1 byte	4 bits
Reversing starter	1 byte	4 bits	1 byte	4 bits

[1] See the topic "Configuring the ET 200pro system"

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