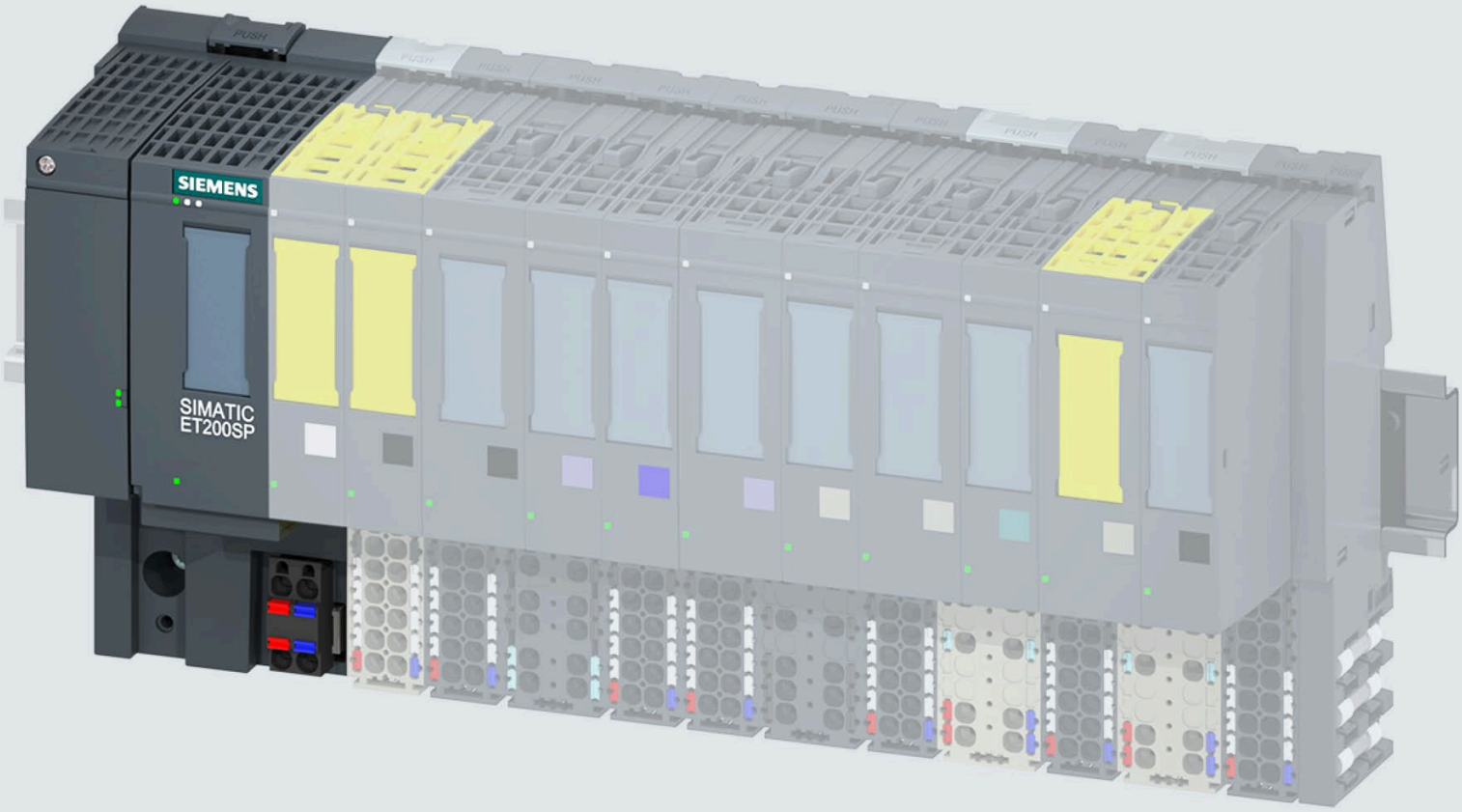
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Equipment Manual

SIMATIC

ET 200SP

Interface module IM 155-6 MF HF
(6ES7155-6MU00-0CN0)

Edition 01/2022

support.industry.siemens.com

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SIMATIC

ET 200SP
Interface module IM 155-6 MF HF (6ES7155-6MU00-0CN0)

Equipment Manual

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Preface

Purpose of the documentation

This equipment manual supplements the system manual ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293).

Functions that generally relate to the system are described in this manual.

The MultiFieldbus function is described in the "MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209)" function manual.

The information provided in this manual and in the system/function manuals supports you in commissioning the ET 200SP distributed I/O system.

Conventions

Also observe notes labeled as follows:

Note

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

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

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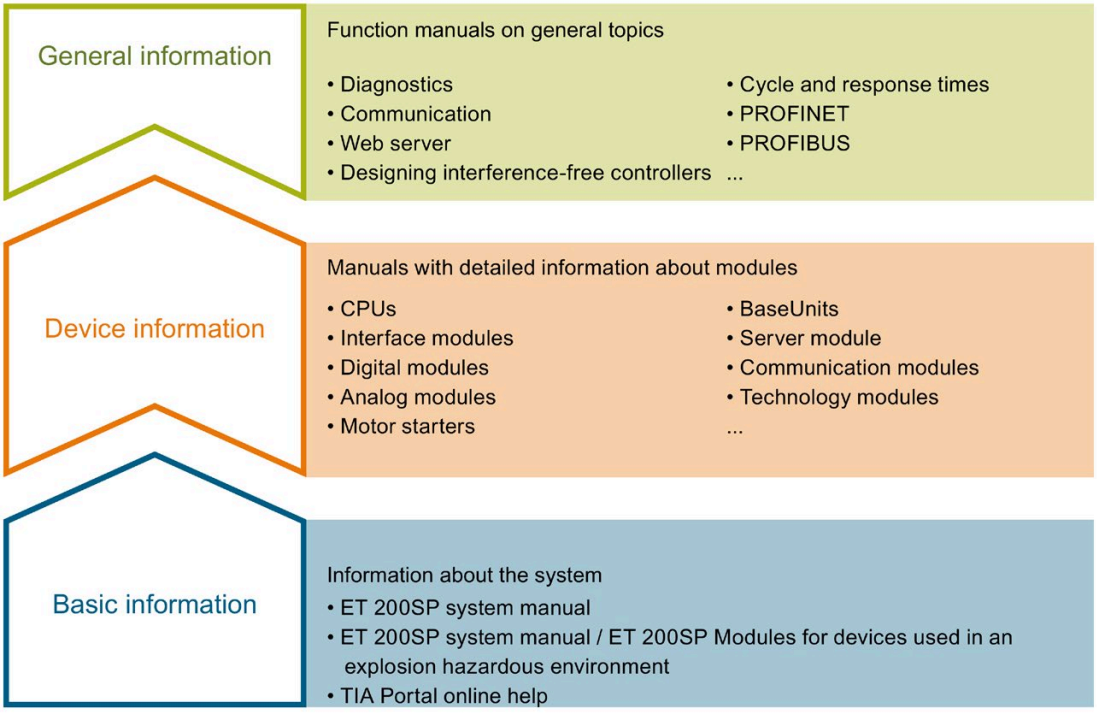
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ET 200SP Documentation Guide

1

The documentation for the SIMATIC ET 200SP distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.



Basic information

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

Device information

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

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200SP distributed I/O system, e.g. diagnostics, communication, Web server, motion control and OPC UA.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742709).

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

You can download the product information free of charge from the Internet (https://support.industry.siemens.com/cs/us/en/view/73021864).

Manual Collection ET 200SP

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

You can find the Manual Collection on the Internet (https://support.automation.siemens.com/WW/view/en/84133942).

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You configure your own download package with a few clicks.

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- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files
- Manuals, characteristics, operating manuals, certificates
- Product master data

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

Application examples

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

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

TIA Selection Tool

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

You can find the TIA Selection Tool on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109767888).

SIMATIC Automation Tool

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

The SIMATIC Automation Tool provides a multitude of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Address assignment (IP, subnet, gateway) and station name (PROFINET device) to a CPU
- Transfer of the date and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- RUN/STOP mode switchover
- CPU localization by means of LED flashing
- Reading out of CPU error information
- Reading of the CPU diagnostics buffer
- Reset to factory settings
- Firmware update of the CPU and connected modules

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

PRONETA

SIEMENS PRONETA (PROFINET network analysis) allows you to analyze the plant network during commissioning. PRONETA features two core functions:

- The topology overview automatically scans the PROFINET and all connected components.
- The IO check is a fast test of the wiring and the module configuration of a plant, incl. fail-safe inputs and outputs.

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

SINETPLAN

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

The advantages at a glance

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

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

Product overview

2

2.1 Properties

Article number

6ES7155-6MU00-0CN0

View of the module

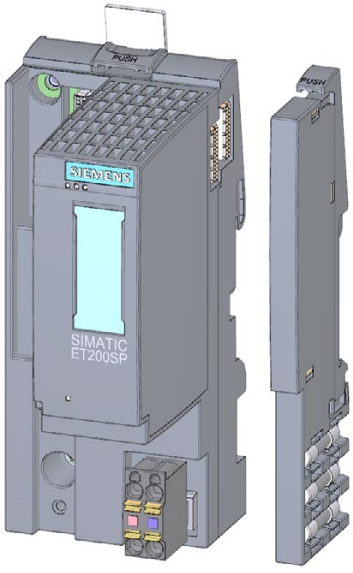


Figure 2-1 View of the 155-6 MF HF interface module with included accessory (24 V DC connector and server module) and optional accessories (labeling strips and reference identification label)

Advantages

- The interface module supports multiple fieldbus protocols.
  - PROFINET IO
  - EtherNet/IP
  - Modbus TCP
- Compatible with the interface module 155-6 PN/2 HF (except for isochronous mode and prioritized startup)
- The system benefits of the ET 200SP distributed I/O system can also be used with the fieldbus protocols EtherNet/IP and Modbus TCP:
  - MF Shared Device: The fieldbus can be selected for each submodule.
  - Least space required
  - Comprehensive range of modules (see section "Applicable modules with EtherNet/IP (Page 44)" and section "Applicable modules with Modbus TCP (Page 57)")
  - Multi Hot Swapping
  - Dynamic reconfiguration of the modules via the user program
- No system change or replacement of the interface module of the I/O is required when using different controllers.

  (series machine manufacturers with end customers in various regions around the world)
- Use of different fieldbus protocols is possible depending on the region and application.

Properties

The module has the following technical properties:

- Using the MultiFieldbus function, it connects the ET 200SP distributed I/O system with
  - PROFINET IO
  - EtherNet/IP
  - Modbus TCP
- Power supply 1 L+ 24 V DC (SELV/PELV). The connection plug is included in the scope of delivery of the interface module and is available as replacement part.
- PROFINET IO, EtherNet/IP and Modbus TCP via selectable BusAdapters
  - BA 2×RJ45 for RJ45 bus connector
  - BA 2xM12 for bus cable with M12 plug
  - BA 2×FC for direct connection of the bus cable
  - BA 2xLC for glass fiber-optic cable
  - BA 2xSCRJ for POF/PCF fiber-optic cable
  - BA SCRJ/RJ45 as media converter for POF/PCF fiber-optic cable ⇔ standard RJ45 connector
  - BA SCRJ/FC as media converter for POF/PCF fiber-optic cable ⇔ direct connection of the bus cable
  - BA LC/RJ45 as media converter for glass fiber-optic cable ⇔ standard RJ45 connector
  - BA LC/FC as media converter for glass fiber-optic cable ⇔ direct connection of the bus cable

  "Monitor" option on the SCRJ BusAdapter is not supported when operating via EtherNet/IP or Modbus TCP
- Supported topologies
  - Linear bus topology
  - Star topology
  - Tree topology

Maximum configuration

- 64 ET 200SP I/O modules + 16 ET 200AL modules
- 1 m backplane bus (without interface module)

Maximum amount of I/O data (PROFINET IO)

Gross data length (for input data and output data):

Without system redundancy S2:

- 1440 bytes
- 1440 bytes for shared device with 2 IO controllers (in total for both IO controllers)
- 360 bytes for shared device with more than 2 IOC (per IO controller)

With system redundancy S2:

- 1000 bytes
- 360 bytes for system redundancy S2 and shared device with min. 1 additional IOC (per IO controller)

The number of maximum net data length for input data and output data depends on the number and type of I/O modules used including ET 200AL modules.

Net data length (for input data and output data):

The following minimum lengths can be applied without shared device and without explicit calculation of the maximum net data length.

- 933 bytes without system redundancy S2
- 493 bytes with system redundancy S2

Calculation of the max. net data length:

Max. net data length = Max. gross length - number of I/O submodules (no user data, input or output data) - number of I/O mixed modules (input and output data) - 5 bytes for interface module and server module without ET-Connection (6 bytes for interface module with ET-Connection)

The result of the calculation of the maximum net data length applies equally to input and output data.

Note

The maximum usable I/O data for EtherNet/IP and Modbus TCP is available in the section "Technical specifications (Page 77)".

Accessories

You order the following accessories separately:

- BusAdapter BA 2×RJ45
- BusAdapter BA 2xM12
- BusAdapter BA 2×FC
- BusAdapter BA 2×LC
- BusAdapter BA 2xSCRJ
- BusAdapter BA SCRJ/RJ45
- BusAdapter BA SCRJ/FC
- BusAdapter BA LC/RJ45
- BusAdapter BA LC/FC
- Strain relief for PROFINET cable
- Labeling strips
- Reference identification label

Information on the BusAdapters is available in the BusAdapter (https://support.industry.siemens.com/cs/ww/en/view/109751716) manual.

You can find more information on accessories in the ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293) system manual.

Server module

The server module is included in the scope of delivery of the interface module and is available separately as a spare part.

The server module has the following properties:

- Terminates the backplane bus of the ET 200SP distributed I/O system
- Includes a holder for 3 spare fuses (5 × 20 mm).
- Provides station functions, e.g., group diagnostics: No supply voltage L+, status bytes.
- Supports identification data I&M 0 to 3

Note

You need to configure and assign parameters to the server module in the configuration software.

Place the server module in the last slot of the configuration. If there are 64 I/O modules, the server module is plugged in slot 65.

You can find more information in the Server module (https://support.automation.siemens.com/WW/view/en/63257531) manual.

First BaseUnit of an ET 200SP in the configuration

The interface modules support plugging a dark-colored BaseUnit in slot 1. This means that modules without a connection to the integrated voltage buses P1 and P2 can also be configured starting with slot 1. The following modules can currently be configured on a dark-colored BaseUnit in slot 1:

- AI Energy Meter ST
- DI 4 x 120...230 V AC ST (6ES7131-6FD00-0BB1)
- DQ 4 x 24...230 V AC/2 A ST (6ES7132-6FD00-0BB1)

Note

First BaseUnit of an ET 200SP in the configuration

Note the information on limiting the overvoltage and power rating in the AC I/O module manuals.

You route the infeed of the 24 V DC supply voltage over an external fuse.

The 24 V DC supply voltage is provided by a light-colored BaseUnit.

See also

PROFINET IO functions (Page 18)

2.2 MultiFieldbus engineering

MultiFieldbus Configuration Tool (MFCT)

The configuration and parameter assignment of the IM 155-6 MF HF interface module is created and downloaded with MFCT, and stored retentively in the interface module.

MFCT creates the following files and makes them available:

- User Defined Data Types (UDT) file (file extension *.l5x), enables structured access to I/O data with Ethernet/IP.
- Electronic Data Sheet (EDS) according to CIP specification Vol.1 for integration into EtherNet/IP configuration systems (the EDA file is also available for download (https://support.industry.siemens.com/cs/ww/en/ps/27993))
- Comma Separated Values (CSV), contains the I/O data mapping of your configuration

You can find additional information on MFCT in the "MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209)" function manual.

2.3 Detect active fieldbus

For exclusive operation on a fieldbus (not MF Shared Device) you can recognize the active fieldbus by the number of green LEDs on the MF device.

This requires that there are no errors and that the MF device is in cyclic data exchange with a controller.

LED schematic:	**RN/NS**	**ER/MS**	**MT/IO**
PROFINET	■ Green	□ Off	□ Off
Modbus TCP	■ Green	■ Green	□ Off
EtherNet/IP	■ Green	■ Green	■ Green

PROFINET IO

3

3.1 PROFINET IO functions

Introduction

The interface module supports the following PROFINET IO functions:

- Integrated switch with 2 ports
- Supported Ethernet services: PING, ARP, SNMP, LLDP
- Port diagnostics
- Disabling ports
- Minimum update time 250 µs
- Device replacement without programming device, also without topological configuration
- Reset to factory settings via PROFINET IO or RESET button
- Firmware update via PROFINET IO
- Media redundancy (MRP)
- Shared device
- Distribution of module channels to a maximum of 4 submodules
- Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)
- System redundancy S2
- Station extension via ET-Connection
- Alternating IO devices during operation ("docking systems")
  - Docking station
  - Docking unit
- Supports BusAdapter for different connection technologies to PROFINET IO.

The interface module supports additional functions:

- Interface-local coupling of IO data (configuration only via GSDML)
- Identification data I&M 0 to I&M 3
- PROFIenergy
- Configuration control (option handling)
- Use of fail-safe modules
- Removal/insertion of multiple I/O modules during operation (Multi Hot Swap)
- Module-to-Module Communication (MtM)
- Setting the time

Use with PROFINET IO

If you want to use the IM 155-6 MF HF with PROFINET IO, select the IM 155-6 PN/2 HF V4.2 module in the engineering system.

As of TIA Portal V17, the IM 155-6 MF HF is offered under "Additional field devices".

Requirements

The table below shows the software requirements for a configuration with the IM 155-6 MF HF interface module:

Table 3- 1 Version dependencies of the module functions

Function	Functional status of the module as of	Firmware version of the module as of	Configuration software [2]			
			Configuration with GSD file (https://support.automation.siemens.com/WW/view/en/19698639/130000)/software from a third-party manufacturer [1]	STEP 7 as of V5.5 SP3 with HSP 233	STEP 7 as of V5.5 SP4 with HSP 250/255	STEP 7 (TIA Portal) as of V12.0.1 with HSP 0058
Real-time communication	1	V5.0	X	X	X	X
Device replacement without programming device	1	V5.0	X	X	X	X
Media redundancy (MRP)	1	V5.0	X	X	X	X
Shared device	1	V5.0	X	X	X	X
Value status	1	V5.0	X	X	X	X
PROFIenergy	1	V5.0	X	X	X	X
Multi Hot Swap	1	V5.0	X	X	X	X
Use of fail-safe modules	1	V5.0	with S7-FCT V2.0	X	X	X
Module-internal Shared Input/Shared Output (MSI/MSO)	1	V5.0	X	---	X	X
System redundancy S2 to S7-400H	1	V5.0	X	---	X	---
System redundancy S2 IEC-compliant	1	V5.0	X	---	---	---
System redundancy S2 to S7-1500R/H (IEC-compliant)	1	V5.0	X	---	---	X (as of V15.1)
Station extension via ET-Connection	1	V5.0	X	---	X (as of V5.5 SP4)	X (as of V13 SP1)
Maximum user data length per module: 288 bytes	1	V5.0	X	X (as of V5.5 SP4)	X (as of V5.5 SP4)	X (as of V13 SP1)
Distribution of module channels to multiple submodules	1	V5.0	X	---	X (as of V5.5 SP4, HSP0255 V4)	X (as of V13 SP1, Update 6)

Function	Functional	Firmware	Configuration software [2]			
Maintenance interrupts of I/O modules	1	V5.0	X	---	X (as of V5.5 SP4, HSP0255 V4)	X (as of V13 SP1, Update 6)
Extended Channel Diagnostics	1	V5.0	X	---	X (as of V5.5 SP4, HSP0255 V4)	X (as of V13 SP1, Update 6)
Module-to-Module Communication (MtM)	1	V5.0	X	---	---	X (as of V15.1)
BusAdapter BA 2xRJ45	1	V5.0.2	X	X	X	X
BusAdapter BA 2xFC	1	V5.0.2	X	X	X	X
BusAdapter BA SCRJ/RJ45	1	V5.1.1	X	---	X (as of V5.5 SP4, HSP0250 V3)	X (as of V13 SP1, HSP0129 V1.0)
BusAdapter BA SCRJ/FC	1	V5.1.1	X	---	X (as of V5.5 SP4, HSP0250 V3)	X (as of V13 SP1, HSP0129 V1.0)
BusAdapter BA 2xLC	1	V5.1.1	X	---	X (as of V5.5 SP4, HSP0250/255 V4)	X (as of V13 SP1, Update 6)
BusAdapter BA LC/RJ45	1	V5.1.1	X	---	X (as of V5.5 SP4, HSP0250/255 V4)	X (as of V13 SP1, Update 6)
BusAdapter BA LC/FC	1	V5.1.1	X	---	X (as of V5.5 SP4, HSP0250/255 V4)	X (as of V13 SP1, Update 6)
BusAdapter BA 2xM12	1	V5.1.1	X	---	X (as of V5.5 SP4 with HSP0250 V5.0)	X (as of V16 with HSP302)
Local data coupling	1	V5.2	X	---	---	---

[1] Systems of third-party manufacturers: Depending on the range of functions of the third-party system

[2] Replacement parts scenario

Cabling with fixed connection setting

If you set a fixed connection setting of the port in STEP 7, you must also disable "Autonegotiation/Autocrossover".

You can find more information on this topic in the STEP 7 online help and

- As of STEP 7 (TIA Portal) V12, in the function manual PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856).
- As of STEP 7 V5.5, in the system manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127).

See also

Compatibility of modules (Page 74)

ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293)

PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856)

3.1.1 Device replacement

Device replacement

Device replacement without topological configuration

The device name is also stored on the BusAdapter in addition to the interface module. A device name saved on the BusAdapter is the requirement for device replacement without topological configuration.

Replacing the interface module produces a range of scenarios for using the device name.

Table 3- 2 Scenarios for using the device name

	Interface module empty	Interface module with device name
BusAdapter without device name	No device name available	The device name from the interface module is used and copied to the BusAdapter.
BusAdapter with device name	The device name from the BusAdapter is used and copied to the interface module.	The device name from the BusAdapter is used and copied to the interface module if this has a different device name.

Be aware of the following constraints:

- Resetting to factory settings deletes the device name in both the interface module and the BusAdapter. To prevent the device name from being deleted in the BusAdapter, you can remove the BusAdapter from the interface module before resetting to factory settings.
- When a BusAdapter is replaced, a device name stored in the BusAdapter is applied to the interface module after a POWER ON.
- Do not pull/plug the BusAdapter while under voltage.

Device replacement with topological configuration

IO devices with this function can be replaced in a simple manner:

- The device name does not have to be assigned with the programming device.

The replacement IO device is assigned the device name by the IO controller and not by the programming device. The IO controller uses the configured topology and the neighboring relationships determined by the IO devices for this purpose. All involved devices must support the LLDP protocol (Link Layer Discovery Protocol). The configured target topology must match the actual topology.

If the IO devices were already used in another configuration, reset them to factory settings before reusing them. You can find information on this in the system manual ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293).

You can find more information on this topic in the STEP 7 online help and

- As of STEP 7 (TIA Portal) V12, in the function manual PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856).
- As of STEP 7 V5.5, in the system manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127).

3.1.2 Real-time communication

Real-time communication

A transmission method for PROFINET IO based on cyclic data exchange with a provider-consumer model.

3.1.3 Submodules

Submodules

The IM 155-6 MF HF interface module supports the division of I/O modules into up to 4 submodules. This allows parts of an I/O module to be separately configured and parameterized.

A maximum of 256 submodules is supported, whereby 4 submodules are used for the interface module and one submodule for the server module.

You can assign each of these submodules to different IO controllers.

The following functions are only executed if you have configured submodule 1 during configuration:

- Firmware update
- Write I&M data
- Calibration
- PROFIenergy

3.1.4 Media redundancy (MRP)

Media redundancy (MRP)

Function for safeguarding communication and plant availability. A ring topology ensures that an alternative communication path is made available if a transmission route fails.

You can find more information on this topic in the STEP 7 online help and

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856).
- As of STEP 7 V5.5, in the system manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127).

3.1.5 Shared device

Shared device

IO device that makes its data available to up to four IO controllers.

The interface module supports shared device at submodule level.

If **there is no validity check of the shared device projects by the Engineering System**, note the following:

- Make sure the configurations are consistent. Assign each module or submodule to only one IO controller. Multiple assignment will result in an error as the module or submodule will only be available in the first controller.
- If you reconfigure the shared device configurations without the validity check mentioned above, you must commission ET 200SP again. This means you must download the projects of all involved IO controllers to the respective CPU again after reconfiguration. If necessary, perform a POWER OFF/POWER ON of the interface module.

You can find more information on this topic in the STEP 7 online help and

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856).
- As of STEP 7 V5.5, in the system manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127).

Note

In the case of a shared device application, make sure that all controllers work with the same send clock. If the controller does not have the same send clock, this results in communication relationships not being set up.

If you set up all controllers in one project, the same send clock is ensured. Set the same send clock for engineering in separate projects.

3.1.6 Module-internal Shared Input/Shared Output (MSI/MSO)

Module-internal Shared Input/Shared Output (MSI/MSO)

The Module-internal Shared Input function allows an input module to make its input data available to up to four IO controllers. Each controller has read access to the same channels.

The Module-internal Shared Output function allows an output module to be operated by up to four IO controllers. One IO controller has write access. Up to three additional IO controllers can have read access to the same channels.

You can find more information on this topic in the STEP 7 online help and:

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856).
- As of STEP 7 V5.5, in the system manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127).

3.1.7 System redundancy S2

System redundancy S2

An IO device with S2 system redundancy supports redundant ARs.

In a redundant system, an IO device with system redundancy S2 has a redundant AR for each of the two CPUs (IO controllers). If one CPU fails, the IO device with S2 system redundancy remains accessible to the remaining IO controller via the AR.

The interface module supports system redundancy S2 on S7-400H CPUs and on S7-1500R/H CPUs.

You can find additional information in the STEP 7 online help and

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856)
- As of STEP 7 V5.5, in the system manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127)

Note

Restrictions in operation with activated system redundancy S2

You cannot use the following functions during operation of the IM155-6 MF HF, firmware version V5.0 with activated system redundancy S2:

- Configuration control (option handling)
- Module-to-Module Communication (MtM)

3.1.8 Alternating IO devices during operation ("docking systems")

Alternating IO devices during operation ("docking systems")

- Docking station
- Docking unit

You can find additional information in the STEP 7 online help and

- As of STEP 7 V12, in the PROFINET with STEP 7 (https://support.automation.siemens.com/WW/view/en/49948856) function manual

3.1.9 Value status

Value status

The IM 155-6 MF HF interface module supports I/O modules with value status.

For more information about the value status, refer to the System Manual and I/O module Equipment Manuals.

3.1.10 PROFIenergy

Properties

PROFIenergy (for PROFINET) reduces the energy consumption by using PROFIenergy commands during production-free periods.

Reference

You will find additional information on PROFIenergy in the following manuals:

- Manual I/O modules (https://support.automation.siemens.com/WW/view/en/55679691/133300)
- Function manual PROFINET as of STEP 7 V12 (https://support.automation.siemens.com/WW/view/en/49948856)
- System manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127)
- PROFIenergy (https://support.automation.siemens.com/WW/view/en/66928686) product information
- Internet (https://www.profibus.com) under Common Application Profile PROFIenergy; Technical Specification for PROFINET; Version 1.0; January 2010; Order No: 3.802

3.1.11 Configuration control (option handling)

Properties

Configuration control allows you to prepare your automation system for future expansions or changes. Configuration control means you can configure the planned maximum expansion of your automation system in advance and flexibly vary it later by means of the user program.

Reference

You can find more information on configuration control:

- In the system manual ET 200SP distributed I/O system. (https://support.automation.siemens.com/WW/view/en/58649293)
- On the Internet under the following link: Application collection (https://support.automation.siemens.com/WW/view/en/29430270).
- In the STEP 7 online help.

3.1.12 Use of fail-safe modules

Properties

The IM 155-6 MF HF interface module supports the use of fail-safe modules with PROFIsafe.

Reaction times for fail-safe modules

The following maximum reaction time of the interface module must be taken into account when calculating the reaction times of fail-safe modules: **Maximum reaction time = configured update time + 400 µs (but at least 1.5 ms)**

Reference

You can find more information in the ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293) system manual.

3.1.13 Multi Hot Swap

Properties

You can remove and insert any number of I/O modules during operation. The interface module and the inserted I/O modules remain in operation.

Note

The IM 155-6 MF HF interface module does not support removal and insertion of the server module, interface module and BusAdapter during operation.

Reference

You can find more information on the removal/insertion of modules in the system manual ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293).

3.1.14 Module-to-Module Communication (MtM)

Introduction

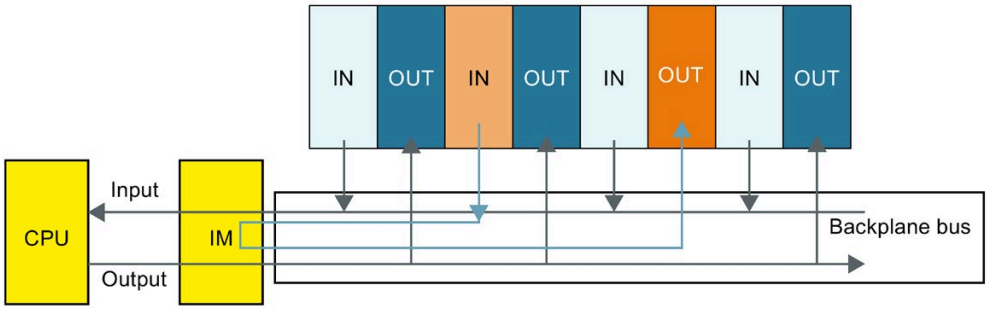
Module-to-Module Communication (MtM) offers the following advantages for operation via PROFINET IO:

- Improved performance during transmission of data by bypassing the IO controller.
- Deterministic cycle times
- Cost-effective, high-performance solutions for applications where the performance of a specific technology module is not required.

Module-to-Module Communication (MtM)

Module-to-Module Communication (MtM) enables direct exchange of data between specific IO modules within a station via the interface module. This enables you to move small and/or time-critical tasks to the IO module. You achieve better performance while reducing the load on the CPU.

With Module-to-Module Communication (MtM), the interface module copies the input data of an IO module directly to a different IO module via the ET 200SP backplane bus. The IO module (data sink) carries out application-specific processing of the data.



You configure the data source and data sink for Module-to-Module Communication (MtM) in the hardware configuration of the respective output module. Programming of the user program is **not** required in the variant for Module-to-Module Communication (MtM).

Note

The preparation of the input data in the output module (mapping) and the output of the data to the outputs are application- and technology-specific.
Example: The DQ 4x24VDC/2A HS digital output module supports

- the application cam control with Module-to-Module Communication (MtM) under the designation DQ 4x24VDC/2A HS **MCC MtM**

Additional information can be found in the manuals of the corresponding IO modules.

3.1.15 Setting the time

The interface module supports time setting, for example with AI Energy Meter 480VAC/CT HF (6ES7134-6PA00-0CU0).

We show you how to set the time in an application example (https://support.automation.siemens.com/WW/view/en/109754890).

3.1.16 Interface local coupling of IO data

Module-internal shared output

In this example, IO data are transferred from one controller to other controllers over the PROFINET interface X1 by means of the module-internal shared output.

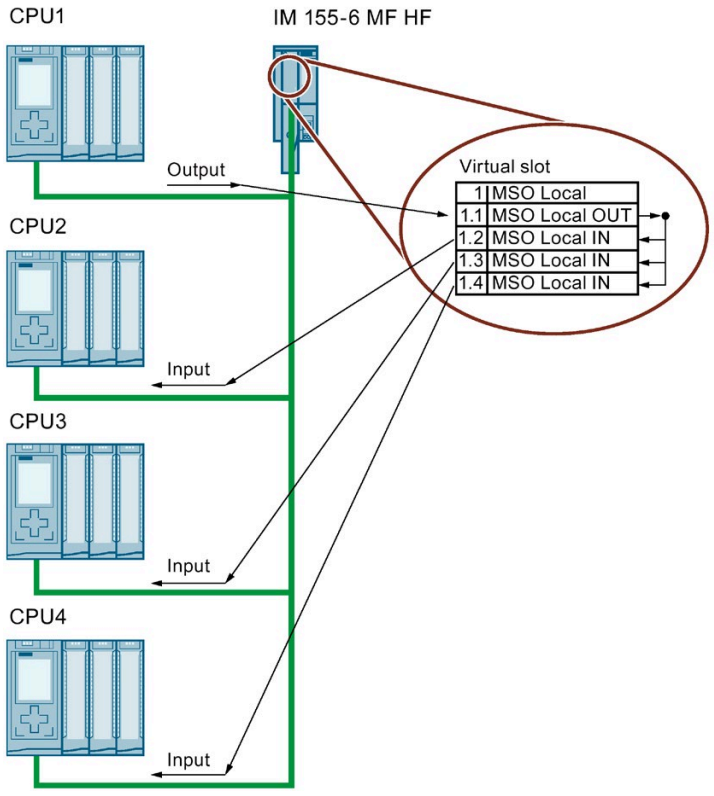


Figure 3-1 I/O data are transferred to other controllers in the same PROFINET network

Configuration

Table 3- 3 Example of the configuration

Virtual slot	Type	I-length	Q-length	Access
1	MSO Local	-	-	-
1.1	MSO Local OUT	-	4 bytes	CPU 1
1.2	MSO Local IN	5 bytes incl. 1 byte DS	-	CPU 2
1.3	MSO Local IN	5 bytes incl. 1 byte DS	-	CPU 3
1.4	MSO Local IN	5 bytes incl. 1 byte DS	-	CPU 4

Editing in the user program

The controller CPU 1 writes I/O data to the MSO Local OUT module with the virtual slot 1.1 of the interface module. The data is available to CPUs 2 to 4 for reading with the remaining MSO Local IN modules. The validity of the provided user data is displayed by the data status byte (DS) of the MSO Local IN modules.

You can also use this example:

- with fewer controllers and
- configure it with other virtual modules.

Note

Virtual IO modules

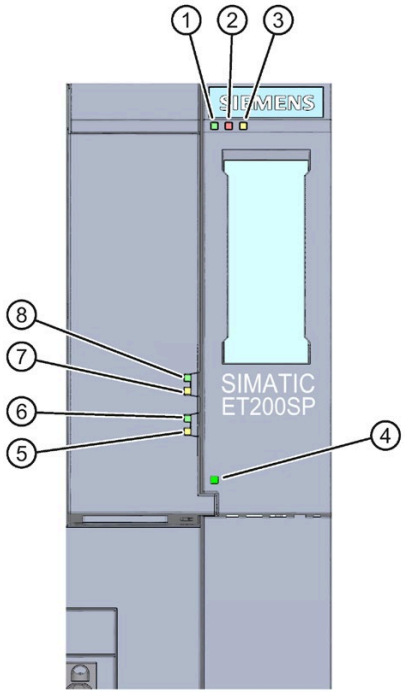
The use of virtual IO modules increases the communication load. This increases the data update time of all IO data accordingly.

3.2 Interrupts, error messages, diagnostics and system alarms

3.2.1 Status and error displays

LED displays

The following figure shows the LED displays on the interface module and BusAdapter.



① RN/NS (red/green)
② ER/MS (red/green)
③ MT/IO (red/green/yellow)
④ PWR (green)
⑤ MT2 (yellow), SCRJ port
⑥ LK2 (green)
⑦ MT1 (yellow), SCRJ port
⑧ LK1 (green)

Figure 3-2 LED displays on the interface module and BusAdapter

Meaning of the LED displays

The following tables contain the meaning of the status and error displays.

The meaning of the NS/MS/IO LEDs for operation with EtherNet/IP can be found in section "Status and error displays for EtherNet/IP (Page 51)" and for Modbus TCP in the section "Status and error displays for Modbus TCP (Page 64)".

RN/ER/MT LEDs on the interface module during operation with PROFINET IO

The LEDs display the status with the highest priority if there are different LED states due to overlaid events. (0 = off, 1 = green flashing, 2 = green, 3 = yellow, 4 = red flashing, 5 = red)

Table 3- 4 Status and error displays of RN/ER/MT LEDs

LEDs			Meaning	Solution
RN (RUN)	ER (ERROR)	MT (MAINT)		
Off	Off	Off	Missing or insufficient supply voltage on interface module.	Check the supply voltage or turn it on at the interface module.*
Flashes	Flashes	Flashes	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s in red. Then for approximately 0.25 s in green.	-
Flashes	Not relevant	Not relevant	Interface module is deactivated.	Activate the interface module with the configuration software or via the user program.
			Interface module is not configured.	Configure the interface module with the configuration software.
			ET 200SP starts up.	-
			ET 200SP is being assigned parameters.	
			ET 200SP is being reset to factory settings.	
On	Not relevant	Not relevant	ET 200SP is currently exchanging data with the IO controller.	-
Not relevant	Flashes	Not relevant	Group errors and group error channels.	Evaluate the diagnostics and eliminate the error.
			The preset configuration does not match the actual configuration of the ET 200SP.	Check the configuration of the ET 200SP to see whether a module is missing, faulty or not configured.
			Invalid configuration states.	For additional information, see section Invalid configuration states of the ET 200SP system (Page 40)
			Parameter assignment error in the I/O module.	Evaluate the display of the module status in STEP 7. Eliminate the error in the corresponding I/O module.
Not relevant	Not relevant	On	Maintenance	For additional information, see section Maintenance events (Page 38)
Flashes	Flashes	Flashes	The "Node flash test" is run (LEDs LK1 and LK2 of the PROFINET interface also flash).	-

LEDs			Meaning	Solution
RN (RUN)	ER (ERROR)	MT (MAINT)		
Flashes	Flashing	Flashing	Hardware or firmware defective (LEDs LK1 and LK2 of the PROFINET interface do not flash).	Restart the device by disconnecting and reconnecting the supply voltage. Run a firmware update. If the error persists, contact Siemens Industry Online Support. Replace the interface module. You can read out the service data with STEP 7 V5.6.
On	On	On	RN/ER/MT LEDs are permanently on: Hardware or firmware defective. Error information will be determined and stored retentively on the Flash memory.	Do not disconnect the interface module from the supply voltage while the LEDs are permanently lit up. This may take a few minutes.

* PWR LED on (on the interface module): Check the backplane bus for a short-circuit.

PWR LED on the interface module

Table 3- 5 Status display of the PWR LED

PWR LED	Meaning	Solution
Off	Supply voltage not present or too small.	Check the supply voltage.
On	Supply voltage present. Observe the maintenance messages if the MAIN LED is lit	-

LED display of configuration errors

Configuration errors of the ET 200SP distributed IO system are indicated on the interface module via the red ERROR LED and the yellow MAINT LED.

The following configuration errors are signaled by the LEDs:

- No server module
- Interruptions or short-circuit on the backplane bus

Operating principle

The LED error display provides information on the cause of the error. After notification by the flash signal, the error type is displayed followed by the error location/error code.

The LED error display:

- Is activated during POWER ON and during operation.
- Has priority over all other states that are displayed by means of the ERROR and MAINT LED.
- Remains on until the cause of the error has been eliminated.

Table 3- 6 Display of error type and error location

Sequence		Description
1	The ERROR and MAINT LEDs flash 3x at 0.5 Hz	Indication of the error type
2	The MAINT LED flashes at 1 Hz	Display of error type (decimal)
3	The ERROR and MAINT LEDs flash 3x at 2 Hz	Signaling of error location/error code
4	The ERROR LED flashes at 1 Hz	Display of tens digit (decimal) of the error location/error code
5	The MAINT LED flashes at 1 Hz	Display of ones digit (decimal) of the error location/error code
6	Repetition of 1 to 5 until the cause of the error has been eliminated.	

Error display

Table 3- 7 Error display

Error type (MAINT)	Error location (ERROR/ MAINT)	Cause of error	Solution
1	65	• No server module • Interruptions on the backplane bus • Short circuit of communication on the backplane bus	Check the configuration of the ET 200SP.

Note

A short circuit in the backplane bus supply or the bus connection supply is indicated by the following LEDs:

- PWR LED: On
- RN, ER and MT LED: Off

3.2.2 Interrupts

Introduction

The I/O device triggers interrupts as a reaction to specific errors. The evaluation of the interrupt is dependent on the PROFINET IO controller used.

Evaluating interrupts with PROFINET IO controllers

The ET 200SP distributed I/O system supports the following interrupts:

- Diagnostic error interrupts
- Hardware interrupts
- Pull/plug interrupts
- Maintenance events

In the event of an interrupt, interrupt OBs are automatically called in the CPU of the IO controller.

Information on the cause and class of the error is already available, based on the OB number and start information.

Detailed information on the error event can be obtained in the error OB using the instruction "RALRM" (read additional interrupt information).

System diagnostics

In STEP 7 (TIA Portal), the innovated system diagnostics is available for the devices of the S7-1500 automation system (IO controller S7-1500 CPU) and ET 200SP (IO device). Independent of the cyclic user program, alarms are made available on the display of the S7-1500 CPU, the CPU web server and the HMI device.

You will find more information on system diagnostics in the Diagnostics (https://support.industry.siemens.com/cs/ww/en/view/59192926) function manual.

3.2.2.1 Triggering of a diagnostics interrupt

Triggering of a diagnostics interrupt

For an incoming or outgoing event (e.g. wire break on a channel of an I/O module), the module triggers a diagnostic error interrupt if this is configured accordingly.

The CPU interrupts processing of the user program and processes the diagnostic error interrupt OB (OB 82). The event that triggered the interrupt is entered in the start information of the diagnostic error interrupt OB.

3.2.2.2 Triggering a hardware interrupt

Triggering a hardware interrupt

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

Note

Diagnostics "Hardware interrupt lost" (from I/O module)

Do not use hardware interrupts for functional purposes (e.g. the cyclic generation of hardware interrupts).

If the hardware interrupt load is too high, hardware interrupts can get lost depending on the number of I/O modules and the communication load.

3.2.2.3 Triggering of a remove/insert module interrupt

Triggering of a remove/insert module interrupt

In the event of a remove/insert module interrupt, the CPU interrupts processing of the user program and processes the remove/insert module OB, e.g. OB 83. The event that triggered the interrupt is entered in the start information of the remove/insert module OB.

Note

Parameter assignment error after removal/insertion

If you write data records from the user program to the modules of the distributed I/O, make sure that these modules actually exist and are available. You can do this by evaluating OB 83. After inserting a module, OB 83 is not called until the module has started up and its parameters are assigned. This ensures that data record operations can be executed without errors.

3.2.3 Alarms

3.2.3.1 Diagnostics alarms

Actions after a diagnostic message

There can be more than one diagnostic message at the same time. Each diagnostic message initiates the following actions:

- The ER/MS LED of the interface module flashes red.
- Diagnostics data is reported as diagnostic interrupts to the CPU of the PROFINET IO controller and can be read via data records.
- Incoming diagnostic messages are saved to the diagnostic buffer of the PROFINET IO controller.
- (S7-300/400) The diagnostic interrupt OB is called. If the diagnostic interrupt OB (OB 82) is not available, the IO controller goes into STOP mode.

You can find more information on using PROFINET IO in the STEP 7 online help.

Reading the diagnostics

Table 3- 8 Reading the diagnostics with STEP 7

Automation system with IO Controller	Application	See...
SIMATIC S7	Diagnostics as plain text in STEP 7 using Online and Diagnostics view	STEP 7 online help • as of STEP 7 V12, Function Manual PROFINET with STEP 7 as of V12 (https://support.automation.siemens.com/WW/view/en/49948856) • as of STEP 7 V5.5, System Manual PROFINET System Description (https://support.automation.siemens.com/WW/view/en/19292127)
	Instruction "RDREC" (SFB 52) Read data records from the IO device	
	Instruction "RALRM" (SFB 54) Receive interrupts from the IO device	

More information on the data records for PROFINET IO

You will find the structure of the diagnostics data records and examples for programming in the Programming Manual, From PROFIBUS DP to PROFINET IO (https://support.automation.siemens.com/WW/view/en/19289930) in the chapters "Structure of diagnostic data records" and "Examples of diagnostic data records" and in Example application (https://support.automation.siemens.com/WW/view/en/24000238).

Causes of error and troubleshooting

The causes of error and remedies for the diagnostic messages are described in the manuals for I/O modules (https://support.automation.siemens.com/WW/view/en/55679691/133300) in the section, "Interrupts, error messages, and system events".

See also

Channel diagnostics (Page 39)

3.2.3.2 Maintenance events

Triggering of a maintenance event

The PROFINET IO interfaces of the interface module support the diagnostic concept and maintenance concept in PROFINET IO according to the IEC 61158 Type 10 standard. The goal is to detect and remove potential problems as soon as possible.

For the interface module, maintenance events signal to the user when a plant component must be checked or replaced.

The CPU interrupts user program execution and executes the diagnostic error interrupt OB. The event that triggered the maintenance event is entered in the start information of the diagnostic error interrupt OB.

The interface module signals a maintenance event to the higher-level diagnostic system in the case of the following event:

Table 3- 9 Triggering of a maintenance event

Maintenance alarm	Event	Alarm/Meaning
Maintenance demanded LED MT/IO lit yellow	Synchronization loss	• No synchronization frame received. No synchronization frame was received by the sync master within the timeout period after parameter assignment or during operation. • Successive synchronization frames are located outside permitted limits (jitter).
	Undervoltage	• Diagnostics Undervoltage If the supply voltage of the interface falls below the value 19.2 V DC, this diagnostics is reported as incoming Maintenance demanded.

System alarms in STEP 7 (TIA Portal)

The maintenance information is generated in STEP 7 (TIA Portal) with the following system alarms:

- Maintenance demanded - indicated for each port by a yellow wrench icon in the device view or in the hardware configuration.

You can find more information in the STEP 7 online help.

3.2.3.3 Channel diagnostics

Function

Channel-related diagnostics provides information about channel faults in modules.

Channel faults are mapped as channel diagnostics data in IO diagnostics data records.

The data record is read using the instruction "RDREC".

Structure of the diagnostics data records

The data records supported by the ET 200SP distributed I/O system are based on the standard PROFINET IO - Application Layer Service Definition V2.2.

If required, you can find the standard on the Internet (https://www.profibus.com) on the PROFIBUS user organization home page.

For example, you can read diagnostics separately for each submodule using the data set 0x800C.

Codes of the extended channel diagnostics

With the IM 155-6 MF HF interface module, the following extended channel diagnostics are reported:

ChannelErrorType (CET)	ExtendedChannelError-Type (ECET)	Associated value AddValue	Diagnostics
0x0602	0x0691	Slot	Station stop - module parameter "Potential group" faulty or incorrect BaseUnit in actual slot (AddValue)
0x0602	0x0693	0x00	Diagnostics with missing server module
0x0602	0x0698	0x00	Diagnostics backplane bus too large
0x0602	0x0699	Slot	Diagnostics with incorrect bus configuration
0x0602	0x069C	0x00	Diagnostics with incorrectly plugged BusAdapter
0x0610	0x06B0	0x00	Group diagnostics: Missing supply voltage L+ for the potential groups Note: The slot in which the light-colored BaseUnit of the respective load module is located is coded in the "ChannelNumber" element.
0x0610	0x06B4	0x00	Diagnostics "Undervoltage power supply" If the supply voltage of the interface falls below the value 19.2 V DC, this diagnostics is reported as incoming Maintenance demanded.

3.2.3.4 Invalid configuration states of the ET 200SP system

Invalid configuration states

The following invalid configuration states of the ET 200SP distributed I/O system lead to the failure of the IO device or prevent data exchange:

- Number of modules exceeds maximum configuration.
- Faulty backplane bus (e.g. defective BaseUnit). ET 200SP backplane bus interruptions do not trigger an interrupt.
- At least one I/O module is plugged into a different BaseUnit as the one configured in the parameters.
- No server module.
- Invalid or incorrectly configured BusAdapter

Note

Removal of the server module will trigger a station stop. All I/O modules of the ET 200SP distributed I/O system fail (substitute value behavior) but the interface module continues to exchange data.

The virtual MSO Local modules are not affected by the failure.

Revoking the station stop (by correcting the invalid configuration state) leads to a brief failure of the ET 200SP distributed I/O system and automatic restart.

See also

Status and error displays (Page 31)

Channel diagnostics (Page 39)

3.2.3.5 Failure of supply voltage L+ at BaseUnit BU...D

Failure of the supply voltage L+

The I/O modules react as follows to failure of the supply voltage L+ on the BaseUnit BU...D:

- If an I/O module is removed during failure of the supply voltage, a pull interrupt is generated for PROFINET IO.
- If an I/O module is installed during failure of the supply voltage, a plug interrupt is generated for PROFINET IO.

3.2.3.6 STOP of the IO controller and recovery of the IO device

STOP of the PROFINET IO controller

Diagnostics received from the IO device while the IO controller is in STOP do not initiate a call of any corresponding OBs when the IO controller goes into RUN. Read the E00C$_H$ data record in startup OB using the instruction "RDREC". This record contains all diagnostics for the slots assigned to an IO controller in an IO device.

Recovery of the PROFINET IO device

If you want to read the occurring diagnostics in the STOP state of the IO controller, you have to read the E00C$_H$ data record with the "RDREC" instruction. This record contains all diagnostics for the slots assigned to an IO controller in an IO device.

EtherNet/IP

4

4.1 EtherNet/IP functions

The interface module supports the following EtherNet/IP functions:

- I/O communication with scanner
- Configuring from the user program
- Read diagnostics (interrupts are not supported)
- Normative CIP objects
- Resetting interface module to factory setting
- Diagnostics bit in data status of cyclic I/O data per submodule
- Integrated switch with 2 ports
- Supported Ethernet services: PING, ARP, SNMP, LLDP
- Minimum RPI 2 ms
- Reset to factory settings via RESET button
- Firmware update via MFCT
- Shared device
- Distribution of module channels to submodules
- Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)
- Station extension via ET-Connection
- Supports BusAdapter for different connection technologies

The interface module supports additional functions:

- Interface-local coupling of IO data
- Identification data I&M 0 to I&M 3
- PROFIenergy
- Removal/insertion of multiple I/O modules during operation (Multi Hot Swap)
- Module-to-Module Communication (MtM)
- Setting the time

Requirements

The following table shows the software requirements of the EtherNet/IP functions:

Table 4- 1 Version dependencies of the EtherNet/IP functions

Function	Functional status of the module as of	Firmware version of the module as of	Configuration software MFCT
			as of V1.0 Update 2
I/O communication with scanner	1	V5.0.2	X
Configuring from the user program	1	V5.0.2	X
Reading diagnostics	1	V5.0.2	X
Normative CIP objects	1	V5.0.2	X
Resetting interface module to factory setting	1	V5.0.2	X
Diagnostics bit in data status of cyclic I/O data per submodule	1	V5.0.2	X
Station extension via ET connection	1	V5.0.2	X
BusAdapter BA 2xRJ45	1	V5.0.2	---
BusAdapter BA 2xFC	1	V5.0.2	---
BusAdapter for fiber-optic cable FOC: BA 2xSCRJ	1	V5.1.1	---
BusAdapter BA SCRJ/RJ45	1	V5.1.1	---
BusAdapter BA SCRJ/FC	1	V5.1.1	---
BusAdapter BA 2xLC	1	V5.1.1	---
BusAdapter BA LC/RJ45	1	V5.1.1	---
BusAdapter BA LC/FC	1	V5.1.1	---
BusAdapter BA 2xM12	1	V5.1.1	---
MF Shared Device	1	V5.2.1	as of V1.3 Update 1
Distribution of module channels to submodules	1	V5.2.1	as of V1.3 Update 1
Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)	1	V5.2.1	as of V1.3 Update 1
Interface-local coupling of IO data	1	V5.2.1	as of V1.3 Update 1
Module-to-Module Communication (MtM)	1	V5.2.1	as of V1.3 Update 1

4.1.1 Applicable modules with EtherNet/IP

With EtherNet/IP the following modules cannot be used or can be used only with limitations.

These modules are divided into 4 categories:

Category	Description
1	Module can be used without functional restrictions. The module needs simple parameter reassignment. Records/interface are described in the Equipment Manual.
2	A function block must be created for the module for the target control. The module operates with a non-locked function block. The function block can be reimplemented.
3	Subfunctions of the module are not supported by the selected fieldbus. Subfunctions are only possible using blocks or additional interfaces.
4	The module is not supported by the selected fieldbus. The module needs a protected function block (e.g. for F-modules).

Note

Module operating modes based on isochronous operation (e.g. oversampling or time stamping) are not supported.

F-modules

Module	Article number	Category	Note
F-DI 8x24VDC HF	6ES7136-6BA00-0CA0	4	-
	6ES7136-6BA01-0CA0	4	-
F-DQ 4x24VDC/2A PM HF	6ES7136-6DB00-0CA0	4	-
F-DQ 8x24VDC/0.5A PP HF	6ES7136-6DC00-0CA0	4	-
F-RQ 1x24VDC/24..230VAC/5A	6ES7136-6RA00-0BF0	4	-
F-PM-E 24VDC/8A PPM ST	6ES7136-6PA00-0BC0	4	-
F-AI 4xI 0(4)..20mA 2-/4-wire HF	6ES7136-6AA00-0CA1	4	-
F-AI 4xU 0..10V HF	6ES7136-6AB00-0CA1	4	-
F-TM Count 1x1Vpp sin/cos HF	6ES7136-6CB00-0CA0	4	-

Technology modules

Module	Article number	Category	Note
TM ECC 2xPWM 12V ST	6FE1242-6TM10-0BB1	2	The control interface is described.
SIWAREX WP321	7MH4138-6AA00-0BA0	3	Only for DR data records (calibrating) The description of the blocks is available on request. Alternatively, commissioning with SIWATOOL V7 is possible.
TM SIWAREX WP351 HF	7MH4138-6BA00-0CU0	3	Commissioning is possible with the integrated web browser.
F-TM ServoDrive 1x24..48V ST	6BK1136-6AB00-0BU0	3	Comprehensive support of controller calculation and diagnostics is currently only available in the TIA Portal.

Communication modules

Module	Article number	Category	Note
CM PtP	6ES7137-6AA00-0BA0	1	PRM, DataEx is described in the Function Manual
CM 4xIO-Link	6ES7137-6BD00-0BA0	3	Time-based IO blocks (isochronous mode)
CM DALI	6ES7137-6CA00-0BU0	2	See the "ET 200SP, CM 1xDALI – Communication Model Description (https://support.industry.siemens.com/cs/ww/en/view/109774228)" Programming Manual

4.1.2 Update time of the I/O data

You can estimate the typical update time for an I/O cycle as follows:

RPI time (can be set starting at 2 ms)

+ I/O processing (typically 1.4 ms, +/- 1 ms jitter due to free-running cycles)

+ EM conversion (dependent on cycle time and parameter assignment of the module)

If necessary, you must take into account other influences caused by the EIP scanner and network components by adding them.

Note

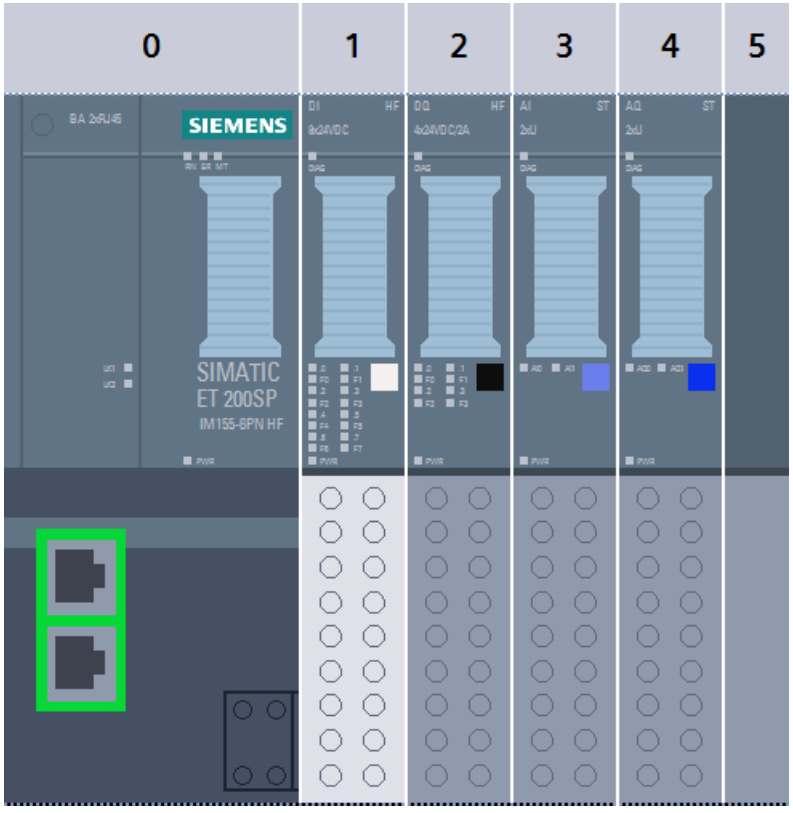
When using ET 200AL I/O modules, the search for nodes at the ET connection can take up to 5 seconds. The user data is temporarily invalid during this period (IDS/ODS = 0x40).

4.1.3 Examples for I/O data mapping

4.1.3.1 Example of I/O data mapping for I/O data alignment Byte

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
0	IM 155-6 MF
1	DI 8 HF
2	DQ 4 HF, QI
3	AI 2 ST
4	AQ 2 ST
5	Server module

Input buffer

The following table shows the input buffer for the example configuration for the I/O data alignment Byte:

Slot	Name*	Data type	Byte offset	Description
0	Slot0_1_IDS	Byte	0	Input Data State for the interface module
1	Slot1_1_I_channel_0_0	Byte	1	1 byte input data for the DI 8 HF module
	Slot1_1_IDS	Byte	2	Input Data State for the DI 8 HF module
2	Slot2_1_QI	Byte	3	Value status for the DQ 4 HF module
	Slot2_1_IDS	Byte	4	Input Data State for the value status of the DQ 4 HF module
3	Slot3_1_I_channel_0_0	Byte	5	2 bytes input data for channel 0 of the AI 2 ST module
	Slot3_1_I_channel_0_1	Byte	6	
	Slot3_1_I_channel_1_0	Byte	7	2 bytes input data for channel 1 of the AI 2 ST module
	Slot3_1_I_channel_1_1	Byte	8	
	Slot3_1_IDS	Byte	9	Input Data State for the AI 2 ST module
5	Slot5_1_IDS	Byte	10	Input Data State for the server module
2	Slot2_1_ODS	Byte	11	Output Data State for the DQ 4 HF module
4	Slot4_1_ODS	Byte	12	Output Data State for the AQ 2 ST module

The sum of the input data is 13 bytes.

Output buffer

The following table shows the output buffer for the example configuration for the I/O data alignment Byte:

Slot	Name*	Data type	Byte offset	Description
2	Slot2_1_O_channel_0_0	Byte	0	1 byte output data for the DQ4 HF module
4	Slot4_1_O_channel_0_0	Byte	1	2 bytes output data for channel 0 of the AQ 2 ST module
	Slot4_1_O_channel_0_1	Byte	2	
	Slot4_1_O_channel_1_0	Byte	3	2 bytes output data for channel 1 of the AQ 2 ST module
	Slot4_1_O_channel_1_1	Byte	4	

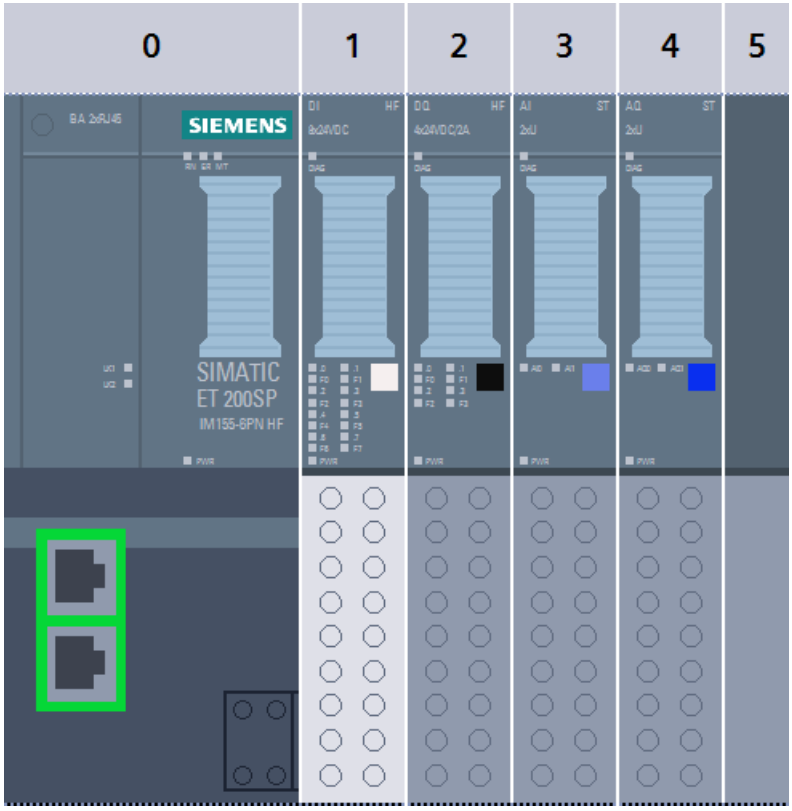
* The name is formed according to the following scheme: Slot<Slot#>_<Subslot#>_<DataItem-TextId>[_<Index>]

The sum of the output data is 5 bytes.

4.1.3.2 Example of I/O data mapping for I/O data alignment Word

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
0	IM 155-6 MF
1	DI 8 HF
2	DQ 4 HF, QI
3	AI 2 ST
4	AQ 2 ST
5	Server module

Input buffer

The following table shows the input buffer for the example configuration for the I/O data alignment Word:

Slot	Name*	Data type	Byte offset	Description
0	Slot0_1_IDS	Byte	0	Input Data State for the interface module
	0x00	Byte	1	*Padding byte*
1	Slot1_1_I_channel_0_0	Byte	2	1 byte input data for the DI 8 HF module
	0x00	Byte	3	*Padding byte*
	Slot1_1_IDS	Byte	4	Input Data State for the DI 8 HF module
	0x00	Byte	5	*Padding byte*
2	Slot2_1_QI	Byte	6	Value status for the DQ 4 HF module
	0x00	Byte	7	*Padding byte*
	Slot2_1_IDS	Byte	8	Input Data State for the value status of the DQ 4 HF module
	0x00	Byte	9	*Padding byte*
3	Slot3_1_I_channel_0_0	Byte	10	2 bytes input data for channel 0 of the AI 2 ST module
	Slot3_1_I_channel_0_1	Byte	11	
	Slot3_1_I_channel_1_0	Byte	12	2 bytes input data for channel 1 of the AI 2 ST module
	Slot3_1_I_channel_1_1	Byte	13	
	Slot3_1_IDS	Byte	14	Input Data State for the AI 2 ST module
	0x00	Byte	15	*Padding byte*
5	Slot5_1_IDS	Byte	16	Input Data State for the server module
	0x00	Byte	17	*Padding byte*
2	Slot2_1_ODS	Byte	18	Output Data State for the DQ 4 HF module
	0x00	Byte	19	*Padding byte*
4	Slot4_1_ODS	Byte	20	Output Data State for the AQ 2 ST module
	0x00	Byte	21	*Padding byte*

The sum of the input data is 22 bytes.

Output buffer

The following table shows the output buffer for the example configuration for the I/O data alignment Word:

Slot	Name*	Data type	Byte offset	Description
2	Slot2_1_O_channel_0_0	Byte	0	1 byte output data for the DQ4 HF module
	0x00	Byte	1	*Padding byte*
4	Slot4_1_O_channel_0_0	Byte	2	2 bytes output data for channel 0 of the AQ 2 ST module
	Slot4_1_O_channel_0_1	Byte	3	
	Slot4_1_O_channel_1_0	Byte	4	2 bytes output data for channel 1 of the AQ 2 ST module
	Slot4_1_O_channel_1_1	Byte	5	

* The name is formed according to the following scheme: Slot<Slot#>_<Subslot#>_<DataItem-TextId>[_<Index>]

The sum of the output data is 6 bytes.

4.1.4 MF Shared Device

Four ARs are available; these are shared by the fieldbuses. For EtherNet/IP and Modbus TCP, only one AR is reserved in each case, regardless of the number of controller connections used.

The maximum amount of I/O data must comply with the rules of the following table:

Number of fieldbus connections			Maximum I/O data per connection[1]		Max. download size with MFCT [1]	
PROFINET	**EtherNet/IP**	**Modbus TCP**	**Inputs**	**Outputs**	**Inputs**	**Outputs**
1	1 to 2	0	EtherNet/IP **or** Modbus TCP: 500 PROFINET: 1440	EtherNet/IP **or** Modbus TCP: 246 PROFINET: 1440	Download size[2]: 1440	Download size[2]: 1440
1	0	1 to 10				
0	1 to 2	1 to 10	500	246	1440	1440
1	1 to 2	1 to 10	360	246	360	360
2	1 to 2	0				
2	0	1 to 10				
2	1 to 2	1 to 10				

[1] Including PROFINET payload qualifier or data status byte for signaling the data validity

[2] PROFINET data + download size as displayed in MFCT ≤ 1440

The download size contains the I/O data of all EtherNet/IP and Modbus TCP connections as well as additional bytes for controlling the download.

Note

To avoid temporarily exceeding the I/O quantity structure, you must proceed as follows in case of a reconfiguration that results in changed I/O lengths:

1. Reduce the amount of I/O data in one configuration and download it to the MF device/CPU.
2. Increase the amount of I/O data in another configuration and download it to the MF device/CPU.

4.2 Diagnostics

4.2.1 Status and error displays for EtherNet/IP

RN/NS, ER/MS, MT/IO LEDs on the MF device

The LEDs display the status with the **highest priority** if there are different LED states due to overlaid events. (0 = off, 1 = green flashing, 2 = green, 3 = yellow, 4 = red flashing, 5 = red)

The following table shows the meaning of the RN/NS, ER/MS LEDs and MT/IO LEDs for EtherNet/IP:

Table 4- 2 Status and error displays of the RN/NS LED

LED RN/NS (NET STATUS)	Meaning	Remedy
Flashes	The MF device is not exchanging data.	• Check the correctness of the download with MFCT and for a valid IP address. • Establish the cyclic communication with the EtherNet/IP scanner.
On	The MF device is exchanging data via at least one connection.	---
Flashes	Timeout	• Check the accessibility of the device via the network from the perspective of the EtherNet/IP scanner.

Table 4- 3 Status and error displays of the ER/MS LED

LED ER/MS (MODUL STATUS)	Meaning	Remedy
Off	There is no MultiFieldbus project in the MF device.	• Create a project with MFCT and transfer it to the MF device.
Flashes	The MF device is not exchanging data. There is a MultiFieldbus project in the MF device.	• Establish the cyclic communication with the EtherNet/IP scanner.

LED ER/MS (MODUL STATUS)	Meaning	Remedy
■ On	The MF device is exchanging data via a connection.	---
☼ Flashes	• Diagnostics are present. • Errors in the configuration or parameter assignment.	• Check for diagnostics information and, if necessary, eliminate the error. • Check the configuration of the MF station and, if necessary, correct the configuration and parameter assignment of the MF device in the MFCT and download them to the MF device again.

Table 4- 4 Status and error displays of the MT/IO LED

LED MT/IO (IO STATUS)	Meaning	Remedy
□ Off	There is no MultiFieldbus project in the MF device, or I/O that is used by EtherNet/IP is in STOP. There is no error.	• Switch the EtherNet/IP scanner to RUN mode.
■ On	I/O used by EtherNet/IP is in RUN mode.	---
■ On	There is a maintenance event	• You will find further information in "Maintenance events (Page 38)."

Combinations of the RN/NS, ER/MS, MT/IO LEDs on the MF device

Combinations of the three LEDs are possible. The following table shows the possible combinations:

Table 4- 5 Status and error displays of the RN/NS, ER/MS, MT/IO LEDs

LEDs			Meaning	Notes
RN/NS (NET STATUS)	ER/MS (MODUL STATUS)	MT/IO (IO STATUS)		
□ Off	□ Off	□ Off	Missing or insufficient supply voltage on the MF device.	• Check the supply voltage or switch on the supply voltage on the MF device. *
☼ Flashes	□ Off	□ Off	The MF device is not exchanging data. There is no MultiFieldbus project in the MF device.	• Create a project with MFCT and transfer it to the MF device. Then establish the cyclic I/O communication with the MF device.
■ On	□ Off	□ Off	The MF device is exchanging data via PROFINET IO. There is no MultiFieldbus project in the MF device.	• Exclusive PROFINET use

LEDs			Meaning	Notes
RN/NS (NET STATUS)	**ER/MS (MODUL STATUS)**	**MT/IO (IO STATUS)**		
☼ Flashes	☼ Flashes	□ Off	The MF device is not exchanging data. There is a MultiFieldbus project in the MF device.	• Establish the cyclic communication via EtherNet/IP.
■ On	■ On	□ Off	The MF device is exchanging data error-free via a connection (EtherNet/IP).	• If a data exchange was configured for EtherNet/IP, the assigned EtherNet/IP scanner is in STOP mode.
■ On	■ On	■ On	The MF device is exchanging data error-free via a connection (EtherNet/IP). I/O used by EtherNet/IP is in RUN mode.	---
■ On	☼ Flashes	■ On *or* □ Off	The MF device is exchanging data via at least one connection. Errors in the configuration or parameter assignment.	• At least one module is configured incorrectly, there is no missing module or I/O diagnostics information. • Check the station configuration and, if necessary, correct the configuration and parameter assignment of the MF device in the MFCT and download them to the MF device again. • Check the device status in the Device-Info area and, if necessary, eliminate the diagnostics error.
☼ Flashes	☼ Flashes	□ Off	The MF device is not exchanging data. The MF device has an error.	• Establish the cyclic communication via the I/O register area of the MF device or via EtherNet/IP. • Check the station configuration and eliminate configuration and parameter assignment errors via MFCT and eliminate diagnostics errors.
☼ Flashes	☼ Flashes	Not relevant	At least one connection existed (EtherNet/IP). A connection has been terminated by timeout.	• Reduce the cycle time. • Check the accessibility of the MF device via the network from the perspective of the EtherNet/IP scanner.
☼ Flashes	☼ Flashes	Not relevant	At least one connection existed (EtherNet/IP or Modbus TCP). A connection has been terminated by timeout. Error in the configuration or parameter assignment, or diagnostics present.	• Check the accessibility of the MF device via the network from the perspective of the EtherNet/IP scanner. • Check the station configuration and eliminate configuration and parameter assignment errors via MFCT and eliminate diagnostics errors.

LEDs			Meaning	Notes
RN/NS (NET STATUS)	**ER/MS (MODUL STATUS)**	**MT/IO (IO STATUS)**		
Flashes	Flashes	Flashes	The "Node flash test" is running.	• The LK1 and LK2 LEDs of the Ethernet interface are also flashing.
Flashes	Flashes	Flashes	Hardware or firmware defective.	• You can read out the service data with STEP 7 V5.6.
Flashes	Flashes	Flashes	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s in red. Then for approximately 0.25 s in green.	---
On	On	On	RN/NS-, ER/MS-, MT/IO-LEDs are permanently on: Hardware or firmware defective. Error information will be determined and stored retentively on the Flash memory.	Do not disconnect the interface module from the supply voltage while the LEDs are permanently lit up. This may take a few minutes.

* PWR LED on (on the MF device): Check the backplane bus for short-circuit.

Modbus TCP

5

5.1 Modbus TCP functions

The interface module supports the following MODBUS TCP functions:

- I/O communication with Modbus client
  - Register access
  - Bit by bit access via FC1 FC2 FC5 FC15 functions
  - Hold time after connection reset for soft redundancy
- Free user registers (e.g. for coordination of the redundancy)
- Device status register
- Config status register
- Diagnostics bit in data status of cyclic I/O data per submodule (interrupts are not supported)
- Data record interface
- Integrated switch with 2 ports
- Supported Ethernet services: PING, ARP, SNMP, LLDP
- Minimum RPI 2 ms
- Reset to factory settings via RESET button
- Firmware update via MFCT
- Shared device
- Distribution of module channels to submodules
- Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)
- Station extension via ET-Connection
- Supports BusAdapter for different connection technologies

The interface module supports additional functions:

- Interface-local coupling of IO data
- Identification data I&M 0 to I&M 3
- PROFIenergy
- Removal/insertion of multiple I/O modules during operation (Multi Hot Swap)
- Module-to-Module Communication (MtM)
- Setting the time

Requirements

The following table shows the software requirements of the Modbus TCP functions:

Table 5- 1 Version dependencies of the Modbus TCP functions

Function	Functional status of the module as of	Firmware version of the module as of	Configuration software MFCT	RegLayoutVersion
			as of V1.0 Update 2	
I/O communication with Modbus client	1	V5.0.2	X	V1.0
Bit by bit access via FC1 FC2 FC5 FC15 functions	1	V5.2.1	as of V1.3 Update 1	≥ V1.1
Free user registers (e.g. for coordination of the redundancy)	1	V5.0.2	X	V1.0
Device status register	1	V5.0.2	X	V1.0
Diagnostics bit in data status of cyclic I/O data per submodule	1	V5.0.2	X	V1.0
Station extension via ET connection	1	V5.0.2	X	---
Module status	1	V5.1.1	X	≥ V1.1
Data record interface	1	V5.1.1	X	≥ V1.1
BusAdapter BA 2xRJ45	1	V5.0.2	---	---
BusAdapter BA 2xFC	1	V5.0.2	---	---
BusAdapter for fiber-optic cable FOC: BA 2xSCRJ	1	V5.1.1	---	---
BusAdapter BA SCRJ/RJ45	1	V5.1.1	---	---
BusAdapter BA SCRJ/FC	1	V5.1.1	---	---
BusAdapter BA 2xLC	1	V5.1.1	---	---
BusAdapter BA LC/RJ45	1	V5.1.1	---	---
BusAdapter BA LC/FC	1	V5.1.1	---	---
BusAdapter BA 2xM12	1	V5.1.1	---	---
MF Shared Device	1	V5.2.1	as of V1.3 Update 1	---
TCP reset hold time for soft redundancy	1	V5.2.1	as of V1.3 Update 1	≥ V1.1
Distribution of module channels to submodules	1	V5.2.1	as of V1.3 Update 1	---
Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)	1	V5.2.1	as of V1.3 Update 1	---
Interface-local coupling of IO data	1	V5.2.1	as of V1.3 Update 1	---
Module-to-Module Communication (MtM)	1	V5.2.1	as of V1.3 Update 1	---

5.1.1 Applicable modules with Modbus TCP

With Modbus TCP, the following modules cannot be used or can be used only with limitations.

These modules are divided into 4 categories:

Category	Description
1	This category is not relevant for Modbus TCP.
2	A function block for the target control must be created for the module. The module operates with a non-locked function block. The function block can be reimplemented.
3	Subfunctions of the module are not supported by the selected fieldbus. Subfunctions are only possible using blocks or additional interfaces.
4	The module is not supported by the selected fieldbus. The module needs a protected function block (e.g. for F-modules).

Note

Module operating modes based on isochronous operation (e.g. oversampling or time stamping) are not supported.

F-modules

Module	Article number	Category	Note
F-DI 8x24VDC HF	6ES7136-6BA00-0CA0	4	-
	6ES7136-6BA01-0CA0	4	-
F-DQ 4x24VDC/2A PM HF	6ES7136-6DB00-0CA0	4	-
F-DQ 8x24VDC/0.5A PP HF	6ES7136-6DC00-0CA0	4	-
F-RQ 1x24VDC/24..230VAC/5A	6ES7136-6RA00-0BF0	4	-
F-PM-E 24VDC/8A PPM ST	6ES7136-6PA00-0BC0	4	-
F-AI 4xI 0(4)..20mA 2-/4-wire HF	6ES7136-6AA00-0CA1	4	-
F-AI 4xU 0..10V HF	6ES7136-6AB00-0CA1	4	-
F-TM Count 1x1Vpp sin/cos HF	6ES7136-6CB00-0CA0	4	-

Technology modules

Module	Article number	Category	Note
TM ECC 2xPWM 12V ST	6FE1242-6TM10-0BB1	2	The control interface is described.
SIWAREX WP321	7MH4138-6AA00-0BA0	3	Commissioning is possible with SIWATOOL V7.
TM SIWAREX WP351 HF	7MH4138-6BA00-0CU0	3	Commissioning is possible with SIWATOOL V7 or the integrated web browser.
F-TM ServoDrive 1x24..48V ST	6BK1136-6AB00-0BU0	3	Comprehensive support of controller calculation and diagnostics is currently only available in the TIA Portal.

Communication modules

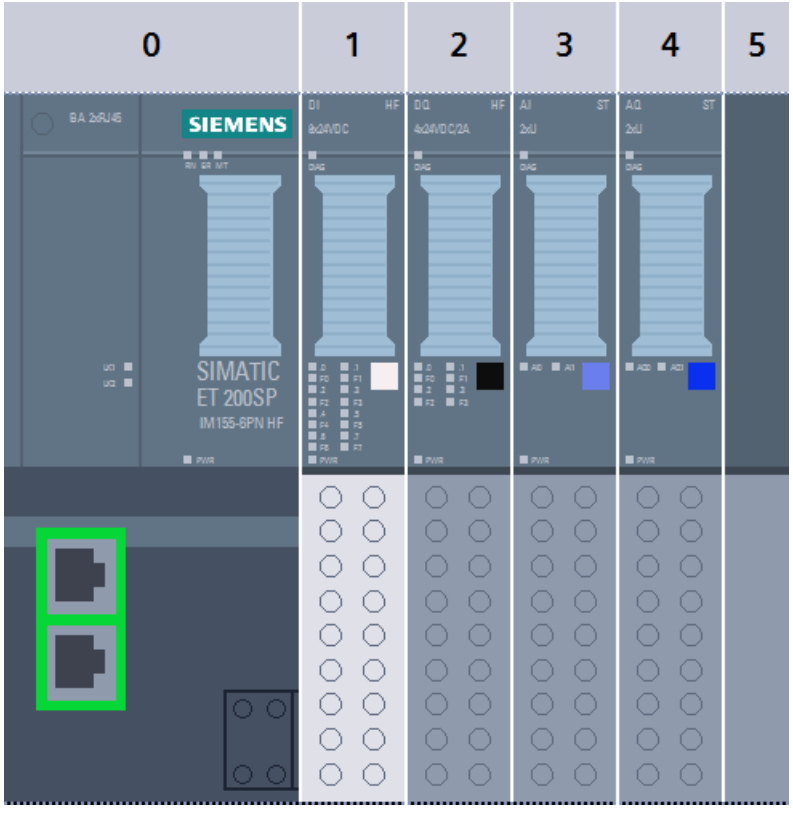
Module	Article number	Category	Note
CM PtP	6ES7137-6AA00-0BA0	2	See the "CM PtP operation with PROFINET controller (https://support.industry.siemens.com/cs/ww/en/view/59062563)" Programming and Operating Manual
CM 4xIO-Link	6ES7137-6BD00-0BA0	3	Time-based IO blocks (isochronous mode)
CM DALI	6ES7137-6CA00-0BU0	2	See the "ET 200SP, CM 1xDALI – Communication Model Description (https://support.industry.siemens.com/cs/ww/en/view/109774228)" Programming Manual

5.1.2 Examples for I/O data mapping

5.1.2.1 Example of I/O data mapping for I/O data alignment Byte

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
0	IM 155-6 MF
1	DI 8 HF
2	DQ 4 HF, QI
3	AI 2 ST
4	AQ 2 ST
5	Server module

Input buffer

The following table shows the input buffer for the example configuration for the I/O data alignment Byte:

Slot	Name*	Data type	Ac-cess	Register offset	Description
0	Slot0_1_IDS	Word	LSB	0	Input Data State for the interface module
1	Slot1_1_I_channel_0_0		MSB	0	1 byte input data for the DI 8 HF module
	Slot1_1_IDS	Word	LSB	1	Input Data State for the DI 8 HF module
2	Slot2_1_QI		MSB	1	Value status for the DQ 4 HF module
	Slot2_1_IDS	Word	LSB	2	Input Data State for the value status of the DQ 4 HF module
3	Slot3_1_I_channel_0_0		MSB	2	2 bytes input data for channel 0 of the AI 2 ST module
	Slot3_1_I_channel_0_1	Word	LSB	3	
	Slot3_1_I_channel_1_0		MSB	3	2 bytes input data for channel 1 of the AI 2 ST module
	Slot3_1_I_channel_1_1	Word	LSB	4	
	Slot3_1_IDS		MSB	4	Input Data State for the AI 2 ST module
5	Slot5_1_IDS	Word	LSB	5	Input Data State for the server module
2	Slot2_1_ODS		MSB	5	Output Data State for the DQ 4 HF module
4	Slot4_1_ODS	Word	LSB	6	Output Data State for the AQ 2 ST module
x	Reserved		MSB	6	Reserved (0x00)

The sum of the input data is 7 registers.

Output buffer

The following table shows the output buffer for the example configuration for the I/O data alignment Byte:

Slot	Name*	Data type	Ac-cess	Register offset	Description
2	Slot2_1_O_channel_0_0	Word	LSB	0	1 byte output data for the DQ4 HF module
4	Slot4_1_O_channel_0_0		MSB	0	2 bytes output data for channel 0 of the AQ 2 ST module
	Slot4_1_O_channel_0_1	Word	LSB	1	
	Slot4_1_O_channel_1_0		MSB	1	2 bytes output data for channel 1 of the AQ 2 ST module
	Slot4_1_O_channel_1_1	Word	LSB	2	
x	Reserved		MSB	2	Reserved (0x00)

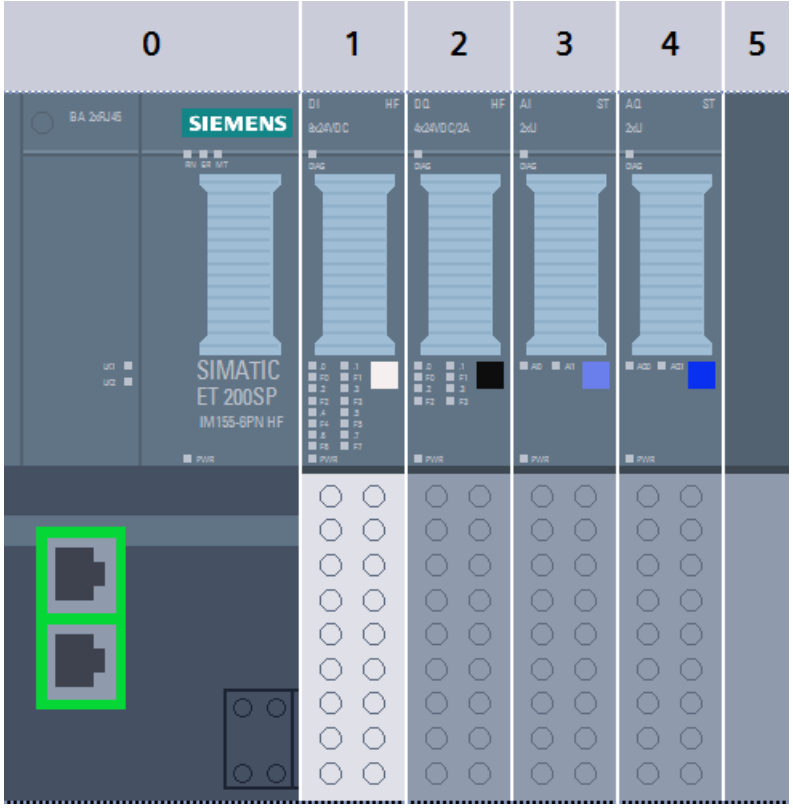
* The name is formed according to the following scheme: Slot<Slot#>_<Subslot#>_<DataItem-TextId>[_<Index>]

The sum of the output data is 3 registers.

5.1.2.2 Example of I/O data mapping for I/O data alignment Word

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
0	IM 155-6 MF
1	DI 8 HF
2	DQ 4 HF, QI
3	AI 2 ST
4	AQ 2 ST
5	Server module

Input buffer

The following table shows the input buffer for the example configuration of the I/O data alignment Word:

Slot	Name*	Data type	Access	Register offset	Description
0	Slot0_1_IDS	Word	LSB	0	Input Data State for the interface module
	0x00		MSB	0	*Padding byte*
1	Slot1_1_I_channel_0_0	Word	LSB	1	1 byte input data for the DI 8 HF module
	0x00		MSB	1	*Padding byte*
	Slot1_1_IDS	Word	LSB	2	Input Data State for the DI 8 HF module
	0x00		MSB	2	*Padding byte*
2	Slot2_1_QI	Word	LSB	3	Value status for the DQ 4 HF module
	0x00		MSB	3	*Padding byte*
	Slot2_1_IDS	Word	LSB	4	Input Data State for the value status of the DQ 4 HF module
	0x00		MSB	4	*Padding byte*
3	Slot3_1_I_channel_0_0	Word	LSB	5	2 bytes input data for channel 0 of the AI 2 ST module
	Slot3_1_I_channel_0_1		MSB	5	
	Slot3_1_I_channel_1_0	Word	LSB	6	2 bytes input data for channel 1 of the AI 2 ST module
	Slot3_1_I_channel_1_1		MSB	6	
	Slot3_1_IDS	Word	LSB	7	Input Data State for the AI 2 ST module
	0x00		MSB	7	*Padding byte*
5	Slot5_1_IDS	Word	LSB	8	Input Data State for the server module
	0x00		MSB	8	*Padding byte*
2	Slot2_1_ODS	Word	LSB	9	Output Data State for the DQ 4 HF module
	0x00		MSB	9	*Padding byte*
4	Slot4_1_ODS	Word	LSB	10	Output Data State for the AQ 2 ST module
	0x00		MSB	10	*Padding byte*

The sum of the input data is 11 registers.

Output buffer

The following table shows the output buffer for the example configuration for the I/O data alignment Word:

Slot	Name*	Data type	Access	Register offset	Description
2	Slot2_1_O_channel_0_0	Word	LSB	0	1 byte output data for the DQ4 HF module
	0x00		MSB	0	*Padding byte*
4	Slot4_1_O_channel_0_0	Word	LSB	1	2 bytes output data for channel 0 of the AQ 2 ST module
	Slot4_1_O_channel_0_1		MSB	1	
	Slot4_1_O_channel_1_0	Word	LSB	2	2 bytes output data for channel 1 of the AQ 2 ST module
	Slot4_1_O_channel_1_1		MSB	2	

* The name is formed according to the following scheme: Slot<Slot#>_<Subslot#>_<DataItem-TextId>[_<Index>]

The sum of the output data is 3 registers.

5.1.3 MF Shared Device

Four ARs are available; these are shared by the fieldbuses. For EtherNet/IP and Modbus TCP, only one AR is reserved in each case, regardless of the number of controller connections used.

The maximum amount of I/O data must comply with the rules of the following table:

Number of fieldbus connections			Maximum I/O data per connection[1]		Max. download size with MFCT[1]	
PROFINET	**EtherNet/IP**	**Modbus TCP**	**Inputs**	**Outputs**	**Inputs**	**Outputs**
1	1 to 2	0	EtherNet/IP **or** Modbus TCP: 500 PROFINET: 1440	EtherNet/IP **or** Modbus TCP: 246 PROFINET: 1440	Download size[2]: 1440	Download size[2]: 1440
1	0	1 to 10				
0	1 to 2	1 to 10	500	246	1440	1440
1	1 to 2	1 to 10	360	246	360	360
2	1 to 2	0				
2	0	1 to 10				
2	1 to 2	1 to 10				

[1] Including PROFINET payload qualifier or data status byte for signaling the data validity

[2] PROFINET data + download size as displayed in MFCT ≤ 1440

The download size contains the I/O data of all EtherNet/IP and Modbus TCP connections as well as additional bytes for controlling the download.

Note

To avoid temporarily exceeding the I/O quantity structure, you must proceed as follows in case of a reconfiguration that results in changed I/O lengths:

1. Reduce the amount of I/O data in one configuration and download it to the MF device/CPU.
2. Increase the amount of I/O data in another configuration and download it to the MF device/CPU.

5.2 Diagnostics

5.2.1 Status and error displays for Modbus TCP

RN/NS, ER/MS LEDs on the MF device

The LEDs display the status with the **highest priority** if there are different LED states due to overlaid events. (0 = off, 1 = green flashing, 2 = green, 3 = yellow, 4 = red flashing, 5 = red)

The following table shows the meaning of the RN/NS LEDs and ER/MS LEDs for Modbus TCP:

Table 5- 2 Status and error displays of the RN/NS LED

LED RN/NS (NET STATUS)	Meaning	Remedy
Flashes	The MF device is not exchanging data.	• Check the correctness of the download with MFCT and for a valid IP address. • Establish the cyclic communication via the I/O register area of the MF device.
On	The MF device is exchanging data via at least one connection.	---
Flashes	Timeout	• Write the Modbus TCP output register within the configured time for the Modbus hold time. • Increase the value for the Modbus hold time in the parameter assignment of the MF device in the MFCT. • Check the accessibility of the MF device via the network from the perspective of the Modbus TCP controller.

Table 5- 3 Status and error displays of the ER/MS LED

LED ER/MS (MODUL STATUS)	Meaning	Remedy
□ Off	There is no MultiFieldbus project in the MF device.	• Create a project with MFCT and transfer it to the MF device.
☼ Flashes	The MF device is not exchanging data. There is a MultiFieldbus project in the MF device.	• Establish the cyclic communication via the I/O register area of the MF device.
■ On	The MF device is exchanging data via a connection.	---
☼ Flashes	Errors in the configuration or parameter assignment.	• Check the configuration of the MF station and, if necessary, correct the configuration and parameter assignment of the MF device in the MFCT and download them to the MF device again. • Check the device status in the Device-Info area and, if necessary, eliminate the error.

Combinations of the RN/NS, ER/MS, MT/IO LEDs on the MF device

Combinations of the three LEDs are possible. The following table shows the possible combinations:

Table 5- 4 Status and error displays of the RN/NS, ER/MS, MT/IO LEDs

LEDs			Meaning	Notes
RN/NS (NET STATUS)	ER/MS (MODUL STATUS)	MT/IO (IO STATUS)		
□ Off	□ Off	□ Off	Missing or insufficient supply voltage on the MF device.	• Check the supply voltage or switch on the supply voltage on the MF device. *
☼ Flashes	□ Off	□ Off	The MF device is not exchanging data. There is no MultiFieldbus project in the MF device.	• Create a project with MFCT and transfer it to the MF device. Then establish the cyclic I/O communication with the MF device.
■ On	□ Off	□ Off	The MF device is exchanging data via PROFINET IO. There is no MultiFieldbus project in the MF device.	• Exclusive PROFINET use
☼ Flashes	☼ Flashes	□ Off	The MF device is not exchanging data. There is a MultiFieldbus project in the MF device.	• Establish the cyclic communication via Modbus TCP I/O register area for configured modules.

LEDs			Meaning	Notes
RN/NS (NET STATUS)	**ER/MS (MODUL STATUS)**	**MT/IO (IO STATUS)**		
■ On	☼ Flashes	□ Off	The MF device is exchanging data via PROFINET IO. There is a MultiFieldbus project in the MF device.	• Establish the cyclic I/O communication with a Modbus TCP controller. The corresponding fieldbus must have been selected via MFCT and downloaded to the MF device in advance. • Select "PROFINET" as the fieldbus in the MFCT for exclusive operation with PROFINET controllers.
■ On	■ On	□ Off	The MF device is exchanging data error-free via a connection (Modbus TCP).	---
■ On	☼ Flashes	□ Off	The MF device is exchanging data. The MF device has an error.	• Check the station configuration and, if necessary, correct the configuration and parameter assignment of the MF device in the MFCT and download them to the MF device again. • Check the device status in the Device-Info area and, if necessary, eliminate the diagnostics error.
☼ Flashes	☼ Flashes	□ Off	The MF device is not exchanging data. The MF device has an error.	• Establish the cyclic communication via the I/O register area of the MF device. • Check the station configuration and eliminate configuration and parameter assignment errors via MFCT and eliminate diagnostics errors.
☼ Flashes	☼ Flashes	□ Off	At least one connection existed (Modbus TCP). A connection has been terminated by timeout.	• Reduce the cycle time for writing the output registers in the Modbus TCP controller to less than the time for the Modbus hold time configured via the MFCT. • Check the accessibility of the MF device via the network from the perspective of the Modbus TCP controller.

LEDs			Meaning	Notes
RN/NS (NET STATUS)	**ER/MS (MODUL STATUS)**	**MT/IO (IO STATUS)**		
Flashes	Flashes	Off	At least one connection existed (Modbus TCP). A connection has been terminated by timeout. Errors in the configuration or parameter assignment.	• Reduce the cycle time for writing the output registers in the Modbus TCP controller to less than the time for the Modbus hold time configured via the MFCT. • Check the accessibility of the MF device via the network from the perspective of the Modbus TCP controller. • Check the station configuration and eliminate configuration and parameter assignment errors via MFCT and eliminate diagnostics errors.
Flashes	Flashes	Flashes	The "Node flash test" is running.	• The LK1 and LK2 LEDs of the Ethernet interface are also flashing.
Flashes	Flashes	Flashes	Hardware or firmware defective.	• You can read out the service data with STEP 7 V5.6.
Flashes	Flashes	Flashes	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s in red. Then for approximately 0.25 s in green.	---
On	On	On	RN/NS-, ER/MS-, MT/IO-LEDs are permanently on: Hardware or firmware defective. Error information will be determined and stored retentively on the Flash memory.	Do not disconnect the interface module from the supply voltage while the LEDs are permanently lit up. This may take a few minutes.

* PWR LED on (on the MF device): Check the backplane bus for short-circuit.

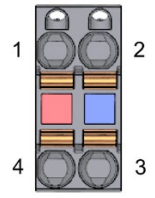
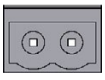
Wiring

6

6.1 Pin assignment

24 V DC supply voltage (X80)

Table 6- 1 Pin assignment 24 V DC supply voltage

View		Signal name[1]		Description
Connector	IM connection			
		1	1L+	+ 24 V DC of the supply voltage
		2	1M	Ground of the supply voltage
		3	2M	Ground of the supply voltage for loop-through[2]
		4	2L+	+ 24 V DC of the supply voltage for loop-through[2]

[1] 1L+ and 2L+ as well as 1M and 2M are bridged internally

[2] Maximum 10 A permitted

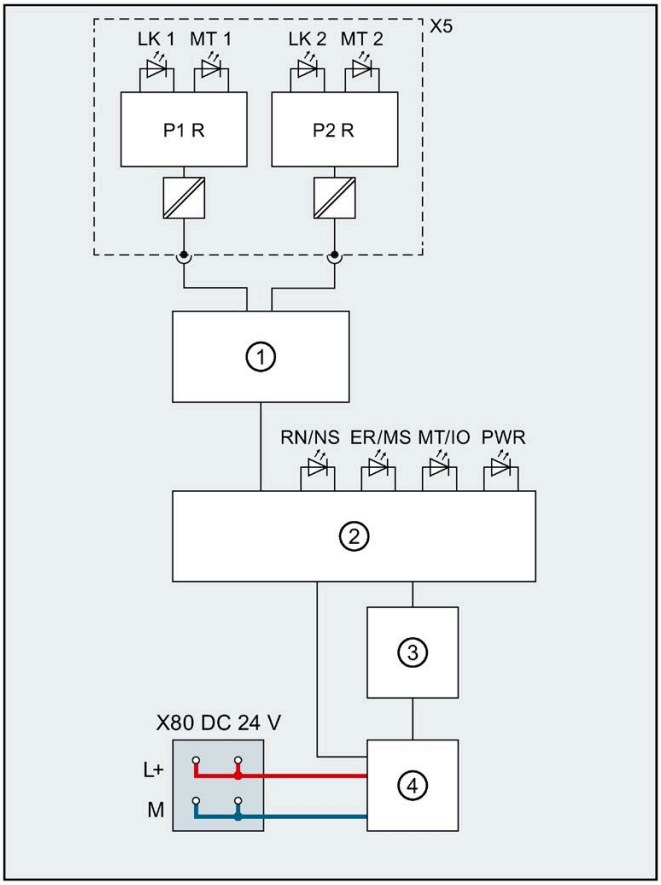
Reference

You can find more information on accessories and how to connect the interface module in the ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293) system manual.

6.2 Block diagram

Block diagram

The following figure shows the block diagram of the IM 155-6 MF HF interface module.



①	Switch	L+	24 V DC supply voltage
②	ET 200SP backplane bus interface and electronics	M	Ground
③	Backplane bus	LK 1,2	Link TX/RX LED (green)
④	Internal power supply	MT 1,2	MAINTENANCE FiberOptic LED (SCRJ port, yellow)
X80 24 V DC	Feed supply voltage	RN/NS	RUN LED (green)/Network status (red)
X5	BusAdapter (For BusAdapters with RJ45 interface, the shielding is connected to functional ground)	ER/MS	ERROR LED (red)/Module status (green)
P1 R	PROFINET interface X1 Port 1	MT/IO	MAINTENANCE LED (yellow)/I/O status (red/green)
P2 R	PROFINET interface X1 Port 2	PWR	POWER LED (green)

Figure 6-1 Block diagram of the IM 155-6 MF HF interface module

Parameters

7

7.1 Parameters

Parameters for IM 155-6 MF HF interface module

The following table shows the parameters for the IM 155-6 MF HF interface module.

Table 7- 1 Parameters for IM 155-6 MF HF interface module (GSD file)

Parameters	Value range	Default	Effective range
Diagnostics: Undervoltage [1]	• Yes • No	No	ET 200SP
Configuration control [2]	• Yes • No	No	ET 200SP
Type of fieldbus	• PROFINET • EtherNet/IP • Modbus TCP	PROFINET	ET 200SP
I/O data alignment [4]	• Byte • Word	Byte	ET 200SP
Connection hold time [3]	1 .. 30,000 ms	5,000 ms	ET 200SP
Hold time after connection reset [3]	0 .. 30,000 ms	0 ms	ET 200SP

[1] Maintenance

[2] only for PROFINET IO

[3] only for Modbus TCP

[4] only for EtherNet/IP and Modbus TCP

7.2 Explanation of parameters

7.2.1 Diagnostics: Undervoltage

Diagnostics: Undervoltage

Diagnostics (maintenance) undervoltage is triggered if the supply voltage falls below the value 19.2 V DC. When the supply voltage then exceeds 20.4 V DC, the diagnostics alarm is reported as outgoing.

See also

Channel diagnostics (Page 39)

7.2.2 Configuration control

Configuration control

You use this parameter to enable the PROFINET configuration control function in the ET 200SP distributed I/O system.

Note

If you configure the enable, the ET 200SP distributed I/O system requires a control data record 196 from the user program in order for the ET 200SP distributed I/O system to operate the I/O modules.

Reference

You can find more information on the control data record in the ET 200SP distributed I/O system (https://support.automation.siemens.com/WW/view/en/58649293) system manual and in the STEP 7 online help.

7.2.3 Type of fieldbus

Type of fieldbus

Select the desired fieldbus with the parameter "Type of fieldbus":

- PROFINET
- EtherNet/IP
- Modbus TCP

7.2.4 I/O data alignment

I/O data alignment

For information on the "I/O data alignment" parameter, refer to the "MultiFieldbus" Function Manual.

7.2.5 Connection hold time

Connection hold time

You use the parameter "Connection hold time" to define the hold time of the outputs after the last valid write access with Modbus TCP to output register.

7.2.6 Hold time after connection reset

Hold time after connection reset

You use the parameter "Hold time after connection reset" to define the hold time of the outputs after a reset of the connection via Modbus TCP.

7.3 Substitute value behavior

The respective output of a digital output module behaves according to its configured substitute value behavior:

- Zero current or zero voltage
- Output substitute value
- Keep last value

The substitute value behavior is triggered in the following cases:

- STOP controller
- Controller failure (connection interrupted)
- Parameter assignment phase during startup
- Deactivating the IO device
- Station stop
  - Missing server module
  - Insertion of invalid I/O modules
  - At least one I/O module is installed on an incorrect BaseUnit

Note

Reducing a configuration

If you reduce the configuration of the ET 200SP distributed I/O system and download the configuration to the CPU, the modules which are no longer configured but still present retain their original substitute value behavior. This applies until the supply voltage is switched off at the interface module.

The "current-free/voltage-free" behavior becomes effective in the following cases:

- Firmware update
- Reset to factory settings
- Configuration control: The IM has not received a valid control data record 196 yet
- Incorrectly configured module
- Module with incorrect parameter assignment

7.4 Status of the supply voltage L+ of the I/O modules

The status of the supply voltage L+ of the ET 200SP I/O modules can be mapped to the server module with the interface module IM 155-6 MF HF.

You can find information on the status of the supply voltage L+ of the I/O modules in the Server module (https://support.automation.siemens.com/WW/view/en/63257531) manual.

Compatibility

8

8.1 Compatibility of modules

Compatibility with the IM 155-6 MF HF interface module

If you exchange or replace an interface module, the following table shows the compatibilities:

- Between the interface modules IM 155-6 MF HF and IM 155-6 PN/2 HF
- Between the various firmware versions

Interface module configured	
Interface module plugged	**IM 155-6 PN/2 HF V4.2**
IM 155-6 MF HF V5.0	Yes*

* except for isochronous mode and prioritized startup

Station configuration with more than 32 I/O modules

Certain I/O modules with functional status 001 and 002 do not support a station configuration with more than 32 I/O modules.

The table below shows all modules that do not support a station configuration with more than 32 I/O modules:

Table 8- 1 Incompatible modules with functional status

Modules	Article number	Up to functional status
Analog modules		
AI 4xI 2-/4-wire ST	6ES7134-6GD00-0BA1	002
AI 4xU/I 2-wire ST	6ES7134-6HD00-0BA1	002
AI 4xRTD/TC 2-/3-/4-wire HF	6ES7134-6JD00-0CA1	002
AI 4xU/I ST	6ES7135-6HD00-0BA1	002
Digital modules		
DI 16x24VDC ST	6ES7131-6BH00-0BA0	002
DI 8x24VDC ST	6ES7131-6BF00-0BA0	002
DQ 16x24VDC/0.5A ST	6ES7132-6BH00-0BA0	002
DQ 4x24VDC/2A ST	6ES7132-6BD20-0BA0	002
DQ 8x24VDC/0.5A ST	6ES7132-6BF00-0BA0	002

Status of the supply voltage

Load voltage diagnostics are only valid if the station started up with a valid and complete configuration.

- For modules without parameter assignment in the following table, the status of the supply voltage (status byte of the server module) is always signaled as "1" regardless of the actual status of the supply voltage.
- If a potential group is exclusively made up of modules without parameter assignment from the table below, no group diagnostics "Missing supply voltage L+" is signaled for this potential group.

Modules	Article number
DI 8x24VDC ST	6ES7131-6BF00-0BA0
DI 16x24VDC ST	6ES7131-6BH00-0BA0
DI 8x24VDC HF	6ES7131-6BF00-0CA0
DQ 4x24VDC/2A ST	6ES7132-6BD20-0BA0
DQ 8x24VDC/0.5A ST	6ES7132-6BF00-0BA0
DQ 16x24VDC/0.5A ST	6ES7132-6BH00-0BA0
DQ 8x24VDC/0.5A HF	6ES7132-6BF00-0CA0

Analog output module AQ 4xU/I ST

Note

For operation of the AQ 4xU/I ST analog output module, firmware version V1.0 (6ES7135-6HD00-0BA1) with the interface module, you need to set the "Reaction to CPU STOP" parameter to "Turn off" with a PROFINET send clock < 1 ms.

Operation and maintenance

9

9.1 Resetting an interface module to factory settings via the RESET button

You reset the interface module with the reset button as follows.

Requirement

The supply voltage to the interface module must be switched on.

Required tools

3 to 3.5 mm screwdriver (for resetting with a RESET button)

Procedure

1. Remove the interface module from the mounting rail and swivel it downwards.
2. The RESET button is located on the back of the interface module behind a small opening: Push a screwdriver into the small opening, thus pressing the RESET button for 3 seconds.
3. Look at the LED display of the interface module to see whether the reset was successful:

   The interface module has restarted and the RN/NS LED flashes green; the ER/MS and the MT/IO LEDs are off.
4. Install the interface module back on the mounting rail.
5. Assign parameters to the interface module again.

9.2 Resetting interface module with MFCT to factory settings

You can also reset the interface module with MFCT to factory settings.

Information on this is available in section "Resetting the MF device" of the "MultiFieldbus" function manual.

9.3 Firmware update with MFCT

With MFCT, you can perform firmware updates for modules and interface modules.

Information on this is available in the "MultiFieldbus" function manual in the section "Firmware update with MFCT".

Technical specifications

10

Technical specifications of the IM 155-6 MF HF

The following table shows the technical specifications as of 01/2022. You will find a data sheet including daily updated technical specifications on the Internet (https://support.industry.siemens.com/cs/de/en/pv/6ES7155-6MU00-0CN0/td?dl=en).

Article number	6ES7155-6MU00-0CN0
General information	
Product type designation	IM 155-6 MF HF
Firmware version	V5.2
• FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	0313H
Manufacturer ID according to ODVA (VendorID)	04E3H
Device ID according to ODVA (Product code)	0FA2H
Product function	
• I&M data	Yes; I&M0 to I&M3
• Module swapping during operation (hot swapping)	Yes; Multi-hot swapping
• Isochronous mode	No
• Tool changer	Yes; Docking station and docking unit
• Local coupling, IO data	Yes
– Number of coupling modules	6; 1x output + max. 5x input
• Local coupling, data records	No
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	via IM155-6PN/2 HF in compatibility mode
• STEP 7 configurable/integrated from version	via IM155-6PN/2 HF in compatibility mode
• PROFINET from GSD version/GSD revision	GSDML V2.3
• Multi Fieldbus Configuration Tool (MFCT)	from V1.3
Configuration control	
via dataset	Yes
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes

Article number	6ES7155-6MU00-0CN0
Mains buffering	
• Mains/voltage failure stored energy time	10 ms; according to IEC 61131-2 (6.2.1.3) severity degree PS2
Input current	
Current consumption, max.	700 mA
Inrush current, max.	4.5 A
I^2t	0.25 $A^2 \cdot s$
Power loss	
Power loss, typ.	2.4 W
Address area	
Address space per module	
• Address space per module, max.	288 byte; For input and output data respectively
Address space per station	
• Address space per station, max.	1 440 byte; Dependent on configuration
Hardware configuration	
Rack	
• Quantity of operable ET 200SP modules, max.	64
• Quantity of operable ET 200AL modules, max.	16
Submodules	
• Number of submodules per station, max.	256
Interfaces	
Number of PROFINET interfaces	1; 2 ports (switch)
1. Interface	
Interface types	
• Number of ports	2; via BusAdapter
• integrated switch	Yes
• BusAdapter (PROFINET)	Yes; compatible BusAdapters: BA 2x RJ45, BA 2x M12, BA 2x FC, BA 2x LC, BA LC/RJ45, BA LC/FC, BA 2x SCRJ, BA SCRJ/RJ45, BA SCRJ/FC,
Protocols	
• PROFINET IO Device	Yes
• Open IE communication	Yes
Interface types	
RJ 45 (Ethernet)	
• Transmission procedure	PROFINET with 100 Mbit/s full duplex (100BASE-TX)
• 10 Mbps	No
• 100 Mbps	Yes; PROFINET with 100 Mbit/s full duplex (100BASE-TX)
• Autonegotiation	Yes
• Autocrossing	Yes
Protocols	
Modbus TCP	Yes

Article number	6ES7155-6MU00-0CN0
Number of connections	
• Number of MtM communication relationships/connections, max.	16
PROFINET IO Device	
Services	
– IRT	No
– PROFIenergy	Yes
– Prioritized startup	No
– Shared device	Yes
– Number of IO Controllers with shared device, max.	14; 2x PN controller + 2x EtherNet/IP scanner + 10x Modbus TCP master
Redundancy mode	
• PROFINET system redundancy (S2)	Yes
– on S7-1500R/H	Yes
– on S7-400H	Yes
• Redundant PROFINET configuration (R1)	No
• H-Sync forwarding	Yes
Media redundancy	
– MRP	Yes
– MRPD	No
EtherNet/IP	
Services	
– CIP Implicit Messaging	Yes
– CIP Explicit Messaging	Yes
– CIP Safety	No
– Configuration control via Explicit Messaging	No
– Shared device	Yes; 2x PN controller + 2x EtherNet/IP scanner + 10x Modbus TCP master
– Number of scanners with shared device, max.	2
Updating times	
– Requested Packet Interval (RPI)	2 ms
Redundancy mode	
– DLR (Device Level Ring)	No
Address area	
– Address space per module, max.	288 byte; (246 byte outputs / 288 byte inputs)
– ForwardOpen (Class1 & 32 bit Header)	500 byte; (246 byte outputs / 500 byte inputs)
– LargeForwardOpen (Class3)	4 002 byte

Article number	6ES7155-6MU00-0CN0
Connections	
– Number of rack connections	2
Modbus TCP	
Services	
– read coils (code=1)	Yes
– read discrete inputs (code=2)	Yes
– Read Holding Registers (Code=3)	Yes
– write single coil (code=5)	Yes
– write multiple coils (code=15)	Yes
– Write Multiple Registers (Code=16)	Yes
– Parameter change by master	Yes
– Modbus TCP Security Protocol	No
Address space per station	
– Address space per station, max.	500 byte; (246 byte outputs / 500 byte inputs)
– Access-consistent address space	250 byte; (246 byte outputs / 250 byte inputs)
Updating time	
– I/O request interval	2 ms
Connections	
– Number of connections per slave	9; (1x inputs / 2x outputs / 4x volatile registers / 2x Device Info)
Open IE communication	
• TCP/IP	Yes
• UDP	Yes
• SNMP	Yes
• LLDP	Yes
• ARP	Yes
• IGMP	Yes
• Multicast	Yes
• Broadcast	Yes
• IPv4	Yes
• IPv6	No
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes

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Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green PWR LED
• NS LED	Yes; green/red LED
• MS LED	Yes; green/red LED
• IO LED	Yes; red-green-yellow LED
• Connection display LINK TX/RX	Yes; 2x green link LEDs on BusAdapter
Potential separation	
between backplane bus and electronics	No
between PROFINET and all other circuits	Yes
between supply and all other circuits	No
Isolation	
Isolation tested with	707 V DC (type test)
Standards, approvals, certificates	
Network loading class	3
Security level	According to Security Level 1 Test Cases V1.1.1
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C; No condensation
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C; No condensation
• vertical installation, max.	50 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual
connection method / header	
ET-Connection	
• via BU/BA Send	Yes; + 16 ET 200AL modules
Mechanics/material	
Strain relief	Yes; Optional
Dimensions	
Width	50 mm
Height	117 mm
Depth	74 mm
Weights	
Weight, approx.	120 g; without BusAdapter

Dimension drawing

A

This appendix contains a dimension drawing of the module mounted on a mounting rail. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

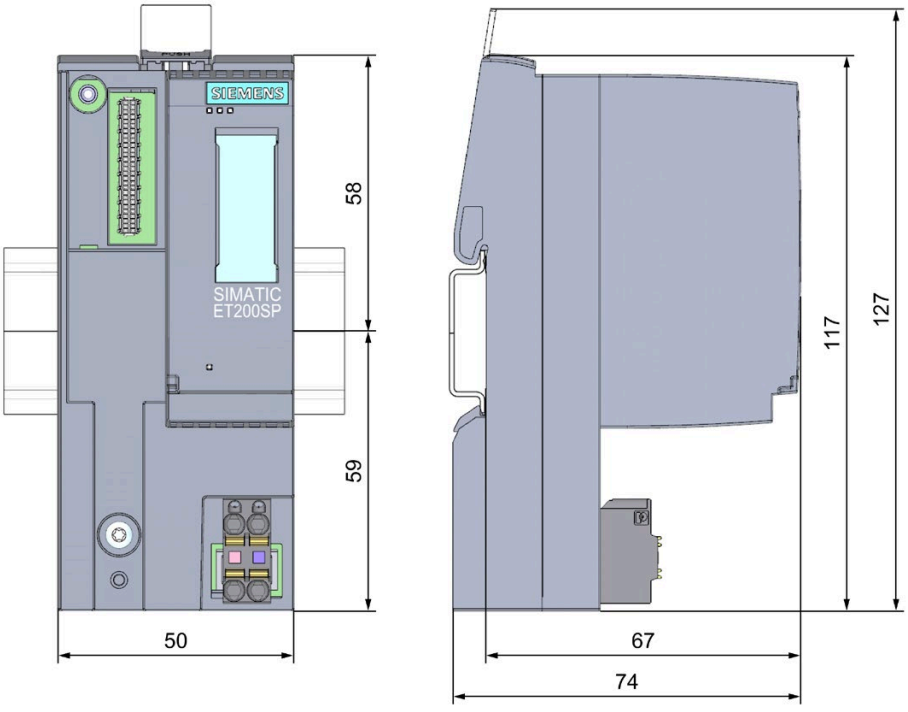


Figure A-1 Dimension drawing of the IM 155-6 MF HF interface module, front and side views