

SIMATIC

ET 200MP

**Interface module IM 155-5 MF HF
(6ES7155-5MU00-0CN0)**

Equipment Manual

Introduction

1

Industrial cybersecurity

2

Product overview

3

PROFINET IO

4

EtherNet/IP

5

Modbus TCP

6

Wiring

7

Parameter

8

Strain relief

9

Operation and maintenance

10

Technical specifications

11

Dimension drawing

A

Response times

B

Legal information

Warning notice system

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified persons are those who, because of their training and experience, are familiar with the installation, assembly, commissioning, operation, decommissioning and disassembly of the product and can recognize risks and avoid possible hazards.

Proper use of Siemens products

Note the following:

WARNING

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

Trademarks

All names identified by ® are registered trademarks of Siemens Aktiengesellschaft. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

Table of contents

1	Introduction.....	6
1.1	S7-1500/ET 200MP Documentation Guide.....	7
1.1.1	S7-1500/ET 200MP documentation guide.....	7
1.1.2	SIMATIC Technical Documentation.....	9
1.1.3	Tool support.....	11
2	Industrial cybersecurity.....	12
2.1	Introduction to industrial cybersecurity.....	12
2.2	Cybersecurity information.....	12
2.3	Cybersecurity-relevant information.....	13
3	Product overview.....	15
3.1	Properties.....	15
3.2	MultiFieldbus engineering.....	19
3.3	Detect active fieldbus.....	19
3.4	Compatibility and limitations.....	20
4	PROFINET IO.....	21
4.1	PROFINET IO functions.....	21
4.1.1	Supported Ethernet services.....	24
4.1.2	Port diagnostics.....	25
4.1.3	Deactivating of ports.....	25
4.1.4	Minimum update time 250 µs.....	25
4.1.5	Real-time communication.....	25
4.1.6	Isochronous real-time communication.....	25
4.1.7	Device replacement without topological configuration.....	26
4.1.8	Device replacement with topology configuration.....	26
4.1.9	Reset to factory settings.....	27
4.1.10	Firmware update with PROFINET IO.....	27
4.1.11	Media redundancy (MRP).....	27
4.1.12	Media redundancy with planned duplication (MRPD).....	27
4.1.13	Shared Device.....	27
4.1.14	Isochronous mode.....	28
4.1.15	Submodules.....	29
4.1.16	Module-internal Shared Input/Shared Output (MSI/MSO).....	29
4.1.17	Interface local coupling of IO data.....	30
4.1.18	S2 system redundancy.....	31
4.1.19	System modifications during ongoing operation on S7-1500R/H (CiR).....	32
4.1.20	Alternating IO devices during operation.....	33
4.1.21	Maintenance events.....	33

4.1.22	Diagnostics interrupts.....	33
4.1.23	Value status (quality information, QI) of I/O modules.....	34
4.1.24	Reading out service data.....	34
4.1.25	Identification data I&M 0 to I&M 4.....	34
4.1.26	Configuration control (option handling).....	35
4.1.27	Use of fail-safe modules.....	35
4.1.28	Removal/insertion of multiple I/O modules during operation (multi hot swapping).....	36
4.2	Interrupts, diagnostics and error messages, and system alarms.....	37
4.2.1	Status and error displays.....	37
4.2.2	Interrupts.....	40
4.2.2.1	Triggering of a diagnostic interrupt.....	40
4.2.2.2	Triggering of a hardware interrupt.....	41
4.2.2.3	Triggering of a pull/plug interrupt.....	41
4.2.3	Alarms.....	42
4.2.3.1	Diagnostic alarms.....	42
4.2.3.2	Maintenance events.....	43
4.2.3.3	Channel diagnostics.....	44
4.2.3.4	Invalid configuration states of the ET 200MP on PROFINET IO.....	45
4.2.3.5	STOP of the IO controller and recovery of the IO device.....	45
5	EtherNet/IP.....	46
5.1	EtherNet/IP functions.....	46
5.1.1	Applicable modules with EtherNet/IP.....	47
5.1.2	Update time of the I/O data.....	49
5.1.3	Examples of I/O data mapping.....	49
5.1.3.1	Example of I/O data mapping for the I/O format byte.....	51
5.1.3.2	Example of I/O data mapping for the I/O format Word.....	53
5.1.3.3	Example of I/O data mapping for the "Flexible Data Type" I/O format.....	55
5.1.4	MF Shared Device.....	57
5.2	Diagnostics.....	58
5.2.1	Status and error displays for EtherNet/IP.....	58
6	Modbus TCP.....	62
6.1	Modbus TCP functions.....	62
6.1.1	Applicable modules with Modbus TCP.....	64
6.1.2	Examples of I/O data mapping.....	66
6.1.2.1	Example of I/O data mapping for the I/O format byte.....	67
6.1.2.2	Example of I/O data mapping for the I/O format Word.....	69
6.1.3	MF Shared Device.....	71
6.2	Diagnostics.....	73
6.2.1	Status and error displays for Modbus TCP.....	73
7	Wiring.....	76
7.1	Pin assignment.....	76
7.2	Block diagram.....	77

8	Parameter.....	78
8.1	Parameters.....	78
8.2	Description of parameters.....	78
8.2.1	Connection to supply voltage L+.....	78
8.2.2	Configuration control (option handling).....	80
8.2.3	Type of fieldbus.....	80
8.2.4	I/O data alignment.....	81
8.2.5	Connection hold time.....	82
8.2.6	Hold time after connection reset.....	82
8.3	Configuration control (option handling).....	82
8.3.1	Configuration control and control data record.....	82
8.3.2	Feedback data record.....	85
8.3.3	Configure configuration control without empty slots.....	87
8.3.4	Extending the configuration.....	88
8.3.5	Combining configurations.....	90
9	Strain relief.....	92
9.1	Product overview.....	92
9.2	Installing.....	93
10	Operation and maintenance.....	95
10.1	Resetting interface module with MFCT to factory settings.....	95
10.2	Firmware update with MFCT.....	95
11	Technical specifications.....	96
A	Dimension drawing.....	102
A.1	Dimension drawing.....	103
A.2	Dimensional drawing with strain relief.....	104
B	Response times.....	105
B.1	Response times of the ET 200MP.....	105

Introduction

Purpose of the documentation

This manual supplements the system manual S7-1500, ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>). Functions that generally relate to the system are described in this manual.

The information provided in this manual and in the system/function manuals supports you in commissioning the system.

Conventions

Please 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.

Recycling and disposal

For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

ID link for the digital nameplate



The ID link is a globally unique identifier according to IEC 61406-1, which you will find in the future as a QR code on your product.

The figure shows an example of an ID link for the interface module IM 155-5 MF HF.

You can recognize the ID link by the frame with a black corner at the bottom right. The ID link takes you to the digital nameplate of your product.

Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call the ID link

(<https://i.siemens.com/1P6ES7155-5MU00-0CN0+S123ABC>).

In the digital nameplate, you will find product data, manuals, declarations of conformity, certificates, and other helpful information about your product.

1.1 S7-1500/ET 200MP Documentation Guide

1.1.1 S7-1500/ET 200MP documentation guide



The documentation for the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require. Changes and supplements to the manuals are documented in a Product Information.

You can download the documentation free of charge from the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/109742691>).

Basic information



The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems.

The STEP 7 online help supports you in the configuration and programming.

Examples:

- Getting Started S7-1500
- S7-1500/ET 200MP System Manual
- Online help TIA Portal

Device information



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

Examples:

- Equipment Manuals CPUs
- Equipment Manuals Interface Modules
- Equipment Manuals Digital Modules
- Equipment Manuals Analog Modules
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules
- Equipment Manuals Power Supply Modules

General information



The function manuals contain detailed descriptions on general topics relating to the SIMATIC S7-1500 and ET 200MP systems.

Examples:

- Function Manual Diagnostics
- Function Manual Communication
- Function Manual Motion Control
- Function Manual Web Server
- Function Manual Cycle and Response Times
- PROFINET Function Manual
- PROFIBUS Function Manual

Product Information

Changes and supplements to the manuals are documented in a Product Information. The Product Information takes precedence over the device and system manuals.

You can find the latest Product Information on the S7-1500 and ET 200MP systems on the Internet (<https://support.industry.siemens.com/cs/de/en/view/68052815>).

Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet.
(<https://support.industry.siemens.com/cs/ww/en/view/86140384>)

Manual Collection fail-safe modules

The Manual Collection contains the complete documentation on the fail-safe SIMATIC modules, gathered together in one file.

You can find the Manual Collection on the Internet.

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet
(<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

1.1.2 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.

The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in Siemens Industry Online Support:



Industry Online Support International

(<https://support.industry.siemens.com/cs/ww/en/view/109742705>)

Watch this short video to find out where you can find the overview directly in Siemens Industry Online Support and how to use Siemens Industry Online Support on your mobile device:



Quick introduction to the technical documentation of automation products per video (<https://support.industry.siemens.com/cs/us/en/view/109780491>)



YouTube video: Siemens Automation Products - Technical Documentation at a Glance (<https://youtu.be/TwLSxxRQsA>)

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
 - Industry Online Support International: (<https://support.industry.siemens.com>)
The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
 - ID link:
Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

The documentation of the product is updated in digital form. In particular in the case of function extensions, the new performance features are provided in an updated version.

1. Download the current version as described above via the Industry Online Support or the ID link.
2. Also retain this version of the documentation.

mySupport

With "mySupport" you can get the most out of your Industry Online Support.

Registration	You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace.
Support requests	Your data is already filled out in support requests, and you can get an overview of your current requests at any time.
Documentation	In the Documentation area you can build your personal library.
Favorites	You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries.
Recently viewed articles	The most recently viewed pages in mySupport are available under "Recently viewed articles".
CAX data	The CAX data area gives you access to the latest product data for your CAX or CAE system. You configure your own download package with a few clicks: • 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" on the Internet. (<https://support.industry.siemens.com/My/ww/en>)

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

1.1.3 Tool support

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).

As successor of the SIMATIC Selection Tools, the TIA Selection Tool assembles the already known configurators for automation technology into a single 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>)

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://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html>).

Industrial cybersecurity

2.1 Introduction to industrial cybersecurity

Due to the digitalization and increasing networking of machines and industrial plants, the risk of cyber attacks is also growing. Appropriate protective measures are therefore mandatory, particularly in the case of critical infrastructure facilities.

Refer to the SIMATIC S7-1500/ET 200MP automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual for general information and measures regarding industrial cybersecurity.

This section provides an overview of security-relevant information pertaining to your SIEMENS device.

2.2 Cybersecurity information

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

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

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

For additional information on industrial cybersecurity measures that may be implemented, please visit <https://www.siemens.com/cybersecurity-industry>.

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

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under <https://new.siemens.com/cert>.

2.3 Cybersecurity-relevant information

Observe all cybersecurity-relevant information.

Topics with cybersecurity-relevant information	Reference
Operational application environment and security assumptions	
Requirements for the operational application environment of the system and security assumptions	This section is found in the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Security properties of the product	
Access protection	Note the information on the topic of access protection in the "Protection" section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Data integrity	The topic of data integrity is described in the "Industrial cybersecurity" section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Signed firmware update	The topic of signed firmware updates is described in the "Industrial cybersecurity" section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Secure Boot	The topic of secure boot is described in the "Industrial cybersecurity" section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
PROFINET Security Class 1 - The device supports PROFINET Security Class 1. - With the introduction of PROFINET Security Class 1, additional security settings have been integrated into the PROFINET communication.	Detailed information about PROFINET Security Class 1 and the additional security settings can be found in the PROFINET with STEP 7 Function Manual (https://support.industry.siemens.com/cs/us/en/view/49948856).
Supported Ethernet services	You can find information on supported services in the Technical specifications (Page 96) section. You can find detailed information on supported Ethernet services in the Communication Function Manual (https://support.industry.siemens.com/cs/us/en/view/59192925).
Interfaces, ports, protocols and services	
Information on the following is security-relevant: - Communication layer and communication role - Default states - Enabling/disabling of ports and services	You can find detailed information on these topics in the Communication Function Manual (https://support.industry.siemens.com/cs/us/en/view/59192925).
Secure operation	
Recommendations for safe operation	Cross-system information on the safe operation of interface modules can be found in the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).

Topics with cybersecurity-relevant information	Reference
Corrective measures for known risks	Corrective measures for known risks are announced on the Siemens ProductCERT and Siemens CERT (https://siemens.com/productcert) web page. For more information on SIEMENS ProductCERT, refer to the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Security checks	Application-specific security measures such as cyclic checks of the configuration via checksums are described in the "Industrial cybersecurity" section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Secure decommissioning Products that contain security-relevant data must be securely decommissioned before disposal or resale.	Information on secure decommissioning can be found in the "Safe operation of the system" section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).

Product overview

3.1 Properties

Article number

6ES7155-5MU00-0CN0

View of the module



Figure 3-1 View of the IM 155-5 MF HF interface module

Advantages

- The interface module supports multiple fieldbus protocols.
 - PROFINET IO
 - EtherNet/IP
 - Modbus TCP
- Functionally compatible with the 155-5 PN HF interface module (except for prioritized startup; isochronous mode must be reconfigured)
- I/O system The system benefits of the ET 200MP distributed I/O system can also be used with the EtherNet/IP and Modbus TCP fieldbus protocols:
 - MF Shared Device: The fieldbus can be selected for each submodule.
 - Highest channel density
 - Comprehensive range of modules (see "Applicable modules with EtherNet/IP (Page 47)" and "Applicable modules with Modbus TCP (Page 64)" sections)
 - Multi hot swapping on the active backplane bus
 - Dynamic reconfiguration of the modules on the active backplane bus via the user program
- No system change or replacement of the I/O interface module is required when using different controllers.
(series machine manufacturers with end users 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:

- Connects the ET 200MP distributed I/O system with
 - PROFINET IO
 - EtherNet/IP
 - Modbus TCP
- 24 V DC supply voltage (SELV/PELV)
- Fieldbus connection via selectable BusAdapters
 - BA 2xRJ45 for RJ45 bus connector
 - BA 2xFC for direct connection of the bus cable
 - BA 2xM12 for bus cable with M12 plug
- Supported topologies
 - Linear bus topology
 - Star topology
 - Tree topology
- Pulling and plugging I/O modules on the active backplane bus (multi hot swapping)
- You can find more information in the Active backplane bus
(<https://support.industry.siemens.com/cs/ww/en/view/109769815>) Equipment Manual.

You can find information on the functions supported by the module here:

- PROFINET IO functions ([Page 21](#))
- EtherNet/IP functions ([Page 46](#))
- Modbus TCP functions ([Page 62](#))

Active backplane bus maximum configuration

- The integrated power supply of the interface module feeds 16 W into the backplane bus. Up to 12 I/O modules can be supplied in this way when operating with an active backplane bus. The exact number of operable modules is determined by the power budget calculation (see relevant section in the S7-1500/ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual).

U-connector setup maximum configuration

- A maximum of one power supply module (PS) upstream from the interface module and two downstream from the interface module is possible.
- If you use a power supply module (PS) upstream from the interface module, the maximum possible configuration is a total of 32 modules (up to 30 modules downstream from the interface module).

Maximum amount of I/O data (PROFINET IO)

Maximum amount of I/O data

The sum of the gross data for all I/O controllers for input and output data must not exceed the following value:

- 5760 bytes

NOTE

With system redundancy S2, the I/O data lengths used for the H system must be included twice in the calculation of the maximum amount of I/O data.

When using the TIA Portal, the maximum net data length is calculated automatically.

The following data and calculations apply equally to input and output data.

Maximum gross data length:

- 1440 bytes per IO controller (independent of the S2 system redundancy)

Maximum net data length without calculation:

The following net data lengths can be used without explicit calculation of the maximum net data length:

- 932 bytes per IO controller (independent of the S2 system redundancy)

Maximum net data length with calculation:

The number of maximum net data lengths for input and output data depends on the number and type of I/O modules used:

Maximum gross data length

- Number of I/O submodules (without payload, input or output data)
- Number of I/O modules (input and output data)
- 4 bytes for interface module
- 1 byte for active backplane bus

Accessories

You order the following accessories separately:

- BusAdapter BA 2xRJ45 (6ES7193-6AR00-0AA0)
(<https://support.industry.siemens.com/cs/ww/en/pv/6ES7193-6AR00-0AA0/pi?dl=en>)
- BusAdapter BA 2xFC (6ES7193-6AF00-0AA0)
(<https://support.industry.siemens.com/cs/ww/en/pv/6ES7193-6AF00-0AA0/pi?dl=en>)
- BusAdapter BA 2xM12 (6ES7193-6AM00-0AA0)
(<https://support.industry.siemens.com/cs/ww/en/pv/6ES7193-6AM00-0AA0/pi?dl=en>)
- Strain relief for PROFINET cable (6ES7590-5DA00-0AA0)
(<https://support.industry.siemens.com/cs/ww/en/pv/6ES7590-5DA00-0AA0/pi?dl=en>)

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

For more information on accessories, refer to the S7-1500/ET 200MP Automation system
(<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual.

See also

24 V DC connector
(<https://support.industry.siemens.com/cs/ww/en/pv/6ES7193-4JB50-0AA0/pi?dl=en>)

3.2 MultiFieldbus engineering

MultiFieldbus Configuration Tool (MFCT)

The configuration and parameter assignment of the IM 155-5 MF HF interface module is created and downloaded with MFCT. The configuration is stored retentively in the interface module.

MFCT creates and makes available the following files:

- 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. You can export the EDS file as follows:
 - Transfer your configuration from the MFCT project to your MF device.
 - Copy the "EDS" folder directly from the supplied MFCT_V***.zip file.
- Comma Separated Values (CSV), contains the I/O data mapping of your configuration

You can find more information on the MFCT in the MultiFieldbus Configuration Tool (MFCT) Configuration Manual (<https://support.industry.siemens.com/cs/us/en/view/109962951>).

3.3 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.

Active fieldbus:	RN/NS	ER/MS	MT/IO
PROFINET	 Green	 Off	 Off
Modbus TCP	 Green	 Green	 Off
EtherNet/IP	 Green	 Green	 Green

3.4 Compatibility and limitations

Non-supported functions compared to IM 155-5 PN HF

- No prioritized startup
- No support for I&M4 data for use by the user

Restrictions on compatibility with IM 155-5 PN HF in regard to spare parts

You can replace a IM 155-5 PN HF with the firmware $\leq$ V4.4 with an IM 155-5 MF HF $\geq$ V5.0 without updating the configuration. In this case, the following restrictions apply:

- The BA2xRJ45 BusAdapter must be plugged in. Other BusAdapters are not compatible
- Isochronous real-time communication (IRT) must not be configured
- The device must be reconfigured as IM 155-5 MF HF for isochronous mode.
- Prioritized startup lasts significantly longer due to Secure Boot
- No support for I&M4 data for use by the user
- Possible restriction in case of topological configuration. You can find more information in the next section. In the case of unsuitably configured cable lengths, you receive the "Cable length mismatch" diagnostics.

There may be limitations of the industrial cybersecurity functions.

Workaround for topological configuration

If you receive the "Cable length mismatch" diagnosis, perform the following workaround:

1. Accept the diagnosis. If you cannot accept the diagnosis, continue with step 2.
2. Deselect the diagnosis in your engineering system. Alternatively, perform step 3.
3. Replace the IM 155-5 PN HF with an IM 155-5 MF HF V5.0 in the configuration.

PROFINET IO

4.1 PROFINET IO functions

Introduction

The interface module supports the following PROFINET IO functions:

- Integrated switch with 2 ports (via BusAdapter)
- Supported Ethernet services: Ping, ARP, SNMP, LLDP
- Port diagnostics
- Deactivating of ports
- Minimum update time 250 μ s
- Real-time communication
- Isochronous real-time communication (IRT)
- Device replacement without programming device
- Reset to factory settings via PROFINET IO
- Firmware update via PROFINET IO
- Media redundancy (MRP)
- Media redundancy with planned duplication (MRPD)
- Shared Device with up to four IO controllers
- Distribution of module channels to a maximum of 9 submodules
- Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)
- Isochronous mode
- S2 system redundancy
- System redundancy on S7-400H
- System redundancy on S7-1500R/H
- System modifications during ongoing operation on S7-1500R/H (CiR)
- Alternating IO devices during operation ("alternating partners")
 - Docking station
- Maintenance concept
- Diagnostics concept
- Value status
- Supports BusAdapter for different connection systems on the fieldbus

The interface module supports additional functions:

- Interface-local coupling of IO data
- Reading out of service data
- Identification data I&M 0 and I&M 3
- Identification data I&M 4
- Configuration control (option handling)
- Use of fail-safe modules
- Removal/insertion of multiple I/O modules during operation (multi hot swapping)

Requirements

The table below shows the software requirements for a configuration with the IM 155-5 MF HF interface module:

Table 4-1 Version dependencies of the module functions

Function	Functional status of the module as of	Firmware version of the module as of	Configuration software ¹	
			Configuration with GSD file (https://support.industry.siemens.com/cs/ww/en/view/6-8189683) ² /third-party software	STEP 7 (TIA Portal)
Real-time communication	FS01	V5.0	X	As of V19
Isochronous real-time communication (IRT)	FS01	V5.0	X	As of V19
Device replacement without programming device	FS01	V5.0	X	As of V19
Media redundancy (MRP)	FS01	V5.0	X	As of V19
Media redundancy with planned duplication (MRPD)	FS01	V5.0	X	As of V19
Shared Device • with up to four IO controllers	FS01	V5.0	X	As of V19
Distribution of module channels to submodules	FS01	V5.0	X	As of V19
Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)	FS01	V5.0	X	As of V19
Isochronous mode	FS01	V.5.2	--	As of V20 HSP 0454
System redundancy on S7-400H	FS01	V5.0	X	As of V19

¹ Replacement part scenario

² The usability of the PROFINET IO functions depends on the configuration software (Siemens and/or third-party). Below, the usability of the PROFINET IO functions is described for STEP 7 only.

Function	Functional status of the module as of	Firmware version of the module as of	Configuration software ¹	
			Configuration with GSD file (https://support.industry.siemens.com/cs/ww/en/view/6-8189683) ² /third-party software	STEP 7 (TIA Portal)
System redundancy on S7-1500R/H	FS01	V5.0	X	As of V19
S2 system redundancy	FS01	V5.0	X	As of V19
System modifications during ongoing operation on S7-1500R/H (CiR)	FS01	V5.3	X	As of V21
Alternating IO devices during operation ("alternating partners") • Docking station	FS01	V5.0	X	As of V19
Value status (quality information, QI) of I/O modules	FS01	V5.0	X	As of V19
Configuration control (option handling)	FS01	V5.0	X	As of V19
BusAdapter BA 2xRJ45	FS01	V5.0	X	As of V19
BusAdapter BA 2xFC	FS01	V5.0	X	As of V19
BusAdapter BA 2xM12	FS01	V5.0	X	As of V19
BusAdapter BA LC/RJ45		--	--	--
BusAdapter BA 2xLC		--	--	--
BusAdapter BA SCRJ/RJ45		--	--	--
BusAdapter BA 2xSCRJ		--	--	--
BusAdapter BA SCRJ/FC		--	--	--
BusAdapter BA LC/FC		--	--	--
Interface-local coupling of IO data	FS01	V5.1	X	As of V20

¹ Replacement part scenario

² The usability of the PROFINET IO functions depends on the configuration software (Siemens and/or third-party). Below, the usability of the PROFINET IO functions is described for STEP 7 only.

Cabling with fixed connection setting

When making the fixed connection setting of the port in STEP 7, you must first deactivate "Autonegotiation/Autocrossover".

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

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

4.1.1 Supported Ethernet services

The module supports the following standardized Ethernet services:

- **Ping**

Ping is a diagnostic tool for checking whether a specific host can be reached in an IP network.

- **ARP – Address Resolution Protocol (RFC 826)**

ARP is a protocol used to determine the hardware address (MAC) of an associated Internet Protocol (IP) address.

- **SNMP – Simple Network Monitoring Protocol (RFC 1157, RFC 3410)**

SNMP is a protocol for transmitting management information across networks.

- **LLDP – Link Layer Discovery Protocol (IEEE 802.1AB)**

LLDP is a protocol for identifying neighboring devices.

4.1.2 Port diagnostics

Depending on the BusAdapter used, the device supports special diagnostic messages that signal the quality of data transfer on the medium used.

4.1.3 Deactivating of ports

The device supports port deactivation by parameter assignment, so that all communication on a port is prevented.

4.1.4 Minimum update time 250 µs

The shortest update cycle of I/O data for this device is 250 µs. To achieve this value, the controller used must also support this time.

4.1.5 Real-time communication

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

4.1.6 Isochronous real-time communication

Synchronized transmission method for cyclic exchange of IRT data between PROFINET devices. A reserved bandwidth is available in the send cycle for IRT data. The reserved bandwidth ensures that IRT data can be transferred at reserved synchronized intervals, without being influenced by other network loads (e.g. TCP/IP communication, or additional real-time communication). A topological configuration is required for IRT.

NOTE

IO controller as sync master with IRT communication

We recommend operating the IO controller as sync master when configuring IRT communication. Otherwise, IO devices with IRT and RT configuration could fail as a result of sync master failure.

You can find more information on configuring synchronized PROFINET devices in sync domains in the STEP 7 online help and

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

4.1.7 Device replacement without topological configuration

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

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

Table 4-2 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.

Note the following constraints:

- Resetting to factory settings deletes the device name in both the interface module and the BusAdapter. To prevent the device name in the BusAdapter from being deleted, unplug the BusAdapter from the interface module and plug in another BusAdapter before restoring the factory settings.
- When a BusAdapter is replaced, a device name stored in the BusAdapter is applied to the interface module on POWER ON.
- Removal/insertion of the BusAdapter under voltage is not permitted.

4.1.8 Device replacement with topology configuration

It is easy to replace IO devices that support this function:

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

The replaced IO device is assigned the device name by the IO controller. The IO controller uses the configured topology and the neighbor relationships determined by the IO devices for this purpose. All involved devices must support the LLDP protocol (Link Layer Discovery Protocol). The configured preset topology must match the actual topology.

IO devices that have been used in another configuration must be reset to the factory settings before they can be used again (see the S7-1500/ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual).

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

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

4.1.9 Reset to factory settings

Resetting to factory settings deletes the device name both in the selected interface module and in the corresponding BusAdapter.

4.1.10 Firmware update with PROFINET IO

You can find information on how to perform a firmware update in the S7-1500/ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual.

4.1.11 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 in the STEP 7 online help and

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

4.1.12 Media redundancy with planned duplication (MRPD)

If media redundancy is to be achieved in the case of short update times (together with IRT), you must use the MRP extension "Media redundancy with planned duplication (MRPD)".

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

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

4.1.13 Shared Device

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

The interface module supports Shared Device operation at the submodule level. A prerequisite for using this function is that the I/O modules also support this.

Please note the following if **the engineering system does not perform a validity check of the Shared Device projects**:

- Make sure that the configurations are consistent. In particular, the modules or submodules may only be assigned to one controller. Multiple assignment will result in an error; the module will only be available in the first controller.
- If you reconfigure Shared Device configurations without the validity check mentioned above, you have to commission the ET 200MP once again. This means that you have to reload the projects of all involved IO controllers to the specific CPU after reconfiguration and, if necessary, switch the interface module POWER OFF/POWER ON.

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

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

4.1.14 Isochronous mode

Isochronous mode

The input and output data of distributed I/O modules in the system is simultaneously acquired and simultaneously output. The I/O data, the transmission cycle via PROFINET IO, and the user program are synchronized for this purpose. The constant PROFINET IO cycle forms the corresponding clock generator. The interface module supports isochronous mode of I/O data for the modules starting at 250 µs. The IO device can exchange isochronous process data with a maximum of one IO controller.

NOTE

If the module is pulled or if no control data record was written with activated configuration control, then the IO controller cannot access a module. In this case, cycle time violations may occur with activated isochronous mode in the synchronous cycle interrupt OB (OB61). The time error OB (OB80) is called in the event of a cycle time violation.

This behavior is associated with updating the process image by means of the "SYNC_PI" (SFC126) and "SYNC_PO" (SFC127) instructions. It depends on the set cycle time and the configuration limits.

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

- As of STEP 7 V12, in the PROFINET with STEP 7 (<https://support.industry.siemens.com/cs/ww/en/view/49948856>) function manual.
- As of STEP 7 V5.5, in the PROFINET System Description (<https://support.industry.siemens.com/cs/ww/en/view/19292127>) System Manual.

4.1.15 Submodules

The IM 155-5 MF HF interface module supports the division of I/O modules into up to 9 submodules. This allows parts of an I/O module to be separately configured and parameterized. You can assign each of these submodules to different IO controllers.

A maximum of 256 submodules are supported. Four submodules are used for the interface module and one submodule for the active backplane bus in the case of an active backplane bus.

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

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

4.1.16 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 (TIA Portal), in the PROFINET with STEP 7
(<http://support.automation.siemens.com/WW/view/en/49948856>) Function Manual
- As of STEP 7 V5.5, in the PROFINET System Description
(<http://support.automation.siemens.com/WW/view/en/19292127>) System Manual

4.1.17
Interface local coupling of IO data

With the interface-local coupling of IO data via the module-internal shared output (MSO), IO data can be easily transferred from a CPU to other controllers via the fieldbus interface and even exchanged between different fieldbus protocols (PROFINET, EtherNet/IP and Modbus TCP). The CPU writes the data to an MSO Local OUT module with the virtual slot 100.1, and other CPUs (2 to 4) can then read this data via MSO Local IN modules (e.g. slot 100.2). The validity of the data is indicated by a data status byte.

Module-internal shared output with virtual slots

In this example, IO data is transferred from a CPU to other controllers via the PROFINET interface X1 using module-internal shared output.

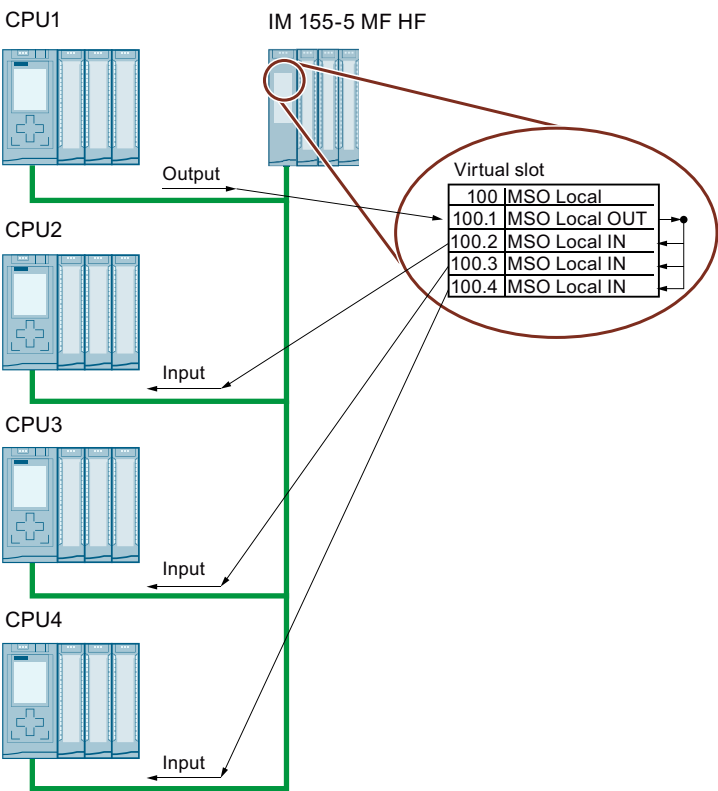


Figure 4-1 I/O data are transferred to other controllers in the same PROFINET network

Configuration

Table 4-3 Example configuration

Virtual slot	Type	I-length	Q-length	Access
100	MSO Local	-	-	-
100.1	MSO Local OUT	-	4 bytes	CPU 1

Virtual slot	Type	I-length	Q-length	Access
100.2	MSO Local IN	5 bytes incl. 1 byte DS	-	CPU 2
100.3	MSO Local IN	5 bytes incl. 1 byte DS	-	CPU 3
100.4	MSO Local IN	5 bytes incl. 1 byte DS	-	CPU 4

Editing in the user program

CPU 1 writes IO data to the MSO Local OUT module with virtual slot 100.1 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 payload 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.

4.1.18 S2 system redundancy

An IO device with S2 system redundancy supports redundant ARs.

In a redundant system, an IO device with S2 system redundancy 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 S2 system redundancy on S7-1500R/H CPUs and S7-400H CPUs.

NOTE

Restrictions in operation with activated system redundancy S2

You cannot use the following functions during operation of the IM155-5 MF HF with activated system redundancy S2:

- Configuration control (option handling)
 - Interface-local coupling
-

Combination of system redundancy and Shared Device

The IM 155-5 MF HF interface module can be connected to up to four IO controllers, but only to one S7-1500H/S7-400H redundant system. As a result, a combination of system redundancy and Shared Device operation is not possible when redundancy mode is used exclusively.

However, you can operate some of the I/O modules of the interface module in system redundancy on the redundant S7-1500H/S7-400H system and the other I/O modules with up to two additional IO controllers in Shared Device mode.

Connection to S7-400H CPUs with system redundancy

When system redundancy is used, you can connect the IM 155-5 MF HF (6ES7155-5MU00-0CN0) interface module to CPUs 41x-5H PN/DP (version 6.0 or higher) of the S7-400.

These CPUs allow you to operate the interface module as a component of a redundant system.

Requirements for the IM 155-5 MF HF interface module:

- With STEP 7 V5.5 SP3 and higher, the IM 155-5 MF HF is configured as a system redundancy device.
- The connection setting (transmission medium/duplex) must be set to "Full duplex".

More information

For more information on the topic of system redundancy:

- In the S7-1500R/H redundant system
(<https://support.industry.siemens.com/cs/us/en/view/109754833>) System Manual
- In the PROFINET with STEP 7
(<http://support.automation.siemens.com/WW/view/en/49948856>) Function Manual
- In the Fault-tolerant systems S7-400H
(<http://support.automation.siemens.com/WW/view/en/60458386>) manual
- In the STEP 7 online help

4.1.19 System modifications during ongoing operation on S7-1500R/H (CiR)

Certain configuration changes in the RUN-Redundant system state can be carried out without interruption with system modifications during ongoing, redundant operation (Configuration in RUN, CiR).

The following configuration changes are possible:

- Add IO device
- Reconfigure I/O module

You can find more information on CiR in the S7-1500 RH system manual (<https://support.industry.siemens.com/cs/us/en/view/109754833>).

4.1.20 Alternating IO devices during operation

Alternating IO devices ("alternating partners") during operation in a docking station

You can use the "Alternating IO devices during operation" ("alternating partners") PROFINET function, e.g. for changing tools on robots. Typical tools include:

- Welding guns
- Positioning tools for manufacturing parts

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

- As of STEP 7 V12 (TIA Portal), in the PROFINET with STEP 7 (<http://support.automation.siemens.com/WW/view/en/49948856>) Function Manual

4.1.21 Maintenance events

A maintenance event indicates identified maintenance required that has no direct influence on the module functioning. The maintenance event indicates that a check or replacement of plant components is required.

When a module with maintenance capability detects a change in its diagnostic state, it sends a maintenance request to the CPU. The CPU then interrupts the processing of the user program and processes the diagnostics interrupt OB (OB 82).

You can find more information in the Interrupts (Page 40) and Alarms (Page 42) sections.

4.1.22 Diagnostics interrupts

A diagnostics interrupt is an indication of an error state.

If a module with diagnostic capability for which the diagnostics interrupt is enabled detects a change in its diagnostic status, it issues a diagnostics interrupt request to the CPU.

The CPU then interrupts the processing of the user program and processes the diagnostics interrupt OB (OB 82).

You can find more information in the Interrupts (Page 40) and Alarms (Page 42) sections.

4.1.23 Value status (quality information, QI) of I/O modules

The IM 155-5 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.

4.1.24 Reading out service data

Reading out service data

The function makes it possible to read out diagnostic and service information from the interface module.

In the case of a pending maintenance alarm, you can read out the service data and make it available to SIEMENS support for queries and product improvement.

Methods of reading service data

- TIA Portal V19
- Multi Fieldbus Configuration Tool (MFCT), V1.4.1 or higher

The tool download and more information, as well as documentation on the individual functions of the MFCT can be found on the Internet

(<https://support.industry.siemens.com/cs/de/de/view/109773881/en>).

4.1.25 Identification data I&M 0 to I&M 4

Identification and maintenance data (I&M data) is information saved on the module. The data is:

- Read-only (I data and checksums CRC) or
- Readable/writable (M data)

Identification data (I&M0): Manufacturer information about the module that can only be read. Some identification data is also printed on the housing of the module, for example article number and serial number.

Maintenance data (I&M 1, 2, 3): Plant-specific information, for example installation location. Maintenance data is created during configuration and loaded to the module.

Checksums CRC (I&M4): The interface module calculates checksums based on its used data and the supplied data from the associated modules, such as parameter settings, IP address, device name, MAC address and I&M data. The interface module stores the checksums in the I&M4 data area.

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

- Checking the system configuration
- Locating hardware changes in a plant
- Correcting faults in a plant
- Inspection of safe operation of a plant

Modules can be clearly identified online using the I&M identification data.

With TIA Portal, you can read out the identification data I&M (see online help of the TIA Portal).

I&M4 data is write-protected due to information integrity.

You can find more information on the identification data I&M0 to I&M4 in the S7-1500, ET 200MP Automation system System Manual

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

NOTE

I&M4 data can be read by an application in the CPU.

4.1.26 Configuration control (option handling)

Properties

Configuration control allows you to prepare your distributed I/O system for future extensions or changes. Configuration control means that you can configure the planned maximum configuration of your distributed I/O system in advance and vary it later in a flexible manner by means of the user program.

Reference

You can find more information

- In chapter Configuration control (option handling) (Page 82)
- On the Internet (<http://support.automation.siemens.com/WW/view/en/29430270>)
- In the STEP 7 online help.

4.1.27 Use of fail-safe modules

Interface module IM 155-5 MF HF supports operation of fail-safe modules with PROFIsafe.

You can find more information in the S7-1500/ET 200MP Automation system

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual.

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)

4.1.28 Removal/insertion of multiple I/O modules during operation (multi hot swapping)

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.

You can find more information on removing/inserting modules in the S7-1500/ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual.

4.2 Interrupts, diagnostics and error messages, and system alarms

4.2.1 Status and error displays

Introduction

Diagnostics by means of LED display is an initial tool for error localization. To narrow down the error, you usually evaluate the display of the CPU, the display of the module status in STEP 7 or the diagnostics buffer of the CPU. The buffer contains plain text information on the error that has occurred. For example, you will find the number of the appropriate error OB there.

LED display

The figure below shows the LED display on the IM 155-5 MF HF interface module.



- ① RUN (green)
- ② ERROR (red)
- ③ MAINT (yellow)

Figure 4-2 LED display on the interface module

Meaning of the LEDs

The following tables show 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 the "Status and error displays for EtherNet/IP (Page 58)" section and for Modbus TCP in the "Status and error displays for Modbus TCP (Page 58)" section.

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 overlapping events. (0 = off, 1 = flashing green, 2 = green, 3 = yellow, 4 = flashing red, 5 = red)

Table 4-4 Meaning of the LEDs RUN/ERROR/MAINT

LEDs			Meaning	Remedy
RUN	ERROR	MAINT		
 Off	 Off	 Off	Supply voltage not present or too low at interface module	Check the supply voltage or turn it on at the interface module.
 Flashes	 Flashes	 Flashes	LED test during startup: The three LEDs light up simultaneously in red for approx. 3.0 s, then for approximately 0.25 s in green.	---
 Flashes	 Off	 Off	Interface module is deactivated.	Activate the interface module with the configuration software or the user program.
			Interface module is not configured.	Configure the interface module with the configuration software.
			ET 200MP is starting up.	---
			ET 200MP is being reset to factory settings.	
 On	Not relevant	Not relevant	ET 200MP is currently exchanging data with the IO controller.	
Not relevant	 Flashes	Not relevant	Group error and group error channels	Evaluate the diagnostics and correct the error.
			The set configuration does not correspond to the actual configuration of the ET 200MP.	Check the configuration of the ET 200MP to see whether a module is missing or defective, or whether a non-configured module is inserted.
			Invalid configuration states	See section Invalid configuration states of the ET 200MP on PROFINET IO (Page 45)
			Parameter assignment error in the I/O module	Evaluate the display of the module status in STEP 7 and correct the error in the corresponding I/O module.
Not relevant	Not relevant	 On	Maintenance	See section Maintenance events (Page 43)
 Flashes	 Flashes	 Flashes	"Node flash test" is being performed. (The P1 and P2 LEDs of the PROFINET interface are also flashing.)	---
 On	 On	 On	RN/NS, ER/MS, and MT/IO LEDs are permanently on: Hardware or firmware defective. Error information is determined and stored retentively on the flash.	Do not disconnect the interface module from the supply voltage as long as the LEDs are lit continuously. This may take a few minutes.
 Flashes	 Flashes	 Flashes	Hardware or firmware defective. (The P1 and P2 LEDs of the PROFINET interface are not flashing.)	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 service data with MFCT and TIA Portal as of V19.

See also

[Status and error displays for Modbus TCP \(Page 73\)](#)

4.2.2 Interrupts

Introduction

The I/O device generates interrupts as a reaction to specific error events. Interrupts are evaluated based on the I/O controller used.

Evaluating interrupts with I/O controllers

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

- Diagnostic 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) as of V12, innovative system diagnostics is available for devices of the S7-1500 automation system and ET 200MP. Independently of the cyclical user program, alarms are made available on the display of the S7-1500 CPU, to the S7-1500 CPU web server, to the HMI device and in STEP 7.

For additional information on the system diagnostics, refer to the System diagnostics function manual (<http://support.automation.siemens.com/WW/view/en/59192926>).

4.2.2.1 Triggering of a diagnostic interrupt

Triggering of a diagnostic interrupt

For an incoming or outgoing event (e.g., wire break on a channel of an I/O module), the module triggers a diagnostic interrupt if this is configured accordingly in STEP 7 (TIA Portal).

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

4.2.2.2 Triggering of a hardware interrupt

Triggering of a hardware interrupt

When a hardware interrupt occurs, the CPU interrupts execution of the user program and processes the hardware interrupt OB. The event that triggered the interrupt is entered in 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. 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.

4.2.2.3 Triggering of a pull/plug interrupt

Triggering of a pull/plug interrupt

In the event of a pull/plug interrupt, the CPU interrupts processing of the user program and processes the pull/plug OB (OB 83). The event that triggered the interrupt is entered in the start information of the pull/plug 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.

4.2.3 Alarms

4.2.3.1 Diagnostic alarms

Actions after a diagnostic alarm

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

- The ERROR LED of the interface module flashes.
- Diagnostics are reported as diagnostic interrupts to the CPU of the IO controller and can be read via data records.
- Incoming diagnostic alarms are saved to the diagnostic buffer of the IO controller.
- (S7-300/400) The diagnostic interrupt OB is called. If the diagnostic interrupt OB (OB82) is not available, the IO controller goes into STOP mode.

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

Reading out the diagnostics

Table 4-5 Reading out the diagnostics with STEP 7

Automation system with IO controller	Application	See...
SIMATIC S7	Diagnostics as plain text in STEP 7 using online view and diagnostic view	Online help of STEP 7 and • As of STEP 7 V12 PROFINET with STEP 7 V12 function manual (http://support.automation.siemens.com/WW/view/en/49948856) • As of STEP 7 V5.5 PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) manual.
	Instruction "RDREC" Read data records from the IO device	
	Instruction "RALRM" Receive interrupts from the IO device	

Additional information on the data records for PROFINET IO

You can find the structure of the diagnostic data records and programming examples in the programming manual From PROFIBUS DP to PROFINET IO

(<http://support.automation.siemens.com/WW/view/en/19289930>) and in the application example on the Internet (<http://support.automation.siemens.com/WW/view/en/24000238>).

Causes of error and corrective measures

The error causes and corrective measures of the diagnostic alarms are described in the manuals for the I/O modules

(<http://support.automation.siemens.com/WW/view/en/67296522/133300>) in the Interrupts/Diagnostic alarms section.

See also

[Channel diagnostics \(Page 44\)](#)

4.2.3.2 Maintenance events

Triggering of a maintenance event

The PROFINET interface of the interface module supports the diagnostic concept and maintenance concept in PROFINET according to the IEC 61158-6-10 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 network component must be checked or replaced.

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

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

Table 4-6 Triggering of a maintenance event

Maintenance alarm	Event	Meaning	Remedy
Maintenance demanded MAINT LED is lit	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)	
	Maintenance event	The maintenance event is handed over.	
	Diagnostics for attenuation that is too high	- Fiber-optic error - Attenuation through the fiber-optic cable is already so high that operation will soon no longer be possible.	1. Replace the fiber-optic cable if damaged or aged. 2. Ensure the correct installation of the PROFINET connectors or PROFINET connections. 3. Adhere to maximum length of 50m for POF cable or 100m for PCF cable. 4. Ensure that the FOC connectors fit securely.

System alarms in STEP 7

The maintenance information is generated in STEP 7 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 additional information in the STEP 7 online help.

4.2.3.3 Channel diagnostics

Function

Channel diagnostics provides information about channel faults in modules.

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

The "RDREC" instruction is used to read the data record.

Structure of the diagnostic data records

- The IM 155-5 MF HF interface module maps channel faults by means of extended channel diagnostics.

The data records supported by the ET 200MP are based on the standard PROFINET IO - Application Layer Service Definition V2.3.

You can purchase the standards from the PROFIBUS User Organization on the Internet (<http://www.profibus.com>).

Codes of the extended channel diagnostics

With the IM 155-5 MF HF interface module, the following extended channel diagnostics are reported by the interface module in slot 1:

Table 4-7 Manufacturer-specific diagnostics in the USI

ChannelError-Type	ExtendedChannelErrorType	Associated value (AddValue)	Diagnostics
0x0601	0x0682	Slot	Communication with slot <No.> has failed
0x0602	0x0692	Slot	Permitted number of I/O modules exceeded
0x0602	0x069A	Slot	Interface module in incorrect slot
0x0602	0x069B	Slot	Permitted number of power supply modules exceeded
0x0602	0x0696	0	No U connector detected on an IM port
0x0602	0x0697	0	More than one bus master module (IM/CPU) detected
0x0610	0x06B1	Slot	Power budget calculation (overload detected in at least one power segment)
0x0610	0x06B2	0 or 1	Error IM power supply: Power supply not active or power supply active
0x0602	0x069C	0	Diagnostics with incorrectly plugged BusAdapter
0x0190	0x012C	Signed firmware update	Security event: Firmware has been successfully downloaded and activated for installation. (New firmware version: <FW version>)
0x0190	0x0193	Signed firmware update	Security event: The firmware integrity checks failed. The new firmware version <FW version> was rejected. - Verify if the firmware update file you are using comes from a secure source. - Download the firmware again from the Siemens Support Web page. - Repeat the firmware update.

See also

ET 200MP system manual (<https://support.industry.siemens.com/cs/ww/en/view/59191792>)

4.2.3.4 Invalid configuration states of the ET 200MP on PROFINET IO**Invalid configuration states**

The following invalid configuration states of the ET 200MP lead to a short failure of the ET 200MP IO device or prevent the exchange of user data with the I/O modules.

- More than two power supply modules (PS) inserted to the right of the interface module
- Number of modules exceeds maximum configuration
- Faulty backplane bus (e.g., additional IM present).
- I/O modules of a power segment consume more power than can be provided (overload).
In the case of an overload, the interface module provides diagnostic information, cyclically checks the connection to the backplane bus and re-establishes it as soon as possible.

Additional information

You can find additional information on maximum configuration, power budget and power segments in the system manual S7-1500, ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

See also:

Status and error displays ([Page 37](#))

4.2.3.5 STOP of the IO controller and recovery of the IO device**STOP of the SIMATIC IO controller**

Diagnostics received from the IO device while the IO controller is in STOP state do not initiate a call of the corresponding OBs when the IO controller starts up. You have to read the data record E00C_H using the "RDREC" instruction in the startup OB. This record contains all diagnostics for the slots assigned to an IO controller in an IO device.

Recovery of the SIMATIC IO device

If you want to read the diagnostics that occurred in the STOP state of the IO controller, you have to read the E00C_H data record using the "RDREC" instruction. This record contains all diagnostics for the slots assigned to an IO controller in an IO device.

EtherNet/IP

5.1 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
- Firmware update via MFCT
- Shared Device
- Distribution of module channels to submodules
- Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)
- 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
- Removal/insertion of multiple I/O modules during operation (multi hot swapping)

Requirements

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

Table 5-1 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
I/O communication with scanner	1	V5.1.1	V1.5 SP3
Configuring from the user program	1	V5.1.1	V1.5 SP3
Reading diagnostics	1	V5.1.1	V1.5 SP3
Normative CIP objects	1	V5.1.1	V1.5 SP3

Function	Functional status of the module as of	Firmware version of the module as of	Configuration software MFCT as of
Resetting interface module to factory setting	1	V5.1.1	V1.5 SP3
Diagnostics bit in data status of cyclic I/O data per submodule	1	V5.1.1	V1.5 SP3
BusAdapter BA 2xRJ45	1	V5.1.1	---
BusAdapter BA 2xFC	1	V5.1.1	---
BusAdapter BA 2xM12	1	V5.1.1	---
BusAdapter BA 2xSCRJ	---	---	---
BusAdapter BA SCRJ/RJ45	---	---	---
BusAdapter BA SCRJ/FC	---	---	---
BusAdapter BA 2xLC	---	---	---
BusAdapter BA LC/RJ45	---	---	---
BusAdapter BA LC/FC	---	---	---
MF Shared Device	1	V5.1.1	V1.5 SP3
Distribution of module channels to submodules	1	V5.1.1	V1.5 SP3
Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)	1	V5.1.1	V1.5 SP3
Interface-local coupling of IO data	1	V5.1.1	V1.5 SP3

5.1.1 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 a simple parameter reassignment. Records/interface are described in the Equipment Manual.
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.

5.1 EtherNet/IP functions

All modules not listed here correspond to category 1 and can be used without functional restrictions.

F-modules

Module	Article number	Category	Note
F-DI 16x24VDC	6ES7 526-1BH00-0AB0	4	-
F-DQ 8x24VDC/2A PPM	6ES7 526-2BF00-0AB0	4	-
F-AI 8xI 0(4)...20mA	6ES7 536-1MF00-0AB0	4	-

Technology modules

Module	Article number	Category	Note
TM SIWAREX WP521 ST	7MH4 980-1AA01	3	Only for DR data records (calibrating) Block description available on request. Alternatively, commissioning with SIWATOOL V7 is possible.
TM SIWAREX WP522 ST	7MH4 980-2AA01	3	Only for DR data records (calibrating) Block description available on request. Alternatively, commissioning with SIWATOOL V7 is possible.

Communication modules

Module	Article number	Category	Note
CM PtP RS422/485 BA	6ES7 540-1AB00-0AA0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM PtP RS232 BA	6ES7 540-1AD00-0AA0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).

Module	Article number	Category	Note
CM PtP RS422/485 HF	6ES7 541-1AB00-0AB0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM PtP RS232 HF	6ES7 541-1AD00-0AB0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM 8xIO-Link V1.0	6ES7 547-1JF00-0AB0	2	You can find additional information in the Equipment Manual (https://support.industry.siemens.com/cs/ww/en/view/109763143).

5.1.2 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)
- + Processing time I/O data (typically 1.4 ms, +/- 1 ms jitter due to free-running cycles)
- + Conversion time in module (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.

5.1.3 Examples of I/O data mapping

I/O data mapping

During parameter assignment of the MF device, you can choose between three formats for the I/O data mapping:

- With the "Byte" format, the input or output data of the modules of an I/O connection are arranged by increasing slot address (Slot.Subslot).
- With the "Word" format, the input or output data of the modules of an I/O connection are arranged by ascending slot address (Slot.Subslot). If the submodule has an odd data length, a padding byte (content 0x00) is inserted after the submodule. This aligns the following data status bytes (IDS, ODS) to word limits. A padding byte (content 0x00) is also inserted after the data status byte (IDS, ODS). Subsequent submodules will then also start at an even byte offset.

- With the "Flexible Data Type" format, the input and output data of the modules of an I/O connection are arranged by ascending slot address (Slot.Subslot). The alignment depends on the data length of the submodule and follows the alignment rules described in Rockwell's specification "Type Encoding of Logix Structures in CIP Data Table R/W". According to these rules, submodule data with a length of 2 bytes should begin at 2-byte address boundaries, which is the same as for "Word", 4-byte data should start at 4-byte address boundaries and so on. Padding bytes (content 0x00) are inserted accordingly to ensure that the data of each submodule starts at the correct boundaries. The format also offers the option of exchanging the endianness of the submodule data.

The output image contains only the output data (with padding bytes if necessary), while the input image also supplies additional status bytes together with the input data (with padding bytes if necessary).

An ODS is available for each output submodule in the image of the inputs.

There is an Input Data Status Byte (IDS) for each input submodule that follows the respective input data of the submodule in the input image.

Submodules with a data length of 0 for input and output data are treated as input submodules. Only an IDS is entered in the input image.

NOTE

You can find the I/O data mapping for your configuration in the CSV file exported from the MFCT.

NOTE

For more information about data mapping, refer to the System and Equipment Manuals.

I/O data status

The following table shows the coding of the status bytes for IDS and ODS:

Field	Bit number	Bit mask	Default	Bit value = '0'	Bit value = '1'
IOValid	7	0x80	0	I/O data invalid	I/O data valid
Problem	6	0x40	0	Initial status	Module problem: - Module not plugged - Incorrect module plugged - Module with incorrect parameter assignment - I/O data temporarily invalid after station startup
NoCoupling	5	0x20	0	Initial status	No I/O data from coupling partner (MSO Local)
Reserved	4...1	0x1E	0000 _B	-	
Diagnosis	0	0x01	0	No diagnostics	Diagnostics available

NOTE

For MSI and MSO submodules, the IDS.Diagnosis bit is 0. Comparable to the diagnostics interrupt of PROFINET, the diagnostics for MSI and MSO are only signaled in the IDS.Diagnosis bit for the default submodule (subslot = 1).

5.1.3.1 Example of I/O data mapping for the I/O format byte

Configuration example

The following figure shows the configuration for this example:



5.1 EtherNet/IP functions

The example uses the following modules:

Slot	Module
1	IM 155-5 MF HF V5.1
2	DI 16x24VDC HF
3	DQ 16x24VDC/0.5A HF QI
4	AI 4xU/I/RTD/TC ST QI
5	AQ 2xU/I ST QI

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 off-set	Description
1	Slot1_1_IDS	Byte	0	Input data state for the interface module
2	Slot2_1_Inputs	Byte	1	2 bytes input data for the DI 16 HF module
	Slot2_1_Inputs	Byte	2	
	Slot2_1_IDS	Byte	3	Input data state for the DI16 HF module
3	Slot3_1_QI	Byte	4	Value status for the DQ 16 HF module
	Slot3_1_QI	Byte	5	Value status for the DQ 16 HF module
	Slot3_1_IDS	Byte	6	Input data state for the DQ 16 HF module
4	Slot4_1_I_channel_0_0	Byte	7	2 bytes input data for channel 0 of the AI 4 module
	Slot4_1_I_channel_0_1	Byte	8	
	Slot4_1_I_channel_1_0	Byte	9	2 bytes input data for channel 1 of the AI 4 module
	Slot4_1_I_channel_1_1	Byte	10	
	Slot4_1_I_channel_2_0	Byte	11	2 bytes input data for channel 2 of the AI 4 module
	Slot4_1_I_channel_2_1	Byte	12	
	Slot4_1_I_channel_3_0	Byte	13	2 bytes input data for channel 3 of the AI 4 module
	Slot4_1_I_channel_3_1	Byte	14	
	Slot4_1_QI	Byte	15	Value status for the AI 4 module
	Slot4_1_IDS	Byte	16	Input data state for the AI 4 module
5	Slot5_1_QI	Byte	17	Value status for the AQ 2 module
	Slot5_1_IDS	Byte	18	Input data state for the AQ 2 module
3	Slot3_1_ODS	Byte	19	Output data state for the DQ 16 HF module
5	Slot5_1_ODS	Byte	20	Output data state for the AQ 2 module
-	-	Byte	21	Reserved

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 Byte:

Slot	Name	Data type	Byte off-set	Description
3	Slot3_1_ Outputs	Byte	0	2 bytes output data for the DQ 16 HF module
	Slot3_1_ Outputs	Byte	1	
5	Slot5_1_ O_channel_0_0	Byte	2	2 bytes output data for channel 0 of the AQ 2 module
	Slot5_1_ O_channel_0_1	Byte	3	
	Slot5_1_ O_channel_1_0	Byte	4	2 bytes output data for channel 1 of the AQ 2 module
	Slot5_1_ O_channel_1_1	Byte	5	

The sum of the output data is 6 bytes.

5.1.3.2 Example of I/O data mapping for the I/O format Word

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
1	IM 155-5 MF HF V5.1
2	DI 16x24VDC HF
3	DQ 16x24VDC/0.5A HF QI
4	AI 4xU/I/RTD/TC ST QI
5	AQ 2xU/I ST QI

Input buffer

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

Slot	Name	Data type	Byte offset	Description
1	Slot1_1_IDS	Byte	0	Input status for IM 155-5 MF HF V5.1 interface module
	0x00	Byte	1	Padding byte
2	Slot2_1_Inputs	Byte	2	2 bytes input data for the DI 16 HF module
	Slot2_1_Inputs	Byte	3	
	Slot2_1_IDS	Byte	4	Input data state for the DI16 HF module
	0x00	Byte	5	Padding byte
3	Slot3_1_QI	Byte	6	Value status for the DQ 16 HF module
	Slot3_1_QI	Byte	7	
	Slot3_1_IDS	Byte	8	Input data state for the DQ 16 HF module
	0x00	Byte	9	Padding byte
4	Slot4_1_I_channel_0_0	Byte	10	2 bytes input data for channel 0 of the AI 4 module
	Slot4_1_I_channel_0_1	Byte	11	
	Slot4_1_I_channel_1_0	Byte	12	2 bytes input data for channel 1 of the AI 4 module
	Slot4_1_I_channel_1_1	Byte	13	
	Slot4_1_I_channel_2_0	Byte	14	2 bytes input data for channel 2 of the AI 4 module
	Slot4_1_I_channel_2_1	Byte	15	
	Slot4_1_I_channel_3_0	Byte	16	2 bytes input data for channel 3 of the AI 4 module
	Slot4_1_I_channel_3_1	Byte	17	
	Slot4_1_QI	Byte	18	Value status for the AI 4 module
	0x00	Byte	19	Padding byte
	Slot4_1_IDS	Byte	20	Input data state for the AI 4 module
	0x00	Byte	21	Padding byte
5	Slot5_1_QI	Byte	22	Value status for the AQ 2 module
	0x00	Byte	23	Padding byte
	Slot5_1_IDS	Byte	24	Input data state for the AQ 2 module
	0x00	Byte	25	Padding byte
3	Slot3_1_ODS	Byte	26	Output data state for the DQ 16 HF module
	0x00	Byte	27	Padding byte
5	ODS	Byte	28	Output data state for the AQ 2 module
	0x00	Byte	29	Padding byte

The sum of the input data is 30 bytes.

Output buffer

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

Slot	Name	Data type	Byte offset	Description
3	Slot3_1_ Outputs	Byte	0	2 bytes output data for the DQ 16 HF module
	Slot3_1_ Outputs	Byte	1	
5	Slot5_1_ O_channel_0_0	Byte	2	2 bytes output data for channel 0 of the AQ 2 module
	Slot5_1_ O_channel_0_1	Byte	3	
	Slot5_1_ O_channel_1_0	Byte	4	2 bytes output data for channel 1 of the AQ 2 module
	Slot5_1_ O_channel_1_1	Byte	5	

The sum of the output data is 6 bytes.

5.1.3.3 Example of I/O data mapping for the "Flexible Data Type" I/O format

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
1	IM 155-5 MF HF V5.1
2	DI 16x24VDC HF
3	DQ 16x24VDC/0.5A HF QI
4	AI 4xU/I/RTD/TC ST QI
5	AQ 2xU/I ST QI

Input buffer

The following table shows the input buffer for the example configuration for flexible data alignment (big-endian):

Slot	Name	Data type	Byte off-set	Description
1	Slot1_1_IDS	Byte	0	Input data state for the interface module
2	Slot2_1_Inputs	Byte	1	2 bytes input data for the DI 16 HF module
	Slot2_1_Inputs	Byte	2	
	Slot2_1_IDS	Byte	3	Input data state for the DI16 HF module
3	Slot3_1_QI	Byte	4	Value status for the DQ 16 HF module
	Slot3_1_QI	Byte	5	Value status for the DQ 16 HF module
	Slot3_1_IDS	Byte	6	Input data state for the DQ 16 HF module
	Slot3_1_ODS	Byte	7	Output data state for the DQ 16 HF module
4	Slot4_1_I_channel_0_0	Byte	8	2 bytes input data for channel 0 of the AI 4 module
	Slot4_1_I_channel_0_1	Byte	9	
	Slot4_1_I_channel_1_0	Byte	10	2 bytes input data for channel 1 of the AI 4 module
	Slot4_1_I_channel_1_1	Byte	11	
	Slot4_1_I_channel_2_0	Byte	12	2 bytes input data for channel 2 of the AI 4 module
	Slot4_1_I_channel_2_1	Byte	13	
	Slot4_1_I_channel_3_0	Byte	14	2 bytes input data for channel 3 of the AI 4 module
	Slot4_1_I_channel_3_1	Byte	15	
	Slot4_1_QI	Byte	16	Value status for the AI 4 module
	Slot4_1_IDS	Byte	17	Input status for AI 4xU/I/RTD/TC ST QI
5	Slot5_1_QI	Byte	18	Value status for the AQ 2 module
	Slot5_1_IDS	Byte	19	Input data state for the AQ 2 module
	Slot5_1_ODS	Byte	20	Output data state for the AQ 2 ST module
-	-	Byte	21	Reserved

The sum of the input data is 22 bytes.

Output buffer

The following table shows the output buffer for the example configuration for flexible data alignment:

Slot	Name	Data type	Byte off-set	Description
3	Slot3_1_ Outputs	Byte	0	2 bytes output data for the DQ 16 HF module
	Slot3_1_ Outputs	Byte	1	
5	Slot5_1_ O_channel_0_0	Byte	2	2 bytes output data for channel 0 of the AQ 2 module
	Slot5_1_ O_channel_0_1	Byte	3	
	Slot5_1_ O_channel_1_0	Byte	4	2 bytes output data for channel 1 of the AQ 2 module
	Slot5_1_ O_channel_1_1	Byte	5	

The sum of the input data is 6 bytes.

5.1.4 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
0	1 to 2	1 to 10	500	246	1440	1440
1	1 to 2	0	EtherNet/IP: 500 Modbus TCP: 500 PROFINET: 1440	EtherNet/IP: 246 Modbus TCP: 246 PROFINET: 1440	Download size ² : 1440	Download size ² : 1440
1	0	1 to 10				
1	1 to 2	1 to 10				
2	1 to 2	0	EtherNet/IP: 500 Modbus TCP: 500 PROFINET: 1440	EtherNet/IP: 246 Modbus TCP: 246 PROFINET: 1440	1440	1440
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 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 overlapping events. (0 = off, 1 = flashing green, 2 = green, 3 = yellow, 4 = flashing red, 5 = red)

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

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

LED	Meaning	Remedy
RN/NS (NET STATUS)		
 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 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 with the EtherNet/IP scanner.
 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 5-4 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	Maintenance event is present.	You can find more information in the "Maintenance events (Page 43)" section.

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 5-5 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.

5.2 Diagnostics

LEDs			Meaning	Notes
RN/NS (NET STATUS)	ER/MS (MODUL STATUS)	MT/IO (IO STATUS)		
 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 EtherNet/IP.
 On	 On	 Off	The MF device is exchanging data error-free via a connection (EtherNet/IP). I/O used by EtherNet/IP is in STOP.	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.
 Flashes	 Flashes	 Flashes	The "Node flash test" is running.	The LK1 and LK2 LEDs of the Ethernet interface are also flashing.

LEDs			Meaning	Notes
RN/NS (NET STATUS)	ER/MS (MODUL STATUS)	MT/IO (IO STATUS)		
 Flashes	 Flashes	 Flashes	LED test during startup: The three LEDs light up simultaneously in red for approx. 3.0 s, 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 is determined and stored retentively on the flash.	Do not disconnect the interface module from the supply voltage as long as the LEDs are lit continuously. This may take a few minutes.
 Flashes	 Flashes	 Flashes	Hardware or firmware defective.	You can read out the service data with TIA Portal as of V19.

Modbus TCP

6.1 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 repetition rate 2 ms
- Firmware update via MFCT
- Shared Device
- Distribution of module channels to submodules
- Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)
- 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
- Removal/insertion of multiple I/O modules during operation (multi hot swapping)

Requirements

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

Table 6-1 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 as of	RegLayoutVersion
I/O communication with Modbus client	1	V5.1.1	V1.5 SP3	V1.1
Bit by bit access via FC1 FC2 FC5 FC15 functions	1	V5.1.1	V1.5 SP3	V1.1
Free user registers (e.g. for coordination of the redundancy)	1	V5.1.1	V1.5 SP3	V1.1
Device status register	1	V5.1.1	V1.5 SP3	V1.1
Diagnostics bit in data status of cyclic I/O data per sub-module	1	V5.1.1	V1.5 SP3	V1.1
Module status	1	V5.1.1	V1.5 SP3	V1.1
Data record interface	1	V5.1.1	V1.5 SP3	V1.1
BusAdapter BA 2xRJ45	1	V5.1.1	---	---
BusAdapter BA 2xFC	1	V5.1.1	---	---
BusAdapter BA 2xM12	1	V5.1.1	---	---
BusAdapter for BA 2xSCRJ	---	---	---	---
BusAdapter BA SCRJ/RJ45	---	---	---	---
BusAdapter BA SCRJ/FC	---	---	---	---
BusAdapter BA 2xLC	---	---	---	---
BusAdapter BA LC/RJ45	---	---	---	---
BusAdapter BA LC/FC	---	---	---	---
MF Shared Device	1	V5.1.1	V1.5 SP3	---
TCP reset hold time for soft redundancy	1	V5.1.1	V1.5 SP3	V1.1
Distribution of module channels to submodules	1	V5.1.1	V1.5 SP3	---
Module-internal or submodule-internal Shared Input/Shared Output (MSI/MSO)	1	V5.1.1	V1.5 SP3	---
Interface-local coupling of IO data	1	V5.1.1	V1.5 SP3	---

6.1.1 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.

All modules not listed here correspond to category 1 and can be used without functional restrictions.

F-modules

Module	Article number	Category	Note
F-DI 16x24VDC	6ES7 526-1BH00-0AB0	4	-
F-DQ 8x24VDC/2A PPM	6ES7 526-2BF00-0AB0	4	-
F-AI 8xI 0(4)...20mA	6ES7 536-1MF00-0AB0	4	-

Technology modules

Module	Article number	Category	Note
TM SIWAREX WP521 ST	7MH4 980-1AA01	3	Only for DR data records (calibrating) Block description available on request. Alternatively, commissioning with SIWATOOL V7 is possible.
TM SIWAREX WP522 ST	7MH4 980-2AA01	3	Only for DR data records (calibrating) Block description available on request. Alternatively, commissioning with SIWATOOL V7 is possible.

Communication modules

Module	Article number	Category	Note
CM PtP RS422/485 BA	6ES7 540-1AB00-0AA0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM PtP RS232 BA	6ES7 540-1AD00-0AA0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM PtP RS422/485 HF	6ES7 541-1AB00-0AB0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM PtP RS232 HF	6ES7 541-1AD00-0AB0	3	You can find more information in the Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59057093). You can find more information in the Programming Manual (https://support.industry.siemens.com/cs/de/en/view/59062563).
CM 8xIO-Link V1.0	6ES7 547-1JF00-0AB0	2	You can find additional information in the Equipment Manual (https://support.industry.siemens.com/cs/ww/en/view/109763143).

6.1.2 Examples of I/O data mapping

I/O data mapping

During parameter assignment of the MF device, you can choose between two formats for the I/O data mapping:

- With the "Byte" format, the input or output data of the modules of an I/O connection are arranged by increasing slot address (Slot.Subslot).
- With the "Word" format, the input or output data of the modules of an I/O connection are arranged by ascending slot address (Slot.Subslot). If the submodule has an odd data length, a padding byte (content 0x00) is inserted after the submodule. This aligns the following data status bytes (IDS, ODS) to word limits. A padding byte (content 0x00) is also inserted after the data status byte (IDS, ODS). Subsequent submodules will then also start at an even byte offset.

The output image contains only the output data (with padding bytes if necessary), while the input image also supplies additional status bytes together with the input data (with padding bytes if necessary).

An ODS is available for each output submodule in the image of the inputs.

There is an Input Data Status Byte (IDS) for each input submodule that follows the respective input data of the submodule in the input image.

Submodules with a data length of 0 for input and output data are treated as input submodules. Only an IDS is entered in the input image.

NOTE

You can find the I/O data mapping for your configuration in the CSV file exported from the MFCT.

NOTE

For more information about data mapping, refer to the System and Equipment Manuals.

I/O data status

The following table shows the coding of the status bytes for IDS and ODS:

Field	Bit number	Bit mask	Default	Bit value = '0'	Bit value = '1'
IOValid	7	0x80	0	I/O data invalid	I/O data valid
Problem	6	0x40	0	Initial status	Module problem: • Module not plugged • Incorrect module plugged • Module with incorrect parameter assignment • I/O data temporarily invalid after station startup

Field	Bit number	Bit mask	Default	Bit value = '0'	Bit value = '1'
NoCoupling	5	0x20	0	Initial status	No I/O data from coupling partner (MSO Local)
Reserved	4...1	0x1E	0000 _B	-	
Diagnosis	0	0x01	0	No diagnostics	Diagnostics available

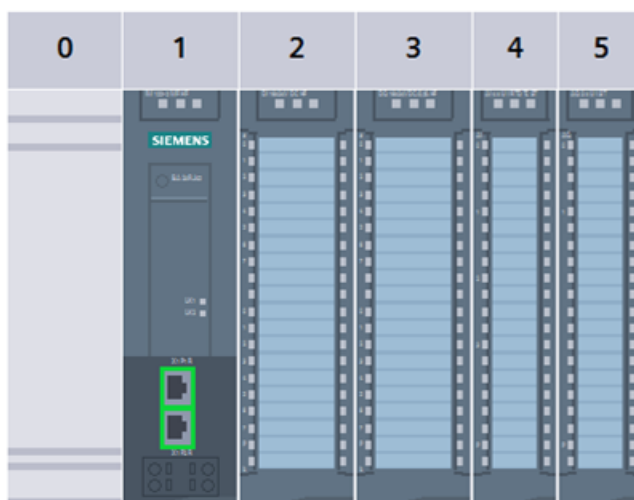
NOTE

For MSI and MSO submodules, the IDS.Diagnosis bit is 0. Comparable to the diagnostics interrupt of PROFINET, the diagnostics for MSI and MSO are only signaled in the IDS.Diagnosis bit for the default submodule (subslot = 1).

6.1.2.1 Example of I/O data mapping for the I/O format byte

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
1	IM 155-5 MF HF V5.1
2	DI 16x24VDC HF
3	DQ 16x24VDC/0.5A HF QI
4	AI 4xU/I/RTD/TC ST QI
5	AQ 2xU/I ST QI

Input buffer

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

Slot	Name	Data type	Access	Register offset*	Description
1	Slot1_1_IDS	Word	MSB	0	Input data state for the interface module
2	Slot2_1_Inputs	Word	LSB	0	2 bytes input data for the DI 16 HF module
	Slot2_1_Inputs	Word	MSB	1	
	Slot2_1_IDS	Word	LSB	1	Input data state for the DI16 HF module
3	Slot3_1_QI	Word	MSB	2	Value status for the DQ 16 HF module
	Slot3_1_QI	Word	LSB	2	Value status for the DQ 16 HF module
	Slot3_1_IDS	Word	MSB	3	Input status for DQ 16x24VDC/0.5A HF QI
4	Slot4_1_I_channel_0_0	Word	LSB	3	2 bytes input data for channel 0 of the AI 4 module
	Slot4_1_I_channel_0_1	Word	MSB	4	
	Slot4_1_I_channel_1_0	Word	LSB	4	2 bytes input data for channel 1 of the AI 4 module
	Slot4_1_I_channel_1_1	Word	MSB	5	
	Slot4_1_I_channel_2_0	Word	LSB	5	2 bytes input data for channel 2 of the AI 4 module
	Slot4_1_I_channel_2_1	Word	MSB	6	
	Slot4_1_I_channel_3_0	Word	LSB	6	2 bytes input data for channel 3 of the AI 4 module
	Slot4_1_I_channel_3_1	Word	MSB	7	
	Slot4_1_QI	Word	LSB	7	Value status for the AI 4 module
	Slot4_1_IDS	Word	MSB	8	Input data state for the AI 4 module
5	Slot5_1_QI	Word	LSB	8	Value status for the AQ 2 module
	Slot5_1_IDS	Word	MSB	9	Input data state for the AQ 2 module
3	Slot3_1_ODS	Word	LSB	9	Output data state for the DQ 16 HF module
5	Slot5_1_ODS	Word	MSB	10	Output data state for the AQ 2 module
-	-	Word	LSB	10	Reserved

*Register offset relative to the data area.

You can find more information in the MultiFieldbus Function Manual (<https://support.industry.siemens.com/cs/ww/en/view/109773209>).

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 Byte:

Slot	Name	Data type	Lo/Hi	Register offset*	Description
3	Slot3_1_ Outputs	Word	MSB	0	2 bytes output data for the DQ 16 HF module
	Slot3_1_ Outputs	Word	LSB	0	
5	Slot5_1_ O_channel_0_0	Word	MSB	1	2 bytes output data for channel 0 of the AQ 2 module
	Slot5_1_ O_channel_0_1	Word	LSB	1	
	Slot5_1_ O_channel_1_0	Word	MSB	2	2 bytes output data for channel 1 of the AQ 2 module
	Slot5_1_ O_channel_1_1	Word	LSB	2	

*Register offset relative to the data area.

You can find more information in the MultiFieldbus Function Manual (<https://support.industry.siemens.com/cs/ww/en/view/109773209>).

The sum of the output data is 3 registers.

6.1.2.2 Example of I/O data mapping for the I/O format Word

Configuration example

The following figure shows the configuration for this example:



The example uses the following modules:

Slot	Module
1	IM 155-5 MF HF V5.1
2	DI 16x24VDC HF

6.1 Modbus TCP functions

Slot	Module
3	DQ 16x24VDC/0.5A HF QI
4	AI 4xU/I/RTD/TC ST QI
5	AQ 2xU/I ST QI

Input buffer

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

Slot	DataItem	Data type	Access	Register offset*	Description
1	Slot1_1_IDS	Word	MSB	0	Input data state for the interface module
	0x00	Word	LSB	0	Padding byte
2	Slot2_1_Inputs	Word	MSB	1	2 bytes input data for the DI 16 HF module
	Slot2_1_Inputs	Word	LSB	1	
	Slot2_1_IDS	Word	MSB	2	Input data state for the DI16 HF module
	0x00	Word	LSB	2	Padding byte
3	Slot3_1_QI	Word	MSB	3	Value status for the DQ 16 HF module
	Slot3_1_QI	Word	LSB	3	Value status for the DQ 16 HF module
	Slot3_1_IDS	Word	MSB	4	Input data state for the DQ 16 HF module
	0x00	Word	LSB	4	Padding byte
4	Slot4_1_I_channel_0_0	Word	MSB	5	2 bytes input data for channel 0 of the AI 4 module
	Slot4_1_I_channel_0_1	Word	LSB	5	
	Slot4_1_I_channel_1_0	Word	MSB	6	2 bytes input data for channel 1 of the AI 4 module
	Slot4_1_I_channel_1_1	Word	LSB	6	
	Slot4_1_I_channel_2_0	Word	MSB	7	2 bytes input data for channel 2 of the AI 4 module
	Slot4_1_I_channel_2_1	Word	LSB	7	
	Slot4_1_I_channel_3_0	Word	MSB	8	2 bytes input data for channel 3 of the AI 4 module
	Slot4_1_I_channel_3_1	Word	LSB	8	
	Slot4_1_QI	Word	MSB	9	Value status for the AI 4 module
	0x00	Word	LSB	9	Padding byte
	Slot4_1_IDS	Word	MSB	10	Input data state for the AI 4 module
	0x00	Word	LSB	10	Padding byte
5	Slot5_1_QI	Word	MSB	11	Value status for the AQ 2 module
	0x00	Word	LSB	11	Padding byte
	Slot5_1_IDS	Word	MSB	12	Input data state for the AQ 2 module
	0x00	Word	LSB	12	Padding byte
3	Slot3_1_ODS	Word	MSB	13	Output data state for the DQ 16 HF module

*Register offset relative to the data area

Slot	Dataltem	Data type	Access	Register offset*	Description
3	0x00	Word	LSB	13	Padding byte
5	Slot5_1_ ODS	Word	MSB	14	Output data state for the AQ 2 ST module
	0x00	Word	LSB	14	Padding byte

*Register offset relative to the data area

You can find more information in the MultiFieldbus Function Manual (<https://support.industry.siemens.com/cs/ww/en/view/109773209>).

The sum of the input data is 15 registers.

Output buffer

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

Slot	Dataltem	Data type	Lo/Hi	Register offset*	Description
3	Slot3_1_ Outputs	Word	MSB	0	2 bytes output data for the DQ 16 HF module
	Slot3_1_ Outputs	Word	LSB	0	
5	Slot5_1_ O_channel_0_0	Word	MSB	1	2 bytes output data for channel 0 of the AQ 2 module
	Slot5_1_ O_channel_0_1	Word	LSB	1	
	Slot5_1_ O_channel_1_0	Word	MSB	2	2 bytes output data for channel 1 of the AQ 2 module
	Slot5_1_ O_channel_1_1	Word	LSB	2	

*Register offset relative to the data area

You can find more information in the MultiFieldbus Function Manual (<https://support.industry.siemens.com/cs/ww/en/view/109773209>).

The sum of the output data is 3 registers.

6.1.3 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
0	1 to 2	1 to 10	500	246	1440	1440
1	1 to 2	0	EtherNet/IP: 500	EtherNet/IP: 246	Download size ² : 1440	Download size ² : 1440
1	0	1 to 10	Modbus TCP: 500	Modbus TCP: 246		
			PROFINET: 1440	PROFINET: 1440		

6.1 Modbus TCP functions

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	1 to 10	EtherNet/IP: 500 Modbus TCP: 500 PROFINET: 1440	EtherNet/IP: 246 Modbus TCP: 246 PROFINET: 1440	1440	1440
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.

6.2 Diagnostics

6.2.1 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 overlapping events. (0 = off, 1 = flashing green, 2 = green, 3 = yellow, 4 = flashing red, 5 = red)

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

Table 6-2 Status and error displays of the RN/NS LED

LED	Meaning	Remedy
RN/NS (NET STATUS)		
 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 6-3 Status and error displays of the ER/MS LED

LED	Meaning	Remedy
ER/MS (MODUL STATUS)		
 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 6-4 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.
 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.

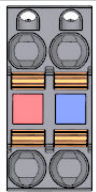
LEDs			Meaning	Notes
RN/NS (NET STATUS)	ER/MS (MODUL STATUS)	MT/IO (IO STATUS)		
 Flashes	 Flashes	 Off	At least one connection existed (Modbus TCP). A connection has been terminated by timeout.	- Reduce the cycle time for writing the output registers in the Modbus TCP controller to less than the time 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.
 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	LED test during startup: The three LEDs light up simultaneously in red for approx. 3.0 s, 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 is determined and stored retentively on the flash.	Do not disconnect the interface module from the supply voltage as long as the LEDs are lit continuously. This may take a few minutes.
 Flashes	 Flashes	 Flashes	Hardware or firmware defective.	You can read out the service data with STEP 7 V5.6.

Wiring

7.1 Pin assignment

24 V DC supply voltage (X80)

Table 7-1 Terminal assignment 24 V DC supply voltage

View	Signal name ¹⁾		Designation
Connector			
	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

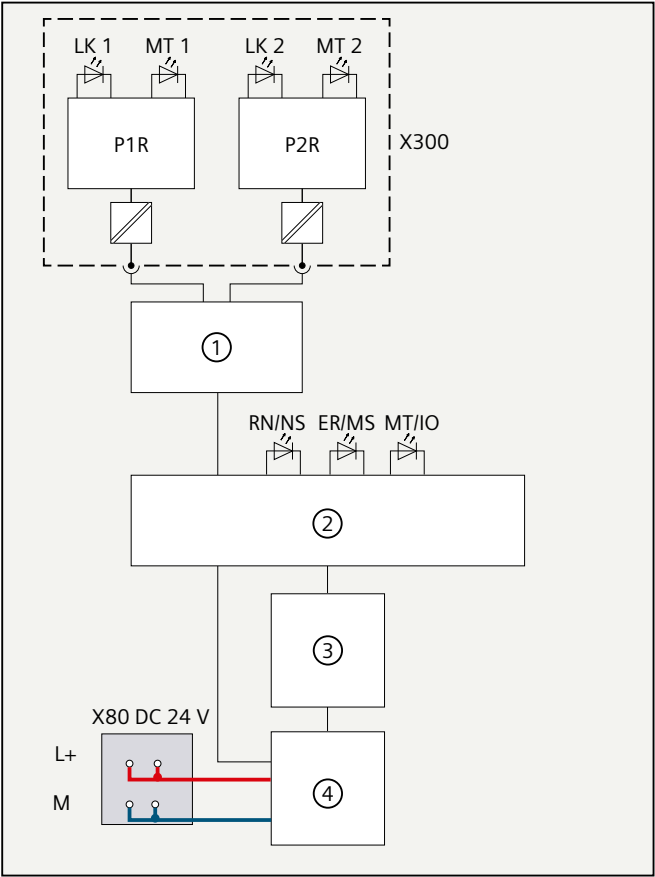
Additional information

You can find additional information on connecting the interface module and on accessories (selectable BusAdapters) in the system manual S7-1500, ET 200MP Automation system (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

Further information on connecting the BusAdapters can be found in the BusAdapter (<https://support.industry.siemens.com/cs/us/en/view/109751716>) Equipment Manual.

7.2 Block diagram

Schematic circuit diagram



①	Switch	L+	24 V DC supply voltage
②	ET 200MP 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 D-C	Supply voltage infeed	RN	RUN LED (green)
X300	BusAdapter (For BusAdapters with RJ45 interface, the shielding is connected to functional grounding)	ER	ERROR LED (red)
P1R	PROFINET interface X1 Port 1	MT	MAINTENANCE LED (yellow)
P2R	PROFINET interface X1 port 2		

Figure 7-1 Schematic circuit diagram of the IM 155-5 MF HF interface module

Parameter

8.1 Parameters

Table 8-1 Parameters for IM 155-5 MF HF interface module

Parameters	Value range	Default setting	Effective range
Connection to supply voltage L+	Connection/no connection	Connection	ET 200MP
Configuration control ¹	Disable/enable	Disable	ET 200MP
Type of fieldbus	- PROFINET - EtherNet/IP - Modbus TCP	PROFINET	ET 200MP
I/O data alignment ³	- Byte - Word - Flexible	Byte	ET 200MP
Connection hold time ²	0... 30,000 ms	5,000 ms	ET 200MP
Hold time after connection reset ²	0... 30,000 ms	0 ms	ET 200MP

¹ Only for PROFINET IO

² Only for Modbus TCP

³ Only for EtherNet/IP and Modbus TCP

8.2 Description of parameters

8.2.1 Connection to supply voltage L+

Parameter "Connection to supply voltage L+"

This parameter is used

- For diagnostics of the ET 200MP:

If the actual configuration is different from the preset configuration of the interface module supply voltage set with this parameter, the ET 200MP generates a diagnostic alarm.

- To check the power budget for the configuration with STEP 7 V13:

Depending on how the parameter is set, either the infeed power for the interface module into the backplane bus or the power consumption from the backplane bus is entered into the calculation of the power budget.

The default setting "Connection to supply voltage L+" means that the front of the interface module is supplied with 24 VDC and feeds power into the backplane bus.

NOTE

We recommend that you always supply the front of the interface module with 24 VDC because if you then insert a power supply module (PS) **upstream** of the interface module, both the power of the power supply module (PS) and the power of the integrated power supply of the interface module are available for the I/O modules (power addition of PS infeed power + IM infeed power in power segment 1).

In this case, you do not have to change the default setting of the parameter in STEP 7.

The setting "No connection to supply voltage L+" means that the interface module is not supplied with 24 VDC on the front. This can only be the case when a power supply module (PS) is inserted upstream from the interface module and supplies the interface module and the downstream modules. In the case of an interface module without power supply, its power consumption from the backplane bus must be considered as consumer in the power budget and the power segments must be formed accordingly.

Reference

See the section on the power budget and the forming of power segments in the system manual S7-1500, ET 200MP Automation system

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

Requirement

In order to generate diagnostics, the IM 155-5 MF HF interface module parameters must have been assigned once.

See also

[Diagnostic alarms \(Page 42\)](#)

8.2.2 Configuration control (option handling)

"Configuration control" parameter

You can use this parameter to enable the configuration control function in the ET 200MP Distributed I/O System.

NOTE

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

Reference

You can find more information on the control data record in chapter Configuration control (option handling) [\(Page 82\)](#) and in the STEP 7 online help.

8.2.3 Type of fieldbus

Type of fieldbus

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

- PROFINET
- EtherNet/IP
- Modbus TCP

8.2.4 I/O data alignment

I/O data alignment

For information on the "I/O data alignment" parameter, refer to the "MultiFieldbus (<https://support.industry.siemens.com/cs/us/en/view/109773209>)" Function Manual.

8.2.5 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.

8.2.6 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.

8.3 Configuration control (option handling)

8.3.1 Configuration control and control data record

Operating principle

You can use the configuration control to operate different real configurations (options) with a single configuration of the ET 200MP distributed I/O system. This is made possible by a configurable assignment of configured station modules to actually existing ones.

We distinguish between the following procedures:

- Configuring configuration control without empty slots (option handling)
- Expanding configuration (step-by-step commissioning)

Requirements

Configuration control can only be used with PROFINET.

Enable the "Configuration control" parameter during configuration for this function. Control takes place with control data record 196 to specify the required configuration.

Configuration control is not ready for operation without control data record:

- All I/O modules of the ET 200MP distributed I/O system fail (substitute value behavior, if configured).
- The interface module continues to exchange data.

Rules: Arrangement of the modules

The following table shows the slot number assignment:

Table 8-2 Assignment of slot numbers

Slot	Modules	Note
0	Power supply module for U-connector setup	Before the interface module
0	Active backplane bus	-
1	Interface module	Interface module (slot 1) is not an element of the configuration control, but rather controls this
2 - 31	I/O modules / max. 2 power supply modules with U-connector setup; max. 3 power supply modules with active backplane bus	After the interface module

Control data record

A control data record 196 is defined for the configuration control that receives a slot assignment.

Table 8-3 Control data record

Byte	Element	Code	Explanation
0	Block length	4 + number of slots	Header
1	Block ID	196	
2	Version	3	
3	Version	0	
4	Assignment of configured slot 0	Real slot 0	Control element Describes in each element which real slot in the device is assigned to the configured slot.
5	Assignment of configured slot 2	Real slot 2	
:	:	:	
4 + (max. slot - 1)	Assignment of configured maximum slot	Real maximum slot	

Control element

Each element must include the following information about the slot:

- Assignment of configured slot $\Leftrightarrow$ real slot

Table 8-4 Code of control element

Byte	Bit	Meaning
Assignment of configured slot (e.g. in byte 5)	0 to 7	01111111: Module not available 00000000 up to maximum slot: Real slot

Special features

Special features you have to observe:

- Configuration control is controlled by the interface module (slot 1/submodule 1). To address the available data records:
 - In STEP 7 V5.5: use the diagnostic address of the interface module.
You can find it in the properties **header** of the interface module in the hardware configuration.
 - In STEP 7 (TIA Portal): use the HW ID of the interface module.
You can find it in the **PLC tags > Default tag table > System constants**. The default name is "IM155-5MF[Head]". Use the associated "value" for addressing.

You can find general information on writing a data record, for example, in the STEP 7 online help.

- The control data record is saved retentively in the interface module, so that it is not necessary to write the control data record 196 again at a restart if the configuration is unchanged.
- Slot entries outside the configured preset configuration are ignored.
- The control data record can be shortened. It must contain the entries up to the last slot of the current preset configuration.
- Each real slot may only exist once in the data record.
- A real slot may only be assigned to one configured slot.
- Power supply (PS) modules can also be subject to configuration control. Make sure to observe the information on maximum configuration [\(Page 15\)](#) and the "Power budget calculation" section in the S7-1500/ET 200MP Automation system System Manual. Particularly for a power supply (PS) module on slot 0, we recommend that you avoid reconfiguration.

NOTE

Modified configuration

When you write a control data record with modified configuration, there is a station failure followed by a restart of the station with the modified configuration.

Combination of configuration control and Shared Device

The configuration control function in a Shared Device is therefore only for the modules of the IO controller that has subscribed to the interface module.

Modules that are assigned to another IO controller or not assigned at all cannot be specified as real slots (Shared Device on module level). A one-to-one assignment is implicitly assumed for the modules. When using the active backplane bus, a configured empty slot behaves in the same way as a module that is not assigned to an IO controller.

If a module intended for configuration control is subscribed by additional controllers (Shared Device on submodule level), only a one-to-one assignment is permitted for this module. Such a module cannot be deselected by the control data record (0x7F code for this slot in the control data record). This means the combination of "Configuration control" and "Shared Device on submodule level" is possible to a limited extent.

Error messages

The following error messages are returned if an error occurs during writing of the control data record:

Table 8-5 Error messages

Error code	Meaning
0x80B1	Invalid length
0x80B5	Configuration control not configured
0x80B6	Data record does not originate from the IO controller which subscribed to the interface module
0x80B8	Parameter error

A parameter error may be caused by:

- Incorrect block ID in the header (not equal to 196)
- Invalid version identification in the header
- A reserve bit was set
- A configured slot was assigned to an invalid real slot (see section **Combination of configuration control and Shared Device**)
- Several configured slots refer to the same real slot
- With Shared Device on submodule level: Violation of defined restrictions (see section **Combination of configuration control and Shared Device**)

See also

ET 200MP system manual (<https://support.industry.siemens.com/cs/ww/en/view/59191792>)

8.3.2 Feedback data record

Feedback data record

The feedback data record provides information on the accuracy of the module assignment and gives you the chance to detect assignment errors in the control data record. The feedback data record is mapped by a separate data record 197.

The feedback data record exists only when configuration control is configured and always refers to the maximum quantity framework **without interface module**, i.e., 31 slots.

The following applies here:

- The power supply module (PS) is plugged into "Slot 0" **before** the interface module or the active backplane bus is used
- Starting from "Slot 2", a maximum of 30 modules follow **after** the interface module.

8.3 Configuration control (option handling)

Partial reading of the feedback data record is possible.

Table 8-6 Feedback data record

Byte	Element	Code	Meaning
0	Block length	66	Header
1	Block ID	197	
2	Version	2	
3		0	
4	Slot 0 status	0/1	Bit 0 = 1: - Configured module is inserted - Slot is marked as not available in the control data record Bit 0 = 0: - Module pulled - Wrong module inserted* Bits 1 to 15: Reserved
5	Reserved	0	
6	Slot 2 status	0/1	
7	Reserved	0	
8	Slot 3 status	0/1	
9	Reserved	0	
:	:	:	
64	Slot n status	Maximum slot	
65	Reserved	0	

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

NOTE

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

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

Error messages

The following error messages are returned if an error occurs during reading of the feedback data record:

Table 8-7 Error messages

Error code	Meaning
80B1 _H	Invalid length
80B5 _H	Configuration control not configured
80B8 _H	Parameter error

8.3.3 Configure configuration control without empty slots

Operating principle

The modules actually not required do not exist. The configuration is pushed together to the left in the direction of IM 155-5 MF HF.

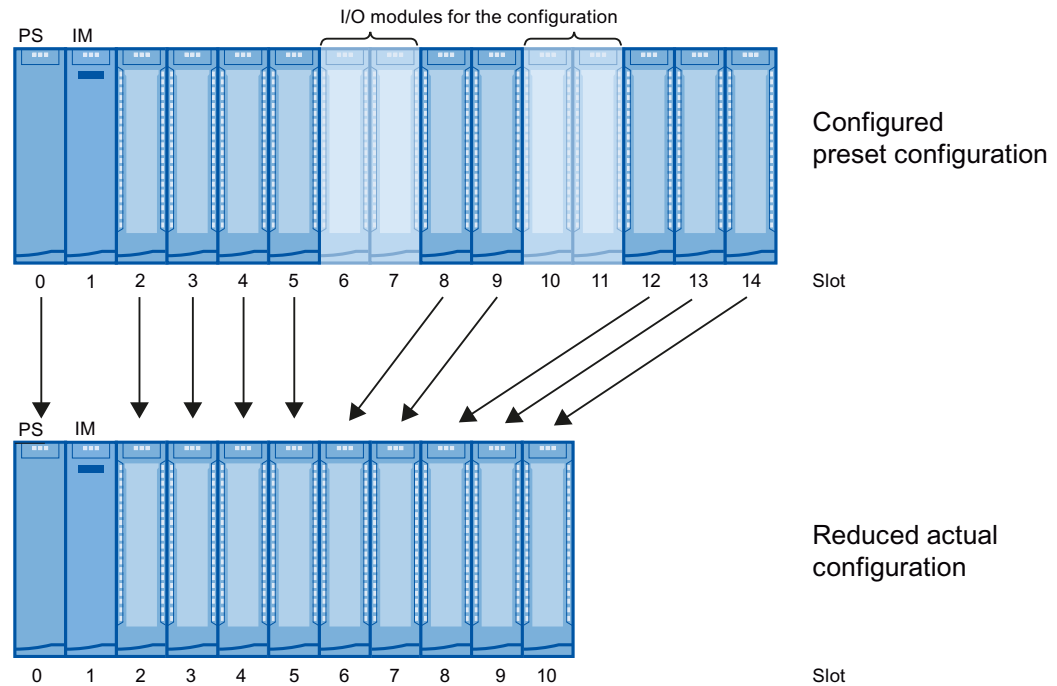


Figure 8-1 Configure configuration control without empty slots

Data record of the example

The following table shows the structure of the control data record for the above example.

Table 8-8 Data record for example "Configure configuration control without empty slots"

Byte	Element	Code	Explanation
0	Block length	18	Header
1	Block ID	196	
2	Version	3	
3	Version	0	
4	Slot 0	00000000 _B	The configured slot 0 is the real slot 0.
5	Slot 2	00000010 _B	The configured slot 2 is the real slot 2.
6	Slot 3	00000011 _B	The configured slot 3 is the real slot 3.
7	Slot 4	00000100 _B	The configured slot 4 is the real slot 4.
8	Slot 5	00000101 _B	The configured slot 5 is the real slot 5.
9	Slot 6	01111111 _B	The configured slot 6 does not exist.
10	Slot 7	01111111 _B	The configured slot 7 does not exist.

8.3 Configuration control (option handling)

Byte	Element	Code	Explanation
11	Slot 8	00000110 _B	The configured slot 8 is the real slot 6.
12	Slot 9	00000111 _B	The configured slot 9 is the real slot 7.
13	Slot 10	01111111 _B	The configured slot 10 does not exist.
14	Slot 11	01111111 _B	The configured slot 11 does not exist.
15	Slot 12	00001000 _B	The configured slot 12 is the real slot 8.
16	Slot 13	00001001 _B	The configured slot 13 is the real slot 9.
17	Slot 14	00001010 _B	The configured slot 14 is the real slot 10.

8.3.4 Extending the configuration

Operating principle

You can add modules at the end of the configuration with this procedure. The configured configuration can also be extended from the center based on freely selectable slot assignment.

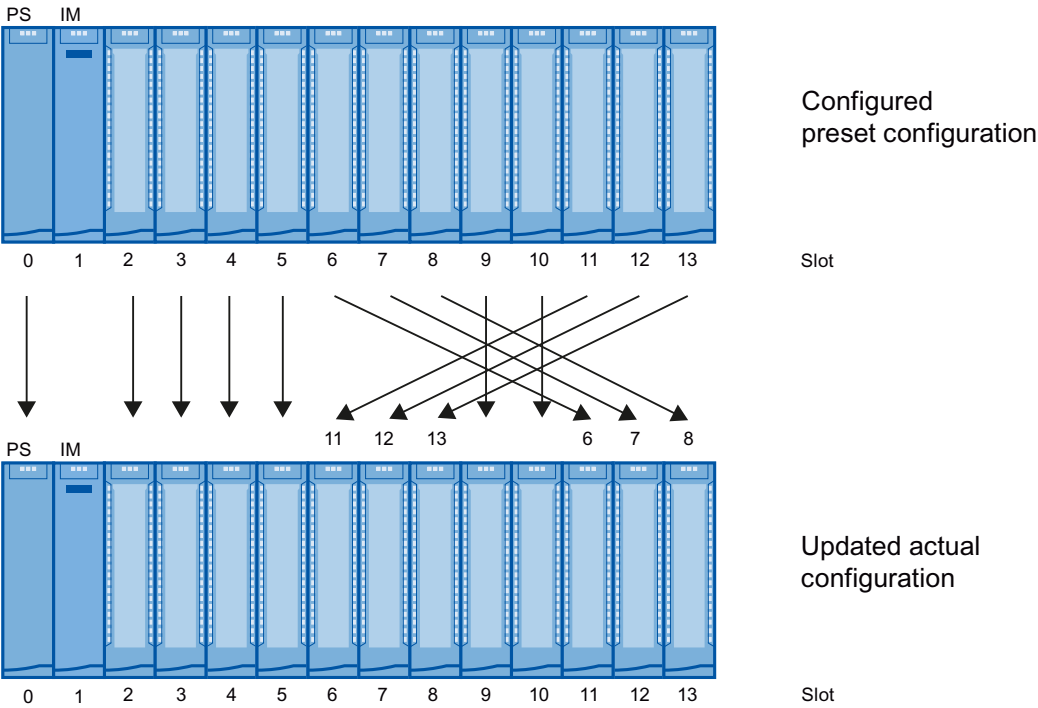


Figure 8-2 Extending the configuration

Data record of the example

The following table shows the structure of the control data record for the above example.

Table 8-9 Data record for example "Extending the configuration"

Byte	Element	Code	Explanation
0	Block length	17	Header
1	Block ID	196	
2	Version	3	
3	Version	0	
4	Slot 0	00000000 _B	The configured slot 0 is the real slot 0.
5	Slot 2	00000010 _B	The configured slot 2 is the real slot 2.
6	Slot 3	00000011 _B	The configured slot 3 is the real slot 3.
7	Slot 4	00000100 _B	The configured slot 4 is the real slot 4.
8	Slot 5	00000101 _B	The configured slot 5 is the real slot 5.
9	Slot 6	00001011 _B	The configured slot 6 is the real slot 11.
10	Slot 7	00001100 _B	The configured slot 7 is the real slot 12.
11	Slot 8	00001101 _B	The configured slot 8 is the real slot 13.
12	Slot 9	00001001 _B	The configured slot 9 is the real slot 9.
13	Slot 10	00001010 _B	The configured slot 10 is the real slot 10.
14	Slot 11	00000110 _B	The configured slot 11 is the real slot 6.
15	Slot 12	00000111 _B	The configured slot 12 is the real slot 7.
16	Slot 13	00001000 _B	The configured slot 13 is the real slot 8.

8.3.5 Combining configurations

Operating principle

You can combine the different procedures with configuration control.

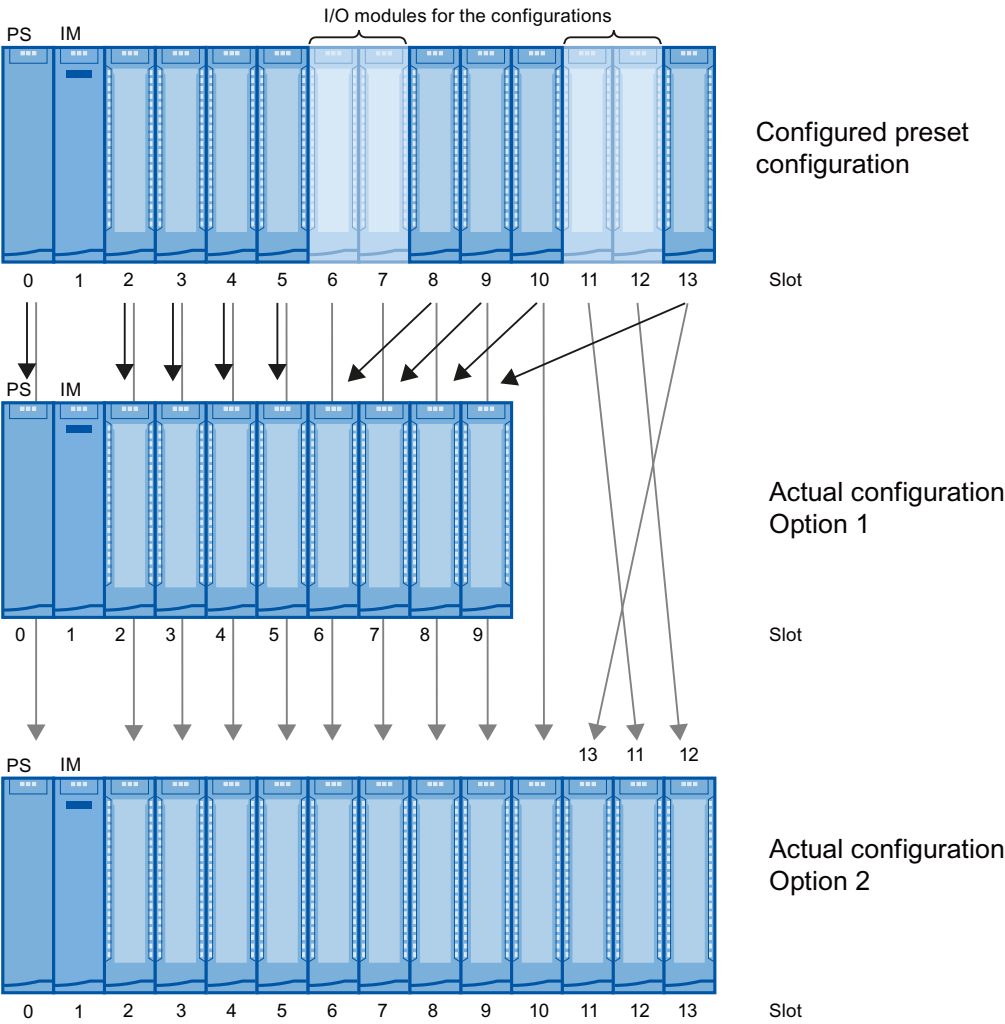


Figure 8-3 Combining configurations

Data record of the example

The following table shows the structure of the control data record for the above example.

Table 8-10 Data record for example "Combining configurations"

Byte	Element	Code configura- tion 1	Code configura- tion 2	Explanation
0	Block length	17		Header
1	Block ID	196		
2	Version	3		
3	Version	0		
4	Slot 0	00000000 _B	00000000 _B	The configured slot 0 is the real slot 0.
5	Slot 2	00000010 _B	00000010 _B	The configured slot 2 is the real slot 2.
6	Slot 3	00000011 _B	00000011 _B	The configured slot 3 is the real slot 3.
7	Slot 4	00000100 _B	00000100 _B	The configured slot 4 is the real slot 4.
8	Slot 5	00000101 _B	00000101 _B	The configured slot 5 is the real slot 5.
9	Slot 6	01111111 _B	00000110 _B	The configured slot 6 does not exist (configuration 1). The configured slot 6 is the real slot 6 (configuration 2).
10	Slot 7	01111111 _B	00000111 _B	The configured slot 7 does not exist (configuration 1). The configured slot 7 is the real slot 7 (configuration 2).
11	Slot 8	00000110 _B	00001000 _B	The configured slot 8 is the real slot 6 (configuration 1). The configured slot 8 is the real slot 8 (configuration 2).
12	Slot 9	00000111 _B	00001001 _B	The configured slot 9 is the real slot 7 (configuration 1). The configured slot 9 is the real slot 9 (configuration 2).
13	Slot 10	00001000 _B	00001010 _B	The configured slot 10 is the real slot 8 (configuration 1). The configured slot 10 is the real slot 10 (configuration 2).
14	Slot 11	01111111 _B	00001100 _B	The configured slot 11 does not exist (configuration 1). The configured slot 11 is the real slot 12 (configuration 2).
15	Slot 12	01111111 _B	00001101 _B	The configured slot 12 does not exist (configuration 1). The configured slot 12 is the real slot 13 (configuration 2).
16	Slot 13	00001001 _B	00001011 _B	The configured slot 13 is the real slot 9 (configuration 1). The configured slot 13 is the real slot 11 (configuration 2).

Strain relief

9.1 Product overview

Article number

6ES7590-5DA00-0AA0 (VPE: 5 strain relief units incl. screws)

View

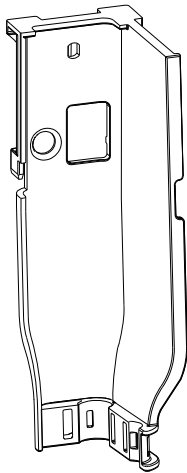


Figure 9-1 Strain relief

Properties

- The strain relief is a mechanical protective device for the electrical Industrial Ethernet/PROFINET cables on the BusAdapter
- The strain relief is suitable for all electrical Industrial Ethernet/PROFINET cables of the BusAdapter
- The strain relief is an optional accessory
- The cable ties are not included in the delivery. Use cable ties with a width of 4.8 mm. The maximum width is 7.0 mm. The length of the cable tie is min. 60 mm. When mounting for smaller cable cross-sections, use a maximum width of 3.6 mm.

9.2 Installing

Requirement

- The Industrial Ethernet/PROFINET cables are not inserted on the BusAdapter. The inserted Industrial Ethernet/PROFINET cables hamper the mounting of the strain relief.
- Mount the strain relief before connecting the BusAdapter.

Tools required

Screwdriver TX10 (torx).

Procedure

To install the strain relief, follow these steps:

1. Attach the strain relief to the interface module at the 4 mounting points in the front cover before screwing on the BusAdapter. Pull the strain relief down as far as it will go.

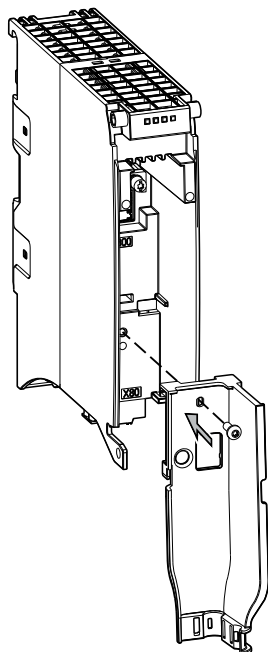


Figure 9-2 Strain relief before mounting

2. Fasten the strain relief (1 screw with 0.7 to 0.8 Nm tightening torque).
3. Plug the BusAdapter into the interface module.
4. Screw the BusAdapter to the interface module (1 screw with 0.25 Nm tightening torque).
5. Connect the Industrial Ethernet/PROFINET connection cable to the BusAdapter. You can find more information in the SIMATIC ET 200SP BusAdapter Equipment Manual (<https://support.industry.siemens.com/cs/us/en/view/109751716>).

6. Fasten each Industrial Ethernet/PROFINET cable individually to the strain relief with the cable ties.

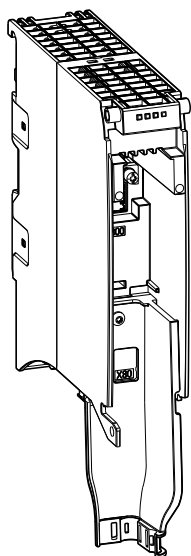


Figure 9-3 Strain relief installed

Operation and maintenance

10.1 Resetting interface module with MFCT to factory settings

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

You can find more information in the "Device resetting" section of the MultiFieldbus Configuration Tool (MFCT) Configuration Manual

(<https://support.industry.siemens.com/cs/us/en/view/109962951>).

10.2 Firmware update with MFCT

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

You can find more information in the "Firmware update" section of the MultiFieldbus Configuration Tool (MFCT) Configuration Manual

(<https://support.industry.siemens.com/cs/us/en/view/109962951>).

Technical specifications

Technical specifications of the IM 155-5 MF HF

The following table shows the technical specifications as of 11/2025. You will find a data sheet including daily updated technical specifications on the Internet

(<https://support.industry.siemens.com/cs/us/en/pv/6ES7155-5MU00-0CN0/td?dl=en>).

Article number	6ES7155-5MU00-0CN0
General information	
Product type designation	IM 155-5 MF HF
HW functional status	from FS01
Firmware version	V5.3.1
FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	0312H
Manufacturer ID according to ODVA (VendorID)	0x04E3
Device ID according to ODVA (Product code)	0x0FA3
Product function	
I&M data	Yes; I&M0 to I&M4
Module swapping during operation (hot swapping)	Yes; In combination with active backplane bus
Isochronous mode	Yes
IRT	Yes
Tool changer	Yes; Docking station
Local coupling, IO data	Yes
– Number of coupling modules	6; 1x MSO local output + max. 5x MSO local input
Engineering with	
STEP 7 configurable/integrated from version	use GSD file
PROFINET from GSD version/GSD revision	GSDML V2.45
Configuration control	
via dataset	Yes
CiR - Configuration in RUN	
Reparameterization possible in RUN	Yes
reconfiguration possible in RUN	Yes; add IO device only
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V

Article number	6ES7155-5MU00-0CN0
Reverse polarity protection	Yes
Short-circuit protection	Yes
Mains buffering	
Mains/voltage failure stored energy time	10 ms
Input current	
Current consumption (rated value)	0.16 A; at 24 V DC and without load
Current consumption, max.	1.2 A
Inrush current, max.	13 A
I^2t	0.1 A ² ·s
Power	
Infeed power to the backplane bus	16 W
Power consumption from the backplane bus	3.4 W; in case of operation with separate system power supply to the left of IM
Power loss	
Power loss, typ.	4.3 W
Address area	
Address space per module	
Address space per module, max.	256 byte; For input and output data respectively
Address space per station	
Address space per station, max.	1 440 byte; For input and output data respectively
Hardware configuration	
Integrated power supply	Yes; 16 W
System power supply can be plugged in to left of IM	Yes; only with design with U-connectors
Number of permissible power segments	3; incl. interface module
Rack	
Modules per rack, max.	30; I/O modules
Submodules	
Number of submodules per station, max.	256; 9 per I/O module
Interfaces	
Number of PROFINET interfaces	1; 2 ports (switch)
1. Interface	
Interface types	
RJ 45 (Ethernet)	Yes; with BusAdapter
Number of ports	2; with BusAdapter
integrated switch	Yes
BusAdapter (PROFINET)	Yes; BA 2x RJ45, BA 2x FC, BA 2x M12
Protocols	
PROFINET IO Device	Yes
Open IE communication	Yes
Media redundancy	Yes; PROFINET MRP client / HRP client

Article number	6ES7155-5MU00-0CN0
PROFINET IO Device	
Services	
– IRT	Yes; 250 µs to 4 ms in 125 µs frame
– PROFINET energy	No
– Prioritized startup	No
– Shared device	Yes
– Number of IO Controllers with shared device, max.	4; for multi-fieldbus mixed operation: 2x PN controller + 2x EtherNet/IP scanner + 10x Modbus TCP master
Interface types	
RJ 45 (Ethernet)	
• Transmission procedure	PROFINET with 100 Mbit/s full duplex (100BASE-TX)
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
Protocols	
Supports protocol for PROFINET IO	Yes
PROFIsafe	Yes
PROFIBUS	No
EtherNet/IP	Yes
Modbus TCP	Yes
Redundancy mode	
• PROFINET system redundancy (S2)	Yes; NAP S2
– on S7-1500R/H	Yes
– on S7-400H	Yes; use GSD file
• PROFINET system redundancy (R1)	No
• H-Sync forwarding	Yes
Media redundancy	
– MRP	Yes
– MRPD	Yes
EtherNet/IP	
Services	
– CIP Implicit Messaging	Yes
– CIP Explicit Messaging	Yes
– CIP Safety	No
– Configuration control via Explicit Messaging	No
– Shared device	Yes; for multi-fieldbus mixed operation: 2x PN controller + 2x EtherNet/IP scanner + 10x Modbus TCP master

Article number	6ES7155-5MU00-0CN0
Number of scanners with shared device, max.	2
Updating times	
Requested Packet Interval (RPI)	2 ms
Address area	
Address space per module, max.	256 byte; 246 byte outputs / 256 byte inputs
ForwardOpen (Class1 & 32 bit Header)	500 byte; (246 byte outputs / 500 byte inputs)
LargeForwardOpen (Class3)	4 002 byte
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 device	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

Article number	6ES7155-5MU00-0CNO
Isochronous mode	
Equidistance	Yes
shortest clock pulse	250 µs
max. cycle	4 ms
Bus cycle time (TDP), min.	250 µs
Jitter, max.	1 µs
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow 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 LEDs on BusAdapter
Potential separation	
between backplane bus and electronics	No
between PROFINET and all other circuits	Yes; 1500 V AC (type test)
between supply and all other circuits	No
Permissible potential difference	
between different circuits	Safety extra low voltage SELV
Isolation	
Isolation tested with	707 V DC (type test)
Standards, approvals, certificates	
Network loading class	3
product functions / security / header	
PROFINET Security Class	1
signed firmware update	Yes
Secure Boot	Yes
safely removing data	Yes
data integrity	Yes
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C
• vertical installation, max.	40 °C

Article number	6ES7155-5MU00-0CN0
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	
ET-Connection via BU/BA Send	No
Mechanics/material	
Strain relief	Yes; Optional
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	260 g; without BusAdapter

Dimension drawing

The dimension drawing of the module on the mounting rail, as well as a dimension drawing with open front panel, are provided in the appendix. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

Dimension drawings of the IM 155-5 MF HF interface module

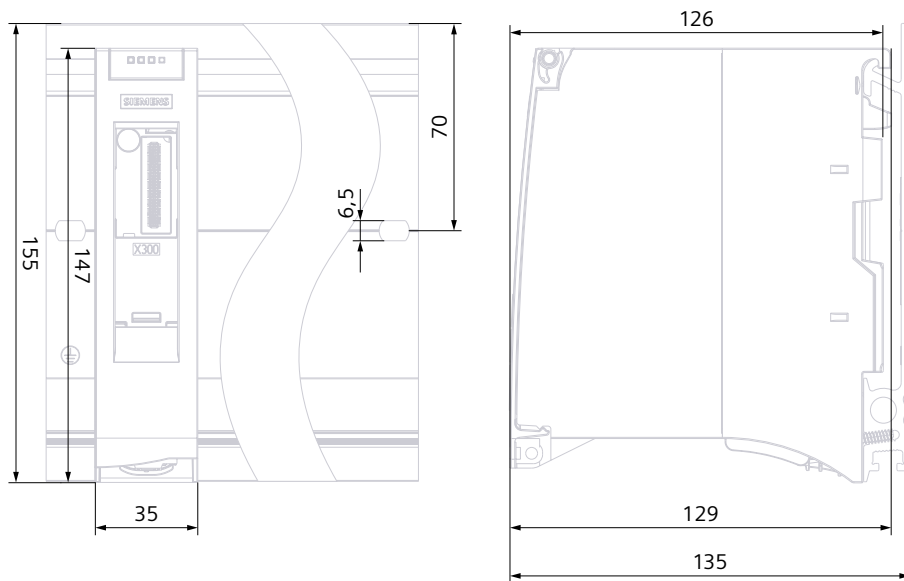


Figure A-1 Dimension drawing of the IM 155-5 MF HF interface module, front and side views

Dimension drawing of the IM 155-5 MF HF interface module, side view with open front cover

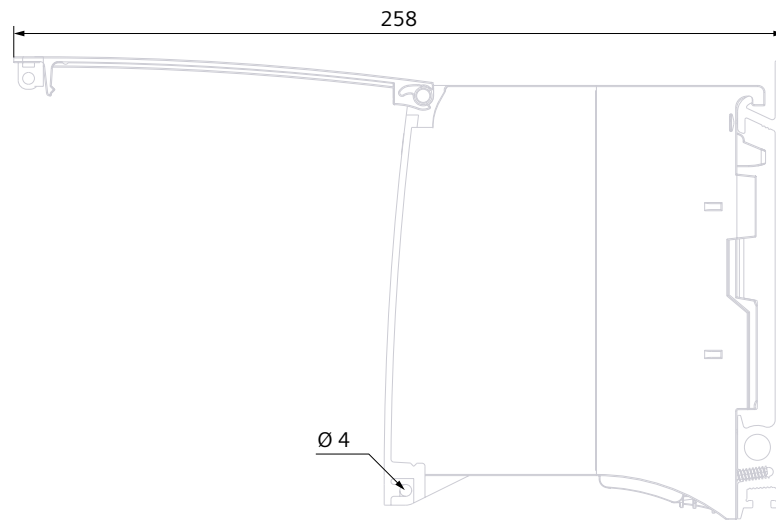


Figure A-2 Dimension drawing of the IM 155-5 MF HF interface module, side view with open front flap

A.1 Dimension drawing

The figure below shows the dimension drawing of the strain relief.

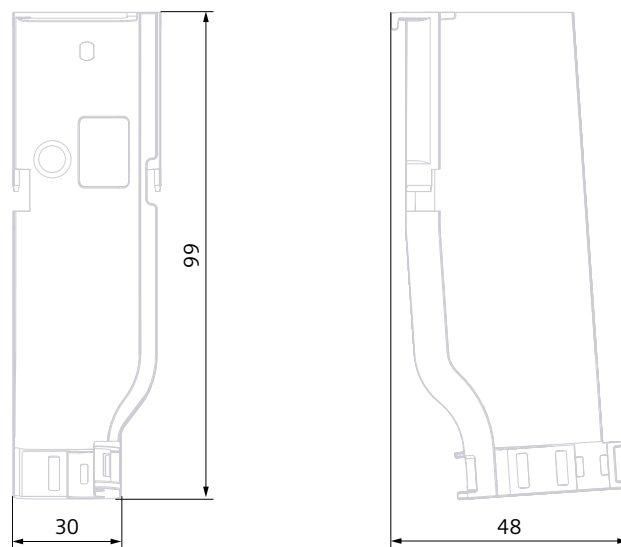


Figure A-3 Dimension drawing of the strain relief, front and side view

A.2 Dimensional drawing with strain relief

The following figure shows the dimensional drawing of the module with mounted strain relief.

Dimensional drawings of interface module IM 155-5 MF HF with strain relief



Figure A-4 Dimensional drawings of interface module IM 155-5 MF HF with strain relief

Response times

B.1 Response times of the ET 200MP

Introduction

The response time of the IM 155-5 MF HF is made up of:

- The update time configured for the IM as IO device.

plus

- The backplane bus cycle time.

NOTE

Validity of the formula

The following formula does not apply to Shared Device mode.

Backplane bus cycle time

The backplane bus cycle time is the time the interface module requires to output new output data, read new input data and then copy them to the PROFINET send buffer.

The backplane bus cycle time in μs is made up as follows:

- $(\text{Number of output data in bytes} + \text{number of output addresses}) \times 0.0668 + 1.6131$
(rounded up)

plus

- $(\text{Number of input data in bytes} + \text{number of input addresses}) \times 0.0959 + 2.5901$ (rounded up)

plus

- Operating system processing time (500 μs).

Example configuration for the calculation of the backplane bus cycle time

The following are used in the example:

Table B-1 Example configuration for the calculation of the backplane bus cycle time

I/O module	Output data in bytes	Input data in bytes	Number of output addresses	Number of input addresses
Analog output module AQ 4xU/I ST	8	-	1	-
Analog output module AQ 4xU/I ST with value status	8	1	1	1
Digital output module DQ 32x24VDC/0.5A ST with value status	4	4	1	1
Digital input module DI 32x24VDC HF	-	4	-	1
Analog input module AI 8xU/I/RTD/TC ST	-	16	-	1
Sum	20	25	3	4

Example calculation of the backplane bus cycle time

Backplane bus cycle time in μs :

- $(20 + 3) \times 0.0668 + 1.6131 = 3.1495 \approx 4 \mu\text{s}$ (rounded up)

plus

- $(25 + 4) \times 0.0959 + 2.5901 = 5.3712 \approx 6 \mu\text{s}$ (rounded up)

plus

- Operating system processing time $500 \mu\text{s}$

Result of backplane bus cycle time

Backplane bus cycle time = $510 \mu\text{s}$

Calculating the response time

It is necessary to differentiate between two cases when calculating the response time of the IM 155-5 MF HF:

- Case 1: The configured update time is greater than/equal to the backplane bus cycle time.

Then:

Response time in μs = backplane bus cycle time + configured update time

- Case 2: The configured update time is less than the backplane bus cycle time.

Then:

Response time in μs = backplane bus cycle time + (configured update time $\times$ (backplane bus cycle time / configured update time)).

If the division of backplane bus cycle time / configured update time does not return an integer without remainder, an additional configured update time must be added next to the integer in the bracket.

Example calculation for case 1: The configured update time is greater than/equal to the backplane bus cycle time.

- Configured update time is, for example, 750 μs
- Backplane bus cycle time = 510 μs

Result of case 1

Response time of the IM 155-5 MF HF = 750 μs + 510 μs = **1260 μs**

Example calculation for case 2: The configured update time is less than the backplane bus cycle time.

- Configured update time is, for example, 500 μs
- Backplane bus cycle time = 510 μs

Result of case 2

Response time of the IM 155-5 MF HF = 510 μs + (500 μs x (510 μs / 500 μs) + 500 μs) = 510 μs + (500 μs x 1 + 500 μs) = 510 μs + 1000 μs = **1510 μs**

See also

Performance measurements

(<http://support.automation.siemens.com/WW/view/en/34677186/136000&cspltfm=0&cssw=0&csbinh=5>)