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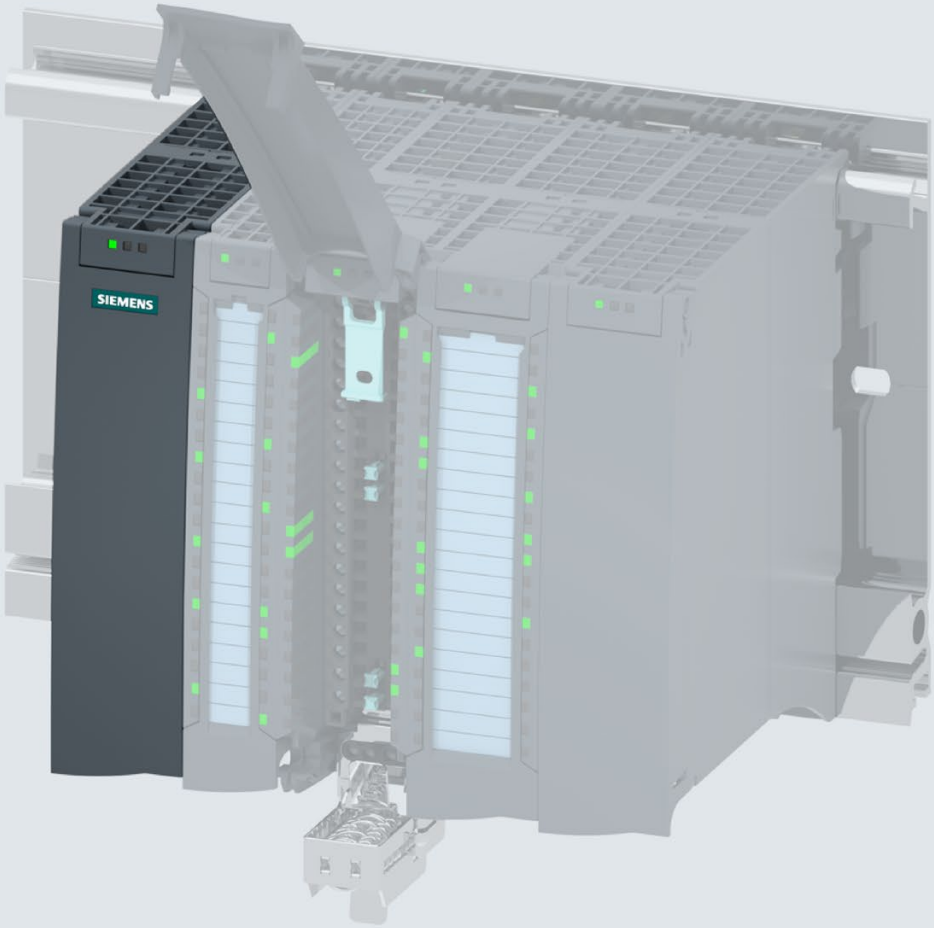


Manual

# SIMATIC

## ET 200MP

Interface module IM 155-5 PN HF
(6ES7155-5AA00-0AC0)

Edition 10/2018

support.industry.siemens.com

SIEMENS

# SIMATIC

# ET 200MP
# IM 155-5 PN HF Interface Module (6ES7155-5AA00-0AC0)

Manual




10/2018
A5E32840985-AB

# 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**

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

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# Preface

## 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.

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

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

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For additional information on industrial security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

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

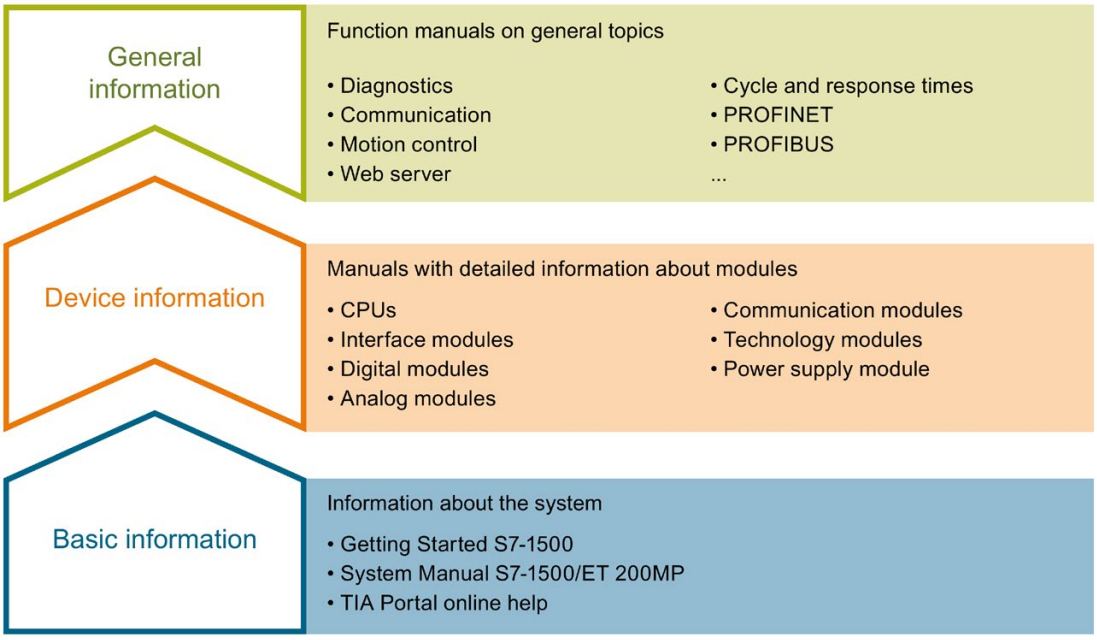
To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under (https://www.siemens.com/industrialsecurity).

# Table of contents

# Guide to documentation

# 1

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.




### Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. The STEP 7 online help supports you in the configuration and programming.

### Device information

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

#### General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC S7-1500 and ET 200MP systems, e.g. diagnostics, communication, motion control, Web server, OPC UA.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742691).

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

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

### 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).

### "mySupport"

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

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

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

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

### "mySupport" - Documentation

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

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

## "mySupport" - CAx data

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

You configure your own download package with a few clicks.

In doing so you can select:

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

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

## Application examples

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

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

## TIA Selection Tool

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

You can find the TIA Selection Tool on the Internet (http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool).

## SIMATIC Automation Tool

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

General function overview:

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

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

## PRONETA

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

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

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

## SINETPLAN

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

The advantages at a glance

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

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

# Product overview

2

## 2.1 Properties

### Order number

6ES7155-5AA00-0AC0

### View of the module

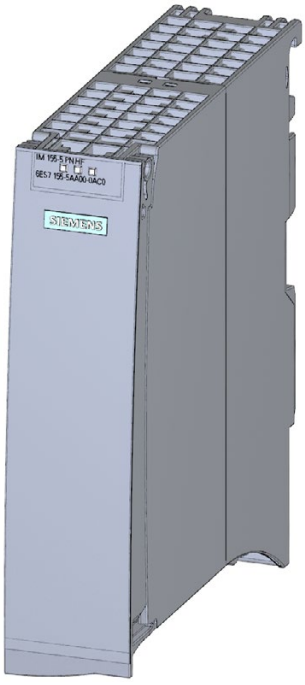


Figure 2-1 View of the IM 155-5 PN HF interface module

### Properties

- Technical properties
  - Connects the ET 200MP distributed I/O system with PROFINET IO
  - 24 VDC supply voltage (SELV/PELV)
  - PROFINET IO connection using RJ45 bus connector
- Supported functions (Page 14)

## Maximum configuration

- 512 bytes I/O data per station
- The integrated power supply of the interface module feeds 14 W into the backplane bus. Up to 12 I/O modules can be supplied with this. The exact number of operable modules is determined by the power budget (see relevant section in the system manual S7-1500, ET 200MP Automation system (https://support.industry.siemens.com/cs/ww/en/view/59191792)).
- 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).

# 2.2 Functions

## 2.2.1 PROFINET IO

### Introduction

The interface module supports the following PROFINET IO functions:

- Integrated switch with 2 ports
- Supported Ethernet services: ping, arp, SNMP, LLDP
- Port diagnostics
- Deactivating ports
- Isochronous real-time communication (IRT)
- Minimum update time 250 µs
- Prioritized startup
- Device replacement without PG
- Media redundancy (MRP)
- Media redundancy with planned duplication (MRPD)
- Shared Device with up to four IO controllers
- Module-internal Shared Input/Shared Output (MSI/MSO)
- Isochronous mode of process data
- Identification data I&M 0 to 3
- Firmware update via PROFINET IO
- Reset to factory settings via PROFINET IO
- Configuration control (option handling)
- System redundancy on S7-400H
- System redundancy S2
- IO devices changing during operation ("alternative partners")
  - Docking station

## Requirements

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

Table 2- 1 Requirements

| PROFINET IO function | Configuration software | | |
|---|---|---|---|
| | with GSD file[1] | | STEP 7 (TIA Portal) V13 or higher |
| | STEP 7 V5.5 SP3 or higher | STEP 7 (TIA Portal) V13 or higher | |
| Real-time communication | X | X | X |
| Isochronous real-time communication (IRT) | X | X | X |
| Prioritized startup | X | X | X |
| Device replacement without PG | X | X | X |
| Media redundancy (MRP) | X | X | X |
| Media redundancy with planned duplication (MRPD) | X | X | - |
| Shared Device<br>• with up to two IO controllers<br>• with up to four IO controllers | X<br>- | X[2]<br>X[2] | -<br>- |
| Isochronous mode | - | - | X |
| System redundancy on S7-400H | X | - | - |
| System redundancy S2 | X | - | As of V15.1 |
| IO devices changing during operation ("alternative partners")<br>• Docking station | As of V5.6 | As of V15.1 | As of V15.1 |

1) 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.

2) No validity check of Shared Device projects

## 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 additional information on configuration of synchronized PROFINET devices in sync domains in the STEP 7 online help and

- As of STEP 7 V12, 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

## Prioritized startup

Prioritized startup denotes the PROFINET functionality for accelerating the startup of IO devices operated in a PROFINET IO system with RT communication.

The function reduces the time that the correspondingly configured IO devices require to return to the cyclic user data exchange in the following cases:

- After the supply voltage has returned
- After a station has returned
- After activation of IO devices

---

**Note**

**Dependency of the startup time**

The startup time depends on the number and type of modules. You can optimize the startup time by

- Inserting no more than 12 I/O modules
- Inserting no power supply module.

---

The prioritized startup function with the requirements listed in the note above is not available for IRT communication and media redundancy.

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

- As of STEP 7 V12, 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

### Cabling with fixed connection setting

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

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

- As of STEP 7 V12, 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

### Device replacement without PG

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 system manual S7-1500, ET 200MP Automation system (https://support.industry.siemens.com/cs/ww/en/view/59191792)).

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

- As of STEP 7 V12, 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

### 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 additional information in the STEP 7 online help and

- As of STEP 7 V12, 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

### 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 additional information in the STEP 7 online help and

- As of STEP 7 V12, 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

### 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 additional information in the STEP 7 online help and

- As of STEP 7 V12, 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

### 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 make its output data available to 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.

The combination of isochronous mode and Shared Device is not supported.

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

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

### Isochronous mode of process data

The process data, transmission cycles via PROFINET IO, and the user program are synchronized to achieve maximum deterministics. The input data and output data of distributed I/O devices in the plant are detected and output simultaneously. The isochronous PROFINET IO cycle forms the clock generator for this.

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

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

### System redundancy S2

An IO device with S2 system redundancy supports redundant ARs.

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

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

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

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

### IO devices changing during operation ("alternative partners") - docking station

You can use the PROFINET functionality "IO devices changing during operation" ("alternative partners"), e.g. for tool change for robots. Typical tools include:

- Welding guns
- Positioning tools for manufacturing parts

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

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

## 2.2.2 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 25)
- On the Internet (http://support.automation.siemens.com/WW/view/en/29430270)
- In the STEP 7 online help.

## 2.2.3 System redundancy on S7-400H

### Interface to H-CPUs with system redundancy

When system redundancy is used, you can connect the IM 155-5 PN HF (6ES7155-5AA00-0AC0) 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 PN HF interface module:

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

Examples of system redundancy can be found in the manual Fault-tolerant systems S7-400H (http://support.automation.siemens.com/WW/view/en/60458386).

### Combination of system redundancy and Shared Device

The IM 155-5 PN HF interface module can be connected to up to four IO controllers but only to one H-CPU pair. As a result, a combination of system redundancy and Shared Device operation is not possible when redundancy operation is used exclusively.

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

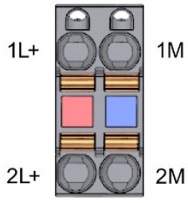
# Wiring

# 3

## 3.1 Pin assignment

### 24 VDC supply voltage

Table 3- 1 Pin assignment 24 VDC supply voltage

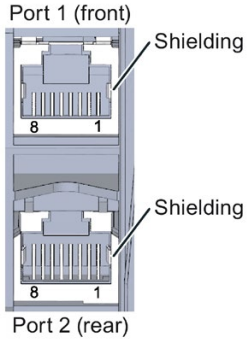
| View | Signal name[1] | Designation |
|---|---|---|
|  | 1L+ | 24 VDC |
| | 2L+ | 24 VDC (for looping through)[2] |
| | 1M | Ground |
| | 2M | Ground (for looping through)[2] |

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

[2] Maximum 10 A permitted

### PROFINET IO with RJ45

Table 3- 2 PROFINET IO pin assignment with RJ45

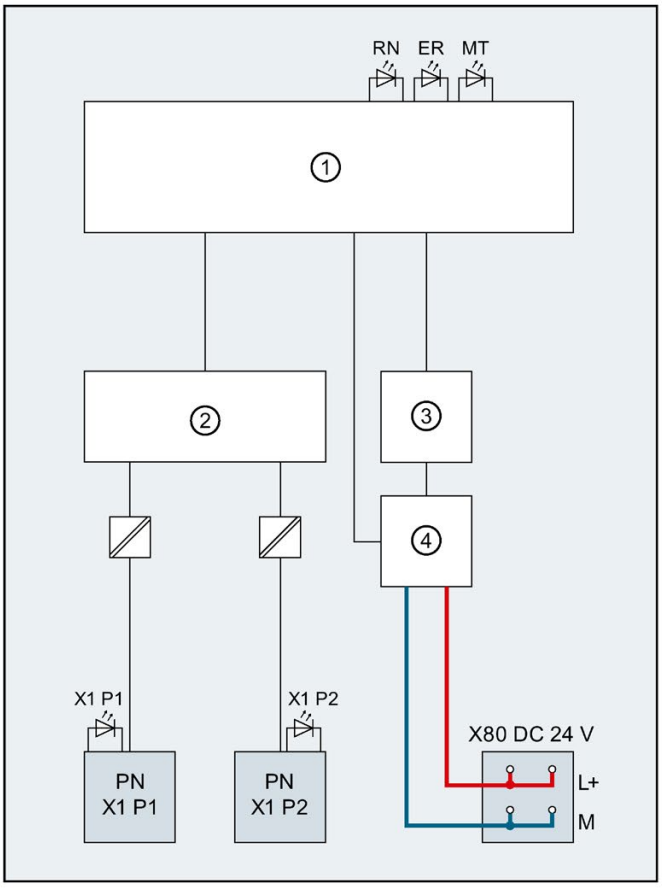
| Bottom view IM | Signal name | | Designation |
|---|---|---|---|
|  | 1 | TD | Transmit data + |
| | 2 | TD_N | Transmit data - |
| | 3 | RD | Receive data + |
| | 4 | GND | Ground |
| | 5 | GND | Ground |
| | 6 | RD_N | Receive data - |
| | 7 | GND | Ground |
| | 8 | GND | Ground |

### Additional information

You can find additional information on connecting the interface module and on accessories (RJ45 bus connector) in the system manual S7-1500, ET 200MP Automation system (https://support.industry.siemens.com/cs/ww/en/view/59191792).

# 3.2 Block diagram

## Block diagram




| | | | |
|---|---|---|---|
| ① | Electronics | L+ | 24 V DC supply voltage |
| ② | PROFINET 2-port switch | M | Ground |
| ③ | Backplane bus interface | RN | RUN LED (green) |
| ④ | Internal supply voltage | ER | ERROR LED (red) |
| X80 24 V DC | Infeed of supply voltage | MT | MAINT LED (yellow) |
| PN X1 P1 | PROFINET interface X1 port 1 | X1 P1, X1 P2 | Link TX/RX LED (green/yellow) |
| PN X1 P2 | PROFINET interface X1 port 2 | | |

Figure 3-1 Block diagram of the IM 155-5 PN HF interface module

# Parameter

# 4

## 4.1 Parameters

Table 4- 1 Parameters for IM 155-5 PN HF interface module

| Parameters | Value range | Default setting | Efficiency range |
|---|---|---|---|
| Connection to supply voltage L+ | Connection/No connection | Connection | ET 200MP |
| Configuration control | Disable/enable | Disable | ET 200MP |

## 4.2 Description of parameters

### 4.2.1 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 PN HF interface module parameters must have been assigned once.

### See also

Diagnostic alarms (Page 41)

## 4.2.2 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 25) and in the STEP 7 online help.

# 4.3 Configuration control (option handling)

## 4.3.1 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

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 4- 2 Assignment of slot numbers

| Slot | Modules | Note |
|---|---|---|
| 0 | Power supply module (optional) | Before the interface module |
| 1 | Interface module | Interface module (slot 1) is not an element of the configuration control, but rather controls this |
| 2 - 31 | I/O modules /<br>max. 2 power supply modules, depending on the configuration variant | After the interface module |

## Control data record

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

Table 4- 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<br>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 ⇔ real slot

Table 4- 4 Code of control element

| Byte | Bit | Meaning |
|---|---|---|
| Assignment of configured slot (e.g. in byte 5) | 0 to 7 | 01111111: Module not available<br>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 "IM155-5PN[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 12) and the section on the power budget in the system manual S7-1500, ET 200MP Automation system (https://support.industry.siemens.com/cs/ww/en/view/59191792). 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.

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 4- 5 Error messages

| Error code | Meaning |
|---|---|
| $80B1_H$ | Invalid length |
| $80B5_H$ | Configuration control not configured |
| $80B6_H$ | Data record does not originate from the IO controller which subscribed to the interface module |
| $80B8_H$ | 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**)

## 4.3.2 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 (PS) module is inserted in "Slot 0" **before** the interface module
- Starting from "Slot 2", a maximum of 30 modules follow **after** the interface module.

Partial reading of the feedback data record is possible.

Table 4- 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:<br>• Configured module is inserted<br>• Slot is marked as not available in the control data record<br>Bit 0 = 0:<br>• Module pulled<br>• Wrong module inserted*<br>Bits 1 to 15: Reserved |
| 5 | Reserved | 0 | |
| 6 | Slot 2 status | 0/1 | |
| 7 | 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 4- 7 Error messages

| Error code | Meaning |
|---|---|
| $80B1_H$ | Invalid length |
| $80B5_H$ | Configuration control not configured |
| $80B8_H$ | Parameter error |

## 4.3.3 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 PN HF.

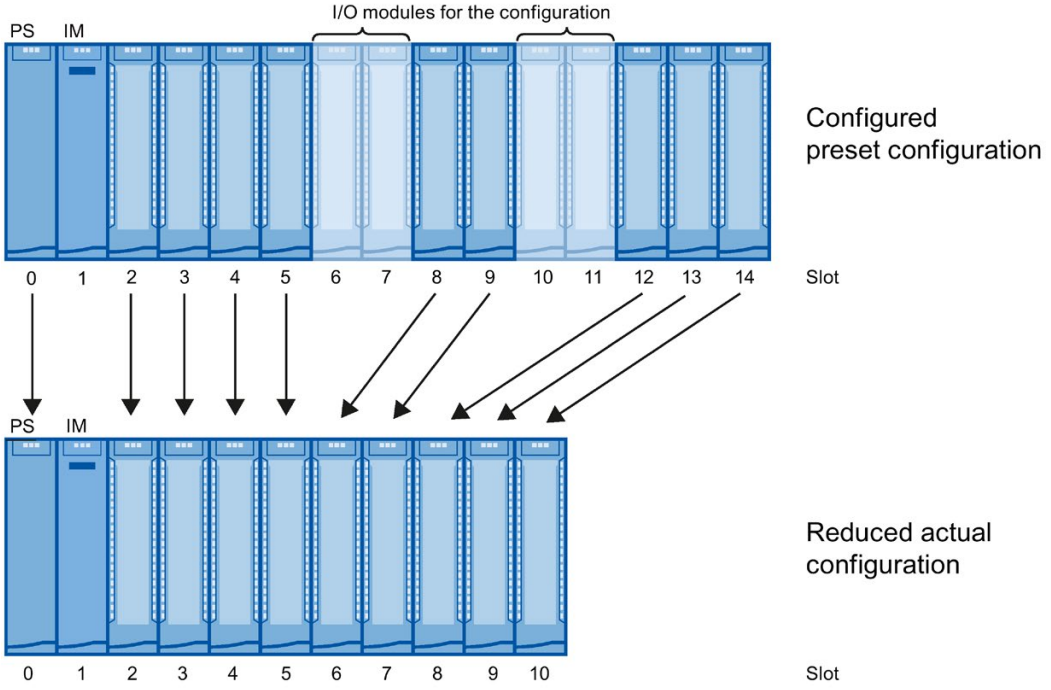



Figure 4-1 Configure configuration control without empty slots

## Data record of the example

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

Table 4- 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. |
| 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. |

## 4.3.4 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.

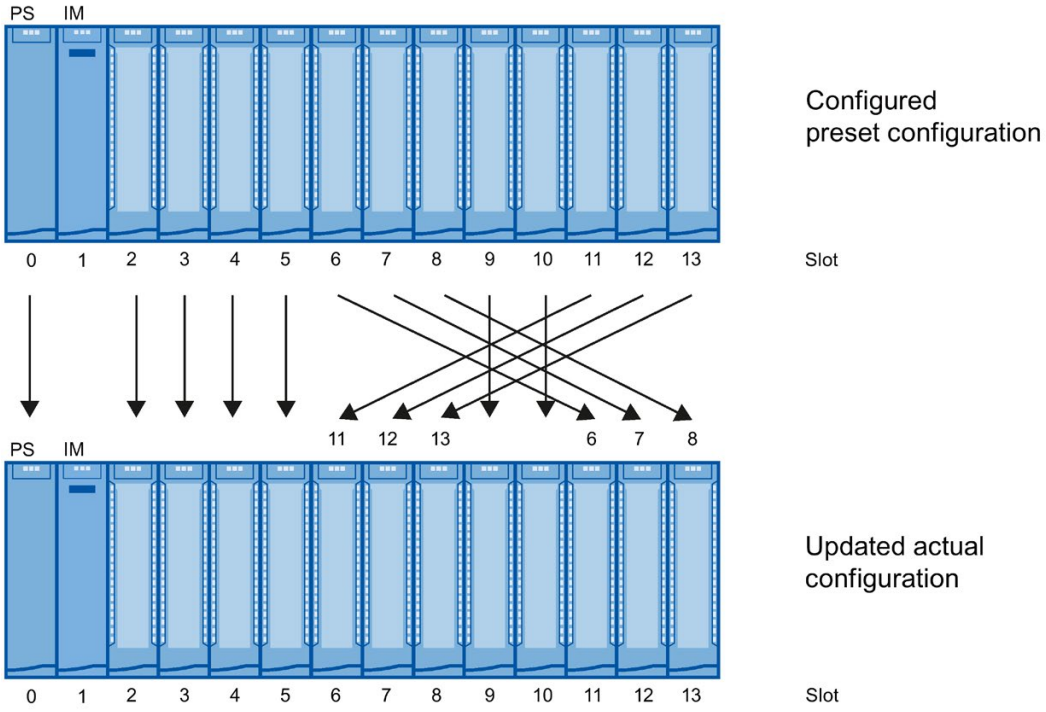



Figure 4-2 Extending the configuration

## Data record of the example

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

Table 4- 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. |

## 4.3.5 Combining configurations

### Operating principle

You can combine the different procedures with configuration control.

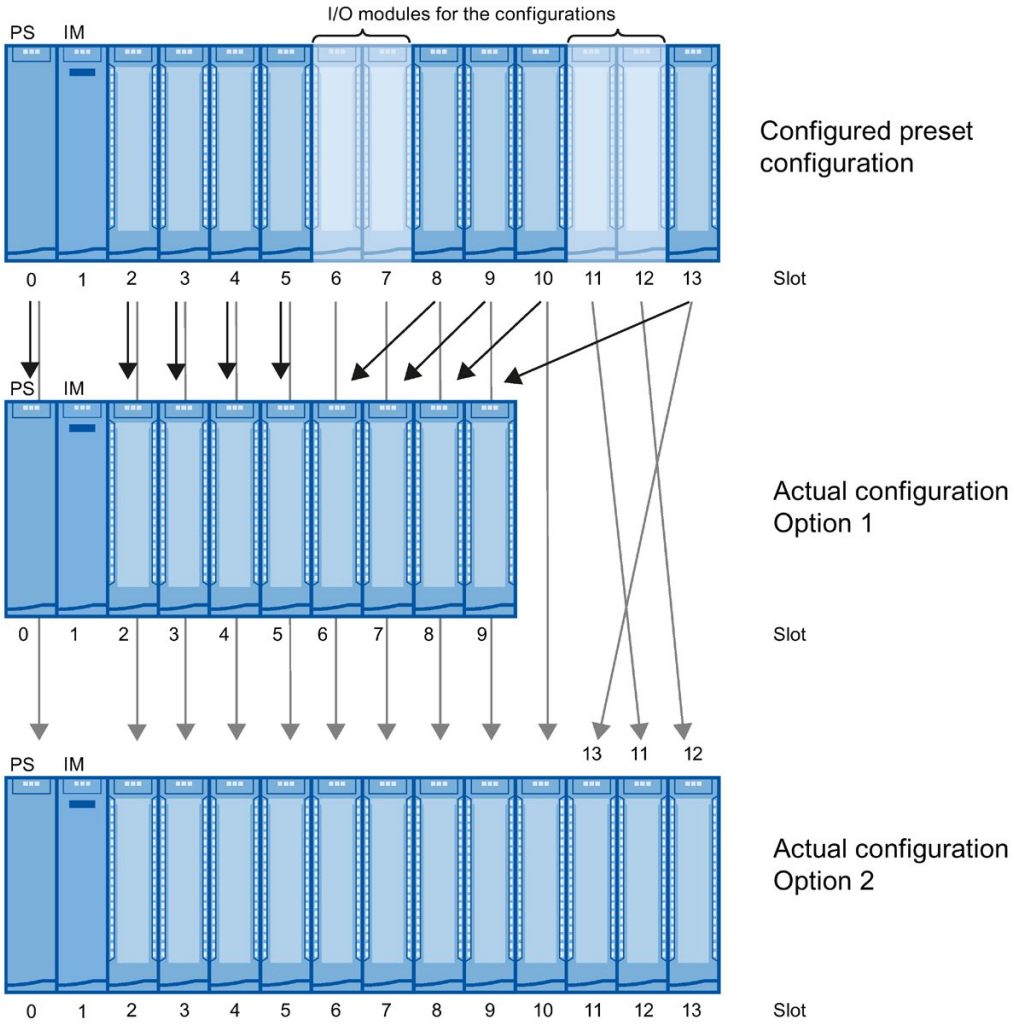



Figure 4-3 Combining configurations

## Data record of the example

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

Table 4- 10 Data record for example "Combining configurations"

| Byte | Element | Code configuration 1 | Code configuration 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).<br>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).<br>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).<br>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).<br>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).<br>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).<br>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).<br>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).<br>The configured slot 13 is the real slot 11 (configuration 2). |

# Interrupts and diagnostic, error, and system alarms 5

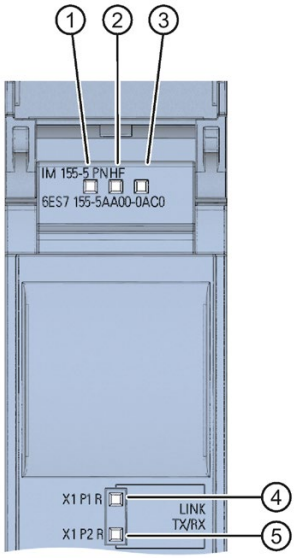
## 5.1 Status and error displays

### 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 PN HF interface module.




① RUN (green)
② ERROR (red)
③ MAINT (yellow)
④ P1 LINK/TX/RX (green/yellow)
⑤ P2 LINK/TX/RX (green/yellow)

Figure 5-1 LED display on the interface module

## Meaning of the LEDs RUN/ ERROR/ MAINT

Table 5- 1 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. |
| On | On | On | Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s. | --- |
| 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 47) |
| | | | 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 42) |
| Flashes | Flashes | Flashes | "Node flash test" is being performed. (The LEDs P1 and P2 of the PROFINET interface are also flashing.) | --- |
| | | | Hardware or firmware defective. (The LEDs P1 and P2 of the PROFINET interface are not flashing.) | Run a firmware update. If the error persists, contact Service & Support.<br>Replace the interface module. |

### Meaning of the LEDs P1 LINK/TX/RX, P2 LINK/TX/RX

Table 5- 2 Meaning of the LEDs P1 LINK/TX/RX, P2 LINK/TX/RX

| LEDs P1 LINK/TX/RX, P2 LINK/TX/RX | Meaning | Remedy |
|---|---|---|
| Off | There is no Ethernet connection between the PROFINET interface of your PROFINET device and a communication partner (e.g. IO controller). | Check whether the bus cable to the switch/IO controller is interrupted. |
| On | There is an Ethernet connection between the PROFINET interface of your PROFINET device and a communication partner (e.g., IO controller). | --- |
| Flickers | There is active data traffic (sending/receiving) via the Ethernet connection. | --- |
| Flashes | "Node flash test" is being performed. (The LEDs RUN/ ERROR/ MAINT are also flashing.) | --- |

## 5.2 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

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).

## 5.2.1 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.

## 5.2.2 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)**

Avoid creating hardware interrupts cyclically.

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.

# 5.3 Alarms

## 5.3.1 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.
- The diagnostic interrupt OB is called. If the diagnostic interrupt OB 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 5- 3 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<br>• As of STEP 7 V12 PROFINET with STEP 7 V12 function manual (http://support.automation.siemens.com/WW/view/en/49948856)<br>• As of STEP 7 V5.5 PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) manual. |
| | Instruction "RDREC"<br>Read data records from the IO device | |
| | Instruction "RALRM"<br>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 43)

## 5.3.2 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 5- 4 Triggering of a maintenance event

| Maintenance alarm | Event | Meaning |
|---|---|---|
| **Maintenance demanded**<br>MAINT LED is lit | Synchronization loss | • No synchronization frame received<br>No synchronization frame was received by the sync master within the timeout period after parameter assignment or during operation.<br>• Successive synchronization frames are located outside permitted limits (jitter) |
| | Maintenance event of an I/O module | The maintenance event of a power supply module is passed through. |

### 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.

## 5.3.3 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

- As of firmware version V4.2: The IM 155-5 PN 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.

- Firmware version lower than V4.2: The IM 155-5 PN HF interface module maps channel faults by means of manufacturer-specific diagnostic data records.

  The data records are based on the PROFINET IO standard - Application Layer Service Definition V2.2.

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

### Coding of the extended channel diagnostics (as of firmware version V4.2)

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

Table 5- 5 Manufacturer-specific diagnostics in the USI

| ChannelError-Type | ExtendedChan-nel ErrorType | Associated value (AddValue) | Diagnostics |
|---|---|---|---|
| 0x0601 | 0x0682 | Slot | Communication with slot <No.> has failed |
| 0x0602 | 0x0692 | Slot | Permitted number of I/O modules exceeded |
| 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 error (overload has been detected in at least one power segment) |
| 0x0610 | 0x06B2 | 0 | Error IM power supply: Power supply not active or power supply active |

## Structure of the manufacturer-specific diagnostic data records (firmware version lower than V4.2)

The structure of the diagnostic data records is differentiated by the BlockVersion. The following BlockVersion applies to the IM 155-5 PN HF interface modules:

Table 5- 6 Structure of the manufacturer-specific diagnostic data records

| IM 155-5 PN HF interface module | BlockVersion |
|---|---|
| 6ES7155-5AA00-0AC0 | W#16#0101 |

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

The following manufacturer-specific diagnostics are signaled in the USI with the IM 155-5 PN HF interface module:

Table 5- 7 Manufacturer-specific diagnostics in the USI

| USI no. W#16#... | Diagnostics |
|---|---|
| 0001 | Power budget error (overload has been detected in at least one power segment) |
| 0002 | Permitted number of power supply modules exceeded |
| 0003 | Permitted number of I/O modules exceeded |
| 0004 | No U connector detected on an IM port |
| 0005 | More than one bus master module (IM/CPU) detected |
| 0006 | Communication with slot <No.> has failed |
| 0007 | Error IM power supply: Power supply not active or power supply active |

## 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).

## Structure USI = W#16#0001

Table 5- 8 Structure of USI = W#16#0001

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| **USI** | | W#16#0001 | Manufacturer-specific diagnostics in case of overload in an ET 200MP power segment | 2 |
| Followed by 3 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| The first power segment with overload starts at slot: <No.> | | | | |
| | **Slot** | B#16#00 to B#16#1F | | 1 |

## Structure USI = W#16#0002

Table 5- 9 Structure of the USI = W#16#0002

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| USI | | W#16#0002 | Manufacturer-specific diagnostics if the permitted number of power supply modules is exceeded | 2 |
| Followed by 3 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| The first surplus module is located in slot: <No.> | | | | |
| | Slot | B#16#00 to B#16#1F | | 1 |

## USI structure = W#16#0003

Table 5- 10 USI structure = W#16#0003

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| USI | | W#16#0003 | Manufacturer-specific diagnostics if the permitted number of I/O modules is exceeded | 2 |
| Followed by 3 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| The first surplus module is located in slot: <No.> | | | | |
| | Slot | B#16#20 to B#16#FF | | 1 |

## USI structure = W#16#0004

Table 5- 11 USI structure = W#16#0004

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| USI | | W#16#0004 | Manufacturer-specific diagnostics if no U connector is detected on an IM port | 2 |
| Followed by 4 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |

## USI structure = W#16#0005

Table 5- 12 USI structure = W#16#0005

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| **USI** | | W#16#0005 | Manufacturer-specific diagnostics if there is more than one bus master module (IM/CPU) | 2 |
| Followed by 4 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |

## USI structure = W#16#0006

Table 5- 13 USI structure = W#16#0006

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| **USI** | | W#16#0006 | Manufacturer-specific diagnostics if the communication with a slot has failed | 2 |
| Followed by 3 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| Communication has failed with slot: <No.> | | | | |
| | **Slot** | B#16#00 to B#16#1F | | 1 |

### USI structure = W#16#0007

Table 5- 14 USI structure = W#16#0007

| Data block name | | Contents | Note | Bytes |
|---|---|---|---|---|
| **USI** | | W#16#0007 | Manufacturer-specific diagnostics if the configuration of the interface module power supply is different from the parameterized configuration | 2 |
| Followed by 3 reserved bytes | | | | |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| | Reserved | | | 1 |
| Error IM power supply: Power supply <bit 0 in the least significant byte can be 0 or 1> | | | | |
| | **Power supply of the interface module** | B#16#00 | Power supply of the interface module is not active. | 1 |
| | | B#16#01 | Power supply of the interface module is active. | |

## 5.3.4 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 36)

## 5.3.5 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.

# Technical specifications

6

## Technical specifications of the IM 155-5 PN HF

| Article number | 6ES7155-5AA00-0AC0 |
|---|---|
| **General information** | |
| Product type designation | IM 155-5 PN HF |
| HW functional status | FS03 |
| Firmware version | V4.2 |
| • FW update possible | Yes |
| Vendor identification (VendorID) | 002AH |
| Device identifier (DeviceID) | 0X0312 |
| **Product function** | |
| • I&M data | Yes; I&M0 to I&M3 |
| **Engineering with** | |
| • STEP 7 TIA Portal configurable/integrated as of version | V13 / V13 |
| • STEP 7 configurable/integrated as of version | V5.5 SP3 / - |
| • PROFINET as of GSD version/GSD revision | V2.3 / - |
| **Configuration control** | |
| via user data | No |
| via dataset | Yes |
| **Supply voltage** | |
| Rated value (DC) | 24 V |
| permissible range, lower limit (DC) | 20.4 V |
| permissible range, upper limit (DC) | 28.8 V |
| Reverse polarity protection | Yes |
| Short-circuit protection | Yes |
| **Mains buffering** | |
| • Mains/voltage failure stored energy time | 5 ms |
| **Input current** | |
| Current consumption (rated value) | 0.2 A |
| Current consumption, max. | 1.2 A |
| Inrush current, max. | 9 A |
| $I^2t$ | 0.09 $A^2 \cdot s$ |

| Article number | 6ES7155-5AA00-0AC0 |
|---|---|
| **Power** | |
| Infeed power to the backplane bus | 14 W |
| Power available from the backplane bus | 2.3 W |
| **Power loss** | |
| Power loss, typ. | 4.5 W |
| **Address area** | |
| **Address space per module** | |
| • Address space per module, max. | 256 byte; per input / output |
| **Address space per station** | |
| • Address space per station, max. | 512 byte; per input / output |
| **Hardware configuration** | |
| Integrated power supply | Yes |
| System power supply can be plugged in to left of IM | Yes |
| Number of permissible power segments | 3 |
| **Rack** | |
| • Modules per rack, max. | 30; I/O modules |
| **Submodules** | |
| • Number of submodules per station, max. | 256 |
| **Interfaces** | |
| Number of PROFINET interfaces | 1 |
| **1. Interface** | |
| **Interface types** | |
| • Number of ports | 2 |
| • integrated switch | Yes |
| • RJ 45 (Ethernet) | Yes |
| **Protocols** | |
| • PROFINET IO Device | Yes |
| • Media redundancy | Yes |
| **Interface types** | |
| **RJ 45 (Ethernet)** | |
| • Transmission procedure | PROFINET with 100 Mbit/s full duplex (100BASE-TX) |
| • 100 Mbps | Yes |
| • Autonegotiation | Yes |
| • Autocrossing | Yes |
| **Protocols** | |
| **PROFINET IO Device** | |
| **Services** | |
| – Isochronous mode | Yes |

| Article number | 6ES7155-5AA00-0AC0 |
|---|---|
| – IRT | Yes |
| – PROFIenergy | No |
| – Prioritized startup | Yes |
| – Shared device | Yes |
| – Number of IO Controllers with shared device, max. | 4 |
| **Redundancy mode** | |
| – MRP | Yes |
| – MRPD | Yes |
| – PROFINET system redundancy (S2) | Yes |
| – Redundant PROFINET configuration (R1) | No |
| – H-Sync forwarding | Yes |
| **Open IE communication** | |
| • TCP/IP | Yes |
| • SNMP | Yes |
| • LLDP | Yes |
| **Isochronous mode** | |
| Isochronous operation (application synchronized up to terminal) | Yes |
| Equidistance | Yes |
| shortest clock pulse | 250 µs |
| max. cycle | 4 ms |
| **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 |
| • Connection display LINK TX/RX | Yes; yellow LED |
| **Potential separation** | |
| between backplane bus and electronics | No |
| between PROFINET and all other circuits | Yes; 1500 V AC |
| between supply and all other circuits | No |
| **Isolation** | |
| Isolation tested with | 707 V DC (type test) |

| Article number | 6ES7155-5AA00-0AC0 |
|---|---|
| **Ambient conditions** | |
| **Ambient temperature during operation** | |
| • horizontal installation, min. | 0 °C |
| • horizontal installation, max. | 60 °C |
| • vertical installation, min. | 0 °C |
| • vertical installation, max. | 40 °C |
| **Altitude during operation relating to sea level** | |
| • Installation altitude above sea level, max. | 2 000 mm |
| **Connection method** | |
| **ET-Connection** | |
| • via BU/BA Send | No |
| **Dimensions** | |
| Width | 35 mm |
| Height | 147 mm |
| Depth | 129 mm |
| **Weights** | |
| Weight, approx. | 350 g |

# Dimension drawing

# A

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 PN HF interface module

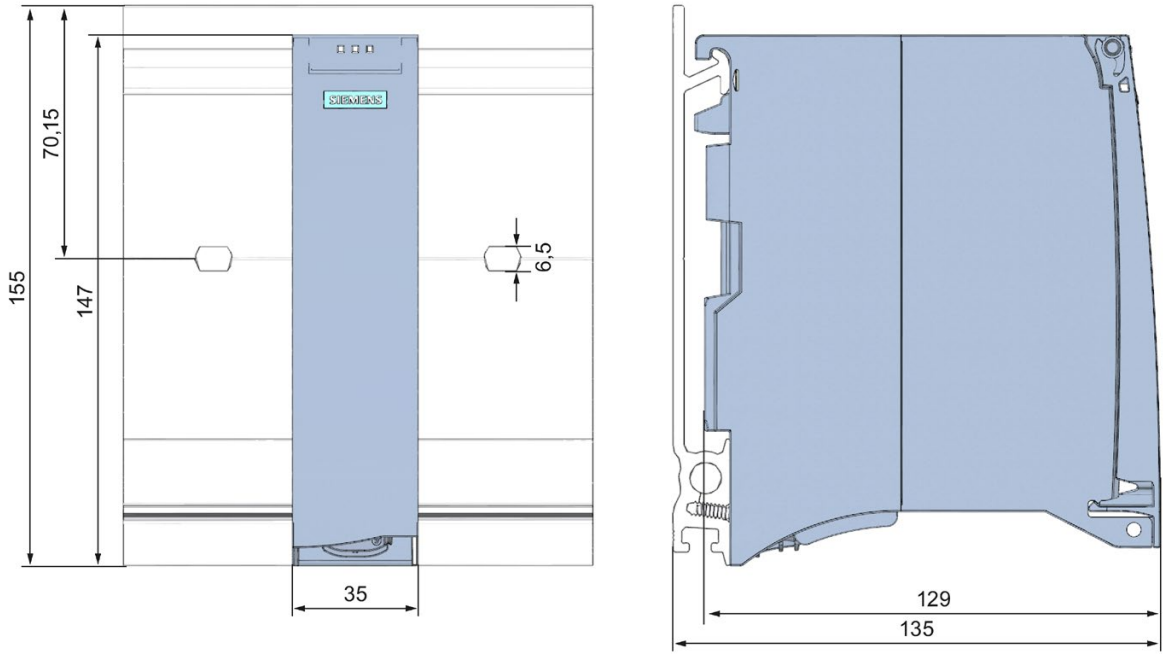



Figure A-1 Dimension drawing of the IM 155-5 PN HF interface module, front and side views

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

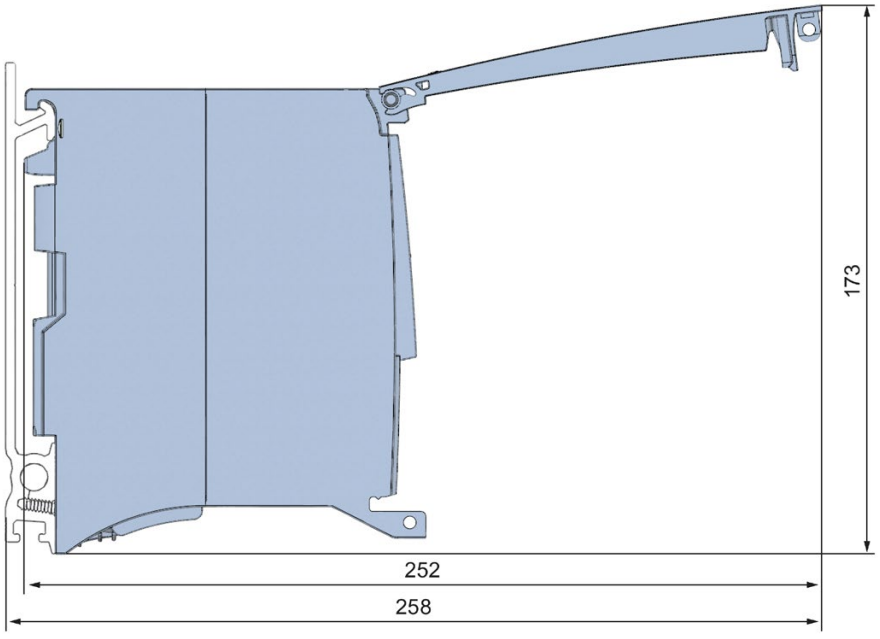



Figure A-2 Dimension drawing of the IM 155-5 PN HF interface module, side view with open front cover

# Response times

# B

## B.1 Response times of the ET 200MP

### Introduction

The response time of the IM 155-5 PN 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:

- (Number of output data in bytes + number of output addresses) x 0.0668 + 1.6131 (rounded up)

plus

- (Number of input data in bytes + number of input addresses) x 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) x 0.0668 + 1.6131 = 3.1495 ≈ 4 µs (rounded up)

plus

- (25 + 4) x 0.0959 + 2.5901 = 5.3712 ≈ 6 µs (rounded up)

plus

- Operating system processing time 500 µs

**Result of backplane bus cycle time**

Backplane bus cycle time = 510 µs

## Calculating the response time

It is necessary to differentiate between two cases when calculating the response time of the IM 155-5 PN 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 x (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 PN 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 PN 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**

## Reference

Additional information about performance measurements is available on the Internet (http://support.automation.siemens.com/WW/view/en/34677186/136000&csplfrm=0&cssw=0&csbinh=5).