SIEMENS

Manual

SIMATIC

S7-1500 / ET 200MP

Interface module IM 155-5 PN BA
(6ES7155-5AA00-0AA0)

Edition 08/2019

support.industry.siemens.com

SIEMENS

SIMATIC

ET 200MP
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A5E38017683-AB

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Preface

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

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

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 support you in commissioning the system.

Conventions

Please also observe notes marked as follows:

Note

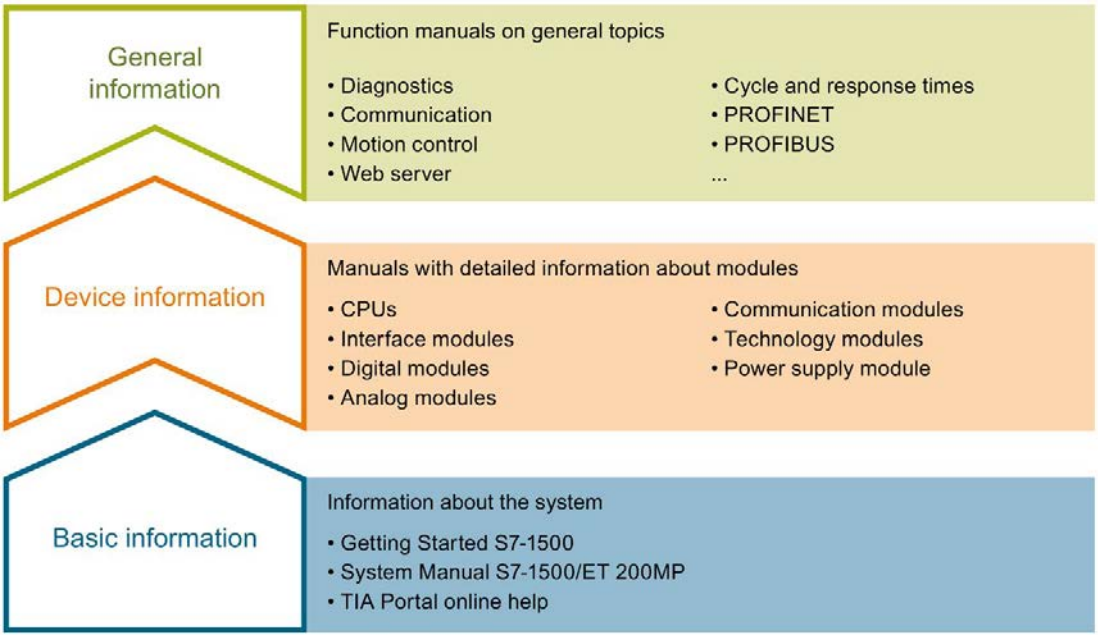
A note contains important information on the product, on the handling of the product and on the section of the documentation to which particular attention should be paid.

Table of contents

S7-1500 / ET 200MP Documentation Guide

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).

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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).

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).

Product overview

2

2.1 Properties

Article number

6ES7155-5AA00-0AA0

View of the module

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

Properties

- Technical properties
  - Connects the ET 200MP distributed I/O system with PROFINET IO
  - 24V DC power supply (SELV/PELV)
  - PROFINET IO connection using RJ45 bus connector
- Supported functions (Page 9)

Maximum configuration

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

The interface module IM 155-5 PN BA does not support any additional power supply (PS) modules.

Maximum amount of I/O data

You can operate a maximum of 64 byte inputs and 64 byte outputs per station.

Accessories

A detailed list of the available accessories is available in the system manual S7-1500, ET 200MP automation system (https://support.industry.siemens.com/cs/ww/en/view/59191792).

2.2 Functions

PROFINET IO

The interface module supports the following PROFINET IO functions:

- Integrated switch with 2 ports
- Supported Ethernet services: ping, arp, SNMP, LLDP
- Port diagnostics
- Disabling ports
- Minimum update time 1 ms
- Device replacement without programming device
- Media redundancy (MRP)
- Shared device with two IO Controllers
- Module-internal Shared Input/Shared Output (MSI/MSO)
- Identification data I&M 0 to 3
- Firmware update via PROFINET IO
- Reset to factory settings via PROFINET IO
- Module division into submodules
- PROFIsafe (as of FW version V4.3.0)

Note

Docking system

The interface module IM155-5 PN BA cannot be used as a docking station. The use as a docking unit (function: IO devices changing during operation) in a docking system is supported.

Requirements

The following requirements apply for the usage of the PROFINET IO functions with the IM 155-5 PN BA interface module:

You use the following as the design software:

- STEP 7 (TIA Portal) as of V15.1 with HSP_V15_1_0187_001_ET200MP_PN_BA_4.3
- With GSD file: 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.
  - STEP 7 as of V5.5 SP3
  - STEP 7 (TIA Portal as of V15.1)

  The GSD file can be found on the Internet (https://support.industry.siemens.com/cs/ww/en/view/68189683).

  With GSD file no F-modules can be used.GSD

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 V15, in the PROFINET with STEP 7 V15 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

Device replacement without programming device

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

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

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

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

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

- as of STEP 7 V15, in the PROFINET with STEP 7 V15 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

Media redundancy

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

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

- as of STEP 7 V15, in the PROFINET with STEP 7 V15 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

Shared device

IO device which makes its data available to multiple IO Controllers.

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

- as of STEP 7 V15, in the PROFINET with STEP 7 V15 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

Submodules

The IM 155-5 PN BA interface module supports the module division of I/O modules into up to 9 submodules. This allows parts of an I/O module to be separately configured and assigned parameters.

It is possible to assign each of these submodules to different IO controllers.

The functions

- Firmware update
- Write I&M data
- Calibration

can only be executed if you have configured Submodule 1 during configuration.

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 a further IO Controller. 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 a further IO Controller. One IO controller has write access. A further IO controller 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 V14, in the PROFINET with STEP 7 V14 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual

Wiring

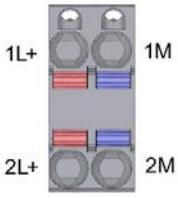
3

3.1 Terminal assignment

24 V DC supply voltage

The following table shows the signal names and the descriptions of the terminal assignment for a 24 V DC supply voltage.

Table 3- 1 Terminal assignment 24 V DC supply voltage

View	Signal name[1]	Description
	1L+	24 V DC
	2L+	24 V DC (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 interface X1 Port 2

If autonegotiation is disabled, the RJ-45 socket (X1 Port 2) has the switch assignment (MDI-X).

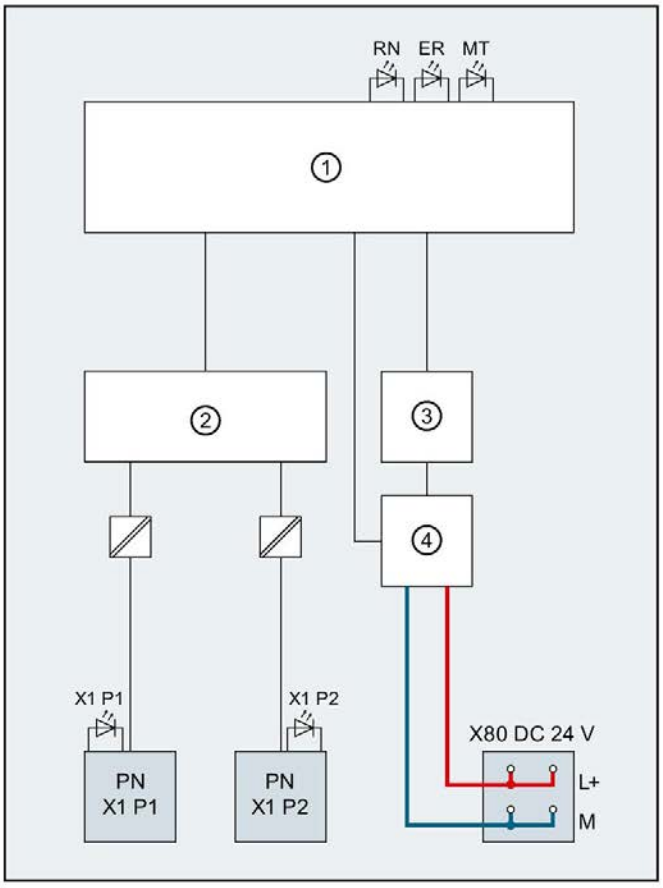
Reference

You can find additional information on connecting the interface module and on the 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

The following figure shows the block diagram of the interface module IM 155-5 PN BA.



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

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

Interrupts and diagnostic, error, and system alarms 4

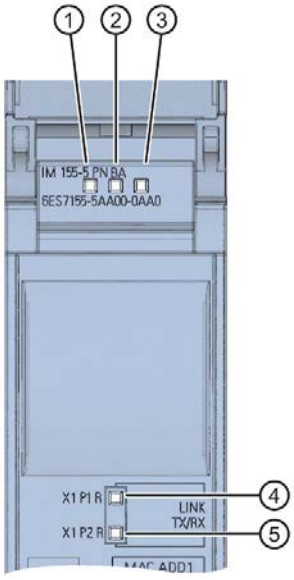
4.1 Status and error displays

Introduction

Diagnostics by means of LED display is an initial tool for error localization. To further limit 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 BA 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 4-1 LED display on the interface module

Meaning of the LEDs RUN / ERROR / MAINT

Table 4- 1 Meaning of the LEDs RUN / ERROR / MAINT

LEDs			Meaning	Remedy
RUN	ERROR	MAINT		
Off	Off	Off	Supply voltage not present at interface module or too small	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 starts up.	---
			ET 200MP is 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 data and correct the error.
			The set configuration does not correspond to the actual configuration of the ET 200MP.	Check the design 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 chapter Invalid configuration states of the ET 200MP on PROFINET IO (Page 21)
			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.
Flashes	Flashes	Flashes	"Node flash test" is 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.)	Replace the interface module.

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

Table 4- 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 performed. (The LEDs RUN/ERROR/MAINT are also flashing.)	---

4.2 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 V14, 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. (https://support.industry.siemens.com/cs/ww/en/view/59192926).

4.2.1 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 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.

4.3 Alarms

4.3.1 Diagnostic alarms

Requirement

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

Actions after a diagnostic alarm

There can be more than one diagnostic alarm at the same time. Actions initiated by diagnostic alarms:

- The ERROR LED of the interface module flashes.
- Diagnostic data is 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.

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

Reading out the diagnostic data

Table 4- 3 Reading out the diagnostic data with STEP 7

Automation system with IO controller	Application	See...
SIMATIC S7	Diagnostic data as plain text in STEP 7 using online view and diagnostic view	STEP 7 online help PROFINET with STEP 7 V15 function manual (https://support.industry.siemens.com/cs/ww/en/view/49948856)
	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 (https://support.industry.siemens.com/cs/ww/en/view/19289930) and in the application example on the Internet (https://support.industry.siemens.com/cs/ww/en/view/24000238).

Causes of error and troubleshooting

The error causes and corrective measures of the diagnostic alarms are described in the manuals for the I/O modules (https://support.industry.siemens.com/cs/ww/en/ps/14039/man) in the Interrupts/Diagnostic alarms section.

4.3.2 Channel diagnostics

Function

Channel diagnostics provides information about channel faults in modules.

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

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

Structure of the diagnostic data records

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 standard from the PROFIBUS User Organization on the Internet (https://www.profibus.com).

Codes of the extended channel diagnostics

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

Table 4- 4 Extended channel diagnostics IM 155-6 PN BA

ChannelError-Type	ExtendedChan-nel ErrorType	Associated value (AddValue)	Diagnostics
0x0601	0x0682	Slot	Communication has failed with slot <No.>
0x0602	0x0692	Slot	Permitted number of I/O 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	1 (Interface module 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

Additional information

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

4.3.3 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.

- Number of modules exceeds maximum configuration
- Faulty backplane bus (e.g., additional IM present).

Additional information

You can find additional information on maximum configuration and on power budget in the s7-1500, ET 200MP automation system (https://support.industry.siemens.com/cs/ww/en/view/59191792) system manual.

See also:

Status and error displays (Page 14)

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

STOP of the SIMATIC IO controller

Diagnostic data received from the IO device while the IO controller is in STOP state does not initiate a call of the corresponding OBs when the IO controller goes into RUN. You have to read the data record $E00C_H$ using the "RDREC" in the startup OB. This record contains all diagnostic data for the slots assigned to an IO controller in an IO device.

Recovery of the SIMATIC IO device

If you want to read the diagnostic data 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 diagnostic data for the slots assigned to an IO controller in an IO device.

Technical specifications

5

Technical specifications of the IM 155-5 PN BA

Article number	6ES7155-5AA00-0AA0
General information	
Product type designation	IM 155-5 PN BA
HW functional status	FS02
Firmware version	V4.3.0
Vendor identification (VendorID)	0x002A
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	V15.1 with HSP 187
• 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	No
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)	1 A
Current consumption, max.	1.7 A
Inrush current, max.	2.8 A
I^2t	0.04 $A^2 \cdot s$
Power	
Infeed power to the backplane bus	14 W

Article number	6ES7155-5AA00-0AA0
Power loss	
Power loss, typ.	3 W
Address area	
Address space per module	
• Address space per module, max.	64 byte; per input / output
Address space per station	
• Address space per station, max.	64 byte; per input / output
Hardware configuration	
Integrated power supply	Yes
System power supply can be plugged in to left of IM	No
Number of permissible power segments	1
Rack	
• Modules per rack, max.	12; I/O modules
Submodules	
• Number of submodules per station, max.	108; 9 submodules / I/O modules
Interfaces	
Number of PROFINET interfaces	1; 2 ports (switch) RJ45
1. Interface	
Interface types	
• Number of ports	2
• integrated switch	Yes
• RJ 45 (Ethernet)	Yes
• BusAdapter (PROFINET)	No
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	No
– Open IE communication	Yes

Article number	6ES7155-5AA00-0AA0
– IRT	No
– PROFIenergy	No
– Prioritized startup	No
– Shared device	Yes
– Number of IO Controllers with shared device, max.	2
Redundancy mode	
• MRP	Yes
• MRPD	No
• PROFINET system redundancy (S2)	No
Open IE communication	
• TCP/IP	Yes
• SNMP	Yes
• LLDP	Yes
Isochronous mode	
Isochronous operation (application synchronized up to terminal)	No
Equidistance	No
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; 2x green-yellow LEDs
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
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	2

Article number	6ES7155-5AA00-0AA0
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.	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	236 g

Dimension drawing

A

The dimensional drawing of the module on the mounting rail, as well as a dimensional 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 BA interface module

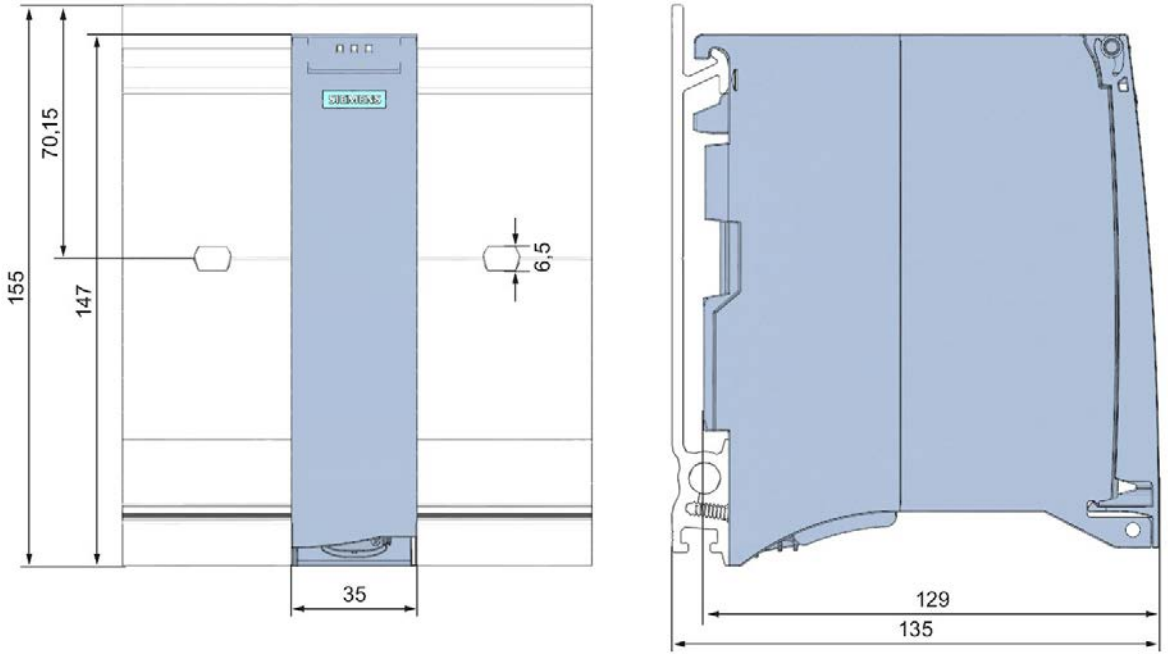


Figure A-1 Dimension drawing of the IM 155-5 PN BA interface module, front and side views

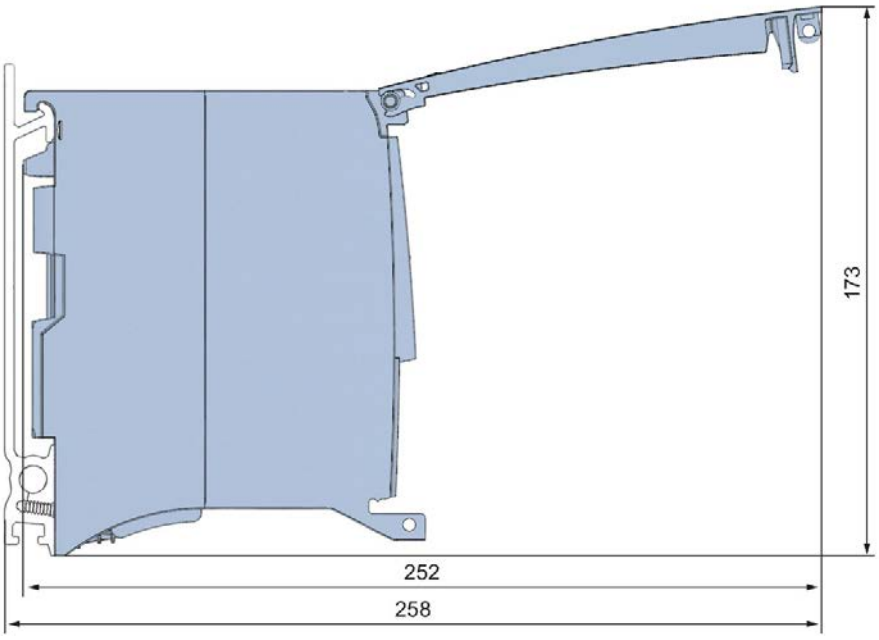


Figure A-2 Dimension drawing of theIM 155-5 PN BA interface module, side view with open front cover