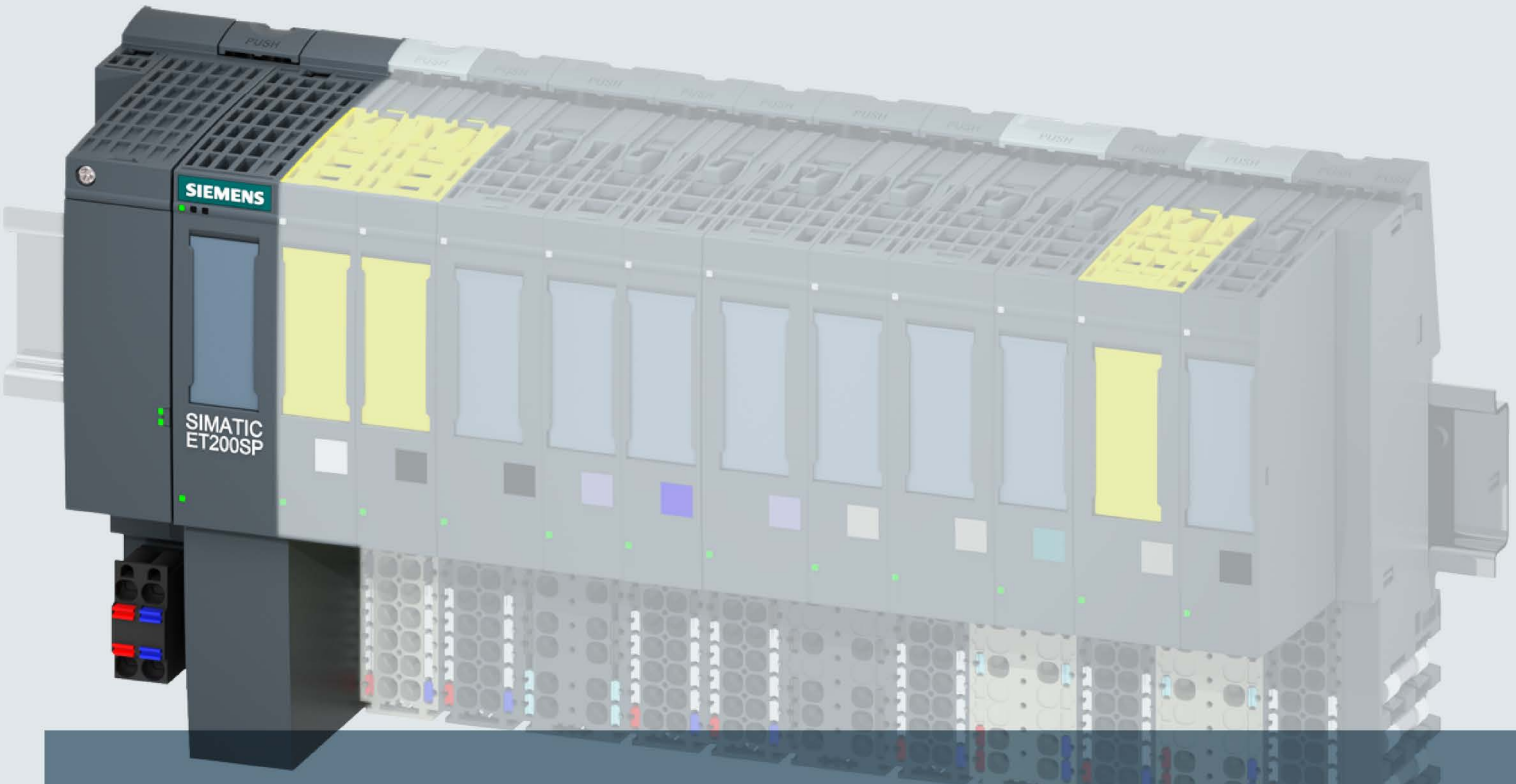
SIEMENS



SIMATIC

ET 200SP

Interface module IM 155-6 PN ST (6ES7155-6AU00-0BN0)

Manual

Edition 12/2015

Answers for industry.

SIEMENS

SIMATIC

ET 200SP
IM 155-6 PN ST interface module (6ES7155-6AU00-0BN0)

Manual

12/2015

A5E03576904-AD

Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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Qualified Personnel

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

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Disclaimer of Liability

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

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℗ 12/2015 Subject to change

Preface

Purpose of the documentation

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

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 ET 200SP distributed I/O system.

Conventions

Please also observe notes marked 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.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. You can find more information about industrial security on the Internet (http://www.siemens.com/industrialsecurity).

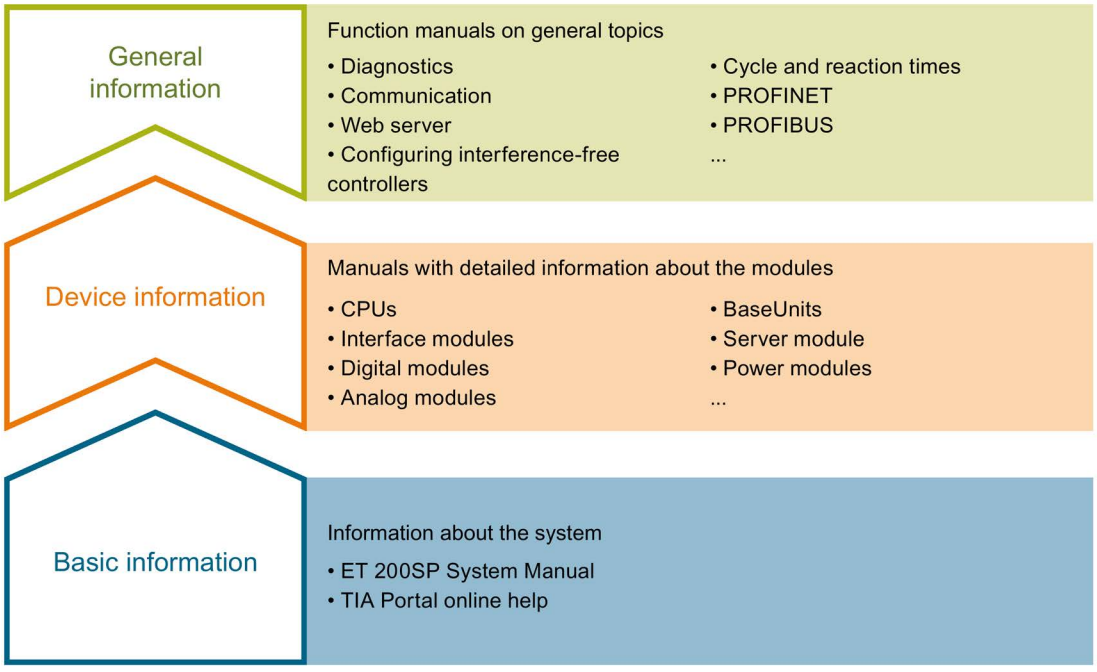
To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet (http://support.automation.siemens.com).

Table of contents

ET 200SP Documentation Guide

1

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



Basic information

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

Device information

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

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200SP distributed I/O system, e.g. diagnostics, communication, Web server, designing interference-free controllers.

You can download the documentation free of charge from the Internet (http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-et200/Pages/Default.aspx).

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

Manual Collection ET 200SP

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

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

My Documentation Manager

The My Documentation Manager is used to 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 the My Documentation Manager on the Internet (http://support.automation.siemens.com/WW/view/en/38715968).

Applications & Tools

Applications & Tools supports 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 in individual products.

You can find Applications & Tools on the Internet (http://support.automation.siemens.com/WW/view/en/20208582).

CAx Download Manager

The CAx Download Manager is used to access the current product data for your CAx or CAe systems.

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 the CAx Download Manager on the Internet (http://support.automation.siemens.com/WW/view/en/42455541).

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).

Product overview

2

2.1 Properties

Article number

6ES7155-6AU00-0BN0 (IM 155-6 PN ST interface module and server module)

6ES7155-6AA00-0BN0 (IM 155-6 PN ST interface module with BusAdapter BA 2×RJ45 and server module)

View of the module

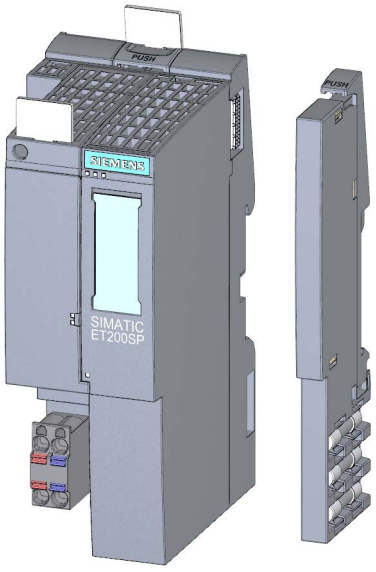


Figure 2-1 View of the IM 155-6 PN ST interface module and the server module

Properties

The module has the following technical properties:

- Connects the ET 200SP distributed I/O system with PROFINET IO
- Supply voltage 1L+ 24 V DC (SELV/PELV). The connection plug is included in the scope of delivery of the interface module.
- PROFINET IO connection via selectable BusAdapter for RJ45 bus connector (BA 2×RJ45) or for direct connection of the bus cable (BA 2×FC)
- Use of fail-safe modules
- As of firmware version V 3.0, you can plug a light-colored or a dark-colored BaseUnit into slot 1.

The module supports the following functions (Page 11)

Maximum configuration

- 32 I/O modules
- 512 bytes I/O data
- 1 m backplane bus (without interface module)

Accessories

The following accessories can be ordered separately:

- BA 2xRJ45 BusAdapter
- BA 2xFC BusAdapter
- 24 V DC connector
- Labeling strips
- Reference identification label

Note

The interface module is also available as a bundle with the BusAdapter BA 2xRJ45 (and the server module). The article number is 6ES7155-6AA00-0BN0.

A detailed list of the available accessories can be found in the system manual ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293).

Server module

The server module is included in the scope of delivery of the interface module and available separately as an accessory.

The server module has the following properties:

- Terminates the backplane bus of the ET 200SP distributed I/O system
- Features a holder for 3 spare fuses (5 × 20 mm)
- Identification data I&M 0 to 3

Note

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

To do this, place the server module in the last configuration slot and enable the parameter Group diagnostics: Missing supply voltage L+. When there are 32 I/O modules, the server module is inserted in slot 33.

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

First BaseUnit of an ET 200SP in the configuration (as of V3.0)

Note

First BaseUnit of an ET 200SP in the configuration

The first BaseUnit of an ET 200SP station may be a dark-colored one if an AC I/O module or AI Energy Meter ST is plugged. Please note the information on limiting the overvoltage and power rating in the AC I/O module manuals.

A light-colored BaseUnit must be plugged into the slot of the first 24 V DC I/O module in order to route the 24 V DC supply voltage via a fuse.

Pay attention to the type of the BaseUnits during the configuration.

As of firmware V3.x, the interface modules support plugging dark-colored BaseUnits in slot 1. This means that modules without a connection to the integrated voltage buses P1 and P2 can now also be configured starting with slot 1. Currently, this applies to the following modules:

- AI EnergyMeter
- DI 4x120..230VAC ST (6ES7131-6FD00-0BB1)
- DQ 4x24..230VAC/2A ST (6ES7132-6FD00-0BB1)

Requirement for configuration of these modules in slot 1:

- Configuration via GSD or GSDML
- Configuration as of STEP 7 V5.5 SP4 with
  - HSP0241 V2.0 for IM155-6 PN ST
  - HSP0242 V2.0 for IM155-6 DP HF
  - HSP0255 V3.0 for IM155-6 PN HF
- Configuration as of STEP 7 V13 SP1

2.2 Functions

Introduction

The interface module supports the following PROFINET IO functions:

- Integrated switch with 2 ports
- Supported Ethernet services: ping, arp, network diagnostics (SNMP)/MIB-2, LLDP-MIB and MRP-MIB
- Port diagnostics
- Disabling ports
- Isochronous real-time communication
- Minimum update time 1 ms
- Prioritized startup
- Media redundancy (MRP)
- Shared device
- Support of submodules on suitable I/O modules
- Module-internal Shared Input/Shared Output (MSI/MSO)
- Device replacement without PG and without topological configuration
- Reset to factory settings via PROFINET IO
- Firmware update via PROFINET IO
- Station extension via ET-Connection
- The BusAdapter provides the connection system for PROFINET IO. The following versions are available for the IM 155-6 PN ST interface module:
  - For standard RJ45 connector: BA 2×RJ45
  - For direct connection of the bus cable: BA 2×FC

The interface module supports additional functions:

- Identification data I&M 0 to 3
- PROFIenergy
- Use of fail-safe modules
- Configuration control (option handling)
- Value status (quality information, QI) of I/O modules

Requirements

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

Table 2- 1 Version dependencies of other module functions

Function	Product version of the module as of	Firmware version of the module as of	Configuration software		
			Configuration with GSD file (http://support.automation.siemens.com/WW/view/en/19698639/130000)/software from a third-party manufacturer [1]	STEP 7 as of V5.5 SP3 with HSP241	STEP 7 (TIA Portal), as of V11 SP2
Real-time communication	1	V1.0.0	X	X	X
Isochronous real-time communication	1	V1.0.0	X	X	X
Prioritized startup	1	V1.0.0	X	X	X
Device replacement without programming device	1	V1.0.0	X	X	X
Media redundancy (MRP)	1	V1.0.0	X	X	X
Shared device	1	V1.0.0	X	X	X (as of V13 SP1)
PROFIenergy	1	V1.0.0	---	X	X
Use of fail-safe modules	1	V1.0.1	X	X	X (as of V13 SP1)
Module-internal Shared Input/Shared Output (MSI/MSO)	1	V3.1.0	X	X	X (as of V13 SP1)
Station extension via ET-Connection	5	V3.1.0	X	X	X (as of V13 SP1)
User data 512 bytes	1	V3.1.0	X	X	X (as of V13 SP1)
Distribution of module channels to multiple submodules	5	V3.3.0	X	X (as of V5.5 SP4, HSP0241 V3)	X (as of V13 SP1, Update 6)

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

Cabling with fixed connection setting

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

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

- As of STEP 7 V12, in the PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856) function manual
- As of STEP 7 V5.5, in the system manual PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)

Isochronous real-time communication

Synchronized transmission method for cyclic exchange of IRT data between PROFINET devices. A reserved bandwidth within the send clock is available for IRT data. The reserved bandwidth ensures that the IRT data can also be transferred without being affected by another high network load (e.g. TCP/IP communication or additional real time communication) at reserved, chronologically synchronized intervals.

A topological configuration is required for IRT.

Note

IO controller as sync master with IRT communication

We recommend also operating the IO controller as a sync master when configuring the IRT communication.

Otherwise, IO devices with IRT and RT configuration could fail as a result of sync master failure.

You can find more information on the 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 V13 (http://support.automation.siemens.com/WW/view/en/49948856) function manual
- As of STEP 7 V5.5, in the system manual PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)

Prioritized startup

Prioritized startup describes the PROFINET IO functionality for accelerating the startup of IO devices in a PROFINET IO system with IRT and RT communication.

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

- After the supply voltage has returned
- After a station has returned
- After IO devices have been activated

Note

Dependency of the startup time

The interface module permits startup times from 0.9 s.

The startup time depends on the number and type of modules.

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

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856)
- As of STEP 7 V5.5, in the system manual PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)

Device replacement

Device replacement without topological configuration

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

Storing the name on the BusAdapter and the interface module produces a range of scenarios for using the device name when the interface module is replaced.

Table 2- 2 Scenarios for using the device name

	Interface module empty	**Interface module with device name**
BusAdapter empty	No device name available	The device name from the interface module is used and copied to the BusAdapter.
BusAdapter with device name	The device name from the BusAdapter is used and copied to the interface module.	The device name from the BusAdapter is used and copied to the interface module if this has a different device name.

Be aware of the following constraints:

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

Device replacement with topological configuration

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

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

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

IO devices that have already been used in another configuration should be reset to their factory settings before reuse (see system manual ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293)).

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

- As of STEP 7 V12, in the PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856) function manual
- As of STEP 7 V5.5, in the system manual PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)

Replacement of an IM 155-6 PN ST

In a replacement scenario, any IO devices in operation must be reset to their as-delivered state via "Reset to factory settings" (see the system manual ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293)).

Media redundancy (MRP)

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

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

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856)
- As of STEP 7 V5.5, in the system manual PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)

Shared device

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

The interface module supports shared device at submodule level.

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

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

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

- As of STEP 7 V12, in the function manual PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856)
- As of STEP 7 V5.5, in the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) system manual

Note

In the case of a shared device application, make sure that all controllers work with the same send clock. If controllers do not have the same send clock, the differing send clock can result in communication relationships that are not set up.

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

Submodules

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

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

The functions:

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

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 up to two IO controllers (for ET 200SP PN ST). 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 two IO controllers. One IO controller has write access. A second 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 V12, in the function manual PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856)

Value status

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

Additional information on the value status can be found in the manuals for the I/O modules.

2.2.1 PROFIenergy

Properties

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

Reference

You can find more information on PROFIenergy in the:

- Product manual I/O modules (http://support.automation.siemens.com/WW/view/en/55679691/133300)
- PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856) function manual.
- System manual PROFINET system description (http://support.automation.siemens.com/WW/view/en/19292127)
- PROFIenergy (http://support.automation.siemens.com/WW/view/en/66928686) product information.
- Internet (http://www.profibus.com) under Common Application Profile PROFIenergy; Technical Specification for PROFINET; Version 1.0; January 2010; Order No: 3.802.

2.2.2 Use of fail-safe modules

Properties

The IM 155-6 PN ST interface module as of firmware V1.0.1 supports the use of fail-safe modules.

Reference

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

2.2.3 Use of technology modules

Technology modules

As of firmware version V3.1, the interface module IM 155-6 PN ST supports the "Position input for Motion Control" mode of the technology modules TM Count 1x24V (6ES7138-6AA00-0BA0) and TM PosInput 1 (6ES7138-6BA00-0BA0).

2.2.4 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 on configuration control

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

Wiring

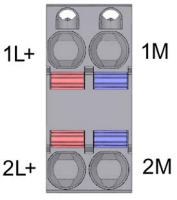
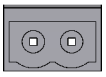
3

3.1 Pin assignment

24 V DC supply voltage

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

Table 3- 1 Pin assignment 24 V DC supply voltage

View		Signal name[1]	Description
Connector	IM connection		
		1L+	24 V DC
		2L+	24 V DC (for looping through)[2]
		1M	Ground
		2M	Ground (for looping through)[2]

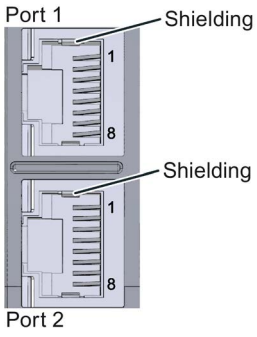
1 1L+ and 2L+ as well as 1M and 2M are bridged internally.

2 Maximum 10 A permitted.

PROFINET IO with BusAdapter BA 2×RJ45

The following table shows the signal name and description of the pin assignment of the BusAdapter BA 2×RJ45.

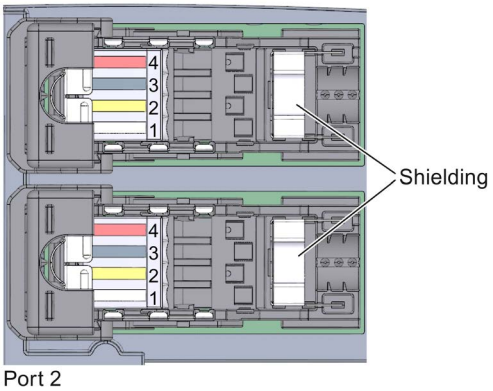
Table 3- 2 PROFINET IO pin assignment with BusAdapter BA 2×RJ45

View	Signal name		Description
	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

PROFINET IO with BusAdapter BA 2×FC

The following table shows the signal name and description of the pin assignment of the BusAdapter BA 2×FC.

Table 3- 3 PROFINET IO pin assignment with BusAdapter BA 2×FC

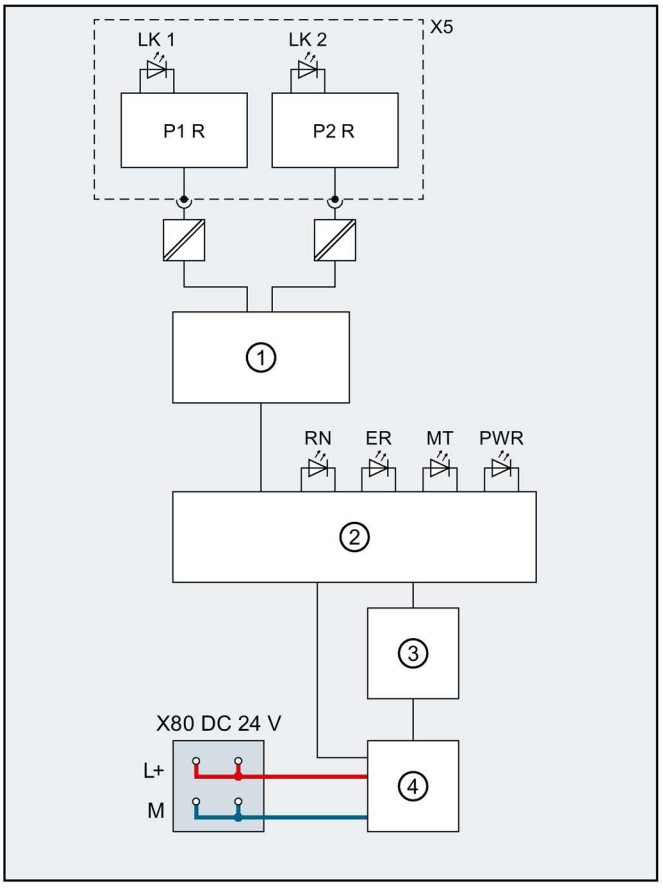
View	Signal name		Description
Port 1  Port 2	1	TD	Transmit data +
	2	TD_N	Transmit data -
	3	RD	Receive data +
	4	RD_N	Receive data -

Reference

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

3.2 Schematic circuit diagram

The following figure shows a block diagram of the interface module IM 155-6 PN ST.



①	Switch	L+	24 V DC supply voltage
②	ET 200SP backplane bus interface and electronics	M	Ground
③	Backplane bus	LK 1,2	LED Link TX/RX
④	Internal power supply	RN	LED RUN/STOP (green/yellow)
X80 24 V DC	Feed supply voltage	ER	ERROR LED (red)
X5	BusAdapter	MT	MAINT LED (yellow)
P1 R	PROFINET interface X1 Port 1	PWR	POWER LED (red)
P2 R	PROFINET interface X1 Port 2		

Figure 3-1 Block diagram of IM 155-6 PN ST interface module

Parameters/address space

4

4.1 Parameters

Parameters for IM 155-6 PN ST interface module

The following table shows the parameters for the IM 155-6 PN ST interface module.

Table 4- 1 Parameters for interface module IM 155-6 PN ST (GSD file)

Parameters	Value range	Default	Efficiency range
Configuration control	Disable/enable	Disable	ET 200SP

4.2 Explanation of parameters

4.2.1 Configuration control

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

Note

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

Reference

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

4.3 Substitute value behavior

The substitute value behavior in the ET 200SP distributed I/O system is executed by the IO controller for each slot.

The respective output behaves according to its configured substitute value behavior:

- Current-free/voltage-free
- Output substitute value
- Keep last value

The substitute value behavior is triggered in the following cases:

- STOP controller
- Controller failure (connection interrupted)
- Firmware update
- Reset to factory settings
- Station stop, for example, due to:
  - Missing server module
  - Removing more than one I/O module at a time.
  - At least one I/O module installed on an incorrect BaseUnit
- Deactivating the IO device

Note

Reducing a configuration

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

The "current-free/voltage-free" behavior takes effect in the following cases:

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

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

Introduction

The "Status of the supply voltage L+ of the I/O modules" is configured on the server module as of IM 155-6 PN ST V1.1.x and GSD file 04/2013. The input data can then be read out on the server module. You will find the relevant description in the Server module (http://support.automation.siemens.com/WW/view/en/63257531) device manual.

Configurations

You can select two configurations for the IM 155-6 PN ST in the configuration software:

- Configuration without input data
- Configuration with input data

Input data

You can read out the status of the supply voltage L+ for each I/O module of the ET 200SP in the input data (byte 0 to 3).

	7	6	5	4	3	2	1	0
Byte 0	8	7	6	5	4	3	2	1
Byte 1	16	15	14	13	12	11	10	9
Byte 2	24	23	22	21	20	19	18	17
Byte 3	32	31	30	29	28	27	26	25

Slots of the I/O modules

Bit = 0: Supply voltage L+ missing or I/O module not installed

Bit = 1: Supply voltage L+ and I/O module available

Figure 4-1 Status of the supply voltage L+

Note

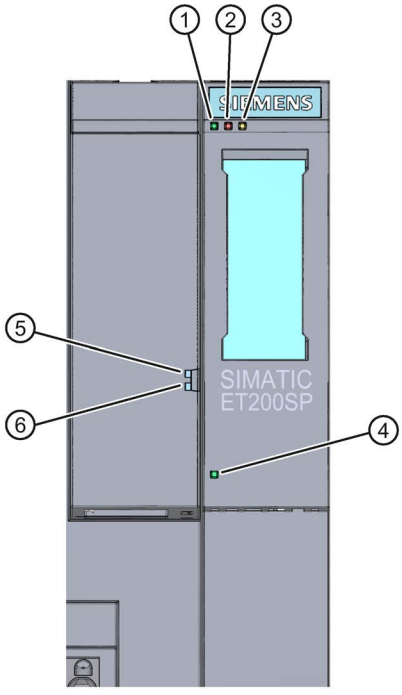
An inserted or missing server module always signals bit = 0 for the slot.

Interrupts, diagnostics, error, and system messages 5

5.1 Status and error displays

LED display

The following diagram shows the LED display on the interface module and the BusAdapter.



① RN (green)
② ER (red)
③ MT (yellow)
④ PWR (green)
⑤ LK1 (green)
⑥ LK2 (green)

Figure 5-1 LED display on the interface module and BusAdapter

Meaning of the LEDs

The meaning of the status and error messages is described in the following tables.

RN/ER/MT LED on the interface module

Table 5- 1 RN/ER/MT status and error displays

LEDs			Meaning	Remedy
RN (RUN)	ER (ERROR)	MT (MAINT)		
Off	Off	Off	Missing or insufficient supply voltage on interface module.	Check the supply voltage or turn in 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 200SP starts up.	-
			ET 200SP is configured.	
			ET 200SP is reset to factory settings.	
On	Not relevant	Not relevant	ET 200SP is currently exchanging data with the IO controller.	
Not relevant	Flashes	Not relevant	Group errors and group error channels.	Evaluate the diagnostics data and remedy the error.
			The configured structure does not correspond to the actual structure of the ET 200SP .	Check the structure of the ET 200SP to see whether a module is missing or defective, or whether a non-configured module is plugged.
			Invalid configuration states.	See section Invalid configuration states of the ET 200SP on PROFINET IO (Page 39)
			Parameter error in the I/O module.	Evaluate the display of the module status in STEP 7 and eliminate the error in the respective I/O module.
Not relevant	Not relevant	On	Maintenance	See section Maintenance events (Page 34)
Flashes	Flashes	Flashes	The "Node flash test" is run (the LEDs LK1 and LK2 of the PROFINET interface also flash).	-
			Hardware or firmware defective (the LEDs LK1 and LK2 of the PROFINET interface do not flash).	Run a firmware update. If the error persists, contact Siemens Industry Online Support. Replace the interface module.

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

PWR LED on the interface module

Table 5- 2 PWR status display on the interface module

PWR LED	Meaning	Remedy
☐ Off	Supply voltage not present or too small	Check the supply voltage.
■ On	Supply voltage present	-

LK1/LK2 LED on the BusAdapter

Table 5- 3 LK1/LK2status display on the BusAdapter

LEDs LK1/LK2	Meaning	Remedy
☐ Off	There is no Ethernet connection between the PROFINET IO 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 IO interface of your PROFINET device and a communication partner (e.g. IO controller).	-
☼ Flashes	The "Node flash test" is run (the RN/ER/MT LEDs also flash).	-

LED display of configuration errors

Configuration errors of the ET 200SP distributed I/O system are output on the interfacemodule by the ERROR (red) and MAINT (yellow) LEDs.

The following configuration errors are indicated by the LEDs:

- More than one I/O module pulled
- Missing server module
- Interruptions or short circuit on the backplane bus

Principle of operation

You determine the information for cause of the error with the LED error display. After notification by the flash signal, the error type is displayed followed by the error location/error code.

The LED error display

- is active during POWER ON as well as during operation.
- has priority before all other states displayed by the ERROR and MAINT LED.
- remains turned on until the cause of the error has been corrected.

Table 5- 4 Display of error type and error location

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

Error display

The following table shows the possible causes of error that can occur.

Table 5- 5 Error display

Error type (MAINT)	Error location (ERROR/MAINT)	Cause of error	Remedy
1	02 to 32*	The number of pulled I/O modules is displayed. The diagnostics data is generated starting with two pulled I/O modules.	Check the configuration of the ET 200SP.
	65*	• Missing server module • Interruptions at the backplane bus • Short circuit of communication on the backplane bus	

* Slot

Note

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

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

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

- Diagnostics interrupts
- Hardware interrupts
- Swapping interrupts
- Maintenance events

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

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

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

System diagnostics

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

You will find more information on system diagnostics in the Diagnostics (http://support.automation.siemens.com/WW/view/en/59192926) function manual.

5.2.1 Triggering of a diagnostics interrupt

Triggering of a diagnostics interrupt

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

The CPU interrupts the user program and processes the diagnostics block OB 82. The interrupt triggering event is logged in the start information of OB 82.

5.2.2 Triggering a hardware interrupt

Triggering a hardware interrupt

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

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.

5.2.3 Triggering a swapping interrupt

Triggering a swapping interrupt

If there is a swapping interrupt, the CPU interrupts user program execution and processes the process interrupt block OB 83. The result that triggered the interrupt is added to the start information of OB 83.

5.3 Alarms

5.3.1 Diagnostics alarms

Actions after a diagnostics alarm

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

- The ERROR LED of the interface module flashes.
- Diagnostics are reported as diagnostic error interrupts to the CPU of the IO controller and can be read via data records.
- Incoming diagnostics alarms are saved to the diagnostics buffer of the I/O controller.
- OB 82 is called. If OB 82 is not available, the I/O controller goes into STOP mode.

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

Reading the diagnostics

Table 5- 6 Reading the diagnostics with STEP 7

Automation system with IO controller	Application	See...
SIMATIC S7	Diagnostics as plain text in STEP 7 using Online and Diagnostics view	STEP 7 online help • as of STEP 7 V12 function manual PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856) • as of STEP 7 V5.5 system manual PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)
	Instruction "RDREC" (SFB 52) Read data records from the IO device	
	Instruction "RALRM" (SFB 54) Receive interrupts from the IO device	

Additional information on the data records for PROFINET IO

The structure of the diagnostic data records and programming examples are available in the programming manual From PROFIBUS DP to PROFINET IO (http://support.automation.siemens.com/WW/view/en/19289930) and in Example application (http://support.automation.siemens.com/WW/view/en/24000238).

Causes of error and troubleshooting

The causes of error and remedies for the diagnostics alarms are described in the Product Manuals for I/O modules (http://support.automation.siemens.com/WW/view/en/55679691/133300) in the section, "Interrupts/diagnostics alarms".

See also

Channel diagnostics (Page 35)

5.3.2 Maintenance events

Triggering of a maintenance event

The PROFINET IO interfaces of the interface module support the diagnostic concept and maintenance concept in PROFINET IO according to the IEC 61158-6-10 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 processes the diagnostic block OB 82. The event that triggered the maintenance event is entered in the start information of the OB 82.

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

Table 5- 7 Triggering of a maintenance event

Maintenance alarm	Event	Meaning
Maintenance demanded (*maintenance demanded*) LED MAINT is lit.	Synchronization loss	• No synchronization frame received No synchronization frame was received by the sync master within the timeout period after parameter assignment or during operation. • Successive synchronization frames are located outside permitted limits (jitter)

System events in STEP 7 (TIA Portal)

The maintenance information is generated in STEP 7 with the following system events:

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

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

5.3.3 Channel diagnostics

Function

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

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

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

Structure of the diagnostics data records

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

You can download the standard for free atPROFIBUS user organization (http://www.profibus.com) from the PROFIBUS user organization home page.

Coding of the extended channel diagnostics (as of V3.3.0)

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

ChannelErrorType (CET)	ExtendedChannelError-Type (ECET)	Associated value AddValue	Diagnostics
0x0602	0x0691	Slot	Station stop - module parameter "Potential group" faulty or incorrect BaseUnit in actual slot (AddValue)
0x0602	0x0693	0x00	Diagnostics with missing server module
0x0602	0x0694	Number of pulled modules	Diagnostics when more than one I/O module has been pulled
0x0602	0x0698	0x00	Diagnostics backplane bus too large
0x0602	0x0699	slot	Diagnostics with incorrect bus configuration
0x0602	0x069C	0x00	Diagnostics with incorrectly plugged BusAdapter
0x0610	0x06B0	0x00	Group diagnostics: Missing supply voltage L+ for the potential groups Note: The slot in which the light-colored BaseUnit of the respective load module is located is coded in the "ChannelNumber" element.

Structure of the manufacturer-specific diagnostics data records

The structure of the diagnostics data records is differentiated by the BlockVersion. The following BlockVersion applies to the IM 155-6 PN ST interface modules:

Table 5- 8 Structure of the manufacturer-specific diagnostics data records

IM 155-6 PN ST interface module	BlockVersion
6ES7155-6AU00-0BN0	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 155-6 PN ST interface module:

Table 5- 9 Manufacturer-specific diagnostics in the USI

USI no. W#16#...	Diagnostics
0003	Group diagnostics: Missing supply voltage L+ for the potential groups *
0004	Diagnostics with missing server module
0005	Diagnostics when more than one I/O module has been pulled
0006	Diagnostics with incorrect BaseUnit
0007	Diagnostics with incorrect bus configuration

* As of IM 155-6 PN ST V1.1.x and GSD file 04/2013, this diagnostics is only signaled if the "Group diagnostics: Missing supply voltage L+" parameter has been activated.

USI structure = W#16#0003

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

Data block name		Content	Comment	Bytes
USI		W#16#0003	Manufacturer-specific diagnostics with failure of supply voltage L+ as of slot x	2
Followed by the slot as of which the supply voltage L+ has failed.				
	Slot	W#16#0001 to W#16#0020	Bit 8 to 15	1
			Bit 0 to 7	1
Followed by 2 reserved bytes:				
	Reserved			1
	Reserved			1

USI structure = W#16#0004

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

Data block name		Content	Comment	Bytes
USI		W#16#0004	Manufacturer-specific diagnostics with missing server module Result: Station stop • The I/O modules fail → substitute value behavior • The interface module continues to exchange data with the IO controller.	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		Content	Comment	Bytes
USI		W#16#0005	Manufacturer-specific diagnostics if more than one I/O module has been pulled. The number of pulled I/O modules is displayed. Result: Station stop • The I/O modules fail → substitute value behavior • The interface module continues to exchange data with the IO controller.	2
The number of pulled I/O modules follows				
	Quantity	W#16#0002 to W#16#0020	Bit 8 to 15	1
			Bit 0 to 7	1
Followed by 2 reserved bytes:				
	Reserved			1
	Reserved			1

USI structure = W#16#0006

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

Data block name		Content	Comment	Bytes
USI		W#16#0006	Manufacturer-specific diagnostics if an I/O module is installed on an incorrect BaseUnit. Result: Station stop • The I/O modules fail → substitute value behavior • The interface module continues to exchange data with the IO controller.	2
Followed by the slot for the I/O module:				
	Slot	W#16#0001 to W#16#0020	Bit 8 to 15	1
			Bit 0 to 7	1
Followed by 2 reserved bytes:				
	Reserved			1
	Reserved			1

USI structure = W#16#0007

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

Data block name		Content	Comment	Bytes
USI		W#16#0007	Manufacturer-specific diagnostics if operation is not possible with existing bus configuration Result: Station stop • The I/O modules fail → substitute value behavior • The interface module continues to exchange data with the IO controller	2
Followed by the slot for the I/O module:				
	Slot	W#16#0001 to W#16#0040	Bit 8 to 15	1
			Bit 0 to 7	1
If slot 0 is specified, check the width of the station configuration (maximum 1 m).				
Followed by 2 reserved bytes:				
	Reserved			1
	Reserved			1

5.3.4 Invalid configuration states of the ET 200SP on PROFINET IO

Invalid configuration states

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

- Number of modules exceeds maximum configuration
- Faulty backplane bus (e.g. defective BaseUnit). ET 200SP backplane bus interruptions do not trigger an interrupt.
- At least one I/O module is installed in a different BaseUnit than the one configured in the parameters.
- Missing server module
- Invalid or incorrectly configured BusAdapter

Note

If you drag more than one I/O module or the server module the node will stop. All I/O modules of the ET 200SP distributed I/O system fail (substitute value behavior) but the interface module is still exchanging data.

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

See also

Status and error displays (Page 26)

Channel diagnostics (Page 35)

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

Failure of the supply voltage L+

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

- If an I/O module is removed during failure of the supply voltage, a pull alarm is generated.
- If an I/O module is installed during failure of the supply voltage, an insert alarm is generated.

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

STOP of the SIMATIC IO controller

Diagnostics frames received from the IO device while the IO controller is in STOP do not initiate a call of any corresponding OBs when the IO controller goes into RUN. You must read the data record $E00C_H$ with the "RDREC" instruction in OB 100. This record contains all diagnostics for the slots assigned to an IO controller in an IO device.

Recovery of the SIMATIC IO devices

If you want to read the diagnostics of a station after its return, you have to read the $E00C_H$ data record with the "RDREC" instruction in OB 86. This record contains all diagnostics for the slots assigned to an IO controller in an IO device.

Compatibility

6

GSD file

The following table describes the use of the different GSD files with the interface modules and the changes.

Config-ured/plugged IM	IM 155-6 ST				Changes compared to the previous configuration
	V1.0.x	V1.1.x	V3.1.x	V3.3.x	
V1.0	Yes	Yes	Yes	Yes	
V1.1	---	Yes	Yes	Yes	• The "Group diagnostics: Missing supply voltage L+" parameter can be set on the server module • "Status of supply voltage L+ of the I/O modules" can be configured on the server module
V3.1	---	---	Yes	Yes	• User data 512 bytes • Station extension via ET-Connection
V3.3	---	---	---	Yes	• Support of submodules

Status of the supply voltage

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

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

Modules	Article number
DI 8x24VDC ST	6ES7132-6BF00-0BA0
DI 16x24VDC ST	6ES7131-6BH00-0BA0
DI 8x24VDC HF	6ES7132-6BF00-0CA0
DQ 4x24VC/2A ST	6ES7132-6BD20-0BA0
DQ 8x24VDC/0,5A ST	6ES7132-6BF00-0BA0
DQ 16x24VDC/0,5A ST	6ES7132-6BH00-0BA0
DQ 8x24VDC/0,5A HF	6ES7131-6BF00-0CA0

Reaction times for fail-safe modules

The following maximum reaction time of the interface module must be taken into account when calculating the reaction times of fail-safe modules:
maximum reaction time = configured update time + 400 µs (but at least 1.4 ms)

Technical specifications

7

Technical specifications of the IM 155-6 PN ST

	6ES7155-6AU00-0BN0
General information	
Product type designation	IM 155-6 PN ST with server module
Firmware version	V3.3
Product function	
I&M data	Yes; I&M0 to I&M3
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V13 SP1
STEP 7 can be configured/integrated as of version	V5.5 SP4 or higher
PROFINET as of GSD version/GSD revision	V2.3 / -
Configuration control	
Via data record	Yes
Supply voltage	
Rated value (DC)	24 V
Valid range, low limit (DC)	19.2 V
Valid range, high limit (DC)	28.8 V
Reverse polarity protection	Yes
Power and voltage failure backup	
Power/voltage failure backup time	5 ms
Input current	
Current consumption, max.	450 mA
Power loss	
Power loss, typ.	1.9 W
Address area	
Address space per module	
Address space per module, max.	256 bytes; per input/output
Address space per station	
Address space per station, max.	512 bytes; depending on configuration
Hardware configuration	
Rack	
Modules per rack, max.	32; + 16 ET 200AL modules

	6ES7155-6AU00-0BN0
Interfaces	
Number of PROFINET interfaces	1; 2 ports (switch)
1st interface	
Interface hardware	
• Number of ports	2
• Integrated switch	Yes
• BusAdapter (PROFINET)	Yes; usable BusAdapters: BA 2x RJ45, BA 2x FC
Protocols	
• PROFINET IO device	Yes
• Media redundancy	Yes; PROFINET MRP
Interface hardware	
RJ45 (Ethernet)	
10 Mbps	Yes; for Ethernet services
100 Mbps	Yes; PROFINET with 100 Mbps full duplex (100BASE-TX)
Transmission method	PROFINET with 100 Mbps full duplex (100BASE-TX)
Autonegotiation	Yes
Autocrossing	Yes
Protocols	
PROFINET IO device	
Services	
• Isochronous mode	No
• Open IE communication	Yes
• IRT	Yes; with send cycles between 250 µs and 4 ms in increments of 125 µs
• MRP	Yes
• MRPD	No
• PROFINET system redundancy	No
• PROFIenergy	Yes
• Prioritized startup	Yes
• Shared device	Yes
• Number of IO controllers with shared device, max.	2
Open IE communication	
TCP/IP	Yes
SNMP	Yes
LLDP	Yes

	6ES7155-6AU00-0BN0
Isochronous mode	
Isochronous mode (application synchronized up to terminal)	No
Interrupts/diagnostics/status information	
Status display	Yes
Interrupts	Yes
Diagnostics functions	Yes
Diagnostics indicator LED	
RUN LED	Yes; green LED
ERROR LED	Yes; red LED
MAINT LED	Yes; yellow LED
Monitoring of the supply voltage (PWR LED)	Yes; green LED
Connection display LINK TX/RX	Yes; 2x green LED
Electrical isolation	
Between backplane bus and electronics	No
Between PROFINET and all other circuits	Yes
Between supply and all other circuits	Yes
Permissible potential difference	
Between different circuits	75 V DC/60 V AC (basic insulation)
Insulation	
Insulation tested with	707 V DC between supply voltage and electronics; 1500 V AC between Ethernet and electronics
Standards, approvals, certificates	
Network loading class	3
Security level	According to Security Level 1 Test Cases V1.1.1
Ambient conditions	
Ambient temperature during operation	
Horizontal mounting position, min.	0 °C
Horizontal mounting position, max.	60 °C
Vertical mounting position, min.	0 °C
Vertical mounting position, max.	50 °C
Connection technology	
ET-Connection	
Via BU/BA-Send	Yes; + 16 ET 200AL modules
Dimensions	
Width	50 mm
Height	117 mm
Depth	74 mm
Weights	
Weight, approx.	147 g; without BusAdapter

Technical specifications of the BusAdapter BA 2×RJ45

Table 7- 1 Technical specifications of the BusAdapter BA 2×RJ45

	6ES7193-6AR00-0AA0
Interfaces	
PROFINET IO	
Number of PROFINET interfaces	1
RJ45	Yes; 2 x
Cable length	
• Copper cables	100 m
Dimensions	
Width	20 mm
Height	69.5 mm
Depth	59 mm
Weights	
Weight, approx.	46 g

Technical specifications of the BusAdapter BA 2×FC

Table 7- 2 Technical specifications of the BusAdapter BA 2×FC

	6ES7193-6AF00-0AA0
Interfaces	
PROFINET IO	
Number of PROFINET interfaces	1
FC (FastConnect)	Yes; 2 x
Cable length	
• Copper cables	100 m
Dimensions	
Width	20 mm
Height	69.5 mm
Depth	59 mm
Weights	
Weight, approx.	53 g

Dimension drawing

A

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

Figure A-1 Dimension drawing of the IM 155-6 PN ST interface module (front and side view)