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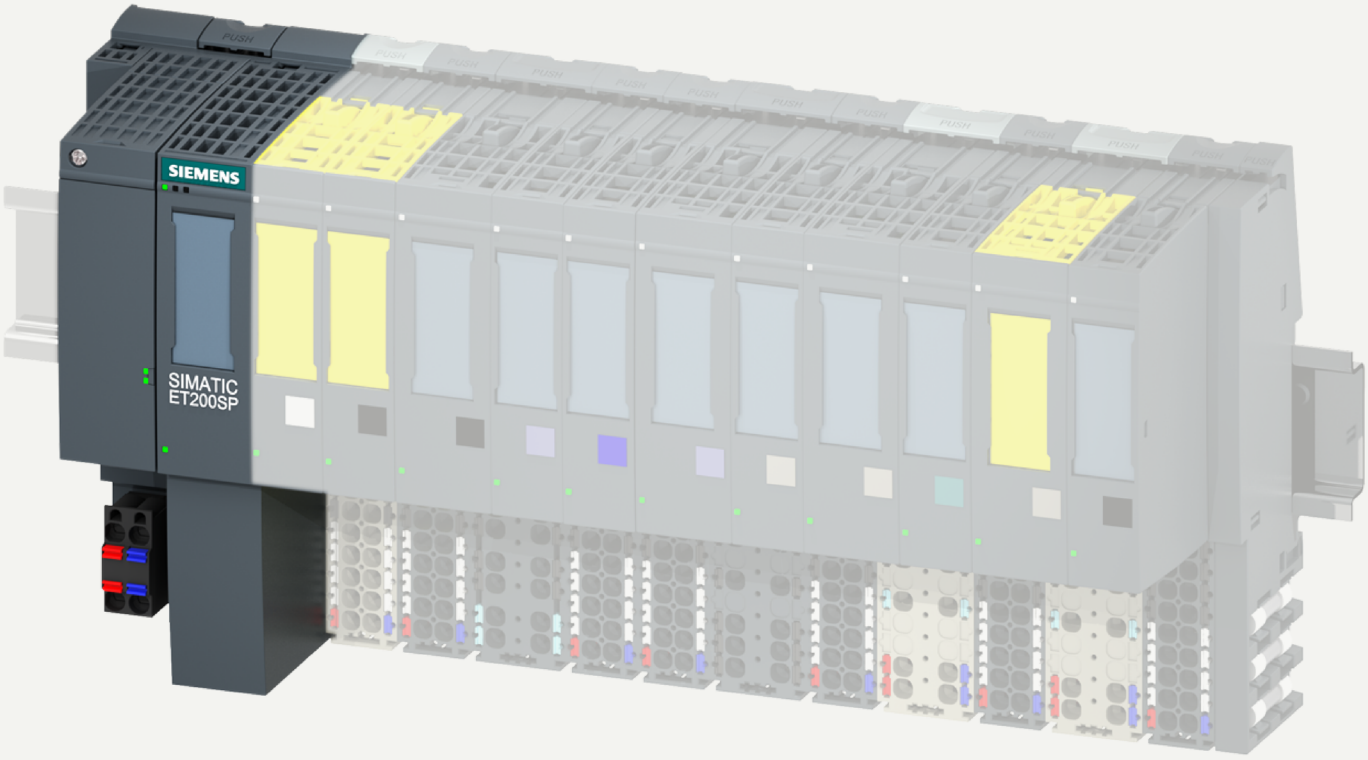


Edition 11/2023

Equipment Manual

# SIMATIC

## ET 200SP

Interface module IM 155-6 PN ST
(6ES7155-6AU02-0BN0)

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# SIMATIC

# ET 200SP
# IM 155-6 PN ST Interface Module (6ES7155-6AU02-0BN0)

Equipment Manual




11/2023
A5E53132379-AA

# Legal information

## Warning notice system

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

**⚠ DANGER**

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

**⚠ WARNING**

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

**⚠ CAUTION**

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

**NOTICE**

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

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

## Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified 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.

## Proper use of Siemens products

Note the following:

**⚠ WARNING**

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

## Trademarks

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

## Disclaimer of Liability

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

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# Table of contents

# Introduction

# 1

## 1.1 Introduction

### Purpose of the documentation

This equipment 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 the system manual.

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

### Conventions

CPU: When the term "CPU" is used hereinafter, it applies to the CPUs of the S7-1500 automation system as well as to the CPUs/interface modules of the ET 200SP distributed I/O system.

STEP 7: In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

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 and on the section of the documentation to which particular attention should be paid.

### Recycling and disposal

For environmentally sustainable 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.

# 1.2 ET 200SP Documentation Guide

## 1.2.1 ET 200SP Documentation Guide

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.

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

### 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.

Examples:

- ET 200SP System Manual
- System Manual ET 200SP HA/ET 200SP modules for devices used in a hazardous area
- Online help TIA Portal

### Device information

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

Examples:

- Equipment Manuals CPUs
- Equipment Manuals Interface Modules
- Equipment Manuals Digital Modules
- Equipment Manuals Analog Modules
- Equipment Manuals Motor Starter
- BaseUnits Equipment Manuals
- Equipment Manual Server Module
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules

### General information

The function manuals contain detailed descriptions on general topics relating to the SIMATIC ET 200SP distributed I/O system.

Examples:

- Function Manual ET 200AL/ET 200SP Mixed Configuration
- Function Manual Diagnostics
- Function Manual Communication
- PROFINET Function Manual
- PROFIBUS Function Manual
- Function Manual Designing Interference-free Controllers
- MultiFieldbus Function Manual

### Product Information

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

You can find the latest Product Information on the ET 200SP distributed I/O system on the Internet. (https://support.industry.siemens.com/cs/de/en/view/73021864)

### Manual Collection ET 200SP

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

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

## 1.2.2 SIMATIC Technical Documentation

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

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

### Overview of the SIMATIC Technical Documentation

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

Industry Online Support International (https://support.industry.siemens.com/cs/ww/en/view/109742705)

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

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

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

### Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
   - Industry Online Support International: (https://support.industry.siemens.com)

     The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
   - ID link:

     Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

## Updating the documentation

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

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

## mySupport

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

| | |
|---|---|
| **Registration** | You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace. |
| **Support requests** | Your data is already filled out in support requests, and you can get an overview of your current requests at any time. |
| **Documentation** | In the Documentation area you can build your personal library. |
| **Favorites** | You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries. |
| **Recently viewed articles** | The most recently viewed pages in mySupport are available under "Recently viewed articles". |
| **CAx data** | The CAx data area gives you access to the latest product data for your CAx or CAe system. You configure your own download package with a few clicks:<br>• Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files<br>• Manuals, characteristics, operating manuals, certificates<br>• Product master data |

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

## Application examples

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

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

### 1.2.3 Tool support

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

#### TIA Selection Tool

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

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

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

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

#### SINETPLAN

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

The advantages at a glance

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

You can find SINETPLAN on the Internet
(https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html).

#### See also

PRONETA Professional (https://support.industry.siemens.com/cs/ww/en/view/109781283)

# 1.3 MultiFieldbus Configuration Tool (MFCT)

## MultiFieldbus Configuration Tool

MultiFieldbus Configuration Tool (MFCT) is a PC-based software and supports the configuration of MultiFieldbus- and DALI-devices. In addition, the MFCT offers convenient options for mass firmware updates of ET 200 devices with MultiFieldbus- support and reading service data for many other Siemens devices.

**Functional scope of the MFCT**

- MultiFieldbus configuration:
  Engineering, configuration and diagnostics of MultiFieldbus-devices, provision of the required project files (project, UDT-, CSV- and EDS-file), transfer/export of the files to device and/or data memory.
- DALI configuration:
  Device selection and online configuration of DALI devices.
- TM FAST:
  Generation and download of FPGA-UPD- and FPGA-DB-files.
- Maintenance:
  Topology scan of a Ethernet network, reading of service data, parameter assignment and firmware update.
- Settings:
  Language switching German / English, network scanner speed, setting of the network adapter, installation of GSDML-and EDS-files.

**System/installation requirements for MFCT**

The MFCT runs under Microsoft Windows and does not require installation or administrator rights.

For MFCT you must also install the following software:

- Microsoft .NET Framework 4.8 (You can find an Offline Installer on the Internet. (https://support.microsoft.com/en-us/topic/microsoft-net-framework-4-8-offline-installer-for-windows-9d23f658-3b97-68ab-d013-aa3c3e7495e0))
- NPcap from directory "Misc"
- PG/PC interface from directory "Misc"
- Microsoft C++ Redistributable for x86-systems (you can find the installation data for download on the Internet. (https://aka.ms/vs/15/release/vc_redist.x86.exe))

The download of the tool and further information as well as documentation on the individual functions of the MFCT can be found on the Internet.
(https://support.industry.siemens.com/cs/ww/en/view/109773881)

# Industrial cybersecurity 2

## 2.1 Introduction to industrial cybersecurity

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

You can find more general information and measures on the subject of industrial cybersecurity in the ET 200SP Distributed I/O system System Manual.

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

## 2.2 Cybersecurity information

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

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

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

For more information on protective industrial cybersecurity measures for implementation, please visit (https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html).

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 at all times, subscribe to the Siemens Industrial Cybersecurity RSS Feed under (https://new.siemens.com/global/en/products/services/cert.html).

## 2.3 Cybersecurity-relevant information

Observe all cybersecurity-relevant information.

| Topics with relevant cybersecurity information | Reference |
|---|---|
| **Operational application environment and security assumptions** | |
| Requirements for the operational application environment of the system and security assumptions | You can find this section in the System Manual. |
| **Security properties of the product** | |
| Access protection | Also note the information on access protection in the Protection chapter of the System Manual. |
| Data integrity | The topic of data integrity is described in the Industrial cybersecurity section of the System Manual. |
| Signed firmware update | The topic of signed firmware updates is described in the Industrial cybersecurity section of the System Manual. |
| PROFINET Security Class 1<br>• The device supports PROFINET Security Class 1.<br>• With the introduction of PROFINET Security Class 1, additional security settings have been integrated into the PROFINET communication. | You can find detailed information about PROFINET Security Class 1 and additional security settings in the PROFINET with STEP 7 Function Manual (https://support.automation.siemens.com/WW/view/en/49948856). |
| Supported Ethernet services | You can find information on supported services in the Technical specifications (Page 50) section.<br>You can find detailed information about supported Ethernet services in the Communication Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59192925). |
| **Interfaces, ports, protocols and services** | |
| Information on the following is security related:<br>• Communications layer and communication role<br>• Default states<br>• Enabling/disabling of ports and services | You can find detailed information on these topics in the Communication Function Manual (https://support.industry.siemens.com/cs/ww/en/view/59192925). |
| **Secure operation** | |
| Recommendations for safe operation | You can find cross-system information on the safe operation of interface modules in the System Manual. |
| Corrective measures for known risks | Corrective measures for known risks are announced on the Siemens ProductCERT and Siemens CERT (https://siemens.com/productcert) web page.<br>For more information on SIEMENS ProductCERT, refer to the System Manual. |
| Security checks | You can find descriptions of specific security measures, such as cyclic checks of the configuration via checksums, in the Industrial cybersecurity section of the System Manual. |
| Secure decommissioning<br>Products that contain security-relevant data must be safely decommissioned before disposal or resale. | You can find information on safe decommissioning in the Safe operation of the system section of the System Manual. |

# Product overview

3

## 3.1 Properties

### Article number

6ES7155-6AU02-0BN0 (IM 155-6 PN ST interface module and server module)

6ES7155-6AA02-0BN0 (IM 155-6 PN ST interface module with BusAdapter BA 2×RJ45 and server module)

### View of the module

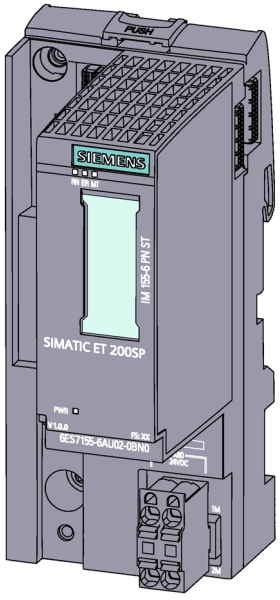



Figure 3-1 View of the IM 155-6 PN ST interface module

### Properties

The module has the following technical properties:

- Connects the ET 200SP distributed I/O system with PROFINET IO
- Power supply 1 L+ 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), for standard M12 connector or push-pull connector (BA 2xM12) or for direct connection of the bus cable (BA 2×FC)
- Use of fail-safe modules

The module supports the following functions (Page 17):

## Maximum configuration

- 32 ET 200SP I/O modules + 16 ET 200AL modules
- 1440 bytes I/O data
- 1 m backplane bus (without interface module)

## Accessories

The following accessories can be ordered separately:

- BA 2×RJ45 BusAdapter for RJ45 bus cable connector
- BA 2×FC BusAdapter for direct connection of the bus cable
- BA 2xM12 BusAdapter for bus cable with standard M12 connector
- 24 V DC connector
- Labeling strips
- Reference identification label
- Strain relief
- M12 unlatching straps
- SIMATIC system rail

**Note**

The interface module is also available as a bundle with the BusAdapter BA 2xRJ45 (and the server module). The article number is 6ES7155-6AA02-0BN0.

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 support for 3 spare fuses (5 × 20 mm)
- Provides station functions, e.g. group diagnostics: No supply voltage L+, status bytes.
- 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

**Note**

**First BaseUnit of an ET 200SP in the configuration**

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

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

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

## 3.2 Functions

### Introduction

The interface module supports the following PROFINET IO functions:

- Integrated switch with 2 ports
- Supported Ethernet services: ICMP, ARP, SNMP, LLDP
- Port diagnostics
- Disabling ports
- Isochronous real-time communication
- Minimum update time 1 ms
- Prioritized startup
- Media redundancy (MRP)
- Shared device
- Distribution of module channels to a maximum of 4 submodules
- Module-internal Shared Input/Shared Output (MSI/MSO)
- Device replacement without programming device (PG) and without topological configuration
- Reset to factory settings via PROFINET IO or RESET button
- 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
  - For standard M12 connector or push-pull connector BA 2xM12
- Identification data I&M 0 to 4
- PROFIenergy
- Use of fail-safe modules
- Configuration control (option handling)
- Value status (quality information, QI) of I/O modules
- Reading out service data
- Reference temperature distribution
- Setting the time
- Diagnostic interrupts
- Hardware interrupts
- Removal/insertion of multiple I/O modules during operation (Multi Hot Swap)
- Maintenance events

## Requirements

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

Table 3- 1 Version dependencies of other module functions

| Function | Functional status 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 SP4 with HSP329 | STEP 7 (TIA Portal) as of V18 with HSP 415 |
| Supported Ethernet services: ICMP, ARP, SNMP, LLDP | 1 | V6.1.0 | X | X | X |
| Port diagnostics | 1 | V6.1.0 | X | X | X |
| Disabling ports | 1 | V6.1.0 | X | X | X |
| Real-time communication | 1 | V6.1.0 | X | X | X |
| Isochronous real-time communication | 1 | V6.1.0 | X | X | X |
| Minimum update time 1 ms | 1 | V6.1.0 | X | X | X |
| Prioritized startup | 1 | V6.1.0 | X | X | X |
| Media redundancy (MRP) | 1 | V6.1.0 | X | X | X |
| Shared device | 1 | V6.1.0 | X | X | X |
| Distribution of module channels to a maximum of 4 submodules | 1 | V6.1.0 | X | X | X |
| Module-internal Shared Input/Shared Output (MSI/MSO) | 1 | V6.1.0 | X | X | X |
| Device replacement without programming device (PG) and without topological configuration | 1 | V6.1.0 | X | X | X |
| Reset to factory settings via PROFINET IO | 1 | V6.1.0 | X | X | X |
| Firmware update via PROFINET IO | 1 | V6.1.0 | X | X | X |
| Station extension via ET-Connection | 1 | V6.1.0 | X | X | X |
| Identification data I&M 0 to I&M 4 | 1 | V6.1.0 | X | X | X |
| PROFIenergy | 1 | V6.1.0 | --- | X | X |
| Use of fail-safe modules | 1 | V6.1.0 | X | X | X |
| Configuration control (option handling) | 1 | V6.1.0 | X | X | X |
| Value status (quality information, QI) of I/O modules | 1 | V6.1.0 | X | X | X |

| Function | Functional | Firmware ver- | Configuration software | | |
|---|---|---|---|---|---|
| Reading out service data | 1 | V6.1.0 | - | X | X |
| Reference temperature distribution | 1 | V6.1.0 | X | X | X |
| Setting the time | 1 | V6.1.0 | X | X | X |
| Time distribution | 1 | V6.1.0 | X | X | X |
| Diagnostic interrupts | 1 | V6.1.0 | X | X | X |
| Hardware interrupts | 1 | V6.1.0 | X | X | X |
| Removal/insertion of multiple I/O modules during operation (Multi Hot Swap) | 1 | V6.1.0 | X | X | X |
| Maintenance events | 1 | V6.1.0 | X | X | X |
| User data<br>• MaxApplicationInputLength 1440 bytes<br>• MaxApplicationOutputLength 1440 bytes | 1 | V6.1.0 | X | X | X |

[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 must 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 PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) system manual

## Replacement of an IM 155-6 PN ST

In a replacement scenario, you reset an IO device that is already in operation to the as-delivered state using "Reset to factory settings". You can find more information in the ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293) system manual.

## 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.

## GSD file

An additional GSD file based on the schema version V2.25 is available for the previous PROFINET GSD files. This is only to be used when the engineering tool used does not support GSD files of the current schema version.

## 3.2.1 Supported Ethernet services: ICMP, ARP, SNMP, LLDP

### Supported Ethernet services: ICMP, ARP, SNMP, LLDP

The module supports the following standardized Ethernet services:

- **ICMP - Internet Control Message Protocol (RFC 792)**

ICMP is a protocol used to transmit informational and error messages over the Internet protocol.

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

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

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

SNMP is a protocol for transmitting management information across networks.

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

LLDP is a protocol for identifying neighboring devices.

## 3.2.2 Port diagnostics

### Port diagnostics

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

## 3.2.3 Disabling of ports

### Disabling of ports

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

## 3.2.4 Isochronous real-time communication

### 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 is also transmitted in time-synchronized intervals, unaffected by other high network loading (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 also as a sync master when configuring the IRT communication.

Otherwise, IRT- and RT-configured IO devices may fail if the sync master fails.

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 PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) system manual

## 3.2.5 Minimum update time 1 ms

### Minimum update time 1 ms

The shortest update cycle of IO data for this device is 1 ms. To achieve this value, the controller used must also support this time.

## 3.2.6 Prioritized startup

### Prioritized startup

Prioritized startup is a PROFINET IO function in a PROFINET IO system with IRT and RT communication. It reduces the time needed for correspondingly configured IO devices to return to cyclic user data exchange.

This function accelerates the startup of IO devices in the following cases:

- After recovery of supply voltage
- After station recovery
- After activation of IO devices

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 (https://support.industry.siemens.com/cs/ww/en/view/49948856) Function Manual.
- As of STEP 7 V5.5 in the PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127) System Manual.

## 3.2.7 Media redundancy protocol (MRP)

### Media redundancy protocol (MRP)

MRP is a function for ensuring 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 (TIA Portal) V12 in the PROFINET with STEP 7 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

## 3.2.8 Shared device

### 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. Assign each module or submodule to only one IO controller. Multiple assignment causes errors because the module or submodule is only available in the first controller.
- If you reconfigure the shared device configurations without the validity check mentioned above, you must commission ET 200SP again. This means you must download the projects of all involved IO controllers to the respective CPU again after reconfiguration. If necessary, perform a POWER OFF/POWER ON of the interface module.

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

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

**Note**

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

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

## 3.2.9 Support of submodules on suitable I/O modules

### Support of submodules on suitable I/O modules

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.

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

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

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

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

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

The Module-internal Shared Input function allows an input module to make its input data available to up to four IO controllers (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 four IO controllers. One IO controller has write access, while the other IO controllers can have read access to the same channels.

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

- As of STEP 7 V12, in the PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856) Function Manual

## 3.2.11 Device replacement without programming device (PG) and without topological configuration

### Device replacement without programming device (PG) and without topological configuration

#### Device replacement without topological configuration

In addition to both interface modules, the device name is also stored on the BusAdapter plugged into the interface module. A stored device name in each of the two BusAdapters is a prerequisite for a device exchange without topological configuration.

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

Table 3- 2 Scenarios for using the device name

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

Note the following constraints:

- When a BusAdapter is replaced, a device name stored in the BusAdapter is applied to the interface module after a POWER ON.
- Removal/insertion of the BusAdapter under voltage is not permitted.

#### Device replacement with topology configuration

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

- The device name does not need to be assigned with the programming device (PG).

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

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

You can find additional information in the STEP 7 online help and as of STEP 7 (TIA Portal) V12 in the PROFINET with STEP 7 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

## 3.2.12 Reset to factory settings via PROFINET IO

### Reset to factory settings

Resetting to factory settings deletes the device name both in the selected interface module and in the corresponding BusAdapter. The device name in the other interface module of the ET 200SP R1 station remains unchanged.

## 3.2.13 Firmware update via PROFINET IO

### Firmware update via PROFINET IO

You can find information on how to perform a firmware update in the ET 200SP Distributed I/O System system manual (https://support.industry.siemens.com/cs/ww/en/view/58649293).

## 3.2.14 Identification data I&M 0 to I&M 4

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

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

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

**Identification data (I&M0):** Manufacturer information about the module that can only be read. Some identification data is also printed on the housing of the module, for example article number and serial number.
**Maintenance data (I&M1, 2, 3):** Plant-dependent information, e.g. installation location. Maintenance data is created during configuration and downloaded to the module.
All modules of the ET 200SP distributed I/O system support identification data (I&M0 to I&M4).

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

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

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

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

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

IM4 is write-protected due to information integrity. You can find more information on the identification data I&M 0 to I&M 3 in the ET 200SP Distributed I/O System system manual (https://support.industry.siemens.com/cs/ww/en/view/58649293).

### 3.2.15 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.

### 3.2.16 Use of fail-safe modules

#### Properties

The IM 155-6 PN ST interface module 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.

## 3.2.17 Use of technology modules

### Technology modules

The IM 155-6 PN ST interface module 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).

## 3.2.18 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.

## 3.2.19 Value status of I/O modules

### Value status

The IM 155-6 PN ST interface module supports I/O modules with value status. The value status provides information about the validity of the individual process values.

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

## 3.2.20 Reading out service data

### Reading out service data

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

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

The service data is read out using the TCP protocol. A connection on port 102 is opened for this.

### Methods of reading service data

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

The download of the tool and additional information as well as documentation on the individual functions of the MFCT can be found on the Internet (https://support.industry.siemens.com/cs/de/de/view/109773881/en).

## 3.2.21 Reference temperature distribution

### Reference temperature distribution

Specific I/O modules require a reference temperature to compensate for temperature dependence. This device supports the function of distributing this temperature on the backplane bus. Up to 4 reference temperatures can be distributed.

## 3.2.22 Setting the time

The interface module supports time setting, for example, with AI Energy Meter 500VAC/CT HF (6ES7134-6PA01-0CU0).

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

## 3.2.23 Diagnostic interrupts

### Diagnostic interrupts

A diagnostic interrupt is a display of an error state.

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

For additional information, refer to the sections Interrupts and Alarms.

## 3.2.24 Hardware interrupts

### Hardware interrupts

According to the configuration, the I/O modules or the interface module trigger a hardware interrupt for certain events/states. When a hardware interrupt occurs, the CPU interrupts the execution of the user program and runs the assigned hardware interrupt OB. The event that triggered the interrupt is entered in the start information of the assigned hardware interrupt OB by the CPU.

## 3.2.25 Removal/insertion of multiple I/O modules during operation (Multi Hot Swap)

### Properties

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

**Note**

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

### Reference

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

## 3.2.26 Maintenance events

### Maintenance events

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

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

For additional information, refer to the sections Interrupts and Alarms.

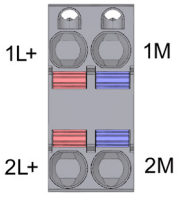
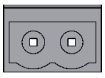
# Wiring

# 4

## 4.1 Pin assignment

### 24 V DC supply voltage (X80)

Table 4- 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

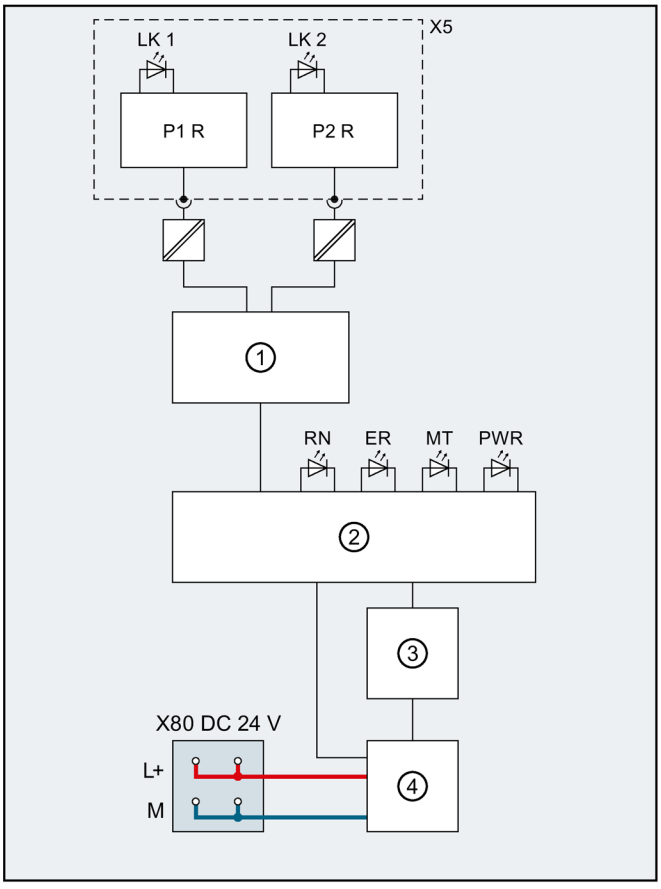
[2] Maximum 10 A permitted

### 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.

## 4.2 Schematic circuit diagram

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




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

Figure 4-1 Block diagram of the IM 155-6 PN ST interface module

# Parameters/address space

# 5

## 5.1 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 5- 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 |

## 5.2 Explanation of parameters

### 5.2.1 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.

## 5.3 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
  - 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

# 5.4 Status of the supply voltage L+ of the I/O modules

## Introduction

The "Status of supply voltage L+ of the I/O modules" is configured on the server module. 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 or the server module of 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 5-1 Status of the supply voltage L+

**Note**

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

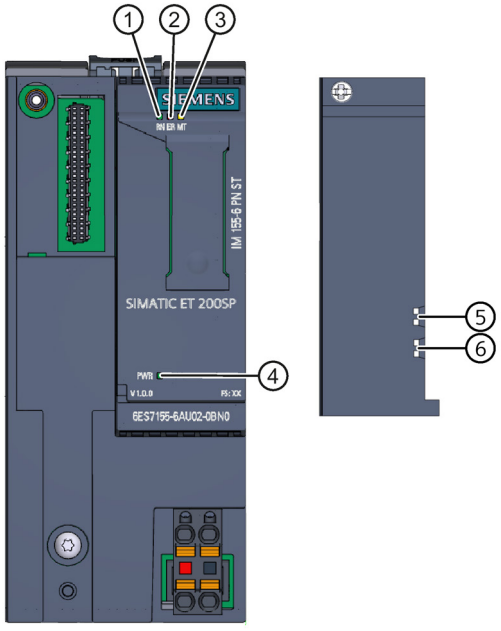
# Interrupts, diagnostics, error, and system messages

# 6

## 6.1 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 6-1 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 6- 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 switch 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 | Not relevant | Not relevant | 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 45) |
| | | | 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 43) |
| 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). | Restart the device by disconnecting and reconnecting the supply voltage.<br>Perform a firmware update.<br>If the error persists, contact Siemens Industry Online Support.<br>Replace the interface module.<br>You can read out the service data with TIA Portal as of V18 and MFCT. |

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

### PWR LED on the interface module

Table 6- 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 6- 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 or whether the port is disabled. |
| ■ 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 indicated on the interface module via the red ERROR LED and the yellow MAINT LED.

The following configuration errors are indicated by the LEDs:

- 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 6- 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 6- 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<br>• Interruptions at the backplane bus<br>• 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

## 6.2 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.

## 6.2.1 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.

## 6.2.2 Triggering a hardware interrupt

### Triggering a hardware interrupt

During a hardware interrupt, the CPU interrupts the processing of the user program and processes the hardware interrupt block, e.g. OB 40. The event that triggered the interrupt is entered in the start information of the hardware interrupt block.

**Note**

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

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

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

## 6.2.3 Triggering a swapping interrupt

### Triggering a swapping interrupt

In the event of a remove/insert interrupt, the CPU interrupts processing of the user program and processes the diagnostic block OB 83. The event which led to the interrupt is entered in the start information of the OB 83.

**Note**

**Parameter assignment error after removal/insertion**

If you write data records from the user program to the modules of the distributed I/O, make sure that these modules actually exist and are available. You can do this by evaluating OB83. After inserting a module, OB83 is not called until the module has started up and its parameters are assigned. This ensures that data record operations can be executed without errors.

## 6.2.4 Triggering of a maintenance event

### Triggering of a maintenance event

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

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

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

# 6.3 Alarms

## Introduction

The ET 200SP distributed I/O system generates the following alarms:

- Diagnostic alarms
- Maintenance alarms

## 6.3.1 Diagnostics alarms

### Actions after a diagnostics alarm

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

- The ERROR LED of the interface module flashes red.
- 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.

Table 6- 6 Diagnostics alarms, their meaning and possible remedies

| Diagnostics alarm | Channel Error Type (CET) | Extended Channel Error Type (ECET) | Associated value AddValue | Meaning / Cause | Remedy |
|---|---|---|---|---|---|
| Configuration error: Module parameter 'potential group' incorrect or wrong BaseUnit/TerminalBlock on real configuration slot <slot> | 0x0602 | 0x0691 | Slot | The configured BaseUnit or the terminal block does not match the real configuration. | Check for suitable base unit or terminal block. |
| **Configuration error:** Station stop - missing or wrong server module | 0x0602 | 0x0693 | - | No server module was plugged in during startup of an ET 200SP station. | Check that the server module is installed correctly in the rack. |
| **Configuration error:** Permitted size of backplane exceeded | 0x0602 | 0x0698 | - | The total width of the installed modules exceeds the permitted configuration length of 1 000 mm. | Check that the configuration of the backplane bus does not exceed the permitted size. |
| **Configuration error:** Incorrect backplane bus configuration in slot <slot> | 0x0602 | 0x0699 | Slot | The maximum power requirement of all installed modules exceeds 2 100 mA in total.<br>The associated value <slot> indicates the faulty slot. | Check backplane mounting. |

| Diagnostics alarm | Channel Error Type (CET) | Extended Channel Error Type (ECET) | Associated value AddValue | Meaning / Cause | Remedy |
|---|---|---|---|---|---|
| **Configuration error:** Invalid BusAdapter on the interface module | 0x0602 | 0x069C | - | The installed BusAdapter does not correspond to the configuration. | Check project planning and mounting of the correct BusAdapter. |
| **Load voltage error:** Missing voltage in load group at slot according channel number | 0x0610 | 0x6B0 | - | No supply voltage to the load group. | Check the load supply voltage of the modules. |

The scope of the diagnostics alarms displayed depends on the configuration and the parameter assignment.

If required, the standard can be downloaded from the Internet (http://www.profibus.com).

## See also

PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)

From PROFIBUS DP to PROFINET IO (http://support.automation.siemens.com/WW/view/en/19289930)

Example application (http://support.automation.siemens.com/WW/view/en/24000238)

I/O modules (http://support.automation.siemens.com/WW/view/en/55679691/133300)

PROFINET with STEP 7 V11 (http://support.automation.siemens.com/WW/view/en/49948856)

## 6.3.2 Maintenance events

### Maintenance alarms

Every time maintenance required is detected, a maintenance event is generated. The maintenance LED on the interface module lights up in yellow.

**Note**

Maintenance alarms have no direct influence on the function of the module.

Table 6- 7 Maintenance alarms, their meaning and possible remedies

| Maintenance alarm | Channel Error Type (CET) | Extended Channel Error Type (ECET) | Associated value AddValue | Meaning / Cause | Remedy |
|---|---|---|---|---|---|
| **Configuration error:** Missing or wrong server module | 0x0602 | 0x069E | - | When operating an ET 200SP station, the server module is pulled. | Check that the server module is installed correctly in the rack. |
| **Hardware error:** Failure on access of flash memory in base unit or in carrier module | 0x0640 | 0x06E0 | Slot | An error in the memory block on the BaseUnit was detected during operation. | Check if the base unit or the carrier module is mounted correctly into the rack or replace base unit or the carrier module. |
| **Hardware error:** Failure on access of flash memory in BusAdapter | 0x0640 | 0x06E1 | Slot | An error of the memory block of the BusAdapter was detected during operation. | Check if the BusAdapter is mounted correctly into the module or replace the BusAdapter. |
| **Hardware error:** Module resource limit has been reached | 0x0640 | 0x06E2 | Error code | The internal memory block was overloaded. Example: Increased memory requirements due to extreme overload via PROFINET (denial of service). | Read out the service data according to the description in the manual and send them to the SIEMENS Customer Support for root cause analysis. |

### 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.

## 6.3.3 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 V2.3.

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

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

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

| Slot number | ChannelError-Type (CET) | ExtendedChannel-ErrorType (ECET) | Associated value AddValue | Diagnostics |
|---|---|---|---|---|
| Module slot | 0x0602 | 0x0691 | Slot | Station stop - module parameter "Potential group" faulty or incorrect BaseUnit in actual slot (AddValue) |
| Slot 0 | 0x0602 | 0x0693 | 0x00 | Diagnostics with missing server module |
| | 0x0602 | 0x0698 | 0x00 | Diagnostics backplane bus too long |
| | 0x0602 | 0x0699 | Slot | Diagnostics with incorrect bus configuration |
| | 0x0602 | 0x069C | 0x00 | Diagnostics with incorrectly plugged BusAdapter |
| Server module slot | 0x0610 | 0x06B0 | 0x00 | Group diagnostics: Missing supply voltage L+ for the potential groups<br>Note: The slot in which the light-colored BaseUnit of the respective load module is located is coded in the "ChannelNumber" element. |
| - | 0x0190 | 0x012C | Signed firmware version | Security event: Firmware has been successfully downloaded and activated for installation. (New firmware version: <FW version>) |
| - | 0x0190 | 0x0193 | Signed firmware version | Security event: The firmware integrity checks failed. The new firmware version <FW version> was rejected.<br>• Verify if the firmware update file you are using comes from a secure source.<br>• Download the firmware again from the Siemens Support Web page.<br>• Repeat the firmware update. |

**Note**

Use advanced channel diagnostics instead of manufacturer-specific diagnostics. Manufacturer-specific diagnostics are backwards compatible.

## 6.3.4 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**

Removal of the server module will trigger a station stop. All I/O modules of the ET 200SP distributed I/O system fail (substitute value behavior) but the interface module 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 35)

Channel diagnostics (Page 44)

### 6.3.5 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.

### 6.3.6 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

# 7

## Compatibility between the versions of the IM 155-6 PN ST

The table below describes which version you can use in the configuration for which actually plugged version of the IM 155-6 PN ST interface module.

| Interface modules plugged | | Interface modules configured | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 155-6AU00-0BN0 | | | | 155-6AU01-0BN0 | | 155-6AU02-0BN0 |
| | | IM155-6 PN ST V1.0 | IM155-6 PN ST V1.1 | IM155-6PN ST V3.1 | IM 155-6 PN ST V3.3 | IM155-6 PN ST V4.1 | IM155-6 PN ST V4.2 | IM155-6 PN ST V6.1 |
| 155-6AU00-0BN0 | IM 155-6 PN ST, V1.0 | X | - | - | - | - | - | - |
| | IM 155-6 PN ST, V1.1 | X | X | - | - | - | - | - |
| | IM 155-6 PN ST, V3.1 | X | X | X | - | - | - | - |
| | IM 155-6 PN ST, V3.3 | X | X | X | X | - | - | - |
| 155-6AU01-0BN0 | IM 155-6 PN ST, V4.1 | X | X | X | X | X | - | - |
| | IM 155-6 PN ST, V4.2 | X | X | X | X | X | X | - |
| 155-6AU02-0BN0 | IM 155-6 PN ST, V6.1 | - | X | X | X | X | X | X |

## 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 | 6ES7131-6BF00-0BA0 |
| DI 16x24VDC ST | 6ES7131-6BH00-0BA0 |
| DI 8x24VDC HF | 6ES7131-6BF00-0CA0 |
| 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 | 6ES7132-6BF00-0CA0 |

## 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)**

# Operation and maintenance

# 8

## 8.1 Resetting interface module to factory settings with RESET button

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

### Requirement

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

### Tools required

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

### Procedure

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

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

## 8.2 Resetting interface module to factory settings with MFCT

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

Information on this is available in the "Resetting the MF device" section of the "MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209)" function manual.

## 8.3 Firmware update with MFCT

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

Information on this is available in the "MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209)" function manual in the section "Firmware update with MFCT".

# Technical specifications

# 9

## Technical specifications of the IM 155-6 PN ST

The following table lists the technical specifications as of the issue date. You can find a data sheet including daily updated technical specifications on the Internet (https://support.industry.siemens.com/cs/de/en/pv/6ES7155-6AU02-0BN0/td?dl=de).

| Article number | 6ES7155-6AU02-0BN0 |
|---|---|
| **General information** | |
| Product type designation | IM 155-6 PN ST |
| Firmware version | V6.1 |
| • FW update possible | Yes |
| Vendor identification (VendorID) | 002AH |
| Device identifier (DeviceID) | 0313H |
| Manufacturer ID according to ODVA (VendorID) | 04E3H |
| Device ID according to ODVA (Product code) | 0FA2H |
| **Product function** | |
| • I&M data | Yes; I&M0 to I&M4 |
| • Module swapping during operation (hot swapping) | Yes; Multi-hot swapping |
| • Isochronous mode | No |
| **Engineering with** | |
| • STEP 7 TIA Portal configurable/integrated from version | V18 |
| • PROFINET from GSD version/GSD revision | GSDML V2.43 |
| **Configuration control** | |
| via dataset | Yes |
| **Supply voltage** | |
| Rated value (DC) | 24 V |
| permissible range, lower limit (DC) | 19.2 V |
| permissible range, upper limit (DC) | 28.8 V |
| Reverse polarity protection | Yes |
| Short-circuit protection | Yes |
| **Mains buffering** | |
| • Mains/voltage failure stored energy time | 10 ms |
| **Input current** | |
| Current consumption (rated value) | 350 mA |
| Current consumption, max. | 450 mA |
| Inrush current, max. | 1 A |
| $I^2t$ | 0.05 $A^2 \cdot s$ |

| Article number | 6ES7155-6AU02-0BN0 |
|---|---|
| **Power loss** | |
| Power loss, typ. | 1.8 W |
| **Address area** | |
| **Address space per module** | |
| • Address space per module, max. | 288 byte; For input and output data respectively |
| **Address space per station** | |
| • Address space per station, max. | 1 440 byte |
| **Hardware configuration** | |
| **Rack** | |
| • Quantity of operable ET 200SP modules, max. | 32 |
| • Quantity of operable ET 200AL modules, max. | 16 |
| **Submodules** | |
| • Number of submodules per station, max. | 256 |
| **Interfaces** | |
| Number of PROFINET interfaces | 1; 2 ports (switch) |
| **1. Interface** | |
| **Interface types** | |
| • RJ 45 (Ethernet) | Yes; with BusAdapter |
| • Number of ports | 2; with BusAdapter |
| • integrated switch | Yes |
| • BusAdapter (PROFINET) | Yes; BA 2x RJ45, BA 2x FC, BA 2x M12 |
| **Protocols** | |
| • PROFINET IO Device | Yes |
| • Open IE communication | Yes |
| • Media redundancy | Yes; PROFINET MRP client |
| **PROFINET IO Device** | |
| **Services** | |
| – IRT | Yes; 250 µs to 4 ms in 125 µs frame |
| – PROFIenergy | Yes |
| – Prioritized startup | Yes |
| – Shared device | Yes |
| – Number of IO Controllers with shared device, max. | 4 |
| **Interface types** | |
| **RJ 45 (Ethernet)** | |
| • Transmission procedure | PROFINET with 100 Mbit/s full duplex (100BASE-TX) |
| • 100 Mbps | Yes |
| • Autonegotiation | Yes |
| • Autocrossing | Yes |

| Article number | 6ES7155-6AU02-0BN0 |
|---|---|
| **Protocols** | |
| Modbus TCP | No |
| **Redundancy mode** | |
| • PROFINET system redundancy (S2) | No |
| **Media redundancy** | |
| – MRP | Yes |
| – MRPD | No |
| **Open IE communication** | |
| • TCP/IP | Yes |
| • SNMP | Yes |
| • LLDP | Yes |
| **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 |
| • Monitoring of the supply voltage (PWR-LED) | Yes; green PWR LED |
| • Connection display LINK TX/RX | Yes; 2x green link LEDs on BusAdapter |
| **Potential separation** | |
| between backplane bus and electronics | No |
| between PROFINET and all other circuits | Yes; 1500 V AC (type test) |
| between supply and all other circuits | No |
| **Permissible potential difference** | |
| between different circuits | Safety extra low voltage SELV |
| **Isolation** | |
| Isolation tested with | 707 V DC (type test) |
| **Standards, approvals, certificates** | |
| Network loading class | 3 |
| **product functions / security / header** | |
| PROFINET Security Class | 1 |
| signed firmware update | Yes |
| Secure Boot | No |
| safely removing data | Yes |
| data integrity | Yes |
| **Ambient conditions** | |
| **Ambient temperature during operation** | |
| • horizontal installation, min. | -30 °C; No condensation |
| • horizontal installation, max. | 60 °C |
| • vertical installation, min. | -30 °C; No condensation |
| • vertical installation, max. | 50 °C |

| **Article number** | **6ES7155-6AU02-0BN0** |
|---|---|
| **Altitude during operation relating to sea level** | |
| • Installation altitude above sea level, max. | 5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200SP system manual |
| **connection method** | |
| **ET-Connection** | |
| • via BU/BA Send | Yes; + 16 ET 200AL modules |
| **Mechanics/material** | |
| Strain relief | Yes; Optional |
| **Dimensions** | |
| Width | 50 mm |
| Height | 117 mm |
| Depth | 74 mm |
| **Weights** | |
| Weight, approx. | 120 g; without BusAdapter |

# Dimension drawing

# A

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

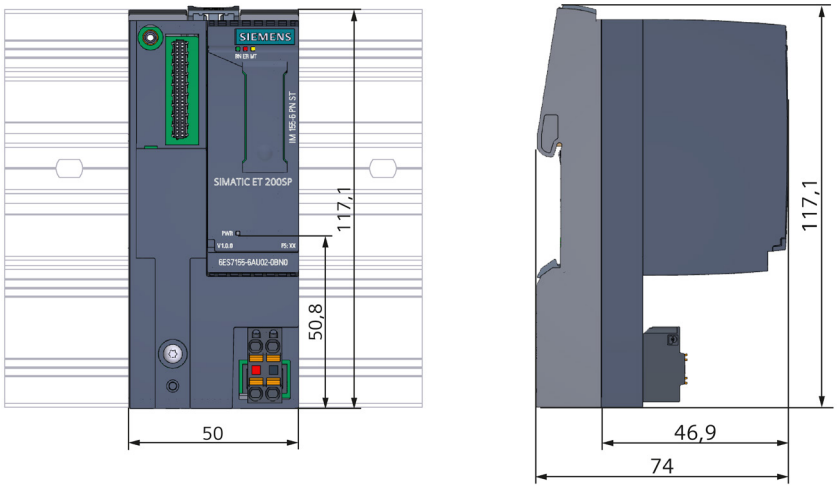



Figure A-1 Dimension drawing of the IM 155-6 PN ST interface module (front and side view)