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SIMATIC

ET 200S distributed I/O IM 151-3 PN FO interface module (6ES7151-3BB23-0AB0)

Manual

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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
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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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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Preface

Preface

Purpose of the manual

This manual supplements the *ET 200S Distributed I/O System* Operating Instructions. Functions that apply to the ET 200S in general are described in the ET 200S distributed I/O system (<http://support.automation.siemens.com/WW/view/en/1144348>) operating instructions.

The information in this document along with the operating instructions will enable you to commission the ET 200S.

Basic knowledge required

To understand these operating instructions you should have general knowledge of automation engineering.

Scope of the manual

The manual applies to this ET 200S module. It describes the components valid at the time of publication.

The manual is valid for the IM151-3 PN FO ((6ES7151-3BB23-0AB0)) firmware version V7.0 and higher.

Changes since the previous version

The following changes have been implemented compared to the IM151-3 PN FO ((6ES7151-3BB23-0AB0)) Manual, Edition 03/2009, number A5E01062514-03:

- Shared device
- Media redundancy
- Option handling
- PROFlenergy
- LED display of the configuration and parameter assignment errors

Recycling and disposal

This ET 200S module is low in contaminants and therefore recyclable. For the environmentally-friendly recycling and disposal of your old device, please contact a company certified for the disposal of electronic waste.

Further support

If you have any questions relating to the products described in this manual and do not find the answers in this document, please contact your local Siemens representative or branch.

Your contact persons are listed in the Internet (<http://www.siemens.com/automation/partner>).

A guide to the technical documentation for the various SIMATIC products and systems is available in the Internet (<http://www.siemens.com/simatic-tech-doku-portal>).

The online catalog and ordering system are available in the Internet (<http://mall.automation.siemens.com>).

Training center

Siemens offers a series of courses that will help you get started with ET 200S and the SIMATIC S7 automation system. Please contact your regional training center or the central training center in D-90327, Nuremberg, Germany.

You will find more information in the Internet (<http://www.sitrain.com>).

Technical support

You can contact Technical Support for all industry automation products using the Internet web form (<http://www.siemens.com/automation/support-request>) for the support request.

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In addition to our documentation, we offer a comprehensive knowledge base on the Internet (<http://www.siemens.com/automation/service&support>).

There you will find:

- our newsletter, which keeps you up to date with the latest information about your products.
- the right documentation for you with our Service & Support search engine
- the bulletin board, a worldwide knowledge exchange for users and experts
- your local contact person for Automation & Drives through our contact database
- information about on-site services, repairs, spare parts and much more.

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Properties

1.1 IM 151-3 PN interface module (6ES7151-3BB23-0AB0)

Properties

The IM151-3 PN FO interface module has the following features:

- It interconnects ET 200S with PROFINET IO via fiber-optic cables.
- It prepares the data for the electronic modules and motor starters that are fitted.
- It supplies the rear panel bus.
- Integrated interfaces for plastic fiber-optic cables(POF) and fiber-optic cables (PCF)
- Transfer and backup of the device name on SIMATIC Micro Memory Card
- Updating firmware
 - Via SIMATIC Micro Memory Card
 - via PROFINET IO
- The reference potential M of the rated supply voltage of the IM151-3 PN FO to the mounting rail (protective conductor) is connected by an RC combination. This permits an ungrounded configuration.
- Interrupts
 - Diagnostic interrupts
 - Process interrupts
 - Insert/remove module interrupts
 - Maintenance interrupts
- Records for IO modules
- Option handling
- Identification data
- The maximum address space is 256 bytes I/O data.
- IM151-3 PN FO can be operated with up to 63 modules.
- Maximum distance between two PROFINET FO interfaces when using plastic fiber-optic cables (POF): 50 m and fiber-optic cables (PCF): 100 m or (PCF-GI): 250 m.
- The maximum bus length at the rear panel bus is 2 m.
- Summary of modules within one byte (packing)
- Use of fail-safe modules (PROFIsafe V2 or higher)

Properties via PROFINET IO

- Integrated switch with 2 ports
- Supported Ethernet services: ping, arp, Net diagnostics (SNMP) / MIB-2, LLDP;
- Port diagnostics
- Port disabling
- Isochronous Real-Time Communication (IRT communication)
- Minimum update time 250 µs
- Prioritized startup
- Device replacement without exchangeable media/programming device
- Shared device
- Media redundancy
- PROFINergy

Isochronous Real-Time Communication

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

- IRT option "high flexibility"

Maximum flexibility in planning and extending the system. It is not necessary to configure the topology.

- IRT option "high performance"

Topological configuration is required.

Note

IO controller as a Sync-Master at IRT communication with the IRT option "high performance"

We recommend also operating the IO controller as a Sync-Master if you configure the IRT communication with the option "high performance".

Otherwise, IRT and RT configured IO devices may fail if the Sync-Master fails.

Note

Quantity structure of modules up to EZ3 and IRT option "high performance"

The maximum address space is 146 bytes I/O data when the IRT option "high performance" is used. If you use a module with the product version EZ1, EZ2 or EZ3, you should limit the quantity structure to 146 bytes I/O data. Otherwise, communication may be interrupted.

For more information about configuring synchronized PROFINET devices in sync domains, refer to the STEP 7 online help and the PROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>) manual.

Requirements

The following conditions apply for a configuration with the IM151-3 PN FO(6ES7151-3BB23-0AB0) interface module:

- When operated with the IRT option "high performance", the IM151-3 PN FO can only be operated with STEP 7 V5.4 SP4 or higher.
- Topology configuration when you configure IRT with the option "high performance"

Prioritized startup

Prioritized startup denotes the PROFINET functionality for accelerating the startup of IO devices for RT and IRT communication within a PROFINET IO system.

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

- After the power supply has returned
- After a station has come back online
- After IO devices have been activated

Note

At a prioritized startup a firmware update using the Micro Memory Card is not possible. It is possible to perform a firmware update via the LAN network.

Note

Ramp-up time depends on the number and type of modules.

Cabling with fixed connection setting

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

For additional information, refer to the STEP 7 online help and the PROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>) manual.

Device replacement without exchangeable media/programming device

IO devices having this function can be replaced simply:

- An exchangeable medium (such as Micro Memory Card) with the stored device name is not required.
- The device name does not have to be assigned using the programming device.

Instead of being assigned a device name from the exchangeable medium or programming device, the inserted IO device now has a device name assigned to it by the IO controller. The IO controller uses the configured topology and the correlations derived from the IO devices. The configured setpoint topology must agree with the actual topology.

We recommend that you reset IO devices that have already been operated to their default settings before you use them again.

For additional information, refer to the STEP 7 online help and the PROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>) manual.

Reset to factory settings

NOTICE

The stations of a line can fail during the reset to factory settings.

Remanently stored SNMP parameters are reset to default settings (*STEP 7*V5.3 SP 3 and higher) in the HW Config dialog "Target system > Ethernet > Edit Ethernet nodes", "Reset" button at "Reset to factory settings".

The following data is **not** deleted during the reset:

- The MAC address
- The I&M0 data

Note

Deleting the device name

The device name is deleted by the "Reset to factory settings" function.

Note

Substitute value behavior at a reset to factory setting

At a "Reset to factory setting" the modules in the station take on the configured substitute value behavior or the non-configured state.

Media redundancy

Function for ensuring network and system availability. Redundant data transmission links (ring topology) ensure that an alternative communication path is made available if a transmission link fails.

For additional information, refer to the STEP 7 online help and the PROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>) manual.

Shared device

IO device which supplies multiple IO controllers with data.

The Shared Device function is not available with the IRT option "high flexibility".

Note

Please note that the power and electronics modules of a potential group must be assigned to the same IO controller so that a load voltage failure can be diagnosed.

For additional information, refer to the STEP 7 online help and the PROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>) manual.

Option handling

Option handling enables you to prepare your automation system for future extensions or options. Option handling means you configure the planned maximum configuration of your automation system in advance and can vary it later depending on the user program. Option handling exists with and without RESERVE modules and adding options.

You can find additional information in the Option handling (Page 23) section and in the STEP 7 online help.

PROFenergy

Function for energy saving in the process, for example, during pauses by briefly switching off the encoder and load supply to the potential group using standardized PROFenergy commands.

You will require the PM-E DC24V/8A RO power module.

For additional information, refer to the online help for STEP 7 and the manualPROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>).

For an example, see PROFenergy application example (<http://support.automation.siemens.com/WW/view/en/41986454>).

Compatibility with the predecessor module

IM151-3 PN FO(6ES7151-3BB23-0AB0) is compatible with IM151-3 PN FO(6ES7151-3BB22-0AB0).

The new interface module directly replaces the predecessor module in an existing system without the need for reconfiguration.

A IM151-3BB23 that has been in operation and is now to be used as a spare part must be "Reset to factory settings."

Firmware updates on the predecessor module are not supported.

Operational constraints

The following modules cannot be used with the IM151-3 PN FO:

Module	Up to order number	Up to product version
2AO U; HIGH FEATURE	6ES7135-4LB01-0AB0	3
2AO I; HIGH FEATURE	6ES7135-4MB01-0AB0	3
1SI 3964(R)/ASCII	6ES7138-4DF00-0AB0	4
1SI Modbus/USS	6ES7138-4DF01-0AB0	4
2PULSE	6ES7138-4DD00-0AB0	6
1Count 24V/100kHz	6ES7138-4DA03-0AB0	-
Motor starter <ul style="list-style-type: none"> • Direct starter • Reversing starter 		3RK1301-xxxxx-1AA1 3RK1301-xxxxx-1AA1

Pin assignment

The following table shows the pin assignment of the IM151-3 PN FO interface module for the 24 V DC voltage supply and of the SC RJ interfaces for PROFINET IO:

Table 1- 1 Pin assignment of the IM151-3 PN FO interface module

View	Signal name	Description
	①	Receiver/receive data
	②	Sender/transmit data
	1L+	24 V DC
	2L+	24 V DC (for loop through)
	1M	Ground
	2M	Chassis ground (for loop through)

Schematic circuit diagram

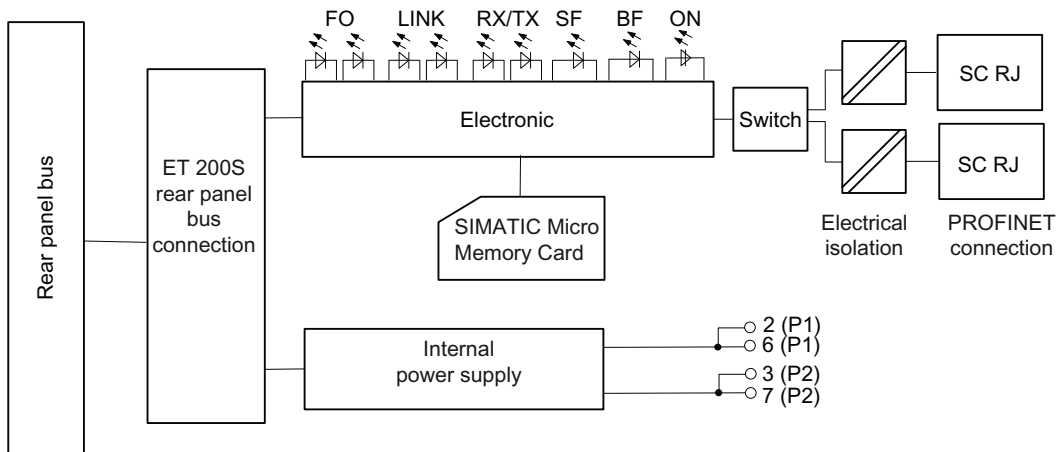


Figure 1-1 Block diagram of the IM151-3 PN FO interface module

Technical data IM151-3 PN FO(6ES7151-3BB23-0AB0)

Dimensions and weight	
Dimension B (mm)	60
Weight	Approx. 150 g
Module-specific specifications	
Data transmission rate	<ul style="list-style-type: none"> • 100 Mbps for Ethernet services • 100 Mbps full duplex for PROFINET IO
Transmission procedure	100BASE-FX
Send cycle	<ul style="list-style-type: none"> • IRT with the option "high performance" 250 μs to 4 ms in 125-μs increments • RT and IRT with the option "high flexibility": 250 μs, 500 μs, 1 ms
Autonegotiation	Yes
Autocrossing	Yes
Bus protocol	PROFINET IO
Supported Ethernet services	<ul style="list-style-type: none"> • ping • LLDP • arp • Net diagnostics (SNMP)/MIB-2 • Prioritized startup • Media redundancy • Shared device
PROFINET interface	2x SC RJ
Manufacturer ID (VendorID)	002A _H
Device ID (DeviceID)	0301 _H
Voltages, currents, potentials	
Rated supply voltage of the electronic components (1L+)	24 V DC
<ul style="list-style-type: none"> • Incorrect polarity protection 	Yes
<ul style="list-style-type: none"> • Power failure bypass 	Min. 20 ms
Galvanic isolation	
<ul style="list-style-type: none"> • Between the rear panel bus and electronic components 	No
<ul style="list-style-type: none"> • Between Ethernet and electronic components 	Yes
<ul style="list-style-type: none"> • Between the supply voltage and electronic components 	No
Permitted potential difference (to the rail)	75 V DC/60 V AC
Insulation test voltage	500 V DC
Current consumption from rated supply voltage (1L+)	Approx. 200 mA
Power dissipation of the module	Approx. 5 W

Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostic function	Yes
• Batch error	Red LED "SF"
• Bus monitoring PROFINET IO	Red "BF" LED
• Monitoring of the supply voltage of the electronics	Green "ON" LED
• FO port diagnostics	One yellow LED "FO" per port
• Existing connection to network	One green LED "LINK" per port
• Maintenance demanded (maintenance)	Yellow "maint" LED
• Transmitting/receiving data on the network	One yellow LED "RX/TX" per port

See also

Service & Support (http://www.siemens.com/automation/csi_en_WW/support)

1.2 SNMP

SNMP

The interface module supports the Ethernet service SNMP. MIB-2 (RFC1213) is supported. R/W objects can be changed using SNMP tools and are stored in the module.

Following replacement with a brand new module, the R/W objects of the interface module are set to the factory settings.

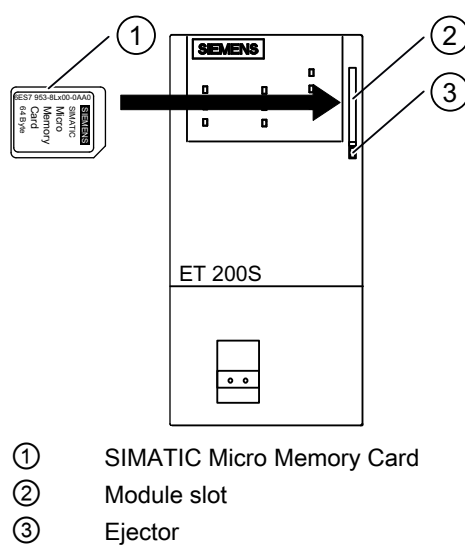
1.3 SIMATIC Micro Memory Card

SIMATIC Micro Memory Card (MMC) as memory medium

A SIMATIC Micro Memory Card is used as a memory medium for the IM 151-3 PN FO. A SIMATIC Micro Memory Card with 64 KB is sufficient for storing the name of the device.

An MMC of 4 MB or higher is required for a firmware update.

Position of the module slot for the SIMATIC Micro Memory Card



Insertion of the SIMATIC Micro Memory Card

Note

You can save **either** process-related data (device names) **or** firmware update data on **one** MMC.

Service life of a SIMATIC Micro Memory Card

The service life of a SIMATIC Micro Memory Card essentially depends on the following factors:

- Number of deletion or programming operations
- External factors, such as ambient temperature

At an ambient temperature of up to 60°C, a SIMATIC Micro Memory Card has a service life of 10 years, with a maximum of 100,000 write/delete operations.

NOTICE
Possible data loss
If the maximum number of write/delete operations is exceeded, data loss is possible.

Available SIMATIC Micro Memory Cards

Table 1- 2 Available SIMATIC Micro Memory Cards

Description	As of order number	Memory size
SIMATIC Micro Memory Card 64k	6ES7953-8LFxx-0AA0	64 KB
SIMATIC Micro Memory Card 128k	6ES7953-8LGxx-0AA0	128 KB
SIMATIC Micro Memory Card 512k	6ES7953-8LJxx-0AA0	512 KB
SIMATIC Micro Memory Card 2M	6ES7953-8LLxx-0AA0	2 MB
SIMATIC Micro Memory Card 4M	6ES7953-8LMxx-0AA0	4 MB
SIMATIC Micro Memory Card 8M	6ES7953-8LPxx-0AA0	8 MB

Inserting/replacing the SIMATIC Micro Memory Card

Note
 In order to ensure that it will function correctly, the SIMATIC Micro Memory Card must only be inserted or removed with the power turned off.

The beveled corner of the SIMATIC Micro Memory Card prevents it from being inserted the wrong way round (reverse polarity protection).

To eject the card, push in the ejector with a suitable object (such as a small screwdriver or ball-point pen).

1.4 Firmware update

Updating firmware

You can update the firmware of an IM151-3 PN FO:

- Using a SIMATIC Micro Memory Card with at least 4 MB of memory.

Additional information can be found on the Internet

(<http://support.automation.siemens.com/WW/view/en/19241998/133100>).

- Via PROFINET IO, e.g. using HW Config or in the SIMATIC Manager via "Target system > Display accessible nodes".

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

Requirements

To update the firmware of an IM151-3 PN FO, you need:

- *STEP 7*, V5.3 SP 2 or higher
- SIMATIC Micro Memory Card (MMC) for the MMC update
- A PC or programming device with a facility for writing to a SIMATIC Micro Memory Card

NOTICE
When the firmware is updated, the stations in a line can fail.

Note

A firmware update with SIMATIC Micro Memory Card is not possible for interface modules that were started with the "Prioritized startup" parameter. In this case you can delete the parameter "Prioritized startup" by a "Reset to factory settings". Firmware updating with the SIMATIC Micro Memory Card is subsequently possible again.

Parameter

2.1 Parameters for the IM151-3 PN FO interface module

Table 2- 1 Parameters for the IM151-3 PN FO interface module

IM151-3	Value range	Default setting	Applicability
Bus length	≤ 1 m/ > 1 m	≤ 1 m	ET 200S
Interference frequency suppression	50 Hz/60 Hz	50 Hz	ET 200S
Reference junction slot	None/2 to 63	None	ET 200S
Reference junction input	RTD on channel 0/ RTD on channel 1	0	ET 200S
Enable option handling	Yes/no	No	ET 200S

2.2 Parameter description

2.2.1 Bus length

≤ 1 m: The default setting for the maximum bus length is 1 m.

> 1 m: The bus length of the ET 200S is > 1 m and can be up to 2 m. However, this setting will increase the response time of the ET 200S.

2.2.2 Interference frequency suppression

The frequency of your AC power system can interfere with the measured value especially when measuring in low voltage ranges and using thermocouple elements. Enter the line frequency for your system here (50 Hz or 60 Hz).

The interference frequency suppression parameter applies to all analog electronic modules. This parameter is also used to specify the integration and conversion time of the various modules. See the technical data for the analog electronic modules.

2.2.3 Reference junction slot

This parameter allows you to assign a slot (none, 2 to 63) with a channel for measuring the reference temperature (calculation of the compensation value).

Reference

Refer to the *manuals* for the *analog electronic modules* for information on connecting thermocouples.

2.2.4 Reference junction input

This parameter can be used to set the channel (0/1) for measuring the reference temperature (calculation of the compensation value) for the assigned slot.

Reference

Refer to the *manuals* for the *analog electronic modules* for information on connecting thermocouples.

2.2.5 Enable option handling

Enable option handling

This parameter can be used to enable the option handling function in ET 200S.

Note

If you configure enabling, the ET 200S will require a control data record from the user program so that the station can operate the I/O modules.

Functions

3.1 Identification data for PROFINET IO

Definition

Identification data are data that are stored in a module for assisting the user in:

- checking the system configuration
- locating modified system hardware
- troubleshooting a system

Identification data enable modules to be uniquely identified online.

In *STEP 7*, the identification data are displayed in the "Module states - IM 151" and "Properties ..." tabs and are loaded to the modules with "Load module identification data..." under the menu command "Target system" (see *STEP 7* Online Help).

Identification data

You can directly access specific identification data by selecting **Read data record**. Obtain the corresponding part of the identification data under the associated data record index.

The data records are structured as follows:

Table 3- 1 Basic structure of data records with identification data for PROFINET IO

Contents	Length (bytes)	Coding (hex)
Header information		
BlockType	2	I&M0: 0020 I&M1: 0021 I&M2: 0022 I&M3: 0023
BlockLength	2	I&M0: 0038 I&M1: 0038 I&M2: 0012 I&M3: 0038
BlockVersionHigh	1	01
BlockVersionLow	1	00
Identification data		
Identification data (see table below)	I&M0 / Index AFF0: 54 I&M1 / Index AFF1: 54 I&M2 / Index AFF2: 16 I&M3 / Index AFF3: 54	

3.1 Identification data for PROFINET IO

The data structures in the data records correspond to the PROFINET IO definitions.

Table 3-2 Identification data for PROFINET IO

Identification data	Access	Default setting	Description
Identification data 0: (data record index AFF0 hex)			
VendorIDHigh	read (1 bytes)	00 hex	The name of the manufacturer is stored here. (42 dec = SIEMENS AG)
VendorIDLow	read (1 bytes)	2A hex	
Order_ID	read (20 bytes)		Order number of the module
IM_SERIAL_NUMBER	read (16 bytes)	-	Serial number (device specific)
IM_HARDWARE_REVISION	read (2 bytes)	1	Corresponding hardware version
IM_SOFTWARE_REVISION	read	Firmware version	Indicates the firmware version of the module.
• SWRevisionPrefix	(1 byte)	V, R, P, U, T	
• IM_SWRevision_Functional_Enhancement	(1 byte)	00 - FF hex	
• IM_SWRevision_Bug_Fix	(1 byte)	00 - FF hex	
• IM_SWRevision_Internal_Change	(1 byte)	00 - FF hex	
IM_REVISION_COUNTER	read (2 bytes)	0000	Provides information on the assigned changes on the module. (not used)
IM_PROFILE_ID	read (2 bytes)	0000	Generic device
IM_PROFILE_SPECIFIC_TYPE	read (2 bytes)	0005 hex	on interface modules
IM_VERSION	read	0101 hex	Provides information on the identification data version (0101 hex = version 1.1)
• IM_Version_Major	(1 byte)		
• IM_Version_Minor	(1 byte)		
IM_SUPPORTED	read (2 bytes)	000E hex	Provides information on existing identification data (I&M1 to I&M3)
Maintenance data 1: (data record index AFF1 hex)			
IM_TAG_FUNCTION	Read/write (32 bytes)	-	Define a unique identifier for the module in this record.
IM_TAG_LOCATION	Read/write (22 bytes)	-	Define the installation location of the module.
Maintenance data 2: (data record index AFF2 hex)			
IM_DATE	Read/write (16 bytes)	YYYY-MM-DD HH:MM	Enter the installation date of the module here.
Maintenance data 3: (data record index AFF3 hex)			
IM_DESCRIPTOR	Read/write (54 bytes)	-	Define a comment describing the module in this record.

3.2 Configuring port 1 and port 2

Introduction

The interface module IM151-3 PN FO has two ports, X1P1 and X1P2.

Configuring the ports in HW Config

Configure both ports in the "Properties of IM151-3 PN - Port..." dialog box of HW Config:

- Addresses tab: Diagnostic address of the respective port.
- Topology tab:
You can specify a port interconnection and the fiber-optic cable.
- Options tab:
To activate the port diagnostics, select the following for "Connection" under "Transmission Medium/Duplex": "Automatic settings (monitor)".
To deactivate the port diagnostics, select the following for "Connection" under "Transmission Medium/Duplex": "Automatic settings".

Reference

For more information about configuring, refer to the PROFINET system description (<http://support.automation.siemens.com/WW/view/en/19292127>) and the *STEP 7* online help.

3.3 Option handling

3.3.1 Option handling and control data record

Operating principle

Option handling is a procedure which allows distributed stations with different real configurations (options) to be operated on the basis of just one configuration. Option handling is available with and without RESERVE modules and adding options.

Requirements

The parameter "Enable option handling" must be selected during configuration. Control takes place via a control data record used to define the desired options. The station will not be operational without a control data record.

Option handling

Option handling is available with and without RESERVE modules and adding options.

Control data record

A control data record 196 containing a slot assignment is defined for option handling.

Table 3- 3 Control data record

Byte	Element	Coding	Explanation
0	Block length	4 + number of slots	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Assignment of configured slot 1	Real slot 1	Describes which real slot in the device has been assigned to the configured slot in each element. Bit 7 = 1: indicates that a RESERVE module is valid.
5	Assignment of configured slot 2	Real slot 2	
:	:	:	
4 + max. slot - 1	Assignment of configured maximum slot	Real maximum slot	

Each element must contain the following information about the slot:

- Assignment of configured slot ⇔ real slot
- A slot can be qualified as a reserve module

Table 3- 4 Control element coding

Bit	Meaning
0 ... 6	0: Module not available (option handling without reserve modules) 1: Real slot (1 ... maximum slot)
7	1: RESERVE module permitted (only for option handling with RESERVE modules)

Special features

There are certain specific aspects of which you must be aware:

- Remanent storage of control data set in the interface module.
- Slot entries outside the target configuration are disregarded.
- This also applies to modules assigned to another IO controller in the shared device.
- The control data record can be reduced, but it must contain all entries up to the last slot of the current target configuration.
- Each real slot may exist only once in the data record.

Note

Changed options

Writing a control data record with changed options will lead to station failure followed by a cold station restart with the changed options.

Combination of option handling and shared device

Option handling is controlled by the head module (slot 0/subslot 1). The option handling function in a shared device is reserved only for those modules of the IO controller that have subscribed to the head module. Modules which have been assigned to another IO controller are therefore not relevant in the control data record. 1 to 1 assignment is implicitly assumed for these modules.

If a reference junction is used (RTD module), you must ensure that the RTD module slot is not changed if you also require the reference junction in TC modules of the sharing IO controller.

Combination of option handling and PROFIenergy

If option handling is used together with PROFIenergy, you must ensure slot number consistency in the structure of data record 196 and data record 3 (PROFIenergy). This means that the slot number in data record 3 must match the real slot.

Error Messages

The control data record will return the following error messages, if necessary:

Error code	Meaning
0x80B1	Invalid length
0x80B5	Option handling not configured
0x80B8	Parameter error

3.3.2 Feedback data record

Feedback data record

The feedback data record is mapped via a separate data record, 197.

The feedback data record only exists for configured option handling. It always refers to the maximum quantity structure, which means 63 I/O slots. Partial reading is not possible.

Table 3- 5 Feedback data record

Byte	Element	Coding	Meaning
0	Block length	67	Header
1	Block ID	197	
2	Version	1	
3		0	
4	Status, slot 1	1	Bit 0 = 0: Reserve module, module removed or invalid
5	Status, slot 2	2	
:	:	:	Bit 0 = 1: Slot with correct module
66	Status, slot n	Maximum slot	Bit 1-7: Reserved

Error Messages

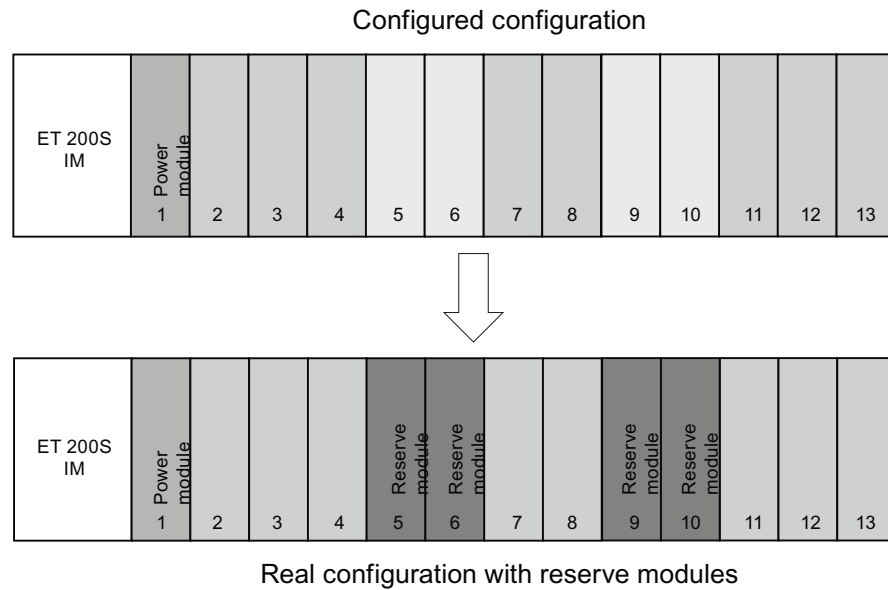
The feedback data record will return the following error messages, if necessary:

Error code	Meaning
0x80B1	Invalid length
0x80B5	Option handling not configured
0x80B8	Parameter error

3.3.3 Option handling when using RESERVE modules

Configuration versions

In option handling, the RESERVE modules will be inserted instead of the original modules in the slots that are not required.



Data record of the example

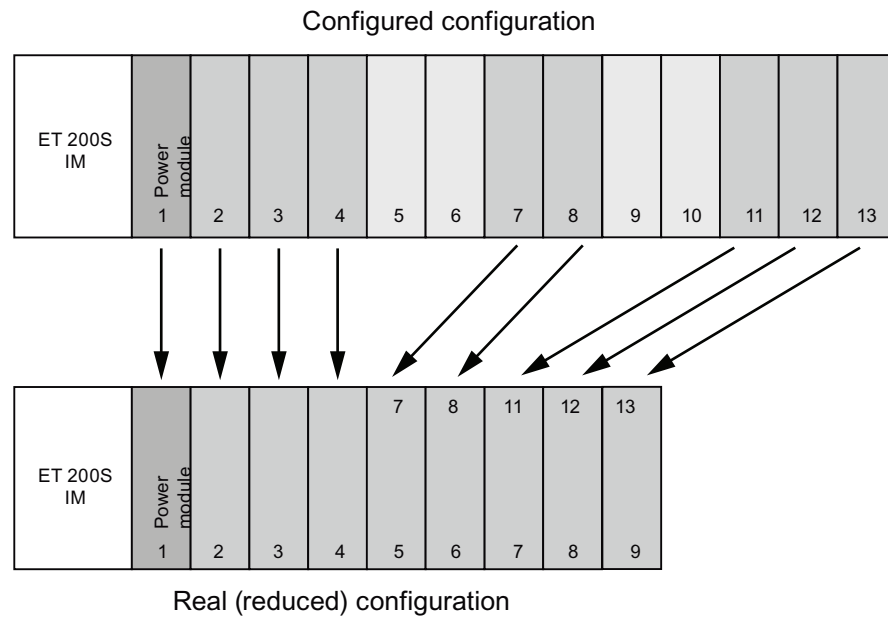
The following control data record structure applies for the example given above:

Byte	Element	Coding	Explanation
0	Block length	17	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Slot 1	1	The configured slot 1 is real slot 1.
5	Slot 2	2	The configured slot 2 is real slot 2.
6	Slot 3	3	The configured slot 3 is real slot 3.
7	Slot 4	4	The configured slot 4 is real slot 4.
8	Slot 5	5 + 0x80	The configured slot 5 is real slot 5 (and RESERVE module).
9	Slot 6	6 + 0x80	The configured slot 6 is real slot 6 (and RESERVE module).
10	Slot 7	7	The configured slot 7 is real slot 7.
11	Slot 8	8	The configured slot 8 is real slot 8.
12	Slot 9	9 + 0x80	The configured slot 9 is real slot 9 (and RESERVE module).
13	Slot 10	10 + 0x80	The configured slot 10 is real slot 10 (and RESERVE module).
14	Slot 11	11	The configured slot 11 is real slot 11.
15	Slot 12	12	The configured slot 12 is real slot 12.
16	Slot 13	13	The configured slot 13 is real slot 13.

3.3.4 Option handling without reserve modules

Configuration version

This version does not include the real modules that are not required. The configuration is compressed to the left towards IM151-3 PN.



Data record of the example

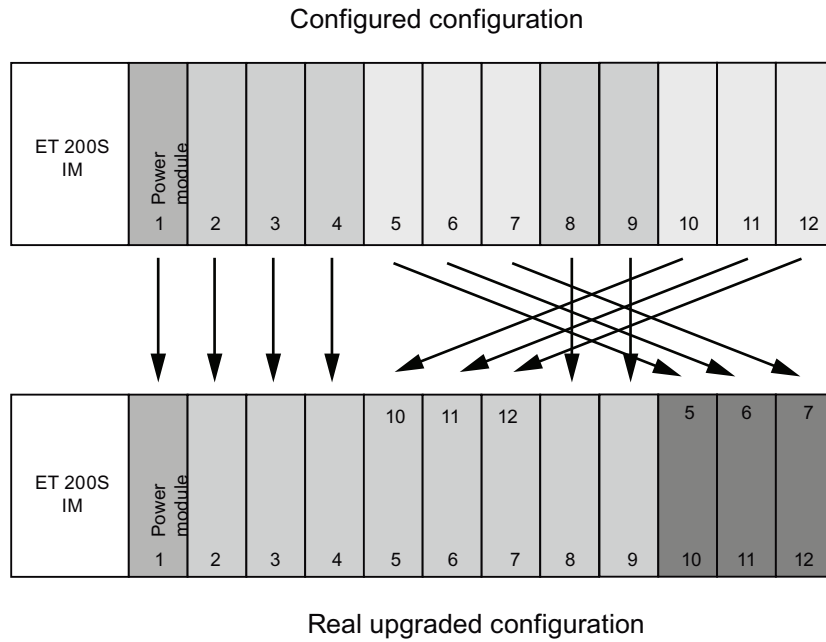
The following control data record structure applies for the example given above:

Byte	Element	Coding	Explanation
0	Block length	17	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Slot 1	1	The configured slot 1 is real slot 1.
5	Slot 2	2	The configured slot 2 is real slot 2.
6	Slot 3	3	The configured slot 3 is real slot 3.
7	Slot 4	4	The configured slot 4 is real slot 4.
8	Slot 5	0	The configured slot 5 does not exist.
9	Slot 6	0	The configured slot 6 does not exist.
10	Slot 7	5	The configured slot 7 is real slot 5.
11	Slot 8	6	The configured slot 8 is real slot 6.
12	Slot 9	0	The configured slot 5 does not exist.
13	Slot 10	0	The configured slot 6 does not exist.
14	Slot 11	7	The configured slot 11 is real slot 7.
15	Slot 12	8	The configured slot 12 is real slot 8.
16	Slot 13	9	The configured slot 13 is real slot 9.

3.3.5 Adding options

Configuration version

This version allows modules to be added to the end of the configuration. If the "add" option is not selected, RESERVE modules need not necessarily be inserted for these modules. You can also add options from the middle of the configurations using free slot assignment.



Data record of the example

The following control data record structure applies for the example given above:

Byte	Element	Coding	Explanation
0	Block length	16	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Slot 1	1	The configured slot 1 is real slot 1.
5	Slot 2	2	The configured slot 2 is real slot 2.
6	Slot 3	3	The configured slot 3 is real slot 3.
7	Slot 4	4	The configured slot 4 is real slot 4.
8	Slot 5	10	The configured slot 5 is real slot 10.
9	Slot 6	11	The configured slot 6 is real slot 11.
10	Slot 7	12	The configured slot 7 is real slot 12.
11	Slot 8	8	The configured slot 8 is real slot 8.
12	Slot 9	9	The configured slot 9 is real slot 9.
13	Slot 10	5	The configured slot 10 is real slot 5.
14	Slot 11	6	The configured slot 11 is real slot 6.
15	Slot 12	7	The configured slot 12 is real slot 7.

3.3.6 Option handling and combining procedures

Configuration versions

You can combine all procedures with option handling.

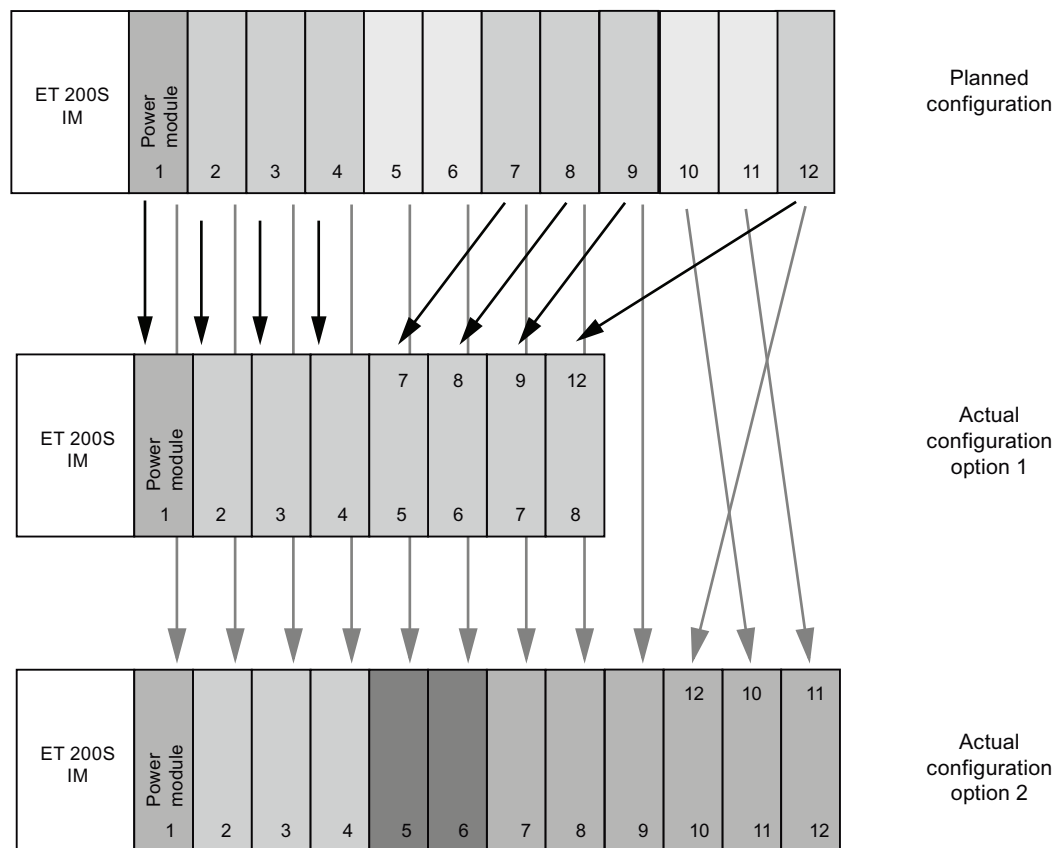


Figure 3-1 Combination of all procedures

Data record of the example

The following control data record structure applies for the example given above:

Byte	Element	Coding option 1	Coding option 2	Explanation
0	Block length	16		Header
1	Block ID	196		
2	Version	1		
3	Version	0		
4	Slot 1	1	1	The configured slot 1 is real slot 1.
5	Slot 2	2	2	The configured slot 2 is real slot 2.
6	Slot 3	3	3	The configured slot 3 is real slot 3.
7	Slot 4	4	4	The configured slot 4 is real slot 4.
8	Slot 5	0	5 + 0x80	The configured slot 5 does not exist (option 1). The configured slot 5 is real slot 5 and RESERVE module (option 2).
9	Slot 6	0	6 + 0x80	The configured slot 6 does not exist (option 1). The configured slot 6 is real slot 6 and RESERVE module (option 2).
10	Slot 7	5	7	The configured slot is real slot 5 (option 1). The configured slot 7 is real slot 7 (option 2).
11	Slot 8	6	8	The configured slot is real slot 6 (option 1). The configured slot 8 is real slot 8 (option 2).
12	Slot 9	7	9	The configured slot 9 is real slot 7 (option 1). The configured slot 9 is real slot 9 (option 2).
13	Slot 10	0	11	The configured slot 10 does not exist (option 1). The configured slot 10 is real slot 11 (option 2).
14	Slot 11	0	12	The configured slot 11 does not exist (option 1). The configured slot 11 is real slot 12 (option 2).
15	Slot 12	8	10	The configured slot 12 is real slot 8 (option 1). The configured slot 12 is real slot 10 (option 2).

Option handling with the packing function

You can combine option handling with the packing function (summary of modules within one byte). However, it is not possible to change the slot order of packed modules.

3.4 PROFlenergy

Basic information

The PROFINET devices and the power modules are turned off by special commands in the user program of the PROFINET IO controller. No additional hardware required; the PROFlenergy commands are directly interpreted by the PROFINET devices.

Principle of operation

At the beginning and end of pauses, the system manager enables or disables the pause function of the system; the IO controller then sends the PROFlenergy command "Start_Pause" / "End_Pause" to the PROFINET devices. The device then interprets the contents of the PROFlenergy command and turns on / off.

Other PROFlenergy functions allow device information to be accessed during the pauses. The user can use this data to transfer the "Start_Pause" / "End_Pause" command on time.

Configuration and programming

The functions can be easily integrated into existing systems. No configuration is required for the use of PROFlenergy. However, extensions to the user program are required:

- Before enabling the Start_Pause command, the user must make sure that the system has the correct status for a pause.
- A timing control for the beginning of the device pause and for punctually restarting the node on pause must be programmed (depending on the required switch on times required by the PROFINET device in question).
- The error messages of the FB must be evaluated and the required reaction programmed (for example, cancellation or continuation of additional commands to the lower-level PROFINET devices).

The components and an application example can be found online in the service and support portal: Service and support - PROFlenergy
(<http://support.automation.siemens.com/WW/view/en/41986454>)

Combination of PROFlenergy and shared device

PROFlenergy is controlled by the head module. The PROFlenergy function in a shared device is therefore only for the power modules which the head module has also subscribed to.

Parameter data record

The parameter data record is provided by FB 53.

Table 3- 6 Parameter data record for PROFlenergy, Index 3

Byte	Element		Coding	Explanation	
0	Version		01	Cannot be modified	
1	Number of blocks		03	Value range 1 ... max. example: There are eight parameter blocks to follow.	
2	Block 1	Slot number	00	00:	Not available
				1 ... 62:	Slot of the power module to be switched off
3	Block 1	Mode	00	Bit 0:	0: Continue Work 1: Switch off
				Bit 1 ... 7:	Reserved
4	Block 2	Slot number	00	00:	Not available
				1 ... 62:	Slot of the power module to be switched off
5	Block 2	Mode	00	Bit 0:	0: Continue Work 1: Switch off
				Bit 1 ... 7:	Reserved
6	Block 3	Slot number	00	00:	Not available
				1 ... 62:	Slot of the power module to be switched off
7	Block 3	Mode	00	Bit 0:	0: Continue Work 1: Switch off
				Bit 1 ... 7:	Reserved
:	:	:	:	:	:
16	Block 8	Slot number	00	00	Not available
				1 ... 62	Slot of the power module to be switched off
17	Block 8	Mode	00	Bit 0:	0: Continue Work 1: Switch off
				Bit 1 ... 7	Reserved

PROFlenergy data records

The data record for PROFlenergy, Index 80A0, supports the following services:

Service	Service ID	Meaning
Start Pause	0x01	Disconnects load voltage and suppresses the corresponding diagnoses
End Pause	0x02	Connects the load voltage, post-configures the modules in the potential group
Query Modes	0x03	Reads the supported modes <ul style="list-style-type: none"> • Request List Energy Saving Modes • Request Get Mode (Energy Saving Mode Data)
PEM status	0x04	Reads the PROFlenergy status
PE_Identify	0x05	Reads the supported PROFlenergy services

Parameters of "Start pause"

Parameters of "Start pause", index 0x80A0, service ID 0x01

Byte	Parameters	read	write
0	BlockType high	0x08	0x08
1	BlockType low	0x00	0x01
2	BlockLength high	0x00	0x00
3	BlockLength low	0x0A	0x08
4	BlockVersion high	0x01	0x01
5	BlockVersion low	0x00	0x00
6	Service Request ID	0x01	0x01
7	Request Reference	0x01 ... 0xFF	0xFF ... 0x01
8	Modifier/Status	0x00	0x01
9	Data Structure ID RQ/RS	0x01	0x01
10	Parameters	Pause_Time	0x01
11			padding byte
12			
13			

Parameters of "End pause"

Parameters of "End pause", index 0x80A0, service ID 0x02

Byte	Parameters	read	write
0	BlockType high	0x08	0x08
1	BlockType low	0x00	0x01
2	BlockLength high	0x00	0x00
3	BlockLength low	0x06	0x0A
4	BlockVersion high	0x01	0x01
5	BlockVersion low	0x00	0x00
6	Service Request ID	0x02	0x02
7	Request Reference	0x01 ... 0xFF	0xFF ... 0x01
8	Modifier/Status	0x00	0x01
9	Data Structure ID RQ/RS	0x00	0x01
10	Parameters		Time_to_operate 0x00002710
11			
12			
13			

Parameters of "Query mode"

Parameters of "Query Mode, List Energy Saving Modes", index 0x80A0, service ID 0x03

Byte	Parameters	read	write
0	BlockType high	0x08	0x08
1	BlockType low	0x00	0x01
2	BlockLength high	0x00	0x00
3	BlockLength low	0x06	0x08
4	BlockVersion high	0x01	0x01
5	BlockVersion low	0x00	0x00
6	Service Request ID	0x03	0x03
7	Request Reference	0x01 ... 0xFF	0xFF ... 0x01
8	Modifier/Status	0x01	0x01
9	Data Structure ID RQ/RS	0x00	0x01
10	Parameters		0x01
11			0x01

Parameters of "Query Mode, Get Mode", index 0x80A0, service ID 0x03

Byte	Parameters	read	write
0	BlockType high	0x08	0x08
1	BlockType low	0x00	0x01
2	BlockLength high	0x00	0x00
3	BlockLength low	0x08	0x28
4	BlockVersion high	0x01	0x01
5	BlockVersion low	0x00	0x00
6	Service Request ID	0x03	0x03
7	Request Reference	0x01 ... 0xFF	0xFF ... 0x01
8	Modifier/Status	0x02	0x01
9	Data Structure ID RQ/RS	0x01	0x02
10	Parameters	0x01	0x01
11		padding byte	PE_Mode_Attributes = 0
12 ... 15			Time_min_Pause 0x00002710
16 ... 19			Time_to_Pause 0x00002710
20 ... 23			Time_to_Operate 0x00002710
24 ... 27			Time_min_Length_of_stay 0x00000000
28 ... 31			Time_max_Length_of_stay 0xFFFFFFFF
32 ... 35			Mode_Power_Consumption = 0
36 ... 39			Energy_Consumption_to_pa use = 0
40 ... 43			Energy_Consumption_to_op erate = 0

Parameters of "PEM status"

Parameters of "PEM status", index 0x80A0, service ID 0x04

Byte	Parameters	read	write
0	BlockType high	0x08	0x08
1	BlockType low	0x00	0x01
2	BlockLength high	0x00	0x00
3	BlockLength low	0x06	0x1C
4	BlockVersion high	0x01	0x01
5	BlockVersion low	0x00	0x00
6	Service Request ID	0x04	0x04
7	Request Reference	0x01 ... 0xFF	0xFF ... 0x01
8	Modifier/Status	0x00	0x01
9	Data Structure ID RQ/RS	0x00	0x01
10	Parameters		0x01/0xFF
11			0xFF/0x01
12 ... 15			Time_to_Operate = 0x00002710/0
16 ... 19			Remaining_time_to_destination = 0/00002710
20 ... 23			Mode_Power_Consumption = 0
24 ... 27			Energy_Consumption_to_Destination = 0
28 ... 31			Energy_Consumption_to_operate = 0

Parameters of "PE_Identify"

Parameters of "PE_Identify", index 0x80A0, service ID 0x05

Byte	Parameters	read	write
0	BlockType high	0x08	0x08
1	BlockType low	0x00	0x01
2	BlockLength high	0x00	0x00
3	BlockLength low	0x06	0x0C
4	BlockVersion high	0x01	0x01
5	BlockVersion low	0x00	0x00
6	Service Request ID	0x05	0x05
7	Request Reference	0x01 ... 0xFF	0xFF ... 0x01
8	Modifier/Status	0x00	0x01
9	Data Structure ID RQ/RS	0x00	0x01
10	Parameters		0x05
11			0x01
12			0x02
13			0x03
14			0x04
15			0x05

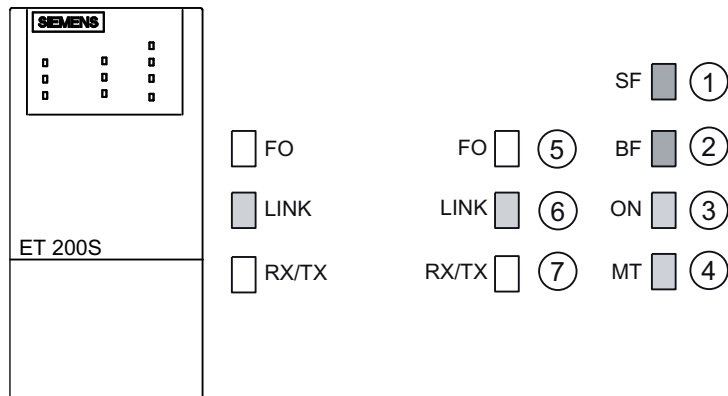
See also

Service and support - PROFlenergy
<http://support.automation.siemens.com/WW/view/en/41986454>

Alarm, error and system messages

4.1 Diagnostics using LED display

LED display



- ① Batch error (red)
- ② Bus fault (red)
- ③ Supply voltage (green)
- ④ Maintenance indicator (yellow)
- ⑤ Status of the FO path (yellow), per port
- ⑥ Connection to a switch or IO controller (green), per port
- ⑦ Data exchange (yellow), per port

Status and error displays

Table 4- 1 Status and error displays of the IM151-3 PN FO

LEDs				Meaning	Remedy
SF	BF	MAINT	ON		
Off	Off	Off	Off	There is no voltage at the interface module, or the interface module has a hardware defect.	<ul style="list-style-type: none"> Switch on the 24 V DC supply voltage at the interface module.
*	*	*	On	There is voltage at the interface module.	–
*	Flashing 0.5 Hz	*	On	Faulty or no connect telegram - no data exchange between the IO controller and the interface module (IO device), although the device is physically connected to the switch. Causes: <ul style="list-style-type: none"> Incorrect device name Configuration error Parameter assignment error There is an error in an I/O module, or the bus cable to the controller is missing. 	<ul style="list-style-type: none"> Check the interface module. Check the configuration and parameter assignment. Check the device name. Assign a valid device name to the interface module. Check the IO controller
*	On	*	On	The IO device is not connected to a switch.	<ul style="list-style-type: none"> Establish a connection to the IO controller (via a switch). Assign a valid device name to the interface module. Check the bus configuration. Check that the bus connector is correctly inserted. Check whether the bus cable to the I/O controller is interrupted.
On	*	*	On	The configured structure of the ET 200S does not coincide with the actual structure of the ET 200S.	<ul style="list-style-type: none"> Check the structure of the ET 200S, whether a module is missing or defective, or whether an unconfigured module has been inserted. Check the configuration (using <i>STEP 7</i>, for example), and correct the parameter assignment error.
				<ul style="list-style-type: none"> There is an error in an I/O module, or the interface module is defective. Diagnostics data available 	<ul style="list-style-type: none"> Replace the interface module, or contact your Siemens representative. Remove error, e.g. wire break
On	On	*	On	A brand new SIMATIC Micro Memory Card is being formatted.	<ul style="list-style-type: none"> Wait until the formatting sequence is complete. This may take several minutes. If the LED behavior changes, the formatting process is complete.
Off	Off	*	On	There is a data exchange between the IO controller and the ET 200S. The target configuration and actual configuration of the ET 200S match.	–

LEDs				Meaning	Remedy
SF	BF	MAINT	ON		
On	On	*	Off	FW update (with Micro Memory Card) is running	
Off	Flashing 0.5 Hz	*	Off	FW update (with Micro Memory Card) has been carried out successfully	
On	Flashing 0.5 Hz	*	Off	External error during FW update (with Micro Memory Card) (incorrect FW, for example)	<ul style="list-style-type: none"> Use the correct FW for the update.
On	Flashing 2 Hz	*	Off	Internal error during FW update (with Micro Memory Card) (read/write error, for example)	<ul style="list-style-type: none"> Repeat the FW update.
*	*	On	On	<ul style="list-style-type: none"> Loss of synchronization Network error Fiber-optic error 	See also section

*) not relevant

LEDs			Meaning	Remedy
FO	LINK	RX/TX		
*	Off	Off	No connection to switch/IO controller.	<ul style="list-style-type: none"> Check the fiber-optic cable.
*	On	*	Connection to switch/IO controller.	—
*	On	On	Transmission/reception is in progress.	—
On	*	*	<ul style="list-style-type: none"> Fiber-optic error Maintenance request: Attenuation through the fiber-optic cable is already so high that operation is shortly no longer possible. 	Causes and measures for the transmission link: <ul style="list-style-type: none"> Replacing the fiber-optic cable if it is damaged or aged, Correct installation of the PROFINET connector / PROFINET connections, Adherence to the max. length of 50 m for POF cables or 100 m for PCF cables. Firm seating of the fiber-optic cable connector

*) not relevant

LED display of structure errors

Properties

The configuration and parameter assignment errors of the ET 200S distributed I/O system are output at the interface module via the batch error LED **SF** (red) and bus error LED **BF** (red).

Requirements

The function is available for IM151-3 as of order number 6ES7151-3BB23-0AB0, firmware version 7.0:

Principle of operation

The LED error display provides information about the cause of the error. The display flashes and the error type is then displayed followed by the error location / error code.

The LED error display of configuration and parameter assignment errors

- is activated both during POWER ON and during operation.
- takes precedence over all other states that are displayed by the SF and BF LED.
- remains activated until the cause of the error has been eliminated.

POWER OFF/POWER ON is required at the interface module after a change in the ET 200S configuration.

Procedure		Description
1	LEDs SF and BF flash 3x at 0.5 Hz	Announcement of error type
2	LED BF flashes at 1 Hz	Display of the error type (decimal)
3	LEDs SF and BF flash 3x at 2 Hz	Announcement of the error location / error code
4	LED SF flashes at 1 Hz	Display of the tens (decimal) of the error location / error code
5	LED BF flashes at 1 Hz	Display of the ones (decimal) of the error location / error code
6	Repetition of 1 - 5 until the cause of the error has been eliminated.	

Error display

Error type (BF)	Error location (SF/BF)	Cause of the error	Corrective measure
1	01 to 63 (slot)	<p>Communication interruption</p> <p>Displays the first slot at which no I/O module is recognized.</p> <ul style="list-style-type: none"> • Missing I/O module during POWER ON or several I/O modules are missing during operation. • Interruptions at the rear panel bus • Short-circuit at the rear panel bus ("01" is output as the slot) • Terminating module missing <p>If the terminating module is missing, then the number of inserted I/O modules + 1 will be output (if there is no target configuration).</p>	Check the configuration of the ET 200S.

4.2 Diagnostic messages of the electronic modules

Actions after a diagnosis message

Each diagnostic message triggers the following actions:

- The SF LED of the interface module lights up.
- Several simultaneous diagnostic messages are possible.
- Diagnostics data are reported as diagnosis interrupts and can be read from data records.
- Following a diagnostic message, they 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.
- Acknowledgment of the diagnostic interrupt (thereafter a new interrupt is possible).

Causes of faults and corrective measures

The causes of errors and corrective measures for the diagnostics messages are described in this manual in the chapter entitled "Channel diagnostics" under "Interrupt, cause and system messages to the PROFINET IO."

4.3 Substitute value behavior

Substitute value behavior

In the IM 151-3 PN FO station the substitute value behavior is effected slot-granularly specifically by controller.

The respective output behaves in accordance with its configured substitute value behavior:

- "De-energized / power down"
- "Output substitute value"
- "Retain last value"

The substitute value behavior is triggered in the following cases:

- Stop controller
- Controller failure (communication interruption)
- FW update
- Reset to factory settings
- Failure of two or more modules in the station

Note

Reducing a configuration

If you reduce the configuration of the station and load the configuration to the CPU, then the modules that are no longer configured but still exist in the station will retain their original substitute value behavior until the supply voltage at the power module or at the interface module is interrupted.

4.4 Diagnostics

4.4.1 Diagnostics readout

Introduction

Diagnostics data are saved in controllers (CPUs) via the device diagnostics in the diagnostic buffer.

Options for reading out the diagnostics

Table 4- 2 Reading diagnostics data in STEP 7 and SCOUT

Automation system with IO controller	Block or tab in <i>STEP 7</i>	Application	Reference
SIMATIC S7	Open in HW Config with the menu command "Station > Online"	Device diagnostics in plain text on the STEP 7 interface (in the Quick View, Diagnostics View, or Module Status windows)	"Diagnosing hardware" in <i>STEP 7 online help</i>
	SFB 52 "RDREC"	Read data sets from the I/O device	SFB see <i>STEP 7 online help</i> (system functions/-function blocks)
	SFB 54 "RALRM"	Receiving interrupts from the IO device	SFB see <i>STEP 7 online help</i> (system functions/-function blocks)
SIMOTION SCOUT	Systemfunktion _ReadRecord	This system function transfers a data record from an I/O module to the user program.	Online Help for SIMOTION SCOUT

4.4.2 Channel diagnostics

Function

Channel diagnostics provide information about channel errors in the modules.

Channel errors are mapped as channel diagnoses in I/O diagnostic data records.

The data record is read with the SFB 52 RDREC (read data record).

Structure of diagnostic data records

Data records supported by ET 200S are based on PROFINET IO - Application Layer Service Definition V2.0.

The standard can be downloaded from the homepage of the PROFIBUS user organization (<http://www.profibus.com>).

Additional information on the data records for PROFINET IO

You can find the structure of the diagnostic data records and examples for programming in the *From PROFIBUS DP to PROFINET IO* Programming Manual under the From PROFIBUS DP to PROFINET IO (<http://support.automation.siemens.com/WW/view/en/19289930>)

Structure of the manufacturer-specific diagnostic data records

The structure of the diagnostic data records is differentiated by the BlockVersion. The following BlockVersions apply to the IM 151-3 PN FO interface module:

IM 151-3 PN FO interface module	BlockVersion
6ES7151-3xx2x-0AB0 or higher	W#16#0101

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

For the IM 151-3 PN FO interface module, the following manufacturer-specific diagnostics are signaled in the USI.

- Interruption of the ET 200S rear panel bus: USI = W#16#0001
- Incorrect module combination: USI = W#16#0002

USI structure = W#16#0001

Table 4- 3 Structure of USI = W#16#0001

Data block name	Contents	Remark	Bytes
USI	W#16#0001	Manufacturer-specific diagnostics for interruption of the ET 200S rear panel bus	2
3 reserved bytes follow			
	Reserved		1
	Reserved		1
	Reserved		1
Then the slot number where the rear panel bus interruption begins.			
	Slot number	B#16#00 to B#16#11	1

Structure USI = W#16#0002

Table 4- 4 Structure of USI = W#16#0002

Data block name	Contents	Remark	Bytes
USI	W#16#0002	Manufacturer-specific diagnostics for incorrect module combinations	2
The slot number at which the incorrect combination was configured.			
Slot number	B#16#00 to B#16#11		1

USI structure = W#16#0000

If USI = W#16#0000 is reported, then IM151-3 will report a process interrupt. Please check how the structure is described in the manual.

See also

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

4.4.3 Incorrect module configurations of ET 200S on the PROFINET IO

Incorrect module configuration

The following incorrect ET 200S module configurations lead to the failure of the ET 200S IO device or prevent data exchange.

- Starting with 2 missing modules
- Terminating module missing
- Number of modules exceeds maximum configuration
- Rear panel bus fault (for example, defective terminal module)

Note

The IO device will not start up if one or more modules are missing (gap) and the ET 200S is switched on.

See also

Diagnostics using LED display (Page 43)

4.4.4 Interruption of the ET 200S backplane bus

Separate diagnostics of bus interruption

If the ET 200S does not start up, this may have the following causes:

- One or several missing modules
- Terminating module missing
- Number of modules exceeds maximum configuration
- Backplane bus fault (for example, defective terminal module)

If the data exchange is interrupted, it may have the following causes:

- At least two modules (compared to a missing module, this is no longer a gap, but rather a loose backplane bus)
- Terminating module missing
- Backplane bus fault (for example, defective terminal module)

ET 200S backplane bus interruptions do not trigger an interrupt.

You can read this information with STEP 7 in the SIMATIC Manager via "Accessible nodes" in the "Module status" window. To this end, the PD must be available in the PROFINET subnet. The information is displayed in text format.

See also

You will find additional information in the programming instructions "From PROFIBUS DP to PROFINET IO (<http://support.automation.siemens.com/WW/view/en/19289930>)."

Diagnostics using LED display (Page 43)

4.4.5 Failure of the load voltage from the power module

Load voltage failure

Should the load voltage of the power module fail, the electronic modules will behave as follows:

- If an electronic module is removed during a load voltage failure, a remove-module interrupt is triggered.
- If an electronic module is inserted during a load voltage failure, an insert-module interrupt is triggered.

Note

Electronic modules that are re-parameterized during operation must be parameterized yet again once the load voltage has been restored to the power module.

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

Diagnostics events triggered by a STOP of the IO controller

Diagnostics frames received from the IO device while the IO controller is in STOP will not initiate a call of any corresponding OBs after when the IO controller goes into RUN. To obtain an overview of the device state, call OB 100.

Diagnostics after recovery of the IO device

After the recovery of an IO device, call SFB 52 to read data record E00CH. This record contains all diagnostics data of the IO device slots IO assigned to an IO controller.

4.5 Maintenance alarms

Introduction

The PROFINET interfaces of the IM151-3 PN FO support the diagnostics concept and maintenance concept in PROFINET as defined in IEC 61158-6-10. The objective is the early detection and correction of potential errors.

Maintenance interrupts

In the IM151-3 PN FO, maintenance interrupts signal to the user that a fiber-optic cable needs to be checked or replaced. This depends on the increase in the attenuation value on the PROFINET interface.

The IM151-3 PN FO signals a maintenance interrupt to the higher-level diagnostics unit when the following events occur:

Maintenance interrupts	Event	Message/Meaning	LEDs
Level 1: Maintenance required (<i>maintenance required</i>)	Fiber-optic error	<ul style="list-style-type: none"> With a system reserve of 2 dB or more: ¹ (limit for POF cable): The affected transmission link must be checked. There is sufficient time to replace the fiber-optic cable before total failure. 	-
	Network error	<ul style="list-style-type: none"> Message frames rejected ² The integrated switch has rejected 3 message frames due to network overload. 	-
Level 2: Maintenance demanded (<i>maintenance demanded</i>)	Loss of synchronization	<ul style="list-style-type: none"> No synchronization message frame received After parameter assignment or during operation, the sync master did not receive a synchronization message frame within the timeout period. Successive synchronization telegrams lie outside the permitted limits (jitter) 	-
	Fiber-optic error	<ul style="list-style-type: none"> With a system reserve of 0 dB or more: The fiber-optic cables affected must be replaced immediately to prevent the total failure of the PROFINET devices. 	FO-LED illuminates MAINT-LED illuminates

¹ These diagnostic messages are deleted automatically after 1 second.

System alarms in *STEP 7*

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

- Maintenance demanded, identified by a green wrench icon at the relevant port.
- Maintenance required, identified by a yellow wrench per port.

4.6 Evaluating the interrupts of the ET 200S

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 IO controller

The ET 200S supports the following interrupts

- Diagnostic interrupts
- Process interrupts
- Insert/remove module interrupts
- Maintenance interrupts

An interrupt automatically initiates execution of the interrupt OBs in the CPU of the IO controller (see the *Programming Manual System Software for S7-300/S7-400*, under "Program design").

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

You can obtain detailed information on the error event in the error OB with SFB 54 RALRM (read supplementary interrupt information).

Triggering of a diagnostic interrupt

When an incoming or outgoing event (e.g., wire break) is registered the module triggers a diagnostic interrupt: if "Enable: Diagnostic interrupt" is set.

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

Triggering a process interrupt

When the CPU receives a process interrupt it interrupts the user program and processes the OB 40 process interrupt. The event that triggered the interrupt is entered in the OB 40 start information.

Note

Process interrupts should not be used for technological purposes (e.g., cyclical generation of process interrupts).

Triggering of an insert/remove-module interrupt

The CPU interrupts processing of the user program and processes the OB 83 diagnostic block instead. The event that triggered the interrupt is entered in the OB 83 start information.

Diagnosis "Process interrupt lost"

The "Process interrupt lost" diagnosis is not currently available for the following modules:

- 2DI DC24V HF (6ES7131-4BB01-0AB0),
- 4DI DC24V HF (6ES7131-4BD01-0AB0) and
- 4DI UC24..48V HF (6ES7131-4CD00-0AB0)

Note

Process interrupts should not be used for technological purposes (e.g., cyclical generation of process interrupts).

Depending on the number of I/O modules and the communication load, process interrupts may be lost if more than approx. 50 are generated per second.

Response times

5.1 Response times of PROFINET IO

Calculation of the response time for this IM 151-3 PN

The following equation enables you to make an approximate calculation of the ET 200S response time:

Response time [μ s]: 390

+ Maximum out (380 + 9m + 11do) or (24m + 40ai + 80t)

+ Maximum out (120 + 9m) or (24 + 9do + 40ao + 80t)

m	Total number of all modules (power modules, digital electronic modules, analog electronic modules, technological modules)
do	Sum total of all digital output modules
di	Sum total of all digital input modules
ao	Sum total of all analog output modules
ai	Sum total of all analog input modules and electronic modules 1SSI fast, 1COUNT fast
t	Number of all technology modules (except 1SSI fast, except 1COUNT fast)

Note

The formula specified applies to cyclic data transfer. The following requirements must be fulfilled:

- No diagnostics are reported.
- No modules are removed and inserted.
- PROFINET sending cycle 1 ms

5.2 Response time for digital input modules

Input delay

The reaction times of the digital input modules depend on the input delay.

Reference

Information on the input delays can be found in the technical data of the *manual* for the relevant digital electronic module.

5.3 Response time for digital output modules

Output delay

The response times correspond to the output delay.

Reference

Information on the output delays can be found in the technical data of the *manual* for the relevant digital electronic module.

5.4 Response time for analog input modules

Conversion time

The conversion time comprises the basic conversion time and the processing time for wire break check diagnostics.

In integrative conversion processes, the integration time is included directly in the conversion time.

Cycle time

The analog/digital conversion and the transfer of the digitized measured values to memory or to the backplane bus take place sequentially. In other words, the analog input channels are converted one after the other. The cycle time, that is, the time until an analog output value is converted again, is the sum of the conversion times of all the activated analog output channels of the analog input modules. You should deactivate unused analog input channels during parameter assignment in order to reduce the cycle time. The conversion and integration time for a deactivated channel is 0.

The following figure gives you an overview of what the cycle time for an n-channel analog input module comprises.

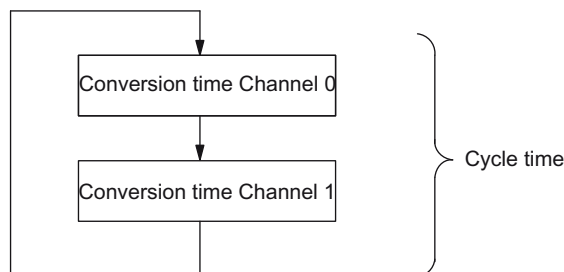


Figure 5-1 Cycle time of the analog input module

Reference

Information on the conversion times can be found in the technical data of the *manual* for the relevant analog electronic module.

5.5 Reaction times of analog output modules

Conversion time

The conversion time of the analog output channels comprises the time for the transfer of the digitized output values from internal memory and the digital/analog conversion.

Cycle time

The conversion of the analog output channels for the module takes place with a processing time and sequentially with a conversion time for channels 0 and 1.

The cycle time, i.e. the time until an analog output value is converted again, is the sum of the conversion times of all the activated analog output channels and of the processing time of the analog output module.

The following figure provides you with an overview of what makes up the cycle time for an analog output module.

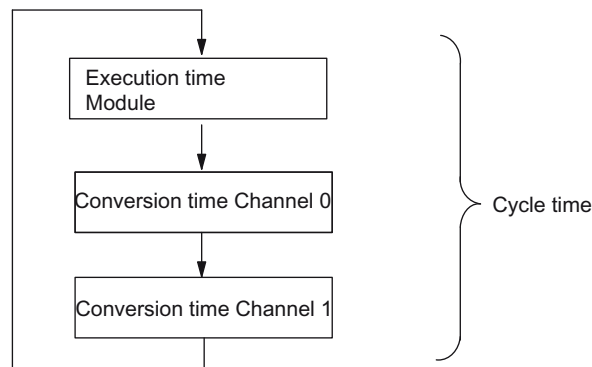


Figure 5-2 Cycle time of the analog output module

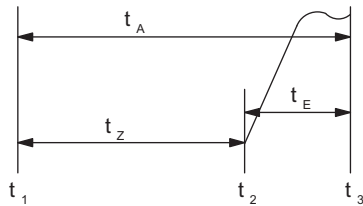
Settling time

The settling time (t_2 to t_3) i.e. the time from the application of the converted value until the specified value is obtained at the analog output - depends on the load. A distinction must be drawn between resistive, capacitive, and inductive loads.

Response time

The response time (t_1 to t_3) i.e., the time from the application of the digital output values in internal memory until the specified value is obtained at the analog output - is, in the most unfavorable case, the sum of the cycle time and the settling time. The most unfavorable case is when the analog channel is converted shortly before the transfer of a new output value and is not converted again until after the conversion of the other channels (cycle time).

This figure shows the response time of an analog output channel:



- t_A Response time
- t_z Cycle time, corresponding to the processing time of the module and the conversion time of the channel
- t_E Settling time
- t_1 new digital value applied
- t_2 output value transferred and converted
- t_3 specified output value obtained

Figure 5-3 Response time of an analog output channel

Reference

Information on the conversion times can be found in the technical data of the *manual* for the relevant analog electronic module.

5.6 Response times for a 4 IQ-SENSE electronic module

The response time of the 4 IQ-SENSE electronic module is specified as a cycle time in the Technical Data.

5.7 Response times for technology modules

The response times of the technology modules are specified as response time or update rate in the Technical Data. See *ET 200S Technological Functions Manual*.

Connection

6.1 Connecting interface module IM151-3 PN FO with PROFINET IO interface (optical)

Introduction

Connect the supply voltage to the interface module IM 151-3 PN FO using a 2-pin connector and the fiber-optic cable for the PROFINET connection using SC RJ connectors.

Requirements

- Wire the interface module with the supply voltage switched off.
- Follow the wiring rules.

Tools required

3 mm screwdriver

Required accessories (see *Order numbers*)

- Connectors for PROFINET connection: IE SC RJ POF Plug
- Fiber-optic cable:
 - IE POF standard cable
 - IE POF trailing cable
 - IE PCF standard cable
 - IE PCF trailing cable
 - IE PCF-GI

Rules for configuring a fiber-optic cable network with IM 151-3 PN FO

In fiber-optic networks with nodes with integrated fiber-optic interfaces:

- If you remove the fiber-optic cable from an integrated fiber-optic interface or the supply voltage to the IM 151-3 PN FO fails, all subsequent nodes will no longer be accessible.
- The fiber-optic cable may have the following maximum lengths:
 - IE POF standard cable: 50 m
 - IE POF trailing cable: 50 m
 - IE PCF standard cable: 100 m
 - IE PCF trailing cable: 100 m
 - IE PCF-GI: 250 m

Preparing fiber-optic cables with connectors

Prepare the IE POF cable with the connectors IE SC RG POF plug or IE SC RJ PCF Plug.

Complete instructions are available in the installation instructions *POF Fiber-Optic Cables with Connectors IE SC RJ POF Plug* (A5E00351141) or *PCF Fiber-Optic Cables with Connectors IE SC RJ PCF Plug* (A5E00835119).

Bending radius for the fiber-optic cable

When installing the fiber-optic cable, ensure that the permissible bending radius is not exceeded:

- IE POF/PCF standard cable: 150 mm
- IE POF/PCF trailing cable: 60 mm

Refer also to the installation guidelines for fiber-optic cable in the *ET 200 Distributed I/O System* or *SIMATIC NET - PROFIBUS Networks* manual.

Reusing fiber-optic cable

Note

If reusing fiber-optic cable, you must shorten both fiber-optic cores by the amount of the curved lengths and reinstall the connectors. This will prevent any attenuation losses caused by re-bent, heavily-stressed portions of the fiber-optic core.

Connecting interface module IM 151-3 PN FO to PROFINET IO

1. Remove the blind plugs of the PROFINET connections.
2. Hold the preassembled connector by the **housing** and push it into the PROFINET socket until it audibly engages. The connectors are coded to ensure safe connection.

If the IM 151-3 PN FO is the last node of the fiber-optic cable network, then you have to connect the unused fiber-optic interface with a blind plug. The blind plugs go into the PROFINET sockets of the IM 151-3 PN FO in the delivery condition.

 CAUTION
--

Do not look directly into the opening of the optical transmit diodes. The emitted light beam can damage your eyes.
--

Operation of optical data transmission links of up to 250m

The IM151-3 PN FO interface module, firmware version 7.0 or higher, is approved not only for PROFINET operation with PCF standard cables of up to 100m, but also for PROFINET operation with PCF-GI cables of up to 250m.

Configuration with STEP 7, V5.5 or higher:

When you configure the topology for the relevant ports in the module in HW Config, select the value "PCF Standard Cable GP" in the drop-down menu **Cable designation** and the value "<1000m" in the drop-down menu **Line length**.

Note

You must remember that any other devices you wish to connect to the IM151-3 PN FO interface module via PCF-GI cables must also be approved for this type of cable.

Order numbers

A

Accessories for fiber-optic cable technology

Table A- 1 Order numbers of accessories

Description	Order No.:
IE Termination Kit SC RJ POF Plug Assembly case for on-site installation of SC RJ POF connectors; consisting of stripping tool, Kevlar scissors, SC RJ grinding disk, grinding paper, grinding base and microscope	6GK1 900-0ML00-0AA0
IE Termination Kit SC RJ PCF Plug Assembly case for on-site installation of SC RJ PCF connectors; consisting of stripping tool, buffer stripping tool, Kevlar scissors, fiber breaking tool and microscope	6GK1 900-0NL00-0AA0
IE SC RJ POF plug Cable connector (20 units)	6GK1 900-0MB00-0AC0
IE SC RJ PCF plug Cable connector (20 units)	6GK1 900-0NB00-0AC0
SC RJ Refill Set POF Refill Set for Termination Kit SC RJ POF Plug consisting of grinding paper and grinding disk (5 units)	6GK1 900-0MN00-0AC0
IE POF Standard Cable GP 980/1000, cut-to-length	6XV1874-2A
IE PCF Standard Cable 200/230, cut-to-length	6XV1861-2A
IE PCF Standard Cable GP 200/230, cut-to-length	6XV1861-2D
IE POF Trailing Cable 980/1000, cut-to-length	6XV1874-2B
IE PCF Trailing Cable 200/230, cut-to-length	6XV1861-2C

For the technical data of the fiber-optic cables, please refer to IKPI 2006.

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