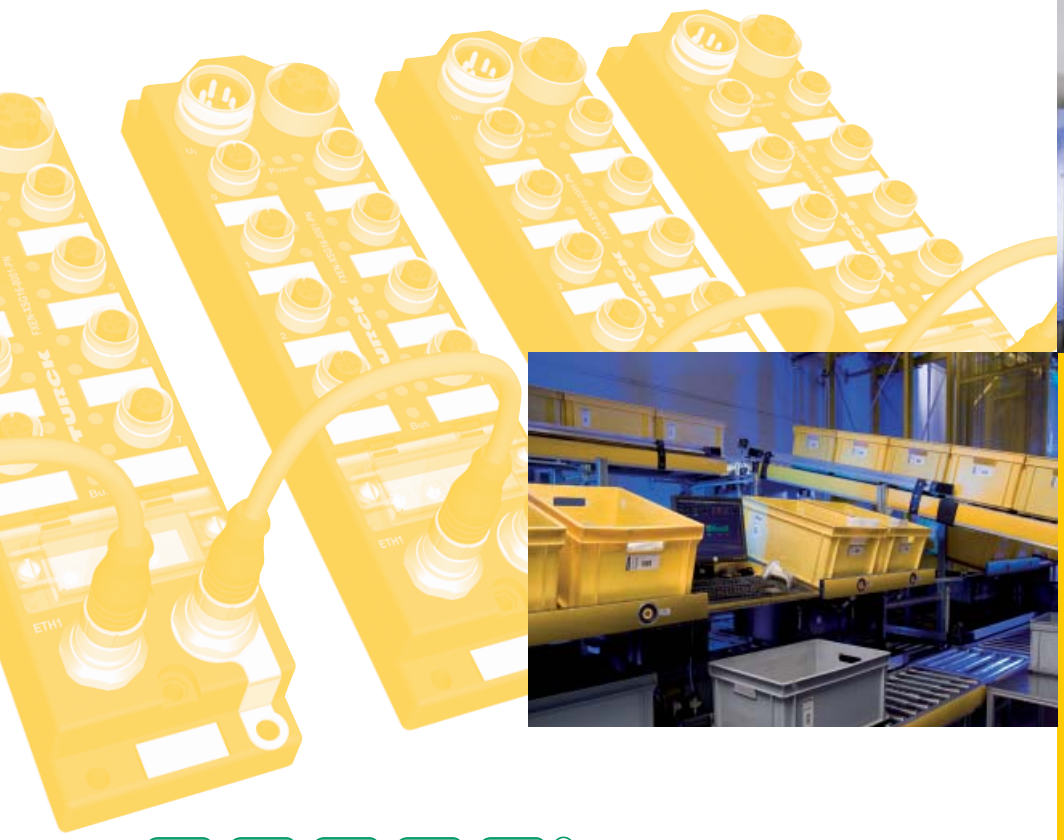
TURCK

Industrial
Automation

FXEN – PROFINET I/O



PROFI® INDUSTRIAL ETHERNET NET

Edition 05/2008

Warning!
Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

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About this Manual

Documentation Concept

This manual contains all information about the TURCK FXEN product series for PROFINET in IP67.

The following chapters contain a short FXEN system description, a description of the fieldbus system PROFINET, exact information about function and structure of the FXEN modules as well as all bus specific information concerning the connection to automation devices, diagnostics and data mapping.

Description of Symbols Used

Warning

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software) and to the facility.

This sign means for the operator: work with extreme caution.

Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel and damages to the system (hardware and software) and to the facility.

Note

This sign can be found next to all general notes that supply important information about one or more operating steps.
These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

Overview

Attention

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual includes all information necessary for the prescribed use of FXEN-modules for PROFINET. It has been specially conceived for personnel with the necessary qualifications.

Prescribed Use

Warning

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

Notes Concerning Planning /Installation of this Product

Warning

All respective safety measures and accident protection guidelines must be considered carefully and without exception.

1 PROFINET IO

PROFINET

PROFINET is the innovative open standard for the implementation of end-to-end integrated automation solutions based on Industrial Ethernet. With PROFINET, simple distributed I/O and time-critical applications can be integrated into Ethernet communication just as well as distributed automation system on an automation component basis.

Distributed I/O with PROFINET IO

Distributed I/O is connected into communication through PROFINET IO. Here, the familiar I/O view of PROFIBUS is retained, in which the peripheral data from the field devices are periodically transmitted into the process model of the control system.

Device Model

PROFINET IO describes a device model oriented to the PROFIBUS framework, consisting of places of insertion (slots) and groups of
I/O channels (subslots). The technical characteristics of the field devices are described by the so-called GSD (General Station Description) on an XML basis.

Field Bus Integration

PROFINET offers a model for integration of existing field buses like PROFIBUS, AS-Interface, and INTERBUS.

This allows the construction of arbitrarily mixed systems consisting of fieldbus- and Ethernet-based segments. Thus a smooth technology transition is possible from fieldbus-based systems to PROFINET. The large number of existing fieldbus systems makes it necessary to support their simple integration into PROFINET for reasons of investment protection.

The integration is done with so-called "proxies". A proxy is a device which connects an underlying fieldbus with PROFINET. The proxy concept allows the device manufacturer, the plant and machine builder as well as the end user a high degree of investment protection.

Communications in PROFINET contain different levels of performance:

- The non-time-critical transmission of parameters, configuration data, and switching information occurs in PROFINET in the standard channel based on UDP and IP. This establishes the basis for the connection of the automation level with other networks (MES, ERP).
- For the transmission of time critical process data within the production facility, there is a real-time channel (RT) available. For particularly challenging tasks, the hardware based communication channel Isochronous real-time (IRT) can be used for example in case of Motion Control Applications and high performance applications in factory automation.

UDP/IP Communication

For non-time-critical processes, PROFINET uses communications with the standard Ethernet mechanisms over UDP/IP which follow the international standard IEEE 802.3.

Similar to standard Ethernet, PROFINET field devices are addressed using a MAC and an IP address. In UDP/IP communications, different networks are recognized based on the IP address. Within a network, the MAC address is a unique criterion for the addressing of the target device. PROFINET field devices can be connected to the IT world without limitations. A prerequisite for this is that the corresponding services, for instance file transfer, must be implemented in the field device involved. This can differ from manufacturer to manufacturer.

Real-Time Communication (RT)

A data communication over the UDP/IP channel is provided with a certain amount of administrative and control information for addressing and flow control, all of which slows data traffic.

To enable real-time capability for cyclical data exchange, PROFINET abandons partially IP addressing and flow control over UDP for RT communications. The communication mechanisms of the Ethernet (Layer 2 of the ISO/OSI model) are very suitable for this. RT communications can always run in parallel with NRT communications.

The Services of PROFINET IO

- Cyclic data exchange
  For the cyclic exchange of process signals and high-priority alarms, PROFINET IO uses the RT channel.
- Acyclic data exchange (record data)
  The reading and writing of information (read/write services) can be performed acyclically by the user. The following services run acyclically in PROFINET IO:
  - parameterization of individual submodules during system boot
  - reading of diagnostic information
  - reading of identification information according to the "Identification and Maintenance (I&M) functions"
  - reading of I/O data

Address Assignment

In IP-based communications, all field devices are addressed by an IP address.

PROFINET uses the Discovery and Configuration Protocol (DCP) for IP assignment.

In the factory configuration, each field device has, among other things, a MAC address and a symbolic name stored. These information are enough to assign each field device a unique name (appropriate to the installation).

Address assignment is performed in two steps:

1 Assignment of a unique plant specific name to the field device.

2 Assignment of the IP address by the IO-Controller before system boot based on the plant specific (unique) name.

Both steps occur through the integrated standard DCP protocol.

Ethernet MAC Address

The Ethernet MAC address is a 6-byte-value which serves to definitely identify an Ethernet device. The MAC address is determined for each device by the IEEE (Institute of Electrical and Electronics Engineers, New York).

The first 3 bytes of the MAC address contain a manufacturer identifier (Turck: 00:07:46:xx:xx:xx). The last 3 bytes can be chosen freely by the manufacturer for each device and contain a definite serial number.

The MAC address can be read out using the software tool I/O-ASSISTANT.

Note

The antecedent description contains a short overview about the properties and the functions of the PROFINET field bus system.
It has been taken from the brochure of the PROFIBUS user organization e.V. (version 2006).
A detailed system description can be found in the standards IEC 61158 and IEC 61784 and in the PROFIBUS-guidelines and -profiles (www.profibus.com).

2 FXEN - General Technical Features

General Information

This chapter contains all information concerning the hardware of the FXEN modules, the general technical data as well as the connection possibilities, the addressing, the diagnostics and concerning the general PROFINET parameters.

Note

All module-specific information can be found within the module descriptions in the respective module-chapters of this manual.

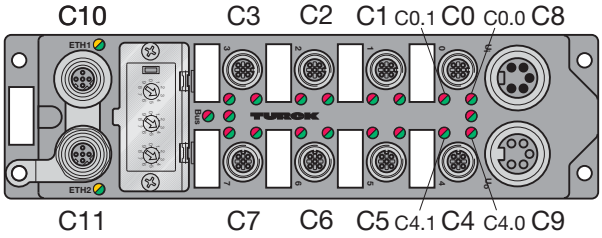
General Information on FXEN

The FXEN-product family offers the following approved features:

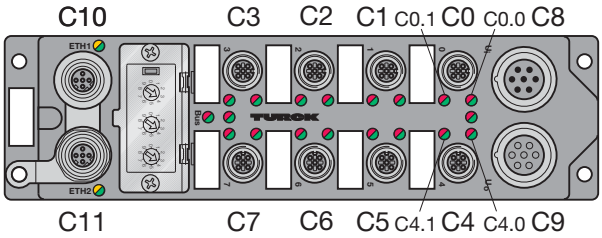
- Suitable for PROFINET applications
- Integrated auto-crossing Ethernet switch (line topology)
- Supported via FDT/DTM
- Power supply via 7/8'' or M23 x 1
- Fibre-glass reinforced PA6 housing
- Vibration and shock resistant
- Encapsulated module electronics
- Metal connector
- Degree of protection IP67

Figure 1: FXEN module

FXEN-module with 7/8'' power supply:



FXEN-module with M23 x 1 power supply:



Address setting

Note

In PROFINET IO, the connected device is not identified by it's IP address, but recognized and addressed by it's device name.

The selection of a device name for a special IO device can thus be compared to the setting of the PROFIBUS address for a DP slave.

The device name can be freely chosen.

PROFINET-Operation Mode

The modules FXEN for PROFINET are set to the PROFINET-operation mode (switch position "700") when delivered.

This mode assures a PROFINET-compliant operation of the modules.

Figure 2: Switches for address setting with switch position "700"

000: 192.168.1.254
1 - 254: static rotary
300: BootP
400: DHCP
500: PGM
600: PGM-DHCP
700: PROFINET

Attention

The cover of the rotary coding-switches must be closed by tightening the screw after use.

The seal in the cover must not be damaged or slipped.

The protection class IP67 can only be guaranteed when the cover is closed correctly.

Note

In order to be able to communicate with a gateway in PROFINET-mode - the rotary coding switches are set to "700" - using the software I/O-ASSISANT, it is first of all necessary to assign a valid IP address to the gateway. This can be done for example by using the HW-Config or the Primary Setup Tool from Siemens).

Rotary coding switch setting "000"

With the setting "000" of the rotary coding switches, the gateway is set to address 192.168.1.254 for IP-based services. In this mode, for example the I/O-ASSISTANT can communicate with the gateway. A PROFINET-communication is not possible in this mode.

GSD-Files

The modules' actual GSD-files can be downloaded from the TURCK-homepage www.turck.com.

Table 1: Name of the GSD-files

Module	GSD-file
FXEN-XSG16-0001-PN	GSDML-V2.0-Turck-FXEN16-JJJJMMTT.xml
FXEN-XSG16-0005-PN	GSDML-V2.0-Turck-FXEN16-JJJJMMTT.xml

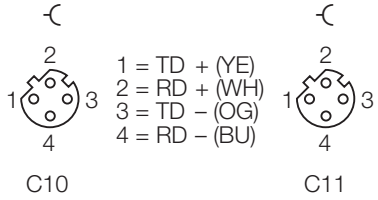
Connection Possibilities

PROFINET

The connection to PROFINET via the integrated auto-crossing switch is done using 2 M12 x 1-Ethernet-female connectors.

Figure 3: Pin assignment of the M12 x 1-female connectors

Female connector M12 x 1



Operation Voltage/ Load Voltage

The power supply is realized either via a 7/8" or via a M23 x 1 male connector on the module.

Note

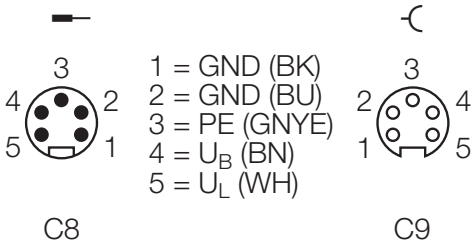
The operation voltage (U_B) and the load voltage (U_L) are fed and monitored seperately. If the voltage falls below the permissible voltage, the outputs are switched off.

U_L can be switched off. In this case, the module still communicated and the inputs are still read in.

In case of an undervoltage at U_L, the "POWER" LED changes from green to red. In case of an undervoltage at U_B, the "POWER" LED is turned off.

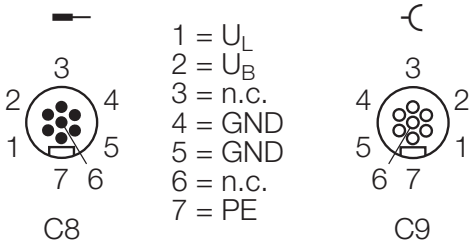
Power supply via 7/8'' (FXEN-XSG16-0001-PN)

Figure 4: 7/8''- male and female connector



Power supply via M23×1 (FXEN-XSG16-0005-PN)

Figure 5: M23 x 1- male and female connector



In-/ and Outputs

The module is equipped throughout with 5-pole metal M12- connectors for connection of the sensor/actuator level.

Note

For the pin assignment of the M12-connectors, please refer to the wiring diagrams in the module specific chapters of this manual.

SET-Button

Pressing the SET-button under the cover on the gateway for about 10 seconds is used to store the factory default values to the module.

This function is only available in the “PROFINET-Operation Mode“.

Default-values:

IP address: 0.0.0.0

Subnet mask: 0.0.0.0

Device name: TURCK-FXEN-default

Attention

When storing the device name or the IP address or when resetting the gateway to the default values, the BUS-LED switches to orange.

During this time, the gateway’s voltage supply must not be interrupted. In case of a power failure, faulty data will be stored in the gateway.

Note

Resetting the gateway is only possible when the station is not connected to the fieldbus (no AR active).

Technical Data

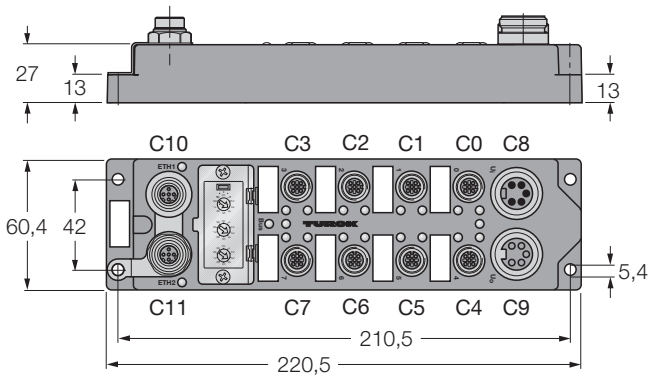
Table 2: Technical data of the FXEN-modules

Power supply	
Operational voltage U_B	18 to 30 V DC
Load voltage U_L	18 to 30 V DC
Internal current consumption (via U_B)	< 200 mA
Connections	nickel-plated brass connectors
PROFINET	2 x female M12 connector (OUT), 4-pole, d-coded
Power supply	7/8” connectors or M23 x 1 connectors
Inputs/outputs	female M12-connectors, 5-pole
Isolation voltages	
U_{BL} (U_B to U_L)	none
U_{ETH} (supply voltage to Ethernet)	500 V AC
U_{CAN} (supply voltage to CAN)	none
U_{IO} (IOs to supply voltage)	none
U_{ETHETH} (ETH1 to ETH 2)	500 V AC
Housing	Fibre-glass reinforced PA6 (PA6-GF30)
Dimensions	60,4 x 220,5 x 27 mm (width x length x height)
Mounting	via 4 through-holes Ø 5.4 mm
Mounting distance module/module	min. ≥ 50 mm **A** Valid for operation in the ambient temperatures mentioned below, with sufficient ventilation as well as maximum load (horizontal mounting).
Degree of protection (IEC 60529/EN 60529)	IP67
Vibration resistance test	acc. to EN 60068-2-6, IEC 68-2-47
Shock resistance test	acc. to EN 60068-2-27
EMC	acc. to EN 61000-6-2, EN 61000-6-4
Temperature range	
– Operating temperature	0 °C to + 55 °C (+ 32 °F to + 131 °F)
– Storage and transport	- 25 °C to + 70 °C (- 13 °F to + 158 °F)

A *In case of low simultaneity factors and low ambient temperatures, mounting distances of < 50 mm may be possible.*

Dimension drawings

Figure 6: Dimensions for the FXEN-modules



LED-Displays

Table 3: LED-displays of the FXEN-modules

LED	Display	Meaning	Remedy
ETHx (blinking during data transfer)	green	Link, 100 Mbps	
	green, flashing	Ethernet Traffic 100 Mbps	
	yellow	Link, 10 Mbps	
	yellow, flashing	Ethernet Traffic 10 Mbps	
	off	No Ethernet link	– Check the Ethernet-connection
U	off	U_B < 18 VDC	– Check the operating voltage
	green	U_B and U_L, within the operating range	
	red	U_L < 18 VDC	– Check the load voltage
Cx.0	green	24 V at input/ output	
	red	Overcurrent at output ot at sensor supply	
Cx.1	green	24 V at input/ output	
	red	Overcurrent at output ot at sensor supply	
BUS	green	Logical connection to a PROFINET IO controller established	
	green, flashing	The gateway has received a identification command from configurator	
	red	No connection to a PROFINET IO controller established	
	orange	Module is storing the device name or the IP address or is set back to its default values.	

Diagnostic Messages via Software

The diagnostic messages are displayed in the corresponding software of the PROFINET PLC as diagnostic error codes.

For the meaning of the individual error codes for the FXEN-modules, please refer to the following section.

Diagnostic Messages (Slot 0 - "PROFINET-Communication")

Table 4: Module diagnostics "PROFINET-communication"

Value (dec.)	Diagnostic meaning
Error-Codes (1 to 9 acc. to specifications)	
2	Undervoltage: Undervoltage Channel 0: Undervoltage at U_B Undervoltage Channel 1: Undervoltage at U_L

Channel Specific Diagnostic Messages for the I/O-Channels (Slot 1)

see page 3-4, ”Diagnostic messages of the I/O-channels (Slot 1)”.

General Parameters

For the FXEN-modules, one has to differentiate between the general PROFINET-parameters of the module and the specific parameters of the I/O-level.

The latter are explained in the descriptions for the I/O-level within the following chapters.

Table 5: Parameters

***A**default-setting*

Parameter name	Value	Meaning
Module parameters- parameters for Slot 0		
parameterization	0 = activate **A**	The module receives its parameter settings from the controller, IO-supervisor, I/O-ASSISTANT or similar. In this case, parameter changes which were done in the meantime for example by a configuration tool or similar will be overwritten with the valid parameter data set.
	1 = deactivate	Changes in the parameter settings are stored permanently to the module and can thus **not** be overwritten by a controller, I/O-supervisor or similar in case of a re-start of the module.
outputs fieldbus error	00 = output 0 **A**	The gateway switches the outputs of the modules to "0". No error information is transmitted.
	01 = Hold current value	The module maintains the actual output settings.
diagnostics	0 = activate	Diagnostic and alarm messages are generated.
	1 = deactivate	Diagnostic and alarm messages are suppressed.
U_L diagnostics	0 = activate **A**	The monitoring of the load voltage U_L is activated.
	1 = deactivate	An eventually occurring under-voltage at U_L will not be detected.
Channel parameters for Slot 1		
The parameter description for the I/O-level can be found within the following chapters.		

Description of User Data for Acyclic Services

The acyclic data exchange is done via Record Data CRs (CR-> Communication Relation).

Via these Record Data CRs the reading and writing of the following services is realized:

- Writing of AR data
- Writing of configuration data
- Reading and writing of device data
- Reading of diagnostic data
- Reading of I/O data
- Reading of Identification Data Objects (I&M functions)
- Reading of differences between the expected and the actually plugged modules

Description of the Acyclic Gateway User Data

Table 6: Gateway User Data

Index (dec.)	Name	Data type	r/w	Remark
1	Gateway-Parameter	DWORD	r	Parameter data the gateway
2	Gateway designation	STRING	r	Productname of the gateway
3	Gateway revision	STRING	r	Firmware-revision of the gateway
4	Vendor ID	WORD	r	Ident number for TURCK
5	Gateway name	STRING	r	Name assigned to the gateway
6	Gateway type	STRING	r	Device type of the gateway
7	Device ID	WORD	r	Ident number of the gateway
8 to 23	reserved			
24	Gateway diagnosis	WORD	r	Diagnosis data of the gateway
25 o 31	reserved			
32	Module input list	Array of BYTE	r	List of all input channels in the station
33	Module output list	Array of BYTE	r	List of all output channels in the station
34	Modul diag. list	Array of BYTE	r	List of all module diagnosis messages
35	Module parameter list	Array of BYTE	r	List of all module parameters
36 to 45039	reserved			
45040	I&M functions		r/w	Identification & Maintaining-services
45041 to 45055	I&M1 to IM15 functions			Actually not supported

Description of the Acyclic Module User Data

Table 7: Module User Data

Index (dec.)	Name	Data type	r/w	Remark
1	Modul parameters	DWORD	r	Parameter rof the module
2	Modul type	ENUM UINT8	r	Module type
3	Modul version	UINT8	r	Firmware-Revision of the module
4	Module ID	DWORD	r	Ident number of the module
5 to 18	reserved			
19	Input data	specific	r	Input data of the respective module
20 to 22	reserved			
23	Output data	specific	r/w	Output data of the respective module
24 to 31	reserved			
32 to 255	Profile-specific	These indices are reserved for the data of several module profiles (e. g. RFID). The definitions of the profile indices can be found in the respective module descriptions.		

3 Digital Input Module FXEN-IM16-0001-PN

FXEN-IM16-0001-PN

The module offers 16 digital inputs for 3-wire-pnp sensors.

Technical Data

Table 8: Techncal data FXEN-IM16-000x-PN

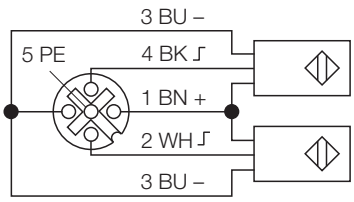
Designation	FXEN-IM16-000x-PN
Configuration file	GSDML-V2.0-Turck-FXEN16-JJJJMMTT.xml
Inputs (configurable)	(n) 3 wire pnp sensors (n = 0...16)
Supply (via U_B)	24 VDC (18... 30 VDC)
Supply current	< 120 mA per connector, short-circuit protected
Switching threshold OFF/ON	2 mA/4 mA
Switching current limitation	6 mA
Switch-on delay	2,5 ms
Switching frequency	< 250 Hz
Galvanic isolation	galvanic isolation to Ethernet

Note

The general technical data for the FXEN-products can be found in Kapitel 2.

Wiring Diagram

Figure 7: Wiring diagram



Process Data Mapping

Process input data

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	In7	In6	In5	In4	In3	In2	In1	In0
Byte 1	In15	In14	In13	In12	In11	In10	In 9	In 8

Parameterization

The parameters described in the following are only valid for the I/O-level of the module FXEN-IM16-0001-PN.

Table 9: Parameters

A *default settings*

Parameter name	Value	Meaning
Module parameters for Slot 0		
The general parameters of the module's PROFINET-level are described in the section „General Parameters", page 2-13.		
Channel parameters for Slot 1		
Digital input x	0 = normal **A**	
	1 = inverted	

Parameter Data Mapping

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	reserved	reserved	reserved	reserved	reserved	reserved	reserved	reserved
Byte 1	reserved	reserved	reserved	reserved	reserved	reserved	reserved	reserved
Byte 2	Invert7	Invert6	Invert5	Invert4	Invert3	Invert2	Invert1	Invert0
Byte 3	Invert15	Invert14	Invert13	Invert12	Invert11	Invert10	Invert9	Invert8

Diagnostics

Diagnostic messages of the I/O-channels (Slot 1)

The channel-specific diagnostic messages are defined as follows:

Table 10: Channel specific diagnostic messages

Value (dec.)	Diagnostic message
Error-Codes (1 to 9 acc. to specifications)	
1	short-circuit
4	overload
Error-Codes (16 to 31, vendor specific)	
16	Parameterization error After a validity check, the parameter data are (partially) rejected by the module. Check the context of parameters.
21	Hardware failure The module detected a hardware failure. Exchange the module.
24	User software error The module detected an user application software error. Check the interoperability of the user application software revisions. Reinitialize user the application software of the module.
26	Sensor supply load dump The module detected a load dump at the sensor supply.
28	Common Error The module detected an error. Refer to the I/O-module manuals for a more detailed description of possible errors. Error types can depend on the operation mode and the parameterization.

Note

For the detection of a wirebreak in the sensor/ actuator cable, pin Pin 1 (U_B - power supply) and pin 2 at the sensor and the actuator have to be bridged.

Diagnostic Data Mapping

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	ErrSens7	ErrSens6	ErrSens5	ErrSens4	ErrSens3	ErrSens2	ErrSens1	ErrSens0

ErrSensX:

0 = normal opreation

1 = Short circuit at sensor supply

4 Configurable I/O-Module FXEN-XSG16

FXEN-XSG16-000x-PN

The in- and output station FXEN-XSG16-000x is a modular PROFINET-slave in compact housing design.
The module is equipped with sixteen channels, which can be configured differently depending on the specific application requirements. Up to sixteen 3-wire pnp sensors or sixteen DC actuators with a maximum output current of 1.4 A per output can be connected.

Technical Data

Table 11: Technical data of FXEN-XSG16-000x-PN

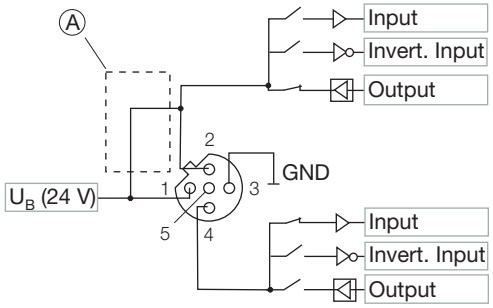
Designation	FXEN-XSG16-000x-PN
Configuration file	GSDML-V2.0-Turck-FXEN16-JJJJMMTT.xml
Inputs (configurable)	(n) 3 wire pnp sensors (n = 0...16)
Supply (via U_B)	24 VDC (18 ... 30 VDC)
Supply current	< 120 mA per connector, short-circuit protected
Switching threshold OFF/ON	2 mA/4 mA
Switching current limitation	6 mA
Switch-on delay	2,5 ms
Switching frequency	< 250 Hz
Galvanic isolation	galvanic isolation to Ethernet
Outputs (configurable)	(16-n) DC actuators (n = 0...16)
Load supply (via U_L)	24 VDC (18 ... 30 VDC)
Output current	1.4 A, short-circuit protected (ON period = 35 %)
Switching frequency	< 250 Hz
Galvanic isolation	galvanic isolation to Ethernet

Note

The general technical data for the FXEN-products can be found in Chapter 2.

Block diagram

Figure 8: Block diagram FXEN-XSG16-000x-PN

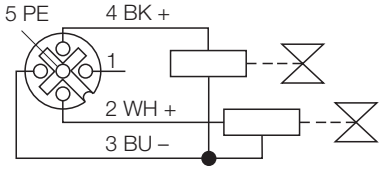


Pin 2 = channel 1, 3, 5 ... (all impair channel numbers)
Pin 4 = channel 0, 2, 4 ...(all pair channel numbers)

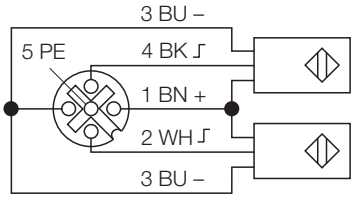
Wiring diagrams

Figure 9: Wiring diagrams

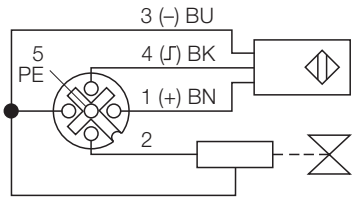
Connection of 2 actuators:

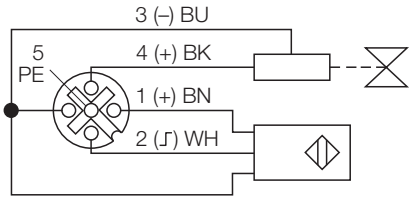


Connection of 2 sensors:



Combinations of sensor and actuator:





Process Data Mapping

Process input data

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	In7	In6	In5	In4	In3	In2	In1	In0
Byte 1	In15	In14	In13	In12	In11	In10	In 9	In 8

Process output data

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0
Byte 1	Out15	Out14	Out13	Out12	Out11	Out10	Out 9	Out 8

Parameterization

The parameters described in the following are only valid for the I/O-level of the module FXEN-XSG16-000x-PN.

Table 12: Parameters

A *default-settings*

Parameter name	Value	Meaning
Module parameters for Slot 0		
The general parameters of the module's PROFINET-level are described in the section "General Parameters", page 2-13.		
Channel parameters for Slot 1		
Digital input x (Invertx)	0 = normal **A**	
	1 = inverted	
Output x (OvlModx)	0 = deactivated **A**	
	1 = activated	
Output on overcurrent x (OutEnx)	0 = automatic recovery **A**	
	1 = controlled recovery: The output is manually switched-off and on again.	

Parameter data mapping

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	reserved	reserved	reserved	reserved	reserved	reserved	reserved	reserved
Byte 1	reserved	reserved	reserved	reserved	reserved	reserved	reserved	reserved
Byte 2	Invert7	Invert6	Invert5	Invert4	Invert3	Invert2	Invert1	Invert0
Byte 3	Invert15	Invert14	Invert13	Invert12	Invert11	Invert10	Invert9	Invert8
Byte 4	OvlMod7	OvlMod6	OvlMod5	OvlMod4	OvlMod3	OvlMod2	OvlMod1	OvlMod0
Byte 5	OvlMod15	OvlMod14	OvlMod13	OvlMod12	OvlMod11	OvlMod10	OvlMod9	OvlMod8
Byte 6	OutEn7	OutEn6	OutEn5	OutEn4	OutEn3	OutEn2	OutEn1	OutEn1
Byte 7	OutEn15	OutEn14	OutEn13	OutEn12	OutEn11	OutEn10	OutEn9	OutEn8

Diagnostics

Diagnostic messages of the I/O-channels (Slot 1)

The channel-specific diagnostic messages are defined as follows:

Table 13: Channel specific diagnostic messages

Value (dec.)	Diagnostic message
Error-Codes (1 to 9 acc. to specifications)	
1	short-circuit
4	overload
Error-Codes (16 to 31, vendor specific)	
16	Parameterization error After a validity check, the parameter data are (partially) rejected by the module. Check the context of parameters.
21	Hardware failure The module detected a hardware failure. Exchange the module.
24	User software error The module detected an user application software error. Check the interoperability of the user application software revisions. Reinitialize user the application software of the module.
26	Sensor supply load dump The module detected a load dump at the sensor supply.
28	Common Error The module detected an error. Refer to the I/O-module manuals for a more detailed description of possible errors. Error types can depend on the operation mode and the parameterization.

Note

For the detection of a wirebreak in the sensor/ actuator cable, pin Pin 1 (U_B - power supply) and pin 2 at the sensor and the actuator have to be bridged.

Diagnostic data mapping

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	ErrSens7	ErrSens6	ErrSens5	ErrSens4	ErrSens3	ErrSens2	ErrSens1	ErrSens0
Byte 1	ErrOut7	ErrOut6	ErrOut5	ErrOut4	ErrOut3	ErrOut2	ErrOut1	ErrOut0
Byte 3	ErrOut15	ErrOut14	ErrOut13	ErrOut12	ErrOut11	ErrOut10	ErrOut9	ErrOut8

ErrOut:

0 = normal opreation

1 = Short circuit or overload at output x

ErrSensX:

0 = normal opreation

1 = Short circuit at sensor supply

5 Coupling the FXEN-Modules for PROFINET IO to a Siemens Step 7

Application Example

For configuring the coupling of an FXEN-module to PROFINET with a Siemens PLC S7, the software tool "SIMATIC Manager" version 5.4 with Service Pack 2 from Siemens is used.

Hardware:

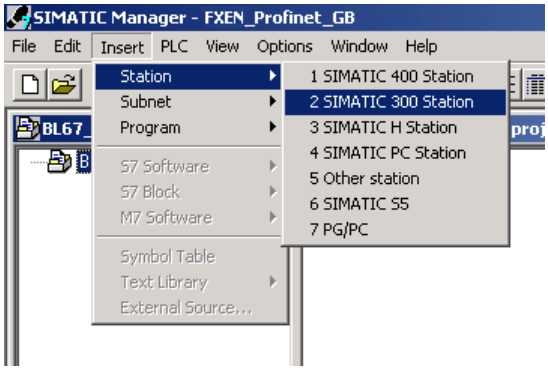
- Siemens PLC S7, CPU 315F-2-PN/DP, 6ES7 315-2FH13-0AB0, firmware V2.3
- one module FXEN-XSG16-0001-PN

New Project in Simatic Manager

Create a new project in the Simatic Manager via "File → New...".

Add a Simatic station using "Insert → Station". In this example, a station "Simatic 300-Station" is used.

Figure 10: Inserting a Simatic station



The Configuration of the PROFINET IO-network will be done afterwards in the Hardware Config.

Setting the PG/PC Interface

In order to be able to build up a communication between PLC and your PG/PC via Ethernet, the respective interface/ network card of the PG/PC has to be activated.

The interface's settings is done in the dialog "PG/PC Interface".

Open this dialog in the Simatic software for example via the "Options → Set PG/PC Interface..." command or directly in the Windows Control Panel for your PG/PC.

Figure 11: Command "Set PG/PC Interface"

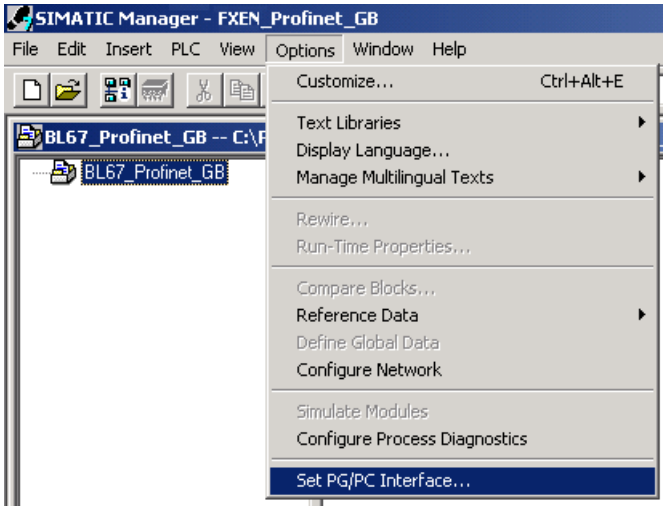
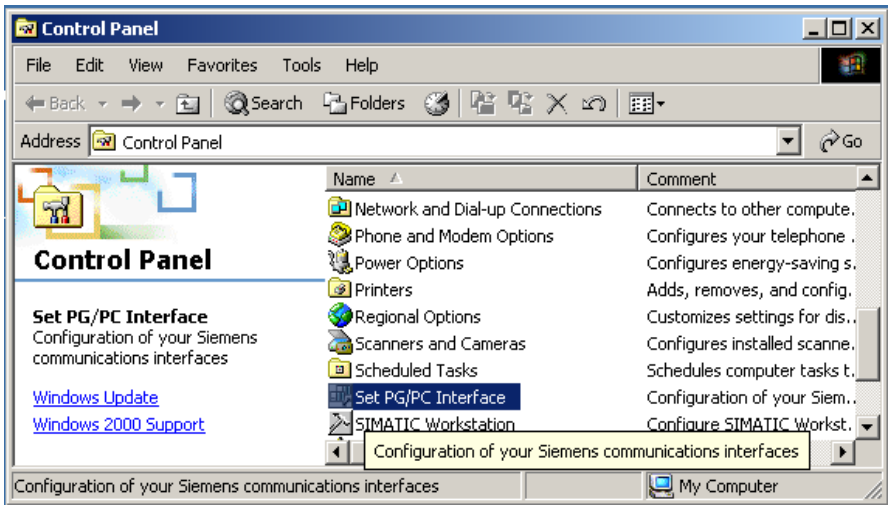
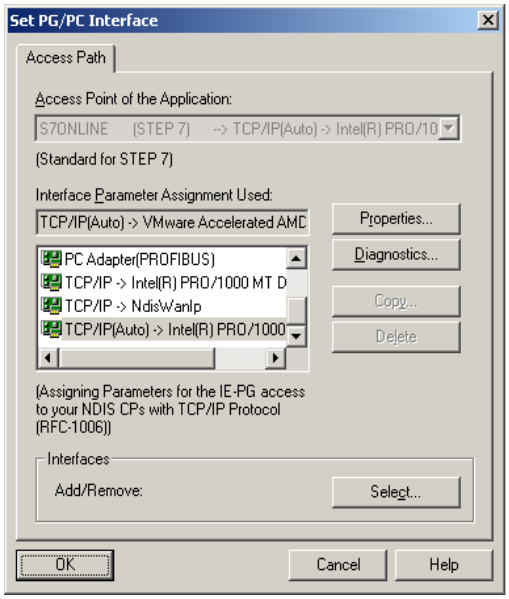


Figure 12: "Set PG/PC interface" in the Control Panel



Select your interface for the connection between S7 PLC and Ethernet-network and confirm the settings.

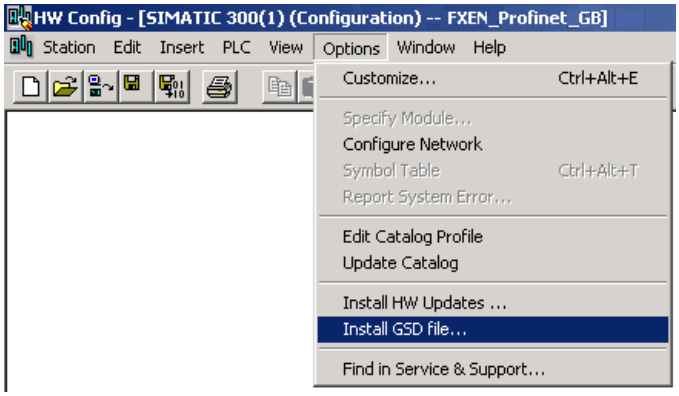
Figure 13: Select PG/PC interface



Installation of the GSD-files

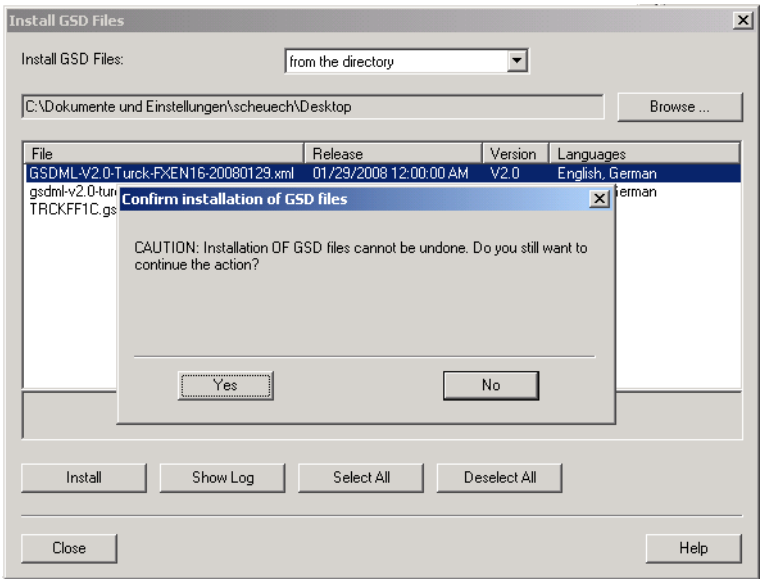
In the hardware configuration "HW config", open the "Options → Install GSD file" command in order to install new GSDML-files.

Figure 14: Install GSD-files



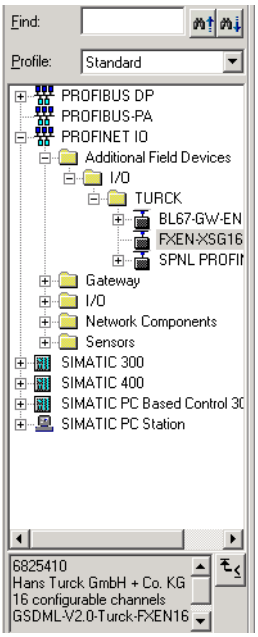
Define the directory for the TURCK GSDML-files by browsing the directories and add the FXEN-module to the hardware catalog.

Figure 15: Install GSD-file



The FXEN-module can now be found under "PROFINET IO → Additional Field Devices → I/O → TURCK".

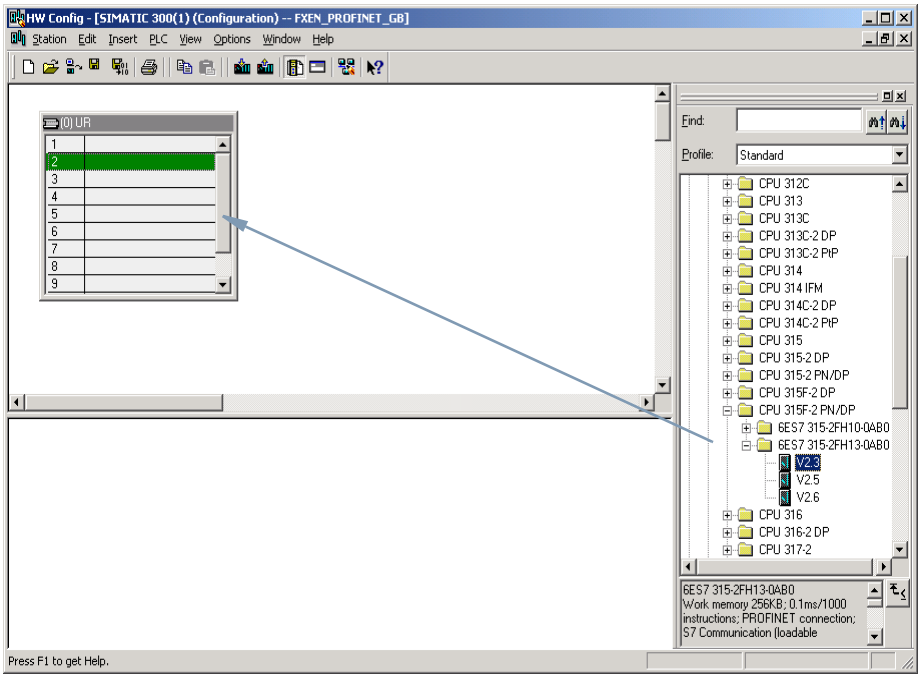
Figure 16: FXEN-module in the hardware catalog



Now, choose the profile rack "RACK-300" for the Siemens CPU from the catalog and add it to the network window.

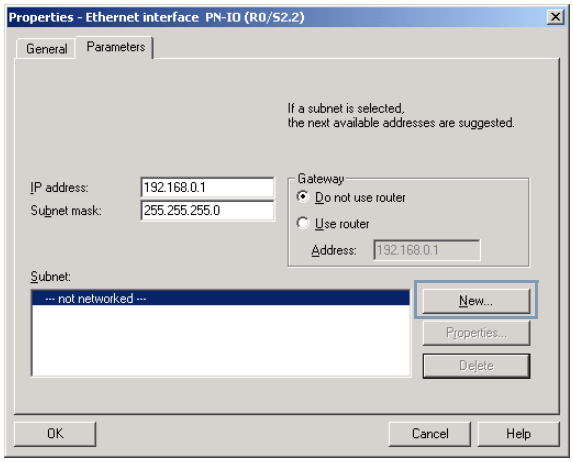
After this, select the Siemens CPU from the hardware catalog. In this example a CPU 315-2 PN/DP, version 6ES7 315-2EG10-0AB0 (V 2.3.2) is used.

Figure 17: Selecting the CPU



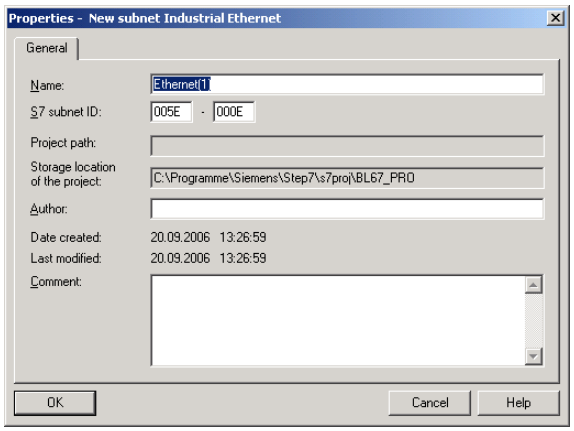
In the dialog "Properties Ethernet Interface", the IP address and the subnet mask for the S7 CPU are defined.

Figure 18: Properties Ethernet interface



The subnet is added using the "New..." button.

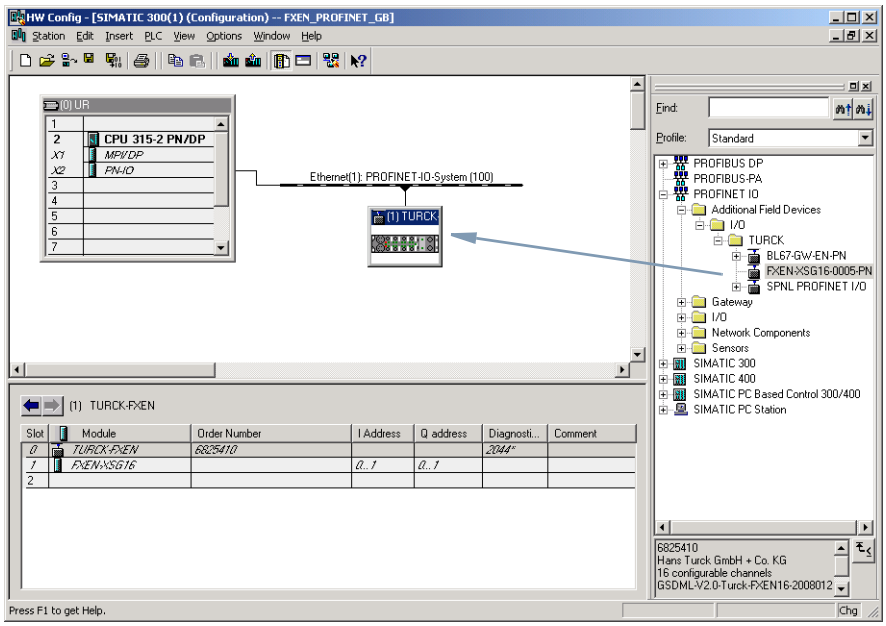
Figure 19: Add new Ethernet subnet



Now, the FXEN-module is chosen from the hardware catalog and added to the configuration.

Select the module under "PROFINET IO → Additional Field Devices → I/O → TURCK" and add it to the Ethernet-network.

Figure 20: Select FXEN-Module

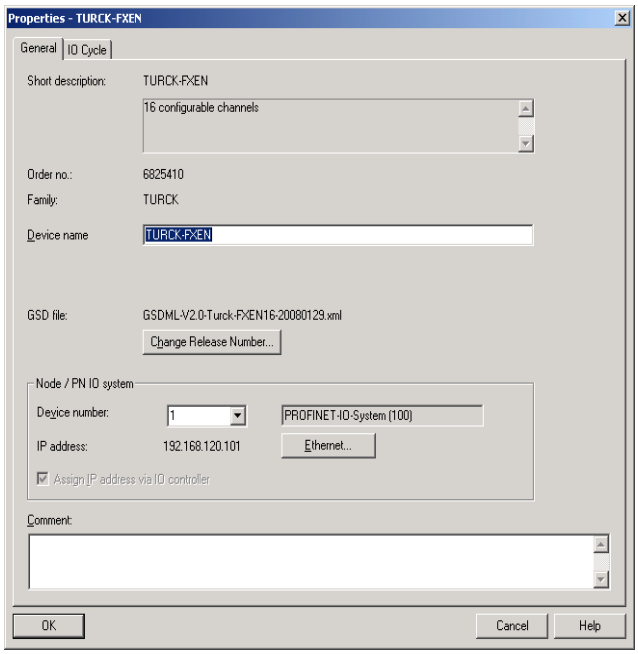


A double-click on the module-symbol opens the dialog "Properties TURCK". Enter the module's device name in this dialog.

Note

When being operated for the first time, the default-device name of the TURCK FXEN-modules for PROFINET is "TURCK-FXEN-default". The IP-Address is 0.0.0.0.

Figure 21: Dialog box: Properties TURCK



Attention

In PROFINET IO, the connected device is not identified by it's IP address, but recognized and addressed by it's device name.

The selection of a device name for a special I/O device can thus be compared to the setting of the PROFIBUS address for a DP slave.

The device name can be freely chosen.

Attention

When storing the device name or the IP address or when resetting the module to the default values, the BUS-LED switches to orange.

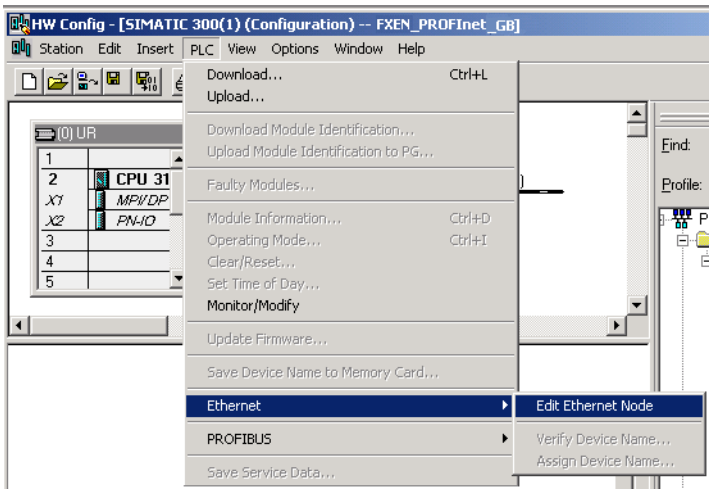
During this time, the module's voltage supply must not be interrupted. In case of a power failure, faulty data will be stored in the module.

Scanning the network for PROFINET IO Nodes

The Simatic hardware configuration offers the possibility to browse the PROFINET IO network using a broadcast command in order to find active PROFINET IO nodes. The active nodes are identified via their MAC address.

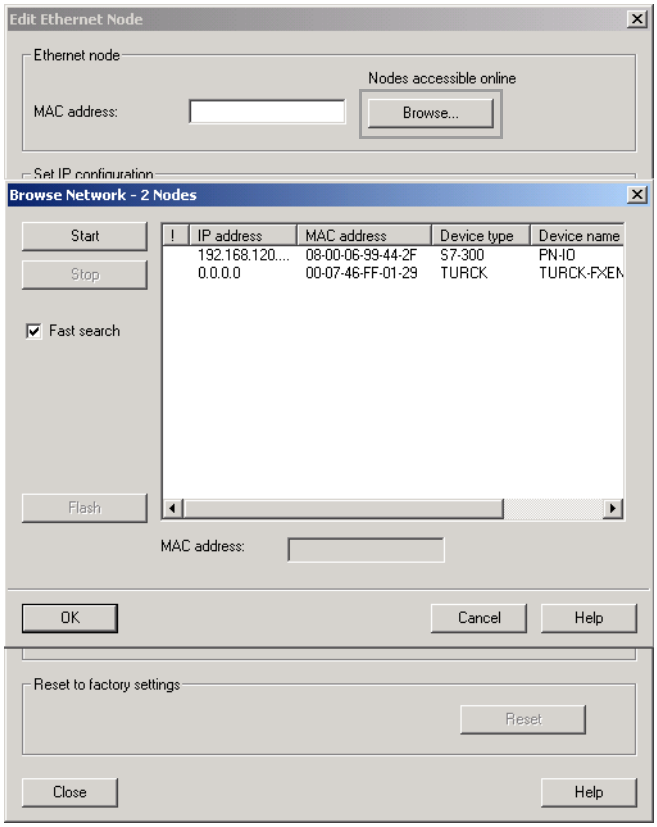
Open the respective dialog box by using "PLC →Ethernet →Edit Ethernet Node".

Figure 22: Configure Ethernet node



Browse the network for active network nodes identified by means of their MAC address, by using the button "Browse" in the field "Ethernet node".

Figure 23: Browse the network



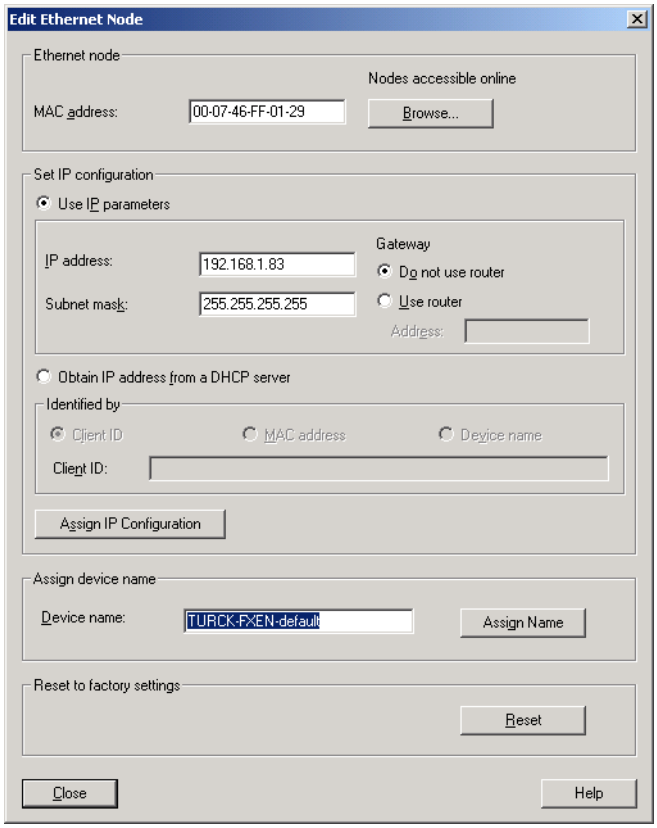
All PROFINET IO nodes found in the network answer the command sending their MAC address and their device name.

Select a node and close the dialog with "OK".

The features of the selected node are now shown in the in the dialog "Edit Ethernet Node".

In this dialog, the node's IP configuration or device name can be adapted, if necessary for the application.

Figure 24: Adaptation of the Ethernet node configuration



Attention

Here, you can also assign an application specific device name to the devices which were found.

Please observe, that the device name assigned here has to be

similar to the device name assigned to the node in the properties

dialog box (see Figure 28: "Dialog box: Properties TURCK").

If this is not guaranteed, the PLC will not be able to clearly identify the node!

Diagnostics with Step 7

Diagnostic Messages in the Hardware Configuration

The FXEN-modules for PROFINET show general module diagnostics and channel-specific diagnostics in the hardware configuration of the Step 7-software.

Furthermore a special help text, which clearly specifies the error, is given for each diagnostic message:

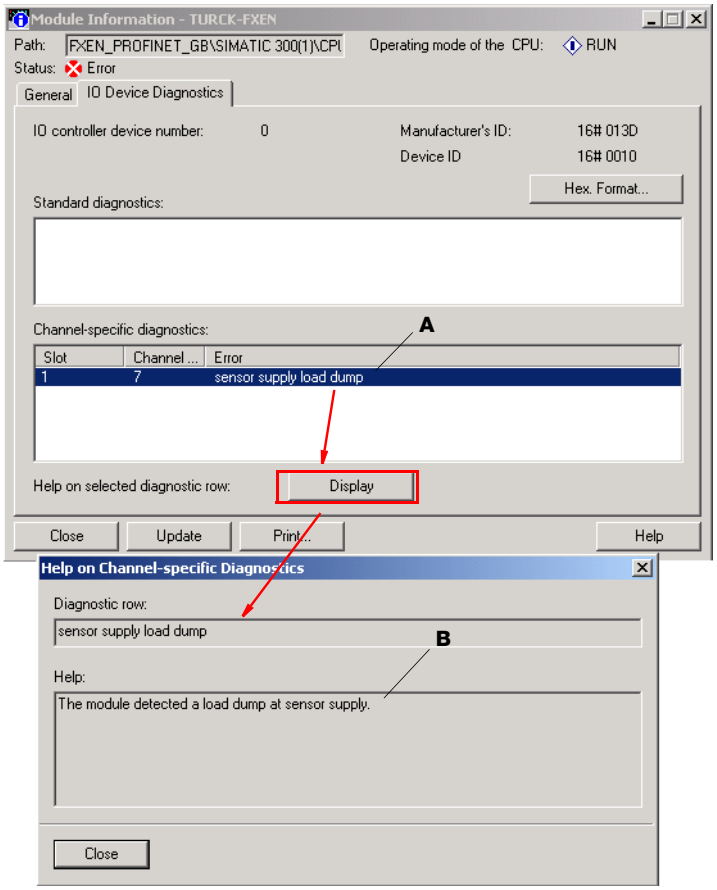


Figure 25: Diagnosis of the PROFINET FXEN-modules in the hardware config

A *channel-specific module diagnosis*
B *manufacturer-specific help texts*

Diagnostics Evaluation in the Application Program

In PROFINET IO, a vendor-independent structure for data records with diagnostic information has been defined. Diagnostic information is generated only for disturbed channels.

The following pages show two possibilities for diagnosis evaluation within an application program.

Note

Please refer to the Step 7 online help or the respective Simatic documentation ("PROFINET IO - From PROFIBUS DP to PROFINET IO - Programming manual", document number A5E00298268-02) for all complete and actual information about the diagnosis evaluation.

Diagnostics with SFB 52 in OB1

Using the SFB52, the diagnosis evaluation is done with every cycle of the application program.

In principle, SFB 52 can be called in any organization block.

Note

Please refer to the complete and actual description of SFB 52 in the software's online help.

Table 14: input data SFB 52

Parameter name	Meaning
REQ	REQ = 1, starts data transfer
ID	Logical address (HW config) of the module to be addressed. When addressing the gateway, the Diagnostic address given in HW config has to be entered. Note: If the module is an output module, bit 15 has to be set (example: for address 5: ID: = DW#16#8005). In combi-modules, the smaller of the two addresses should be specified.
INDEX	Data record number; in PROFINET specify the number of the PROFINET diagnosis data record for the reading of channel diagnosis (diagnosis data records: W#16#800A$_{hex}$ to W#16#E00A$_{hex,}$ according to PROFINET specification).
MLEN	Maximum length of the data to be read.

Table 15: output data SFB 52

Parameter name	Meaning
VALID	New data record has been received and is valid.
BUSY	BUSY = 1: The read operation is not yet complete.
ERROR	ERROR = 1: An error occurred during the read operation
STATUS	Error code of the function block (see Siemens online help for SFB54 "RALRAM")
LEN	Length of loaded data.
RECORD	Destination area for the read data record.

Diagnostics with SFB 54 in case of error/ alarm in the alarm OB

Signal and function modules with diagnosis function detect interrupts and generate a diagnosis alarm. A response to this alarm is done via alarm Organization Blocks.

Based on the OB number and start information for the interrupt event, you already have some first information about its cause and location.

Detailed information about the interrupt event in this error OB can be read using SFB 54 (Read supplementary interrupt information).

The interrupt evaluation is done as follows:

Diagnostic event:

→ **Alarm-OB** is called

→ **SFB 54** is called.

→ Diagnostic data is stored in the **AINFO** (header information and supplementary interrupt information) and **TINFO** (OB start information and housekeeping information) destination areas.

Note

Please refer to the Step 7 online help or the respective Simatic documentation ("PROFINET IO - From PROFIBUS DP to PROFINET IO - Programming manual", document number A5E00298268-02) for all complete and actual information about the diagnosis evaluation.

Table 16: input data SFB 54

Parameter name	Meaning
MODE	Operation mode
F_ID	Logical start address of the module from which interrupt information should be received.
MLEN	Maximum length of diagnosis information to be received in bytes.

Table 17: output data SFB 54

Parameter name	Meaning
NEW	A new interrupt has been received.
STATUS	Error code of SFB or IO controller.
ID	Start address of component (module) from which an interrupt was received Bit 15 contains the I/O identifier: "0" for an input address, "1" for an output address.
LEN	Length of the received interrupt information in bytes.
TINFO	(Task information) Destination area for OB start information and housekeeping information.
AINFO	(Alarm information) Destination area for header information and supplementary interrupt information.

Note

Please refer to the Step 7 online help or the respective Simatic documentation ("PROFINET IO - From PROFIBUS DP to PROFINET IO - Programming manual", document number A5E00298268-02) for all complete and actual information about the AINFO and TINFO.

6 Coupling the FXEN-Modules for PROFINET IO to the PLC ILC 370 PN 2TX-IB from Phoenix Contact

Application Example

For configuring the coupling of an FXEN-module to PROFINET with a Phoenix Contact PLC ILC 370 PN 2TX-IB, the software tool PC WorX, version 5.10.22, SP 2.3.1 is used.

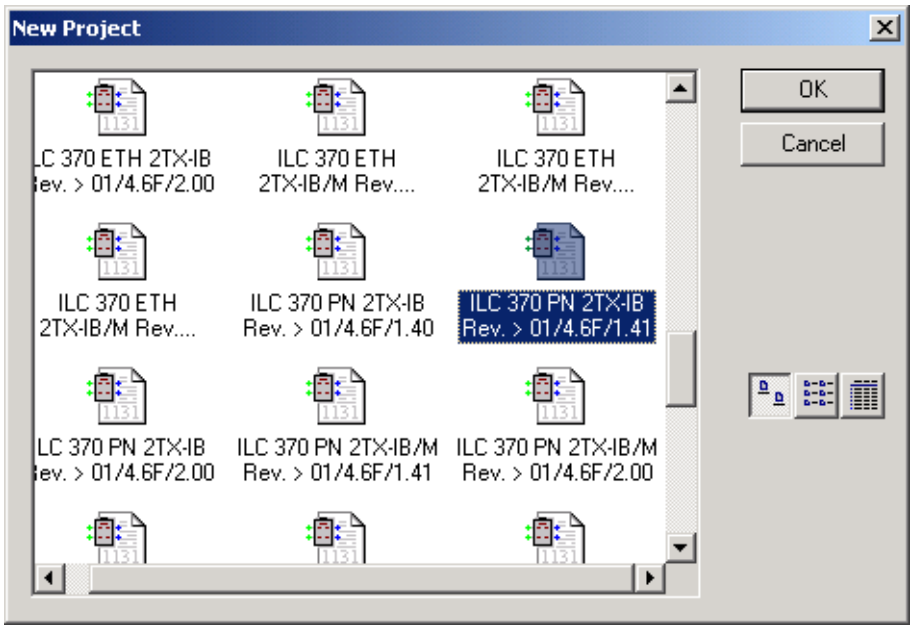
Hardware:

- Phoenix Contact PLC ILC 370 PN 2TX-IB Rev.01/4.6F/142
- one module FXEN-XSG16-0001-PN

New Project in PC WorX

Open the dialog "New Project" using the "File → New Project..." command and select the PLC used in your project. In this example, we use a ILC 370 PN 2TX-IB.

Figure 26: Selection of the PROFINET PLC

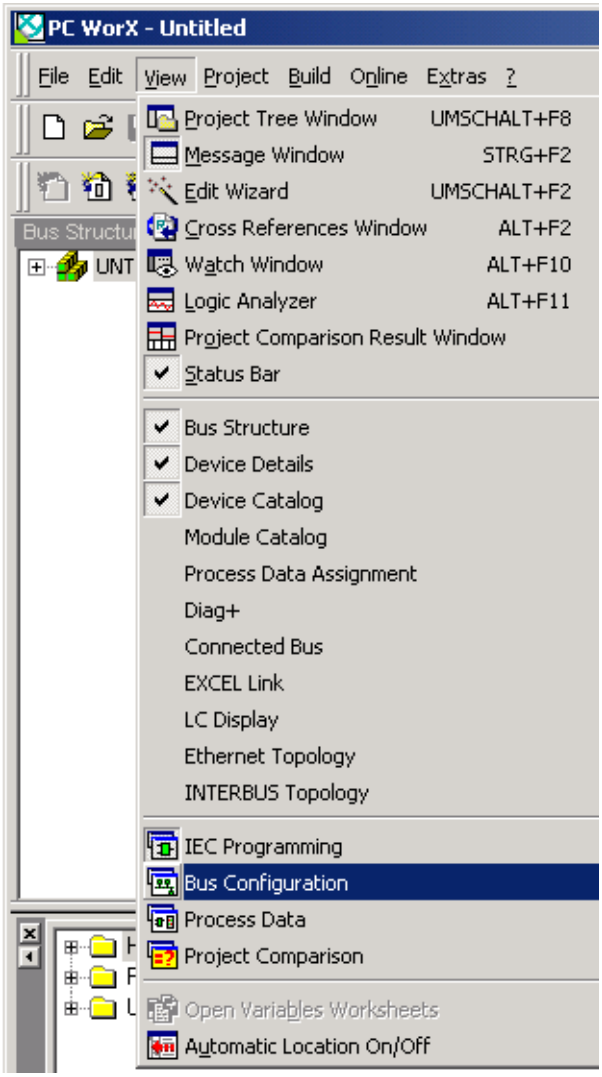


Save the project using the "File → Save Project As.../ Zip Project As...". The project is generated.

Bus Configuration

The configuration of the PROFINET IO-network is done in the "Bus Configuration" part of the software. It is opened using the "View → Bus configuration" command.

Figure 27: Opening the Bus Configuration

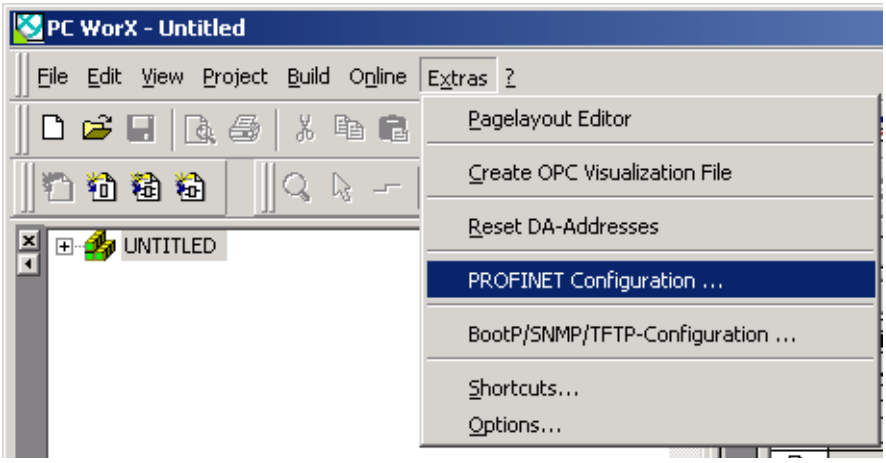


Activating the Communication Interface

In order to be able to build up the communication between the PLC and your PC via Ethernet, the respective interface/ network card has to be activated.

The interface's activation is done via the "Extras → PROFINET configuration..." command. Chose the used interface card in the dialog "PROIFNET"

Figure 28: "PROFINET configuration" command



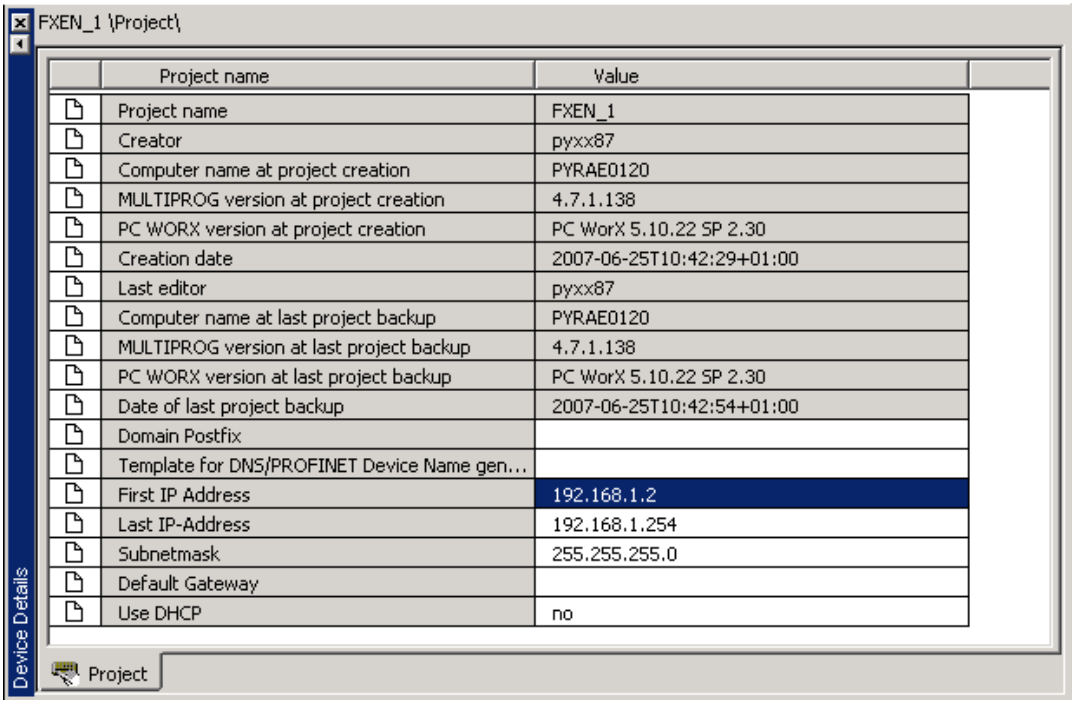
IP-Settings in the Project

The IP-settings of the entire PC WorX project have to be adapted to the application.

Open the dialog box "Bus Structure" using the "View → Bus Structure" command and the dialog box "Device Details" using the "View → Device Details" command.

Mark the project name in the Bus Structure and set the "First IP Address" and the "Last IP Address" for the project according to your application.

Figure 29: Device Details of the project

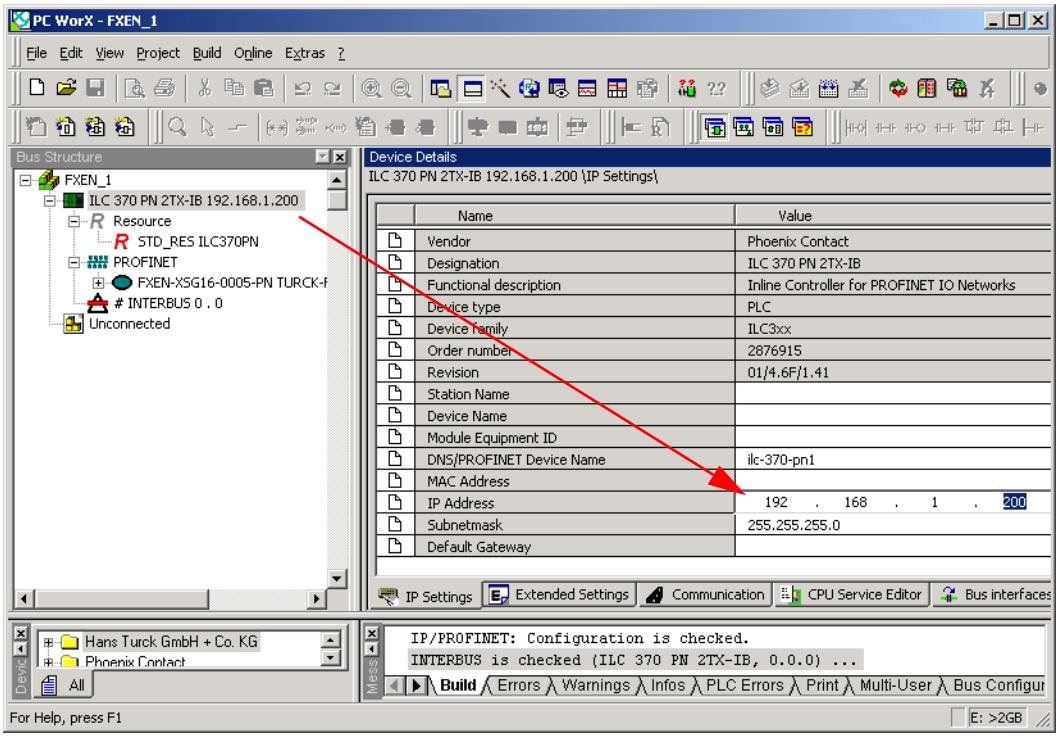


Configuration of the PLC

If necessary, the IP settings of the PLC have to be adapted, too.

Doubleclick the PLC entry in the Bus Structure and enter the PLC's IP address in the respective row.

Figure 30: Device Details for the PLC



Import of the GSD-Files

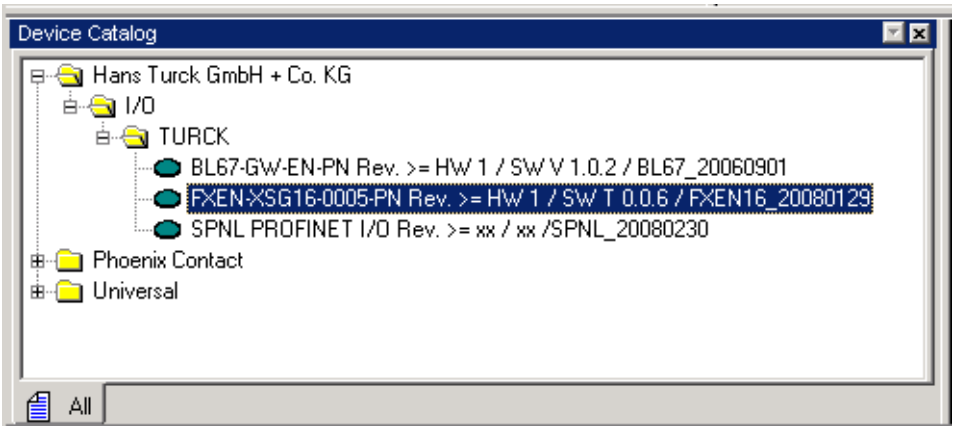
The GSD-file import is done in the Bus Configuration in the dialog box "Device Catalog". Open it using the "View → Device Catalog" command.

A right click in the Device Catalog opens the context menu. Open the import dialog box using the "Import GSD File..." command.

Define the GSD-file's storage position, install it and add the FXEN-module for PROFINET to the Device Catalog.

The FXEN-module is now listed in the Device Catalog under "Hans Turck GmbH & Co. KG → I/O → TURCK".

Figure 31: FXEN in the Device Catalog



Adding the FXEN-Module to the Bus Configuration

Adding the module to the PROFINET network can be done manually or automatically (see section “Scanning the Network for PROFINET IO-Nodes“)

Mark the entry "PROFINET" in the Bus Configuration. A doubleclick on the module-entry in the Device Catalog adds the FXEN to the Bus Structure.

Scanning the Network for PROFINET IO-Nodes

PC WorX offers the possibility to scan the network for active PROFINET-nodes using a Broadcast commend. The nodes are identified by means of their MAC-ID.

Attention

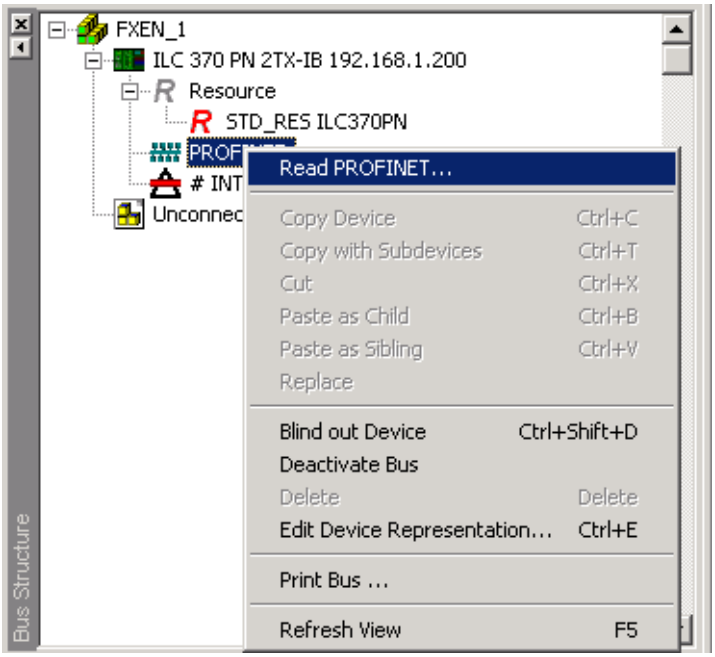
In PROFINET IO, the connected device is not identified by it’s IP address, but recognized and addressed by it’s device name.

The selection of a device name for a special I/O device can thus be compared to the setting of the PROFIBUS address for a DP slave.

The device name can be freely chosen.

Open the context menu with an right-click on the "PROFINET"-entry and select the option "Read PROFINET...".

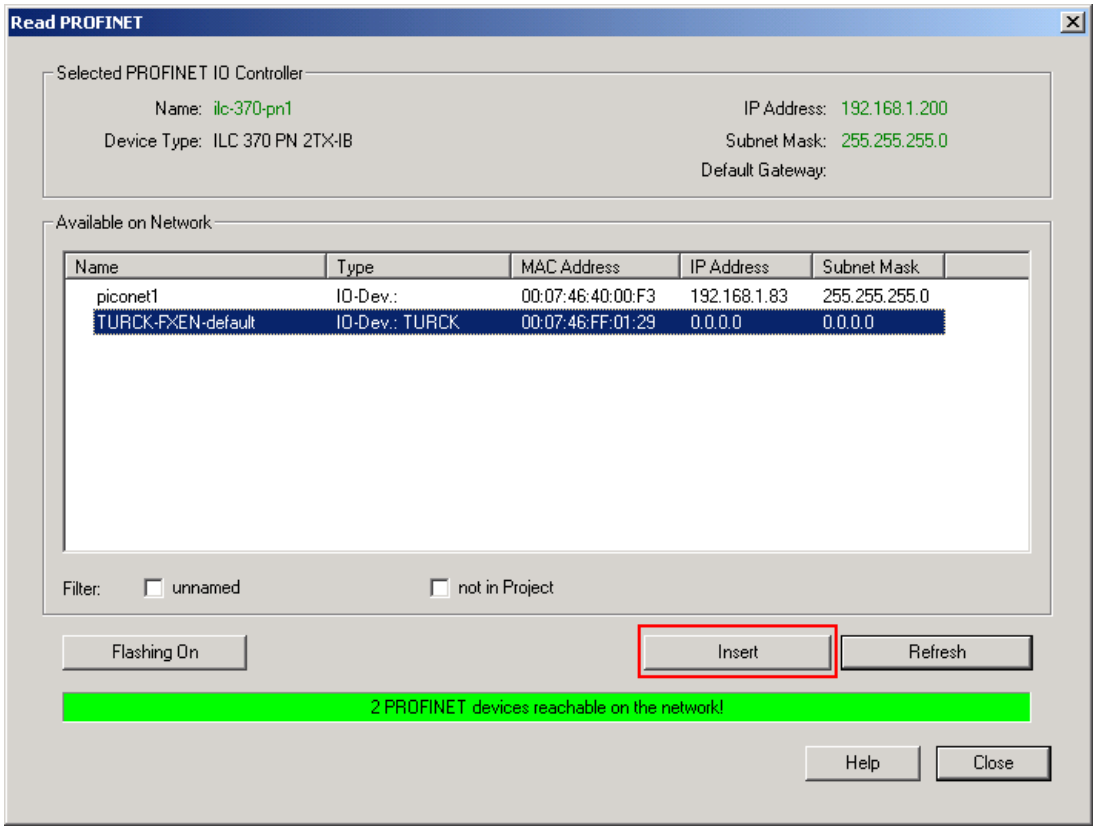
Figure 32: Read PROFINET



o

All PROFINET IO nodes found in the network answer the command sending their MAC address and their device name.

Figure 33: Read PROFINET



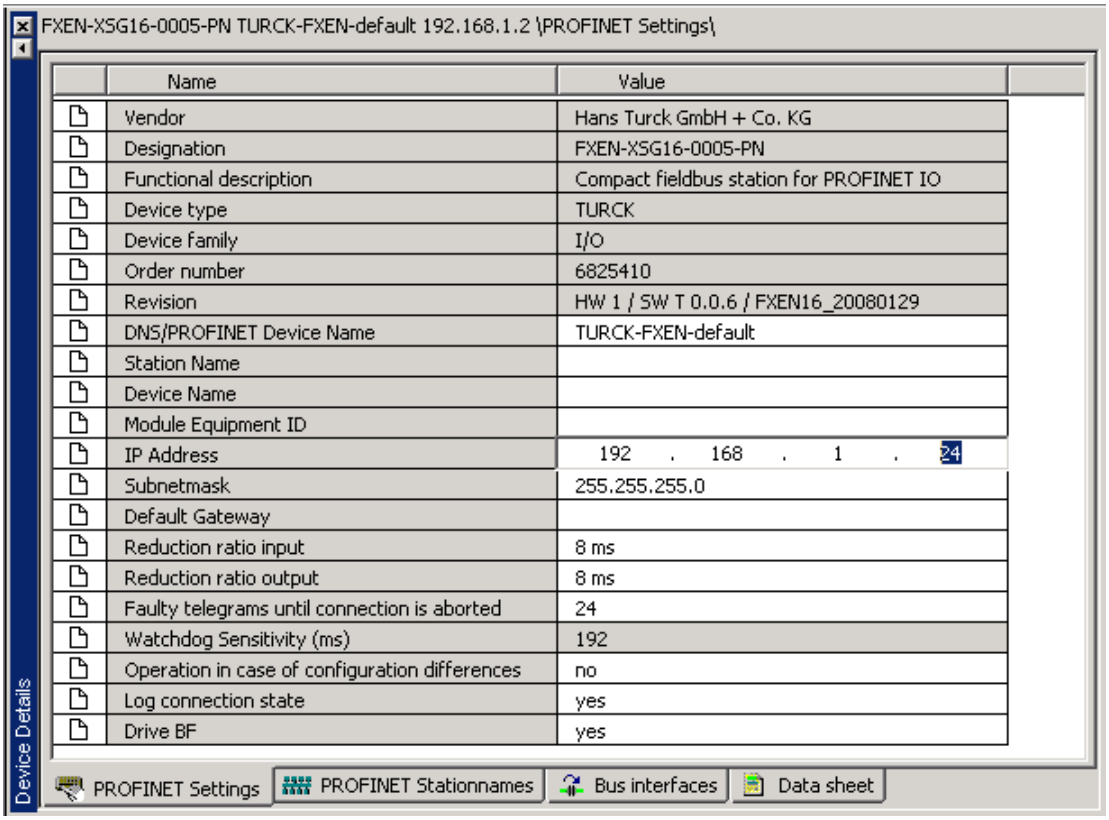
Note

When being operated for the first time, the default-device name of the FXEN-modules for PROFINET is "TURCK-FXEN-default". The IP-Address is 0.0.0.0.

Select the FXEN-module and close the dialog box.

The module will be added to the "Bus Structure". The software PC WorX automatically assigns an IP address to the module. In the dialog box "Device Details", both, the IP address as well as the PROFINET-name of the node can be changed according to the application.

Figure 34: Device Details FXEN



Name	Value
Vendor	Hans Turck GmbH + Co. KG
Designation	FXEN-XSG16-0005-PN
Functional description	Compact fieldbus station for PROFINET IO
Device type	TURCK
Device family	I/O
Order number	6825410
Revision	HW 1 / SW T 0.0.6 / FXEN16_20080129
DNS/PROFINET Device Name	TURCK-FXEN-default
Station Name	
Device Name	
Module Equipment ID	
IP Address	192 . 168 . 1 . 24
Subnetmask	255.255.255.0
Default Gateway	
Reduction ratio input	8 ms
Reduction ratio output	8 ms
Faulty telegrams until connection is aborted	24
Watchdog Sensitivity (ms)	192
Operation in case of configuration differences	no
Log connection state	yes
Drive BF	yes

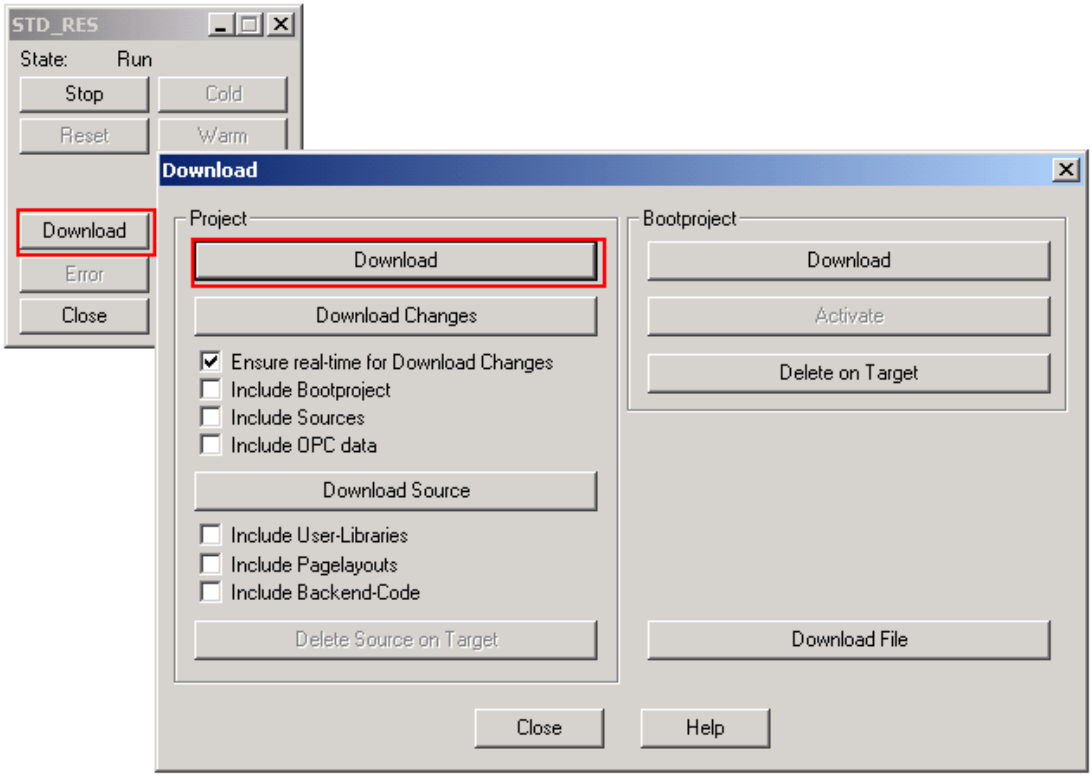
Compiling a Project

If you compile a project for the first time, use the "Build → Rebuild Project" command.

After the compilation load the project to the PLC. Open the dialog box "STD-RES" via "Online Project Control...". In this dialog box, you can send new projects, new programs, changes etc. to the PLC.

Press the Download button to send the Bus Configuration to the PLC and restart the PLC using the "Warm" button.

Figure 35: Download of the Bus Configuration



After a successful download of the Bus Configuration the module's BUS-LED changes from "red" to "green" and the bus communication is running.

7 Guidelines for Electrical Installation

General Notes

General

Cables should be grouped together, for example: signal cables, data cables, heavy current cables, power supply cables.

Heavy current cables and signal or data cables should always be routed in separate cable ducts or bundles. Signal and data cables must always be routed as close as possible to ground potential surfaces (for example support bars, cabinet sides etc.).

Cable Routing

Correct cable routing prevents or suppresses the reciprocal influencing of parallel routed cables.

Cable Routing Inside and Outside of Cabinets:

To ensure EMC-compatible cable routing, the cables should be grouped as follows:

Various types of cables within the groups can be routed together in bundles or in cable ducts.

Group 1:

- shielded bus and data cables
- shielded analog cables
- unshielded cables for DC voltage ≤ 60 V
- unshielded cables for AC voltage ≤ 25 V

Group 2:

- unshielded cables for DC voltage > 60 V and ≤ 400 V
- unshielded cables for AC voltage > 25 V and ≤ 400 V

Group 3:

- unshielded cables for DC and AC voltages > 400 V

The following group combination can be routed only in separate bundles or separate cable ducts (no minimum distance apart):

- **Group 1/Group 2**

The group combinations:

- **Group 1/Group 3 and Group 2/Group 3**

must be routed in separate cable ducts with a minimum distance of 10 cm apart. This is equally valid for inside buildings as well as for inside and outside of switchgear cabinets.

Cable Routing Outside Buildings

Outside of buildings, cables should be routed in closed (where possible), cage-type cable ducts made of metal. The cable duct joints must be electrically connected and the cable ducts must be earthed.

Warning

Observe all valid guidelines concerning internal and external lightning protection and grounding specifications when routing cables outside of buildings.

Lightning Protection

The cables must be routed in double-grounded metal piping or in reinforced concrete cable ducts.

Signal cables must be protected against overvoltage by varistors or inert-gas filled overvoltage arrestors. Varistors and overvoltage arrestors must be installed at the point where the cables enter the building.

Transmission Media

For a communication via Ethernet, different transmission media can be used:

- coaxial cable
  10Base2 (thin koax),
  10Base5 (thick koax, yellow cable)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP).

Note

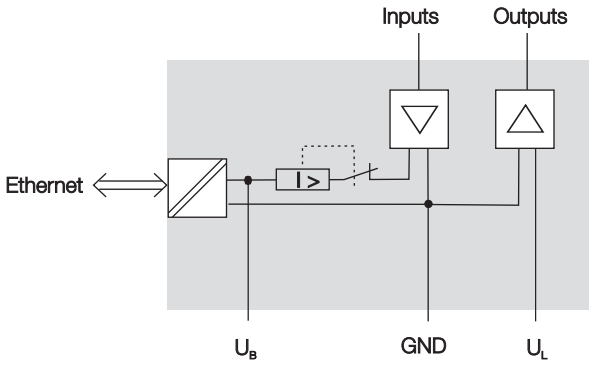
TURCK offers a variety of cable types for fieldbus lines as premoulded or bulk cables with different connectors.

The ordering information for the available cable types can be found in the fieldbus technology catalog.

Potential Relationships

The potential relationship of a Ethernet system realized with FXEN-modules is characterized as shown in the following figure:

Figure 36: Block diagram of FXEN-station



Electromagnetic Compatibility (EMC)

FXEN products comply in full with the requirements pertaining to EMC regulations.

Nevertheless, an EMC plan should be made before installation. Hereby, all potential electro-mechanical sources of interference should be considered such as galvanic, inductive and capacitive couplings as well as radiation couplings.

Ensuring Electromagnetic Compatibility

The EMC of FXEN modules is guaranteed when the following basic rules are adhered to:

- Correct and large surface grounding of inactive metal components.
- Correct shielding of cables and devices. The grounding lug at the Ethernet-connectors has to be connected as low-impedance as possible to earth.
- Proper cable routing – correct wiring.
- Creation of a standard reference potential and grounding of all electrically operated devices.
- Special EMC measures for special applications.

Grounding of Inactive Metal Components

All inactive metal components (for example: switchgear cabinets, switchgear cabinet doors, supporting bars, mounting plates, tophat rails, etc.) must be connected to one another over a large surface area and with a low impedance (grounding). This guarantees a standardized reference potential area for all control elements and reduces the influence of coupled disturbances.

- In the areas of screw connections, the painted, anodized or isolated metal components must be freed of the isolating layer. Protect the points of contact against rust.
- Connect all free moving groundable components (cabinet doors, separate mounting plates, etc.) by using short bonding straps to large surface areas.
- Avoid the use of aluminum components, as its quick oxidizing properties make it unsuitable for grounding.

Warning

The grounding must never – including cases of error – take on a dangerous touch potential. For this reason, always protect the ground potential with a protective cable.

PE Connection

A central connection must be established between ground and PE connection (protective earth).

Shielding of Cables

Shielding is used to prevent interference from voltages and the radiation of interference fields by cables. Therefore, use only shielded cables with shielding braids made from good conducting materials (copper or aluminum) with a minimum degree of coverage of 80 %.

The cable shield should always be connected to both sides of the respective reference potential (if no exception is made, for example, such as high-resistant, symmetrical, analog signal cables). Only then can the cable shield attain the best results possible against electrical and magnetic fields.

A one-sided shield connection merely achieves an isolation against electrical fields.

Attention

When installing, please pay attention to the following...

- the shield should be connected immediately when entering the system,
- the shield connection to the shield rail should be of low impedance,
- the stripped cable-ends are to be kept as short as possible,
- the cable shield is not to be used as a bonding conductor.

If the data cable is connected via a SUB-D connector, the shielding should never be connected via pin 1, but to the mass collar of the plug-in connector.

The insulation of the shielded data-cable should be stripped and connected to the shield rail when the system is not in operation. The connection and securing of the shield should be made using metal shield clamps. The shield clamps must enclose the shielding braid and in so doing create a large surface contact area. The shield rail must have a low impedance (for example, fixing points of 10 to 20 cm apart) and be connected to a reference potential area.

The cable shield should not be severed, but routed further within the system (for example, to the switchgear cabinet), right up to the interface connection.

Note

Should it not be possible to ground the shield on both sides due to switching arrangements or device specific reasons, then it is possible to route the second cable shield side to the local reference potential via a capacitor (short connection distances). If necessary, a varistor can be connected parallel to the capacitor, to prevent disruptive discharges of the capacitor when interference pulses occur.

A further possibility is a double-shielded cable (galvanically separated), whereby the innermost shield is connected on one side and the outermost shield is connected on both sides.

Potential Compensation

Potential differences can occur between installation components that are in separate areas and these

- are fed by different supplies,
- have double-sided conductor shields which are grounded on different installation components.

A potential-compensation cable must be routed to the potential compensation.

Warning

Never use the shield as a potential compensation.

A potential compensation cable must have the following characteristics:

- Low impedance. In the case of compensation cables that are routed on both sides, the compensation line impedance must be considerably smaller than that of the shield connection (max. 10 % of shield connection impedance).
- Should the length of the compensation cable be less than 200 m, then its cross-section must be at least 16 mm^2 / 0.025 $inch^2$. If the cable length is greater than 200 m, then a cross-section of at least 25 mm^2 / 0.039 $inch^2$ is required.
- The compensation cable must be made of copper or zinc coated steel.
- The compensation cable must be connected to the protective conductor over a large surface area and must be protected against corrosion.
- Compensation cables and data cables should be routed as close together as possible, meaning the enclosed area should be kept as small as possible.

Switching Inductive Loads

In the case of inductive loads, a protective circuit on the load is recommended.

Protection against Electrostatic Discharge (ESD

Attention

Electronic modules and base modules are at risk from electrostatic discharge when disassembled. Avoid touching the bus connections with bare fingers as this can lead to ESD damage.

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9 Glossary

A

Acknowledge

Acknowledgment of a signal received.

Active metal component

Conductor or conducting component that is electrically live during operation.

Address

Identification number of, e.g. a memory position, a system or a module within a network.

Addressing

Allocation or setting of an address, e. g. for a module in a network.

Analog

Infinitely variable value, e. g. voltage. The value of an analog signal can take on any value, within certain limits.

Automation device

A device connected to a technical process with inputs and outputs for control. Programmable Logic Controllers (PLC) are a special group of automation devices.

B

Baud

Baud is a measure for the transmission speed of data. 1 Baud corresponds to the transmission of one bit per second (Bit/s).

Baud rate

Unit of measurement for measuring data transmission speeds in Bit/s.

Bidirectional

Working in both directions.

Bus

Bus system for data exchange, e. g. between CPU, memory and I/O levels. A bus can consist of several parallel cables for data transmission, addressing, control and power supply.

Bus cycle time

Time required for a master to serve all slaves or stations in a bus system, i. e. reading inputs and writing outputs.

Bus line

Smallest unit connected to a bus, consisting of a PLC, a coupling element for modules on the bus and a module.

Bus system

All units which communicate with one another via a bus.

C

Capacitive coupling

Electrical capacitive couplings occur between cables with different potentials. Typical sources of interference are, for example, parallel-routed signal cables, contactors and electrostatic discharges.

Coding elements

Two-piece element for the unambiguous assignment of electronic and base modules.

Configuration

Systematic arrangement of the I/O modules of a station.

CPU

Central Processing Unit. Central unit for electronic data processing, the processing core of the PC.

D

Digital

A value (e. g. a voltage) which can adopt only certain statuses within a finite set, mostly defined as 0 and 1.

DIN

German acronym for German Industrial Standard.

E

EIA

Electronic Industries Association – association of electrical companies in the United States.

Electrical components

All objects that produce, convert, transmit, distribute or utilize electrical power (e. g. conductors, cable, machines, control devices).

EMC

Electromagnetic compatibility – the ability of an electrical part to operate in a specific environment without fault and without exerting a negative influence on its environment.

EN

German acronym for European Standard.

ESD

Electrostatic Discharge.

F

Field power supply

Voltage supply for devices in the field as well as the signal voltage.

Fieldbus

Data network on sensor/actuator level. A fieldbus connects the equipment on the field level. Characteristics of a fieldbus are a high transmission security and real-time behavior.

G

GND

Abbreviation of ground (potential „0“).

Ground

Expression used in electrical engineering to describe an area whose electrical potential is equal to zero at any given point. In neutral grounding devices, the potential is not necessarily zero, and one speaks of the ground reference.

Ground connection

One or more components that have a good and direct contact to earth.

Ground reference

Potential of ground in a neutral grounding device. Unlike earth whose potential is always zero, it may have a potential other than zero.

GSD

Acronym for Electronic Device Data Sheet which contains standardized PROFIBUS DP station descriptions. They simplify the planning of the DP master and slaves. Default language is English.

H

Hexadecimal

System of representing numbers in base 16 with the digits 0... 9, and further with the letters A, B, C, D, E and F.

Hysteresis

A sensor can get caught up at a certain point, and then “waver“ at this position. This condition results in the counter content fluctuating around a given value. Should a reference value be within this fluctuating range, then the relevant output would be turned on and off in rhythm with the fluctuating signal.

I

I/O

Input/output.

Impedance

Total effective resistance that a component or circuit has for an alternating current at a specific frequency.

Inactive metal components

Conductive components that cannot be touched and are electrically isolated from active metal components by insulation, but can adopt voltage in the event of a fault.

Inductive coupling

Magnetic inductive couplings occur between two cables through which an electrical current is flowing. The magnetic effect caused by the electrical currents induces an interference voltage. Typical sources of interference are for example, transformers, motors, parallel-routed network and HF signal cables.

Intelligent modules

Intelligent modules are modules with an internal memory, able to transmit certain commands (e. g. substitute values and others).

L

Load value

Predefined value for the counter module with which the count process begins.

Lightning protection

All measures taken to protect a system from damage due to overvoltages caused by lightning strike.

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant Bit

M

Mass

All interconnected inactive components that do not take on a dangerous touch potential in the case of a fault.

Master

Station in a bus system that controls the communication between the other stations.

Master/slave mode

Mode of operation in which a station acting as a master controls the communication between other stations in a bus system.

Module bus

The module bus is the internal bus in a BL20 station. The BL20 modules communicate with the gateway via the module bus which is independent of the fieldbus.

MSB

Most Significant Bit

Multi-master mode

Operating mode in which all stations in a system communicate with equal rights via the bus.

N

NAMUR

German acronym for an association concerned with standardizing measurement and control engineering. NAMUR initiators are special versions of the two-wire initiators. NAMUR initiators are characterized by their high immunity to interference and operating reliability, due to their special construction (low internal resistance, few components and compact design).

O

Overhead

System administration time required by the system for each transmission cycle.

P

PLC

Programmable Logic Controller.

Potential compensation

The alignment of electrical levels of electrical components and external conductive components by means of an electrical connection.

Potential free

Galvanic isolation of the reference potentials in I/O modules of the control and load circuits.

Potential linked

Electrical connection of the reference potentials in I/O modules of the control and load circuits.

PROFIBUS-DP

PROFIBUS bus system with DP protocol. DP stands for decentralized periphery. PROFIBUS-DP is based on DIN 19245 Parts 1 + 3 and has been integrated into the European fieldbus standard EN 50170.
It ensures a fast cyclic data exchange between the central DP master and the decentralized periphery devices (slaves). Its universal use is realized by the multi master concept.

PROFIBUS-DP address

Each PROFIBUS-DP module is assigned an explicit PROFIBUS-DP address, with which it can be queried by the master.

PROFIBUS-DP master

The PROFIBUS-DP master is the central station on the bus and controls access of all stations to PROFIBUS.

PROFIBUS-DP slave

PROFIBUS-DP slaves are queried by the PROFIBUS-DP master and exchange data with the master on request.

Protective earth

Electrical conductor for protection against dangerous shock currents. Generally represented by PE (protective earth).

R

Radiation coupling

A radiation coupling appears when an electromagnetic wave hits a conductive structure. Voltages and currents are induced by the collision. Typical sources of interference are for example, sparking gaps (spark plugs, commutators from electric motors) and transmitters (e. g. radio), that are operated near to conducting structures.

Reaction time

The time required in a bus system between a reading operation being sent and the receipt of an answer. It is the time required by an input module to change a signal at its input until the signal is sent to the bus system.

Reference potential

Potential from which all voltages of connected circuits are viewed and/or measured.

Repeater

The phase and the amplitude of the electric data signals are regenerated during the transmission process by the repeater.
Further, it is possible to change the topology of the PROFIBUS network. It can be extended considerably by means of the repeater.

Root-connecting

Creating a new potential group using a power distribution module. This allows sensors and loads to be supplied individually.

RS 485

Serial interface in accordance with EIA standards, for fast data transmission via multiple transmitters.

S

Serial

Type of information transmission, by which data is transmitted bit by bit via a cable.

Setting parameters

Setting parameters of individual stations on the bus and their modules in the configuration software of the master.

Shield

Conductive screen of cables, enclosures and cabinets.

Shielding

Description of all measures and devices used to join installation components to the shield.

Short-circuit proof

Characteristic of electrical components. A short-circuit proof part withstands thermal and dynamic loads which can occur at its place of installation due to a short circuit.

Station

A functional unit or I/O components consisting of a number of elements.

SUB-D connector

9-pin connector for connecting the fieldbus to the I/O-stations.

T

Terminating resistor

Resistor on both ends of a bus cable used to prevent interfering signal reflections and which provides bus cable matching. Terminating resistors must always be the last component at the end of a bus segment.

To ground

Connection of a conductive component with the grounding connection via a grounding installation.

Topology

Geometrical structure of a network or the circuitry arrangement.

U

UART

Universal Asynchronous Receiver/Transmitter. UART is a logic circuit which is used to convert an asynchronous serial data sequence to a parallel bit sequence or vice versa.

Unidirectional

Working in one direction.

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