TURCK

Industrial
Automation

BL67 –

USER MANUAL FOR PROFINET IO

edition 04/2007

Safety Notes!

Before starting 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.

Table of Contents

About this Manual

Documentation Concept

This manual contains information about the BL67 PROFINET IO-gateway.

The following chapters contain a short BL67 system description, a description of the field bus system, exact information about function and structure of the BL67 gateways as well as all bus specific information concerning the connection to automation devices, the maximum system extension etc.

The bus-independent I/O-modules for BL67 as well as all further fieldbus-independent chapters like mounting, labelling etc. are described in a separate manual.

- BL67 I/O-modules
  (TURCK-Documentation-No.: German D300572/
  English D300529)

Furthermore, the manual mentioned above contains a short description of the project planning and diagnostics software for TURCK I/O-systems, the engineering software I/O-ASSISTANT.

General Information

Attention

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

This manual contains all necessary information about the prescribed use of the TURCK BL67 gateways for PROFINET IO.
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.

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.

List of Revisions

In comparison to the previous manual edition, the following changes/ revisions have been made:

Table 1: List of revisions

Chapter	Subject	new	revised
Chap. 3			X

Note

The publication of this manual renders all previous editions invalid.

1 BL67 Philosophy

The Basic Concept

BL67 is a modular IP67 I/O-system for use in industrial automation. It connects the sensors and actuators in the field to the higher-level master.

BL67 offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (RS232 interface,...)

A complete BL67 station counts as **one** station on the bus and therefore occupies **one** fieldbus address in any given fieldbus structure. A BL67 station consists of a gateway, power distribution modules and I/O-modules.

The connection to the relevant fieldbus is made via the bus-specific gateway, which is responsible for the communication between the BL67 station and the other fieldbus stations.

The communication within the BL67 station between the gateway and the individual BL67 modules is realized via an internal module bus.

Note

The gateway is the only fieldbus-dependent module on a BL67 station. All other BL67 modules are not dependent on the fieldbus used.

Flexibility

A BL67 station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industries.

Convenient Handling

All BL67 modules, with the exception of the gateway, consist of a base module and an electronic module.

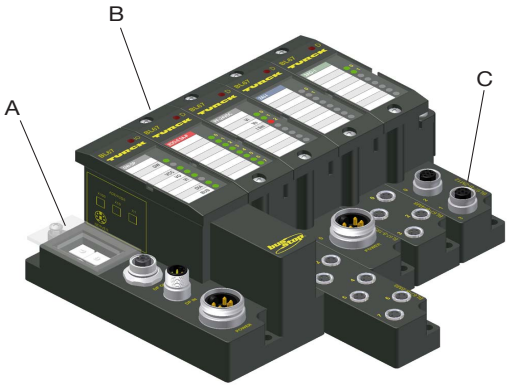
The gateway and the base modules are either snapped onto a mounting rail or are directly mounted onto the machine frame. The electronic modules are plugged onto the appropriate base modules.

After disconnection of the load, the electronic modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

BL67 Components

Figure 1:
BL67 station

A *gateway*
B *electronic module*
C *base module*



Gateways

The gateway connects the fieldbus to the I/O-modules. It is responsible for handling the entire process data and generates diagnostic information for the higher-level master and the software tool I/O-ASSISTANT.

Figure 2:
BL67 gateway

Electronic Modules

Electronic modules contain the functions of the BL67 modules (Power Feeding modules, digital and analog input/output modules, technology modules).

Electronic modules are plugged onto the base modules and are not directly connected to the wiring. They can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

Figure 3: electronic module

Power Feeding Modules

Power Feeding modules distribute the required 24 V DC field voltage to the I/O-modules. They are necessary for building groups of modules with different potentials within a BL67 station, or if the rated supply voltage for the outputs cannot be guaranteed.

Power Feeding modules are potentially isolated from the gateway, the adjoining power supply module and the I/O-modules to the left side.

Note

For detailed information about the individual BL67 I/O components, please refer to the chapters 2 to 8 of the manual "BL67- I/O-modules" (TURCK Documentation-No.: German D300572; English: D300529).
The "Appendix" to the manual mentioned above contains (amongst others) a list of all BL67 components and the assignment of electronic modules to base modules.

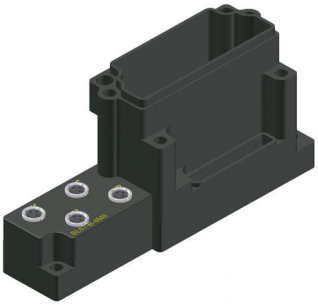
Base Modules

The field wiring is connected to the base modules.

These are available in the following connection variations:

- 1 × M12, 1 × M12-8, 2 × M12, 2 × M12-P, 4 × M12, 4 × M12-P
- 4 × M8, 8 × M8
- 1 × M23, 1 × M23-19
- 1 × 7/8'' (for Power Feeding Module)

Figure 4: example of a base module



End Plate

An end plate on the right-hand side physically completes the BL67 station.

It protects the module bus connections of the last base module in a station and guarantees the protection class IP67.

Figure 5: end plate

2 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).

3 Technical Features

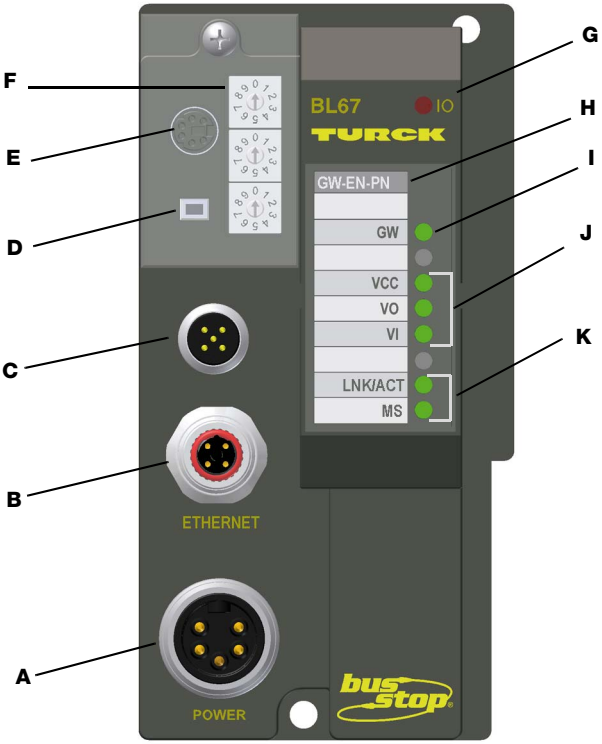
Function

The gateway is the connection between the BL67 I/O-modules and the PROFINET-network.

It handles the entire process data traffic between the I/O-level and the fieldbus and generates diagnostic information for higher-level nodes and the software tool I/O-ASSISTANT.

Figure 6:
BL67-GW-EN

A *power supply*
B *Ethernet*
C *n.c.*
D *SET-button*
E *service-interface*
F *rotary coding switches*
G *module bus LED*
H *designation*
I *status LED*
J *LEDs for supply voltage monitoring*
K *Ethernet LEDs*



Gateway structure

The BL67 gateway has the following structure:

Figure 7: Gateway structure

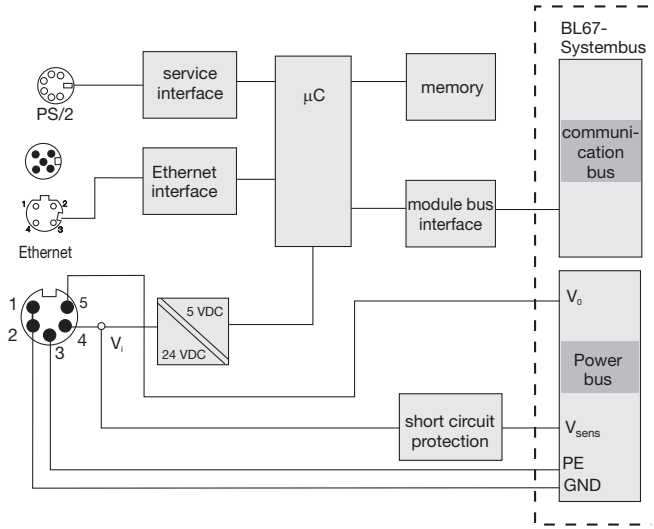


Table 2: Technical data Ethernet gateway

Supply voltage		
System supply V_I (U_B)	24 VDC	used to generate the galvanically isolated module bus supply
permissible range	18 to 30 VDC	
Field supply V_O (U_L)	24 VDC	
permissible range	18 to 30 VDC	
I_{sys}	600 mA	current consumption CPU + module bus at maximum system extension

I_{MB}	max. 1,3 A	maximum output current of module bus supply
I_{VI}	max. 4 A	short-circuit and overload protection of the sensor supply from gateway or power feeding module
Isolation voltages		
U_{RS} (Ethernet/ service interface)	500 V AC	
U_{EN} (Ethernet/ module bus)	500 V DC	
U_{sys} (V_O/V_I to U_{sys})	1000 V DC	
Ambient conditions		
Ambient temperature		
– $t_{Ambient}$	0 to +55 °C /32 to 131 °F	
– t_{Store}	- 25 to +85 °C / - 13 to 185 °F	
Relative humidity	5 up to 95 % (inside), level RH-2, no condensation (at 45 °C storage temperature)	
Climatic tests	according to IEC 61131-2	
Corrosive gas	according to IEC 60068-2-42/43	
– SO_2	10 ppm (rel. humidity < 75 %, no condensation)	
– H_2S	1.0 ppm (rel. humidity < 75 %, no condensation)	

Resistance to vibration	according to EN 61131
– 10 to 57 Hz, constant amplitude 0.075 mm, 1 g	yes
– 57 to 150 Hz, constant acceleration 1 g	yes
– Vibration mode	frequency cycles with a change rate of 1 octave/min
– Vibration duration	20 frequency cycles per coordinate axis
Application conditions	according to EN 61131
Shock resistant	according to IEC 68-2-27, 18 shocks, semi-sinusoidal 15 g threshold/11 ms, each in ± direction per space coordinate
Repetitive shock resistance	according to IEC 68-2-29, 1000 shocks, semi-sinusoidal 25 g threshold/6 ms, each in ± direction per space coordinate
Drop and topple	according to IEC 68-2-31 and free fall according to IEC 68-2-32
– Drop height (weight < 10 kg)	1 m
– Drop height (weight 10 to 40 kg)	0.5 m
– Test cycles	7
Protection class	IP67 according to IEC 60529

Electromagnetic capability (EMC)	according to EN 61131-2/ EN 50082-2 (Industrial)
Static electricity according to EN 61000-4-2	
Air discharge (direct)	8 kV
Relay discharge (indirect)	4 kV
Electromagnetic HF fields	according to IEC 61131-2
Fast transients (Burst)	according to IEC 61131-2
Conducted interferences induced by HF fields	according to IEC 61000-4-6 10 V Criteria A
High energy transients (Surge) **A** voltage supply	according to IEC 61000-4-5 0,5 kV CM, 12 Ω/ 9 µF 0,5 kV DM, 2 Ω/ 18 µF Criteria B
Reliability	
Operational life MTBF	min. 120000 h
Electronics modules pull/ plug cycles	20
Housing material	PC-V0 (Lexan)
Dimensions	
Width x length x height (mm/inch)	64,5 x 145,0 x 77,5 / 2,54 x 5,71 x 3,05

A *I/O-line-length ≤ 30 m*

Warning

This device can cause radio disturbances in residential areas and in small industrial areas (residential, business and trading). In this case, the operator can be required to take appropriate measures to suppress the disturbance at his own cost.

Connection Possibilities

Field Bus Connection

Ethernet-connection

The connection to Ethernet is realized via a 4-pole and D-coded female connector on the gateway according to IAONA-standards.

Figure 8: M12-female connector

Table 3: Pin assignment

Pin-No.		
1	TD+	Transmission Data +
2	RD+	Receive Data +
3	TD-	Transmission Data -
4	RD-	Receive Data -

Power Supply via 7/8" Connector

The power supply is realized via a 7/8" male connector on the gateway.

Figure 9: power supply via 7/8" male connector

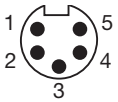


Table 4: Pin assignment of the 7/8" power supply connector

Pin-No.	Color	7/8"	Description
1	black	GND	
2	blue	GND	
3	green/ yellow	PE	Protective earth
4	brown	V_I (U_B)	Feed-in of nominal voltage for input modules (sensor supply); also used for the generation of the system supply voltage
5	white	V_O (U_L)	Feed-in of nominal voltage for output modules (can be switched off separately)

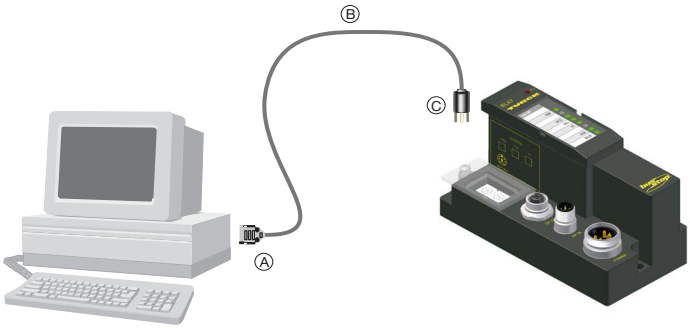
Service Interface Connection

Two types of cables can be used to connect the service interface (female PS/2 connector) to a PC for the purpose of using I/O-ASSISTANT (project planning and diagnostic software).

- special I/O-ASSISTANT-connection cable from TURCK (IOASSISTANT-ADAPTERKABEL-BL20/BL67; Ident-no.: 6827133)
- Commercially available PS/2 cable with adapter cable SUB-D/ PS/2

Connection with I/O-ASSISTANT-Connection Cable

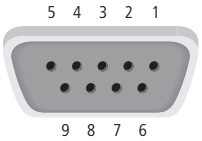
Figure 10: BL67-gateway connected to PC via special cable



The I/O-ASSISTANT-cables have a PS/2 male connector (connection for female connector on gateway) and a SUB-D female connector (connection for male connector on PC).

Figure 11: PS/2 male connector on the connection cable to the gateway (top view)

Figure 12: 9-pole SUB-D female connector on the cable for connecting to PC (top view)



Connection Using Commercially Available Cables

A further possibility to connect PC and BL67 gateway is to use a commercially available connection and adapter cable.

The connection shown in the following figure (PS2-male/ PS2-male) is a 6-wire 1:1 connection.

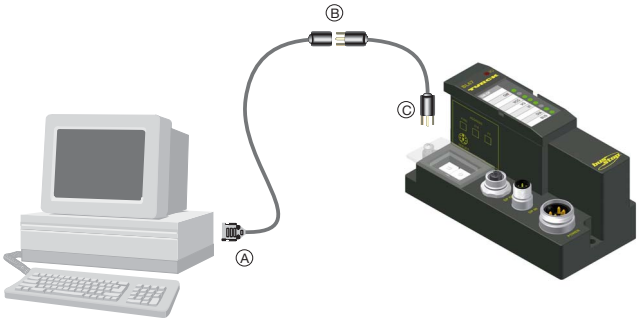


Figure 13: Connection between PC and BL67 gateway via commercially available cable

A *SUB-D- female*
B *PS/2-female <–> PS/2-male*
C *PS/2-male*

The following two cables are necessary:

- 1 x PS/2 cable (PS/2 male connector/PS/2 male connector) (commercially available keyboard extension cable)
- 1 x adapter cable (PS/2 female connector/SUB-D female connector) (commercially available extension cable for a PC mouse)

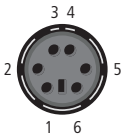


Figure 14: PS/2 female connector on the gateway (top view)

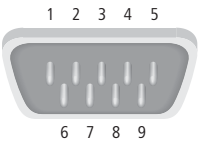


Figure 15: 9-pole SUB-D male connector on PC (top view)

Pin Assignment

The table below shows the pin assignment when using a PS/2 cable and adapter:

Table 5: Pin assignment when using PS/2 cable and adapter

A *not supported by all adapter cables.*

PS/2			**9-pole serial interface on PC**	
Pin-No.	Standard PS/2 male connector	BL67 gateway: PS/2 female connector	Pin-No.	Male connector
1	CLK	+5 V (from gateway)	4, 6 **A**	DTR, DSR
2	GND	GND	5	GND
3	DATA	not connected	–	–
4	n.c. (DATA2)	TxD	2	RxD
5	+5 V	/CtrlMode	7	RTS
6	n.c. (CLK2)	RxD	3	TxD

Address Assignment

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

The device name can be freely chosen.

Note

It is not necessary to address the station's internal module bus.

PROFINET-Operation Mode

The gateway BL67-GW-EN-PN is set to the PROFINET-operation mode (switch position "700") when delivered.

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

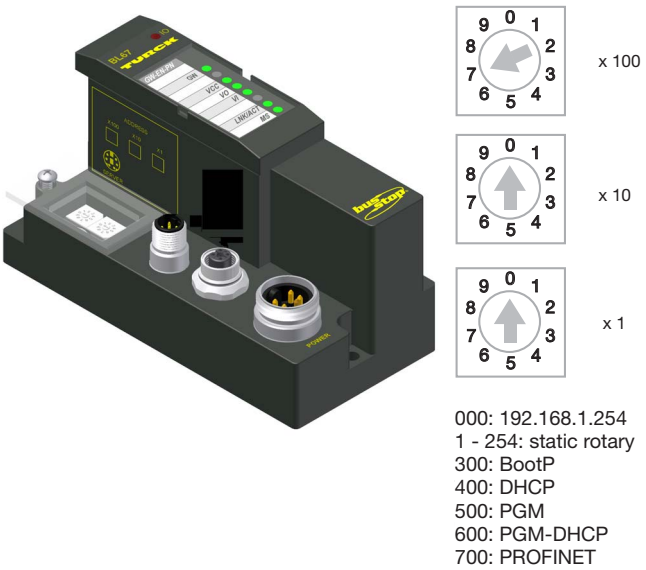


Figure 16: Decimal rotary coding switches for address setting

Attention

The cover of the decimal 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

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.

GSDML-FIle

You can download the actual GSDML file for the gateway BL67-GW-EN-PN “GSDML-V××-Turck-BL67-×××.xml“ from our Homepage www.turck.com.

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 gateway.

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-BL67-default

Attention

When storing the device name or the IP address or when resetting the gateway to the default values, the GW-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).

Parameterization

Gateway-Parameters

The BL67 gateways for PROFINET use 5 bytes of parameters, of which byte 3 and 4 contain the user-specific parameter data.

Description of the Gateway-Parameters

The texts in the columns parameter name and value correspond to those defined in the general station description files (GSDML-files).

Table 6: Gateway parameters

A *default-settings*

Byte/ parameter name	**Value**	**Meaning**
Byte 3:		
bit 0 and 1: outputs module exchange		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules (with the exception of analog output modules) to "0". Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".

Table 6: Gateway parameters

A *default-settings*

Byte/ parameter name	**Value**	**Meaning**
Byte 3:		
bit 0 and 1: outputs module exchange		
10	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or maintain the original values. The non-configured analog output modules maintain their current output settings.
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.

Table 6: Gateway parameters

A *default-settings*

Byte/ parameter name	**Value**	**Meaning**
Byte 3:		
bit 4 and 5: outputs fieldbus error		
00	output 0 **A**	The gateway switches the outputs of the modules to "0". No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules (with the exception of analog output modules) to "0". Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or maintain the original values. The non-configured analog output modules set their outputs to "0".
11	Hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or maintain the original values. The non-configured analog output modules maintain their current output settings.

Table 6: Gateway parameters

A *default-settings*

Byte/ parameter name	**Value**	**Meaning**
Byte 4:		
bit 1: Diagnostics from modules		
0	activate **A**	Diagnostic messages from the module bus stations are made known to the fieldbus master as extended diagnostics.
1	deactivate	Diagnostic messages from the module bus stations will not be displayed. A station diagnostic is not automatically generated along with module diagnostics.
– Bit 2: V_O diagnostics		
0	activate **A**	The monitoring function for the field supply V_O (from gateway and power feeding modules) is activated. If this parameter is set but the parameter "Diagnostics from modules" (see bit 1) deactivated, then only the voltage supply at the gateway is monitored. A monitoring of the voltage supply at the power feeding module is not realized.
1	deactivate	
– Bit 3 to 5: reserved		

Table 6: Gateway parameters

Byte/ parameter name	Value	Meaning
– Bit 6: Static configuration		
0	activate **A**	Changes in the station configuration are stored in the gateway following a power-on reset.
1	deactivate	If the static configuration is deactivated, a dynamic configuration take-over is realized directly following station configuration changes (important for acyclic parameterization).
– Bit 7: reserved		

Parameter "module parameterization"

Each parameterizable module, gets the additional parameter "module parameterization" via the GSDML-file of the gateway.

Note

This parameter is not part of the module parameters, but is only important for the communication between gateway and the modules.

This parameter extension is always necessaray, even if the module is parameterized via a IO-supervisor.

- **"module parameterization" activated**
  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 e obverwritten with the valid parameter data set.
- **"module parameterization" deactivated**
  Changes in the parameter settings are ignored for the respective module. The stored parameter data will be used.

Note

If the "module parameterization" is activated and a module is replaced by a new one, the gateway has to be operated with active V_I, in order to keep the module's parameter-settings for the new module.
V_o has to be switched-off and the station has to be separated from the field bus.
Now, the gateway sends the parameters defined for the old module, into the new module.

Module Parameters

Parameters: BL67-4DI-PD

Table 7: Parameters BL67-4DI-PD

A *default-settings*

Byte	Bit	Parameters	Value/ Meaning
1	0	input filter 1	0 = deactivate **A** 1 = activate
	...		
	3	input filter 4	
2	0	digital input 1	0 = normal **A** 1 = inverted
	...		
	3	digital input 3	
3	0	operation mode group A	0 = normal **A** 1 = Open circuit detection
	1	operation mode group B	

Parameters: BL67-8DI-PD

Table 8: Parameters BL67-8DI-PD

A *default-settings*

Byte	Bit	Parameters	Value/ Meaning
1	0	input filter 1	0 = deactivate **A** 1 = activate
	...		
	7	input filter 8	
2	0	digital input 1	0 = normal **A** 1 = inverted
	...		
	7	digital input 8	
3	0	operation mode group A	0 = normal **A** 1 = Open circuit detection
	...	...	
	3	operation mode group D	

Parameters: BL67-2AI-I

Table 9: Parameters BL67-2AI-I

A *default-settings*

Byte	Bit	Parameters	Value/ Meaning
– channel 0			
1	0	current mode	0 = 0...20 mA **A** 1 = 4...20 mA
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	2	diagnosis	0 = release **A** 1 = block
	3	channel	0 = activate **A** 1 = deactivate
– channel 1			
2	Parameter assignment according to byte 1, channel 0		

Parameter: BL67-2AI-V

Table 10: Parameter BL67-2AI-V

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
– channel 0			
1	0	voltage mode	0 = 0...10 V **A** 1 = -10...+10 V
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	2	diagnosis	0 = release **A** 1 = block
	3	channel	0 = activate **A** 1 = deactivate
– channel 1			
2	Parameter assignment according to byte 1, channel 0		

Parameter: BL67-2AI-PT

Table 11: Parameter BL67-2AI-PT

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
– channel 0			
1	0	Mains suppression	0 = 50 Hz **A** 1 = 60 Hz
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	2	diagnosis	0 = release **A** 1 = block
	3	channel	0 = activate **A** 1 = deactivate
	4 to 7	element	0000 = Pt100, -200...850 °C **A** 0001 = Pt100, -200...150 °C 0010 = Ni100, -60...250 °C 0011 = Ni100, -60...150 °C 0100 = Pt200, -200...850 °C 0101 = Pt200, -200...150 °C 0110 = Pt500, -200...850 °C 0111 = Pt500, -200...150 °C 1000 = Pt1000, -200...850 °C 1001 = Pt1000, -200...150 °C 1010 = Ni1000, -60...250 °C 1011 = Ni1000, -60...150 °C 1100 = resistance, 0...100 Ω 1101 = resistance, 0...200 Ω 1110 = resistance, 0...400 Ω 1111 = resistance, 0...1000 Ω
2	0	measuring mode	0 = 2-wire **A** 1 = 3-wire
– channel 1			
3	Parameter assignment according to byte 1 for channel 0		
4	Parameter assignment according to byte 2 for channel 0		

Parameter: BL67-2AI-TC

Table 12: Parameter BL67-2AI-TC

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
– channel 0			
1	0	Mains suppression	0 = 50 Hz **A** 1 = 60 Hz
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	2	diagnosis	0 = release **A** 1 = block
	3	channel	0 = activate **A** 1 = deactivate
	7 to 4	element	0000 = type K, -270...1370 °C **A** 0001 = type B, +100....1820 °C 0010 = type E, -270...1000 °C 0011 = type J, -210...1200 °C 0100 = type N, -270...1300 °C 0101 = type R, -50...1760 °C 0110 = type S, -50...1540 °C 0111 = type T, -270...400 °C 1000 = ±50 mV 1001 = ±100 mV 1010 = ±500 mV 1011 = ±1000 mV
– channel 1			
2	Parameter assignment according to byte 1 for channel 0		

Parameter: BL67-4AI-V/I

Table 13: Parameter BL67-4AI-V/I

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
– channel 0			
1	0	range	0 = 0...10 V/0...20mA **A** 1 = -10...10 V/4...20mA
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	2	diagnosis	0 = release **A** 1 = block
	3	channel	0 = activate **A** 1 = deactivate
	4	measuring mode	0 = voltage **A** 1 = current
– channel 1			
2	Parameter assignment according to byte 1 for channel 0		
– channel 2			
3	Parameter assignment according to byte 1 for channel 0		
– channel 3			
4	Parameter assignment according to byte 1 for channel 0		

Parameter: BL67-16DO-0.1A-P

Table 14: Parameter BL67-16DO-0.1A-P

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
1	3 to 0	open circuit current	0000 = 0 mA 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA **A**
	7 to 4	overcurrent/ short circuit	0000 = 0 mA 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA **A**
2	0	Overcurrent monitoring	0 = deactivated 1 = activated **A**
	1	Open circuit monitoring	0 = deactivated **A** 1 = activated

Parameter BL67-2AO-I

Table 15: Parameter BL67-2AO-I

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
– channel 0			
2	0	current mode	0 = 0...20 mA **A** 1 = 4...20 mA
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	3	channel	0 = activate **A** 1 = deactivate
2 and 3		substitute value A1	The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value".
– channel 1			
4	Parameter assignment according to byte 1 for channel 0		
5 and 6	Parameter assignment according to byte 2 and 3		

Parameter BL67-2AO-V

Table 16: Parameter BL67-2AO-V

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
– channel 0			
1	0	Voltage mode	0 = 0...10 V **A** 1 = -10...10 V
	1	value description	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left justified)
	3	channel	0 = activate **A** 1 = deactivate
2 and 3		substitute value A1	The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value".
– channel 1			
4	Parameter assignment according to byte 1 for channel 0		
5 and 6	Parameter assignment according to byte 2 and 3.		

Parameter: BL67-4DI4DO-PD

Table 17: Parameter BL67-4DI4DO-PD

A *default-settings*

Byte	Bit	Parameter	Value/ Meaning
1	0	input filter 1	0 = deactivate **A** 1 = activate
	...		
	3	input filter 4	
2	0	digital input 1	0 = normal **A** 1 = inverted
	...		
	3	digital input 3	
3	0	output on overcurrent 1	0 = automatic recovery **A** 1 = controlled recovery
	...		
	3	output on overcurrent 4	

Parameter: BL67-8XSG-PD

Table 18: Parameter BL67-XSG-PD

A *default-settings1*

Byte	Bit	Parameter	Value/ Meaning
1	0	input filter 1	0 = deactivate **A** 1 = activate
	...		
	7	input filter 8	
2	0	digital input 1	0 = normal **A** 1 = inverted
	...		
	7	digital input 8	
3	0	output on overcurrent 1	0 = automatic recovery **A** 1 = controlled recovery
	...		
	7	output on overcurrent 8	
4	0	output 1	0 = deactivate **A** 1 = activate
	...		
	7	output 8	

Parameter: BL67-1RS232

Table 19: parameters BL67-1RS232

A *default-settings*

Byte	Bit	Parameters	Value/ Meaning
1	3 to 0	data rate	0000 = reserved 0001 = 300 bit/s 0010 = 600 bit/s 0011 = 1200 bit/s 0100 = 2400 bit/s 0101 = 4800 bit/s 0110 = 9600 bit/s **A** 0111 = 14400 bit/s 1000 = 19200 bit/s 1001 = 28800 bit/s 1010 = 38400 bit/s 1011 = 57600 bit/s 1100 = 115200 bit/s 1101 = reserved 1110 = reserved 1111 = reserved
	5 to 4	reserved	
	6	Disable ReducedCtrl	1 Constant setting: The diagnostic messages are mapped into byte 6 of the process input data (independent of "diagnostic") Byte 7 contains the status byte, user data are displayed in bytes 0 - 5.
	7	diagnosis	0 = release 1 = block **A**

Byte	Bit	Parameters	Value/ Meaning
2	0	stop bits	0 = 1 1 = 2 **A**
	2, 1	parity	00 = none 01 = odd **A** 10 = even
	3	data bits	0 = 7 **A** 1 = 8
	5, 4	data flow control	00 = none **A** 01 = XON/XOFF 10 = RTS/CTS 11 = reserved
3		XON character	0 to 255 XON-character (17 **A**) This character is used to start the data transfer of the data terminal device when the software-handshake is activated
4		XOFF character	0 to 255 XOFF-character (19 **A**) This character is used to stop the data transfer of the data terminal device when the software-handshake is activated

Parameters: BL67-1RS485/422

Table 20: Parameters BL67-1RS485/422

A *default-settings*

Byte	Bit	Parameters	Value/ Meaning
1	3 to 0	data rate	0000 = reserved 0001 = 300 bit/s 0010 = 600 bit/s 0011 = 1200 bit/s 0100 = 2400 bit/s 0101 = 4800 bit/s 0110 = 9600 bit/s **A** 0111 = 14400 bit/s 1000 = 19200 bit/s 1001 = 28800 bit/s 1010 = 38400 bit/s 1011 = 57600 bit/s 1100 = 115200 bit/s 1101 = reserved 1110 = reserved 1111 = reserved
	4	select RS485	0 = parameterization as RS422 1 = parameterization as RS485
	5	reserved	
	6	Disable ReducedCtrl	1 Constant setting: The diagnostic messages are mapped into byte 6 of the process input data (independent of "diagnostic") Byte 7 contains the status byte, user data are displayed in bytes 0 - 5.
	7	diagnosis	0 = release 1 = block **A**

Byte	Bit	Parameters	Value/ Meaning
2	0	stop bits	0 = 1 1 = 2 **A**
	2, 1	parity	00 = none 01 = odd **A** 10 = even
	3	data bits	0 = 7 **A** 1 = 8
	5, 4	data flow control	00 = none **A** 01 = XON/XOFF 10 = RTS/CTS 11 = reserved
3		XON character (only for RS422)	0 to 255 XON-character (17 **A**) This character is used to start the data transfer of the data terminal device when the software-handshake is activated
4		XOFF character (only for RS422)	0 to 255 XOFF-character (19 **A**) This character is used to stop the data transfer of the data terminal device when the software-handshake is activated

Parameters: BL67-1SSI

Table 21: Parameters BL67-1SSI

A *default-settings*

Byte	Bit	Parameters	Value/ Meaning
1	4 to 0	reserved	
	5	Sensor idle data signal test	0 = activate **A** 1 = deactivate
	7 to 6	reserved	
2	3 to 0	Invalid bits (LSB)	0000 to 1111
	6 to 4	Invalid bits (MSB)	000 to 111
	7	reserved	
3	3 to 0	data rate	000 = 1000000 bit/s 001 = 500000 bit/s **A** 010 = 250000 bit/s 011 = 125000 bit/s 100 = 100000 bit/s 101 = 83000 bit/s 110 = 71000 bit/s 111 = 62500 bit/s
	7 to 4	reserved	-
Byte	**Bit**	**Parameters**	**Value/ Meaning**
4	5 to 0	Data frame bits	1 to 32 Number of bits in the SSI data frame. Basically, SSI_FRAME_LEN must be larger than INVALID_BITS. 25 = 19hex **A**
	6	reserved	
	7	Data format	0 = binary coded **A**: 1 = GRAY coded

Parameters: BL67-1CVI

Table 22: Parameters BL67-1CVI

A *default-settings*
n = 0 → *typisierte Moduldarstellung*
n = 1 → *Standard Moduldarstellung*

Byte	Bit	Parameters	Value/ Meaning
1	0	node 1	0 = deactivate **A** 1 = activate
	1	guarding	0 = deactivate **A** 1 = activate
	4,3,2	input bits	000 = 0 bit **A** 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit
	7,6,5	output bits	000 = 0 bit **A** 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit
2		Parameter assignment according to byte 1 for Node 2.	
...	...		
8		Parameter assignment according to byte 0 for Node 8.	
9		guarding time [0,1s]	Setting the Guard-Time in steps of 100 ms (Values 0 to 255); Default 3 = 300 ms
10		life time factor	Factor which defines how often a node is allowed not to answer a request or to exceed the Guard-Time (values 0 to 255); default = 3

Byte	Bit	Parameters	Value/ Meaning
11	2, 1, 0	data rate	000 = 1000 kbit/s 001 = 500 kbit/s 010 = 250 kbit/s 011 = 125 kbit/s **A** 100 = 50 kbit/s 101 = 20 kbit/s 111 = 10 kbit/s
	3	terminating resistor	0 = deactivate **A** 1 = activate
...		reserved	

Status Indicators/ Diagnostic Messages Gateway

The gateway sends the following diagnostic messages:

- undervoltage monitoring for system- and field supply,
- monitoring of the station status,
- monitoring of the communication via the internal module bus,
- monitoring of the communication to PROFINET
- monitoring of the gateway status

Diagnostic messages are displayed in two different ways:

- via the LEDs
- via the respective configuration software

Diagnostic Messages via LEDs

Every BL67 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IOs**
- 2 LEDs for the PROFINET communication (fieldbus-LEDs): **LINK/ACT** and **MS**.
- 3 LEDs for monitoring the voltage supply (system, $\mathbf{V_{CC}}$/ inputs, $\mathbf{V_i}$/ outputs, $\mathbf{V_o}$).

Table 23: LED-displays

LED	Status	Meaning	Remedy
GW	Off	CPU not supplied.	
	Green	Firmware active, gateway ready to operate and transmit	-
	Green, flashing, 1 Hz	Firmware not active.	If LED "**IOs**" red → Firmware download necessary
	Green, flashing, 4 Hz	Firmware active, gateway hardware defect.	Replace the gateway.
	Red	Controller is not ready, VCC level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.

Table 23: LED-displays

LED	Status	Meaning	Remedy
IOs	Off	CPU not supplied.	– Check the voltage supply at the gateway.
	Green	Module bus is running, - if MS-LED green: modules configured from PROFINETIO-Controller correspond to the modules connected to the gateway.	
	Green, flashing 1 Hz	Station is in the I/O-ASSISTANT Force Mode.	– Deactivate the I/O-ASSISTANT Force Mode.
	Green, flashing 4 Hz	Maximum number of modules at the gateway is exceeded.	– Check the number of modules connected to the gateway, dismount modules
	Red	Controller is not ready, V_{CC} level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in – gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.

Table 23: LED-displays

LED	Status	Meaning	Remedy
IOs	Red flashing, 1 Hz	Non-adaptable modification of the physically connected station.	– Compare the planned BL67 station with the physical station. – Check the physical station for defective or incorrectly fitted electronics modules.
	Red flashing, 4 Hz	no module bus communication	– At least one module has to be plugged and has to be able to communicate with the gateway.
	Red/ green flashing, 1 Hz	Adaptable modification of the physically connected station; data transfer possible	– Check the physical station for pulled or new but not planned modules.
V_{CC}	Off	CPU not supplied	– Check the system supply at the gateway.
	Green	Module bus and CPU running	-
V_O	Off	No voltage supply.	Check the system supply at the gateway.
	output supply ok.	– Check the wiring at the gateway and the voltage supply.	Green
	Green flashing, 1 Hz	Undervoltage V_O, system running	– Check the system supply at the gateway
	Green flashing, 4 Hz	Overvoltage V_O, system running	

Table 23: LED-displays

LED	Status	Meaning	Remedy
V_I	Off	No voltage supply.	– Check the wiring of the voltage supply at the gateway
	Green	sensor supply ok.	-
	Green, flashing, 1 Hz	Undervoltage V_I, system running	– Check the wiring of the voltage supply at the gateway
	Green, flashing, 4 Hz	Overvoltage V_I, system running	
	Red	Short circuit or overload at sensor supply → sensor supply is switched off	– Automatic restart when debugging.
CAN	-	optional	-
LINK/ ACT	Off	No Ethernet link	– Check the Ethernet-connection
	Green	Link, 100 Mbit/s	
	Green flashing	Ethernet Traffic 100 Mbit/s	
	Yellow	Link, 10 Mbit/s	
	Yellow, flashing	Ethernet Traffic 10 Mbit/s	

Table 23: LED-displays

LED	Status	Meaning	Remedy
MS	Green	Logical connection to a PROFINETIO controller established	
	Green, flashing	The gateway has received a identification command from configurator	
	Red	No connection to a PROFINETIO controller established	

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 error codes, please refer to the following section.

Gateway Diagnostic Messages

Table 24: Gateway-Diagnostics

Value (dec.)	Diagnostics meaning for the gateway
Error codes (1 to 9 acc. the standards)	
2	Undervoltage: Undervoltage Channel 0: Undervoltage at V_i Undervoltage Channel 1: Undervoltage at V_o
3	Overvoltage: Overvoltage Channel 0: Overvoltage at V_i Overvoltage Channel 1: Overvoltage at V_o
Error codes (16 to 31, manufacturer specific)	
16	Parametrization error/ configuration error – **Station configuration changed** The configuration is currently deviating from the reference list of modules. Process data can still be exchanged with the module bus stations which are at present connected to the module bus. The constellation of the module bus station that is set in the configuration software (CheckConfig-Cmd) of the corresponding controller serves as a reference. – **Master configuration error** → The actual list of modules has been altered in such a manner, that no process data can be exchanged with the module bus stations which are at present connected to the module bus. – **Station configuration error** → The gateway could not prepare the station's configuration to be read out.

Value (dec.)	Diagnostics meaning for the gateway
22	Communication error – **Module bus error** → Communication with the module bus station on the module bus is not possible.

Channel-specific diagnosis messages of the modules

The channel-specific diagnosis messages are defined as follows:

Table 25: channel-specific diagnosis

Value (dec.)	Diagnosis
Error-Codes (1 to 9 according to DP-spec.)	
1	short-circuit
2	Undervoltage at channel Exception for BL67-PF-24VDC Undervoltage channel 0: Undervoltage at V_i Undervoltage channel 1: Undervoltage at V_o
3	Overvoltage at channel Exception for BL67-PF-24VDC Overvoltage channel 0: Overvoltage at V_i Overvoltage channel 1: Overvoltage at V_o
4	overload
5	overtemperature
6	wire-break
7	upper limit value exceeded
8	lower limit value exceeded
9	error
Error-Codes (16 to 31, manufacturer-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.

Value (dec.)	Diagnosis
22	**Communication failure** The module detected a communication problem at its ports, e. g. RS232/485/422, SSI or other interface. Check the connection or the function of the attached devices.
23	**Direction error** The direction is detected to be wrong. Check the parameterization or the control interface versus use case.
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.
25	**Cold-junction compensation error** The module detected a defect or missing cold-junction compensation.
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.

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 26: 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

Index	Name	Data type	r/w	Remark
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 27: 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.		

4 Connection of the PROFINET IO Gateway to a Siemens PLC S7

Application Example

In order to configure the connection of a BL67 gateway to a Siemens PLC S7, the software tool "SIMATIC Manager" version 5.3 with Service Pack 3 from Siemens is used.

Hardware:

- Siemens PLC S7, CPU 315-2-PN/DP, 6ES7 315-2EG10-0AB0, firmware V2.3.2
- BL67 station with a gateway BL67-GW-EN-PN for the connection to PROFINET IO with the following BL67 example station:

Table 28: example station

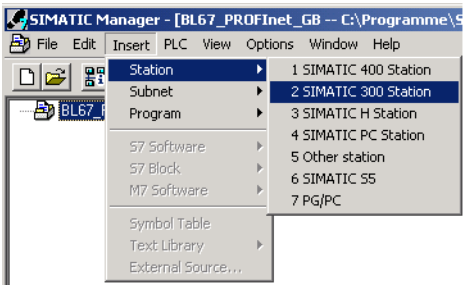
Module		Data width		
		Process input	**Process output**	**Alignment**
GW	BL67-GW-EN-PN			
0	BL67-2AI-I	2 words	-	word by word
1	BL67-4DI-P	4 bit	-	bit by bit
2	BL67-8DI-PD	8 bit	-	bit by bit
3	BL67-1RS232	4 words	4 words	word by word
4	BL67-8XSG-PD	8 bit	8 bit	bit by bit
5	BL67-4DI-PD	4 bit	-	bit by bit
6	BL67-2AI-I	2 words	-	word by word
7	BL67-2AI-TC	2 words	-	word by word

New Project in Simatic Manager

Create a new project in the Simatic Manager using the "File → new" command.

Add a Simatic Station to the project with "Insert → Station...". In this example, a "Simatic 300-Station" is used.

Figure 17: Adding a Simatic Station to the project



The configuration of the PROFINET IO-network is done subsequently in the hardware configuration (HW config) of the software.

Setting the PG/ PC Interface

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

The configuration of the interface is done via the dialog " Set PG/PC Interface" command.

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 18: Command "Set PG/PC Interface"

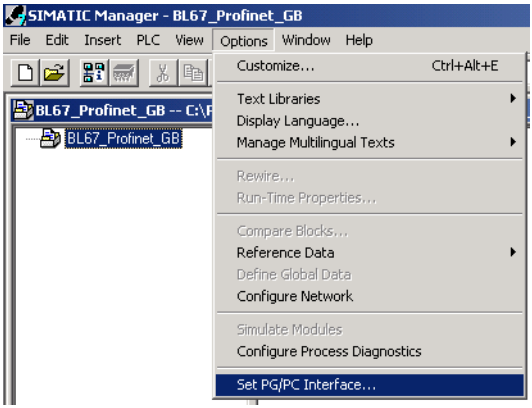
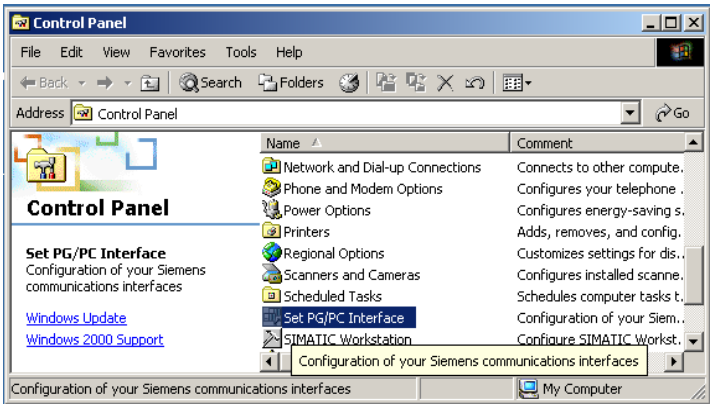
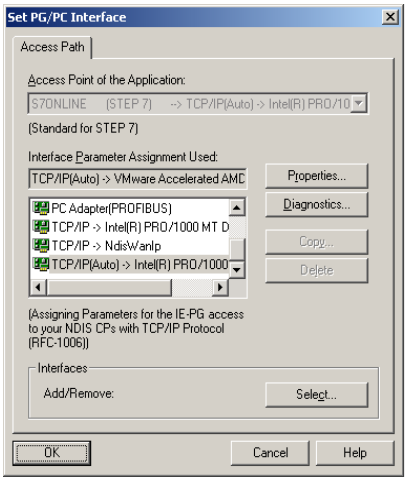


Figure 19: "Set PG/PC interface" in the Control Panel



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

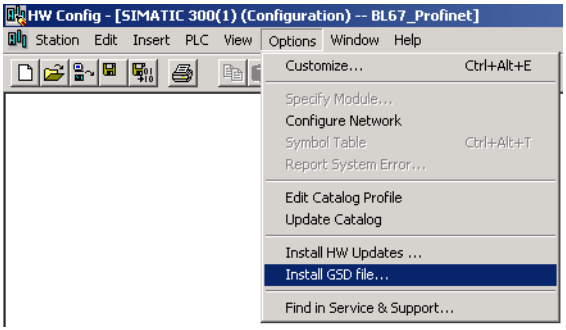
Figure 20: Select PG/PC interface



Installation of the GSDML-files

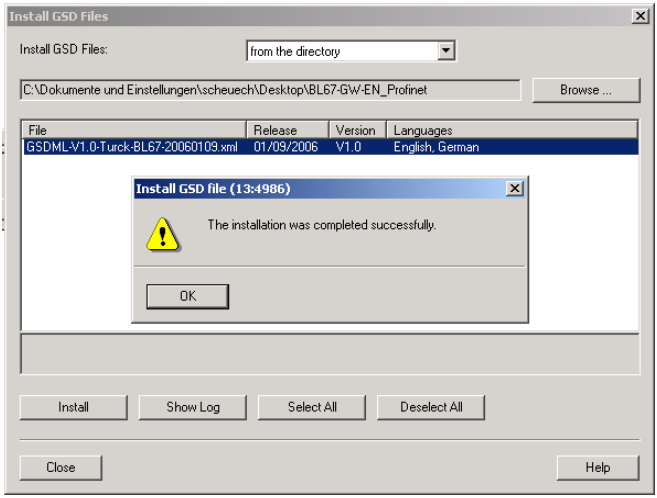
In the hardware configuration "HW config", open the "Options → Install GSD file" command in order to install new GSD-files.

Figure 21: Install GSD-files



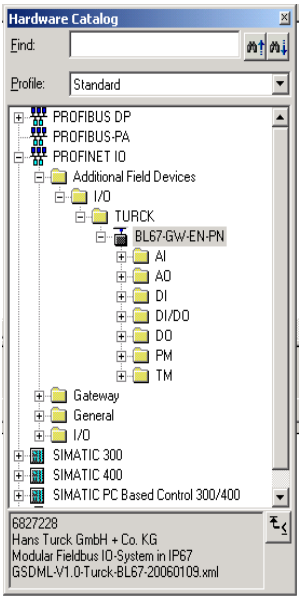
Define the directory for the TURCK GSDML-files by browsing the directories and add the BL67 PROFINET IO gateway to the hardware catalog.

Figure 22: Install GSDML-file



The BL67 gateway can now be found under "PROFINET IO → Additional Field Devices → I/O → TURCK".

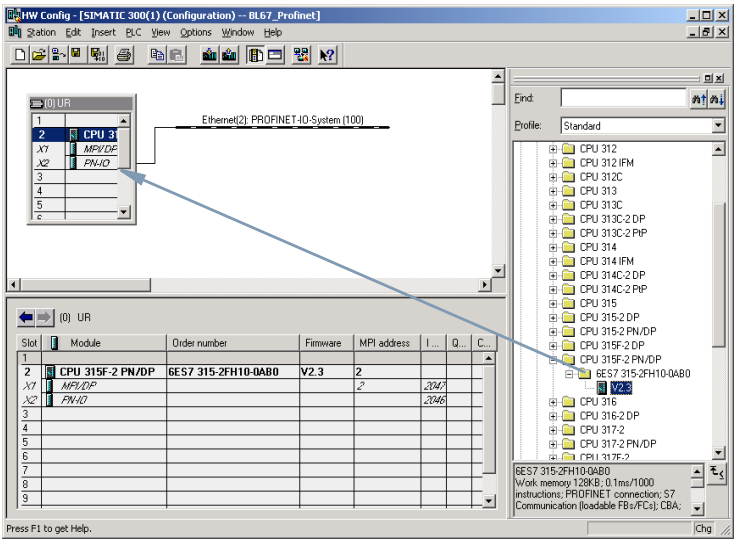
Figure 23: BL67 gateway in the hardware catalog



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

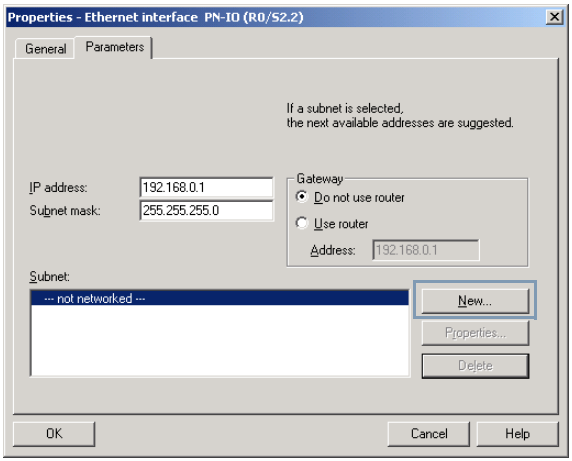
After this, select the Siemens CPU from the hardware catalog. In this example a CPU 315-2 PN/DP, version 6ES7 315-2EG10-0AB0 (V 2.3.2) is used.

Figure 24: Selecting the CPU



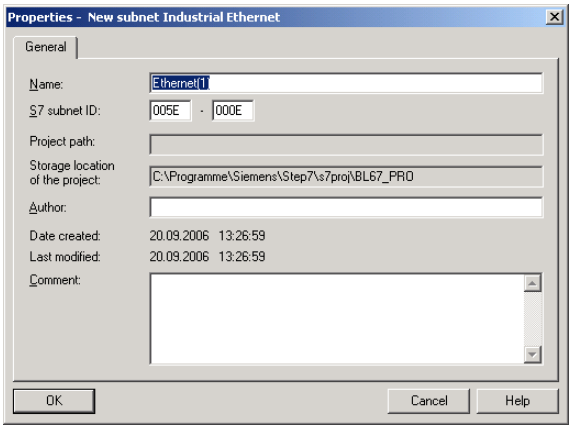
In the dialog "Properties Ethernet Interface", the IP address and the subnet mask for the S7 CPU are defined.

Figure 25: Properties Ethernet interface



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

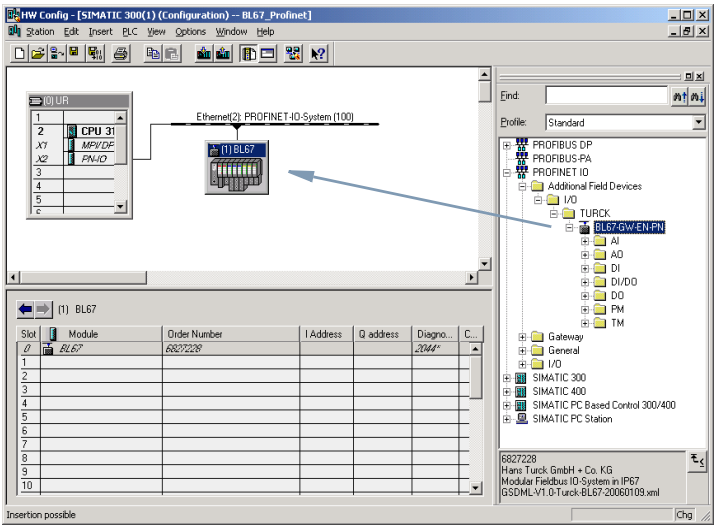
Figure 26: Add new Ethernet subnet



Now, the BL67 gateway is chosen from the hardware catalog and added to the configuration.

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

Figure 27: Select BL67 gateway

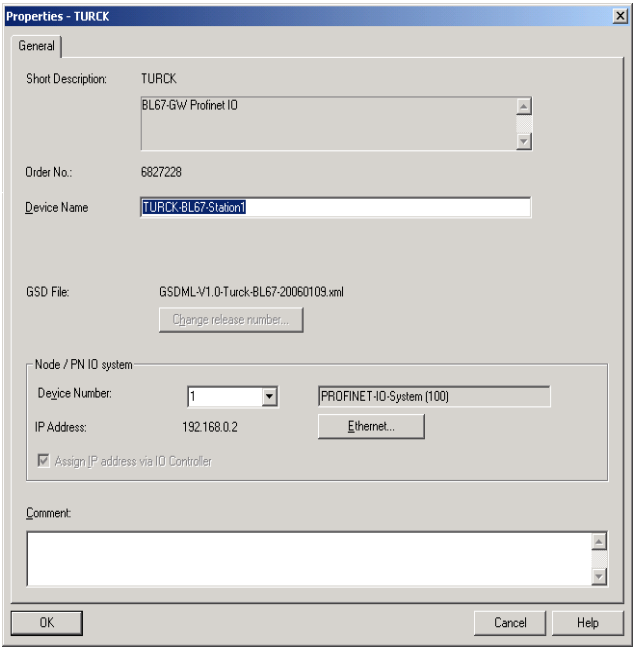


A double-click on the gateway-symbol opens the dialog "Properties TURCK". Enter the gateway's device name in this dialog.

Note

When being operated for the first time, the default-device name of the TURCK BL67 gateways for PROFINET is "TURCK-BL67-default". The IP-Address is 0.0.0.0.

Figure 28:
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

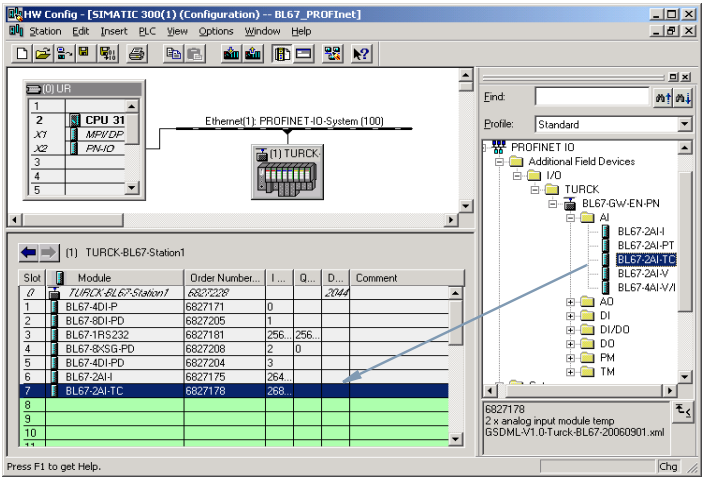
When storing the device name or the IP address or when resetting the gateway to the default values, the GW-LED switches to orange.

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.

Configuration of the BL67 station

After the assignment of the device name, the I/O modules, which are connected to the BL67 gateway, are added to the station configuration. They have to be selected from the Hardware Catalog in the same order as they appear physically in the station.

Figure 29: Add I/O-modules to the station



Save your hardware configuration via "Station → Save and Compile" and download it to the PLC via "PLC → Download...".

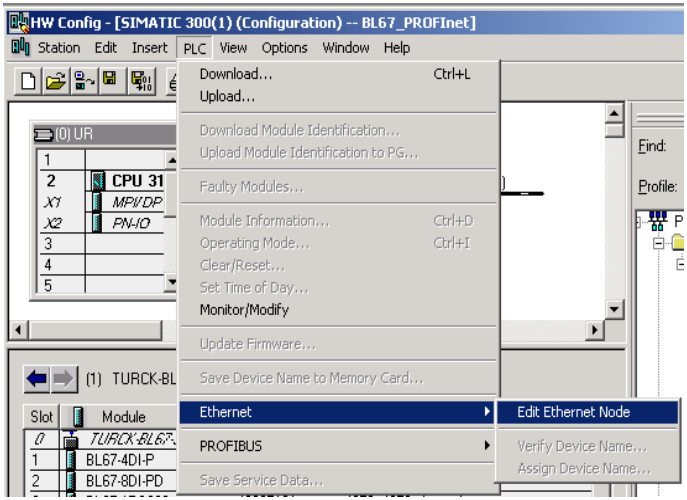
The hardware configuration is completed.

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.

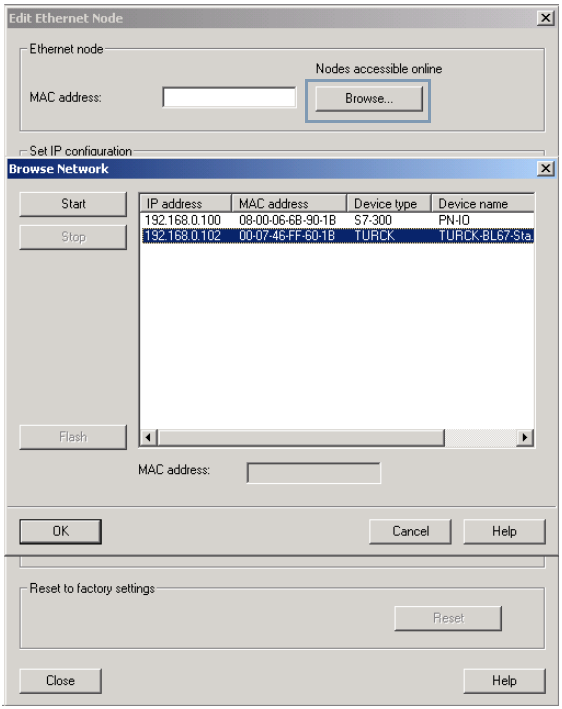
Open the respective dialog box by using "PLC → Ethernet → Edit Ethernet Node".

Figure 30: 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 31: Browse the network



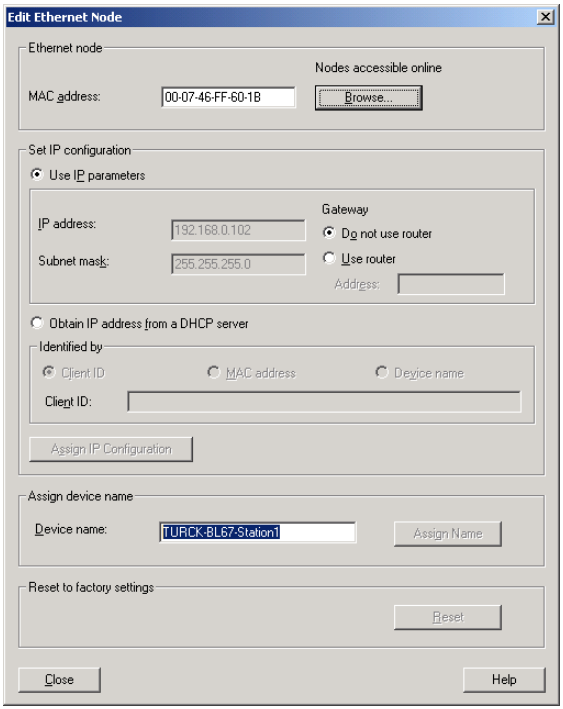
All PROFINET IO nodes found in the network answer the command sending their MAC address and their device name.

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 32: Adaptation of the Ethernet node configuration



Achtung

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!

Diagnosis with Step 7

Diagnostic Messages in the Hardware Configuration

The BL67 gateways for PROFINET show gateway diagnostics and channel-specific module 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:

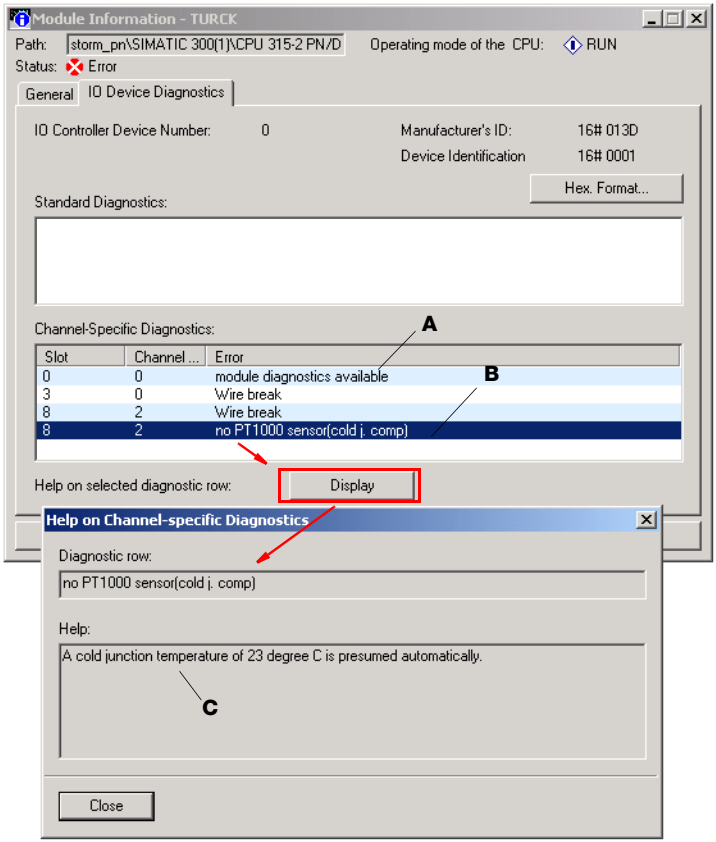


Figure 33: Diagnosis of the PROFINET gateways in the hardware config

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

Diagnosis 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.

Diagnose 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 29: input data SFB 52

Parameter name	Meaning
REQ	REQ = 1, starts data transfer
ID	Logical address (HW config) of the BL67-I/O-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 30: 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.

Diagnosis 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 31: 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 32: 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.

5 Integration of BL67 Technology Modules

Integration of the RS232 Module

Data Image of the RS232 Module

Process Input Data (PDin)

The incoming data are stored in the receive-buffer of the BL67-1RS232 module, segmented and transferred to the PLC via the module bus and the gateway.

The transmission is realized in a 8-byte format, structured as follows:

- 1 status byte, used to guarantee error free data-transmission
- 1 byte diagnostic data
- 6 byte user data.

Figure 34: Data image PLC input data

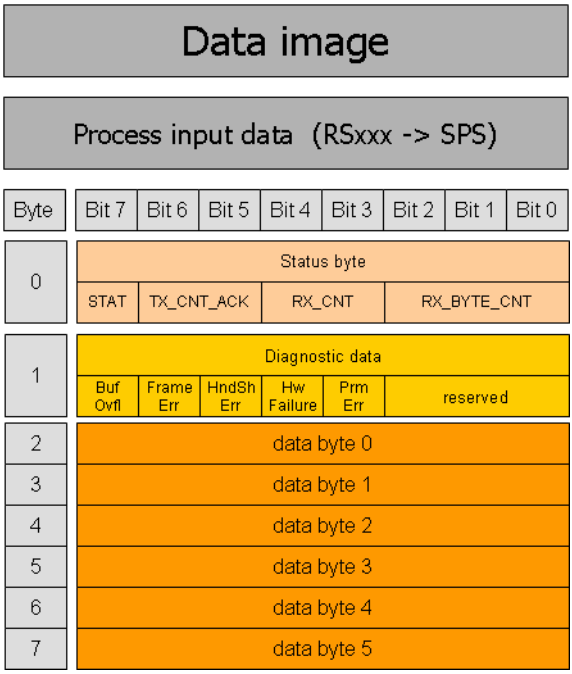


Table 33: Meaning of the data bits (process input)

Designation	Value	Meaning
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostic information (correspond to the diagnostic information in the diagnosis telegram). These diagnostics are always displayed and independent to the setting of the parameter „Diagnostics“.
STAT	0-1	1: The communication with the data terminal equipment (DTE) is error free 0: The communication with the data terminal equipment (DTE) is disturbed. A diagnosis message is generated if the parameter „Diagnostics“ is set to „0/ release“. The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. TX_CNT has been transmitted together with the last data segment of the process output data. TX_CNT_ACK is an acknowledge for the successful transmission of the data segment with TX_CNT.
RX_CNT	0-3	This value is transferred together with every data segment. The RX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
RX_BYTE_CNT	0-7	Number of the valid bytes in this data segment.

Process Output Data (PDout)

Process output data are data which are sent from the PLC via the gateway and the BL67-1RS232 module to a connected field device.

The data received from the PLC are loaded into the transmit- buffer in the BL67-1RS232 module.

The fieldbus specific transmission is realized in a 8-byte format which is structured as follows:

- 1 control byte, used to guarantee error free data-transmission
- 1 byte containing signals to flush the transmit- and receive buffer.
- 6 byte user data.

Figure 35: Process output data

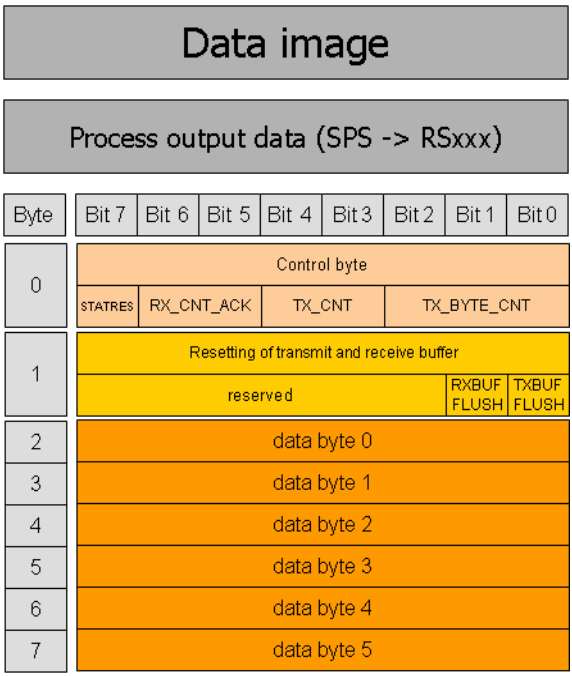


Table 34: Meaning of the data bits (process output)

Designation	Value	Meaning
RXBUF FLUSH	0 - 1	This bit is used to flush the receive-buffer. If STATRES = 1: The command RXBUF FLUSH = 1 is ignored. If STATRES = 0: RXBUF FLUSH = 1 causes the flushing of the receive-buffer.
TXBUF FLUSH	0-1	This bit is used to flush the transmit-buffer. If STATRES = 1: The command TXBUF FLUSH = 1 is ignored. If STATRES = 0: TXBUF FLUSH = 1 causes the flushing of the tranceive-buffer.
STATRES	0-1	This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the STAT bit is reset (from 0 to 1). If this bit is 0, all changes in TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. Flushing the transmit-/ receive-buffer with RXBUF FLUSH/ TXBUF FLUSH is possible. If this bit is 1 or with the change from 0 to 1, the flushing of the transmit-/ receive-buffer with RXBUF FLUSH/ TXBUF FLUSH is not possible.

RX_CNT_ACK	0-3	The value RX_CNT_ACK is a copy of the value RX_CNT. TX_CNT has been transmitted together with the last data segment of the process input data. TX_CNT_ACK is an acknowledge for the successful transmission of the data segment with RX_CNT.
TX_CNT	0-3	This value is transferred together with every data segment. The TX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
TX_BYTE_CNT	0 - 7	Number of the valid user data in this data segment.

Integration of the RS485/422 Module

Data Image of the RS485/422 Module

Process Input Data (PDin)

The incoming data are stored in the receive-buffer of the BL67-1RS485/422 module, segmented and transferred to the PLC via the module bus and the gateway.

The transmission is realized in a 8-byte format, structured as follows:

- 1 status byte, used to guarantee error free data-transmission
- 1 byte diagnostic data
- 6 byte user data.

Figure 36: Data image PLC input data

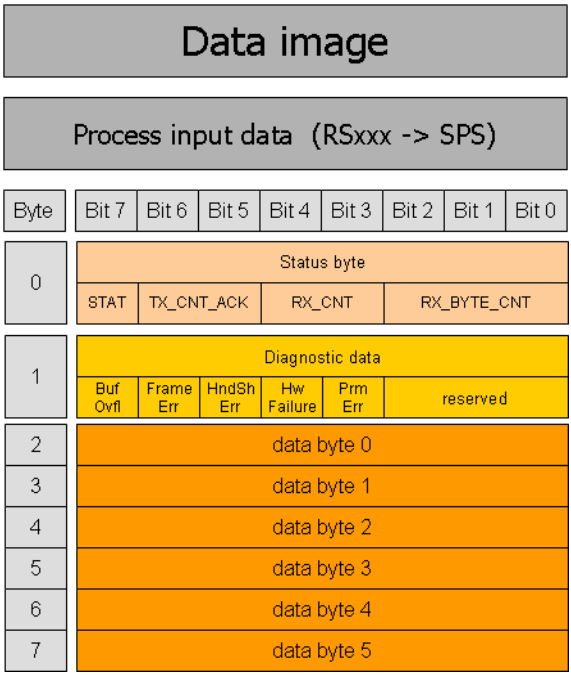


Table 35: Meaning of the data bits (process input)

Designation	Value	Meaning
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostic information (correspond to the diagnostic information in the diagnosis telegram). These diagnostics are always displayed and independent to the setting of the parameter „Diagnostics“.
STAT	0-1	1: The communication with the data terminal equipment (DTE) is error free 0: The communication with the data terminal equipment (DTE) is disturbed. A diagnosis message is generated if the parameter „Diagnostics“ is set to „0/ release“. The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. TX_CNT has been transmitted together with the last data segment of the process output data. TX_CNT_ACK is an acknowledge for the successful transmission of the data segment with TX_CNT.
RX_CNT	0-3	This value is transferred together with every data segment. The RX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
RX_BYTE_CNT	0-7	Number of the valid bytes in this data segment.

Process Output Data (PDout)

Process output data are data which are sent from the PLC via the gateway and the BL67-1RS485/422 module to a connected field device.

The data received from the PLC are loaded into the transmit- buffer in the BL67-1RS485/422 module.

The fieldbus specific transmission is realized in a 8-byte format which is structured as follows:

- 1 control byte, used to guarantee error free data-transmission
- 1 byte containing signals to flush the transmit- and receive buffer.
- 6 byte user data.

Figure 37: Process output data

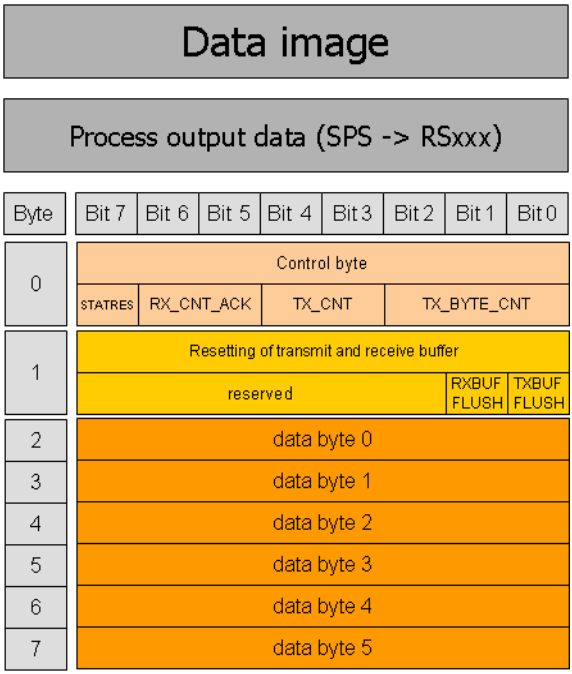


Table 36: Meaning of the data bits (process output)

Designation	Value	Meaning
RXBUF FLUSH	0 - 1	This bit is used to flush the receive-buffer. If STATRES = 1: The command RXBUF FLUSH = 1 is ignored. If STATRES = 0: RXBUF FLUSH = 1 causes the flushing of the receive-buffer.
TXBUF FLUSH	0-1	This bit is used to flush the transmit-buffer. If STATRES = 1: The command TXBUF FLUSH = 1 is ignored. If STATRES = 0: TXBUF FLUSH = 1 causes the flushing of the tranceive-buffer.
STATRES	0-1	This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the STAT bit is reset (from 0 to 1). If this bit is 0, all changes in TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. Flushing the transmit-/ receive-buffer with RXBUF FLUSH/ TXBUF FLUSH is possible. If this bit is 1 or with the change from 0 to 1, the flushing of the transmit-/ receive-buffer with RXBUF FLUSH/ TXBUF FLUSH is not possible.

RX_CNT_ACK	0-3	The value RX_CNT_ACK is a copy of the value RX_CNT. TX_CNT has been transmitted together with the last data segment of the process input data. TX_CNT_ACK is an acknowledge for the successful transmission of the data segment with RX_CNT.
TX_CNT	0-3	This value is transferred together with every data segment. The TX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
TX_BYTE_CNT	0 - 7	Number of the valid user data in this data segment.

Integration of the SSI Module

Data image of the SSI Module

Process input Data (PDin)

The field input data is transferred from the connected field device to the BL67-1SSI module.

The process input data is the data that is transferred to the PLC from the BL67-1SS1 via a gateway.

This is transferred in an 8 byte format as follows:

- 1 byte contains messages concerning the communication status between the BL67-1SSI module and the SSI encoder, as well as other results of comparison operations.
- 1 byte contains the results of comparison operations with the SSI encoder value.
- 1 byte can be used to transfer status messages of the SSI encoder. This byte also contains an acknowledgement that the write operation to the register was successful and indication of an active write operation.
- When necessary, 1 byte represents the register address of the read data and an acknowledgement that the read operation was successful.
- 4 bytes are used for representing the data that was read from the register with the address stated at REG_RD_ADR.

The following table describes the structure of the 8 x 8 bits of the process input data.

STS (or ERR) contains non-retentive status information, i.e. the bit concerned indicates the actual status.

FLAG describes a retentive flag that is set in the event of a particular event. The bit concerned retains the value until it is reset.

Figure 38: Process input data

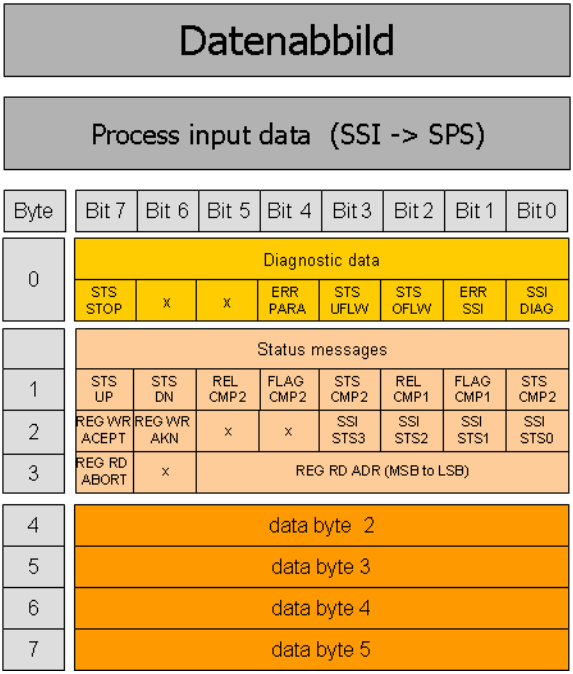


Tabelle 37: Meaning of the data bits (process input)

Designation	Value	Meaning
REG_RD_DATA	0... 2^{32}-1	Content of the register to be read if REG_RD_ABORT = 0. If REG_RD_ABORT = 1, then REG_RD_DATA = 0.
REG_RD_ABORT	0	The reading of the register stated at REG_RD_ADR was accepted and executed. The content of the register is located in the user data range (REG_RD_DATA Bytes 0-3).
	1	The reading of the register stated at REG_RD_ADR was not accepted.The user data range (REG_RD_DATA Bytes 0-3) is zero.
REG_RD_ADR	0...63	The reading of the register stated at REG_RD_ADR was not accepted.The user data range (REG_RD_DATA Bytes 0-3) is zero.
REG_WR_ACEPT	0	The writing of user data for process output to the register with the address stated at REG_WR_ADR in the process output data could not be executed.
	1	The writing of user process output data to the register with the address stated at REG_WR_ADR in the process output data was successfully completed.

Designation	Value	Meaning
REG_WR_AKN	0	No modification of the data in the register bank by process output, i.e. REG_WR = 0. A write job would be accepted with the next telegram of process output data. (handshake for data transmission to the register.)
	1	A modification of the register contents by a process output was initiated, i.e. REG_WR = 1. A write job would not be accepted with the next telegram of process output data.
SSI_STS3	0	These four bits transfer the status bits of the SSI encoder with the status messages of the SSI module. With some SSI encoders, the status bits are transferred together with the position value.
	1	
SSI_STS2	0	
	1	
SSI_STS1	0	
	1	
SSI_STS0	0	
	1	
STS_UP (LED UP)	0	The SSI encoder values are decremented or the values are constant.
	1	The SSI encoder values are incremented.
STS_DN (LED DN)	0	The SSI encoder values are incremented or the values are constant.
	1	The SSI encoder values are decremented.

Designation	Value	Meaning
REL_CMP2	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP2)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_CMP2)
FLAG_CMP2	0	Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP2) since the last reset.
	1	The contents of the registers match (REG_SSI_POS) = (REG_CMP2). This marker must be reset with CLR_CMP2 = 1 in the process output data.
STS_CMP2	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP2)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP2)
REL_CMP1	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP1)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) ≥ (REG_CMP1)
FLAG_CMP1	0	Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP1) since the last reset.
	1	The contents of the registers match: (REG_SSI_POS) = (REG_CMP1). This marker must be reset when CLR_CMP1 = 1 in the process output data.

Designation	Value	Meaning
STS_CMP1	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP1)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP1)
STS_STOP	0	The SSI encoder is read cyclically.
	1	Communication with the SSI encoder is stopped as STOP = 1 (process output) or ERR_PARA = 1.
ERR_PARA	0	The parameter set of the module has been accepted.
	1	Operation of the module is not possible with the present parameter set.
STS_UFLW	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_LOWER_LIMIT)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT)
STS_OFLW	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≤ (REG_UPPER_LIMIT)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT)

Designation	Value	Meaning
ERR_SSI	0	SSI encoder signal present.
	1	SSI encoder signal faulty. (e.g. due to a cable break).
SSI_DIAG	0	No enabled status signal is active (SSI_STSx = 0).
	1	At least one enabled status signal is active (SSI_STSx = 1).

Process output data (PDout)

The field output data is transferred from the BL67-1SSI module to the connected field device.

The process output data is the data that is output from the PLC to the BL67-1SSI module via a gateway.

This is transferred in an 8 byte format as follows:

- 1 byte contains a Stop bit for interrupting communication with the encoder.
- 1 byte is used for controlling the comparison operations.
- 1 byte contains the register address of the data to be written to bytes 0 to 3 of this telegram and a write request.
- 1 byte contains the register address for the data that is to be read with the next response telegram.
- 4 bytes are used for representing the data that is to be written to the register with the address specified at REG_WR_DATA.

Figure 39: Process output data

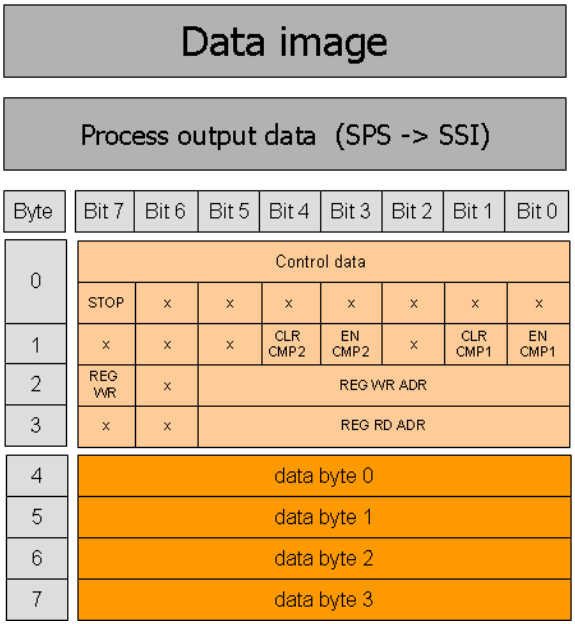


Tabelle 38: Meaning of the data bits (process output)

Designation	Value	Meaning
REG_WR_DATA	0... 2^{32}-1	Value to be written to the register with the address stated at REG_WR_ADR.
REG_RD_ADR	0...63	Address of the register to be read. If the read operation is successful (REG_RD_ABORT = 0), the user data is located in REG_RD_DATA of the process input data (bytes 4 – 7).
REG_WR	0...63	Default status, i.e. there is no request to overwrite the content of the register with the address stated at REG_WR_ADR with REG_WR_DATA. Bit REG_WR_AKN is reset (0) if necessary.
	1	Request to overwrite the content of the register with the address stated at REG_WR_ADR with REG_WR_DATA.
REG_WR_ADR	0...63	Address of the register to be written with REG_WR_DATA.
CLR_CMP2	0	Default status, i.e. no reset of FLAG_CMP2 active.
	1	Reset of FLAG_CMP2 active
EN_CMP2	0	Default status, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 always have the value 0, irrespective of the actual SSI encoder value.
	1	Comparison active, i.e. the data bits REL_CMP2,STS_CMP2 and FLAG_CMP2 have a value based on the result of the comparison with the SSI encoder value.
CLR_CMP1	0	Default status, i.e. reset of FLAG_CMP1 not active.
	1	Reset of FLAG_CMP1 active

Designation	Value	Meaning
EN_CMP1	0	Default status, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 always have the value 0, irrespective of the actual SSI encoder value.
	1	Comparison active, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 have a value based on the result of the comparison with the SSI encoder value.
STOP	0	Request to read the SSI encoder cyclically
	1	Request to interrupt communication with the encoder

6 Guidelines for Station Planning

Module Arrangement

Random Module Arrangement

The arrangement of the I/O-modules within a BL67 station can basically be chosen at will.

Nevertheless, it can be useful with some applications to group certain modules together.

Complete Planning

The planning of a BL67 station should be thorough to avoid faults and increase operating reliability.

Attention

If there are more than two empty slots next to one another, the communication is interrupted to all following BL67 modules.

Maximum System Extension

A BL67 station can consist of a gateway and a maximum of 32 modules (equivalent to 1 m station length).

The following overview shows the maximum number of channels possible under these conditions:

- The entire station is made up of the respective channel type only.

Table 39: Maximum system extension

Module type	maximum number	
	Channels	Modules
BL67-4DI-P	128	32
BL67-8DI-P	256	32
BL67-4DO-xA-P	128	32
BL67-8DO-xA-P	256	32
BL67-16DO-0.1A-P	512	32
BL67-4DI4DO-PD	256	32
BL67-8XSG-PD	256	32
BL67-2AI-x	64	32
BL67-2AI-PT	64	32
BL67-2AI-TC	64	32
BL67-4AI-V/I	128	32
BL67-2AO-I	64	32
BL67-2AO-V	50 **A**	25 **A**
BL67-1RS232	10 **A**	10 **A**
BL67-1RS485/422	21 **A**	21 **A**
BL67-1SSI	26 **A**	26 **A**
BL67-1CVI	32	32
BL67-2RFID	4	4

A *limited due to the high current consumption (max. 1,5 A) on the module bus (5 V)*

Attention

Ensure that a sufficient number of Power Feeding modules are used if the system is extended to its maximum.

Note

If the system limits are exceeded, the software I/O-ASSISTANT generates an error message when the user activates the command ‹Station → Verify›.

Creating Potential Groups

Power Feeding modules can be used to create potential groups. The potential isolation of potential groups to the left of the respective power distribution modules is provided by the base modules.

Plugging and Pulling Electronic Modules

BL67 enables the pulling and plugging of electronic modules without having to disconnect the field wiring. The BL67 station remains in operation if an electronic module is pulled.
The voltage and current supplies as well as the protective earth connections are not interrupted.

Attention

If the field and system supplies remain connected when electronic modules are plugged or pulled, short interruptions to the module bus communications can occur in the BL67 station. This can lead to undefined statuses of individual inputs and outputs of different modules.

Extending an Existing Station

Attention

Please note that extensions to the station (mounting further modules) should be carried out only when the station is in a voltage-free state.

Firmware Download

Firmware can be downloaded via the service interface on the gateway using the software tool I/O-ASSISTANT ore directly via the Ethernet. More information is available in the program's online help.

The firmware download via Ethernet is recommended.

Attention

The station should be disconnected from the fieldbus when downloading.

Firmware must be downloaded by authorized personnel only.

The field level must be isolated.

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 BL67 catalog.

Potential Relationships

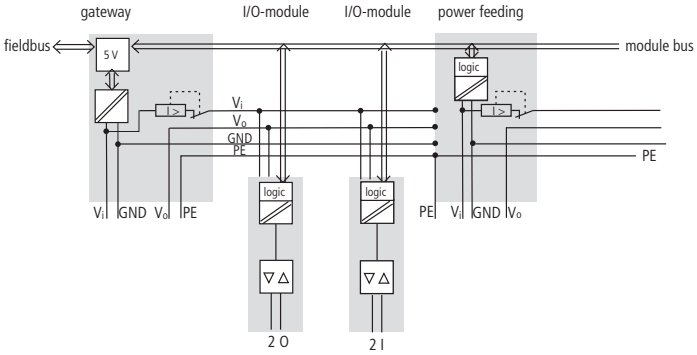
General

The potential relationship of a Ethernet system realized with BL67 modules is characterized by the following:

- The system supply of gateway and I/O-modules as well as the field supply are realized via one power feed at the gateway.
- All BL67 modules (gateway, Power Feeding and I/O-modules), are connected capacitively via base modules to the mounting rails.

The block diagram shows the arrangement of a typical BL67 PROFINET IO-station.

Figure 40: Block diagram of a BL67 station



Electromagnetic Compatibility (EMC)

BL67 products comply in full with the requirements pertaining to EMC regulations.

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

Ensuring Electromagnetic Compatibility

The EMC of BL67 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.
- 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).

Earth-Free Operation

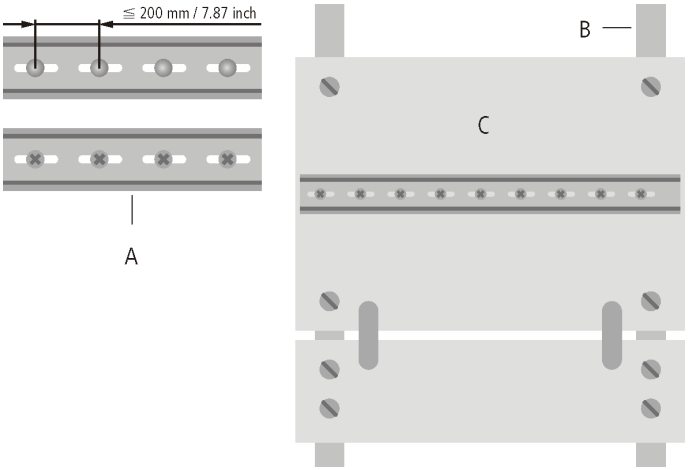
Observe all relevant safety regulations when operating an earthfree system.

Mounting Rails

All mounting rails must be mounted onto the mounting plate with a low impedance, over a large surface area, and must be correctly earthed.

Figure 41:
Mounting options

A *TS 35*
B *Mounting rail*
C *Mounting plate*



Mount the mounting rails over a large surface area and with a low impedance to the support system using screws or rivets.

Remove the isolating layer from all painted, anodized or isolated metal components at the connection point. Protect the connection point against corrosion (for example with grease; caution: use only suitable grease).

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 or resistor can be connected parallel to the capacitor, to prevent disruptive discharges 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.

8 Appendix

Nominal Current Consumption of Modules at PROFINET

Table 40: nominal current consumptions of the modules at Ethernet

Module	Current consumptions on 24 V DC
BL67-GW-EN-PN	
Power supply modules	
BL67-PF-24VDC	≤ 9 mA
Digital input modules	
BL67-4DI-P	≤ 9 mA
BL67-8DI-P	≤ 9 mA
BL67-4DI-PD	≤ 35 mA
BL67-8DI-PD	≤ 35 mA
BL67-4DI-N	≤ 8 mA
BL67-8DI-N	≤ 8 mA
Analog input modules	
BL67-2AI-I	≤ 10 mA
BL67-2AI-V	≤ 10 mA
BL67-2AI-PT	≤ 13 mA
BL67-2AI-TC	≤ 10 mA
Digital output modules	
BL67-4DO-0.5A-P	≤ 9 mA
BL67-4DO-2A-P	≤ 9 mA
BL67-8DO-0.5A-P	≤ 9 mA
BL67-4DO-2A-N	≤ 24 mA
BL67-8DO-0.5A-N	≤ 24 mA
BL67-16DO-0.1A-P	≤ 9 mA

Analog output modules	
BL67-2AO-I	≤ 12 mA
BL67-2AO-V	≤ 17 mA
Digital combi modules	
BL67-4DI/4DO-PD	≤ 35 mA
BL867-8XSG-PD	≤ 35 mA
Technology modules	
BL67-1RS232	≤ 28 mA
BL67-1RS485/422	≤ 20 mA
BL67-1SSI	≤ 32 mA
BL67-1CVI	≤ 24 mA

Note

Please find any information about the bus-independent, module specific current consumptions in the manual "BL67- I/O-modules" (TURCK-Documentation No.: German D300572/ English D300527).

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.

AR

Abbreviation for Application Relation. Logical application relation between two network nodes, which can contain one or more communication relations.

ARP

Used to definitely allocate the hardware addresses (MAC address) assigned worldwide to the IP addresses of the network clients via internal tables.

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.

Bonding strap

Flexible conductor, normally braided, that joins inactive components, e. g. the door of a switchgear cabinet to the cabinet main body.

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.

Check-back interface

The check-back interface is the interface from the counter module to the internal module bus. The bits and bytes are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

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.

Control interface

The control interface is the interface from the internal module bus to the counter module. The commands and signals directed to the counter module are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

CPU

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

DHCP

Client-Server-protocol which reduces the effort of assigning IP addresses or other parameters. Serves for dynamic and automatic configuration of devices.

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.

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.

Force Mode

Software mode which enables the user to set his plant to a required state by forcing certain variables on the input and output modules.

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.

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).

IP

Abbreviation for Internet-Protocol, protocol for the packet-oriented and connectionless transport of data packets from a transmitter to a receiver crossing different networks.

L

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.

Module bus

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

MSB

Most Significant bit

P

Ping

Implementation of an echo-protocol, used for testing whether a particular host is operating properly and is reachable on the network from the testing host.

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.

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

Amplifier for signals transmitted via a bus.

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.

T

Terminating resistance

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

UDP

Abbreviation for User Datagram Protocol. UDP is an transport protocol for the connectionless data between Ethernet hosts.

Unidirectional

Working in one direction.

10 Index

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