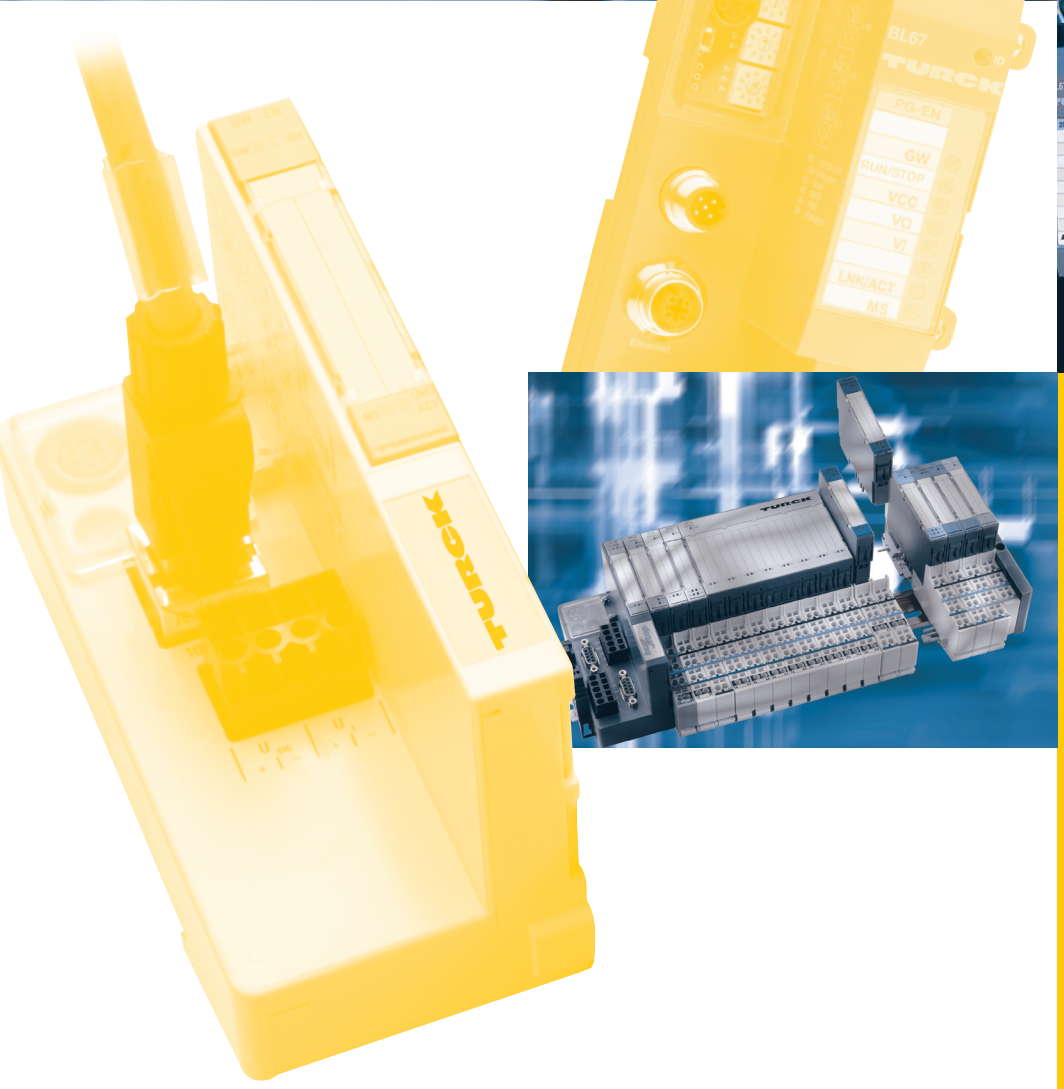
TURCK

Industrial Automation

USER MANUAL

BL67-programmable Gateway BL67-PG-DP



Edition 05/2011

Danger
Electrical voltage
The following precautions must be taken 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 (AWA) 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

1 About this Manual

1.1 Documentation Concept

This manual contains information about the programmable BL67 Ethernet-gateway with PROFIBUS-DP interface BL67-PG-DP.

The following chapters contain a short BL67 system description, a description of the field bus system Ethernet, exact information about function and structure of the BL67 Ethernet 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.

1.2 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 prescibed use of the programmable TURCK gateway BL67-PG-DP.
It has been specially conceived for personnel with the necessary qualifications.

1.2.1 Prescribed Use

Danger

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.

1.2.2 Notes Concerning Planning /Installation of this Product

Danger

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

1.3 Description of Symbols Used

Danger

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.

1.4 List of Revisions

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

Table 1: List of revisions

Chapter	Subject/ Description	new	changed
3	Technical Data, Field bus (page 4-5)		X
	DP-address setting via CoDeSys (page 4-12)	X	
	DP-address setting via rotary coding switches (page 4-12)	X	
4	Assignment of the PROFIBUS-DP slave-addresses via CoDeSys-parameters (page 5-12)	X	
	Assignment of the PROFIBUS-DP slave-addresses via rotary coding switches (page 5-12)	X	

Note

The publication of this manual renders all previous editions invalid.

2 BL67 Philosophy

2.1 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.

2.1.1 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.

2.1.2 Convenient Handling

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

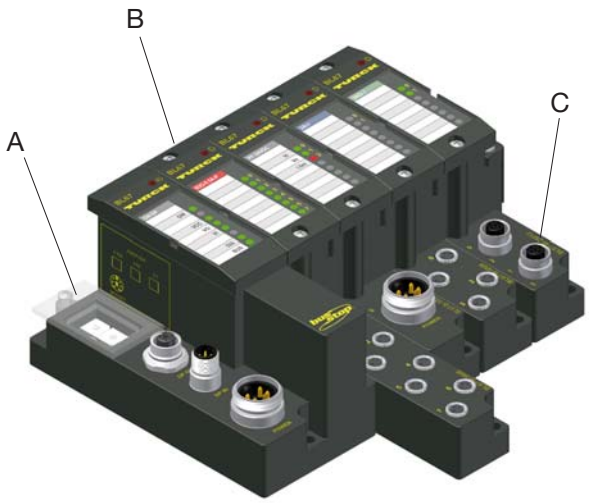
The gateway and the base modules are either snapped onto a mounting rail or are directly mounted onto the machine frame. The electronic modules are plugged onto the appropriate base modules.

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.

2.2 BL67 Components

Figure1:
BL67 station

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



2.2.1 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.

Figure2:
BL67 gateway

2.2.2 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.

Figure3: 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.

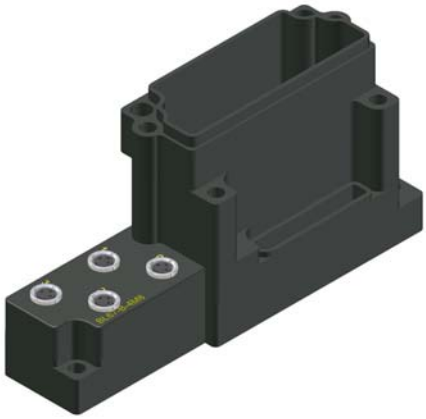
2.2.3 Base Modules

The field wiring is connected to the base modules.

These are available in the following connection variations:

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

Figure4: example of a base module



2.2.4 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.

Figure5: end plate

3 Ethernet

3.1 System Description

Originally developed by DEC, Intel and Xerox (as DIX standard) for data transmission between office equipment, Ethernet stands for the IEEE 802.3 CSMA/CD specification published in 1985.

The rapid increase of application and the worldwide use of this technology enables problem-free and above all cost-effective connection to existing networks.

3.1.1 Ethernet MAC-ID

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

The first 3 bytes of the MAC-ID 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.

A label on the TURCK modules shows the respective MAC-ID.

In addition to that, the MAC-ID can be read out using the software tool "I/O-ASSISTANT".

3.1.2 IP address

Each Ethernet-host receives its own IP address. In addition to that the node knows its netmask and the IP address of the default gateway.

The IP address is a 4-byte-value which contains the address of the network to which the node is connected as well as the host address in the network.

The default IP address of the gateway BL67-PG-DP is predefined as follows:

IP address: 192.168.1.254

netmask: 255.255.255.0

gateway: 192.168.1.1

The netmask shows which part of the IP address defines the network as well as the network class and which part of the IP address defines the single node in the network.

In the example mentioned above, the first 3 bytes of the IP address define the network. They contain the subnet-ID 192.168.1.
The last byte of the IP address defines the node's address within the network.

Note

In order to build up the communication between a PC and an Ethernet-module, both have to be nodes of the same network.

If necessary, the nodes' network addresses have to be adapted one to another. Please read chapter 8, Changing the IP address of a PC/ network interface card, page 8-3.

3.1.3 Network Classes

The available networks are divided into the different network classes A, B, and C.

Figure 6: Network classes

Class	Network addresses	Bytes for net address	Bytes for host address	No. of the possible networks/ hosts
A	1.xxx.xxx.xxx- 126.xxx.xxx.xxx	1	3	126/ 2^{24}
B	128.0.xxx.xxx - 191.255.xxx.xxx	2	2	2^{14}/ 2^{16}
C	192.0.0.xxx - 223.255.255.xxx	3	1	2^{21}/ 256

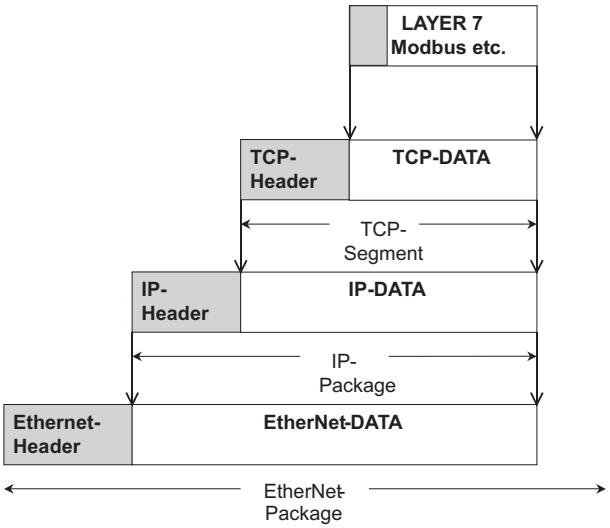
According to their predefined address 192.168.1.xxx the BL67 gateways are thus nodes of a Class C network.

3.1.4 Data transfer

The data are transferred from a transmitter to a receiver via the Ethernet. This data transfer uses no acknowledgement of reception, which means data telegrams can get lost. Data transfer via Ethernet without any protocol implementation can thus not be absolutely safe.

In order to assure a safe transmission of data, frame-protocols like TCP/IP are used.

Figure 7: Telegram structure



IP (Internet Protocol)

The Internet Protocol is a connection-free transport protocol. The protocol does not use acknowledgement messages, telegrams can get lost. It is thus not suitable for safe data transfer. The main functions of the internet protocol are the addressing of hosts and the fragmentation of data packages.

TCP (Transmission Control Protocol)

The Transmission Control Protocol (TCP) is a connection-oriented transport protocol and is based on the Internet Protocol. A safe and error-free data transport can be guaranteed by means of certain error diagnostic mechanisms as for example acknowledgement and time monitoring of telegrams.

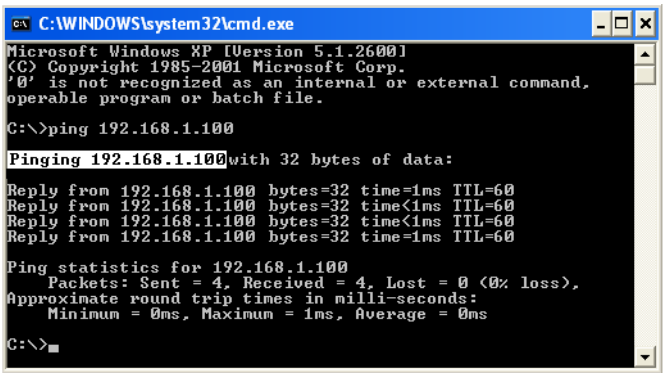
3.1.5 Checking the communication via "ping-signals"

You can check the communication between nodes in a network using ping-signals in the DOS-prompt of your PC.

For that purpose, please enter the command "ping" and the IP address of the network node to be checked.

If the node answers the ping-signal, it is ready for communication and takes part in the data transfer.

Figure 8: ping-signal



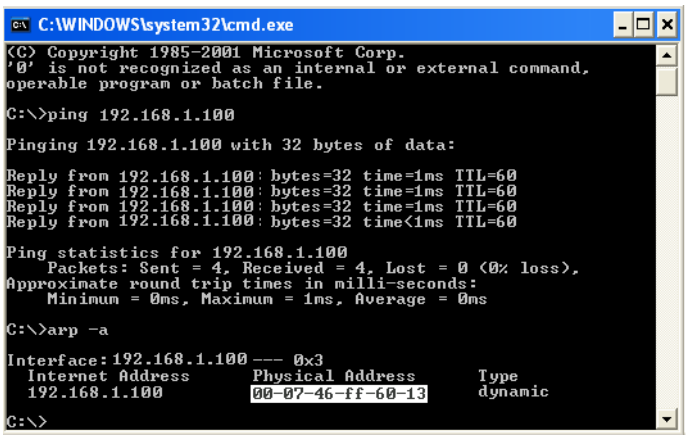
3.1.6 ARP (Address Resolution Protocol)

In each TCP/IP-capable computer, ARP serves to clearly assign the worldwide unique hardware addresses (MAC-IDs) to the single IP addresses of the network nodes via internal tables.

Using ARP in the DOS-prompt, every node in a network can be clearly identified via its MAC-ID.

- Write a ping command for the respective station/ IP address: (example: "x:\\ping 192.168.1.100").
- Via the command "x:\\arp -a" the MAC-ID (00-07-46-ff-60-13) for this IP address is determined. This MAC-ID clearly identifies the network node.

Figure 9: Determination of the MAC-ID of a BL67 module via ARP



3.1.7 Transmission Media

For a communication via Ethernet, different transmission media can be used (see chapter 7, page 7-3).

4 Technical Features

4.1 General

This chapter contains the general technical description of the programmable BL67 Ethernet-gateway with integrated PROFIBUS-DP slave BL67-PG-DP.

4.2 Function

The programmable BL67 gateways can be used as an autonomous PLC or as a de-central PLC in a network interconnection for fast signal processing

Hinweis

The programmable BL67 gateway BL67-PG-DP is designed as a Single Task System.

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

4.2.1 Programming

The gateways BL67-PG-××× are programmable according to IEC 61131-3 using the software tool CoDeSys V2.3 from 3S - Smart Software Solutions GmbH.

For programming the gateway, the following programming languages according the standards can be used:

LD = Ladder

FDB = Function Block Diagram

IL = Instruction List

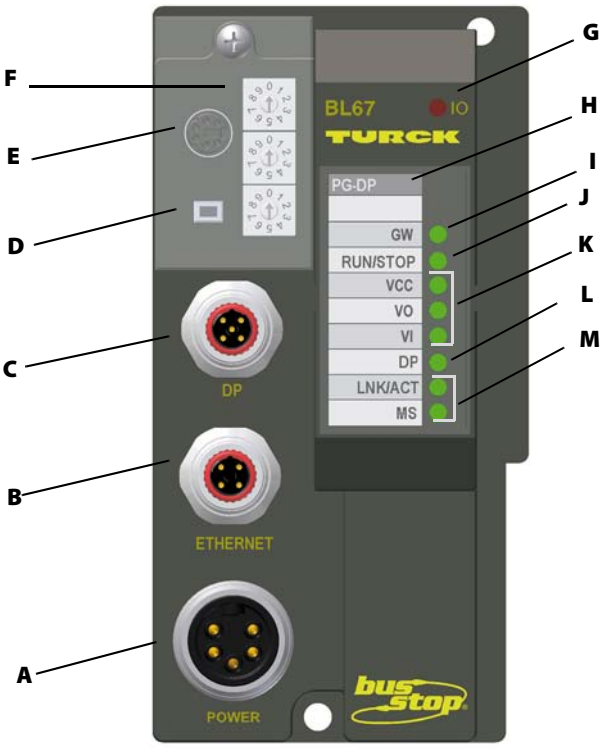
ST = Structured Text

SFC = Sequential Function Chart

4.3 Technical Data

Figure 10: BL67-PG-DP

A *power supply*
B *Ethernet*
C *PROFIBUS-DP*
D *SET-button*
E *service-interface*
F *rotary coding switches*
G *module bus LED*
H *designation*
I *status LED*
J *RUN/STOP LED*
K *LEDs for supply voltage monitoring*
L *PROFIBUS-DP LED*
M *Ethernet LEDs*



4.3.1 Gateway structure

The BL67 gateway has the following structure:

Figure 11: Gateway structure

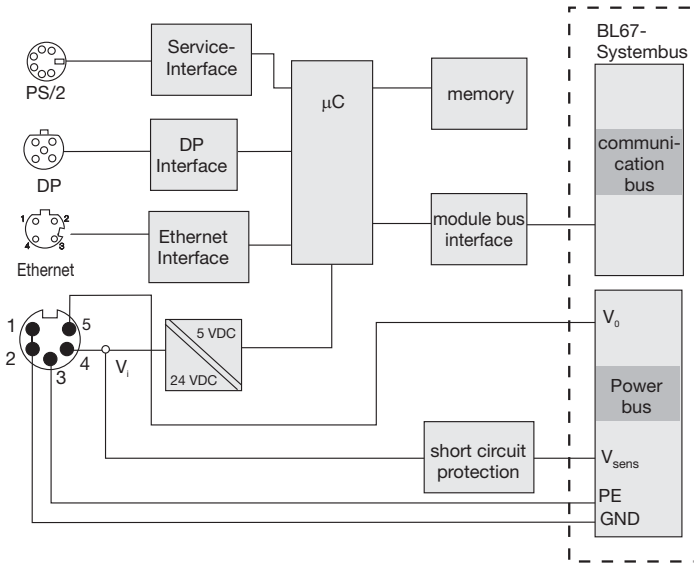


Table 2: Technical data Ethernet gateway

Supply voltage		
Demands on the voltage supply acc. to EN 61131-2		
System supply VI (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	
current consumption I_{sys}	600 mA	current consumption CPU + module bus at maximum system extension
maximum output current I_{MB}	max. 1,3 A	maximum output current of module bus supply
short-circuit and overload protection I_{VI}	max. 4 A	short-circuit and overload protection of the sensor supply from gateway or power feeding module
Field bus		
PROFIBUS-DP baud rate Einstellung der Adressbereich Feldbus	9.6 kbps to 12 mbps	
Setting the baud rate	autobaud function	
Address range	1...125 (via CoDeSys , see also DP-address setting via CoDeSys (page 4-12)	
	1 ... 99 (via rotary coding switch, see also DP-address setting via rotary coding switches (page 4-12)	
Isolation voltages		
U_{RS} (Ethernet/ service interface)	500 V AC	
U_{EN} (Ethernet/ module bus)	500 V DC	
U_{sys} (V_O/VI to U_{sys})	1000 V DC	
U_{field} / service interface	1000 V DC	
PLC-data		
Programming		
– Software – Released for	CoDeSys V 2.3 V 2.3.5.8	
– Programming languages	IEC 61131-3 (IL, LD, FDB, SFC, ST)	
– Application tasks	1	

– No. of POUs (Program Organization Unit)	1024
– Programming interfaces	RS232-interface, Ethernet
Processor	RISC, 32 bit
– Cycle time	< 1 ms for 100 IL-commands (without I/O-cycle)
– Real Time Clock (RTC)	yes, but no buffering during voltage breakdown
Memory	
– Program memory	512 KByte
– Data memory	512 KByte
– Input data	4 KByte
– Output data	4 KByte
– Non-volatile memory	16 KByte
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*

Danger

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.

4.4 Connection possibilities

4.4.1 Programming interface

Ethernet

The connection of the BL67 Ethernet gateways to the Ethernet network is done via the 4-pole M12-female connector “Ethernet“.

It is designed as a D-coded connector according to PNO and ODVA-standards.

Figure 12: 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 -

Serial interface

The programming of the gateways BL67-PG-×××× can also be done via the Serial interface (PS2 female connector), page 4-9 on the gateway.

4.4.2 PROFIBUS-DP

A reverse keyed M12 x 1 female connector is provided for the gateway communication via the PROFIBUS-DP fieldbus.

- M12 x 1 female connector:

Figure 13: PBDP-female connector

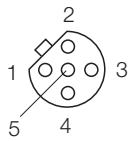


Table 4: PIN assignment of the M12 x 1 connectors

Pin-No.	M12 x 1	Description
1	5 V	Supply of external devices
2	A	(+)-data line; reception/ transmission-data-N
3	GND	Data reference potential
4	B	(-)-data line; reception/ transmission-data-P
5	Shield	Shield connection/ protective earth

Note

Please note, the special SUB-D connector should have 4 inductances (pro 100 nH to 110 nH) in the P and the N supply wires (recommended by the PROFIBUS User Organization).

4.4.3 Power Supply via 7/8" connector

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

Figure 14: power supply via 7/8" male connector

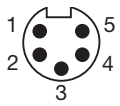


Table 5: Pin assignment of the 7/8" power supply connector

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)

4.4.4 Serial interface (PS2 female connector)

The PS/2 female connector is used for the gateway's connection to the I/O-ASSISTANT (project planning and diagnostic software) or as programming interface for connection to the software CoDeSys
V 2.3 of 3S according to IEC 61131-3.

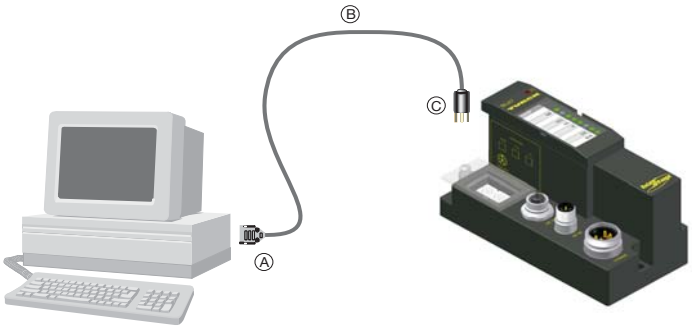
The interface is conceived as a 6-pole mini DIN connector.

In order to connect the gateway to the PC, two types of cables can be used:

- 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/2Connection with I/O-ASSISTANT-Connection Cable

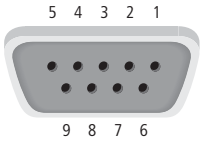
Figure 15: BL67-gateway connected to PC via special cable



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

Figure 17: 9-pole SUB-D female connector on the cable for connecting to PC (top view)



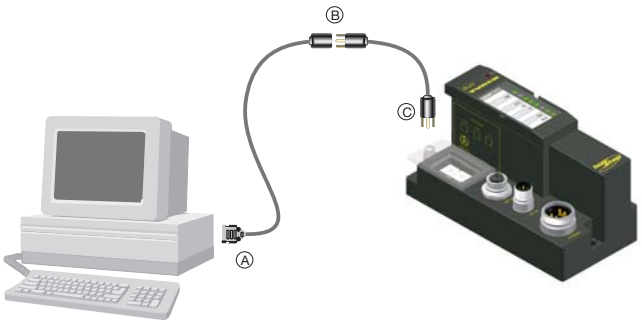
Connection Using Commercially Available Cables

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 18: 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 19: PS/2 female connector on the gateway (top view)

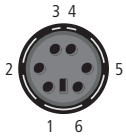
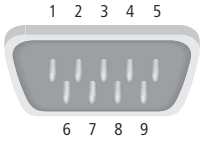


Figure 20: 9-pole SUB-D male connector on PC (top view)



Pin assignment

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

Table 6: 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

4.5 Address setting on PROFIBUS-DP

The addressing of the BL67-PG-DP at PROFIBUS-DP can be different ways:

1. Parameter settings in CoDeSys
   DP-addresses from 1 to 125 can be set.
2. Rotary coding switches at the gateway
   DP-addresses from 1 to 99 can be set.

4.5.1 DP-address setting via CoDeSys

In order to address the slave at the PROFIBUS-DP via CoDeSys, please read the explanation in Assignment of the PROFIBUS-DP slave-addresses via CoDeSys-parameters (page 5-12).

4.5.2 DP-address setting via rotary coding switches

1. Set the parameter „DPSlaveAddrMode" in CoDeSys to "RotaryMode".
2. The slave‘s DP-address is taken from the settings of the two lower rotary coding switches at the gateway (x1, x10) (see also Assignment of the PROFIBUS-DP slave-addresses via rotary coding switches (page 5-12).
3. Those two rotary coding switches are used twice in the rotary mode (see Figure 21: Decimal rotary coding-switches for the address setting).

Example
Setting of the rotary coding switches :
x100 = 1
x10 = 5
x1 = 7
→ = 157 (IP-address)
→ = 57 (DP-address)

4.6 Address setting on Ethernet

The addressing of the gateway on Ethernet can be realized via different modes:

- rotary mode (manual addressing via rotary coding-switches)
- PGM mode (manual addressing via software)
- BootP mode, DHCP mode (automatic addressing via BootP/DHCP-server at the boot-up of the gateway).

The setting of the address modes is done via the 3 rotary coding-switches at the gateway.

Note

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

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.

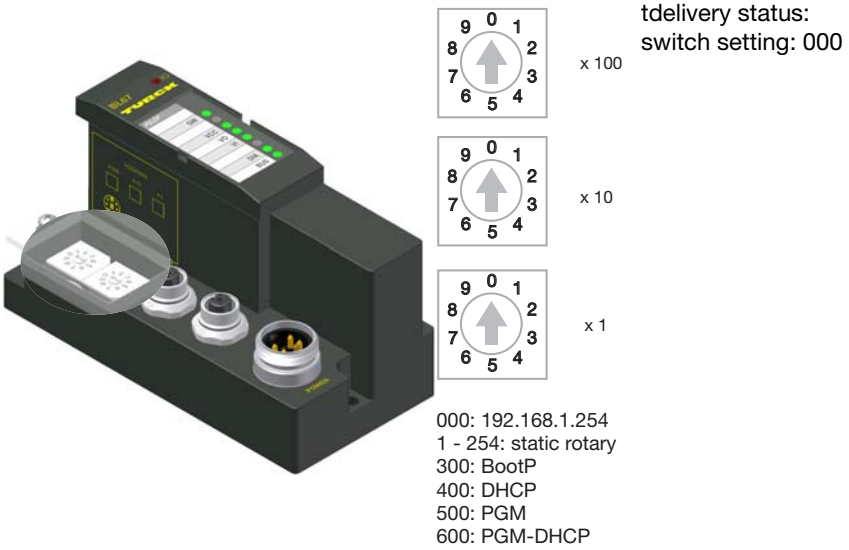


Figure 21: Decimal rotary coding-switches for the address setting

Attention

After every change of the address-mode, a voltage reset must be carried out.

4.6.1 LED-behavior

During it's start-up, the module waits for the address setting via the BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green, as soon as the address setting via the server is completed. The station is ready for communication.

4.6.2 Default setting of the gateway

The gateway's default-settings are the following:

IP address	192.168.1.254
subnet mask	255.255.255.000
default gateway	192.168.1.1

Note

The gateway can be reset to these default settings by the user at any time.
To reset the gateway, please set the three coding-switches at the gateway to "000" followed by a power-on reset.

Note

"000" is no operation mode. Setting the three coding-switches to "000" only serves to reset the gateway to the default settings.

4.6.3 Address setting via the rotary-mode

When using the rotary-mode, the last byte of the gateway's IP address can be set via the rotary coding-switches at the gateway.

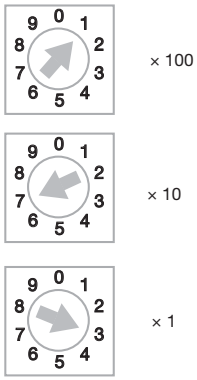
Note

All other network settings are stored in the module's non-volatile EEPROM and can not be changed in the rotary-mode.

Addresses in the range from 0 to 254 can be allocated. The addresses 0 and 255 are reserved for broadcast messages in the subnet.

The following example shows the setting of the address **173**.

Figure 22: Address setting



Attention

The settings carried out in the rotary-mode are not stored in the module's EEPROM. Thus, they will get lost in case of a subsequent address-assignment via a BootP/ DHCP or PGM.

Attention

After changing the position of the rotary coding-switches, a voltage reset must be carried out to store the new address.

4.6.4 Address setting via BootP-mode

The address setting is carried out by a BootP-server in the network after the start-up of the gateway.

In order to activate the BootP-mode, the rotary coding-switches have to be set to "300".

Figure 23: BootP-mode

Note

The IP address as well as the default subnet mask assigned to the gateway by the BootP-server are stored in the gateway's non-volatile memory.

If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via BootP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

4.6.5 Address setting via DHCP-mode

The address setting is carried out by a DHCP-server in the network after the start-up of the gateway.

In order to activate the DHCP-mode, the rotary coding-switches have to be set to "400".

Figure 24: DHCP-Modus

Note

The IP address as well as the default subnet mask assigned to the gateway by the DHCP-server are stored in the gateway's non-volatile memory.

If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via DHCP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

DHCP supports three mechanisms for IP address allocation:

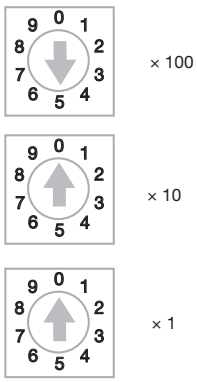
- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual allocation", a client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client.

4.6.6 Address setting via PGM-mode

The PGM-mode enables the access of I/O-ASSISTANTs to the module's network settings.

In order to activate the PGM-mode, the rotary coding-switches have to be set to "500".

Figure 25: PGM-mode



Note

In the PGM-mode, all network settings (IP address, subnet mask, etc.) are read from the module's internal EEPROM.

The settings carried out in the rotary-mode are stored in the module's non-volatile EEPROM.

4.6.7 Addressing via PGM-DHCP

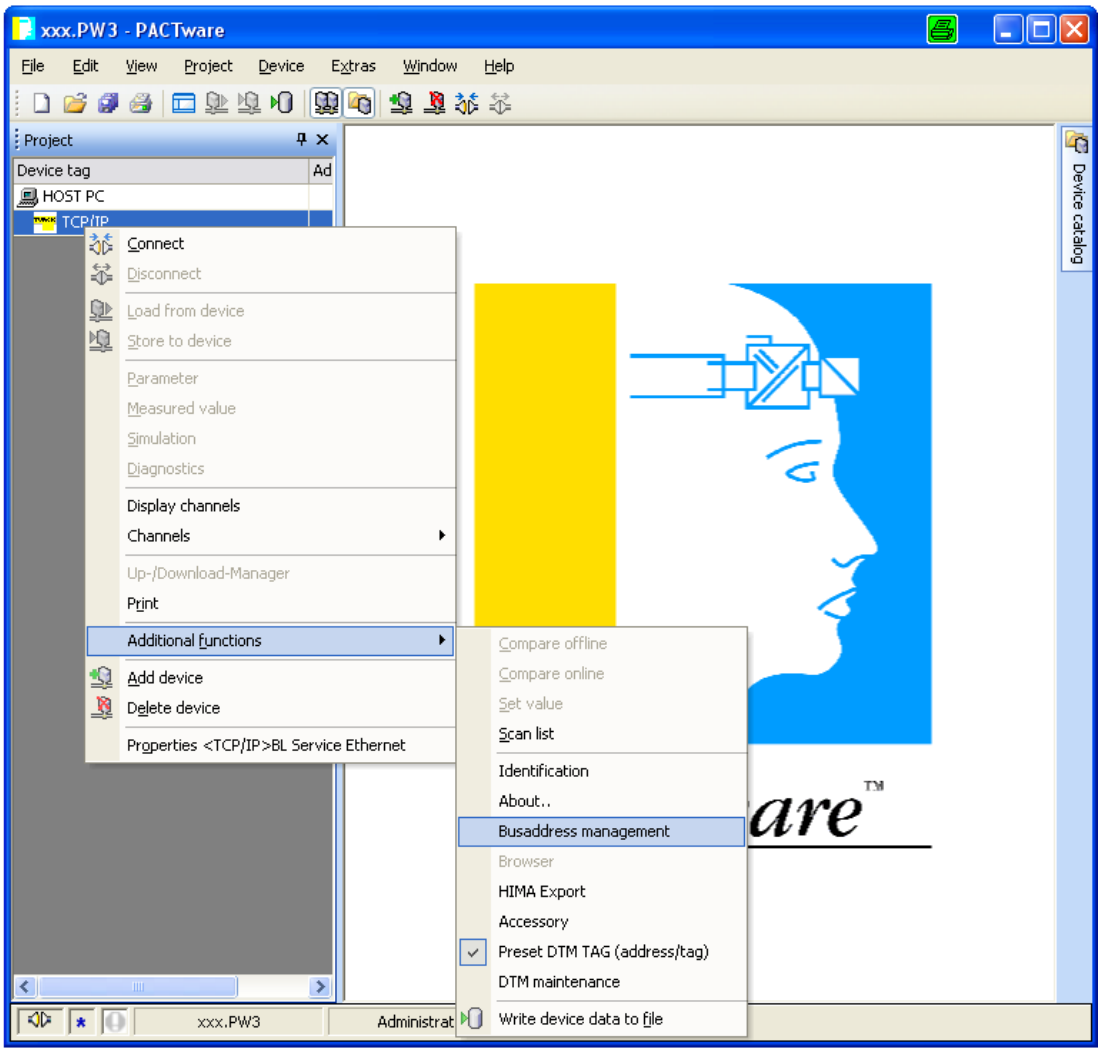
The addressing of the gateway via PGM-DHCP is at the moment comparable to the addressing via DHCP (see page 4-15).

Address-setting via I/O-ASSISTANT 3 (FDT/DTM)

The software I/O-ASSISTANT enables direct access to the Ethernet-network via the Ethernet-cable.

Naturally, the access to the single station via the service interface at the gateway is possible as well.

Figure 26: Busaddress management



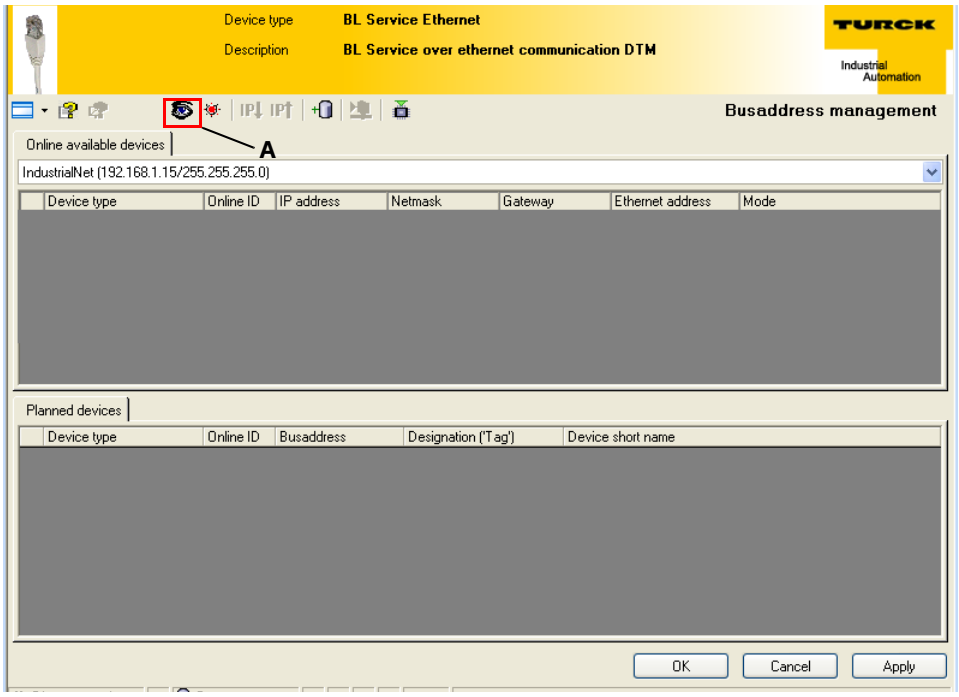


Figure 27: Search for Network- nodes

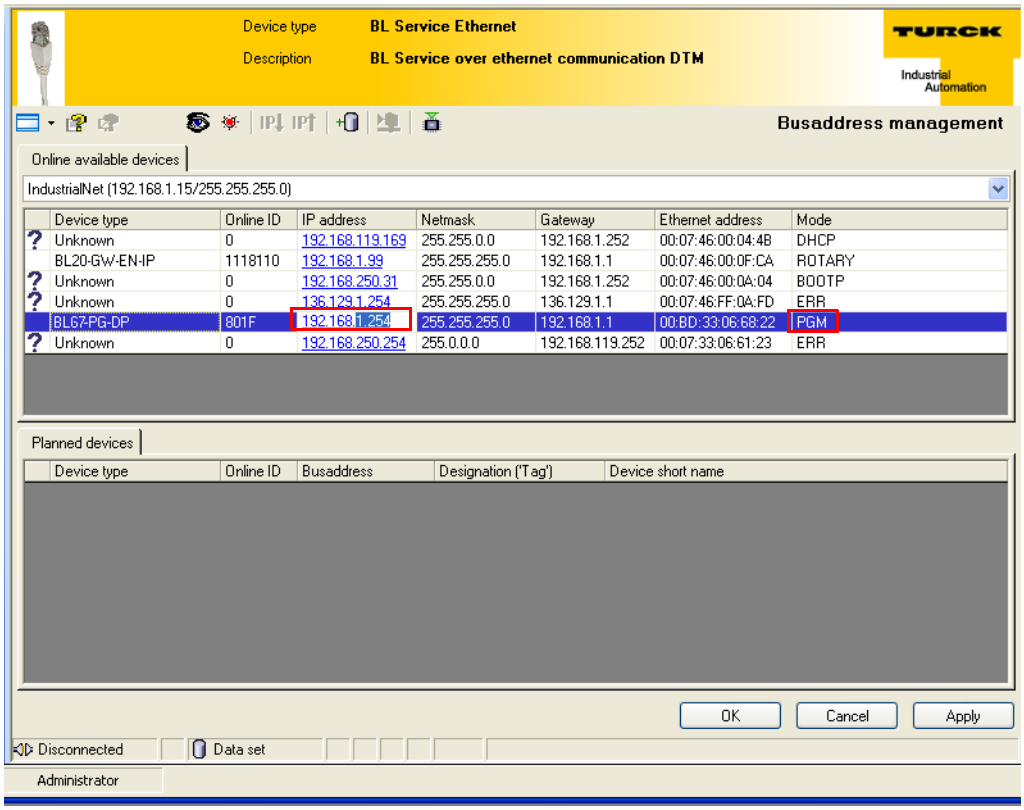
A *Search function in the busaddress management*

The IP address as well as the subnet mask of the TURCK Ethernet gateways can be changed according to the application by using the integrated Busaddress Management function.

Note

The access of the IO-ASSISTANT to the gateway is only possible if the gateway is operated in PGM-mode (see also „Address setting via PGM-mode“, page 4-16).

Figure 28: Changing the IP-address



Attention

When using Windows XP as operating system, difficulties may occur with system-integrated firewall.

It may inhibit the access of PACT*ware* (I/O-ASSISTANT V3) to the Ethernet-network. In this case, please adapt your firewall respectively or deactivate it (see also Deactivating/ adapting the firewall in Windows XP (page 8-5)).

4.7 SET Button

The SET button on the gateway is used to save the Current Configuration of the station as the Reference Configuration in the gateway's non volatile configuration memory.

Note

After every change in the station's hardware configuration, please press the SET button for 10 seconds or respectively as long as the GW LED changes from green to red in order to save the Current Configuration as the Reference Configuration in the Gateway.
The gateway will then be booted automatically. This procedure may last up to 60 seconds.

4.8 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 Ethernet
- monitoring of the gateway status

Diagnostic messages are displayed in two different ways:

- via the LEDs
- via the respective configuration software

4.8.1 Diagnostic Messages via LEDs

Every BL67 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IO**
- 1 LED for displaying if the gateway/ the program in the gateway has started: **RUN/STOP**
- 3 LEDs for monitoring the voltage supply (system, $\mathbf{V}_{CC}$/ inputs, $\mathbf{V}_{i}$/ outputs, $\mathbf{V}_{o}$).
- 3 LEDs for the fieldbus communication (fieldbus-LEDs): **DP**, **LINK/ACT** and **MS**.

Table 7: 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 "IO" 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 7: LED-displays

LED	Status	Meaning	Remedy
IO	Off	CPU not supplied.	– Check the voltage supply at the gateway.
	Green	Module bus is running, the configured module bus station corresponds to the physically connected station, communication is active.	-
	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.
IO	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.
RUN/STOP	Off	No program loaded into the gateway.	–
	Green	Application loaded to gateway, program running.	–
	Green flashing	Application loaded to gateway, PLC not yet started or stopped.	– Start the gateway/ the PLC program.
	Red	PLC test during gateway start.	–
V_{cc}	Off	CPU not supplied	– Check the system supply at the gateway.
	Green	Module bus and CPU running	-

Table 7: LED-displays

LED	Status	Meaning	Remedy
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	
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.
DP	Green	PROFIBUS-DP-communication established	–
	Red	PRFOFIBUS-DP-communication disturbed	– Check the PROFIBUS-DP-wiring as well as the settings for slave address and baudrate.
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 7: LED-displays

LED	Status	Meaning	Remedy
MS	Green	Displays the logical connection to an Ethernet Node.	
	Green, flashing	Gateway is ready for operation	
	Red	Gateway indicates error	
	Red, flashing	DHCP/BootP search of settings	

5 Configuration of the BL67-PG-DP with CoDeSys

5.1 General

This chapter describes the configuration of a BL67 station with the programmable Ethernet gateway with PROFIBUS-DP interface in CoDeSys (Controller Development System) from "3S - Smart Software Solutions GmbH" on the basis of an example.

5.1.1 System requirements

- Installation of CoDeSys (version 2.3.5.8)
- Installation of the BL67 target files "TSP_Turck_×××.zip" (can be downloaded from www.turck.com)

Figure 29: CoDeSys from 3S

5.2 Installation of the BL67 Target Support Packages

Before configuring the BL67 station with CoDeSys and programming the BL67-PG-DP, the BL67 Target Support Package (short: targets) has to be installed.

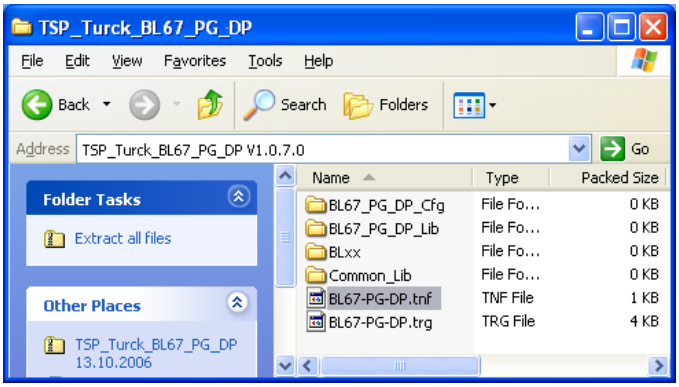
Target files contain all information necessary for integrating a system into the programming tool.

The Target Support Package (TSP) for the BL67-PG-DP can be downloaded from the TURCK homepage as a zipped archive (TSP_Turck_BL67_PG_DP×××.zip).

This archive contains the target file and other manufacturer specific files like libraries etc. which are necessary for the operation of the gateway at CoDeSys.

The files have to be stored on your PC showing following directory structure:

Figure 30: Directory structure of the target file



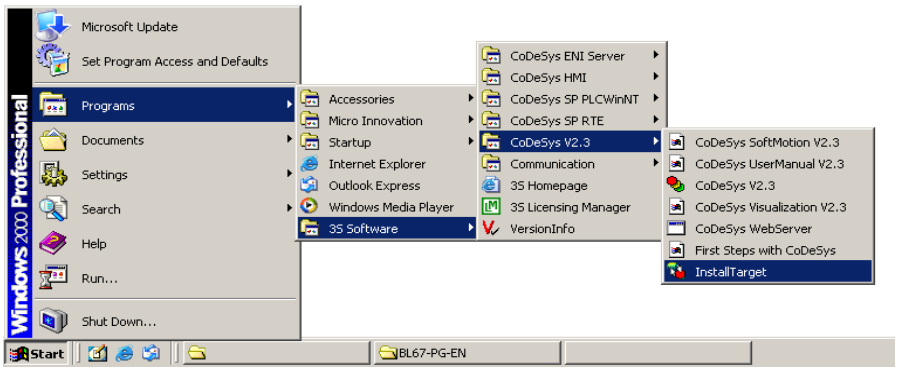
Note

Please observe, that the files have to be stored in this directory structure after having been extracted from the *.zip-file. Otherwise, problems may occur during the target installation.

5.2.1 Installation

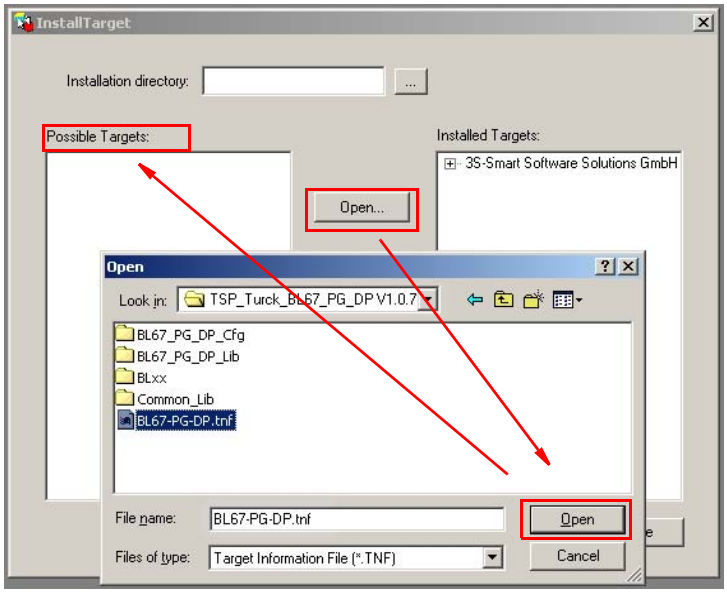
The target installation in CoDeSys is done using the "Start → Programs→ 3S Software → CoDeSys V2.3 → Install Target"-command.

Figure 31: Install Target



Search the target information file "BL67-×××.tnf" using the "Open" button and add the TURCK gateways to "Possible Targets“.

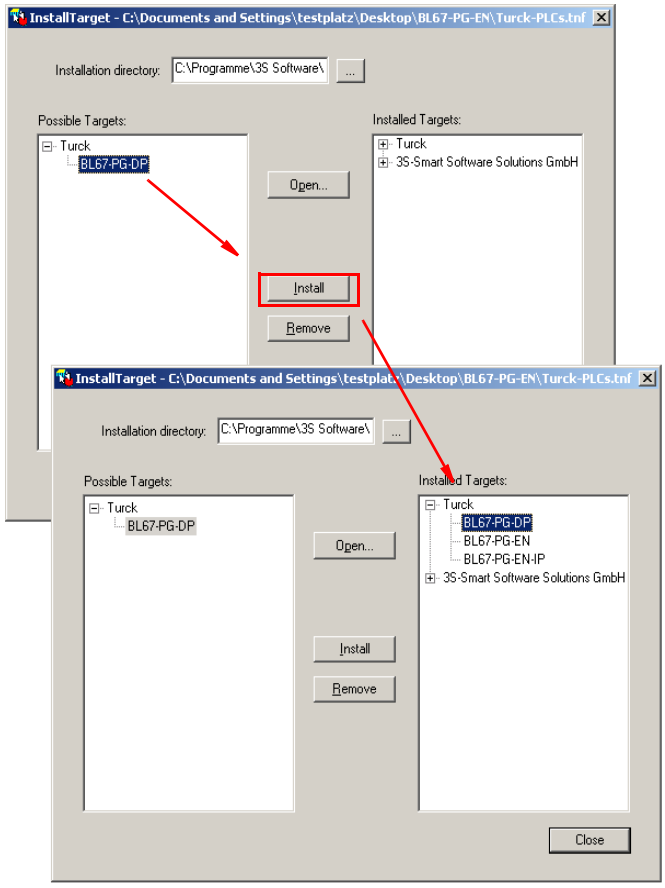
Figure 32: Select the target file



The BL67 target is installed using the "Install" button.

The BL67-PG-DP can now be found under "Installed Targets" and can be chosen in CoDeSys as a target now.

Figure 33: Installation of the TURCK target



5.3 BL67 Hardware Configuration

1. At first, configure your BL67 station (BL67-PG-DP and I/O modules) and switch on the power supply.
2. The gateway saves the actual station configuration, if the SET button under the cover on the gateway is pressed for approx. 10 seconds.
   The actual station configuration is now stored in the gateway as a reference module list.

Note

As soon as an application is loaded to the PG, the station configuration stored in the application is stored to the PG as reference module list.
IF no application is loaded to the PG, the SET button has to be pressed after every change in the station configuration.

3. The gateway now executes a reset.
4. If the "IO"-LED lights up green after the gateway's reset, the new station configuration has been successfully stored.

5.4 Configuration/ Programming of the PG in CoDeSys

5.4.1 Creating a new project

Start the Software an create a new project using the "File → New"-command.

Chose the BL67-PG-DP as target.

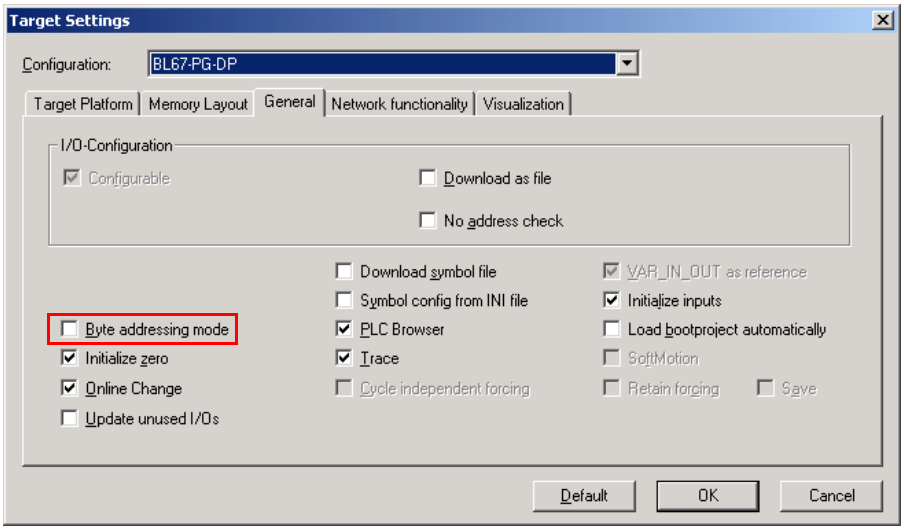
Normally, a further configuration of the gateway in the dialog box "target settings" is not necessary.

Note

The BL67-PG-DP uses the word addressing mode (see the following table).
Please observe therefore, that the parameter "Byte addressing mode" in the "General" tab is always deactivated.

%IX0.0 - %IX0.7	%IX0.8 - %IX0.15	%IX1.0 - %IX1.7	%IX1.8 - %IX1.15	%IX2.0 - %IX2.7	%IX2.8 - %IX2.15	%IX3.0 - %IX3.7	%IX3.8 - %IX3.15	%IX4.0 - %IX4.7	%IX4.8 - %IX4.15	%IX5.0 - %IX5.7	%IX5.8 - %IX5.15
%IB0	%IB1	%IB2	%IB3	%IB4	%IB5	%IB6	%IB7	%IB8	%IB9	%IB10	%IB11
%IW0		%IW1		%IW2		%IW3		%IW4		%IW5	
%ID0				%ID1				%ID2			

Figure 34: Target settings



Pressing the "Ok" button created a new CoDeSys-project.

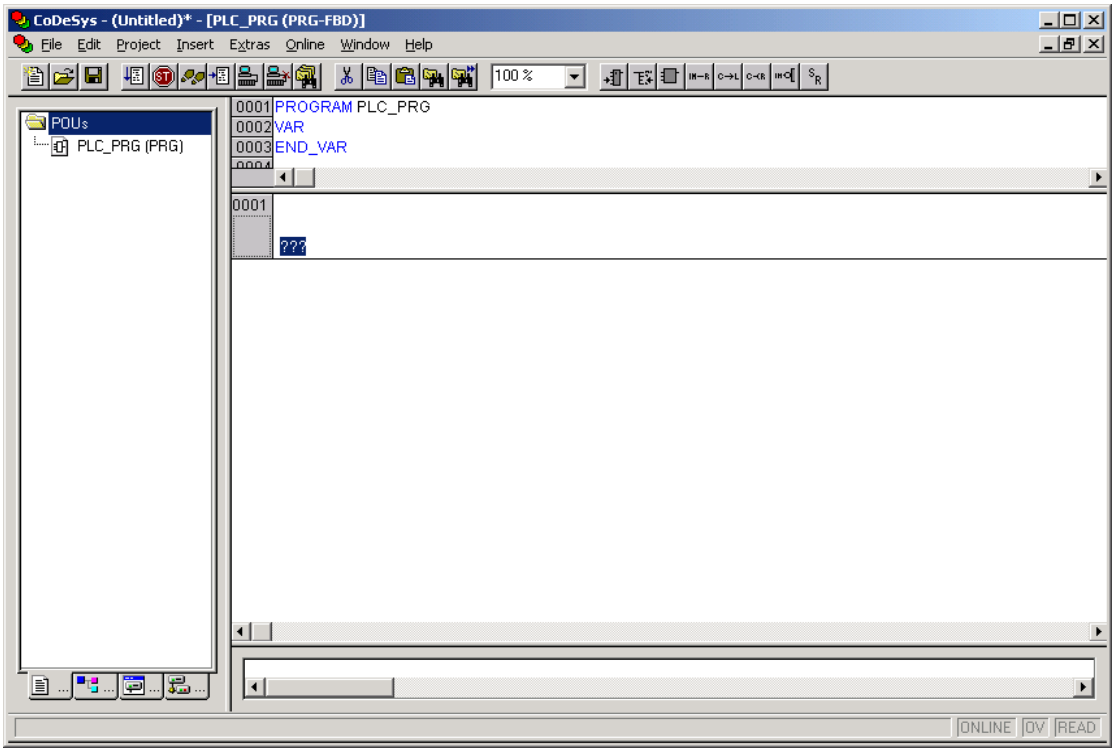
Attention

CoDeSys offers the possibility to control the processing of a project using the task management.

If no task configuration is defined, the project must contain a program named **PLC_PRG**.
The block PLC_PRG is automatically generated and is cyclically called by the runtime system.

PLC_PRG is always the main program in a Single-Task program.
If PLC_PRG is deleted or renamed, the project **must** be controlled using a task configuration.

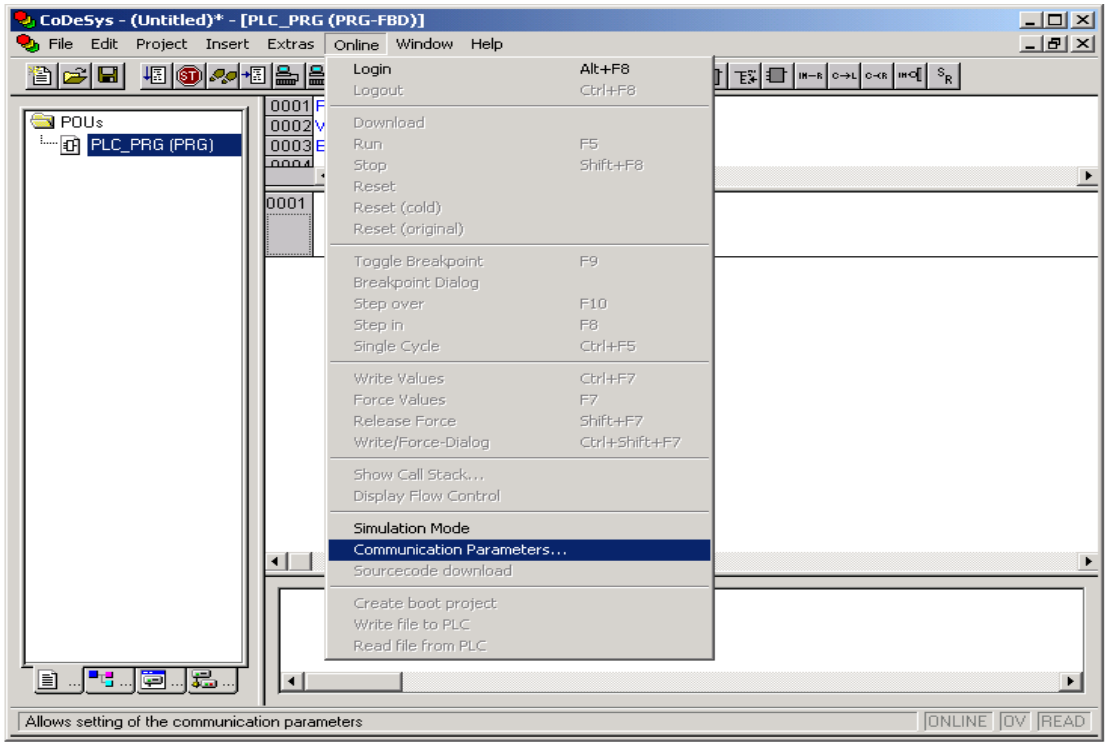
Figure 35: New CoDeSys-project



Now, the communication parameters for the target have to be adapted.

Communication parameters of the target

Figure 36: Opening the communication parameters



Mark "'localhost' via TCP/IP" in the "Channels" field and define a new channel by pressing the "New" button.

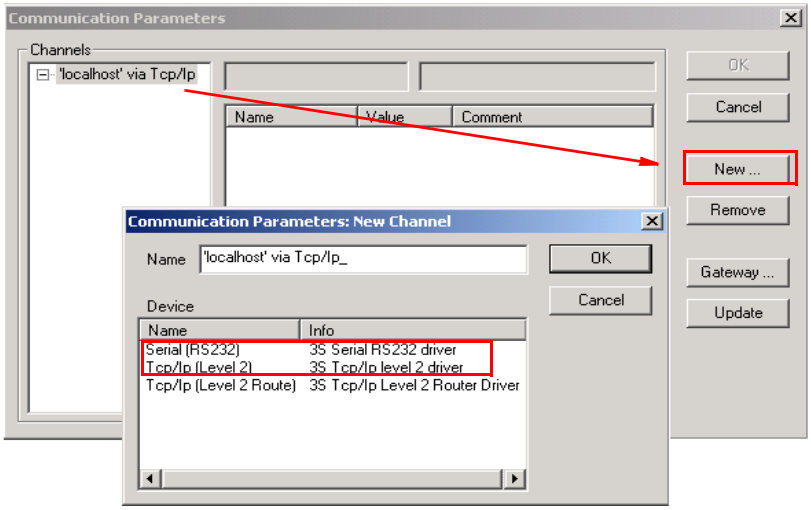
In the dialog box "Communication Parameters: New Channel" the name for the new channel is edited and the communication interface is selected in the "Device" field.

The BL67 gateway offers 2 possible communication interfaces:

1 PS/2 female connector for a serial RS232-communication

2 Ethernet connector (M12, 4-pole, D-coded) for a "TCP/IP (Level 2)"-communication.

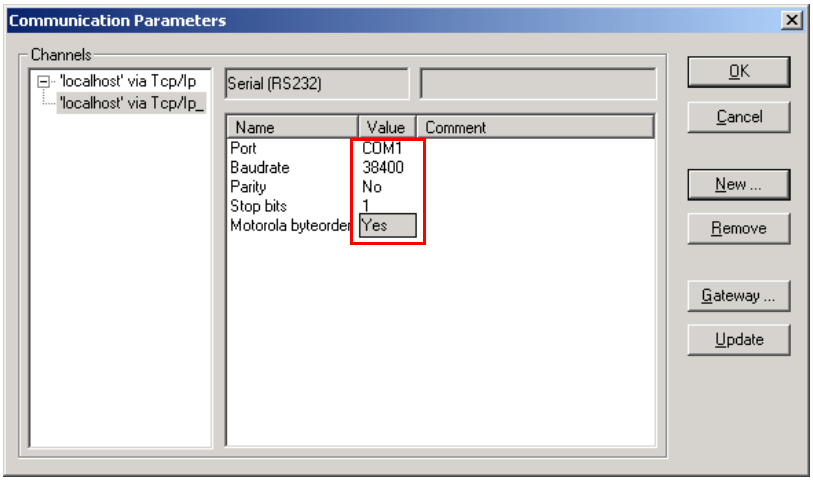
Figure 37: Defining a new channel



Select the preferred interface and set the parameters depending on the interface as follows:

1 serial RS232-communication:

Figure 38: Setting the communication parameters for RS232



Attention

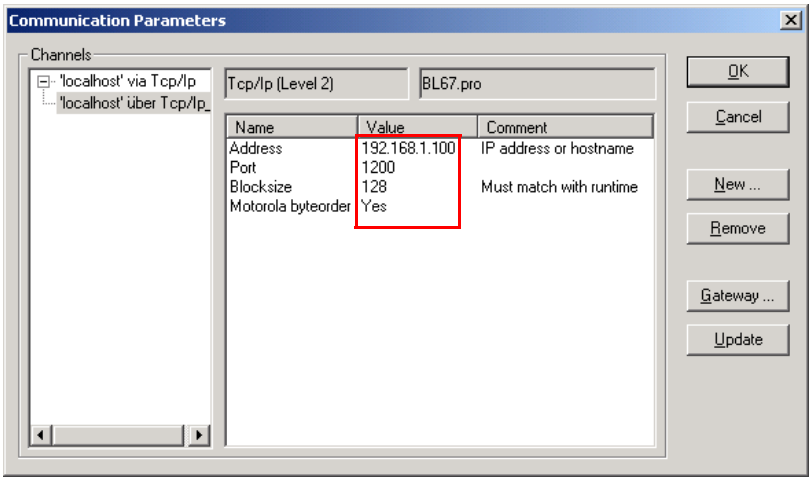
The Parameter "Motorola byteorder" must be set to "YES". Otherwise, no error-free communication with the gateway is possible.

Please observe that the communication with the PG is only possible with a baudrate of 115200 Baud, when using the serial RS232-interface.

2 TCP/IP (Level 2)-communication

Adapt the gateway's communication parameters (IP address, Motorola byteorder) as shown in the following figure.

Figure 39: Setting the communication parameters for TCP/IP (Level 2)



Attention

The Parameter "Motorola byteorder" must be set to "YES". Otherwise, no error-free communication with the gateway is possible.

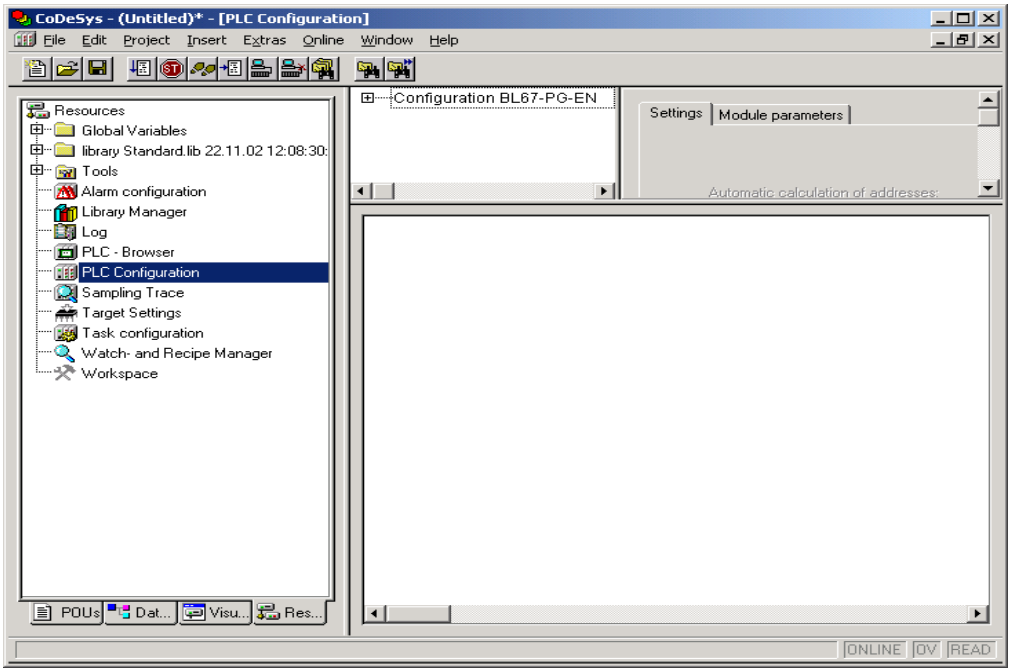
Note

When setting the IP address of the gateway, please observe that it has to match the settings of you PC network interface card. Otherwise, no communication can be built up between PC and PG (please read chapter 8, Network Configuration).

5.4.2 Configuration of the BL67 Station

Open the “PLC Configuration" in the “Resources" tab.

Figure 40:
PLC Configuration



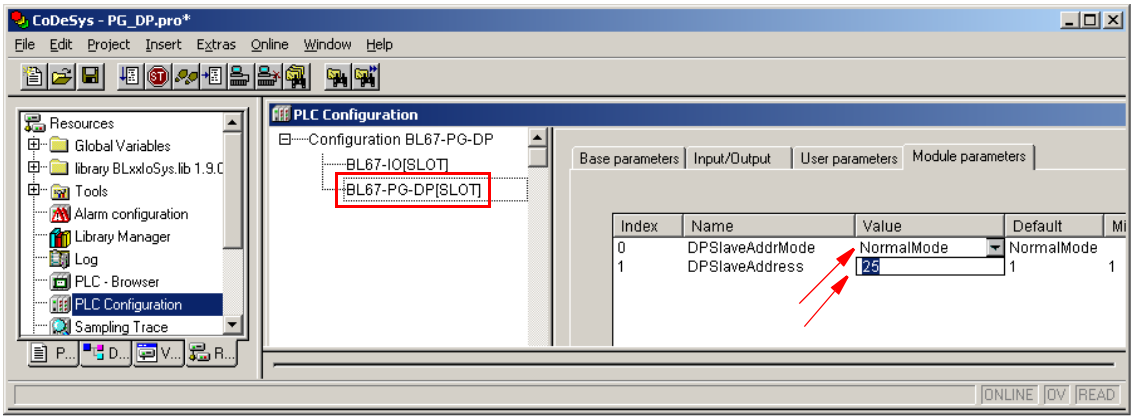
Assignment of the PROFIBUS-DP slave-addresses via CoDeSys-parameters

1 Mark the entry "ProfibusDP[Slot]" in the configuration dialog box.

2 In the register tab "Module parameters", set the parameter "DPSlaveAddrMode" to "Nomal".

3 Enter the PROFIBUS-DP-address under "DPSlaveAddress".

Figure 41: Assigment of the PROFIBUS-DP-address via CoDeSys



Assignment of the PROFIBUS-DP slave-addresses via rotary coding switches

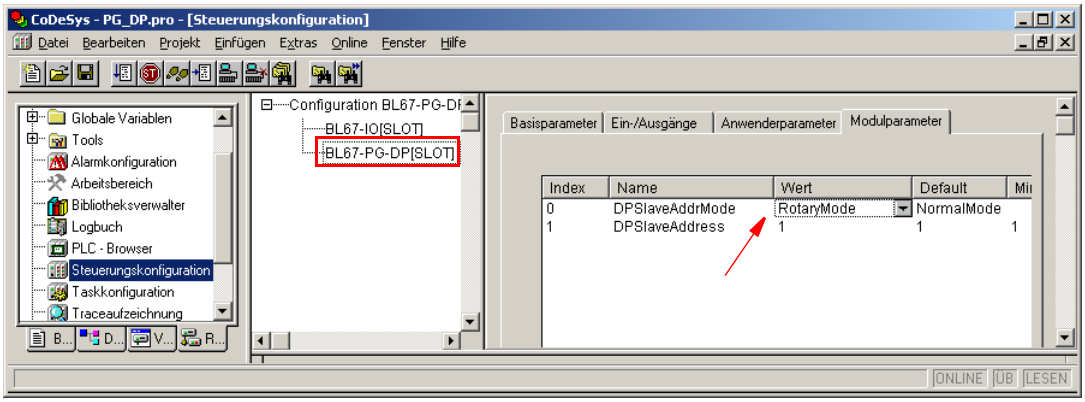
The assignment of the DP-address is also possible using the rotary coding switches at the gateway.

1 Please set the parameter "DPSlaveAddrMode" to "RotaryMode".

2 The setting in parameter "DPSlaveAddr" will be ignored.

3 If the parameter "DPSlaveAddrMode" is set to "Rotary", the DP-address is built from the settings of the two lower rotary coding switches (x10, x1)! Those two rotary coding switches will be used doubly (see also DP-address setting via rotary coding switches (page 4-12).

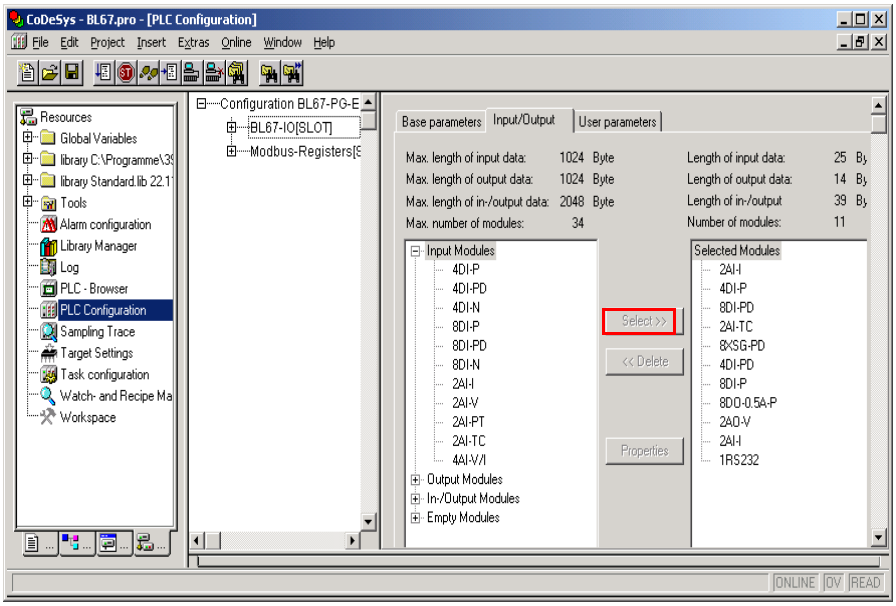
Figure 42: Assignment of the PROFIBUS-DP-slave-address via rotary coding switches



Configuration of the I/O modules

Mark the BL67-IO[SLOT] and add the I/O modules to the gateway in the “Input/Output" tab.

Figure 43: Selecting the I/O modules



Attention

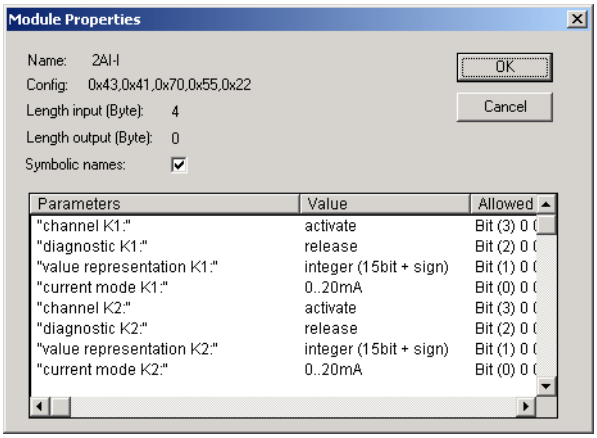
When configuring the BL67 station in the software, please observe that the order of the modules added to the gateway has to match the physical module order of the hardware configuration.

5.4.3 Parameterization of the I/O modules

For the parameterization of an I/O module mark the respective module in the “Selected Modules" field and press the “Properties" button.

In the “Module Properties" dialog box each Parameter can be changed by double clicking the "Value“.

Figure 44: Parameterization of I/O modules



5.4.4 Addressing the in- and output data

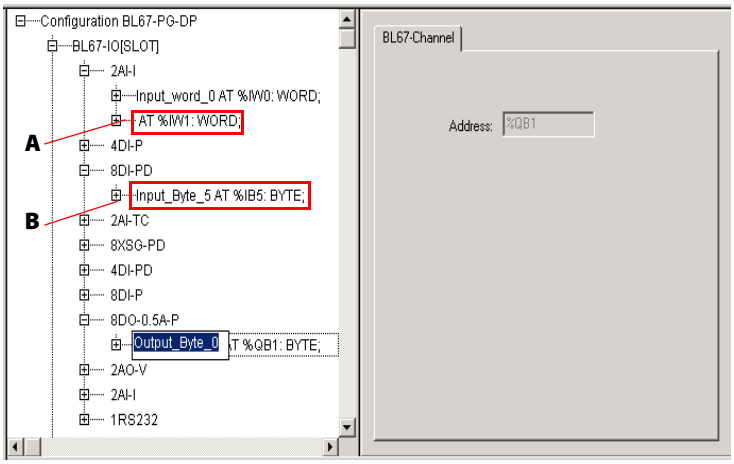
In- and output addresses are automatically assigned to the gateway and the connected modules.

Note

The assignment of the in- and output addresses is done automatically and cannot be changed by the user.
In case of configuration changes, this assignment is also adapted automatically which may cause byte adjustments.
It is therefore recommended to add symbolic addresses to the logical address assignment of in- and outputs and to use only these symbolic addresses in the PLC program. (see Figure 45: Hardware configuration with symbolic address allocation).

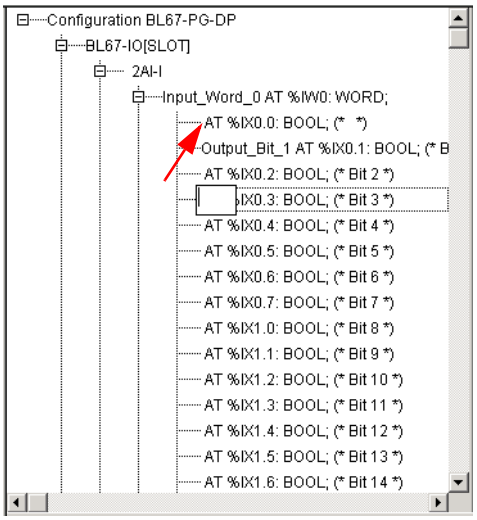
Figure 45: Hardware configuration with symbolic address allocation

A *logical address assignment (automatic)*
B *symbolic address assignment (application specific)*



A double click directly to the left of the entry of automatic addressing "AT%..." opens the input field for the symbolic addressing.

Figure 46: Symbolic addressing



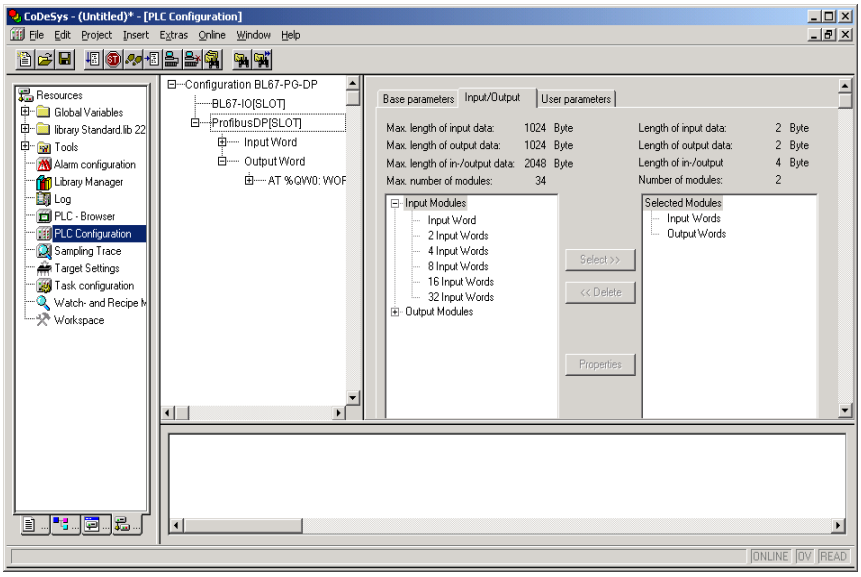
5.4.5 Mapping of PROFIBUS-DP input and output words

For the PROFIBUS-DP-communication of the BL67-PG-DP with a higher level master, the in- and output words have to be added to the PLC-configuration.

Therefore, chose the necessary in- and output words under "Configuration BL67-PG-DP → PROFIBUS-DP[Slot]" and add them to the PLC-configuration.

The in- and output addresses for each PROFIBUS-DP-register (of type WORD) are automatically assigned.

Figure 47: Configuration of the in- and output words

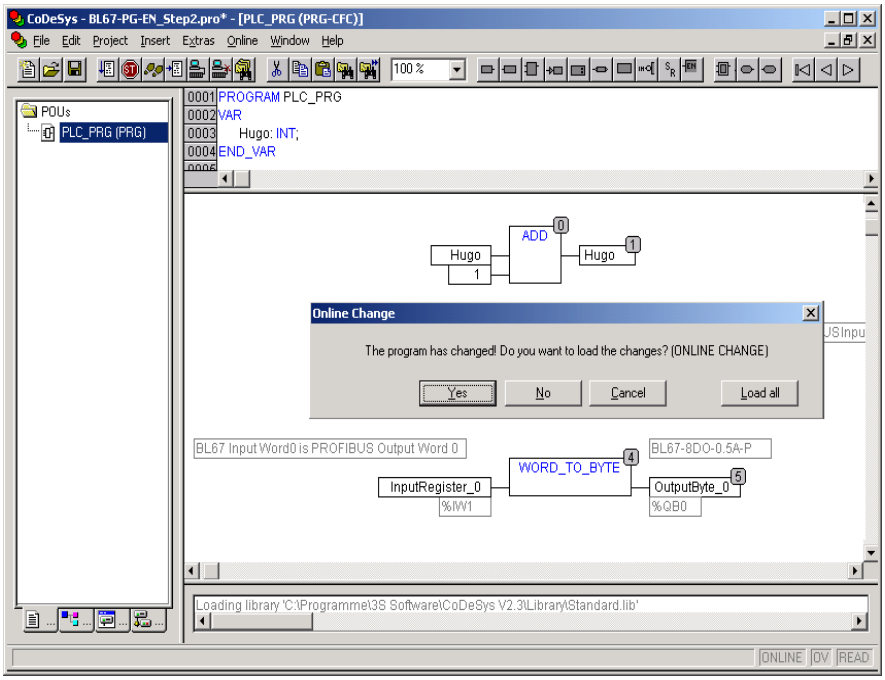


Therefore, a symbolic address allocation is also recommended for the PROFIBUS-DP-registers (see also Note on page 5-14).

5.5 PLC-Programming

Programming is done in the "POUs" tab.

Figure 48: Programming in "POUs" tab

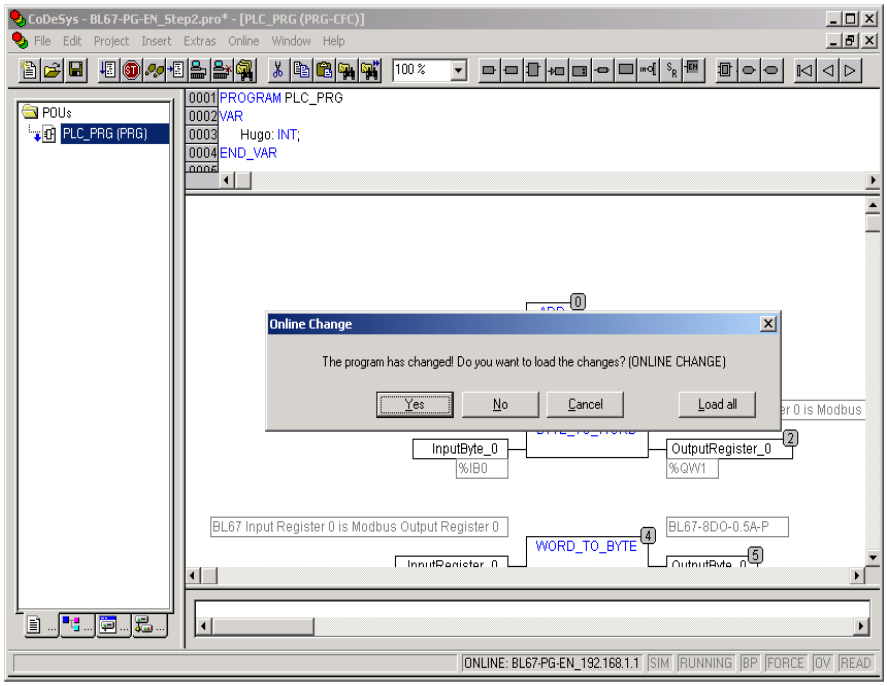


After the completion of the program, it is compiled using the "Project → Rebuild all..." command.

5.5.1 Online

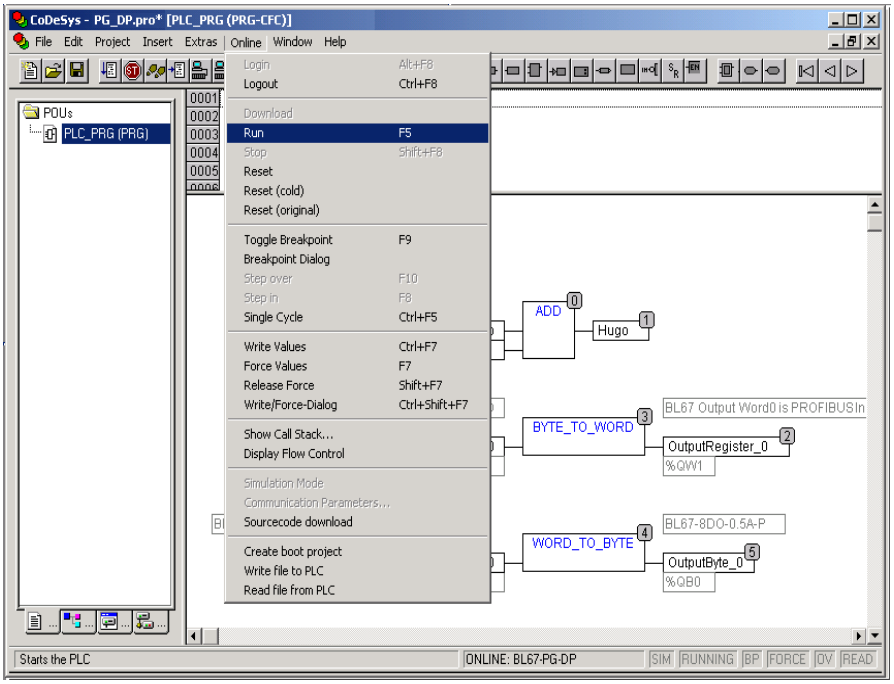
The connection to the gateway is established with "Online → Login".

Figure 49: Download of the program



Download the program to the gateway and start it with "Online → Run".

Figure 50: Starting the program



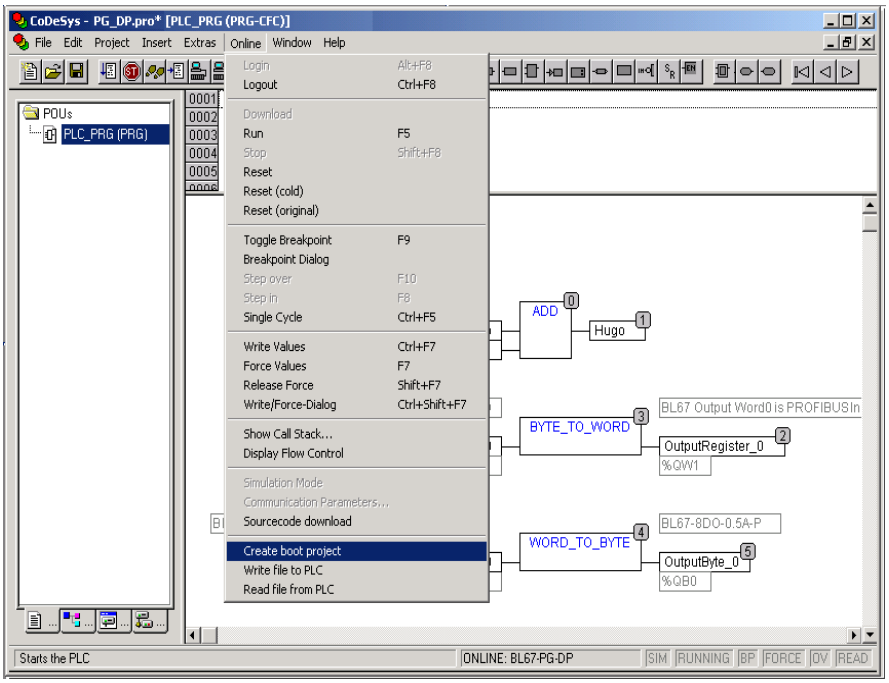
Note

Please observe, projects must be downloaded and saved as boot projects (for further information see the description in the following section Creating a boot project) in order to be stored permanently to the gateway!
All other projects are deleted in case of a boot-up of the gateway!

5.5.2 Creating a boot project

With "Online → create boot project" your program is saved as a boot project which is stored to the BL67-PG-DP and is automatically loaded at every re-start of the gateway.

Figure 51: Create boot project



5.5.3 Sourcecode download

Using the option "Online → Sourcecode download" stores all necessary symbolic information of the CoDeSys-project to the PG. If the symbolic information is not stored within the PG, a project-upload from the PG is not possible.

6 Guidelines for Station Planning

6.1 Module Arrangement

6.1.1 Random Module Arrangement

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

Attention

Please observe, that RFID modules used within a station always have to be mounted directly following the gateway (slot 1 to 4).

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

6.2 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.

6.3 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 8: 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-A	8	4
BL67-2RFID-C	8	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›.

6.3.1 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.

6.4 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.

6.5 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.

7 Guidelines for Electrical Installation

7.1 General Notes

7.1.1 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.).

7.1.2 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.

Danger

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

7.1.3 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.

7.1.4 Transmission Media

Ethernet

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.

PROFIBUS-DP

- Media specification
  The bus stations are connected to one another via fieldbus cables, which comply with the RS 485 specifications and with DIN 19245. Accordingly, the cable must have the following characteristics:

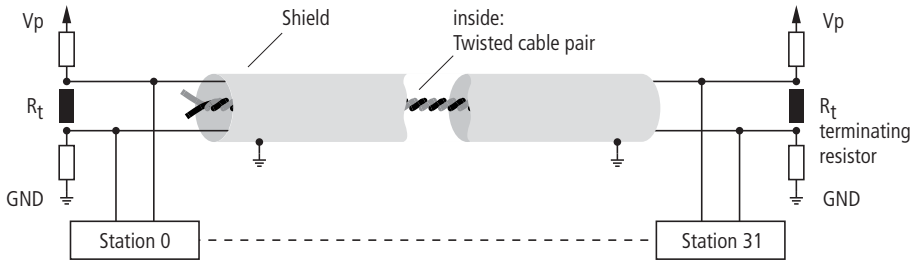
Table 9: Parameter of cable type A

Parameter	Cable A (DIN 19245, part 3)
Characteristic impedance	35 bis 165 (3 bis 20 MHz) 100 bis130 (f >100 kHz)
Capacitance per unit length	< 30 nF/km
Loop resistance	< 110 Ω/km
Wire diameter	> 0.64 mm
Wire cross-section	> 0.34 mm^2
Terminating resistor	220 Ω

Attention

The adherence to these parameters becomes more important the higher the baud rate, the more stations there are on the bus and the longer the length of the cable.

Abbildung 52: Representation of a PROFIBUS-DP cable



- Cable types
  Turck offers a variety of cable types for fieldbus lines as premoulded or bulk cables with different M12-connectors. The ordering information for the available cable types can be found in the internet under www.turck.com.

7.2 Potential Relationships

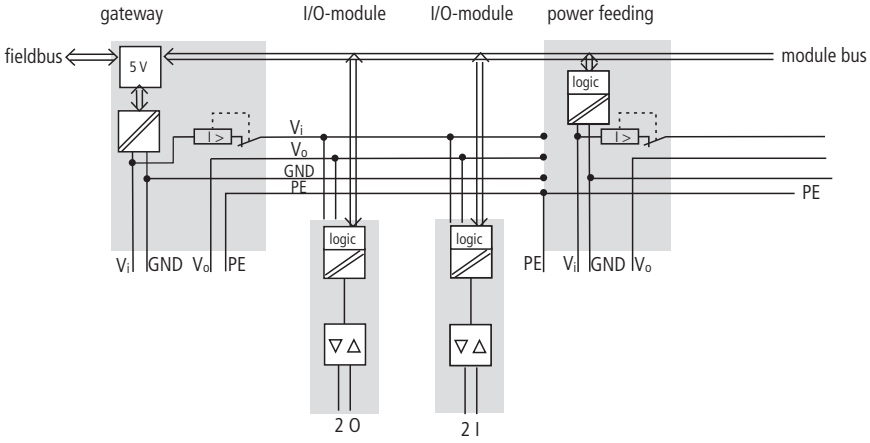
7.2.1 General

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 station.

Figure 53: Block diagram of a BL67 station



7.3 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.

7.3.1 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.

7.3.2 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.

Danger

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.

7.3.3 PE Connection

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

7.3.4 Earth-Free Operation

Observe all relevant safety regulations when operating an earthfree system.

7.3.5 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.

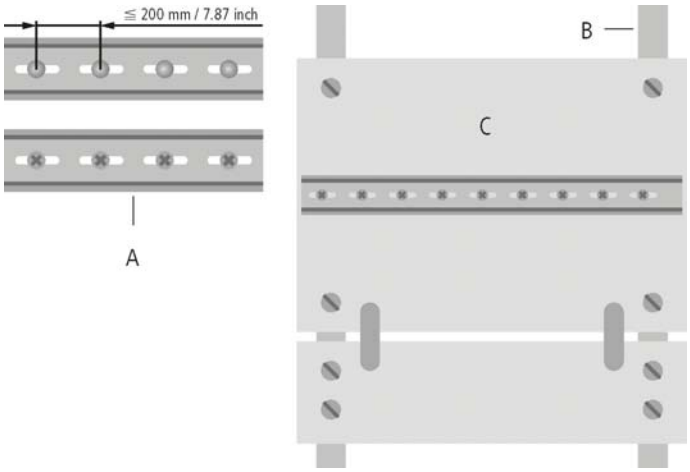


Figure 54: Mounting options

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).

7.4 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.

7.5 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.

Danger

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.

7.5.1 Switching Inductive Loads

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

7.5.2 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

8.1 Network Configuration

Note

In order to build up the communication between the BL67-gateway and a PLC/ PC or a network interface card, both devices have to be hosts in the same network.

The network is already defined by the default-settings in the BL67-gateways.

The default IP address for the BL67-gateways is 192.168.1.254 (see also chapter 3, page 3-2, section IP address).

If necessary, please adjust the IP address of the PLC/ PC or the network interface card.

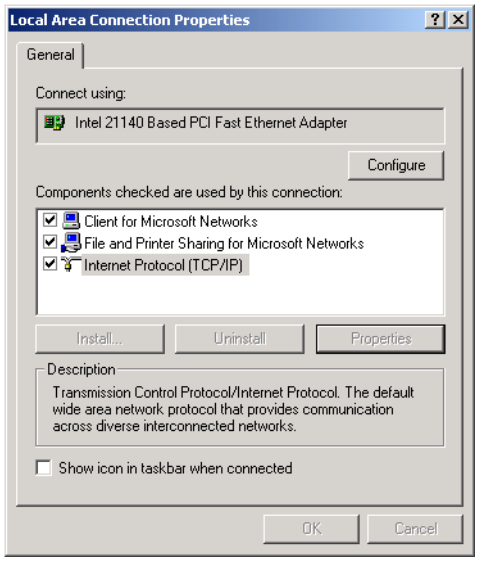
8.1.1 Changing the IP address of a PC/ network interface card

Changing the IP address in Windows 2000/ Windows XP

The IP address is changed in the "Control Panel" in "Network and Dial-up Connections":

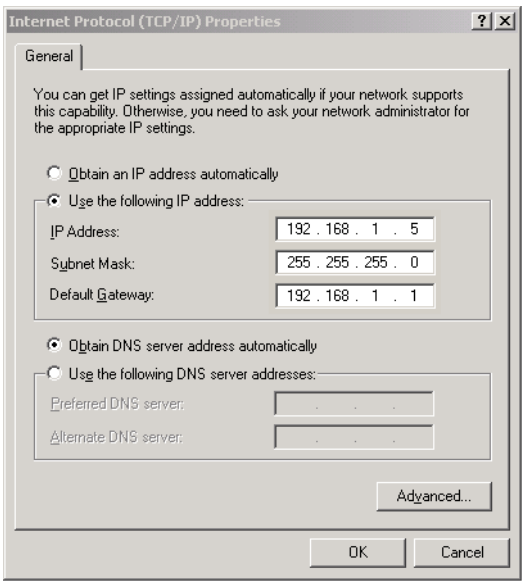
1. Open the folder "Local Area Connection" and open the dialog "Local Area Connection Properties" via the button "Properties" in the dialog "Local Area Connection Status".
2. Mark "Internet Protocol (TCP/IP)" and press the "Properties"-button to open the dialog "Internet Protocol (TCP/IP) Properties".

Figure 55: Local Area Connection Properties



3. Activate "Use the following IP address" and assign an IP address of the network mentioned above to the PC/ Network interface card (see the following figure).

Figure 56: Changing the PC's IP address

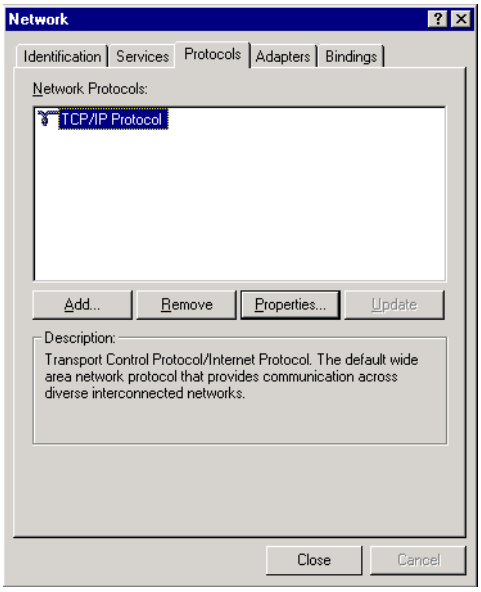


Changing the IP address in Windows NT

1 Open the folder "Network" in the Control Panel.

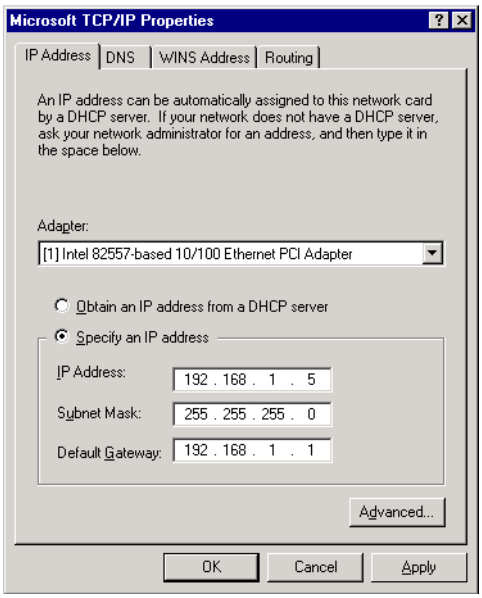
2 Activate TCP/IP connection in the tab "Protocols" and click the "Properties" button.

Figure 57: Network configuration WIN NT



3 Activate "Specify IP address " and set the address as follows.

Figure 58: Specify IP address



Changing the IP address via I/O-ASSISTANT

The Busaddressmanagement integrated in the I/O-ASSISTANT offers the possibility to browse the whole Ethernet network for connected nodes and to change their IP address as well as the subnet mask according to the application.

Note

Please read Address-setting via I/O-ASSISTANT 3 (FDT/DTM) (page 4-17) for the procedure for changing the IP-address via I/O-ASSISTANT.

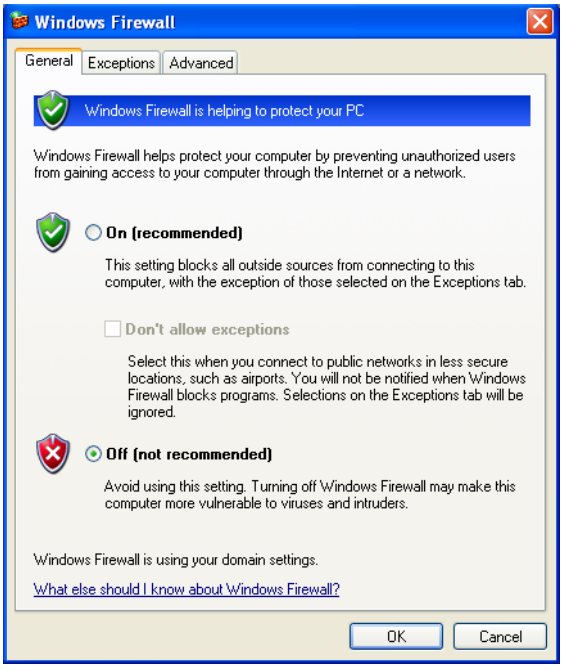
8.1.2 Deactivating/ adapting the firewall in Windows XP

If Windows XP is used as operating system, problems with the system-integrated firewall may occur in case of an access of outside sources to your computer or in case of tools like the I/O-ASSISTANT which are used for changing the IP address of the gateways.

In this case, you can deactivate the system integrated Windows XP firewall completely or adapt it to your application.

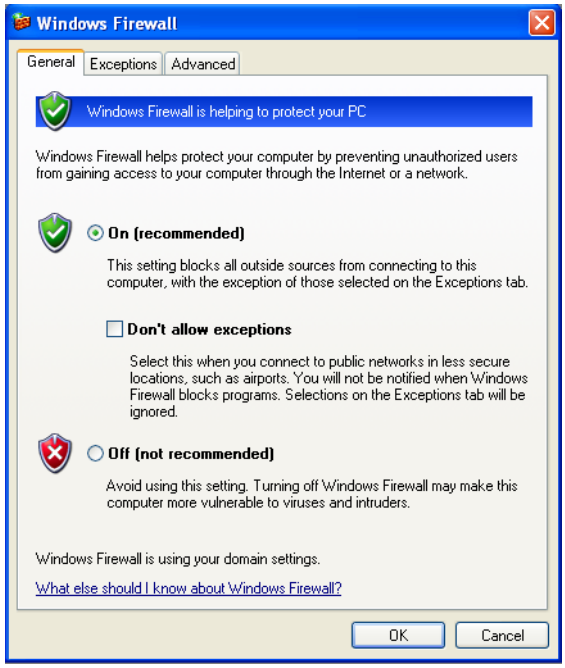
- **Deactivating the firewall**
  Open the "Windows Firewall" dialog in the control panel of your PC and deactivate it as follows:

Figure 59: Deactivating the Windows firewall



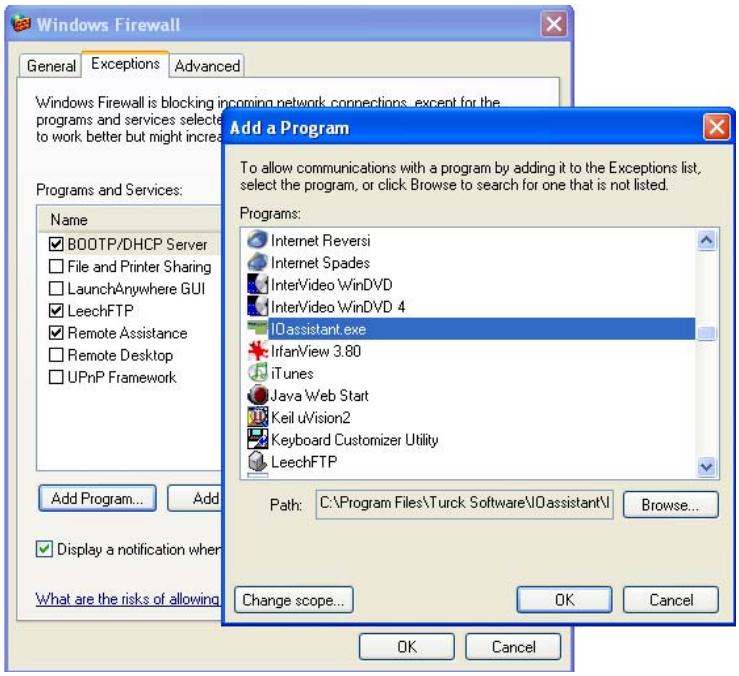
- **Adapting the firewall**
  The firewall remains active, the option "Don't allow exceptions" it deactivated:

Figure 60: Activating the Windows firewall



- In the "Exceptions"-tab, add the programs or services for which you want to allow the access to your computer.

Figure 61: "Exceptions"-tab



Note

Despite an active firewall, the I/O-ASSISTANT for example is now able to browse the network for hosts and the address changing via the software is possible for the connected nodes.

8.2 Nominal Current Consumption of Modules at Ethernet

Table 10: nominal current consumptions of the modules at Ethernet

Module	Current consumptions on 24 V DC
BL67-GW-EN	
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

Table 10: nominal current consumptions of the modules at Ethernet

Module	Current consumptions on 24 V DC
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.

ARP

Used to definitely allocate the hardware addresses (MAC-IDs) 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.

D

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.

E

EIA

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

Electrical components

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

EMC

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

EN

German acronym for European Standard.

ESD

Electrostatic Discharge.

F

Field power supply

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

Fieldbus

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

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

TCP

Abbreviation for Transmission Control Protocol, connection-oriented transport protocol within the Internet protocol suite. Certain error detection mechanisms (i.e. acknowledgements, time-out monitoring) can guarantee a safe and error free data transport.

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.

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TURCK

Industrial
Automation

www.turck.com

Hans Turck GmbH & Co. KG
45472 Mülheim an der Ruhr
Germany
Witzlebenstraße 7
Tel. +49 (0) 208 4952-0
Fax +49 (0) 208 4952-264
E-Mail more@turck.com
Internet www.turck.com

D301047 0511