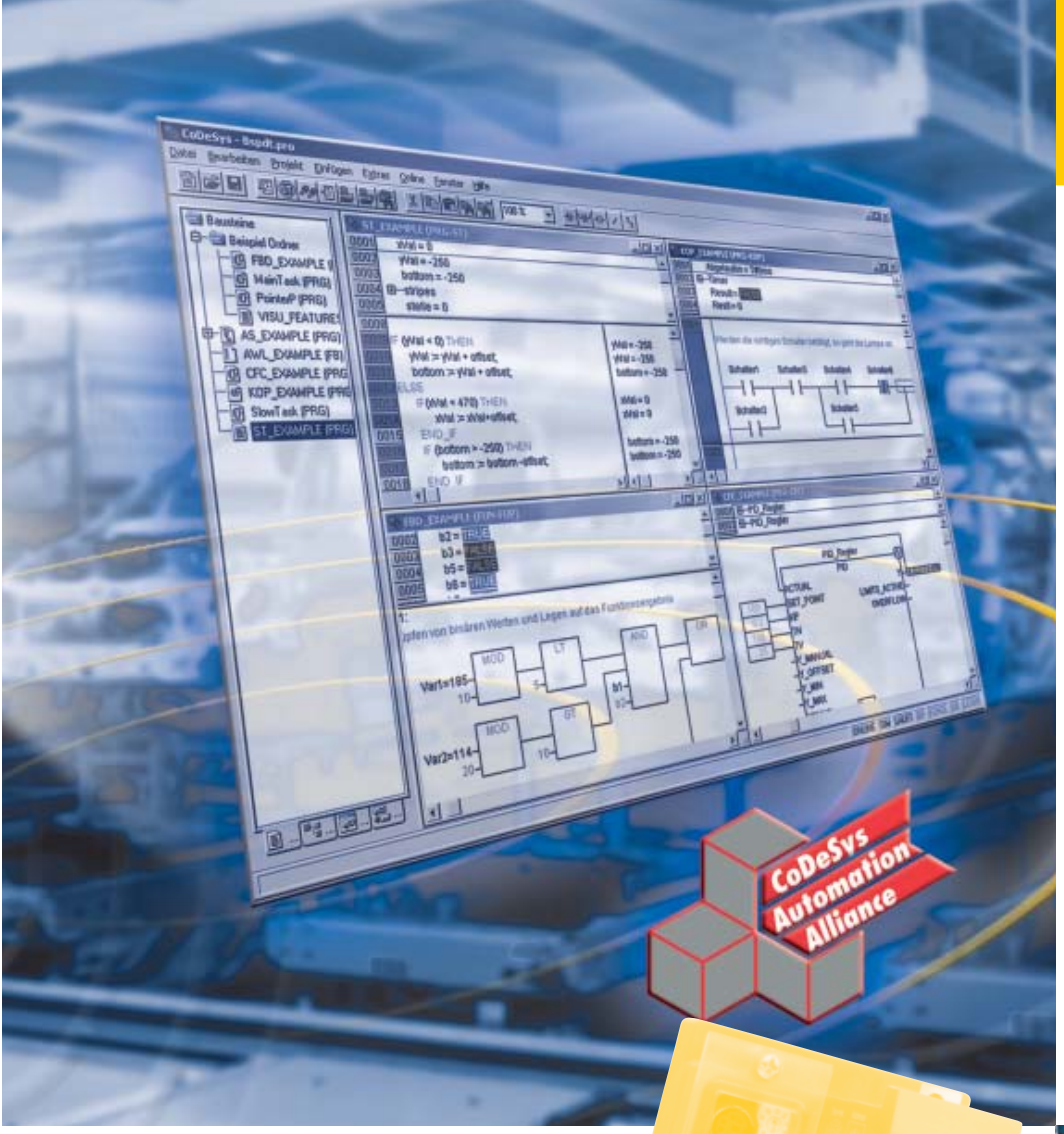
TURCK

Industrial
Automation

# BL20 –

# USER MANUAL

## PROGRAMMABLE GATEWAY FOR EtherNet/IP




Edition 12/2011

## 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 BL20 EtherNet/IP gateway BL20-PG-EN-IP.

The following chapters contain a short BL20 system description, a description of the field bus system Ethernet, exact information about function and structure of the BL20 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 BL20 as well as all further fieldbus-independent chapters like mounting, labelling etc. are described in a separate manual.

- BL20 I/O-modules (TURCK-Documentation-No.: German D300716/ English D300717)

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 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.

## 1.3 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 BL20-PG-EN-IP.
It has been specially conceived for personnel with the necessary qualifications.

### 1.3.1 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.

### 1.3.2 Notes Concerning Planning /Installation of this Product

**Danger**

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

## 1.4 List of Revisions

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

*Table 1-1: List of revisions*

| Chapter | Subject/ Description | new | changed |
|---|---|---|---|
| Chap. 4 | Address-setting via I/O-ASSISTANT 3 (FDT/DTM) | X | |
| Chap. 9 | BL20-Approvals for Zone 2/ Division 2<br>→ separate manual D301255 | | X |

**Note**

The publication of this manual renders all previous editions invalid.

# 2 BL20 Philosophy

## 2.1 The Basic Concept

BL20 is a modular IP20 I/O-system for use in industrial automation. It connects the sensors and actuators in the field to the higher-level master.

BL20 offers modules for practically all applications:

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

A complete BL20 station counts as **one** station on the bus and therefore occupies **one** fieldbus address in any given fieldbus structure. A BL20 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 BL20 station and the other fieldbus stations.

The communication within the BL20 station between the gateway and the individual BL20 modules is realized via an internal module bus.

**Note**

The gateway is the only fieldbus-dependent module on a BL20 station. All other BL20 modules are not dependent on the fieldbus used.

### 2.1.1 Flexibility

A BL20 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 BL20 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.

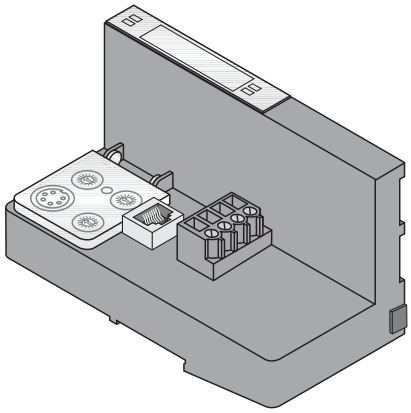
After disconnection of the load, the electronic modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

## 2.2 BL20 Components

### 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.

*Figure 2-1: BL20 gateway*



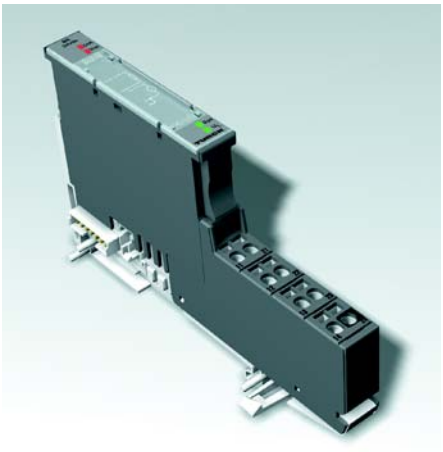
The BL20 gateways BL20-PG-EN-IP offer an integrated power supply unit for feeding the gateway and the connected I/O modules.

It is not necessary to supply each individual module with a separate voltage.

### 2.2.2 Power Distribution Modules

The power supply for gateways and I/O modules is fed to the power distribution modules; therefore, it is not necessary to supply each individual module with a separate voltage.

*Figure 2-2: Power distribution module*



### 2.2.3 Electronics Modules

Electronics modules contain the functions of the BL20 modules (power distribution modules, digital and analog input/output modules, and technology modules).

Electronics modules are plugged onto the base modules and are not directly connected to the wiring. The assignment table in the Section “Ordering Information“ of the “Appendix“ shows the possible combinations of electronics and base modules. 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 2-3: Electronics module in slice design*

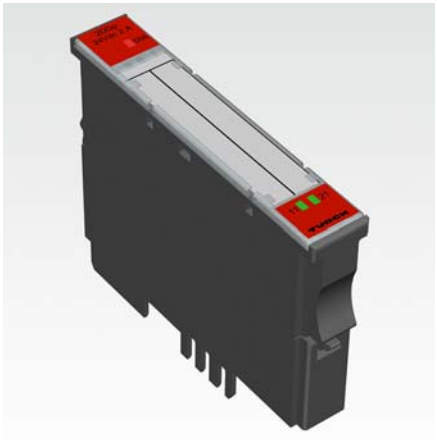
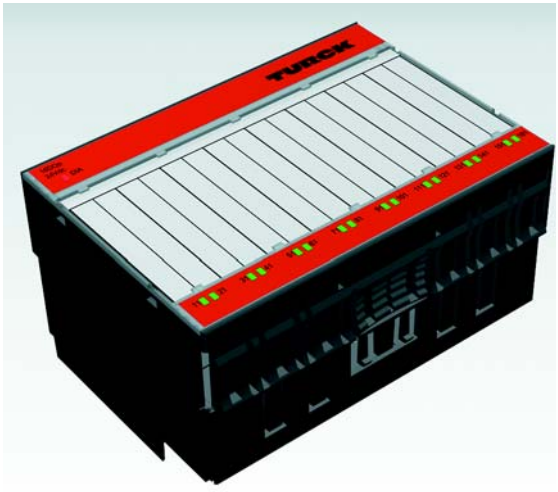


*Figure 2-4: Electronics module in block design*



## 2.2.4 Base Modules

The field wiring is connected to the base modules. These are constructed as terminals in block and slice designs and are available in the following variations with either tension clamp or screw connections: 2-/3-wire (2-channel), 4-wire (2-channel) and 4x 2-/3-wire (4-channel).

The assignment table in the Section “Ordering Information“ of the “Appendix“ shows the possible combinations of electronics and base modules.

*Figure 2-5: Base module with tension clamp connection*

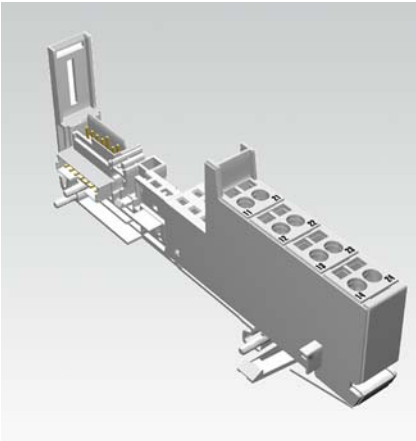


*Figure 2-6: Base module with screw connection*

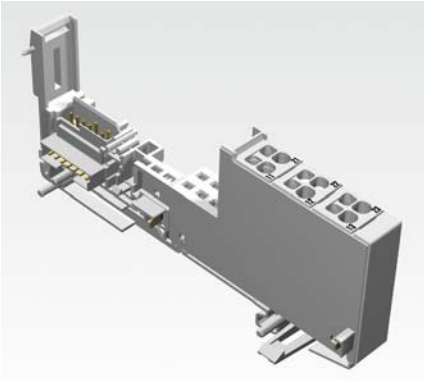
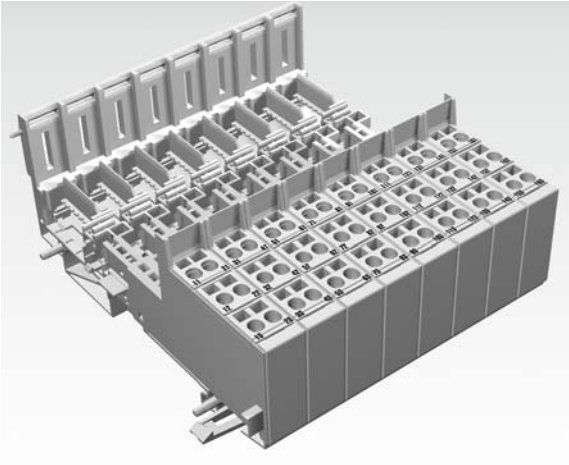


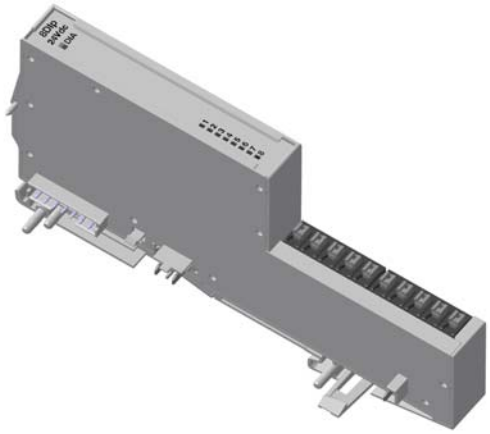
*Figure 2-7: Base module in block design*



### 2.2.5 BL20 Economy

With the BL20 Economy modules the electronics and connection technology is integrated into a single housing. Thus, the selection of a base module is unnecessary. Within a station the Economy modules can be combined with the modules with separate electronics/connection technology, provided that the base modules feature tension spring connections.

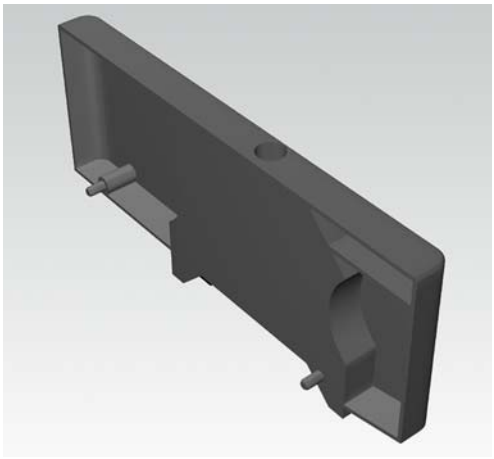
*Figure 2-8:*
*BL20 Economy*



### 2.2.6 End Plate

An end plate on the right-hand side physically completes the BL20 station. An end bracket mounted into the end plate ensures that the BL20 station remains secure on the mounting rail even when subjected to vibration.

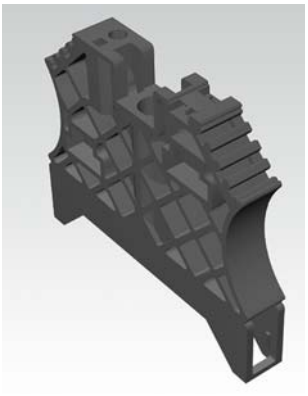
*Figure 2-9:*
*End plate*



### 2.2.7 End Bracket

A second end bracket to the left of the gateway is necessary, as well as the one mounted into the end plate to secure the station.

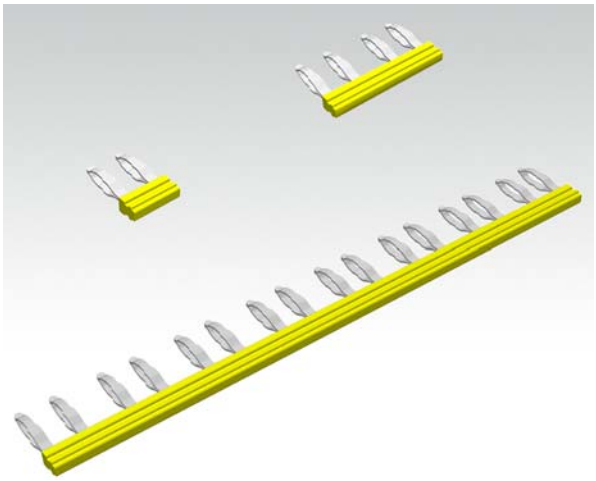
*Figure 2-10: End bracket*



### 2.2.8 Jumpers

Jumpers (QVRs) are used to bridge a connection level of a 4-wire base module. They can be used to connect potentials in relay modules (bridging the relay roots); thus considerably reducing the amount of wiring.

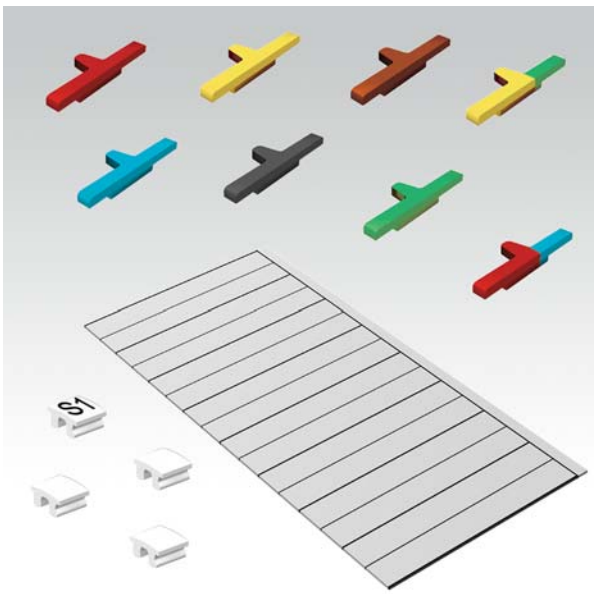
*Figure 2-11: Jumpers*



### 2.2.9 Marking Material

- Labels: for labeling BL20 electronics modules.
- Markers: for colored identification of connection levels of BL20 base modules.
- Dekafix connector markers: for numbering the mounting slots on BL20 base modules.

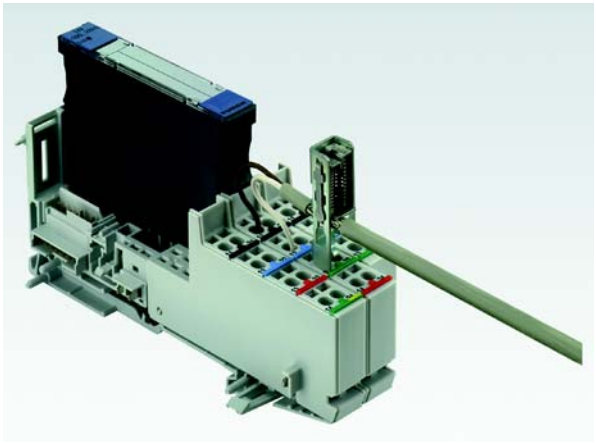
*Figure 2-12: Marking material*



### 2.2.10 Shield Connection, 2-Pole for Analog Modules

The 2-pole shield connection can be used to connect signal-cable shielding to the base modules of analog input and output modules. A special tension-clamp operating tool (BL20-ZBW5-2) is required to mount the shield connection onto the base module.

*Figure 2-13: Shield connection*



# 3 EtherNet/IP

## 3.1 System Description

Ethernet Industrial Protocol (EtherNet/IP) is a communication system for industrial applications.


It is used to exchange time-critical application information between industrial devices such as simple I/O devices (sensors/actuators) or even complex control devices (robots, programmable logic controllers, etc.).

EtherNet/IP is an open network because it uses:

- IEEE 802.3 Physical and Data Link standard
- Ethernet TCP/IP protocol suite (Transmission Control Protocol/Internet Protocol), the Ethernet industry standard.
- Common Industrial Protocol (CIP), the protocol that provides real-time I/O messaging and information/peer-to-peer messaging. ControlNet and DeviceNet networks also use CIP.

**Note**

For further infomation about CIP and EtherNet/IP, please contact also the user organization ODVA (www.odva.org).

### IP (Internet Protocol)

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

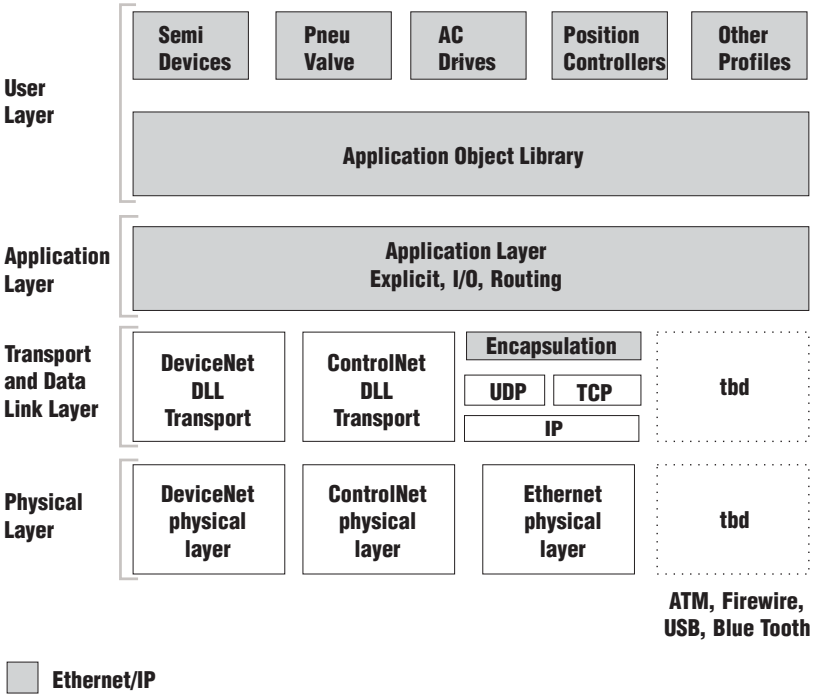
### TCP (Transmission Control Protocol)

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. For example, the acknowledgement and time monitoring of telegrams.

### UDP/IP (User Datagram Protocol)

UDP/IP provides the fast, efficient data transport necessary for real-time data exchange. To make EtherNet/IP successful, CIP has been added on top of TCP/UDP/IP to provide a common application layer.

*Figure 3-1: EtherNet/IP in OSI 7 layer model*




## 3.1.1 Network-Topology

EtherNet/IP network uses an active star topology in which groups of devices are connected point-to-point to a switch.

Products with both transmission speeds (10 and 100 Mbit/s) can be used in the same network and most Ethernet switches will negotiate the speed automatically.

### Transmission Media

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

- coaxial cable (10Base5)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP)

### 3.1.2 Addressing on EtherNet/IP

#### Ethernet MAC-ID

The Ethernet MAC-ID is a 6-byte-value which serves to 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 serial number.

The MAC-ID can be read from the module using the software tool "I/O-ASSISTANT".

#### IP address

Each Ethernet-host receives its own IP address. In addition, 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 IP address of the BL20-PG-EN-IP gateway is predefined as follows:

IP address: 192.168.1.×××

netmask: 255.255.255.0

gateway: 192.168.1.001

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 communication between a PC and an Ethernet-module, both have to be nodes on the same network.

If necessary, the nodes' network addresses have to be adapted one to another. Please read chapter 10, Changing the IP address of a PC/ network interface card, page 10-3.

### 3.1.3 Network Classes

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

*Table 3-1: Network classes*

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

According to their predefined address 192.168.1.××× BL20 gateways are nodes on a Class C network.

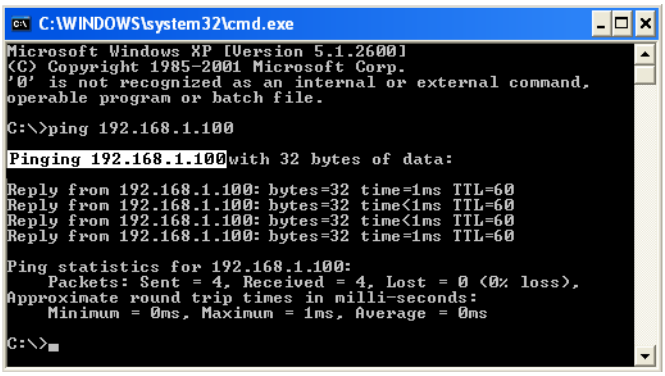
### 3.1.4 Checking the communication via "ping-signals"

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

For that purpose, 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 3-2: ping-signal*



### 3.1.5 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.

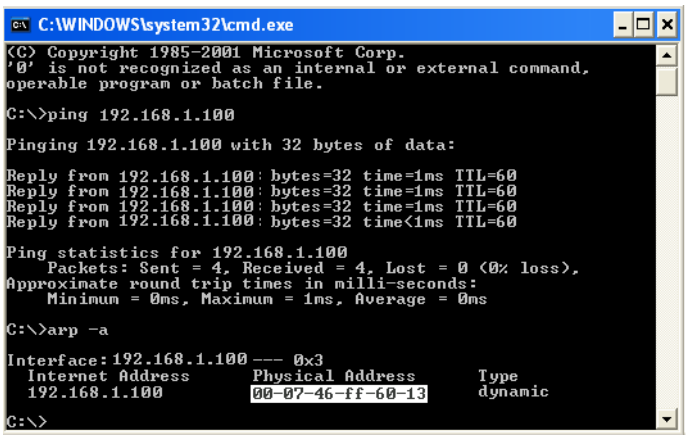



*Figure 3-3: Determination of the MAC-ID of a BL20 module via ARP*

# 4 Technical Features

## 4.1 General

This chapter contains the general technical description of the BL20 gateway for Ethernet. The following technical features are independent of the implemented protocol.
The chapter describes: the technical data, the connection possibilities, the addressing of the gateway etc.

## 4.2 Function

This chapter contains the general technical description of the programmable BL20 gateway for EtherNet/IP.

## 4.3 Function

The programmable BL20 gateways can be used as an autonomous PLC or as a de-central PLC in a network interconnection for fast signal processing

**Note**
The programmable BL20 gateway BL20-PG-EN is designed as a Single Task System.

The gateway handles the entire process data traffic between the I/O-level and the PLC runtime system.

### 4.3.1 Programming

The gateways BL20-PG-×××× are programmable according to IEC61131-3 using the software tool CoDeSys V2.3 from 3S - Smart Software Solutions GmbH.

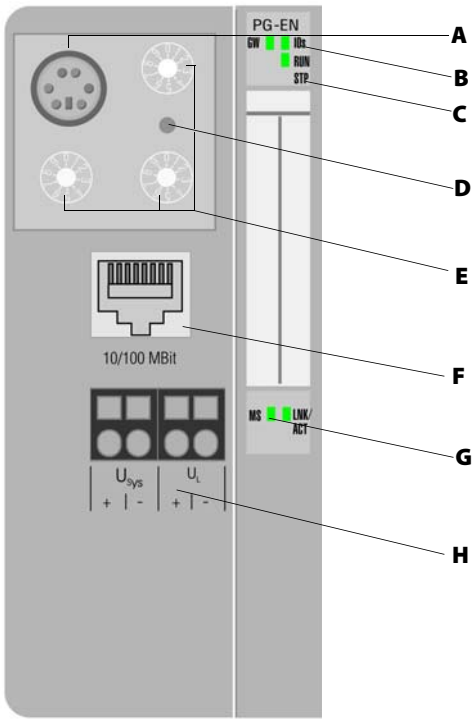
For programming the gateway, the following programming languages according the standards can be used:

| | |
|---|---|
| LD | = Ladder |
| FDB | = Function Block Diagram |
| IL | = Instruction List |
| ST | = Structured Text |
| SFC | = Sequential Function Chart |

## 4.4 Technical Data

*Figure 4-1: BL20-PG-EN*

**A***service-interface*
**B***module bus LEDs*
**C***RUN/STOP-LEDs*
**D***SET-button*
**E***rotary coding switches*
**F***Ethernet*
**G***Ethernet LEDs*
**H***power supply*




### 4.4.1 Gateway structure

The BL20 gateway has the following structure:

*Figure 4-2: Gateway structure*

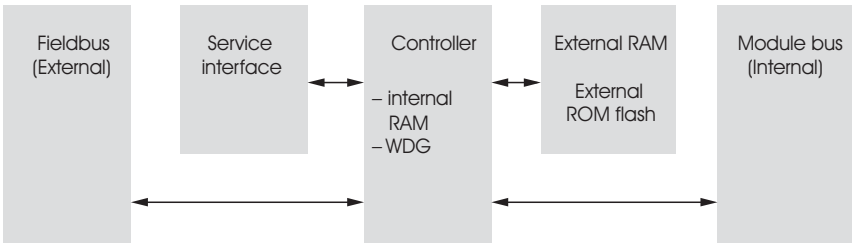


*Table 4-1: Technical data Ethernet gateway*

| | |
|---|---|
| Supply voltage | |
| field supply | |
| $U_L$ nominal value (permissible range) | 24 VDC (18 to 30 VDC) |
| $I_L$ max. field current | 10 A |
| System | 24 VDC |
| $U_{sys}$ nominal value (permissible range) | 24 VDC (18 to 30 VDC) |
| $I_{sys}$ | max. 500 mA |
| $I_{MB}$ (Supply of the module bus nodes) | max. 1,2 A |
| Physical interfaces | |
| field bus | |
| transmission rate | 10/100 MBit |
| passive LWL can be connected | current consumption max. 100 mA |
| field bus connection technology | RJ45 female connector |
| field bus shielding connection | via Ethernet cable |
| Isolation voltages | |
| $U_{RS}$ (Ethernet/ service interface) | 500 V AC |
| $U_{EN}$ (Ethernet/ module bus) | 500 V DC |
| $U_{sys}$ ($U_L$ to $U_{sys}$) | 1000 V DC |
| **PLC-data** | |
| Programming | |
| – Software<br>– Released for | CoDeSys V 2.3<br>V 2.3.5.8 |
| – Programming languages | IEC 61131-3<br>(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 1000 IL-commands<br>(without I/O-cycle) |

| | |
|---|---|
| Memory | |
| – Program memory | 512 KByte |
| – Data memory | 512 KByte |
| – Input data | 4 KByte (physical input data and network variables) |
| – Output data | 4 KByte (physical output data and network variables) |
| – Non-volatile memory | 16 KByte |

**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.

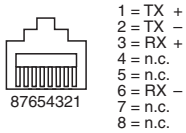
## 4.5 Connection possibilities

### 4.5.1 Field bus connection

**Ethernet-connection**

The connection to Ethernet is realized via female RJ45 connector:

*Figure 4-3: female RJ45 connector*




### 4.5.2 Power Supply via terminal block with screw connection

The power supply is realized via terminal block with screw connection technology.

*Table 4-2: Pin assignment the terminal blocks*

| Signal | Description |
|---|---|
| $U_{SYS}$ + | System supply (Gateway, module bus) |
| $U_{SYS}$ - | |
| $U_L$+ | Field supply (max. 10 A) |
| $U_L$- | |

### 4.5.3 Service Interface Connection (female PS/2 connector)

The service interface is used to connect the gateway to the project planning and diagnostic software I/O-ASSISTANT.

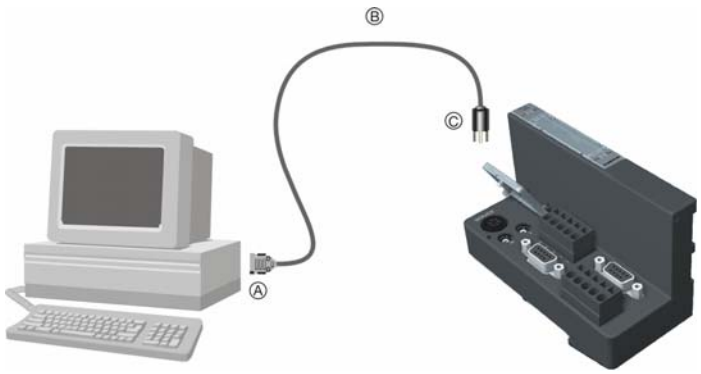
The service interface is designed as a 6 pole Mini-DIN-connection.

Two types of cables can be used to connect the service interface to a PC.

- 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**

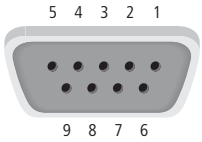
*Figure 4-4: BL20-gateway connected to PC via special cable*



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 4-5: PS/2 male connector on the connection cable to the gateway (top view)*


*Figure 4-6: 9-pole SUB-D female connector on the cable for connecting to PC (top view)*



## 4.6 Address Setting

The addressing of the BL20 EtherNet/IP gateway 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.

### 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 | 192.168.1.001 |

**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.

*Figure 4-7: Decimal rotary coding-switches for the address setting*


x 100


x 10


x 1

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

**Attention**

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

### 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.

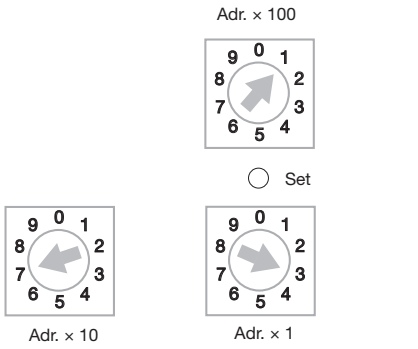
**Note**

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 4-8: Address setting*




000 : 192.168.1.254
1-254 : Static rotary
300 : BootP
400 : DHCP
500 : PGM
600 : PGM-DHCP

**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**

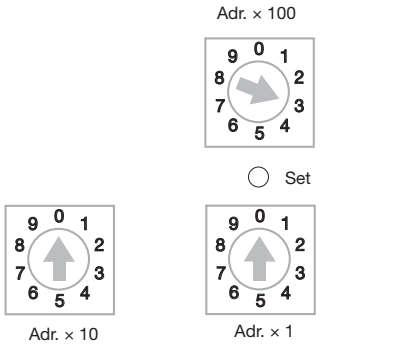
After changing the position of the rotary coding-switches, a voltage reset must be carried out to store the new address.

### 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 4-9: BootP-mode*




000 : 192.168.1.254
1-254 : Static rotary
300 : BootP
400 : DHCP
500 : PGM
600 : PGM-DHCP

**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.

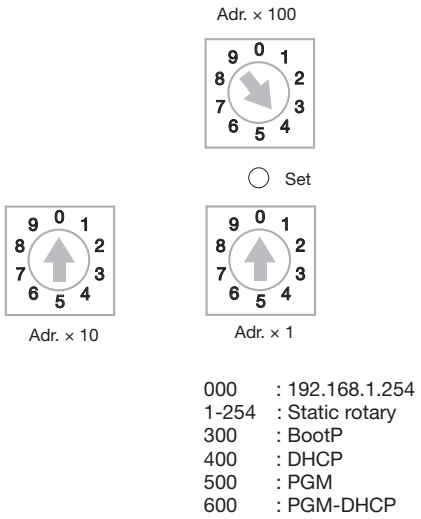
If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via BootP (IP address, subnet mask, etc.) will be taken from the module's EEPROM.

### 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 4-10: 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:

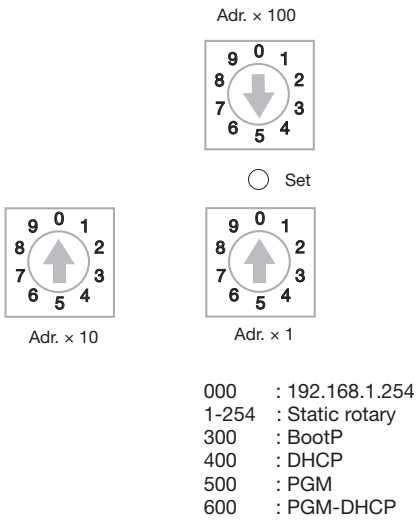
- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual 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 4-11: 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 BL20 EtherNet/IP gateway via PGM-DHCP is at the moment comparable to the addressing via DHCP (see page 4-11).

### 4.6.8 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.

The IP address, as well as the subnet mask of the TURCK Ethernet modules, can be changed according to the application by using the Busaddress Management function of the BL Service Ethernet interface in the I/O-ASSISTANT.

**Note**

Please observe, the changing the IP-Address is only possible by using the gateway's Ethernet interface. Select the interface "BL Service Ethernet" in the DTM and connect the gateway to the PC using the Ethernet port (page 4-6).

Changing the address using the RS232-interface is not possible.

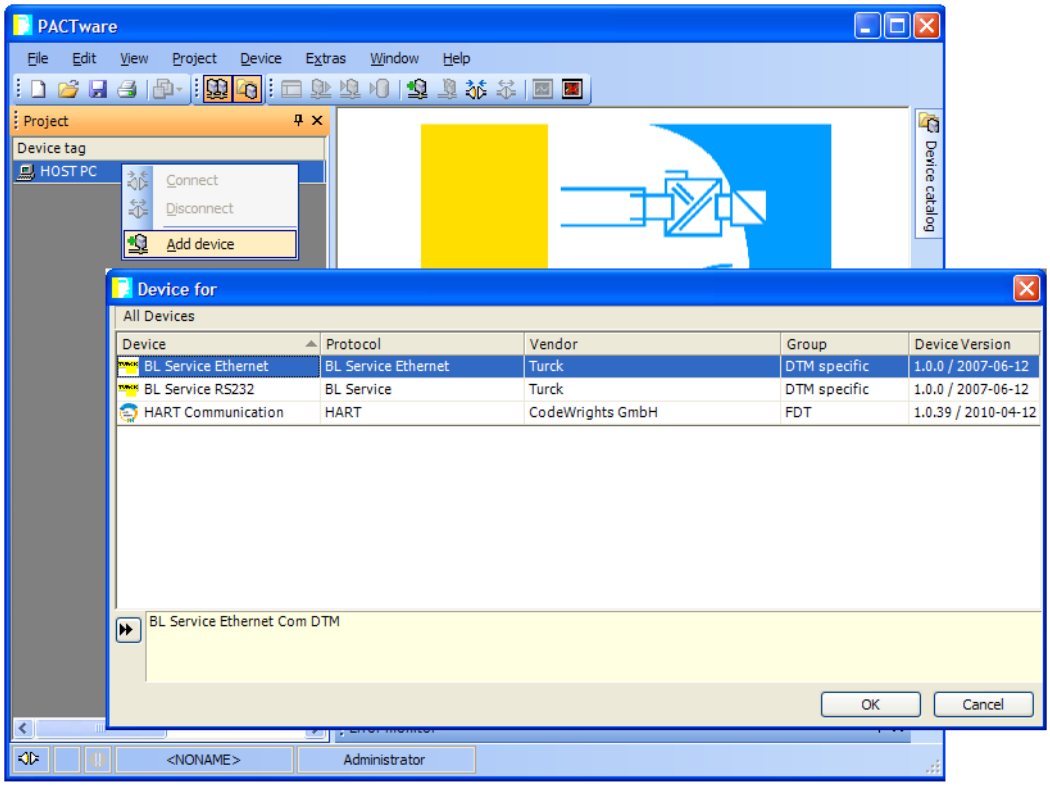



*Figure 4-12: BL Service Ethernet*

*Figure 4-13: Busaddress management*

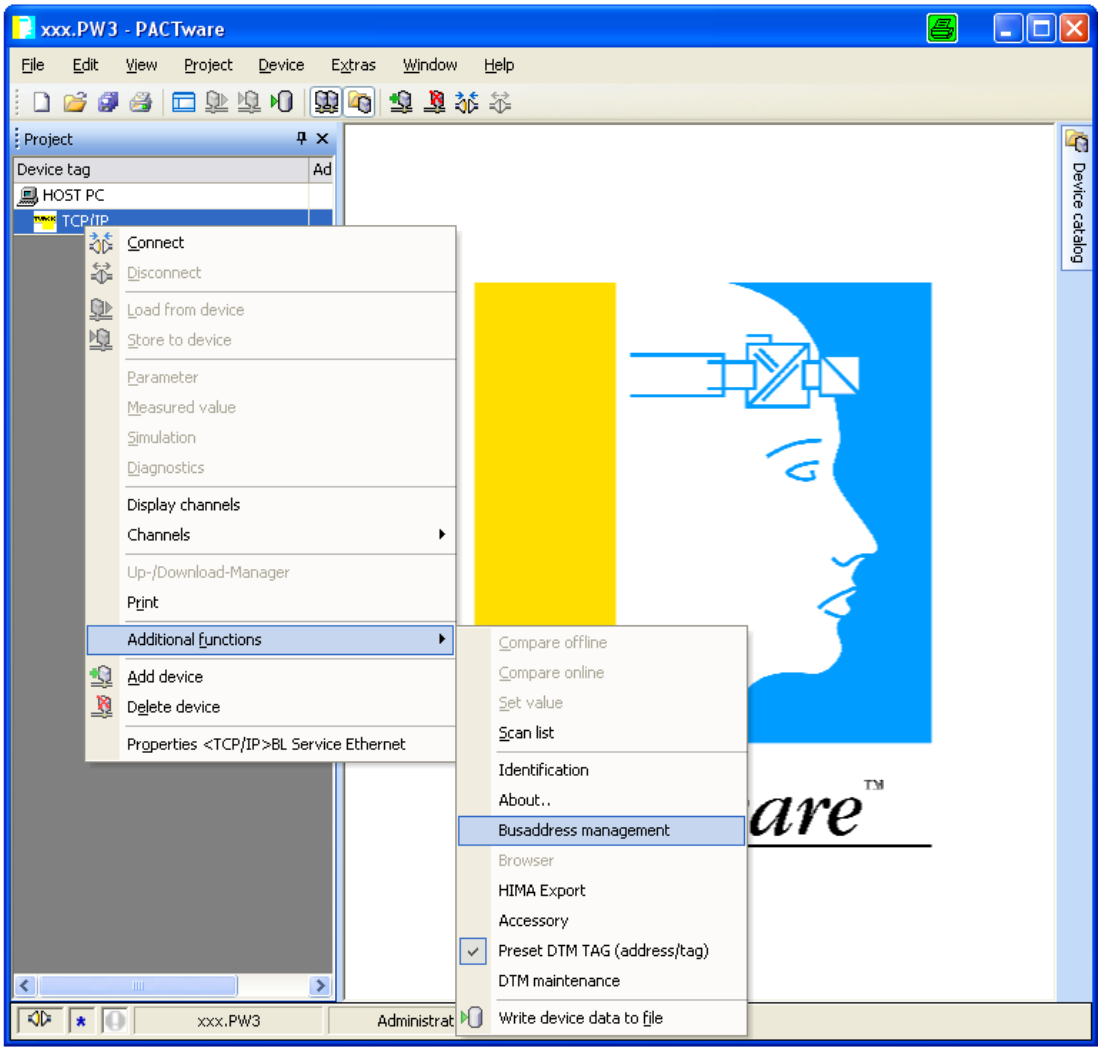
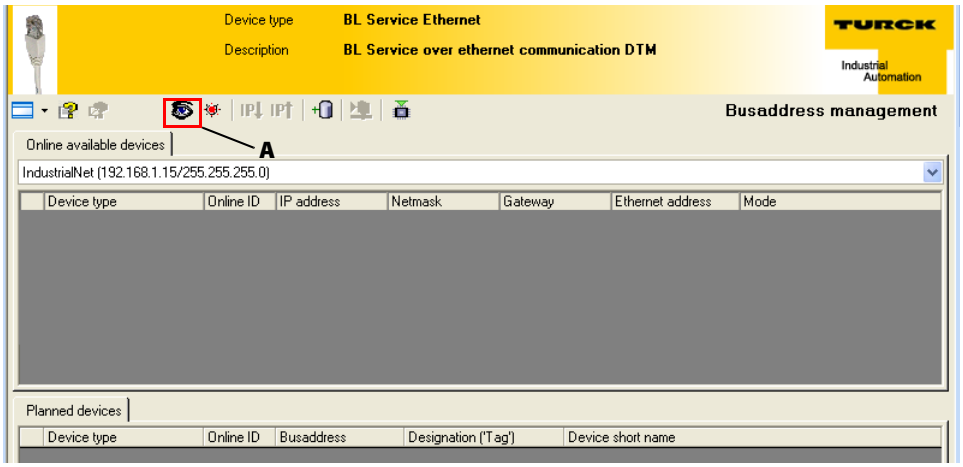



*Figure 4-14: Search for Network- nodes*

**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 in the IO-ASSISTANT 3 (FDT/DTM).

**Note**

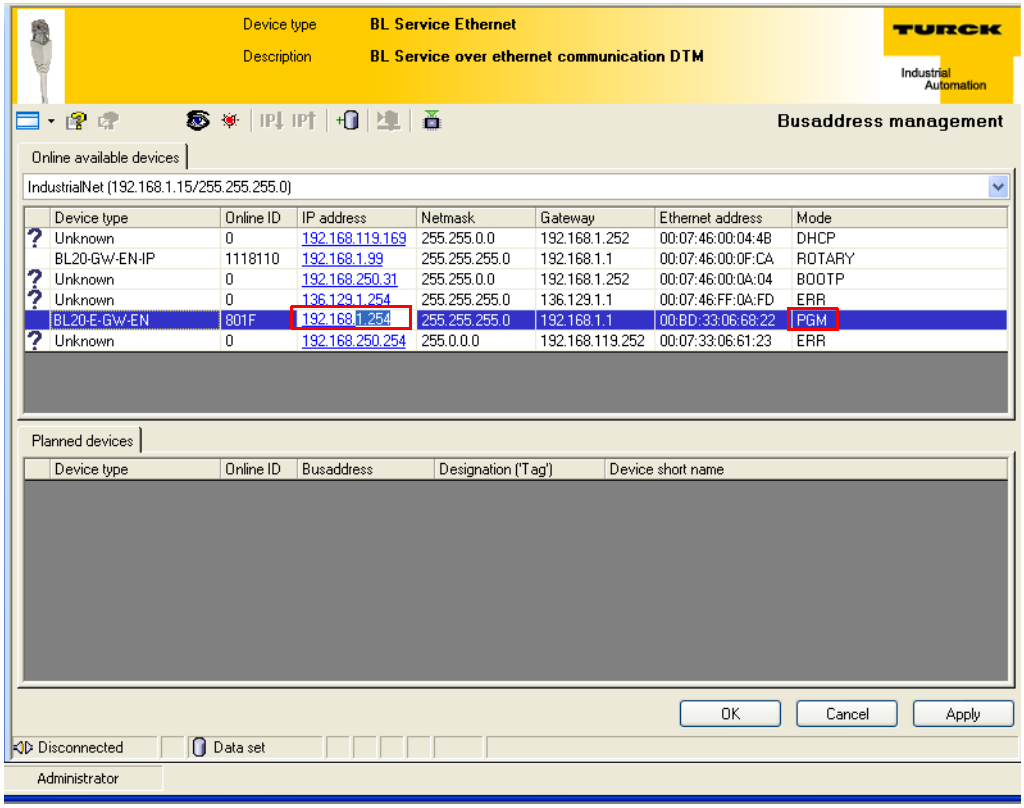
The access of the IO-ASSISTANT to the gateway is only possible if the gateway is operated in PGM-mode (see also Address setting via PGM-mode (page 4-12)).

**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 6-6)).

*Figure 4-15: Changing the IP-address*




**Note**

Please observe that chaning the IP-address is only possible via the Ethernet interface at the gateway, not via the RS232 interface.

## 4.7 SET Button

The Current Configuration of the station is saved as the Actual Configuration when the SET button on the gateway is pressed for approximately 10 seconds; it is also saved to the both the Temp-Required Configuration Memory and the Required Configuration Memory. The LED "GW" flashes.

## 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 BL20 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IOs**
- 1 LED for displaying if the gateway/ the program in the gateway has started: **RUN/STP**
- 2 LEDs for the Ethernet communication (fieldbus-LEDs): **LINK/ACT** and **MS**.

*Table 4-3: 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:<br>– too many modules connected to the gateway<br>– short circuit in connected module<br>– hardware error in gateway | – Check wiring at the gateway and the voltage supply.<br>– Dismount modules<br>– Replace the gateway. |
| **IOs** | 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 4Hz | 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:<br>– too many modules connected to the gateway<br>– short circuit in connected module<br>– hardware error in<br>– gateway | – Check wiring at the gateway and the voltage supply.<br>– Dismount modules<br>– Replace the gateway. |

*Table 4-3: LED-displays*

| LED | Status | Meaning | Remedy |
|---|---|---|---|
| **IOs** | Red, flashing, 1 Hz | Non-adaptable modification of the physically connected station. | – Compare the planned BL20 station with the physical station.<br>– 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/ STP** | 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. | – |
| **LINK/ ACT** | Off | No Ethernet link | – Check the Ethernet-connection |
| | Green | Link, 100 Mbit | |
| | Green flashing | Ethernet Traffic 100 Mbit | |
| | Yellow | Link, 10 Mbit | |
| | Yellow, flashing | Ethernet Traffic 10 Mbit | |
| **MS** | Green | Displays an active CIP Class 1 I/O connection | |
| | Green, flashing | Gateway is ready for operation | |
| | Red | Gateway indicates error | |
| | Red, flashing | DHCP/BootP search of settings | |

# 5 Implementation of EtherNet/IP

## 5.1 The EtherNet/IP Communications Profile

EtherNet/IP is based on a connection-oriented communication model. This means that it is only possible to exchange data via specified connections assigned to the devices.

Communication between the nodes in the EtherNet/IP network can be carried out either via I/O Messages or Explicit Messages.

### 5.1.1 I/O Messages

I/O Messages serve to exchange high priority process and application data over the network. Communication between the slaves in the EtherNet/IP network is carried out according to the Server/Client Model, which means a producing application transmits data to another or a number of consuming applications. It is quite possible that information is passed to a number of Application Objects in a single device.

### 5.1.2 Explicit Messages

Explicit Messages are used to transmit low-priority configuration data, general management data or diagnostic data between two specific devices. This is a point-to-point connection in a Server/Client System that requires a request from a client always to be confirmed by a response from the server.

Explicit messages, whether connected or unconnected, use the Message Router (for detailed information, read Abschnitt „Message Router Request/Response Formats“, page 5-8).

- Message Router Request
  Consists of a service code, path size value, a message router path and service data. An EPATH is used in the message router path to indicate the target object.
- Message Router Response
  Consists of a service field with the most significant bit set. This is an echo of the service code in the request message with the most significant bit set. A reserved byte follows the service code, which is followed by the General Status code.

### 5.1.3 Communications Profile of the BL20 EtherNet/IP Gateway

The EtherNet/IP gateway behaves as an EtherNet/IP Server in the network; the scanner of the higher-level controller operates as a EtherNet/IP Client.

The following EtherNet/IP communications types are supported:

- Point to Point or Multicast
- COS Connection
- Cyclic I/O Connection
- Cyclic and Change of State I/O Triggers
- Unconnected (UCMM) Explicit Messaging
- Connected Explicit Messaging

**Point to point**

A connection that exists between two nodes only.

**Multicast**

A packet with a special destination address, which multiple nodes on the network may be willing to receive.

### COS I/O Connection

COS (Change Of State) I/O Connections establish event-controlled connections. This means that the EtherNet/IP devices generate messages as soon as a change of status occurs.

### Cyclic I/O Connection

Messages are triggered time-controlled in Cyclic I/O connections by means of a time generator.

### UCMM

The EtherNet/IP gateway offers the option of establishing explicit messaging via the UCMM port (Unconnected Message Manager Port).

UCMM-based explicit messaging is normally used for random, non-periodic requests. It is not recommended for frequent messaging because the UCMM input queue in a product is typically limited to just a few messages. Once this limit is reached, subsequent requests are ignored and must be retried.

### Connected Explcit messaging

CIP is a connection-based system. For most communications between nodes, a connection is used.

A connection is a path or a virtual circuit between two or more end points in a system. The purpose is to transfer data in the most efficient manner possible.

The Connection ID is a number that is associated with a communication relationship. Receiving nodes decode this key to know whether they must accept the data or not.

## 5.2 Classes and Instances of the EtherNet/IP-Gateway

### 5.2.1 EtherNet/IP Standard Classes

The BL20 gateway supports the following EtherNet/IP Standard Classes in accordance with the CIP specification.

*Table 5-1: EtherNet/IP Standard Classes*

| Class Code | Object-Name | Description |
|---|---|---|
| 01 (0×01) | Identity | The Identity Object is required on all devices and provides general information about the device. It enables clear and unambiguous identification of modules. Contains information such as manufacturer name, product type, ident number, revision number etc. |
| 02 (0×02) | Message Router | The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device. |
| 04 (0×04) | Assembly | The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms ”input” and ”output” are defined from the network’s point of view. An input will produce data on the network and an output will consume data from the network. |
| 06 (0×06) | Connection Manager | The Connection Manager Class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Manager Class is referred to as a Connection Instance or a Connection Object. |
| 15 (0×0F) | Parameter Object | Provides a known, public interface to the device configuration data. |
| 244 (0×F4) | Port Object | Provides a standard way of describing a device’s ports. |
| 245 (0×F5) | TCP/IP Interface Object | Contains the device TCP/IP-related configuration information. |
| 246 (0×F6) | Ethernet Link Object | Contains link-specific counters and status information for an Ethernet 802.3 communications interface. |

### 5.2.2 Identity Object

The following description of the Identity Object is taken from the CIP specification, Vol. 1, Rev. 2.1, by ODVA & ControlNet International Ltd. and adapted to BL20.

**Class Attributes**

*Table 5-2: Class attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Value |
|---|---|---|---|---|
| 1 (0×01) | REVISION | G | UINT | 1 |
| 2 (0×02) | MAX OBJECT INSTANCE | G | UINT | 1 |
| 6 (0×06) | MAX CLASS ATTRIBUTE | G | UINT | 7 |
| 7 (0×07) | MAX INSTANCE ATTRIBUTE | G | UINT | 7 |

**Instance Attributes**

*Table 5-3: Instance attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 1 (0×01) | VENDOR | G | UINT | Contains the vendor ID, managed by the Open DeviceNet Vendor Association, Inc. (ODVA) and ControlNet International (CI):<br>TURCK = 48 |
| 2 (0×02) | PRODUCT TYPE | G | UINT | Indicates the general type of product.<br>Communications Adapter<br>$12_{dez}$ = 0×0C |
| 3 (0×03) | PRODUCT CODE | G | UINT | Identifies a particular product within a device type.<br>Default: 27248 |
| 4 (0×04) | REVISION<br><br>Major Minor | G | STRUCT OF:<br>USINT USINT | Revision of the item the Identity Object is representing.<br>0x01<br>0x02 |
| 5 (0×05) | DEVICE STATUS | G | WORD | See Table 5-4: Device Status |
| 6 (0×06) | SERIAL NUMBER | G | UDINT | Contains the ident-no. of the product (3 last bytes of the MAC-ID). |
| 7 (0×07) | PRODUCT NAME<br><br>LENGTH NAME | G | STRUCT OF:<br><br>USINT<br>STRING [13] | BL20-PG-EN-IP |

### Device Status

*Table 5-4: Device Status*

| Bit | Name | Definition |
|---|---|---|
| 0 to 1 | reserved | Default = 0 |
| 2 | Configured | TRUE<br>→ The application of the device has been configured (≠ default-settings). |
| 3 | reserved | Default = 0 |
| 4 to 7 | Extended Device Status | 0011 = No I/O connections established<br>0110 = At least one I/O connection in run mode<br>0111 = At least one I/O connection established, all in idle mode<br>All other settings = reserved |
| 8 to 15 | reserved | Default = 0 |

### Common Services

*Table 5-5: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 01 (0x01) | yes | yes | Get_Attribute_All<br>Returns a predefined listing of this objects attributes. |
| 05 (0x05) | no | yes | Reset<br>Starts the Reset service for the device. |
| 14 (0x0E) | yes | yes | Get_Attribute_Single<br>Returns the contents of a specified attribute. |
| 16 (0x10) | no | no | Set_Attribute_Single<br>Modifies a single attribute. |

### 5.2.3 Message Router Object

This object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

The following description of the Message Router Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL20.

**Class Attributes**

*Table 5-6: Class attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Value |
|---|---|---|---|---|
| 1 (0×01) | REVISION | G | UINT | 1 |
| 4 (0×04) | OPTIONAL ATTRIBUTE NUMBER | G | UINT | 0 |
| 5 (0×05) | OPTIONAL SERVICE NUMBER | G | UINT | 0 |
| 6 (0×06) | MAX CLASS IDENTIFIER | G | UINT | 7 |
| 7 (0×07) | MAX INSTANCE ATTRIBUTE | G | UINT | 2 |

**Instance Attributes**

*Table 5-7: Instance attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 1 (0×01) | OBJECT LIST | G | STRUCT OF | Structure with an array of object class-codes supported by the device. |
| | NUMBER | G | UINT | Depending |
| | CLASSES | G | ARRAY of UINT | Number of the classes supported by the gateway. |
| 2 (0×02) | MAX NUMBER OF CONNECTIONS | G | UINT | Count of the maximum number of connections supported. |

**Common Services**

*Table 5-8: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 01 (0x01) | yes | yes | Get_Attribute_All |
| 14 (0x0E) | yes | yes | Get_Attribute_Single |

### Message Router Request/Response Formats

- Message Router Request Format:

*Table 5-9: Message Router Request*

| Parameter | Data Type | Description |
|---|---|---|
| Service | USINT | Service code of the request. |
| Request Path Size | USINT | Number of 16 bit words in the "Request Path". |
| Request Path | Padded EPATH | Array of bytes containing the information for the path of request (class ID, Instance ID, etc.) for this transaction. |
| Request Data | Array of octed | Additional service specific data to be delivered in the Explicit Messaging Request. |

- Message Router Response Format:

*Table 5-10: Message Router Request*

| Parameter | Data Type | Description |
|---|---|---|
| Reply Service | SINT | Reply service code. |
| General Status | USINT | General Status Code according to CIP specification.<br>See Table 5-11: General Status Codes according to CIP spec. |
| Size of Additional Status | USINT | Number of 16 bit words in "Additional Status". |
| Additional Status | Array of USINT | Additional status. |
| Response Data | Array of octet | Response data from request or additional error data if an error was indicated in "General Status". |

*Table 5-11: General Status Codes according to CIP spec.*

| Status Code (hex) | Status Name | Description |
|---|---|---|
| 00 | Success | Service successfully performed by the object specified. |
| 01 | Connection failure | A connection related service failed along the connection path. |
| 02 | Resource unavailable | Resources needed for the object to perform the requested service were unavailable. |
| 03 | Invalid parameter value | See Status Code 0x20, which is the preferred value to use for this condition. |
| 04 | Path segment error | The path segment identifier or the segment syntax was not understood by the processing node. Path processing shall stop when a path segment error is encountered. |

*Table 5-12:*

*Table 5-13:*

*Table 5-14:*

*Table 5-15:*

*Table 5-16:*

*Table 5-11: General Status Codes according to CIP spec.*

| Status Code (hex) | Status Name | Description |
|---|---|---|
| 05 | Path destination unknown | The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node. Path processing shall stop when a path destination unknown error is encountered. |
| 06 | Partial transfer | Only part of the expected data was transferred. |
| 07 | Connection lost | The messaging connection was lost. |
| 08 | Service not supported | The requested service was not implemented or was not defined for this Object Class/Instance. |
| 09 | Invalid attribute value | Invalid attribute data detected. |
| 0A | Attribute list error | An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status. |
| 0B | Already in requested mode/state | The object is already in the mode/state being requested by the service. |
| 0C | Object state conflict | The object cannot perform the requested service in its current mode/state. |
| 0D | Object already exists | The requested instance of object to be created already exists. |
| 0E | Attribute not settable | A request to modify a non-modifiable attribute was received. |
| 0F | Privilege violation | A permission/privilege check failed. |
| 10 | Device state conflict | The device's current mode/state prohibits the execution of the requested service. |
| 11 | Reply data too large | The data to be transmitted in the response buffer is larger than the allocated response buffer. |
| 12 | Fragmentation of a primitive value | The service specified an operation that will fragment a primitive data value, i.e. half a REAL data type. |
| 13 | Not enough data | The service did not supply enough data to perform the specified operation. |
| 14 | Attribute not supported | The attribute specified in the request is not supported. |
| 15 | Too much data | The service supplied more data than expected. |

*Table 5-11: General Status Codes according to CIP spec.*

| Status Code (hex) | Status Name | Description |
|---|---|---|
| **Status Code (hex)** | **Status Name** | **Description** |
| 16 | Object does not exist | The object specified does not exist in the device. |
| 17 | Service fragmentation sequence not in progress | The fragmentation sequence for this service is not currently active for this data. |
| 18 | No stored attribute data | The attribute data of this object was not saved prior to the requested service. |
| 19 | Store operation failure | The attribute data of this object was not saved due to a failure during the attempt. |
| 1A | Routing failure, request packet too large | The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service. |
| 1B | Routing failure, response packet too large | The service response packet was too large for transmission on a network in the path from the destination. The routing device was forced to abort the service. |
| 1C | Missing attribute list entry data | The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior. |
| 1D | Invalid attribute value list | The service is returning the list of attributes supplied with status information for those attributes that were invalid. |
| 1E | Embedded service error | An embedded service resulted in an error. |
| 1F | Vendor specific error | A vendor specific error has been encountered. The Additional Code Field of the Error Response defines the particular error encountered. Use of this General Error Code should only be performed when none of the Error Codes presented in this table or within an Object Class definition accurately reflect the error. |
| 20 | Invalid parameter | A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements of this specification and/or the requirements defined in an Application Object Specification. |
| 21 | Write-once value or medium already written | An attempt was made to write to a write-once medium (e.g. WORM drive, PROM) that, has already been written, or to modify a value that cannot be changed once established. |
| 22 | Invalid Reply Received | An invalid reply is received (e.g. reply service code does not match the request service code, or reply message is shorter than the minimum expected reply size). This status code can serve for other causes of invalid replies. |

*Table 5-11: General Status Codes according to CIP spec.*

| Status Code (hex) | Status Name | Description |
|---|---|---|
| 23 to 24 | Reserved by CIP for future extensions | |
| 25 | Key Failure in path | The Key Segment that was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed. |
| 26 | Path Size Invalid | The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included. |
| 27 | Unexpected attribute in list | An attempt was made to set an attribute that is not able to be set at this time. |
| 28 | Invalid Member ID | The Member ID specified in the request does not exist in the specified Class/Instance/Attribute |
| 29 | Member not settable | A request to modify a non-modifiable member was received |
| 2A | Group 2 only server general failure | This error code may only be reported by DeviceNet Group 2 Only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable. |
| 2B to CF | Reserved by CIP for future extensions | |
| D0 to FF | Reserved for Object Class and service errors | This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be performed when none of the Error Codes presented in this table accurately reflect the error that was encountered. |

### 5.2.4 Assembly Object

Assembly Objects bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

The following description of the Assembly Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL20.

**Class Attributes**

*Table 5-17: Class attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Value |
|---|---|---|---|---|
| 1 (0×01) | REVISION | G | UINT | 2 |
| 2 (0×02) | MAX OBJECT INSTANCE | G | UINT | 2 |

**Instance Attributes**

*Table 5-18: Instance attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 1 (0×01) | NUMBER OF MEMBERS IN LIST | G | UINT | 0 (no dynamic) |
| 2 (0×02) | MEMBER LIST | G | ARRAY of STRUCT UINT UINT Packed EPATH | Depends on Instance. |
| 3 (0×03) | DATA | S | ARRAY OF BYTE | |
| 4 (0×04) | SIZE | G | UINT Number of bytes in Attr. 3 | 256 |

**Instance 101**

Contains the station's input data as long as no PLC program has been downloaded to the device.

2 Bytes Status information + process data.

**Note**

If a PLC program is downloaded to the PG, this instance contains the station's input data (2 Bytes Status information + process data) mapped in CoDeSys to the PGs output words for external EtherNet/IP communication with superordinate EtherNet/IP clients (e. g. ControlLogix) → Abschnitt „Mapping of the EtherNet/IP In- and Output Words“, page 6-13.

#### Instance 102

Contains the station's output data as long as no PLC program has been downloaded to the device.

2 Bytes Control data + process data

**Note**

If a PLC program is downloaded to the PG, this instance contains the station's output data (2 Bytes Control data + process data) mapped in CoDeSys to the PGs input words for external EtherNet/IP communication with superordinate EtherNet/IP clients (e. g. ControlLogix) → Abschnitt „Mapping of the EtherNet/IP In- and Output Words“, page 6-13.

#### Common Services

*Table 5-19: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 01 (0x01) | yes | yes | Get_Attribute_All |
| 14 (0x0E) | no | yes | Get_Attribute_Single |

### 5.2.5 Connection Manager Object

This object is used for connection and connectionless communications, including establishing connections across multiple subnets.

The following description of the Connection Manager Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL20.

#### Common Services

*Table 5-20: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 84 (0x54) | no | yes | FWD_OPEN_CMD<br>(Opens a connection) |
| 78 (0x4E) | no | yes | FWD_CLOSE_CMD<br>(Closes a connection) |
| 82 (0x52) | no | yes | UNCONNECTED_SEND_CMD<br>(Unconnected Send Service. Only originating devices and devices that route between links need to implement). |

### 5.2.6 Port Object

The following description of the Port Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL20.

**Class Attributes**

*Table 5-21: Class attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Value |
|---|---|---|---|---|
| 1 (0×01) | REVISION | G | UINT | 1 |
| 2 (0×02) | MAX OBJECT INSTANCE | G | UINT | 1 |
| 3 (0×03) | NUMBER OF INSTANCES | G | UINT | 1 |
| 8 (0×08) | ENTRY PORT | G | UINT | 1 |
| 9 (0×09) | ALL PORTS | G | ARRAY of STRUCT UINT UINT | 0,0 for class<br>4,2 for TCP_IP_PORT |

**Instance Attributes**

*Table 5-22: Instance attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 1 (0×01) | ATTRIBUTE PORT TYPE | G | UINT | 4 for TCP_IP_PORT |
| 2 (0×02) | ATTRIBUTE PORT NUMBER | G | UINT | 2 |
| 3 (0×03) | ATTRIBUTE PORT OBJECT | G | UINT EPATH Logical path | 2<br>0x12, 0x02<br>0x00, 0x00 |

**Common Services**

*Table 5-23: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 01 (0x01) | yes | yes | Get_Attribute_All |
| 14 (0x0E) | yes | yes | Get_Attribute_Single |

### 5.2.7 TCP/IP Interface Object

The following description of the TCP/IP Interface Object is taken from the CIP specification, Vol. 2, Rev. 1.1 and adapted to BL20.

**Class Attributes**

*Table 5-24: Class attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Value |
|---|---|---|---|---|
| 1 (0×01) | REVISION | G | UINT | 1 |
| 2 (0×02) | MAX OBJECT INSTANCE | G | UINT | 1 |
| 3 (0×03) | NUMBER OF INSTANCES | G | UINT | 1 |
| 6 (0×06) | MAX CLASS IDENTIFIER | G | UINT | 7 |
| 7 (0×07) | MAX INSTANCE ATTRIBUTE | G | UINT | 6 |

### Instance Attributes

*Table 5-25: Instance attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 1 (0×01) | STATUS | G | DWORD | Interface status (see page 5-17) |
| 2 (0×02) | CONFIGURATION CAPABILITY | G | DWORD | Interface Capability Flag (see page 5-17) |
| 3 (0×03) | CONFIGURATION CONTROL | G/S | DWORD | Interface Control Flag (see page 5-18) |
| 4 (0×04) | PHYSICAL LINK OBJECT | G | Structure of: | |
| | Path size | | UINT | Number of 16bit words: 0×02 |
| | Path | | Padded EPATH | 0×20, 0×F6, 0×24, 0×01 |
| 5 (0×05) | INTERFACE CONFIGURATION | G | Structure of: | TCP/IP Network Interface Configuration (see page 5-18) |
| | IP ADDRESS | G | UDINT | 0 = no IP address configured |
| | NETWORK MASK | G | UDINT | 0 = no network mask address configured |
| | GATEWAY ADDRESS | G | UDINT | 0 = Default gateway IP address configured |
| | NAME SERVER | G | UDINT | 0 = no name server address configured |
| | NAME SERVER 2 | | UDINT | 0 = no secondary name server address configured |
| **Attr. No.** | **Attribute Name** | **Get/ Set** | **Type** | **Description** |
| 5 (0×05) | DOMAIN NAME | G | UDINT | 0 = no Domain Name configured |
| 6 (0×06) | HOST NAME | G | STRING | 0 = no Host Name configured (see page 5-18) |

### Common Services

*Table 5-26: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 01 (0x01) | yes | yes | Get_Attribute_All |
| 02 (0x02) | no | no | Set_Attribute_All |
| 14 (0x0E) | yes | yes | Get_Attribute_Single |
| 16 (0×10) | no | yes | Set_Attribute_Single |

### Interface Status

The Status attribute indicates the status of the TCP/IP network interface.
Refer to the state diagram, Figure 5-1: TCP/IP object state diagram (acc. to CIP Spec., Vol.2, Rev. 1.1) for a description of object states as they relate to the Status attribute.

*Table 5-27: Interface Status*

| Bit(s) | Name | Definition |
|---|---|---|
| 0-3 | Interface Configuration Status | Indicates the status of the Interface Configuration attribute:<br>0 = The Interface Configuration attribute has not been configured<br>1 = The Interface Configuration attribute contains valid configuration.<br>2 to 15 = Reserved |
| 4 to 31 | reserved | |

### Configuration Capability

The Configuration Capability indicates the device's support for optional network configuration capability.

*Table 5-28: Configuration Capability*

| Bit(s) | Name | Definition | Value |
|---|---|---|---|
| 0 | BOOTP Client | The device is capable of obtaining its network configuration via BOOTP. | 1 |
| 1 | DNS Client | The device is capable of resolving host names by querying a DNS server. | 0 |
| 2 | DHCP Client | The device is capable of obtaining its network configuration via DHCP. | 1 |

### Configuration Control

The Configuration Control attribute is used to control network configuration options.

*Table 5-29: Configuration Control*

| Bit(s) | Name | Definition |
|---|---|---|
| 0-3 | Startup Configuration | Determines how the device shall obtain its initial configuration at start-up.<br>0 = The device shall use the interface configuration values previously stored (for example, in non-volatile memory or via hardware switches, etc).<br>1 to 3 = reserved |
| 4 | DNS Enable | Always 0 |
| 5-31 | Reserved | Set to 0. |

### Interface Configuration

This attribute contains the configuration parameters required to operate as a TCP/IP node.

To modify the Interface Configuration attribute, get the Interface Configuration attribute first, change the desired parameters, then set the attribute.
The TCP/IP Interface Object applies the new configuration upon completion of the Set service. If the value of the Startup Configuration bits (Configuration Control attribute) is 0, the new configuration is stored in non-volatile memory.
The device does not reply to the set service until the values are safely stored to non-volatile memory.
An attempt to set any of the components of the Interface Configuration attribute to invalid values results in an error (status code 0x09) returned from the Set service.
If initial configuration is obtained via BOOTP or DHCP, the Interface Configuration attribute components are all zeros until the BOOTP or DHCP reply is received.
Upon receipt of the BOOTP or DHCP reply, the Interface Configuration attribute shows the configuration obtained via BOOTP/DHCP.

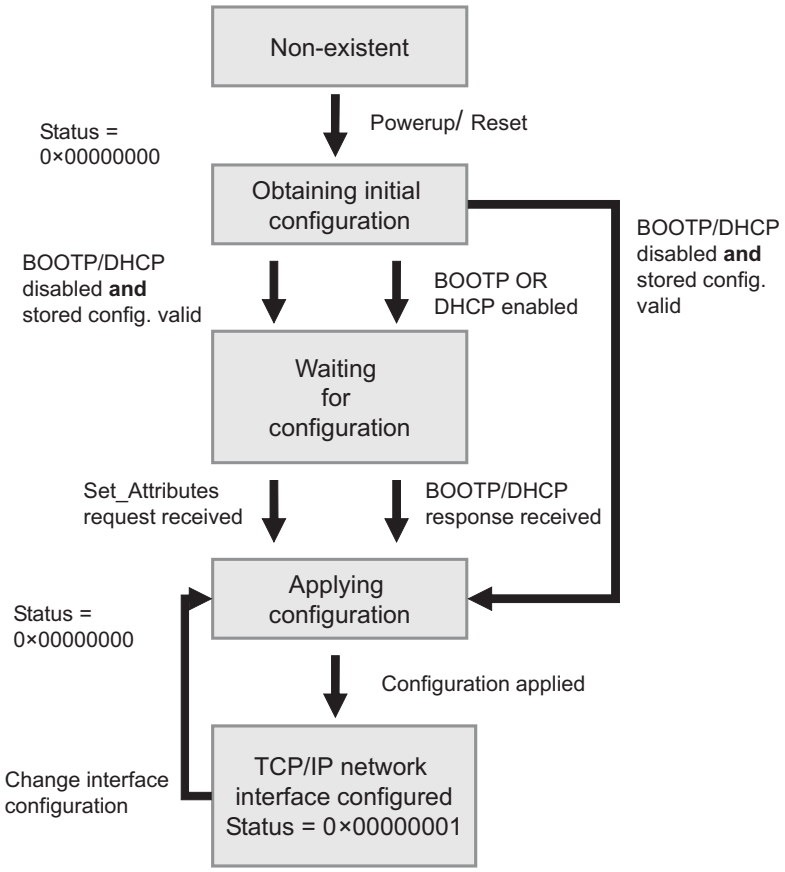
### Host Name

The Host Name attribute contains the device's host name.

The host name attribute is used when the device supports the DHCP-DNS Update capability and has been configured to use DHCP upon start up.
The mechanism allows the DHCP client to transmit its host name to the DHCP server. The DHCP server then updates the DNS records on behalf of the client. The host name attribute does not need to be set for the device to operate normally. The value of the Host Name attribute, if it is configured,

is used for the value of the FQDN option in the DHCP request. If the Host Name attribute has not been configured, then the device shall not include the FQDN option in the DHCP request.

*Figure 5-1: TCP/IP object state diagram (acc. to CIP Spec., Vol.2, Rev. 1.1)*



### 5.2.8 Ethernet Link Object

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 1.1 by ODVA & ControlNet International Ltd. and adapted to BL20.

**Class Attributes**

*Table 5-30: Class attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Value |
|---|---|---|---|---|
| 1 (0×01) | REVISION | G | UINT | 1 |
| 2 (0×02) | MAX OBJECT INSTANCE | G | UINT | 1 |
| 3 (0×03) | NUMBER OF INSTANCES | G | UINT | 1 |
| 6 (0×06) | MAX CLASS IDENTIFIER | G | UINT | 7 |
| 7 (0×07) | MAX INSTANCE ATTRIBUTE | G | UINT | 6 |

**Instance Attributes**

*Table 5-31: Instance attributes*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 1 (0×01) | INTERFACE SPEED | G | UDINT | Speed in megabits per second (e.g., 10, 100, 1000, etc.) |
| 2 (0×02) | INTERFACE FLAGS | G | DWORD | see Table 5-32: Interface flags |
| 3 (0×03) | PHYSICAL ADDRESS | G | ARRAY OF USINTs | Contains the interface's MAC address (TURCK: 00:07:46:××:××:××) |

*Table 5-32: Interface flags*

| Bits | Name | Definition | Default-Value |
|---|---|---|---|
| 0 | Link Status | Indicates whether or not the Ethernet 802.3 communications interface is connected to an active network.<br>0 = inactive link<br>1 = active link. | Depends on application |
| 1 | Half / Full Duplex | 0 = half duplex;<br>1 = full duplex<br>If the Link Status flag is 0, the value of the Half/ Full Duplex flag is indeterminate. | Depends on application |
| 2 to 4 | Negotiation Status | Indicates the status of link auto-negotiations.<br>0 = Auto-negotiation in progress<br>1 = Auto-negotiation and speed detection failed.<br>Using default values for speed and duplex (10Mbps/half duplex).<br>2 = Auto negotiation failed but detected speed (default: half duplex).<br>3 = Successfully negotiated speed and duplex.<br>4 = Auto-negotiation not attempted. Forced speed and duplex. | Depends on application |

*Table 5-33:*

| | | | |
|---|---|---|---|
| 5 | Manual Setting Requires Reset | 0 = interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically<br>1 = device requires a Reset service to be issued to its Identity Object in order to adapt the changes | 0 |

*Table 5-34:*

| | | | |
|---|---|---|---|
| 6 | Local Hardware Fault | 0 = interface detects no local hardware fault<br>1 = a local hardware fault is detected | 0 |

**Common Services**

*Table 5-35: Common services*

| Service Code | Class | Instance | Service Name |
|---|---|---|---|
| 01 (0x01) | yes | yes | Get_Attribute_All |
| 14 (0x0E) | yes | yes | Get_Attribute_Single |
| 76 (0×4C) | no | yes | Enetlink_Get_and_Clear |

## 5.3 VSC-Vendor Specific Classes

In addition to supporting the above named CIP Standard Classes, the BL20 gateway for EtherNet/IP supports the below vendor specific classes.

It is possible to gain read (**G**= Get) and/or write (**S**= Set) access to the attributes of classes described in the following:

*Table 5-36: VSC-Vendor Specific Classes*

| Class Code | Name | Description |
|---|---|---|
| 100 (0×64) | Gateway Class, page 5-23 | Contains data and settings concerning the gateway and the BL20 system as a whole. |

### Class Instances of the VSC

**Note**

Class Instance attributes are the same for each Vendor Specific Class.

Class-specific Object Instances and the corresponding attributes are explained below for the different VSC.

The general VSC - Class Instance attributes are defined as follows:

*Table 5-37: Class instance*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 100 (0×64) | CLASS REVISION | G | UINT | States the revision number of the class: Maj. Rel. *1000 + Min. Rel.. |
| 101 (0×65) | MAX INSTANCE | G | USINT | Contains the number of the highest instance of an object created on this level in the class hierarchy. |
| 102 (0×66) | # OF INSTANCES | G | USINT | Contains the number of Object Instances created in this class. |
| 103 (0×67) | MAX CLASS ATTRIBUTE | G | USINT | Contains the number of the last Class Attribute to be implemented. |

### Gateway Class (VSC 100)

The Gateway Class contains all the parameters of the BL20 system and the gateway.

### Class Instance

**Note**

Please refer to paragraph Class Instances of the VSC, page 5-22, for the description of the class instances for VSC.

### Object Instances

*Table 5-38: Object Instance 2, Gateway Instance*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 109 (0×6D) | STATUS REGISTER 2 | G | STRUCT | Gateway-Status contains general gateway status information:<br>**Gateway**<br>– Bit 15: "I/O Controller Error" The communication controller for the I/O-system is faulty.<br>– Bit 14: "Force Mode Active Error" The Force Mode is activated.<br>– Bit 13: reserved<br>– Bit 12: reserved<br>**Module bus**<br>– Bit 11: "I/O Cfg Modified Error" The I/O-configuration has been changed and is now incompatible.<br>– Bit 10: "I/O Communication Lost Error" No communication on the I/O module bus. |
| 109 (0×6D) | STATUS REGISTER 2 | G | STRUCT | **Voltage errors**<br>Bit 09: "$U_{sys}$ too low" System supply voltage too low (< 18 VDC).<br>Bit 08: "$U_{sys}$ too high" System supply voltage too high (> 30 VDC).<br>Bit 07: "$U_L$ too low" Load voltage too low (< 18 VDC).<br>Bit 06: "$U_L$ too high" Load voltage too high (> 30 VDC)<br>Bit 05: "$I_{sys}$ too high" Overload of the system voltage supply.<br>Bit 04: reserved<br><br>**Warnings**<br>Bit 03: "I/O Cfg Modified Warning"<br>Bit 02: reserved<br>Bit 01: reserved<br>Bit 00: "I/O Diags Active Warning" At least one I/O-module sends active diagnosics. |

*Table 5-38: Object Instance 2, Gateway Instance*

| Attr. No. | Attribute Name | Get/ Set | Type | Description |
|---|---|---|---|---|
| 116 (0×74) | MODULE DIAG SUMMARY | G | ARRAY OF STRUCT | Contains diagnostic information for all modules.<br>ARRAY OF STRUCT:<br>USINT SLOT #:<br>Indicates the slot number (module position) with diagnostic messages.<br>BYTE SLOT FLAGS:<br>Offers slot-related information.<br>Bit 7 = module missing<br>Bit 6 = false module plugged<br>DWORD DIAG:<br>Contains the module diagnostic information. Module diagnostic bits that are not used are indicated by a "0". |

# 6 Configuration of the BL20-PG-EN-IP with CoDeSys

## 6.1 General

This chapter describes the configuration of a BL20 station with the programmable BL20 gateway for Modbus TCP in CoDeSys (Controller Development System) from "3S - Smart Software Solutions GmbH" on the basis of an example.

### 6.1.1 System requirements

- Installation of CoDeSys (version 2.3.5.8)
- Installation of the BL20 target files "TSP_Turck_×××.zip" (can be downloaded from www.turck.com)

*Figure 6-1: CoDeSys from 3S*

## 6.2 Installation of the BL20 target files

Before configuring the BL20 station with CoDeSys and programming the BL20-PG-EN-IP, the BL20 Target Support Package (short: targets) have to be installed.

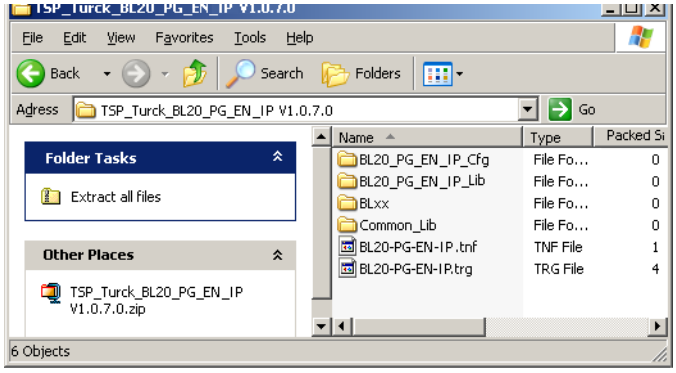
Target files contain all information necessary for integrating a system into the programming tool.

The Target Support Package (TSP) for the BL20-PG-EN-IP can be downloaded from the TURCK homepage as a zipped archive (TSP_Turck_BL20_PG_EN ×××.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 6-2: Directory structure of the target file*



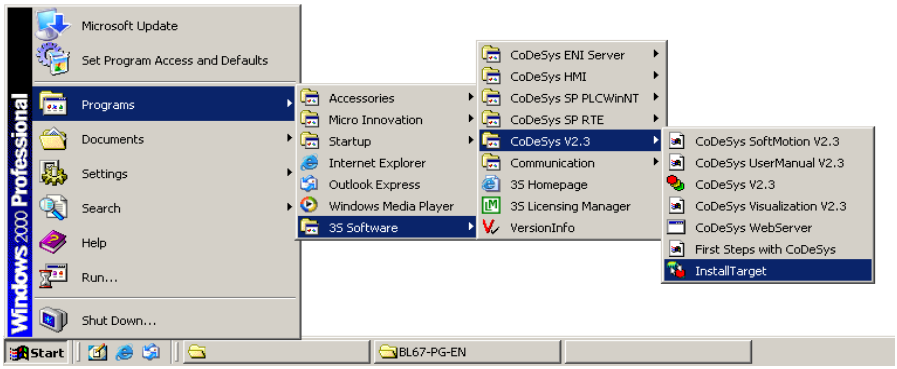

**Note**

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.

### 6.2.1 Installation

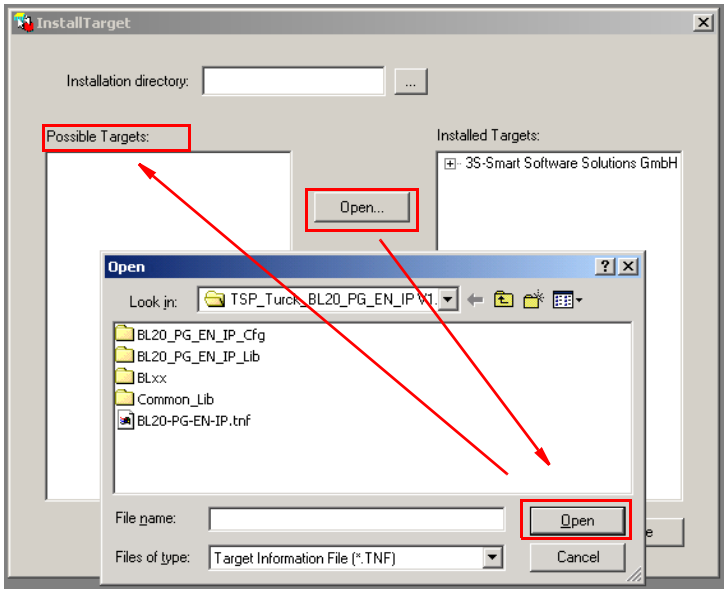
The target installation in CoDeSys is done using the "Start → Programs→ 3S Software → CoDeSys → V2.3 → Install Target"-command.

*Figure 6-3: Install Target*



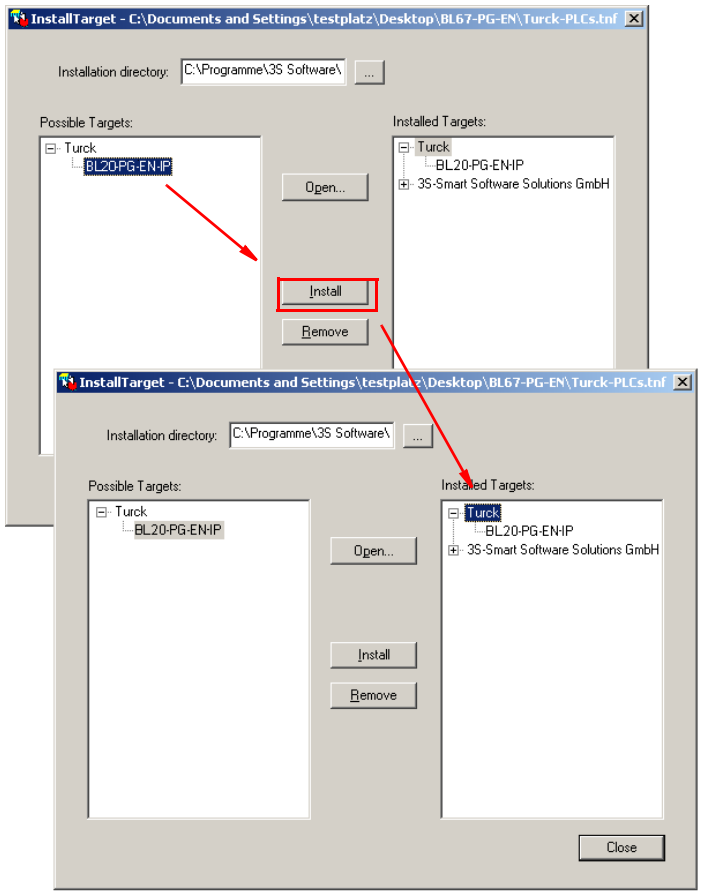
Search the target information file "BL20-×××.tnf" using the "Open" button and add the TURCK gateways to "Possible Targets".

*Figure 6-4: Select the target file*




The BL20 target is installed using the "Install" button. The BL20-PG-EN-IP can now be found under "Installed Targets" and can be chosen in CoDeSys as a target now.

*Figure 6-5: Installation of the TURCK target*



## 6.3 BL20 Hardware Configuration

1. At first, configure your BL20 station (BL20-PG-EN-IP 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.

## 6.4 Configuration/ Programming of the PG in CoDeSys

### 6.4.1 Creating a new project

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

Chose the BL20-PG-EN-IP as target.

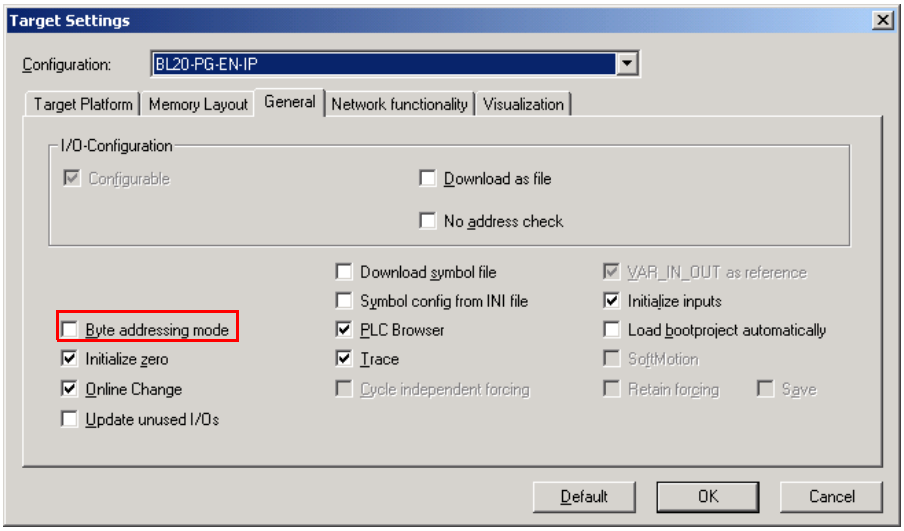
Normally, a further configuration of the gateway in the dialog box „target settings“ is not necessary.

**Note**

The BL20-PG-EN-IP 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.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| %IX**0**.0 - %IX**0**.7 | %IX**0**.8 - %IX**0**.15 | %IX**1**.0 - %IX**1**.7 | %IX**1**.8 - %IX**1**.15 | %IX**2**.0 - %IX**2**.7 | %IX2.8 - %IX**2**.15 | %IX**3**.0 - %IX**3**.7 | %IX**3**.8 - %IX**3**.15 | %IX**4**.0 - %IX**4**.7 | %IX**4**.8 - %IX**4**.15 | %IX**5**.0 - %IX**5**.7 | %IX**5**.8 - %IX**5**.15 |
| %IB0 | %IB1 | %IB2 | %IB3 | %IB4 | %IB5 | %IB6 | %IB7 | %IB8 | %IB9 | %IB10 | %IB11 |
| %IW**0** | | %IW**1** | | %IW**2** | | %IW**3** | | %IW**4** | | %IW**5** | |
| %ID0 | | | | %ID1 | | | | %ID2 | | | |

*Figure 6-6: Target settings*




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

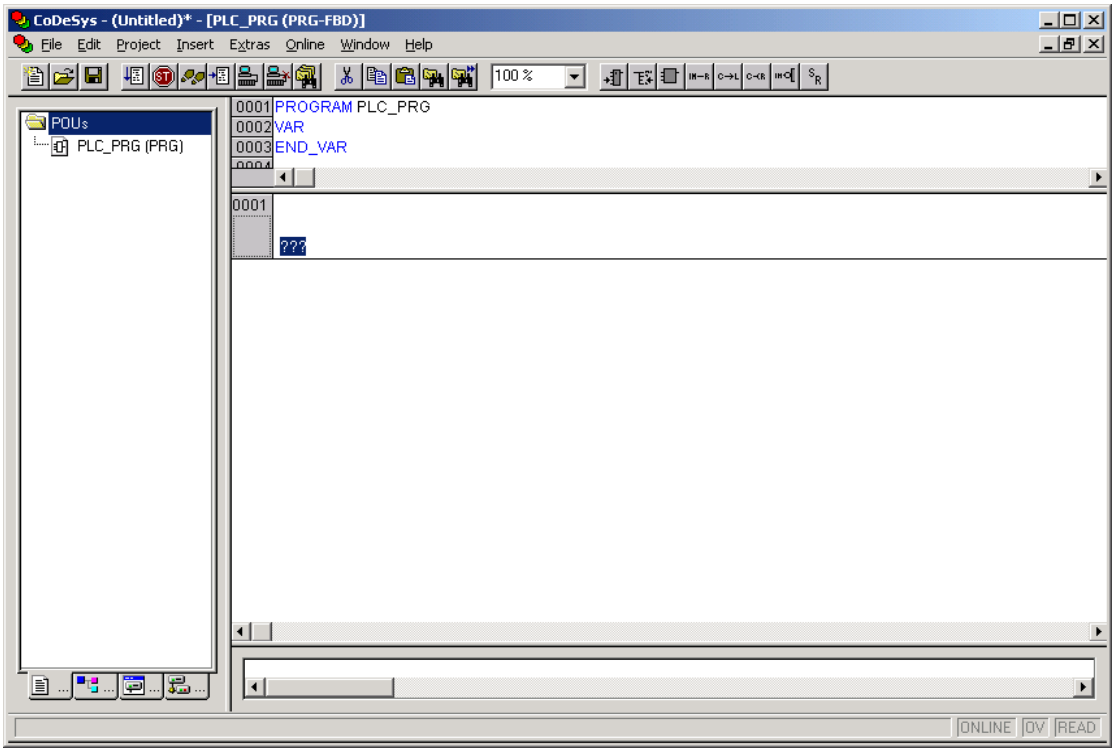
**Attention**

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.

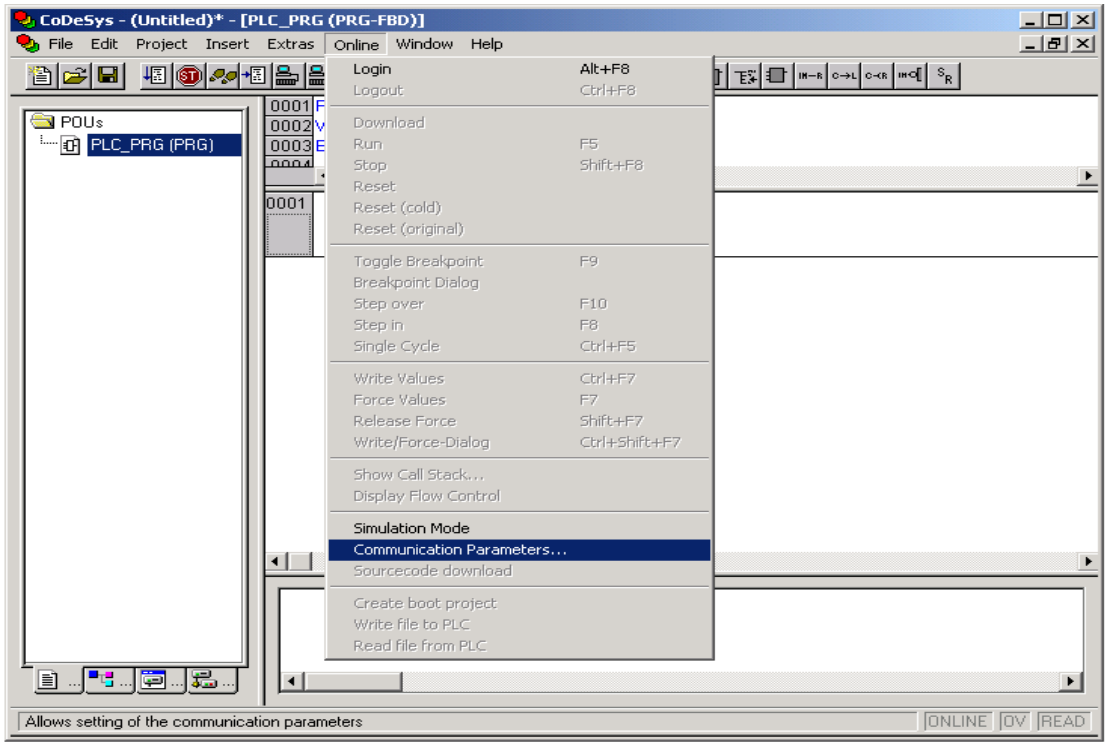
*Figure 6-7: New CoDeSys-project*




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

**Communication parameters of the target**

*Figure 6-8: Opening the communication parameters*




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

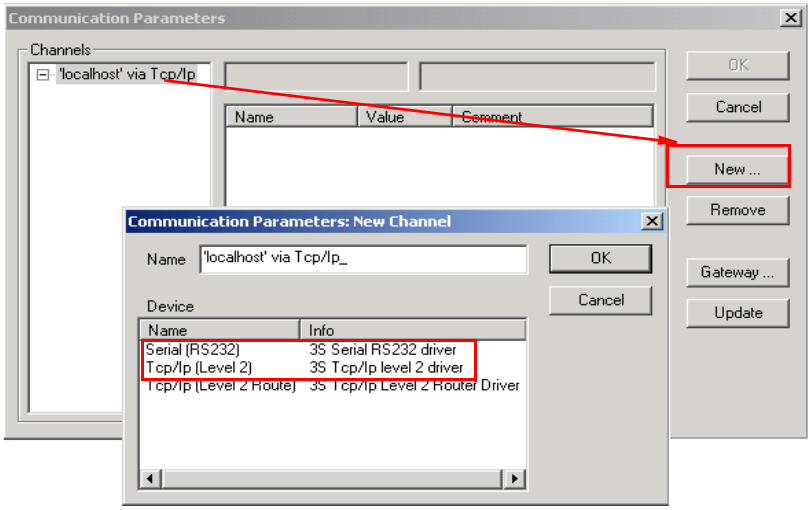
In the dialog box „Communication Parameters: New Channel“ the name for the new channel is edited and the communication interface is selected in the „Device“ field.

The BL20 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.

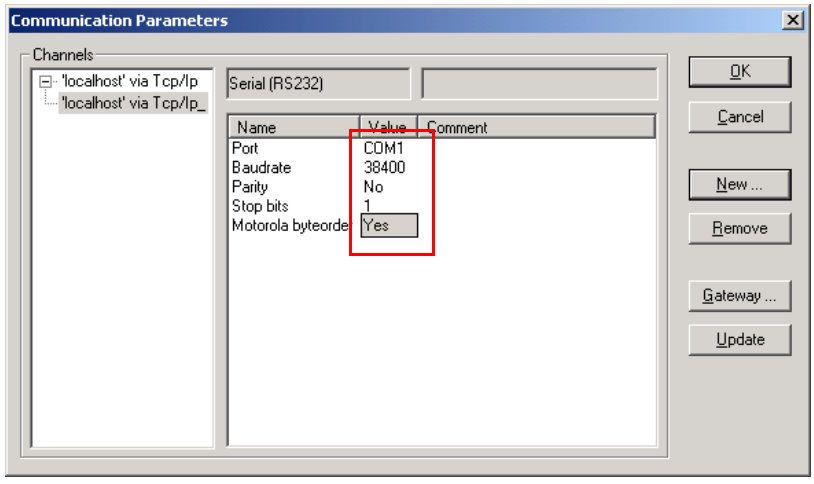
*Figure 6-9: Defining a new channel*




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

**1** serial RS232-communication:

*Figure 6-10: 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 RS32-interface.

**2** TCP/IP (Level 2)-communication

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

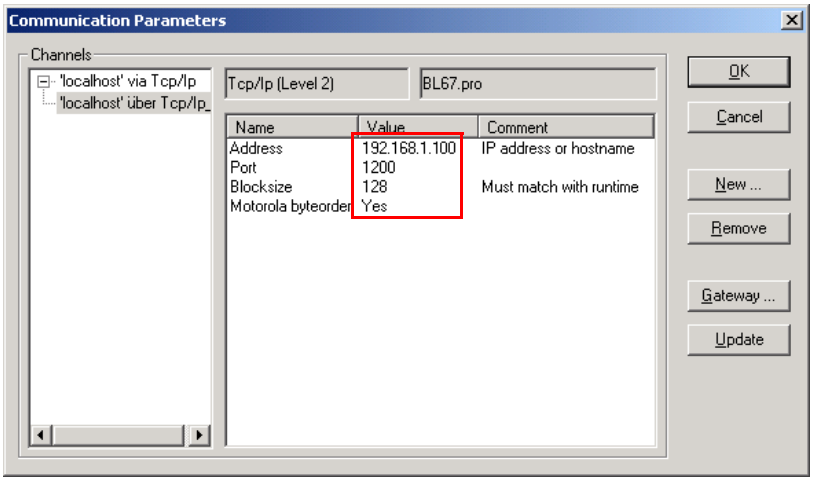



*Figure 6-11: Setting the communication parameters for TCP/IP (Level 2)*

**Attention**

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

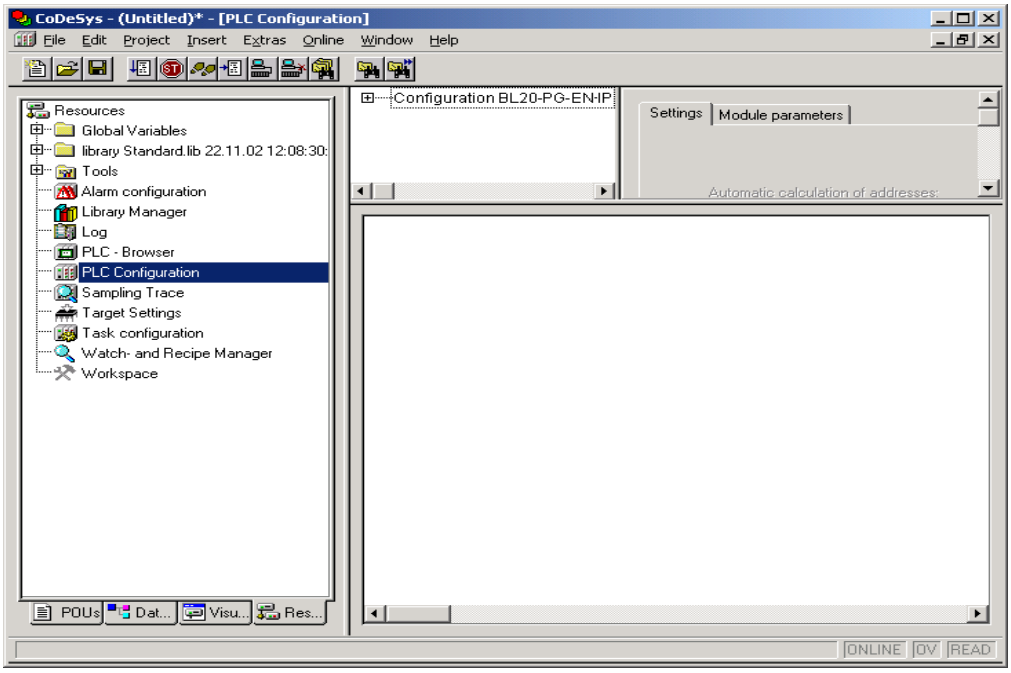
**Note**

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 10.1, Network Configuration).

## 6.5 Configuration of the BL20 Station

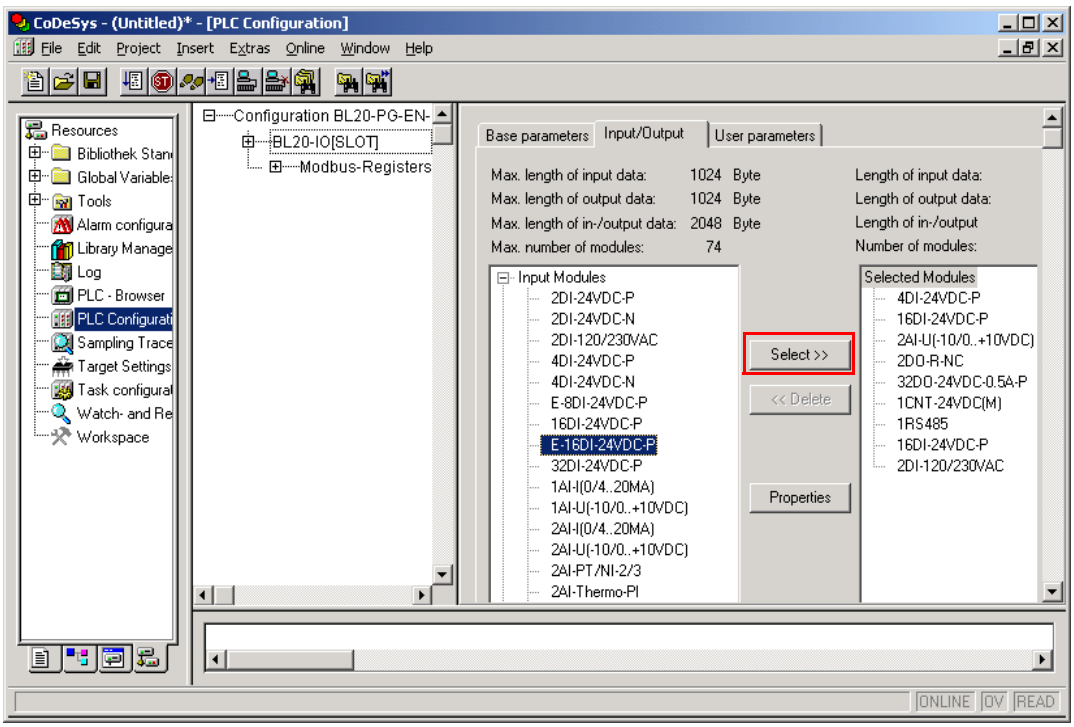
Open the „PLC Configuration“ in the „Resources“ tab.

*Figure 6-12: PLC Configuration*




Mark the BL20-IO[SLOT] and add the I/O modules to the gateway in the „Input/Output“ tab.

*Figure 6-13: Selecting the I/O modules*



**Attention**

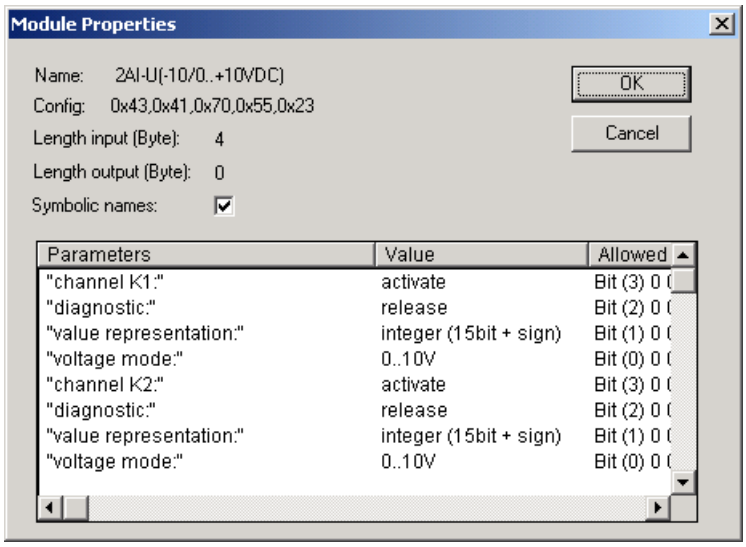
When configuring the BL20 station in the software, please observe that the order of the modules added to the gateway has to match the physical module order of the hardware configuration.

### 6.5.1 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 6-14: Parameterization of I/O modules*




### 6.5.2 Addressing the in- and output data

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

In addition to that, the gateway automatically receives a module ID as a unique identifier of the node within the entire configuration and a node number shows the gateway’s position in the configuration structure.

**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 6-15: Hardware configuration with symbolic address allocation).

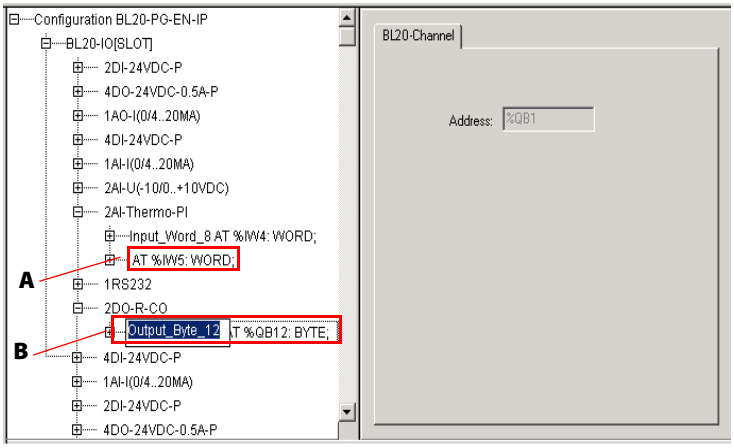



*Figure 6-15: Hardware configuration with symbolic address allocation*

**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.

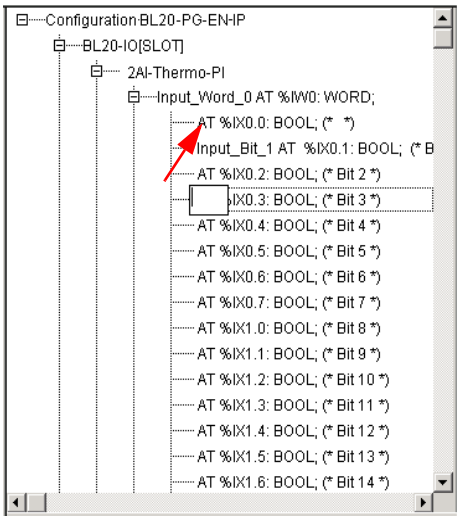



*Figure 6-16: Symbolic addressing*

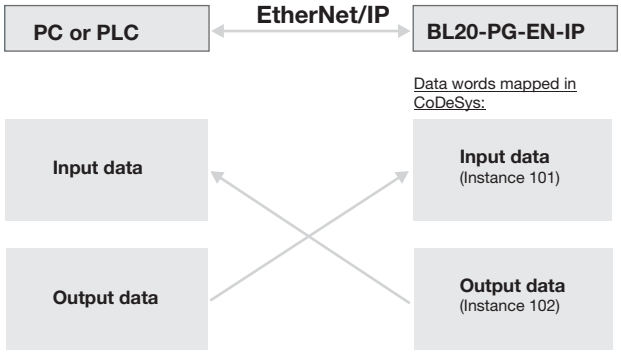
### 6.5.3 Mapping of the EtherNet/IP In- and Output Words

In order to enable EtherNet/IP communication of BL20-PG-EN-IP with other EtherNet/IP nodes, the EtherNet/IP in- and output words have to be added to the PG configuration.

The output data coming from an external client are mapped as input data in the PG.

The output data from the PG are input data on the PLC-side.

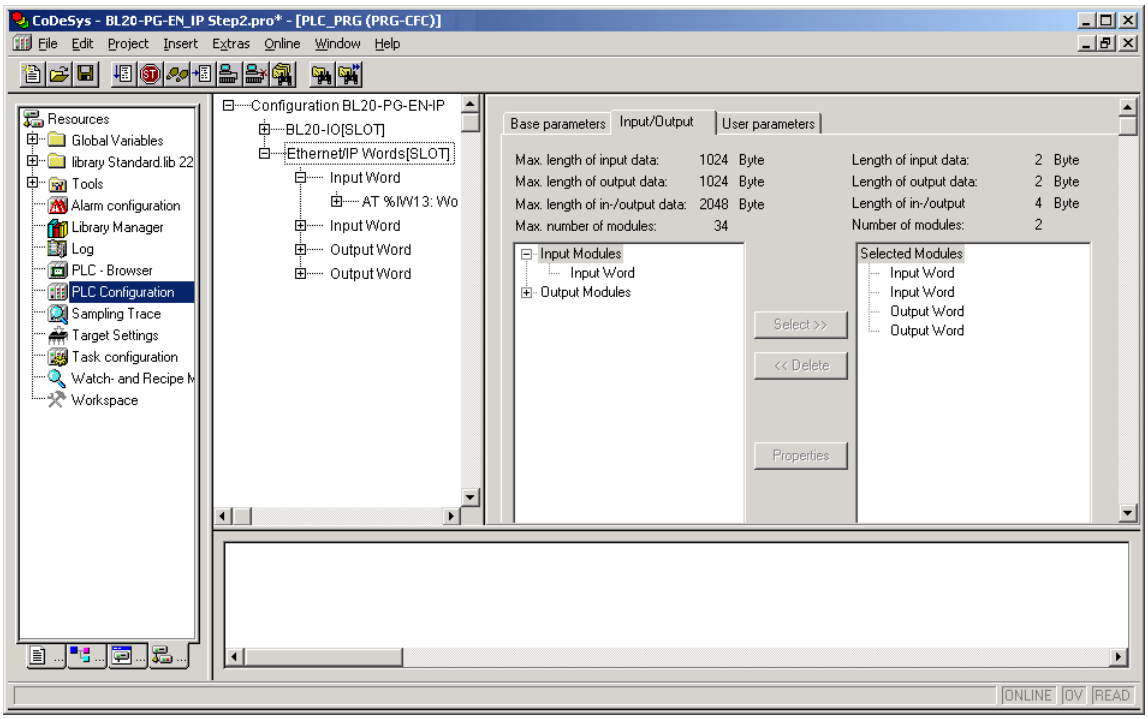
*Figure 6-17: Mapping of in- and output words*




Add the necessary in- and output words to the PG configuration under "Configuration BL20-PG-EN-IP → Ethernet/IP Words [SLOT]".

The in- and output addresses are automatically assigned to the in- and output words.

*Figure 6-18: Configuration of EtherNet/IP in- and output words*




Therefore, a symbolic address allocation is also recommended for the in- and output words (see also Note on page 6-11).

**Note**

Please observe, that BL20 EtherNet/IP gateways are Big-Endian-systems (Motorola format).

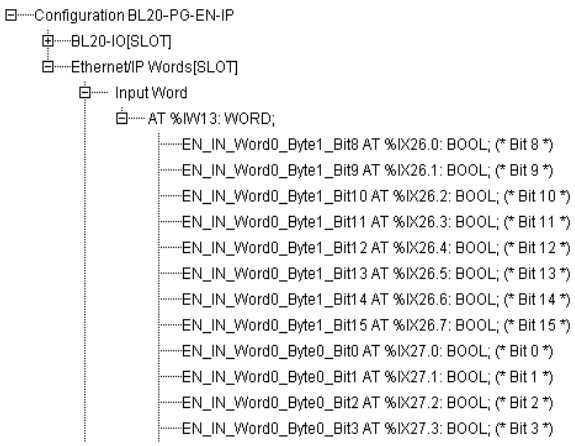
As shown in the following figure, the high byte of the word is listed first (%IX26 → bit 8 to bit 15), the low byte follows the high byte (%IX27 → bit 0 to bit 7).

The comments (*Bit 0*, *Bit 1* etc.) in the example have been changed according to the application.

**Attention**

Up to the time of the release of this manual, the automatic allocation of the comments by the software was faulty and did not show the correct bit order.
The CoDeSys-comments always start with *Bit 0* for the first bit of the in- and output words. But, due to the Big-Endian (Motorola format) of the BL20-PG-EN-IP, this is not correct!
The correct data mapping starts with the high byte (bit 8 to bit 15) of the data word, the low byte (bit 0 to bit 7) follows the high byte (see the following figure).

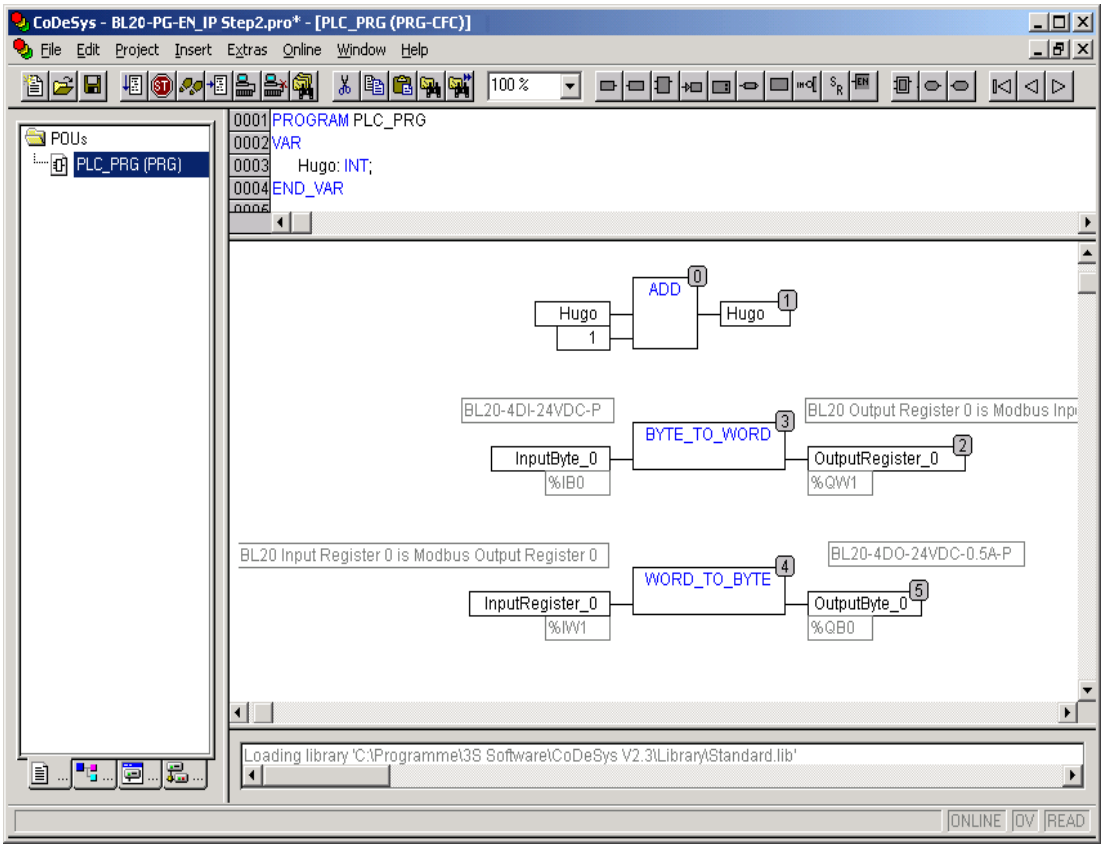
*Figure 6-19: Symbolic address allocation for EtherNet/IP words*



## 6.6 Programming of the BL20-PG-xxx

Programming is done in the "POUs" tab.

*Figure 6-20: Programming in "POUs" tab*

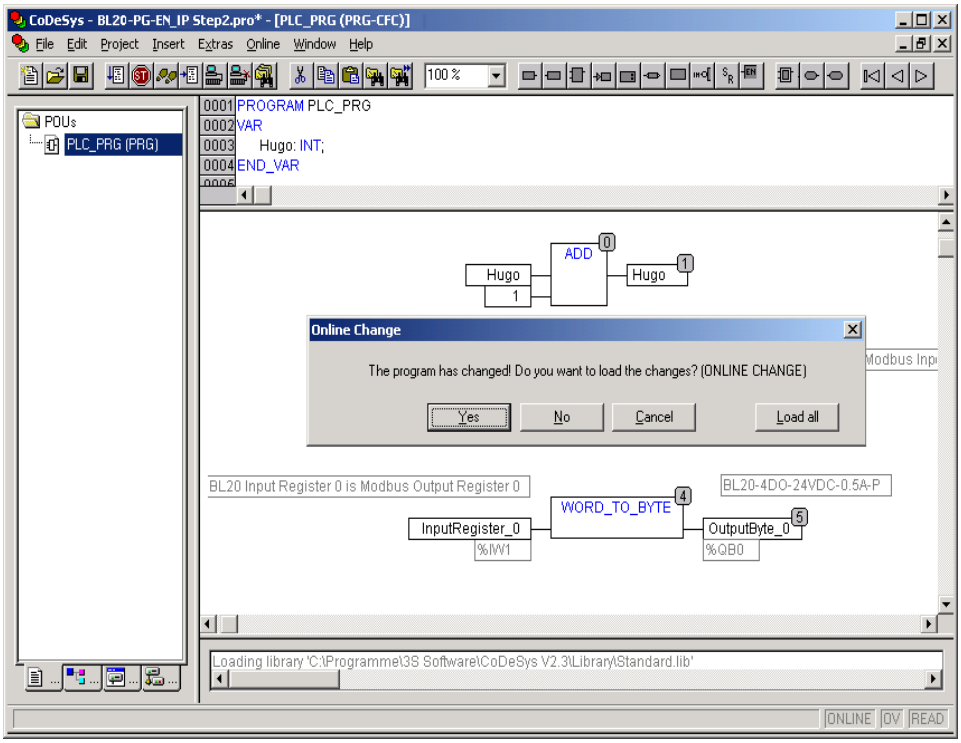



After the completion of the program, it is compiled using the „Project → Rebuild all..." command.

### 6.6.1 Online

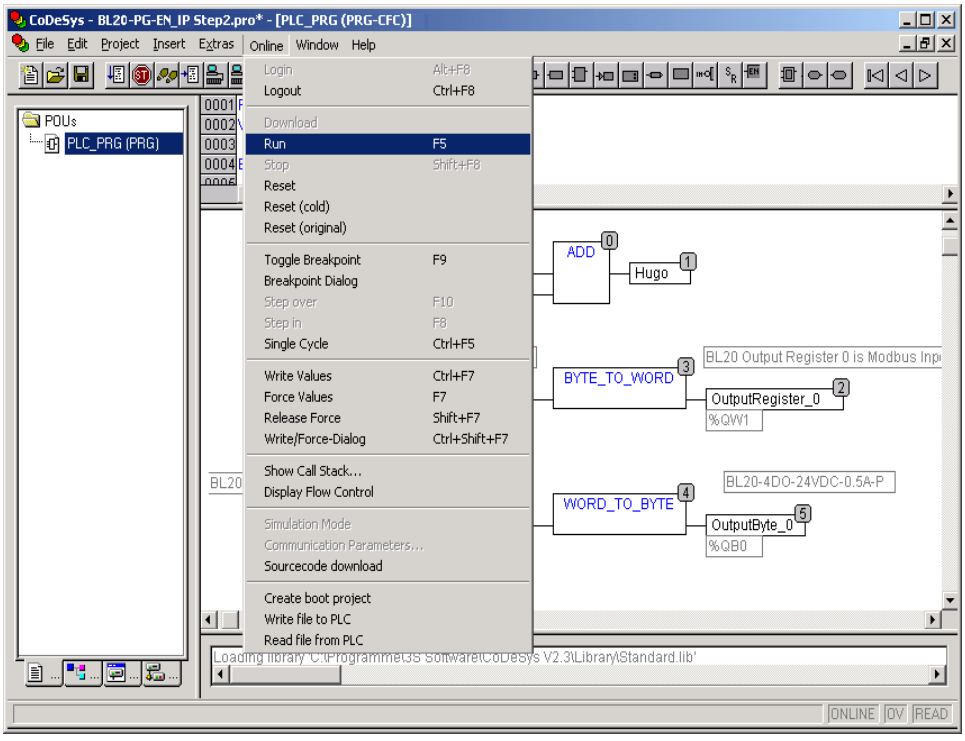
The connection to the gateway is established with "Online → Login".

*Figure 6-21: Download of the program*




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

*Figure 6-22: Starting the program*



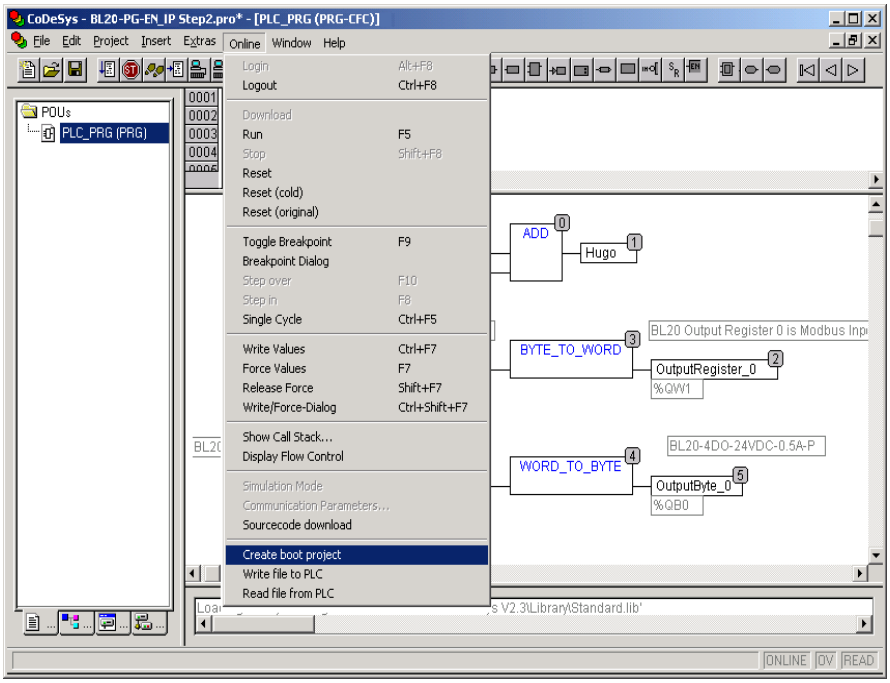
**Note**

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!

### 6.6.2 Creating a boot project

With "Online → create boot project" your program is downloaded and saved as a boot project which is stored to the BL20-PG-EN-IP and is automatically loaded at every re-start of the gateway.

*Figure 6-23: Create boot project*



## 6.7 EtherNet/IP-communication between PG and superordinate PLC

The following pictures show an example for the data image correlation between the BL20-PG-EN-IP and a superordinate PLC (ControlLogix by Allen Bradley) with EtherNet/IP-scanner.

*Figure 6-24: Output word in CoDeSys*

**A***Output word 2 in BL20-PG-EN-IP*

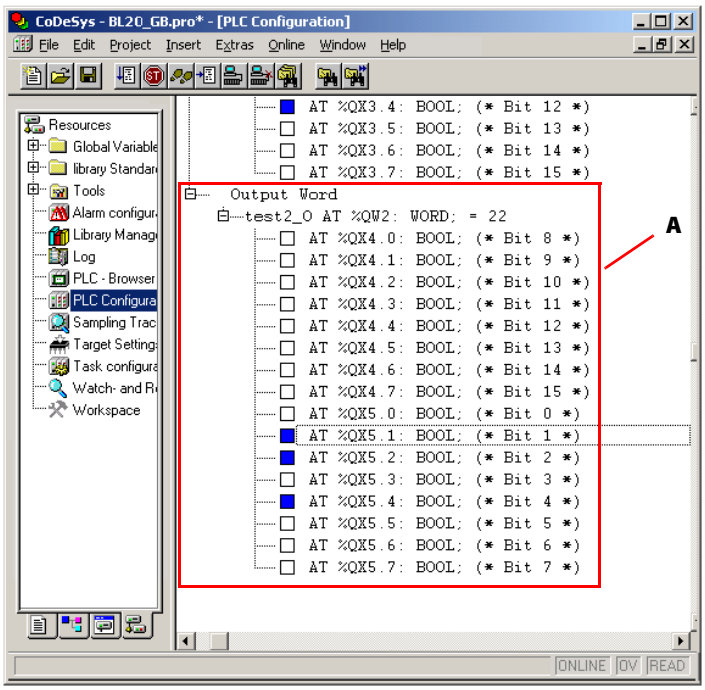



*Figure 6-25: Inputs in the ControlLogix*

**A***Input word 2 in RSLogix-Software*

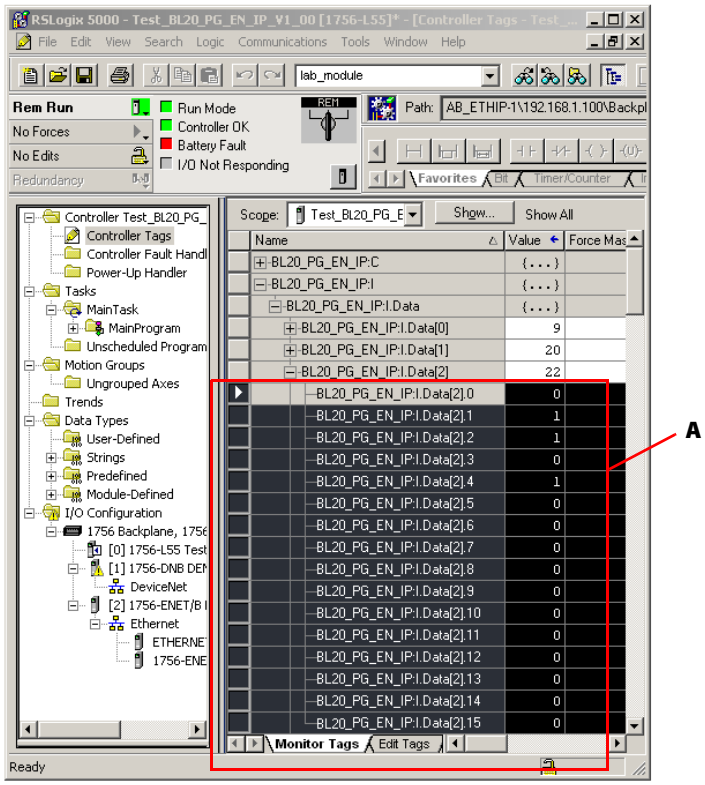
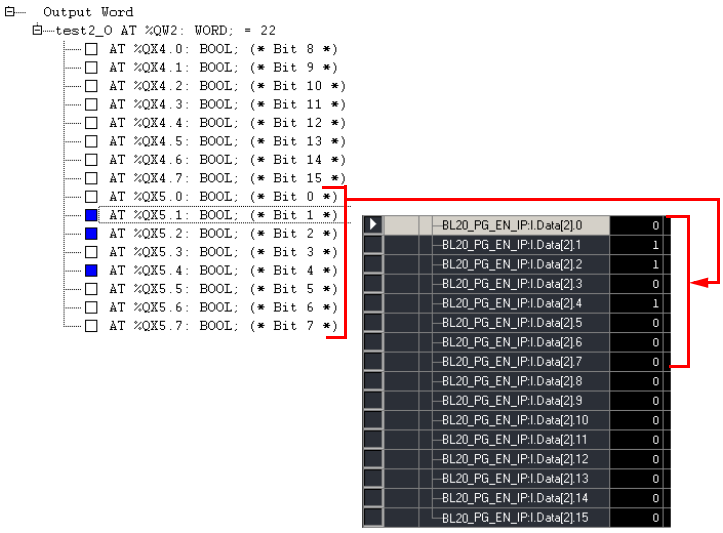


*Figure 6-26: Data image correlation (BL20-PG-EN-IP and ControlLogix)*

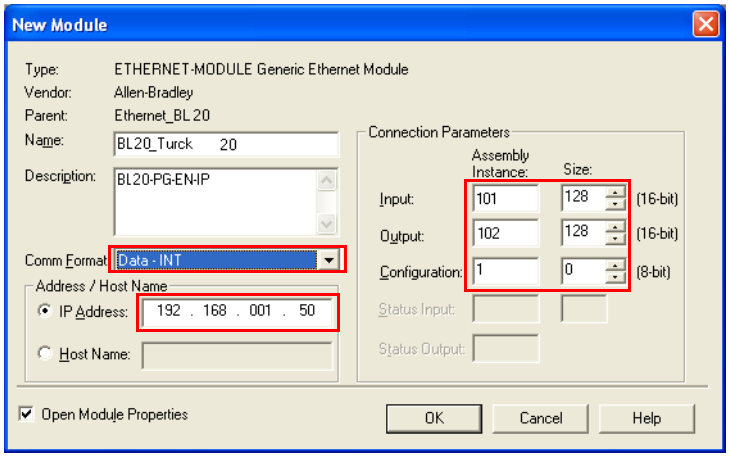



## 6.7.1 Configuration of the BL20-PG-EN-IP in RSLogix

**Note**

When configuring the Generic Ethernet Module BL20-PG-EN-IP as a new module in RSLogix, its connection parameters have to be set as follows (see Figure 6-27:) .

*Figure 6-27: Configuration of BL67-PG-EN-IP*



# 7 Guidelines for Station Planning

## 7.1 Random Module Arrangement

The arrangement of the I/O-modules within a BL20 station can basically be chosen at will.

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

**Attention**

Please observe, that RFID modules used within a station always have to be mounted directly following the gateway (slot 1 to 34).

**Note**

The mixed usage of base modules with screw connections and base modules with tension clamp connections requires a further power supply module to be mounted. Thereby, it must be ensured that the base modules are fitted with the same connection technology (screw or tension clamp) as the power supply module.

### 7.1.1 Complete Planning

The planning of a BL20 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 BL20 modules.

### 7.1.2 Maximum System Extension

A BL20 station can consist of a gateway and a maximum of 74 modules in slice design (equivalent to 1 m in length of mounting rail including the end bracket and end plate). The maximum number of modules is less when using block modules (1 block module is equivalent to 8 modules in slice design).

The following overview shows the maximum number of channels possible, on condition that the entire station is made up of that respective type of channel only:

*Table 7-1: Maximum system extension, process data dependent*

**A***plus 1*
*Bus Refreshing module*
**B***plus 2*
*Bus Refreshing modules*
**C***plus 3*
*Bus Refreshing modules*

| **Channels** | | **Modules** | |
|---|---|---|---|
| Type | Max. no. | Type | Max. no. |
| Digital inputs | 288 | BL20-4DI-24VDC-P | 72 **B** |
| Digital outputs | 288 | BL20-4DO-24VDC-0.5A-P | 72 **B** |
| Analog inputs, current | 126 | BL20-2AI-I(0/4...20MA) | 63 **C** |
| Analog inputs, voltage | 126 | BL20-2AI-U(-10/0...+10VDC) | 63 **C** |
| Analog inputs, PT /Ni | 126 | BL20-2AI-PT/NI-2/3 | 63 **C** |
| Analog inputs, Thermocouple | 126 | BL20-2AI-THERMO-PI | 63 **C** |
| Analog outputs, current | 126 | BL20-2AO-I(0/4...20MA) | 63 **C** |
| Analog inputs, voltage | 126 | BL20-2AO-U(-10/0...+10VDC) | 63 **C** |
| Counter | 31 | BL20-1CNT-24VDC | 31 **A** |
| RS232 | 31 | BL20-1RS232 | 31 **A** |
| RS485/422 | 31 | BL20-1RS485/422 | 31 **A** |
| SSI | 31 | BL20-1SSI | 31 **A** |

Further limitations can be placed on the maximum possible number of BL20 modules by the use of the Power Feeding modules
BL20-PF-24VDC-D or BL20-PF-120/230VAC-D; these being used either for creating potential groups or by insufficient field supply.

**Attention**

Ensure that a sufficient number of Power Feeding or Bus Refreshing 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 "Station →
Verify" command.

## 7.2 Power Supply

### 7.2.1 Module Bus Refreshing

The number of BL20 modules that can be supplied by the gateway or a separate Bus Refreshing module via the internal module bus depends on the respective nominal current consumption of the individual modules on the module bus.

**Attention**

The sum total of the nominal current consumption of the connected BL20 modules must not exceed 1.5 A.

The following examples show the calculation for the required number of Bus Refreshing modules:

Example 1:

The BL20 station consists of 20 BL20-1AI-I(0/4...20MA) modules. The number of additional Bus Refreshing modules required is calculated as follows:

| | | |
|---|---|---|
| Gateway | | 430 mA |
| 20 BL20-1AI-I(0/4...20MA) | 20 x 41 mA | 820 mA |
| | Total: | 1250 mA |
| Maximum permissible current via module bus: | | 1 500 mA |

The calculation shows that no further Bus Refreshing module is required.

Example 2:

The BL20 station comprises 15 BL20-1AI-U(-10/0...+10VDC) modules, 10 BL20-2AO-U(-10/0...+10VDC) modules,
10 BL20-2DI-24VDC-P modules and 5 BL20-2DO-24VDC-0.5A-P modules.
The required number of Bus Refreshing modules is calculated as follows:

| | | |
|---|---|---|
| Gateway | | 430 mA |
| 15 BL20-1AI-U(-10/0...+10VDC) | 15 x 41 mA | 615 mA |
| 10 BL20-2AO-U(-10/0...+10VDC) | 10 x 43 mA | 430 mA |
| 10 BL20-2DI-24VDC-P | 10 x 28 mA | 280 mA |
| 5 BL20-2DO-24VDC-0.5A-P | 5 x 32 mA | 160 mA |
| | Total: | 1 915 mA |
| Maximum permissible current via module bus: | | 1 500 mA |

The calculation shows that an additional/further Bus Refreshing module is required at the latest following the last BL20-2AO module. This Bus Refreshing module is sufficient to supply the remaining modules.

**Note**

The power requirements of the BL20 gateway is to be considered when calculating the required number of Bus Refreshing modules.

The following table offers an overview of the nominal current consumption of the individual BL20 modules on the module bus:

*Table 7-2: Nominal current consumption of the BL20 modules on the module bus*

| Module | Supply | Nominal current consumption |
|---|---|---|
| Gateway | 1 500 mA | 430 mA |
| BL20-PF-24VDC-D | | 28 mA |
| BL20-PF-120/230VAC-D | | 25 mA |
| BL20-2DI-24VDC-P | | 28 mA |
| BL20-2DI-24VDC-N | | 28 mA |
| BL20-2DI-120/230VAC | | 28 mA |
| BL20-4DI-24VDC-P | | 29 mA |
| BL20-4DI-24VDC-N | | 28 mA |
| BL20-4DI-NAMUR | | 40 mA |
| BL20-E-8DI-24VDC-P | | 15 mA |
| BL20-E-16DI-24VDC-P | | 15 mA |
| BL20-16DI-24VDC-P | | 45 mA |
| BL20-32DI-24VDC-P | | 30 mA |
| BL20-1AI-I(0/4...20MA) | | 41 mA |
| BL20-2AI-I(0/4...20MA) | | 35 mA |
| BL20-1AI-U(-10/0...+10VDC) | | 41 mA |
| BL20-2AI-U(-10/0...+10VDC) | | 35 mA |
| BL20-2AI-PT/NI-2/3 | | 45 mA |
| BL20-2AI-THERMO-PI | | 45 mA |
| BL20-4AI-U/I | | 30 mA |
| BL20-2DO-24VDC-0.5A-P | | 32 mA |

| Module | Supply | Nominal current consumption |
|---|---|---|
| BL20-2DO-24VDC-0.5A-N | | 32 mA |
| BL20-2DO-24VDC-2A-P | | 33 mA |
| BL20-2DO-120/230VAC-0.5A | | 35 mA |
| BL20-4DO-24VDC-0.5A-P | | 30 mA |
| BL20-E-8DO-24VDC-0.5A-P | | 15 mA |
| BL20-E-16DO-24VDC-0.5A-P | | 25 mA |
| BL20-16DO-24VDC-0.5A-P | | 120 mA |
| BL20-32DO-24VDC-0.5A-P | | 30 mA |
| BL20-1AO-I(0/4...20MA) | | 39 mA |
| BL20-2AO-I(0/4...20MA) | | 40 mA |
| BL20-2AO-U(-10/0...+10VDC) | | 43 mA |
| BL20-2DO-R-NC | | 28 mA |
| BL20-2DO-R-NO | | 28 mA |
| BL20-2DO-R-CO | | 28 mA |
| BL20-1CNT-24VDC | | 40 mA |
| BL20-1RS232 | | 140 mA |
| BL20-1RS485/422 | | 60 mA |
| BL20-1SSI | | 50 mA |
| BL20-2RFID | | 30 mA |
| BL20-E-1SWIRE | | 60 mA |

If the power supply from the module bus is not guaranteed, thereby making a further Bus Refreshing module necessary, the software I/O-ASSISTANT generates an error message when the user activates the command “Station → Verify“.

**Note**

Bus Refreshing modules which do not supply the gateway with power are to be combined with either a BL20-P3T-SBB-B or a BL20-P4T-SBBC-B (tension clamp connection) base module or with the base modules BL20-P3S-SBB-B or BL20-P4S-SBBC-B (screw connection).

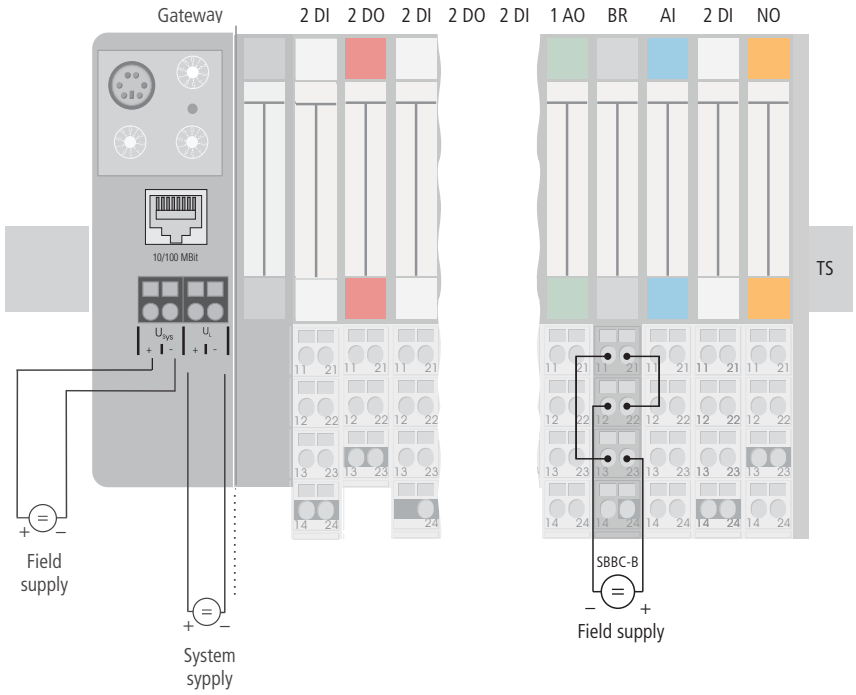



*Figure 7-1: Power supply of the station*

It must be ensured that the same ground potential and ground connections are used. If different ground potentials or ground connections are used, compensating currents flow via the module bus, which can lead to the destruction of the Bus Refreshing module.

All Bus Refreshing modules are connected to one another via the same ground potential.

The power to the module bus is supplied via the connections 11 and 21 on the base module.

**Attention**

In order to comply with radiation limit values in accordance with EN 55 011/ 2 000, the supply lines of the BL20-BR-24VDC-D module for supplying the gateway with power are to be fed through a ferrite ring (PS416-ZBX-405). This is to be placed immediately next to the connection terminals. From there on, it is not permitted to make connections to further devices.

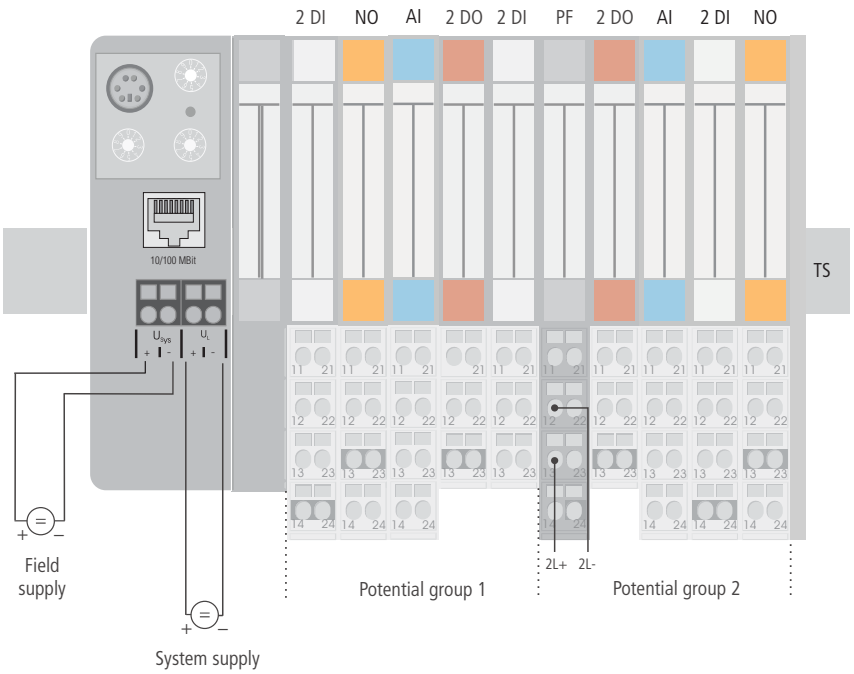
### 7.2.2 Creating Potential Groups

Bus Refreshing and 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.

**Attention**

Ensure that the correct base modules are planned for when using Bus Refreshing modules.

*Figure 7-2: Example for creating potential groups*




**Note**

The system can be supplied with power independent of the potential group formation described above.

When using a digital input module for 120/230 V AC, it should be ensured that a potential group is created in conjunction with the Power Feeding module BL20-PF-120/230VAC-D.

**Attention**

It is not permitted to use the modules with 24 V DC and 120/230 V AC field supply in a joint potential group.

### 7.2.3 Protecting the Service Interface on the Gateway

During operation, the cover protecting the service interface and the hexadecimal rotary coding-switches must remain closed due to EMC and ESD.

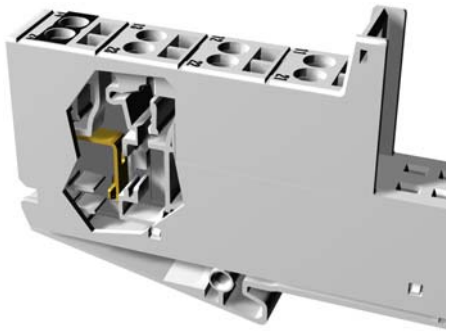
### 7.2.4 C-Rail (Cross Connection)

The C-rail runs through all base modules. The C-rail of the base modules for power distribution modules is mechanically separated; thus potentially isolating the adjoining supply groups.

Access to the C-rail is possible with the help of base modules with a C in their designation (for example, BL20-S4T-SBCS). The corresponding connection level is indicated on these modules by a thick black line. The black line is continuous on all I/O modules. On power distribution modules, the black line is only above the connection 24. This makes clear that the C-rail is separated from the adjoining potential group to its left.

*Figure 7-3:*
*C-rail front view*

*Figure 7-4:*
*C-rail side view*



**Danger**

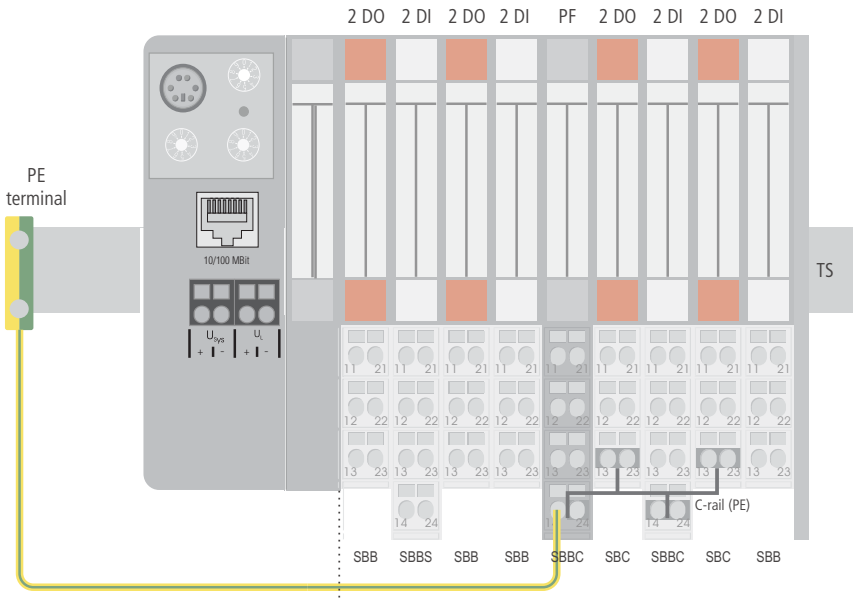
It is permitted to load the C-rail with a maximum of 24 V. Not 230 V!

The C-rail can be used as required by the application, for example, as a protective earth (PE). In this case, the PE connection of each power distribution module must be connected to the mounting rail via an additional PE terminal, which is available as an accessory.

**Note**

For information about introducing a BL20 station into a ground reference system, please read chapter 8.

*Figure 7-5: Using the C-rail as a protective earth*

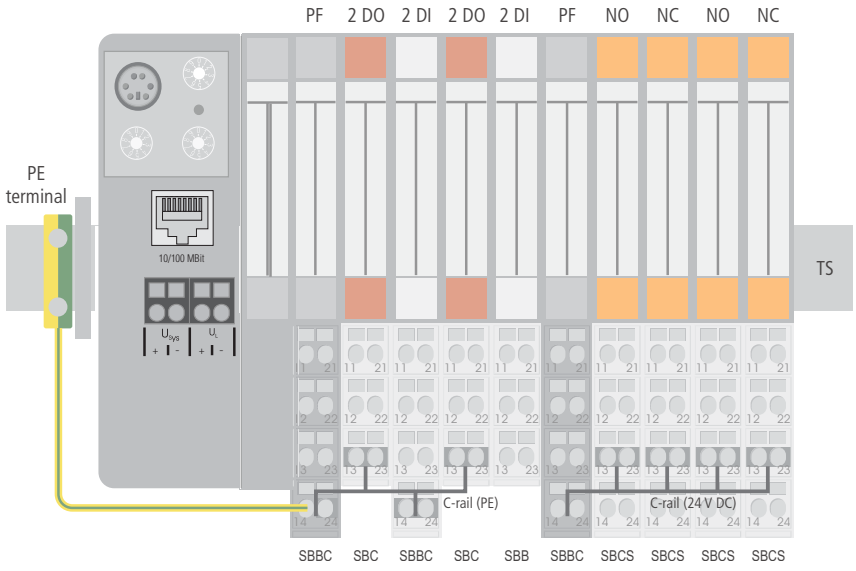



C-rails can be used for a common voltage supply when relay modules are planned. To accomplish this, the load voltage is connected to a Power Feeding module with the BL20-P4x-SBBC base module with tension clamp or screw connection. All the following relay modules are then supplied with power via the C-rail.

**Attention**

When relay modules are planned and the C-rail is used for a common voltage supply, a further power distribution module must be used for the potential isolation to the following modules. The C-rail can only again be used as a PE following potential isolation.

*Figure 7-6: Using the C-rail as protective earth and for the power supply with relay modules*




Cross-connecting relay module roots is achieved by the use of jumpers. The corresponding connection diagrams can be found in the manuals for the BL20 I/O modules (German: D300716, English: D300717

### 7.2.5 Direct Wiring of Relay Modules

As well as the options mentioned above, relay modules can be wired directly. In this case, base modules without C-rail connections should be chosen to guarantee the potential isolation to the adjoining modules.

## 7.3 Plugging and Pulling Electronics Modules

BL20 enables the pulling and plugging of electronics modules without having to disconnect the field wiring. The BL20 station remains in operation if an electronics 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 electronics modules are plugged or pulled, short interruptions to the module bus communications can occur in the BL20 station. This can lead to undefined statuses of individual inputs and outputs of different modules.

## 7.4 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.

## 7.5 Firmware Download

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

**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.

# 8 Guidelines for Electrical Installation

## 8.1 General Notes

### 8.1.1 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.).

### 8.1.2 Cable Routing

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

### 8.1.3 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.

### 8.1.4 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.

### 8.1.5 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 BL20 catalog.

## 8.2 Potential Relationships

### 8.2.1 General

The potential relationship of a Ethernet system realized with BL20 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 BL20 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 BL20 station.

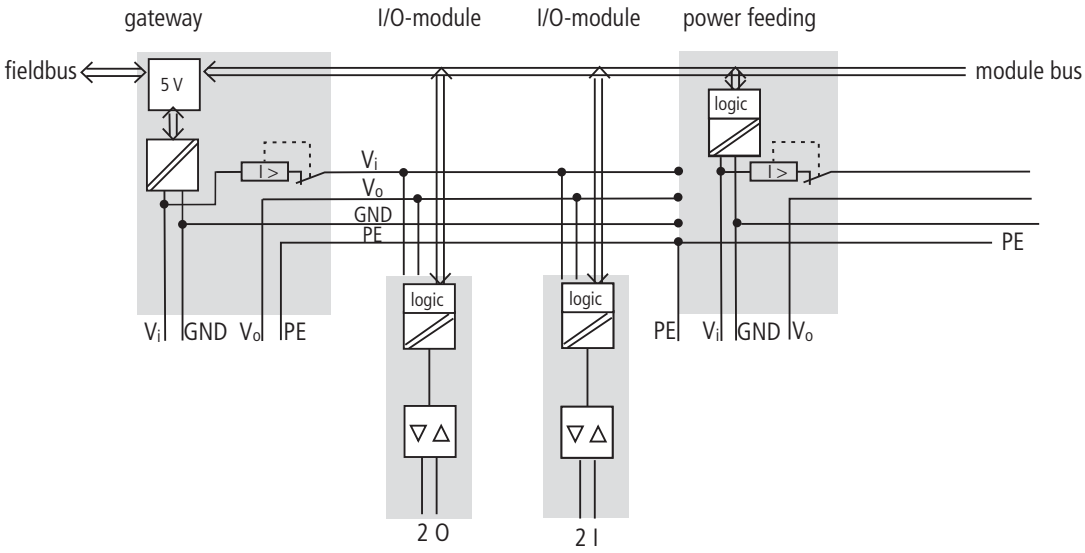



*Figure 8-1: Block diagram of a BL20 station*

## 8.3 Electromagnetic Compatibility (EMC)

BL20 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.

### 8.3.1 Ensuring Electromagnetic Compatibility

The EMC of BL20 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.

### 8.3.2 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.

### 8.3.3 PE Connection

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

### 8.3.4 Earth-Free Operation

Observe all relevant safety regulations when operating an earthfree system.

### 8.3.5 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.

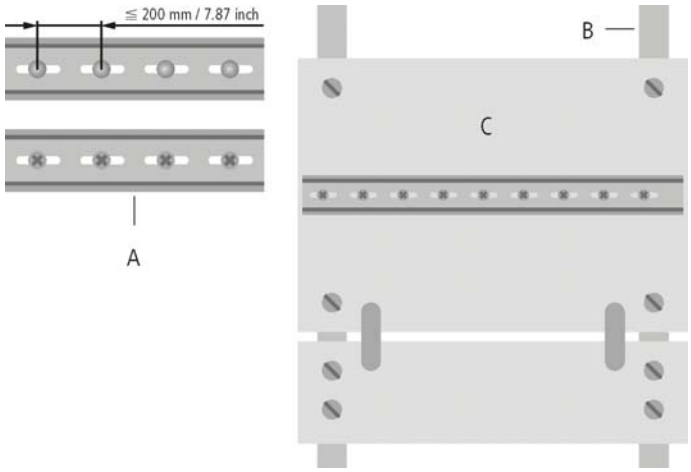



*Figure 8-2: Mounting options*

**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).

## 8.4 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.

## 8.5 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.

### 8.5.1 Switching Inductive Loads

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

### 8.5.2 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.

# 9 BL20-Approvals for Zone 2/ Division 2

**Note**

The Zone 2 - approval certificates for BL20 can be found in a separate manual for approvals D301255 on www.turck.de.

# 10 Appendix

## 10.1 Network Configuration

**Note**

In order to build up the communication between the BL20-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 BL20-gateways.

The default IP address for the BL20-gateways is 192.168.1.1 (see also chapter 3, page 3-4, section IP address).

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

## 10.2 Changing the IP address of a PC/ network interface card

### 10.2.1 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".

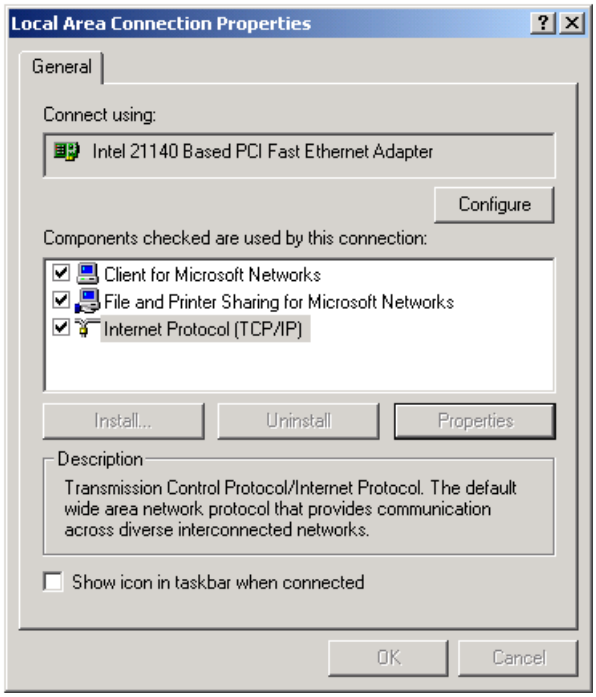
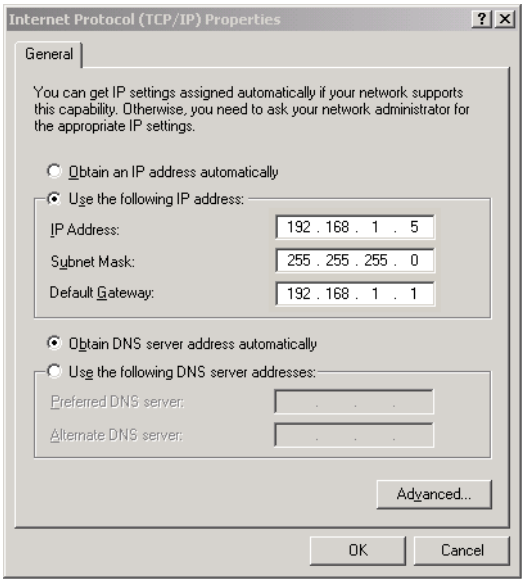



*Figure 10-1: Local Area Connection Properties*

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 10-2: Changing the PC's IP address*

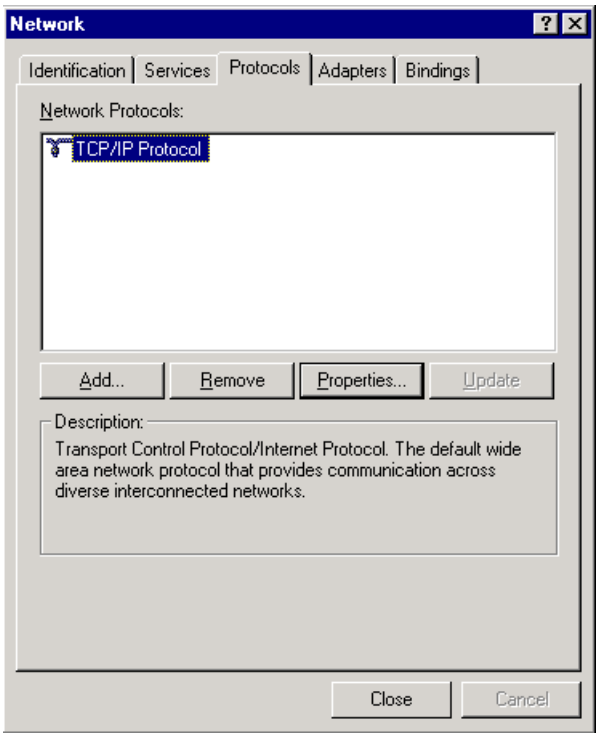



### 10.2.2 Changing the IP address in Windows NT

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

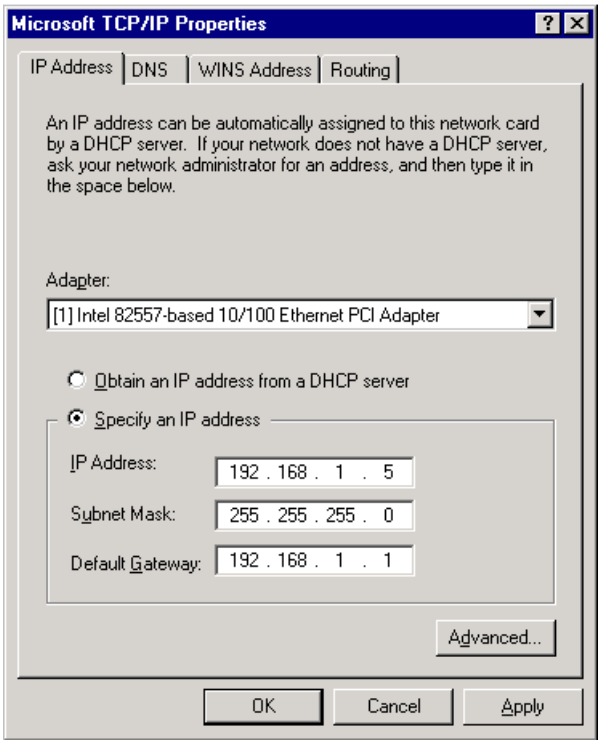
2 Activate TCP/IP connection in the tab "Protocols" and click the "Properties" button.

*Figure 10-3: Network configuration WIN NT*



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

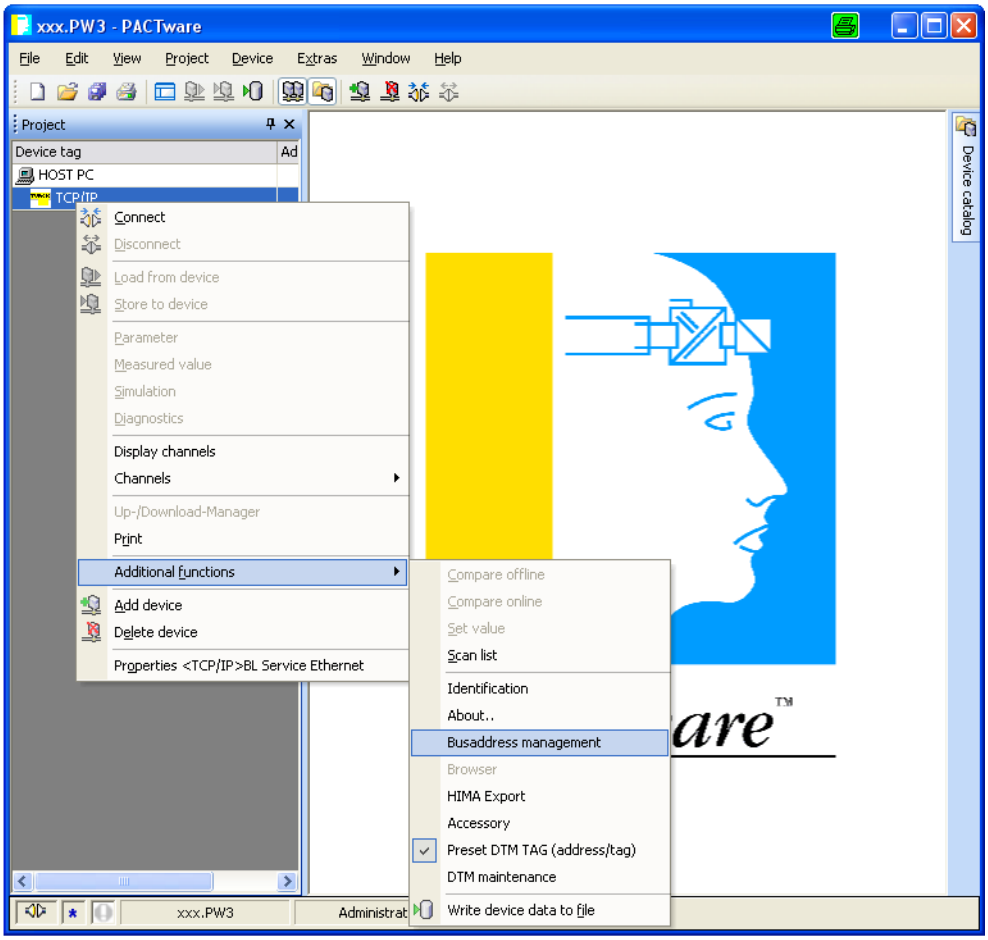
*Figure 10-4: Specify IP address*



### 10.2.3 Changing the IP address via I/O-ASSISTANT

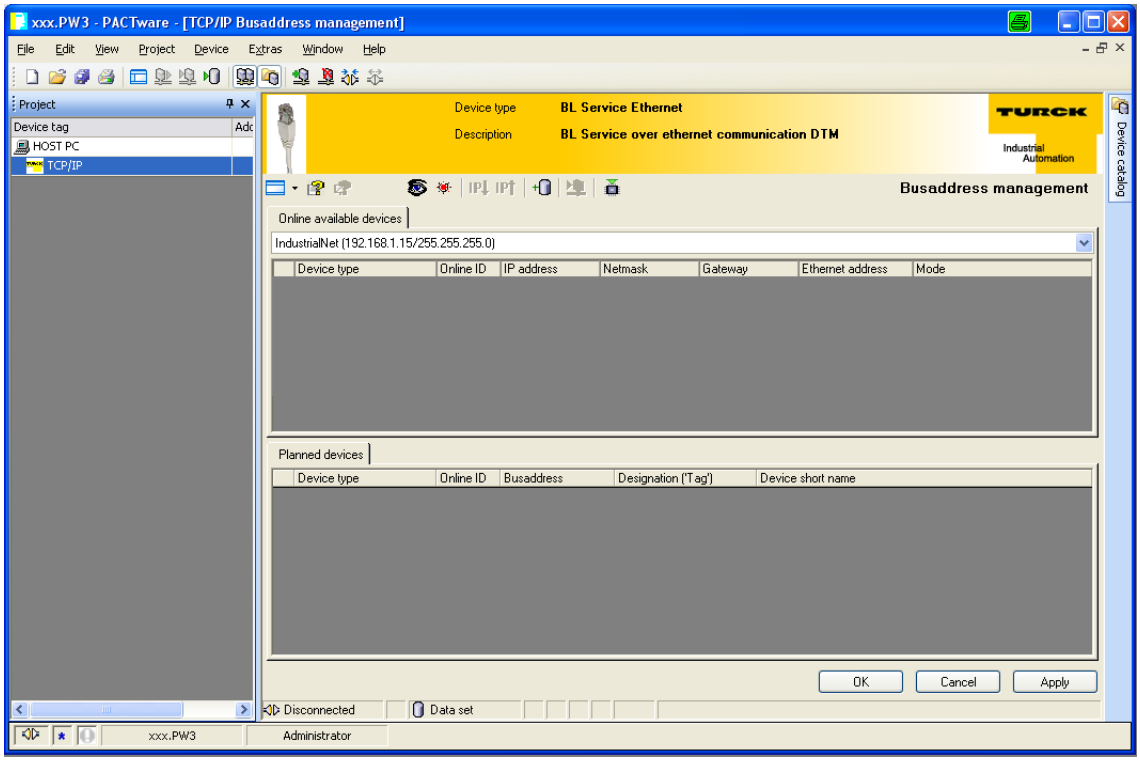
The Busaddress management tool integrated in the I/O-ASSISTANT offers the possibility to browse the whole Ethernet network for connected nodes and to change their IP address as well as the subnet mask according to the application.

*Figure 10-5: Busaddress management tool*



The network is browsed by using the search function in the Address Tool.

*Figure 10-6: Search function in the Address Tool*




**Attention**

If Windows XP is used as operating system, problems with the system internal firewall may occur.

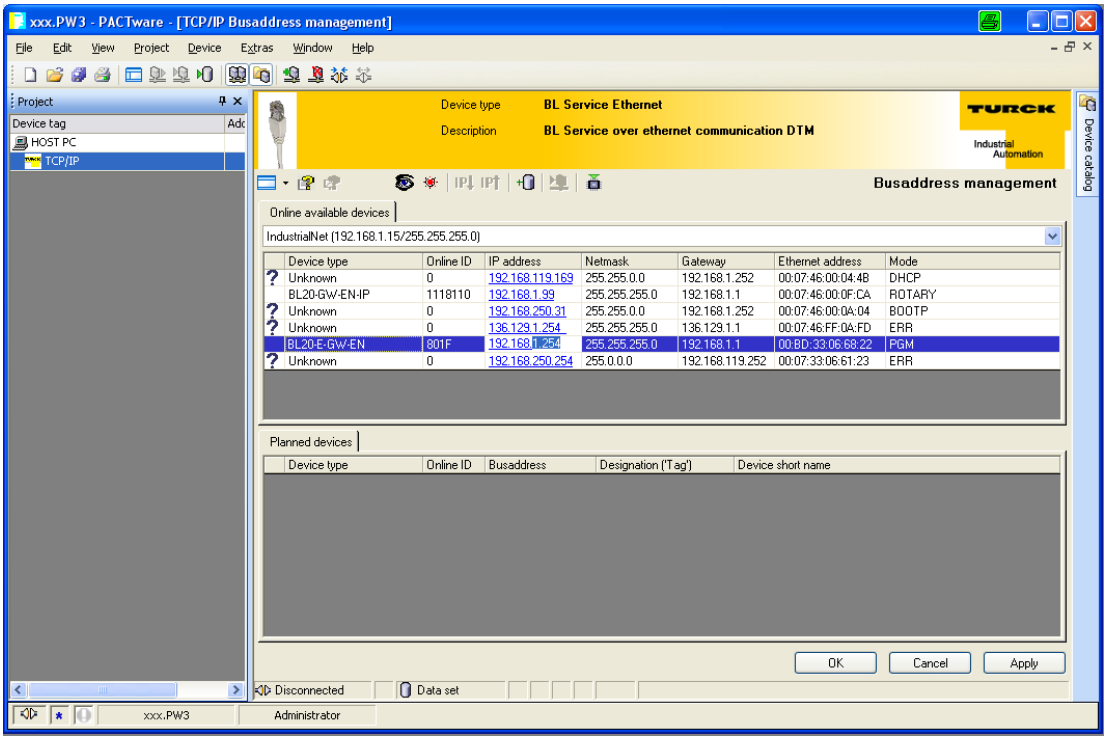
It may eventually inhibit the access of the I/O-ASSISTANT to the Ethernet. Please adapt your firewall settings accordingly or deactivate it completely (see also Deactivating/ adapting the firewall in Windows XP, page 10-9).

The network is browsed for connected hosts which are then listed in the Address Tool.

The address changing is done via "Tools → Changing IP settings...".

It is now possible to change the address settings for all nodes in the list or only for the selected one.

*Figure 10-7: Address changing for selected nodes*



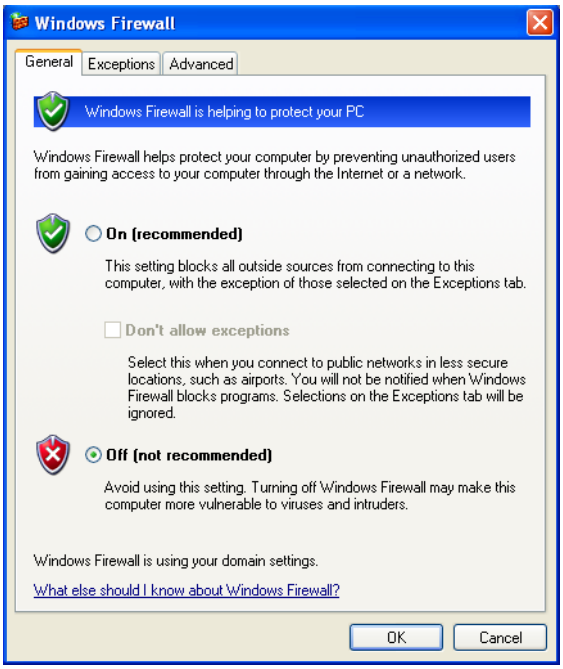
## 10.3 Deactivating/ adapting the firewall in Windows XP

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.

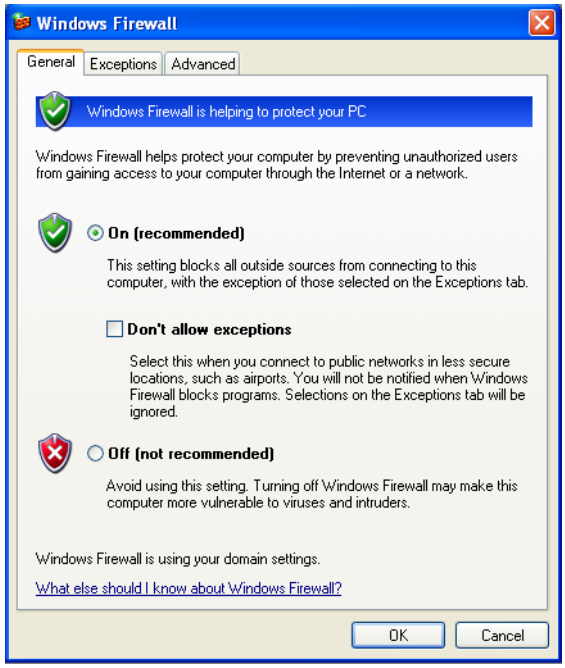
- **Deactivating the firewall**
  Open the "Windows Firewall" dialog in the control panel of your PC and deactivate it as follows:

*Figure 10-8: Deactivating the Windows firewall*



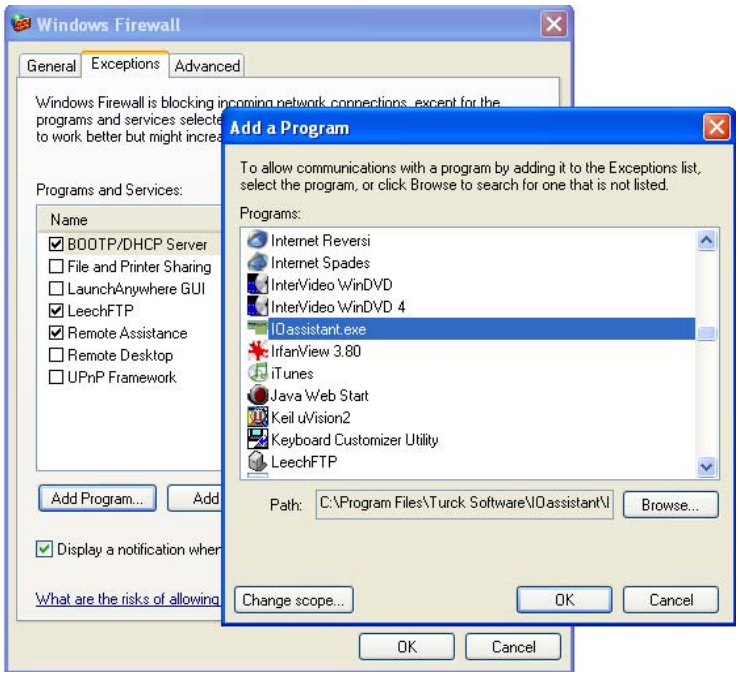
- **Adapting the firewall**
  The firewall remains active, the option "Don't allow exceptions" it deactivated:

*Figure 10-9: 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 10-10: "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.

# 11 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.

# 12 Index

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