TURCK

Industrial
Automation

BL20 –
USER MANUAL

PROFINET IRT-
GATEWAY

Edition 02/2013

Table of Contents

1 About this manual

1.1 Documentation concept

This manual contains all information about the PROFINET-IO-Gateway of the product line BL20 (BL20-E-GW-PN).

The following chapter contain a short BL20-description, a description of the field bus system PROFINET, exact information about function and structure of the field bus specific BL20-gateway for PROFINET as well as all bus specific information concerning the connection to automation devices, the maximum system extension etc.

The bus-independent I/O-modules of the BL20-system as well as all bus independent information as mounting, labeling etc. are described in a separate manual.

- BL20 I/O-modules (TURCK-documentation no.: German D300716; English D300717)

In addition to that, the manual contains a short description of the I/O-ASSISTANT, the project planning and configuration software tool for TURCK I/O-systems-

1.2 Description of symbols used

Warning

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

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

Attention

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

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

Note

This sign can be found next to all general notes that supply important information about one or more operating steps.

These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

1.3 General

Attention

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

This manual includes all information necessary for the prescribed use of the BL20-E-GW-PN. It has been specially conceived for personnel with the necessary qualifications.

1.3.1 Prescribed use

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

Warning

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

1.3.2 Notes concerning planning/ installation of this product

Warning

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

2 BL20-philosophy

2.1 The basic concept

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

BL20 offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (counters, 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 regulated 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

All BL20 stations can be planned to accommodate the exact number of channels to suit your needs, because the modules are available with different numbers of channels in block and slice design.

A BL20 station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industry.

2.1.2 Compactness

The slim design of the BL20 modules (standard gateway 50.4 mm / 1.98 inch, ECO gateway 34 mm/ 1.34 inch, standard slice 12.6 mm / 0.49 inch, ECO slice 13 mm / 0.51 inch and block 100.8 mm / 3.97 inch) and their low overall height favor the installation of this system in confined spaces.

2.1.3 Easy to handle

All BL20 modules of the standard line, with the exception of the gateway, consist of a base module and an electronics module.
The gateway and the base modules are snapped onto a mounting rail. The electronics modules are plugged onto the appropriate base modules.

The base modules of the standard line are designed as terminal blocks. The wiring is secured by tension clamp or screw connection.

The electronics 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.

The ECO electronics modules combine base module and electronics module in one housing. All BL20-ECO modules can be used with the standard products with tension clamp connection technology.

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 PACTware with the corresponding TURCK DTMs (I/O-ASSISTANT).

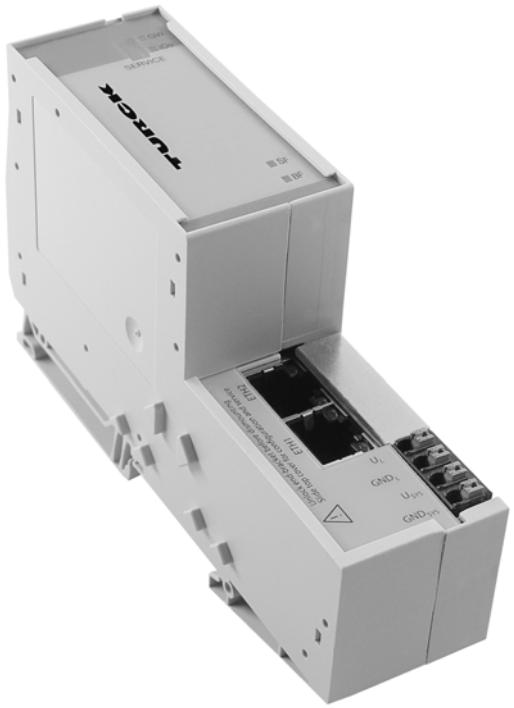
ECO-gateways

The BL20-ECO gateways enlarge the product portfolio of BL20. They offer an excellent cost/ performance ratio.

Further advantages of the BL20- gateways in the ECO-housing:

- At the moment available for PROFIBUS-DP, DeviceNet, CANopen, Modbus TCP, EtherNet/IP, PROFINET-IO and EtherCat
- Low required space: width 34 mm/ 1.34 inch minimal space requirements
- Integrated power supply
- Can be combined with all existing standard modules (with tension clamp connection technology) and ECO modules
- Simple wiring with "Push-in" tension clamp terminals, via DeviceNet-Open Style Connector or via Ethernet RJ45-connectors
- Automatic bit rate detection for PROFIBUS-DP and DeviceNet
- Setting of fieldbus address and bus terminating resistor (PROFIBUS-DP, DeviceNet, CANopen) via DIP-switches
- Service interface for commissioning with I/O-ASSISTANT 3 (FDT/DTM), without PLC

Figure 2-1: Gateway BL20-E-GW-PN



Gateways with integrated power supply

All standard gateways BL20-GWBR-xxx as well as the BL20-gateways for DPV1 and Ethernet (BL20-GW-DPV1, BL20-GW-EN, BL20-GW-EN-IP, BL20-GW-EN-PN, BL20-PG-EN and 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.

Gateways without integrated power supply

Note

The gateways without integrated power supply unit need an additional power supply module (bus refreshing module) which feeds the gateway an the connected I/O modules.

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 (standard product line)

The standard electronics modules contain the I/O-functions of the BL20 modules (power distribution modules, digital and analog input/output modules, and technology modules).

They are plugged onto the base modules and are not directly connected to the wiring

and 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.

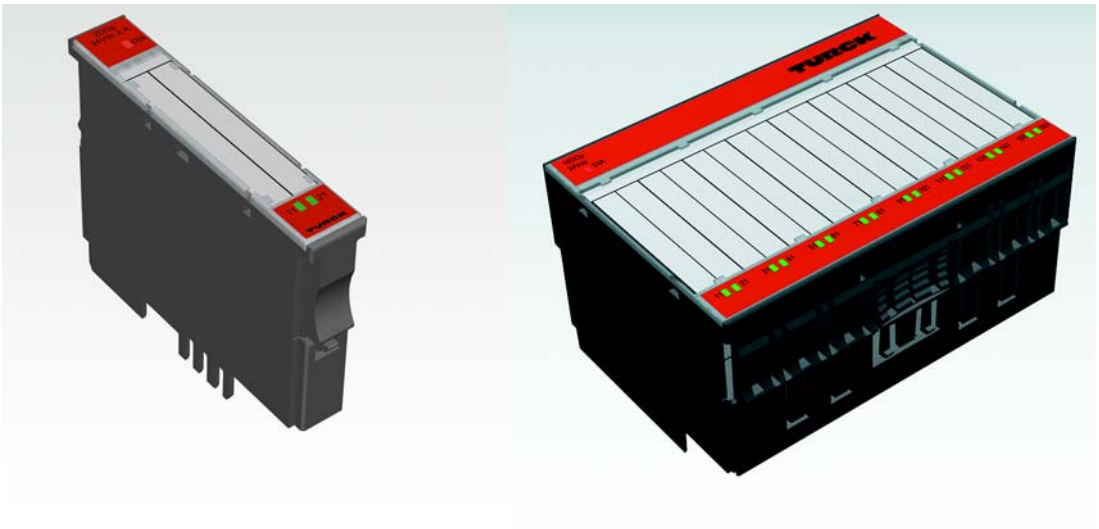


Figure 2-3: Electronics module in slice design (left) and in Block design (right)

2.2.4 ECO electronics modules

New ECONOMY modules with a high signal density and exceptionally low channel price expand the BL20 I/O bus terminal system.

Depending on type, up to 16 digital inputs and outputs can be connected on only 13 mm. This high connection density considerably reduces the mounting width required for typical applications.

All advantages at a glance:

- Space saving thanks to 16 channels on 13 mm/ 0.51 inch width
- Cost saving thanks to electronics with integrated connection level
- High signal density
- Tool-less connection via "push-in" spring-type terminal technology for simple and fast mounting
- Flexibility in combining them with standard I/O-modules in tension clamp technology, the standard- and the ECO-gateways.
- Simple assembly reduces error sources

Figure 2-4:
ECO I/O-module

2.2.5 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 4x2-/3-wire (4-channel).

Figure 2-5: Base module with tension clamp connection

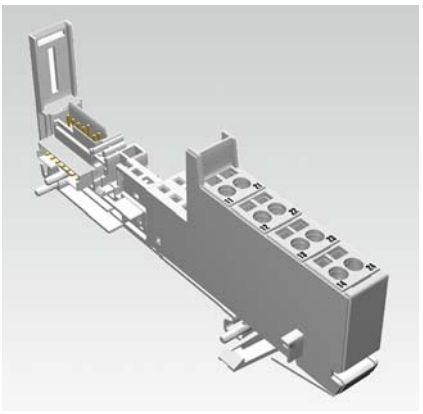


Figure 2-6: Base module with screw connection

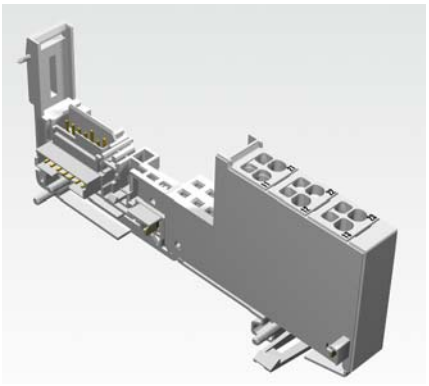
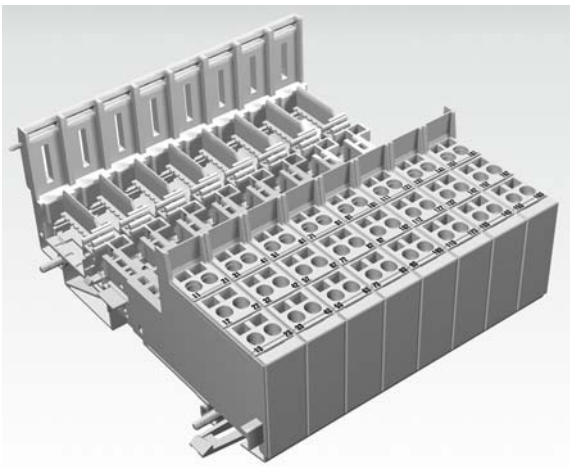


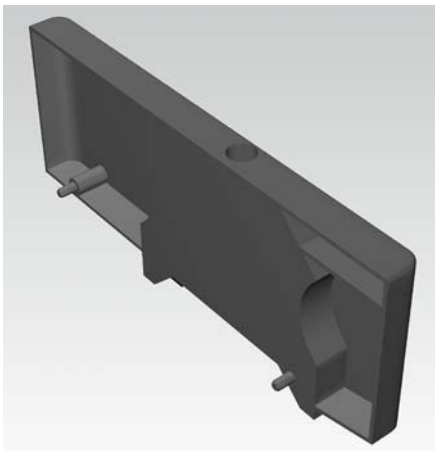
Figure 2-7: Base module in block design



2.2.6 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.

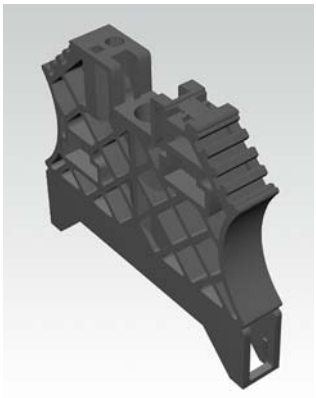
Figure 2-8: End plate



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 2-9: End bracket



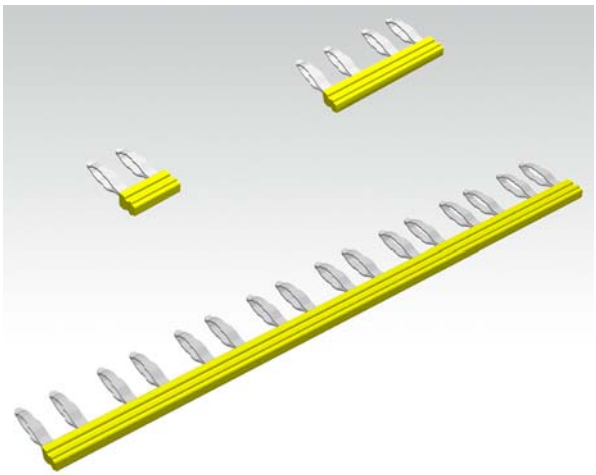
Note

The end plate and two end brackets are delivered with the gateway.

2.2.8 Jumpers

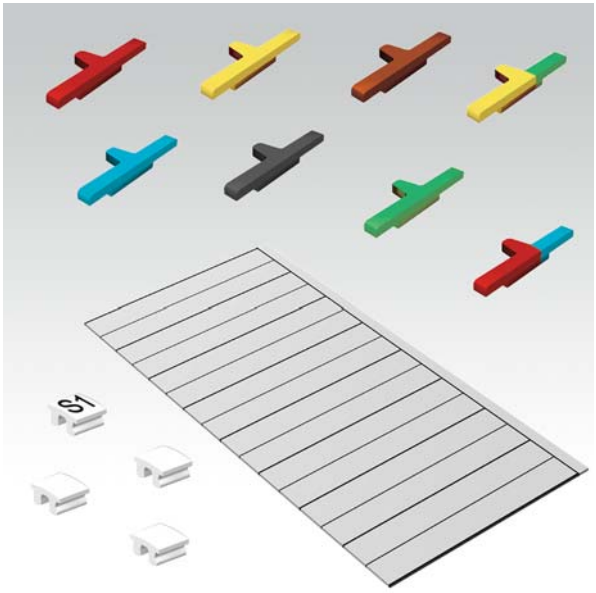
Jumpers (QVRs) are used to bridge a connection level of a 4-wire base module. They can be used to connect potentials in relay modules (bridging the relay roots); thus considerably reducing the amount of wiring.

Figure 2-10: Jumpers



- 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.

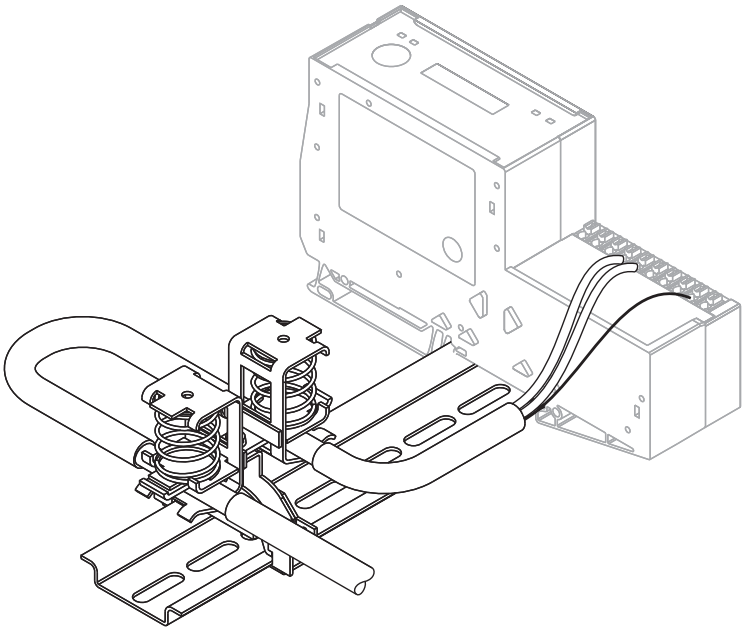
Figure 2-11: Marking material



2.2.9 Shield connection gateway

If the gateway is wired directly to the fieldbus, it is possible to shield the connection using a special gateway-shielding connection attachment (BS3511/KLBUE4-31.5).

Figure 2-12: Shield connection (gateway)



3 PROFINET

3.1 PROFINET

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

3.1.1 Distributed I/O with PROFINET

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

Device Model

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

3.1.2 Communications in PROFINET

Communications in PROFINET contain different levels of performance:

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

The services of PROFINET

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

3.1.3 Address assignment

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

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

In the delivery state, amongst others 3 MAC-addresses - one MAC for each (virtual) port for the topology discovery - and one symbolic name are stored in each field device. These information are enough to assign each field device a unique name (appropriate to the installation).

Address assignment is performed in two steps:

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

Both steps occur through the integrated standard DCP protocol.

3.1.4 Ethernet MAC address

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

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

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

Note

The antecedent description contains a short overview about the properties and the functions of the PROFINET field bus system.
It has been taken from the brochure of the PROFIBUS user organization e.V. (version 2006).

A detailed system description can be found in the standards IEC 61158 and IEC 61784 and in the PROFIBUS-guidelines and -profiles (www.profibus.com).

3.1.5 LLDP-Protokoll (Link Layer Discovery Protocol)

This protocol serves for neighborhood detection between PROFINET nodes and thus allows the simple exchange of PROFINET network nodes without additional engineering tool.

Note

Detailed information about the automatic topology discovery in PROFINET via LLDP can be found on the homepage of the PROFIBUS user organization under www.profibus.com..

4 Technical features

4.1 Function

BL20-gateways for PROFINET are used to connect BL20 IO modules to a PROFINET-IO-network.

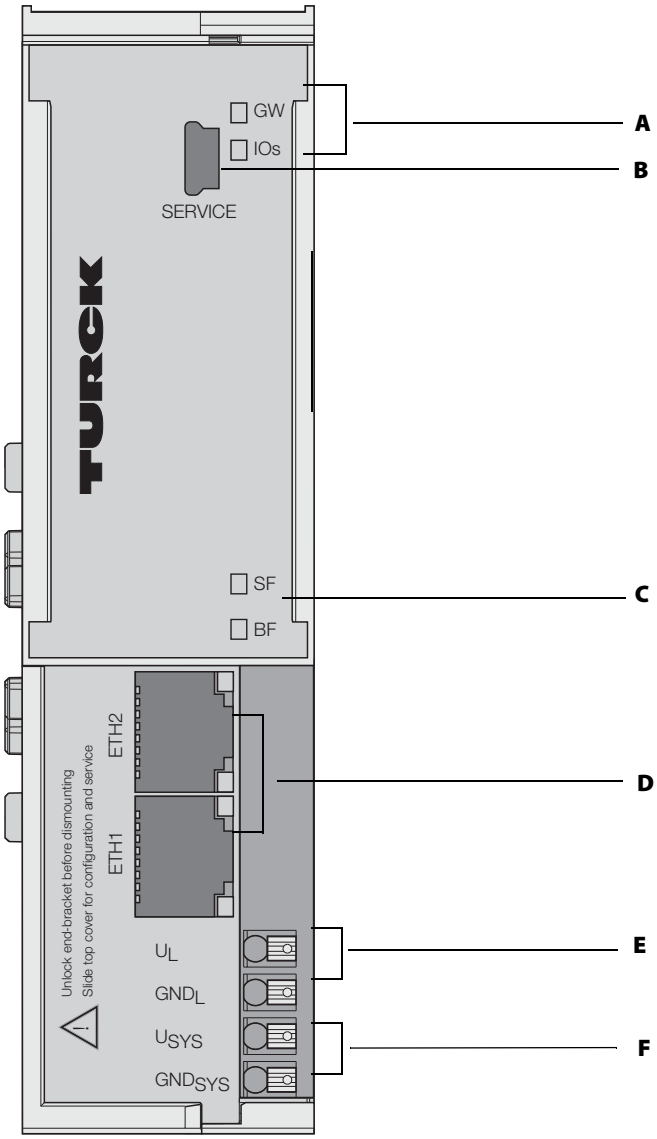
The gateway handles the entire process data exchange between the I/O-level and the fieldbus and generates diagnostic information for higher-level nodes and the software tool I/O-ASSISTANT.

The BL20-E-GW-PN supports RT/IRT-applications as well as the topology detection via LLDP (see also PROFINET neighborhood detection via LLDP (page 5-13)).

4.2 Technical data

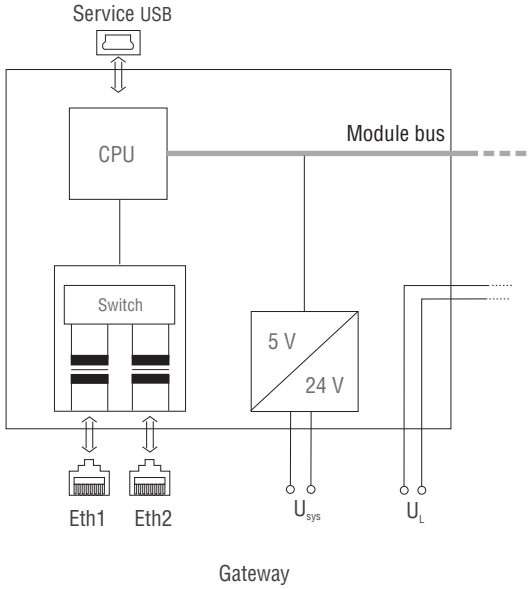
Figure 4-1: Front view

A *LEDs for BL20 module bus*
B *service interface*
C *LEDs for the PROFINET-IO-communication*
D *EtherNet-switch with EtherNet-LEDs*
E *terminals for field supply*
F *terminals for system supply*



4.2.1 Block diagram

Figure 4-2: Block diagram BL20-E-GW-PN



4.2.2 General technical data of a station

Attention

The auxiliary power supply must comply with the stipulations of SELV (Safety Extra Low Voltage) according to IEC 364-4-41.

Table 4-1: General technical data of a station

PROFINET	
address assignment	DCP
Conformance Class	C (IRT)
MinCycleTime	1 ms
Diagnostics	acc. to PROFINET Alarm Handling
Topology detection	supported
Automatic addressing	supported
Connection technology	Push-in tension clamp terminals, LSF from Weidmueller
Physical interfaces	
Field bus	Ethernet
Transmission rate	10/100 Mbps
Passive fiber-optic-adapters can be connected	current consumption max. 100 mA
Fieldbus connection technology	RJ45-female connector, RJ45-male connector
Fieldbus shielding connection	via Ethernet cable
service interface	mini USB
Address setting	Address switch without function
Supply voltage/auxiliary voltage	
U_{sys} (nominal value) (provision for other modules)	24 VDC
I_{sys} (at max. system extension, → see chapter 7, from page 7-3)	approx. 600 mA
U_L nominal value	24 VDC
I_{Lmax} (maximum current of field supply)	8 A
permissible range	according to EN 61 131-2 (18 to 30 V DC)
Residual ripple	according to EN 61 131-2
Isolation voltage (U_L to U_{SYS})	500 V_{eff}
Voltage anomalies	according to EN 61 131-2
I_{MB} (supply of module bus nodes)	800 mA
Isolation voltages	
U_{BL}(U_{sys} against service interface)	-
U_{ETH} (supply voltage against Ethernet)	500 V AC
U_{USB} (supply voltage against U_{SB})	-
U_{ETHETH} (ETH1 to ETH2)	500 V AC

Ambient conditions	
Ambient temperature	
$t_{Ambient}$	0…+55 °C
t_{Store}	- 25…+85 °C
Relative humidity according to EN 61131-2/EN 50178	5 to 95 % (indoor), Level RH-2, no condensation (storage at 45 °C, no function test)
Climatic tests	according to IEC 61131-2
Vibration resistance	
10 to 57 Hz, constant amplitude 0.075 mm, 1 g	yes
57 to 150 Hz constant acceleration 1 g	yes
Mode of vibration	Frequency sweeps with a change in speed of 1 Octave/min
Period of oscillation	20 frequency sweeps per axis of coordinate
Shock resistant according to IEC 68-2-27	18 shocks, sinusoidal half-wave 15 g peak value/ 11 ms, in each case in ± direction per space coordinate
Resistance to repetitive shock according to IEC 68-2-29	1 000 shocks, half-sinus 25 g peak value/6 ms, in each case in ± direction per space coordinate
Drop and topple	
Height of fall (weight < 10 kg)	1.0 m
Height of fall (weight 10 to 40 kg)	0.5 m
Test runs	7
Device with packaging, electrically tested printed-circuit board.	
Electromagnetic compatibility (EMC) according to EN 50 082-2 (Industry)	
Static electricity according to EN 61 000-4-2	
Discharge through air (direct)	8 kV
Relay discharge (indirect)	4 kV
Electromagnetic HF fields according to EN 61 000-4-3 and ENV 50 204	10 V/m
Conducted interferences induced by HF fields according to EN 61 000-4-6	10 V
Fast transients (Burst) according to EN 61 000-4-4	
Emitted interference according to EN 50 081-2 (industry)	according to EN 55 011 Class A **A**, Group 1

A *Using the device in residential areas can cause disturbances. In this case, appropriate measures to suppress the disturbance have to be done.*

Approvals and tests

Table 4-2: Approvals and tests for a BL20 station

Approvals	
UL CSA	in preparation
Tests (EN 61131-2)	
Cold	DIN IEC 68-2-1, Temperature -25 °C / 185 °F, duration 96 h; device not in use
Dry heat	DIN IEC 68-2-2, Temperature +85 °C / 185 °F, duration 96 h; device not in use
Damp heat, cyclic	DIN IEC 68-2-30, temperature +55 °C / 131 °F, duration 2 cycles every 12 h; device in use
Pollution severity according to IEC 664 (EN 61 131-2)	2
Protection class according to IEC 529	IP20

4.2.3 Technical data for the push-in tension clamp terminals

Table 4-3: Technical data Push-in tension clamp terminals

Designation	
Protection class	IP20
Insulation stripping length	8 mm + 1/ 0.32 inch + 0,039
Max. wire range	0.14 to 1.5 mm^2 / 0.0002 to 0.0023 $inch^2$ / 26 to 16 AWG
Crimpable wire	
"e" solid core H 07V-U	0.14 to 1.5 mm^2 / 0.0002 to 0.0023 $inch^2$/ 26 to 16 AWG
"f" flexible core H 07V-K	0.5 to 1.5 mm^2 / 0.0008 to 0.0023 $inch^2$ / 25 to 16 AWG
"f" with ferrules according to DIN 46 228/1 (ferrules crimped gas-tight)	0.25 to 1.5 mm^2 / 0.0004 to 0.0023 $inch^2$ / 30 to 16 AWG

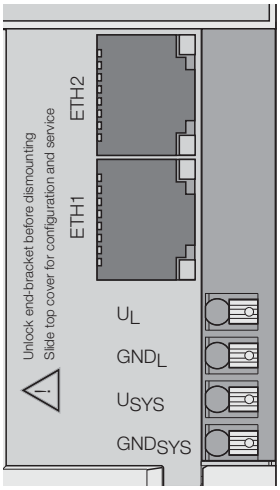
Note

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.

4.3 Connection options at the gateway

The fieldbus connection is realized via an integrated RJ45-Ethernet-switch, the connection of the power supply via push-in tension clamps..

Figure 4-3: Connection options at the gateway



4.3.1 Power supply

The BL20-E-GW-PN provides an integrated power supply unit and push-in tension clamps for:

- field supply (U_L, GND_L)
- system supply (U_{SYS}, GND_{SYS})

4.3.2 Field bus connection via Ethernet-switch

The BL20-ECO-gateways for Ethernet provide an integrated RJ45-Ethernet-switch.

Figure 4-4: RJ45 female connector

1 = TX +
2 = TX –
3 = RX +
4 = n.c.
5 = n.c.
6 = RX –
7 = n.c.
8 = n.c.

Table 4-4: RS485, pin assignment

Pin-no.	Signal		Color	
1	TX+	Transmit data +	YE	yellow
2	TX–	Transmit data -	OG	orange
3	RX+	Receive data +	WH	white
4	not connected		-	-
5	not connected		-	-
6	RX–	Receive data –	BU	blue
7	not connected		-	-
8	not connected		-	-

Ethernet Port properties:

- Integrated switch
- Auto-crossing
- Data rate: 10/100 Mbps

Ethernet LED-states

(see Status displays, LNK- and ACT-LED page 4-13)

4.3.3 Service interface connection (mini USB female 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 5 pole mini-USB-connection.

In order to connect the gateway's service-interface to the PC, a commercial cable with mini USB connector (commonly used for e.g. digital cameras) is necessary.

Note

The Ethernet-ports can not be used as service-interface!

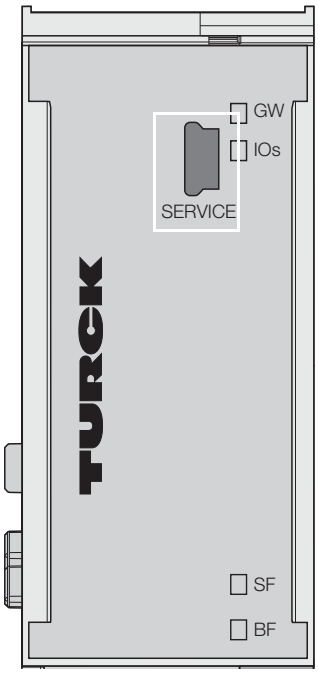


Figure 4-5: Mini-USD female connector at the gateway

4.4 Address assignment

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

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

Note

The DIP-switches under the gateway label have **no** function on BL20-E-GW-PN.

Note

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

4.5 GSDML-file

You can download the actual GSDML file for the gateway BL20-E-GW-PN "GSDML-V××-Turck-BL20-×××.xml" from our Homepage www.turck.com.

4.6 Default-values

Default-values:

IP-address	0.0.0.0
subnet mask:	0.0.0.0
Name:	-

Note

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

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

Note

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

4.7 Status displays

Every BL20 gateway displays the following statuses via LEDs:

- 2 LEDs for the module bus communication (module bus-LEDs): **GW** and **IOs**
- 2 LEDs for the PROFINET-communication (field bus-LEDs): **SF** and **BF**
- 4 LEDs for the EtherNet-Link: LNK and ACT (at both female connectors of the EtherNet-switch).

LED-displays

Table 4-5: LED-displays

LED	Status	Meaning	Remedy
GW	OFF	No power supply of the CPU.	Check the system power supply at the gateway.
	green	Firmware active, gateway ready	-
	green flashing, 1 Hz	Firmware not active	If LED "**IOs**" red, then firmware-download necessary
	green flashing, 4 Hz	Firmware active. gateway-hardware-failure	Replace the gateway.
	red	hardware-failure, no communication possible	Replace the gateway.
	red / green flashing, 4 Hz	WINK	WINK-Command active (serves for the identification of the device)
IOs	OFF	No power supply of the CPU.	Check the system power supply at the gateway.
	green	Module bus is running if MS-ED is green: the modules configured by the PROFINET-controller correspond to the modules in the station	-
	green flashing, 1 Hz	Station is in the Force Mode of the I/O-ASSISTANT.	Deactivate the Force Mode of the I/O-ASSISTANT
	green flashing, 4 Hz	The max. admissible number of modules connected to the gateway is exceeded.	Check the number of modules connected to the gateway, dismount modules
IOs	red	Hardware error	Replace the gateway.
	red flashing, 4 Hz	No communication via the module bus.	At least one module has to be plugged and has to be able to communicate with the gateway.
	red / green flashing, 1 Hz	The current and configured module list do not match but the data exchange proceeds as normal.	Check the physical station for pulled or new but not planned modules.

Table 4-5: LED-displays

LED	Status	Meaning	Remedy
SF	red	Hard- or software failure (module- or gateway diagnosis pending)	Check the station.
	OFF	No diagnostic message	
BF	red	Bus failure (no physical connection to a subnet or switch).	Check the: – connection to the switch – the data rate – the transmission type (full-duplex)
	red, flashing:	IO-Device-error, no process data transfer, possible reasons: – watchdog time-out – bus communication via PROFINET is disturbed – wrong IP-address – wrong configuration – wrong parameterization – wrong or missing device name – I/O-controller not found/ not active, but Ethernet-connection established	Check and eliminate the possible error-reasons
	OFF	Process data exchange	
LNK (left LED)	green	Link established,100 Mbps	
	OFF	no link	Check the Ethernet-connection.
ACT (right LED)	yellow	Data exchange (Ethernet-Traffic 100 Mbps)	
	OFF	no data exchange	Check the Ethernet-connection.

4.8 Diagnosis in PROFINET

In PROFINET, critical events (diagnostic messages) are reported acyclically as alarms.

In addition to information as slot-number, subslot-number, channel type etc., the diagnostic telegrams contain error codes which define the diagnostic event more precisely.

The error codes are interpreted by the PLC-software or respective function block, so that the diagnostic messages are normally displayed as plain text.

You will find an example of a diagnostic telegram in chapter 5, under Diagnostic telegram with error code (page 5-18).

Please read the following sections, for the meaning of the error codes of the gateway and the I/O-modules.

4.8.1 Gateway Error codes

Table 4-6: gateway error codes

Value (dec.)	Diagnostics meaning for the gateway
Error codes (1 to 9 according to the standards)	
2	Undervoltage: Undervoltage channel 0: Undervoltage at U_{SYS} Channel 1: Undervoltage at U_L
Error codes (16 to 31 manufacturer specific)	
16	Parametrization error/ configuration error – **Station configuration changed** → The configuration is currently deviating from the reference list of modules. Process data can still be exchanged with the module bus stations which are at present connected to the module bus. The constellation of the module bus station that is set in the configuration software of the corresponding controller serves as a reference. **– Master configuration error** → **display**: Configuration error/ Parameterization error at **channel 1** → The actual list of modules has been altered in such a manner, that no process data can be exchanged with the module bus stations which are at present connected to the module bus. **– Station configuration error** → **display**: Configuration error/ Parameterization error at **channel 0** → The gateway could not prepare the station's configuration to be read out.
22	behavior at communication loss – **Module bus error** → Communication with the module bus station on the module bus is not possible.

4.8.2 Channel -specific error codes of the I/O-modules

The channel-specific diagnostic messages of the I/O-modules using error codes are defined as follows:

Table 4-7: channel-specific error codes

Value (dec.)	Diagnostics
Error codes (1 to 9 according to the standards)	
1	Short circuit
2	under voltage
4	overload
5	over temperature
6	wire break
7	overshoot upper limit
8	undershoot lower limit
9	error
Error codes (16 to 28 according to the standards)	
16	Parametrization error/ configuration error After a validity check, the parameter data are (partially) rejected by the module. Check the context of parameters. Check the context of parameters.
21	hardware failure The module detected a hardware failure. Exchange the module.
22	behavior at communication loss The module detected a communication problem at its ports, e. g. RS232/485/422, SSI or other interface. Check the connection or the function of the attached devices.
23	Direction error The direction is detected to be wrong. Check the parameterization or the control interface versus use case.
24	User software error The module detected an user application software error. Check the interoperability of the user application software revisions. Re-initialize user the application software of the module. Cold-junction compensation error Re-initialize user the application software of the module.
25	Cold-junction compensation error The module detected a defect or missing cold-junction compensation.
26	Overload sensor supply The module detected a load dump at the sensor supply.
28	Common error The module detected an error. Refer to the I/O-module manuals for a more detailed description of possible errors. Error types can depend on the operation mode and the parameterization.

Meaning of the error codes for the BL20 I/O-modules

The gateway changes the diagnostic messages sent by the BL20 I/O-modules to PROFINET error codes.

The following table shows, which module message will be changed to which error code.

Tabelle 5: Error codes / module diagnostics

PROFINET Error code		possible module diagnostics	
No. (dec.)	**Text**	**I/O module**	**diagnostic message of the module**
1	Short circuit	BL20-2AIH-I	Short circuit
		BL20-4DI-NAMUR	overcurrent
2	under voltage	BL20-BR-24VDC	**channel 0**: undervoltage at U_{SYS} **channel 1**: undervoltage at U_L
		BL20-PF-24VDC	**channel 1**: undervoltage at U_L
		BL20-E-1SWIRE	voltage U_{SW}, U_{SWERR}
		BL20-2RFID-x	transceiver voltage supply error
3	overvoltage	not sent	
4	overload	BL20-BR-24VDC-D	overcurrent
		BL20-PF-120/230VAC-D	
		BL20-xDO-24VDC-0.5A-×	
		BL20-E-1SWIRE	Overcurrent protective circuit-breaker, $PKZE_{RR}$
		BL20-2RFID-×	Ident-overcurrent (supply of transceiver is switched-off)
		BL20-4AI-U/I	short circuit (SC)
		BL20-E-8AI-U/I-4AI-PT/NI	
		BL20-2AI-PT/NI-2/3	
		BL20-E-2CNT-2PWM	short-circuit at channel CH2 = P1_DIAG CH4 = P2_DIAG CH3 = D1_DIAG CH5 = D2_DIAG
5	over temperature	not sent	

Tabelle 5: Error codes / module diagnostics

PROFINET Error code		possible module diagnostics	
No. (dec.)	**Text**	**I/O module**	**diagnostic message of the module**
6	open circuit	BL20-×AI-I(0/4...20MA)	open circuit
		BL20-2AI-PT/NI-2/3	
		BL20-2AI-THERMO-PI	
		BL20-2AIH-I	
		BL20-4AI-U/I	
		BL20-E-8AI-U/I-4AI-PT/NI	
		BL20-E-4AI-TC	
		BL20-2AOH-I	
		BL20-4DI-NAMUR	
7	overshoot upper limit	BL20-×AI-×	Measurement value range errot (OoR)
		BL20-2AI-PT/NI-2/3	
		BL20-2AI-THERMO-PI	
		BL20-E-4AI-TC	
		BL20-4AI-U/I	
		BL20-E-8AI-U/I-4AI-PT/NI	
		BL20-2AIH-I	overflow
		BL20-E-4AO-U/I	Measurement value range errot (OoR)
		BL20-2AOH-I	Value above upper limit
		BL20-1SSI	sensor value overflow
8	undershoot lower limit	BL20-×AI-×	Measurement value range errot (OoR)
		BL20-2AI-PT/NI-2/3	
		BL20-2AI-THERMO-PI	
		BL20-E-4AI-TC	
		BL20-4AI-U/I	
		BL20-E-8AI-U/I-4AI-PT/NI	
		BL20-2AIH-I	undervoltage
		BL20-E-4AO-U/I	Measurement value range errot (OoR)
		BL20-2AOH-I	value below lower limit
		BL20-1SSI	sensor value underflow

Tabelle 5: Error codes / module diagnostics

PROFINET Error code		possible module diagnostics	
No. (dec.)	**Text**	**I/O module**	**diagnostic message of the module**
9	error	BL20-E-8AI-U/I-4AI-PT/NI	overflow/ underflow OUFL
		BL20-E-4AO-U/I	
		BL20-2AOH-I	invalid value
16	parameterization error	BL20-E-1SWIRE	SPS SLAVE, RDYerr
		BL20-1RS×××	parameterization error
		BL20-1SSI	
		BL20-2RFID-×	invalid parameter
		BL20-E-2CNT-2PWM	parameter error at channel CH0 = CNT1_PAR _ERR CH1 = CNT2_PAR _ERR CH2 = PWM1_PAR _ERR CH4 = PWM2_PAR _ERR
21	hardware failure	BL20-E-8AI-U/I-4PT/NI	hardware error
		BL20-2AIH-I	
		BL20-E-4AI-TC	
		BL20-E-4AO-U/I	
		BL20-2AOH-I	
		BL20-2RFID-×	transceiver hardware error
		BL20-1RS×××	Hardware error
22	behavior at communication loss	BL20-2AIH-I	communication error error
		BL20-2AOH-I	
		BL20-E-1SWIRE	Communication SWIRE slave (SD_{ERR})
		BL20-2RFID-×	parameter not supported by transceiver
24	User software error	BL20-2AIH-I	invalid parameter
		BL20-2AO-H	
		BL20-2RFID-×	software error
25	Cold-junction compensation error	BL20-2AI-THERMO-PI	no Pt1000-sensor found
		BL20-E-4AI-TC	
27	unknown error	BL20-E-2CNT-2PWM	Hardware error

Tabelle 5: Error codes / module diagnostics

PROFINET Error code		possible module diagnostics	
No. (dec.)	**Text**	**I/O module**	**diagnostic message of the module**
28	Common error	BL20-2AIH-I	HART status error
		BL20-E-4AI-TC	Measurement value range error
		BL20-2AOH-I	HART status error
		BL20-E-1SWIRE	general error message, GEN_{ERR}
		BL20-1SSI	SSI group diagnostics
29	configuration error	BL20-E-1SWIRE	SWIRE MASTER (SW_{ERR}) TYPE ERROR ($TYPE_{ERR}$)

4.9 Parameterization

4.9.1 Gateway parameters

The BL20 gateways for PROFINET use 2 bytes of parameters.

Description of the gateway-parameters (gateway-version VN 01-00)

Table 4-1: gateway parameters (VN 01-00)

A *default setting*

Byte Parameter name	**Value**	**Meaning**
Byte 0		
bit 0 and bit 1: Outputs module sequence deviation		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules to "0" (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
10	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.
bit 2 and bit 3: Outputs module sequence error		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules to "0" (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".

Table 4-1: gateway parameters (VN 01-00)

A *default setting*

Byte Parameter name	**Value**	**Meaning**
10	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.
bit 4 and bit 5: Outputs fieldbus error		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules to "0" (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
11	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
Byte 1		
bit 1: diagnostics from modules		
0	activate **A**	Diagnostic messages and alarms are generated.
1	de activate	Diagnostic messages and alarms are not generated.

Table 4-1: gateway parameters (VN 01-00)

A *default setting*

Byte Parameter name	Value	Meaning
bit 2: Vo diagnostics		
0	activate **A**	A monitoring of the field supply V_O (from the gateway and the Power-Feeding modules) is activated. If this parameter is set but the parameter "Diagnostics from modules" (see bit 1) deactivated, then only the voltage supply at the gateway is monitored. The voltage supply with V_O at is not monitored at the power feeding modules.
1	de activate	An possible over- or undervoltage for V_O is not monitored.
bit 3: reserved		
bit4: I/O-ASSISTANT Force Mode		
0	release **A**	-
1	block	The I/O-ASSISTANT is not able to access the gateway using Force Mode.
bit 5: reserved		
bit 6 static configuration		
0	activate **A**	Changes in the station configuration are stored in the gateway following a power-on reset.
1	de activate	If the static configuration is deactivated, a dynamic configuration take-over is realized directly following station configuration changes (important for acyclic parameterization).
Bit 7: reserved		

Description of the gateway-parameters (gateway-version > VN 01-00)

Table 4-2: gateway parameters (> VN 01-00)

A *default setting*

Byte Parameter name	Value	Meaning
Byte 0		
bit 0 and bit 1: Output behaviour if one module is missing		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules to "0" (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
10	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.
bit 2 and bit 3: Output behaviour if one module is wrong		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules to "0" (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
10	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".

A *default setting*

Table 4-2: gateway parameters (> VN 01-00)

Byte Parameter name	**Value**	**Meaning**
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.
bit 4 and bit 5: Output behaviour at communication loss		
00	output 0 **A**	The gateway switches the outputs of modules to "0". No error information is transmitted. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules to "0" (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
11	hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to "0" or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to "0".
Byte 1		
bit 1: Disable all diagnosis		
0	deactivated **A**	Diagnostic messages and alarms are generated.
1	activated	Diagnostic messages and alarms are not generated.

Table 4-2: gateway parameters (> VN 01-00)

A *default setting*

Byte Parameter name	Value	Meaning
bit 2: Disable output power diagnosis		
0	deactivated **A**	A monitoring of the field supply V_O (from the gateway and the Power-Feeding modules) is activated. If this parameter is set but the parameter "Diagnostics from modules" (see bit 1) deactivated, then only the voltage supply at the gateway is monitored. The voltage supply with V_O at is not monitored at the power feeding modules.
1	activated	An possible over- or undervoltage for V_O is not monitored.
bit 3: reserved		
bit4: I/O-ASSISTANT Force Mode disabled		
0	deactivated **A**	-
1	activated	The I/O-ASSISTANT is not able to access the gateway using Force Mode.
bit 5: reserved		
bit 6 Startup also if configuration does not match		
0	deactivated **A**	Changes in the station configuration are stored in the gateway following a power-on reset.
1	activated	If the static configuration is deactivated, a dynamic configuration take-over is realized directly following station configuration changes (important for acyclic parameterization).
Bit 7: reserved		

4.9.2 Parameter "module parameterization"

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

Note

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

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

- **"module parameterization" activated**

  The module receives its parameter settings from the controller, IO-supervisor, I/O-ASSISTANT or similar.
  In this case, parameter changes which were done in the meantime for example by a configuration tool or similar will be overwritten with the valid parameter data set.

- **"module parameterization" deactivated**

  Changes in the parameter settings are ignored for the respective module. The stored parameter data will be used.

Note

If the "module parameterization" is activated and a module is replaced by a new one, the gateway has to be operated with active U_{SYS}, in order to keep the module's parameter-settings for the new module.

U_L has to be switched-off and the station has to be separated from the field bus. Now, the gateway sends the parameters defined for the old module, into the new module.

4.9.3 I/O-module parameters

Digital input modules

- BL20-4DI-NAMUR

Table 4-3: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value – Meaning
0 to 3	0	input filter x	0 = deactivate – (input filter 0,25 ms) **A** 1 = activate – (input filter 2,5 ms)
	1	digital input x	0 = normal **A** 1 = inverted
	2	Short circuit monitoring x	0 = deactivate **A** 1 = activate
	3	Short circuit diagnosis x	0 = deactivate **A** 1 = activate
	4	Open circuit monitoring x	0 = deactivate **A** 1 = activate
	5	Open circuit diagnosis x	0 = deactivate **A** 1 = activate
	6	Input on diagnostic x	output substitute value **A** 1 = keep last value
	7	Substitute value on diag x	0 = off **A** 1 = on

Analog Input Modules

- BL20-1AI-I(0/4...20MA)

Table 4-4: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0	0	current mode	0 = 0...20 mA **A**
			1 = 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	Diagnostics	0 = activate **A**
			1 = deactivate

- BL20-2AI-I(0/4...20MA) (1 byte per channel)

Table 4-5: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0/1	0	current mode	0 = 0...20 mA **A**
			1 = 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	Diagnostics	0 = activate **A**
			1 = deactivate
	3	Channel	0 = activate **A**
			1 = deactivate

- BL20-1AI-U(-10/0...+10VDC)

Table 4-6: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0	0	voltage mode	0 = 0...10 V **A**
			1 = -10...+10 V
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	Diagnostics	0 = activate A
			1 = deactivate

- BL20-2AI-U(-10/0...+10VDC) (1 byte per channel)

Table 4-7: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0/1	0	voltage mode	0 = 0...10 V **A**
			1 = -10...+10 V
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	Diagnostics	0 = activate **A**
			1 = deactivate
	3	Channel	0 = activate **A**
			1 = deactivate

- BL20-2AI-PT/NI-2/3 (2 byte per channel)

Table 4-8: Module parameters

A *default setting*

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

- BL20-2AI-THERMO-PI (2 byte parameters per channel)

Table 4-9: Module parameters

A *default setting*

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

- BL20-4AI-U/I (1 byte parameters per channel)

Table 4-10: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0 to 3	0	range	0 = 0...10 V/ 0...20 mA **A**
			1 = -10...+10 V/ 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	Diagnostics	0 = release **A**
			1 = block
	3	Channel	0 = activate **A**
			1 = deactivate
	4	Operation mode	0 = voltage **A**
			1 = current

- BL20-4AI-U/I (1 byte parameters per channel)

Table 4-11: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0 to 3	0	reserved	
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	Diagnostics	0 = release **A**
			1 = block
	3	Channel x	0 = activate **A**
			1 = deactivate
	4	Element Kx	0000 = Type K, -270...1370 °C**A** 0001 = Type B, +100....1820 °C 0010 = Type E, -270...1000 °C 0011 = Type J, -210...1200 °C 0100 = Type N, -270...1300 °C 0101 = Type R, -50...1760 °C 0110 = Type S, -50...1540 °C 0111 = Type T, -270...400 °C 1000 = ±50 mV 1001 = ±100 mV 1010 = ±500 mV 1011 = ±1000 mV 1100 = Type K, -454..2498 °F 1101 = Type J, -346...2192 °F 1110 = Type C 0... 2315 °C 1111 = Type G 0... 2315 °C

- BL20-2AIH-I

Table 4-12: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0 (channel 1)	0	Channel	0 = activate **A**
			1 = deactivate
	1	short circuit diagnostics	0 = block
			1 = release **A**
	2	open circuit diagnostics	0 = block
			1 = release **A**
	3 + 4	Operation mode	0 = 0...20 mA (polling of HART-status not possible)
			1 = 4...20 mA (polling of HART-status not possible)
			2 = 4…20 mA HART active **A** Cyclic polling of HART-status activated.
	5 + 6	reserved	
	7	HART-diagnostics	0 = release **A**
			1 = block
1 (channel 1)	0 + 1	value representation	0 = Integer (15 bit + sign) **A**
			1 = NE 43
			2 = Extended Range
2 + 3 (channel 2)		similar to byte 0 + 1	
4	HART-Variable VA		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)

Table 4-12: Module parameters

Byte	Bit	Parameter name	Value
5	HART-Variable B		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)
6	HART-variable C		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)
7	HART-variable D		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)

- BL20-E-8AI-U/I-4PT/Ni (1 byte per channel)

Table 4-13: Module parameters

Byte	Bit	Parameter name	Value	Meaning
0 to 7	0 to 5	Operation mode	000000	voltage -10...10 V DC Standard **A**
			000001	voltage 0...10 V DC Standard
			000010	voltage -10...10 V DC PA (NE 43)
			000011	voltage 0...10 V DC PA (NE 43)
			000100	voltage -10...10 VDC, Extended Range
			000101	voltage 0...10 VDC, Extended Range
			000110	reserved
			000111	reserved
			001000	current 0...20 mA Standard
			001001	current 4...20 mA Standard
			001010	current 0...20 mA, NE 43
			001011	current 4...20 mA, NE 43
			001100	current 0...20 mA, Extended Range
			001101	current 4...20 mA, Extended Range
			001110	reserved
			001111	reserved
			010000	Pt 100, -200°C...850 °C, 2-wire
			010001	Pt 100, -200°C...150 °C, 2-wire
			010010	Pt 200, -200°C...850 °C, 2-wire
			010011	Pt 200, -200°C...150 °C, 2-wire
			010100	Pt 500, -200°C...850 °C, 2-wire
			010101	Pt 500, -200°C...150 °C, 2-wire
			010110	Pt 1000, -200°C...850 °C, 2-wire
			010111	Pt 1000, -200°C...150 °C, 2-wire
			011000	Pt 100, -200°C...850 °C, 3-wire **B**
			011001	Pt 100, -200°C...150 °C, 3-wire **B**
			011010	Pt 200, -200°C...850 °C, 3-wire **B**
			011011	Pt 200, -200°C...150 °C, 3-wire **B**
			011100	Pt 500, -200°C...850 °C, 3-wire **B**
			011101	Pt 500, -200°C...150 °C, 3-wire **B**

A *default setting*

B *In 3-wire measurement, only the first of the used channel has too be parameterized. The parameterization of the second channel is ignored.*

Table 4-13: Module parameters

Byte	Bit	Parameter name	Value	Meaning
0 to 7	0 to 5	Operation mode	011110	Pt 1000, -200°C...850 °C, 3-wire **B**
			011111	Pt 1000, -200°C...150 °C, 3-wire **B**
			100000	Ni 100, -60 °C...250 °C, 2-wire
			100001	Ni 100, -60°C...150 °C, 2-wire
			100010	Ni 1000, -60 °C...250 °C, 2-wire
			100011	Ni 1000, -60°C...150 °C, 2-wire
			100100	Ni 1000TK5000, -60 °C...250 °C, 2-wire
			100101	reserved
			100110	reserved
			100111	reserved
			101000	Ni 100, -60 °C...250 °C, 3-wire
			101001	Ni 100, -60°C...150 °C, 3-wire
			101010	Ni 1000, -60 °C...250 °C, 3-wire
			101011	Ni 1000, -60°C...150 °C, 3-wire
			101100	Ni 1000TK5000, -60 °C...250 °C, 3-wire
			101101	reserved
			101110	reserved
			101111	reserved
			110000	resistance, 0...250 Ω
			110001	resistance, 0...400 Ω
			110010	resistance, 0...800 Ω
			110011	resistance, 0...2000 Ω
			110100	resistance, 0...4000 Ω
			110101 to 111110	reserved
			111111	deactivated
	6	value representation Kx	0	0 = Integer (15 bit + sign) **A**
			1	1 = 12 bit (left-justified)
	7	Diagnostics Kx	0	release **A**
			1	block

Analog output modules

- BL20-1AO-I(0/4...20MA)

Table 4-14: Module parameters

Byte	Bit	Parameter name	Value
0	0	current mode	0 = 0...20 mA **A**
			1 = 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2 to 7	reserved	
1		Substitute value low byte	
2		Substitute value high byte	

A *default setting*

- BL20-2AO-I(0/4...20MA) (3 byte per channel)

Table 4-15: Module parameters

Byte	Bit	Parameter name	Value
0/3	0	current mode	0 = 0...20 mA **A**
			1 = 4...20 mA
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	reserved	
	3	Channel	0 = activate **A**
			1 = deactivate
	4 to 7	reserved	
1/4		Substitute value low byte	
2/5		Substitute value high byte	

A *default setting*

- BL20-2AO-U(-10/0...+10VDC) (3 byte per channel)

Table 4-16: Module parameters

Byte	Bit	Parameter name	Value
0/3	0	voltage mode	0 = 0...10 V **A**
			1 = -10...+10 V
	1	value representation	0 = Integer (15 bit + sign) **A**
			1 = 12 bit (left-justified)
	2	reserved	
	3	Channel	0 = activate **A**
			1 = deactivate
	4 to 7	reserved	
1/4		Substitute value low byte	
2/5		Substitute value high byte	

A *default setting*

- BL20-2AOH-I

Table 4-17: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0 (channel 1)	0	Channel	0 = activate **A**
			1 = deactivate
	1	Diagnostics	0 = block **A**
			1 = release
	3 + 4	Operation mode Kx	0 = 0...20 mA (polling of HART-status not possible)
			1 = 4...20 mA (polling of HART-status not possible)
			2 = 4…20 mA HART active **A** (cyclic polling of HART-status activate)
	7	HART-diagnostics Kx	0 = release **A**
			1 = block
1 (channel 1)	0+1	value representation Kx	0 = Integer (15 bit + sign) **A**
			1 = NE 43
			2 = Extended Range
	6 + 7	Behavior on module bus error Ax	
2 +3 (channel 1)		substitute value Ax	
4 to 7 (channel 2)	similar to byte 0 to 3		
8	HART-Variable VA		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)

Table 4-17: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
9	HART-Variable B		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)
10	HART-variable C		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)
11	HART-variable D		Defines the channel of which the HART-variable is read.
	0	channel mapping	0 = channel 1
			1 = channel 2
	6 + 7	variable mapping	Defines which HART-variable of the connected sensor is mapped into the module's process data.
			0= PV (primary variable)
			1= SV (2nd variable)
			2 = TV (3rd variable)
			3 = QV (4th variable)

- BL20-E-4AO-U/I (3 byte parameters per channel)

Table 4-18: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value	Meaning
0/3/6/9	0 to 3	Operation mode Kx	000000	voltage -10...10 V DC Standard **A**
			000001	voltage 0...10 V DC Standard
			000010	voltage -10...10 V DC PA (NE 43)
			000011	voltage 0...10 V DC PA (NE 43)
			000100	voltage -10...10 VDC, Extended Range
			000101	voltage 0...10 VDC, Extended Range
			000110	reserved
			000111	reserved
			001000	current 0...20 mA Standard
			001001	current 4...20 mA Standard
			001010	current 0...20 mA, NE 43
			001011	current 4...20 mA, NE 43
			001100	current 0...20 mA, Extended Range
			001101	current 4...20 mA, Extended Range
			001110	reserved
			001111	deactivated
	4	value representation Kx	0	0 = Integer (15 bit + sign) **A**
			1	1 = 12 bit (left-justified)
	5	Diagnostics Kx	0	release **A**
			1	block
	6 + 7	substitute value options	00	output substitute value
			01	hold current value
			10	output min. value
			11	output max. value
1/4/7/10		substitute value low byte Ax		
2/5/8/11		substitute value Ax high byte		

Technology modules

- BL20-1RS232

Table 4-19: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0	3 to 0	Data rate	0000 = 300 bps 0001 = 600 bps 0010 = 1200 bps 0100 = 2400 bps 0101 = 4800 bps 0110 = 9600 bps **A** 0111 = 14400 bps 1000 = 19200 bps 1001 = 28800 bps 1010 = 38400 bps 1011 = 57600 bps 1100 = 115200 bps ... reserved
	5 + 4	reserved	
	6	DisableReducedCtrl	Constant setting: The diagnostic messages are shown in Byte 6 of the process input data (independently from “Diagnosis"). Byte 6 of the process output data contains 2 bits, with which the receive or transmit buffer can be cleared. Byte 7 contains the status or control byte. User data are represented in Bytes 0 - 5.
0	7	Diagnostics	0 = release **A** – Diagnostic activated: This affects the separate fieldbus-specific diagnostic message – not the diagnosis embedded in the process input data.
			1 = block

Table 4-19: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
1	0	Stop bits	0 = 1 bit **A**
			1 = 2 bit
	2 + 1	Parity	00 = none
			01 = odd **A** – The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is odd.
			10 = even – The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is even.
	3	Data bits	0 = 7 **A** – The number of data bits is 7.
			1 + 8 – The number of data bits is 8.
1	4 to 5	Flow control	00 = none **A** – Data flow control is switched off. 01 = XON/XOFF – Software handshake (XON/XOFF) is switched on. 10 = RTS/CTS – Hardware handshake (RTS/CTS) is switched on.
	7 + 6	reserved	
2		XON character	0 – 255 (17 **A**) XON character This character is used to start the transmission of data from the data terminal device if the software handshake is active.
3		XOFF character	0 – 255 (19 **A**) XOFF character This character is used to stop the transmission of data from the data terminal device if the software handshake is active.

- BL20-1RS485/422

Table 4-20: Module parameters

A *default setting*

Byte	Bit	Parameter name	Value
0	3 to 0	Data rate	0000 = 300 bps 0001 = 600 bps 0010 = 1200 bps 0100 = 2400 bps 0101 = 4800 bps 0110 = 9600 bps **A** 0111 = 14400 bps 1000 = 19200 bps 1001 = 28800 bps 1010 = 38400 bps 1011 = 57600 bps 1100 = 115200 bps ... reserved
	4	Select RS485	0 = parameterization of the module as RS422
			1 = parameterization of the module as RS485
	5	reserved	
	6	DisableReducedCtrl	Constant setting: The diagnostic messages are shown in Byte 6 of the process input data (independently from “Diagnosis"). Byte 6 of the process output data contains 2 bits, with which the receive or transmit buffer can be cleared. Byte 7 contains the status or control byte. User data are represented in Bytes 0 - 5.
0	7	Diagnostics	0 = release **A**
			1 = block
1	0	Stop bits	0 = 1 bit **A**
			1 = 2 bit
	2 + 1	Parity	00 = none
			01 = odd **A** The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is odd.
			10 = even The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is even.
	3	Data bits	0 = 7 **A** The number of data bits is 7.
			0 = 8 **A** The number of data bits is 8.

Table 4-20: Module parameters	Byte	Bit	Parameter name	Value
	2		XON character	0 – 255 (17 **A**) only in the RS422-mode: XON character This character is used to start the transmission of data from the data terminal device if the software handshake is active.
	3		XOFF character	0 – 255 (19 **A**) only in the RS422-mode: XOFF character: This character is used to stop the transmission of data from the data terminal device if the software handshake is active.

- BL20-1SSI

Table 4-21: Module parameters	Byte	Bit	Parameter name	Value **– Meaning**
A *default setting*	0	4 to 0	reserved	
		5	Sensor idle data cable test	0 = activate **A** ZERO test of data cable.
				1 = deactivate After the last valid bit, a ZERO test of the data cable is not carried out.
		7 + 6	reserved	
	1	3 to 0	Number of invalid bits (LSB)	0000 to 1111 Number of invalid bits on the LSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: SSI_FRAME_LEN -INVALID_BITS_MSB-INVALID_BITS_LSB. The invalid bits on the LSB side are removed by shifting the position value to the right, starting with the LSB. (Default 0 bit = 0×0). INVALID_BITS_MSB +INVALID_BITS_LSB must always be less than SSI_FRAME_LEN.

Table 4-21: Module parameters

Byte	Bit	Parameter name	Value – Meaning
1	6 to 4	Number of invalid bits (MSB)	000 to 111 Number of invalid bits on the LSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: SSI_FRAME_LEN - INVALID_BITS_MSB - INVALID_BITS_LSB. Number of invalid bits on the MSB side of the position value supplied by the SSI encoder. INVALID_BITS_MSB +INVALID_BITS_LSB must always be less than SSI_FRAME_LEN. Default: 0 = 0hex
	7	reserved	
2	3 to 0	Data rate	0000 = 1000000 bps 0001 = 500000 bps **A** 0010 = 250000 bps 0011 = 125000 bps 0100 = 100000 bps 0101 = 83000 bps 0110 = 71000 bps 0111 = 62500 bps ... reserved
	7 to 4	reserved	
3	5 to 0	Number of data frame bits	00000 to 100000 Number of bits of the SSI data frame. SSI_FRAME_LEN must always be greater than INVALID_BITS. Default: 25 = 19hex
	6	reserved	
	7	Data type	binary coded **A** SSI encoder sends data in binary code
			GRAY coded SSI encoder sends data in GRAY code

A *default setting*

- BL20-E-1SWIRE

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	reserved	free	free	MC	MNA	configuration	Disable Cfg	free
Byte 2	free	U_{AUXERR}	TYP_{ERR}	TYP_{INFO}	PKZ_{ERR}	PKZ_{INFO}	SD_{ERR}	SD_{INFO}
Byte 3	reserved							
Byte 4	reserved (life guarding time until version VN 01-03)							
Byte 5	$SC_{DIAG}S8$	$SC_{DIAG}S7$	$SC_{DIAG}S6$	$SC_{DIAG}S5$	$SC_{DIAG}S4$	$SC_{DIAG}S3$	$SC_{DIAG}S2$	$SC_{DIAG}S1$
Byte 6	$SC_{DIAG}S16$	$SC_{DIAG}S15$	$SC_{DIAG}S14$	$SC_{DIAG}S13$	$SC_{DIAG}S12$	$SC_{DIAG}S11$	$SC_{DIAG}S10$	$SC_{DIAG}S9$
Byte 7	reserved							
Byte 8	reserved							
Byte 9 - 24	Type designation slave 1 - 16							

The following table shows the meaning of the parameter bits:

Table 4-22: Module parameters

Parameter name	Value	
Byte 1		
Disable Cfg	If the physical structure of the SWIRE bus does not match the configuration stored in the BL20-E-1SWIRE on power up (SW LED flashing), the physical structure of the SWIRE bus must be stored in the BL20-E-1SWIRE.	
	0 = inactive **A**	Manual SWIRE configuration: To store the physical structure of the SWIRE bus in the BL20-E-1SWIRE, the CFG button of the BL20-E-1SWIRE must be pressed manually (only functions if the SW LED is flashing).
	1 = active	Automatic SWIRE configuration: If the physical structure of the SWIRE bus does not match the configuration stored in the BL20-E-1SWIRE on power up, the physical structure is stored automatically in the BL20-E-1SWIRE.
configuration	PLC configuration check If the PLC configuration check is activated, the configuration stored in the BL20-E-1SWIRE is compared with the SET configuration stored in the PLC.	
	0 = active **A**	The configuration stored in BL20-E-1SWIRE is compared with the SET configuration stored in the PLC. Only SWIRE slaves in the SWIRE bus are accepted that have a device ID completely matching the SET configuration..
	1 = inactive	All slaves are mapped in 4Bit INPUT/ 4Bit OUTPUT without checking the device ID.

A *default setting*

Table 4-22: Module parameters

Parameter name	Value	
Byte 1		
MNA active/ passive	Configuration check Bus or slave-oriented configuration check (without function if MC = 1)	
	0 = Bus based **A**	If the PLC configuration check is activated, data exchange is only started if the configuration stored in the BL20-E-1SWIRE fully matches the SET configuration stored in the PLC. Modifying the bus during operation causes the system to be aborted.
	1 = Slave based	If the PLC configuration check is activated, data exchange is started with all SWIRE slaves that match the SET configuration stored in the PLC. The SWIRE slaves that do not match the SET configuration stored in the PLC do not perform any data exchange.
MC	Moeller conformance (from version VN 01-04) Behavior of the BL20-E-1SWIRE in accordance with SWIRE Conformance criteria.	
	inactive **A**	Default behavior
	active	The BL20-E-1SWIRE master responds according to the Moeller SWIRE Conformance criteria (see manual for the IO-modules D300717).
SD_{INFO}	Slave error field Activate slave diagnostics info field $SD_{ERR}Sx$. As soon as a slave on the bus clears its PKZ bit, this is indicated as an individual error depending on the parameter setting.	
	active	Single diagnostics is activated
	inactive	Single diagnostics is not activated
Byte 2		
SD_{ERR}	Group error - slave error Activate slave diagnostics $SD_{ERR}Sx$. Activate slave diagnostics SDERRSx. As soon as only one slave on the bus sets its error bit, this is indicated as a group error depending on the parameter setting.	
	0 = active **A**	Group diagnostics is activated
	1 = inactive	Group diagnostics is not activated
PKZ_{INFO}	PKZ error field Activate slave diagnostics info field $PKZ_{ERR}Sx$. As soon as a slave on the bus clears its PKZ bit, this is indicated as an individual error depending on the parameter setting.	
	0 = active **A**	Single diagnostics is activated
	1 = inactive	Single diagnostics is not activated

Table 4-22: Module parameters

Parameter name	Value	
Byte 2		
PKZ_{ERR}	Group PKZ error field Activate slave diagnostics PKZ_{ERR}. As soon as a slave on the bus clears its PKZ bit, this is indicated as an individual error depending on the parameter setting.	
	0 = active **A**	Group diagnostics is activated
	1 = inactive	Group diagnostics is not activated
TYP_{INFO}	Configuration error field As soon as a slave on the bus does not match the set configuration and therefore cannot be started, this is indicated as an individual error depending on the parameter set.	
	0 = active **A**	Single diagnostics is activated
	1 = inactive	Single diagnostics is not activated
TYP_{ERR}	Group configuration error field Activate slave diagnostics TYP_{ERR}Sx. As soon as only one slave on the bus is incorrectly configured, this is indicated as an error depending on the parameter setting.	
	0 = active **A**	Group diagnostics is activated
	1 = inactive	Group diagnostics is not activated
U_{AUXERR}	Error message Voltage U_{AUX} Activate system diagnostics U_{AUXERR}. U_{AUXERR} will generate an error message as soon as the power supply goes below a level at which the function of the relays is not guaranteed.	
	0 = active **A**	Error message U_{AUXERR} activated
	1 = inactive	Error message U_{AUXERR} not activated
Byte 3	reserved	
Byte 4		
reserved (Lifeguarding time only up to version VN01-03)	Was up to version VN 01-03: Lifeguarding time of the SWIRE slaves. Lifeguarding time of the SWIRE slaves	
	0x02-0xFF 0x64 **A**	Lifeguarding time of the SWIRE slaves Setting of lifeguarding time of SWIRE slaves, timeout time up to automatic reset of the slaves in the event of communication failure. (n * 10ms) (Default 1s) 0xFF: 0xFF: Lifeguarding off
Byte 5 - +6		
SD_{DIAG}Sx	Input bit communication error, slave x Slave diagnostics message from Byte 1 / Bit 7 is accepted in the feedback interface as Bit 4	
	0 = active **A**	SD_{DIAG}Sx is accepted
	1 = inactive	SD_{DIAG}Sx is not accepted

Table 4-22: Module parameters

Parameter name	Value	
Byte 7 + 8:	reserved	
Byte 9 to 24		
Device ID, slave x	TYPE setting for the LIN slave at position x on the SWIRE bus	
	0x20	SWIRE-DIL-MTB (: 0xFF)
	0xFF	Basic setting (no slave)

- BL20-E-2CNT-2PWM (see separate manual for the module, D301224, „BL20 – I/O-MODULES BL20-E-2CNT-2PWM“, chapter 2)
- BL20-2RFID-S/ -A (see RFID-documentation www.turck.de)

4.10 Description of user data for acyclic services

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

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

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

4.10.1 Description of the acyclic gateway user data

Table 4-23: Gateway Application Instance

Index (dec.)	Name	Data type	r/w	Comment
1	Gateway parameters	WORD	r/w	Parameter data of the module
2	gateway Designation	STRING	r	Product name of the gateway
3	Gateway revision	STRING	r	Firmware-revision of the gateway
4	Vendor-ID	WORD	r	Ident number for TURCK
5	Gateway-Name	STRING	r	Name assigned to the gateway
6	Gateway type	STRING	r	Device type of the gateway
7	Device-ID	WORD	r	Ident number of the gateway
8 to 23	reserved			
24	Gateway diagnosis	WORD	r	Diagnosis data of the gateway
25 to 31	reserved			
32	Module input list	Array of BYTE	r	List of all input channels in the station
33	Module output list	Array of BYTE	r	List of all output channels in the station
34	Module diag. list	Array of BYTE	r	List of all module diagnosis messages
35 0×23	Module parameter list	Array of BYTE	r	List of all module parameters
36 to 45039	reserved			
45040	I&M0-functions		r	Identification & Maintenance - services

Table 4-23: Gateway Application Instance

Index (dec.)	Name	Data type	r/w	Comment
45041 to 45055	I&M1 to IM15			Actually not supported

4.10.2 Description of the acyclic module user data

Table 4-24: Module user data

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

5 Connection of the PROFINET gateway to a Siemens PLC S7

5.1 Application example

5.1.1 General

In order to configure the connection of a BL20-gateway for PROFINET BL20-E-GW-PN to a Siemens PLC S7, the software package "SIMATIC Manager" version 5.5 from Siemens is used.

5.1.2 Example network

- Siemens PLC S7, CPU 315-2 PN/DP, 6ES7 315-2EH14-0AB0, V3.2
  IP-address 192.168.144.112
- Siemens switch, 4-port (2 RJ45, 2 LWL)
  - Device name: SCALANCE-X202-2P IRT
  - IP address: 192.168.144.166
- ET200S, IM-151-3 PN
  - Device name: ET200-S
  - IP address: 192.168.144.188
- BL20-E-GW-PN
  Gateway for connecting PROFINET to the BL20 example station (see Table 5-1: Example station).
  - Device name: not assigned, yet
  - IP-address: not assigned, yet

Table 5-1: Example station

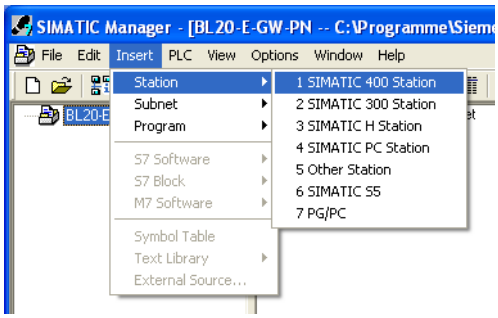
Module		Data width	
		Process input	Process output
GW	BL20-E-GW-PN		
1	BL20-2DI-24VDC-P	2 Bit	-
2	BL20-4DI-24VDC-P	4 Bit	-
3	BL20-16DI-24VDC-P	2 Byte	-
4	BL20-2AI-I(0/4...20MA)	4 Byte	-
5	BL20-2AI-U(-10/0...+10VDC)	4 Byte	-

5.1.3 New project in the Simatic Manager

1 Create a new project in the Simatic Manager using the "File →New"-command

2 Add a Simatic station to the project using the "Insert → station..."-command. In this example a "Simatic 300 station" is used.

Figure 5-1: Selecting a Simatic station



The configuration of the PROFINET-network is then done in the software's hardware configuration

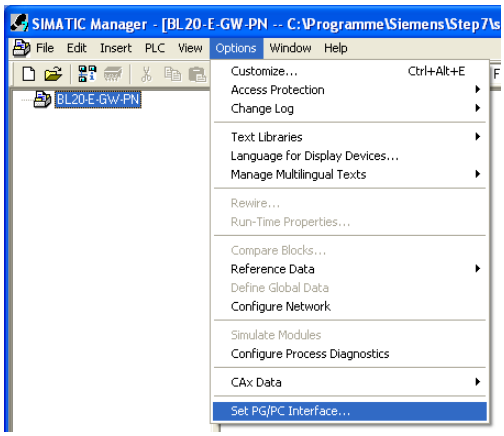
5.1.4 Setting the PG/PC-interface

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

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

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

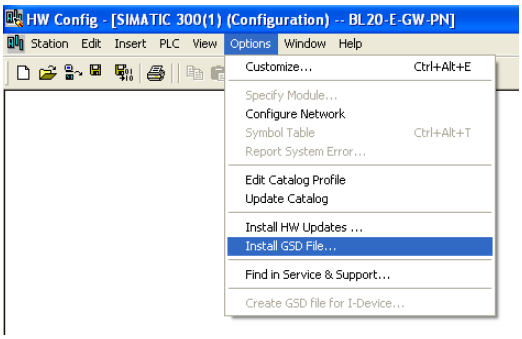
Figure 5-2: Command "Set PG/PC Interface..."



5.1.5 Installation of the GSDML-files

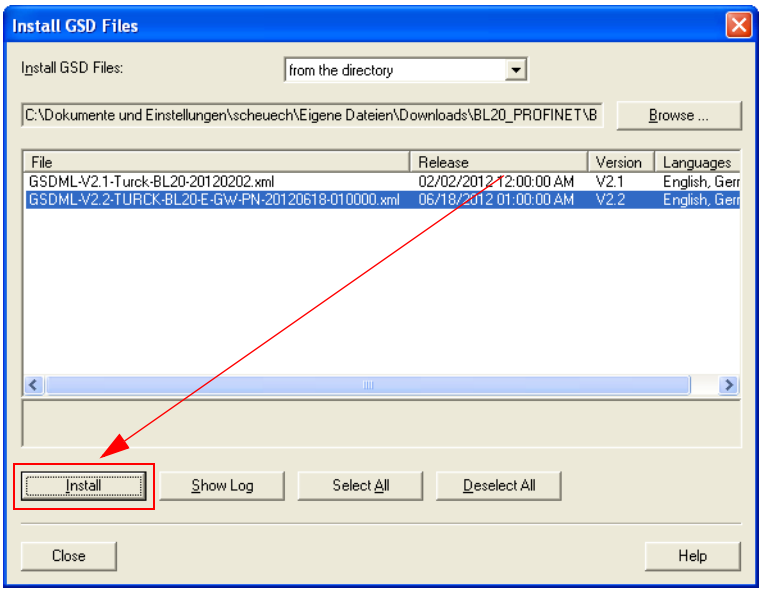
1 In the hardware configuration "HW config", open the "Options→ Install GSD file" command in order to install new GSD-files.

Figure 5-3: Install GSD files



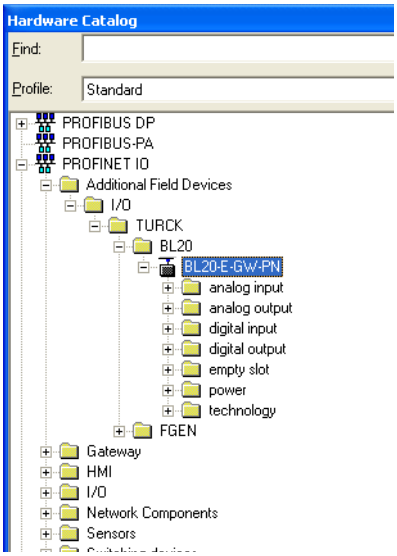
2 Define the directory for the TURCK GSDML-files by browsing the directories and add the BL20 PROFINET gateway to the hardware catalog.

Figure 5-4: Install GSD files



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

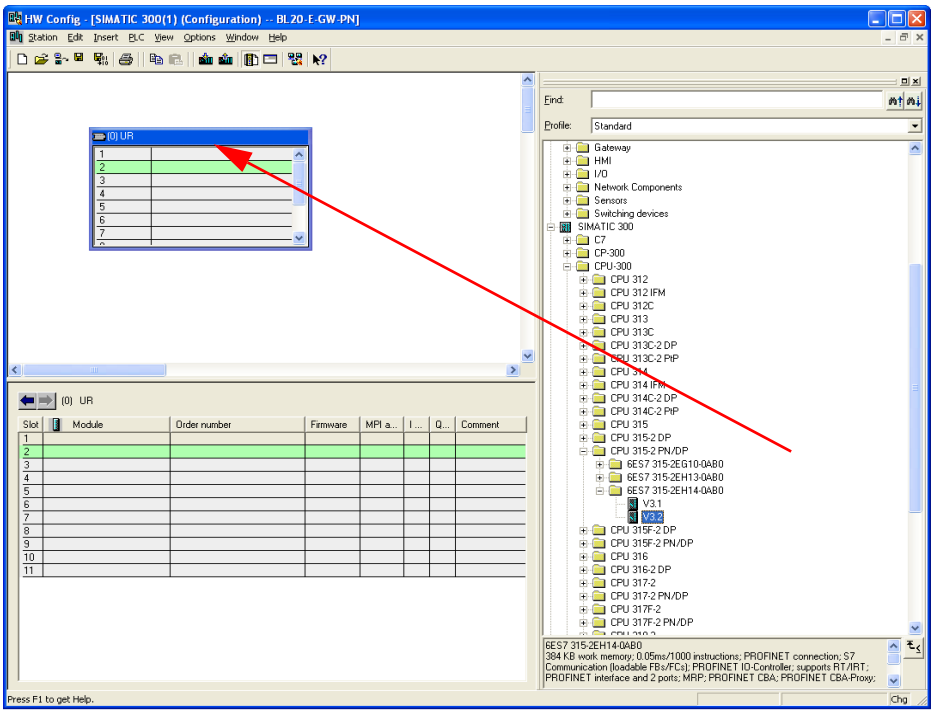
Figure 5-5: BL20 gateway in the hardware catalog



3 Chose the profile rack "RACK-300" for the Siemens CPU from the catalog and add it to the network window.

4 After this, select the Siemens CPU from the hardware catalog. In this example a CPU 315-2 PN/DP, version 6ES7 315-2EH14-0AB0 (V 3.2). is used.

Figure 5-6: Selecting the CPU



5 In the dialog "Properties Ethernet Interface", define the IP address and the subnet mask for the S7 CPU and add the subnet using the "New..." button.

Figure 5-7: Properties Ethernet interface

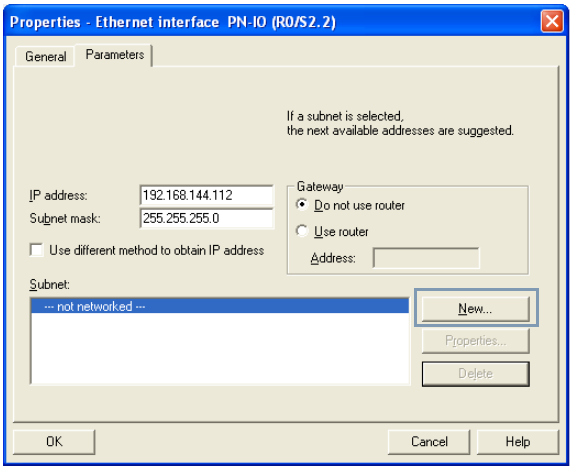
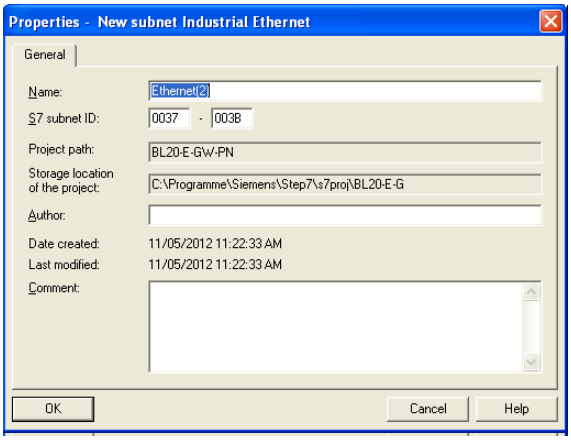


Figure 5-8: Add new Ethernet subnet

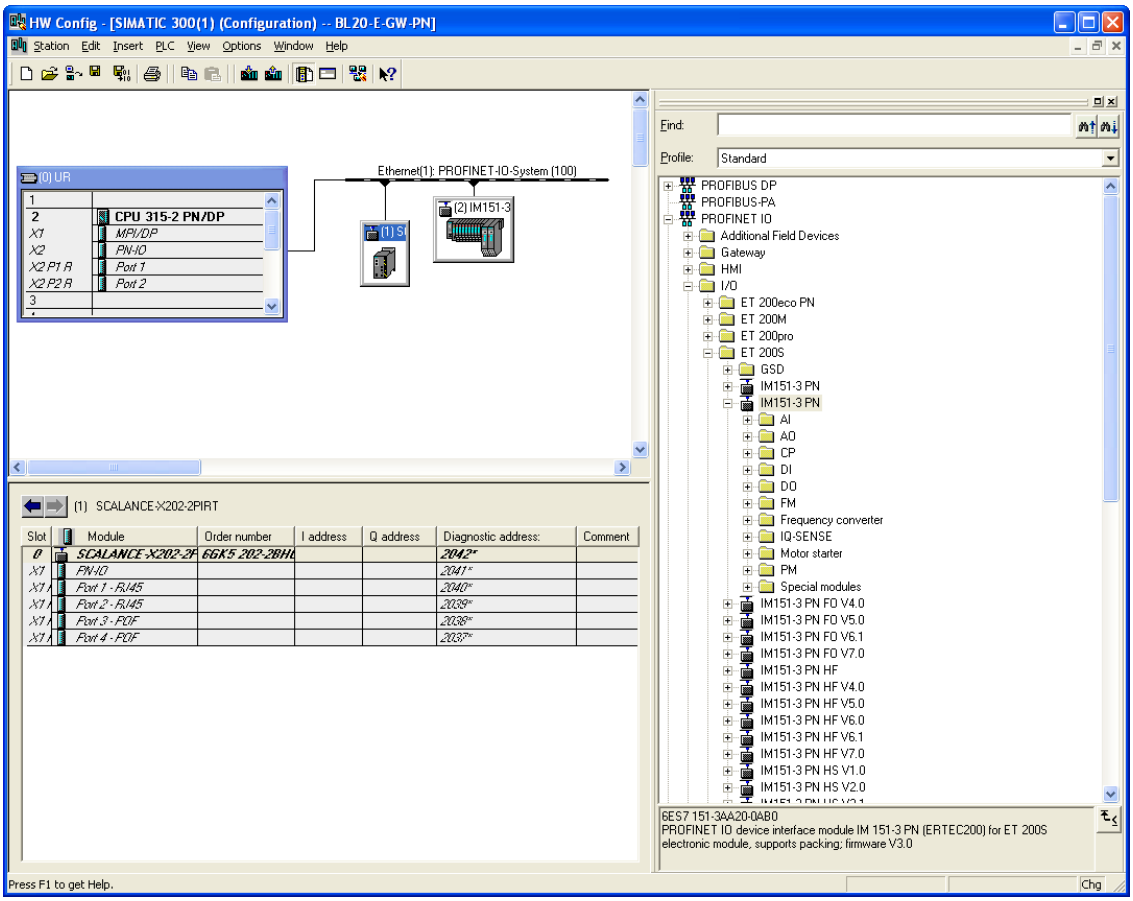


5.1.6 Adding PROFINET network nodes

The nodes of the example network (see page 5-2) are added to the PROFINET as follows:

- Siemens-switch
  - Device name: SCALANCE-X202-2P
  - IP address: 192.168.144.166
- ET200S
  - Device name: ET200-S
  - IP address: 192.168.144.188

Figure 5-9: Add network node



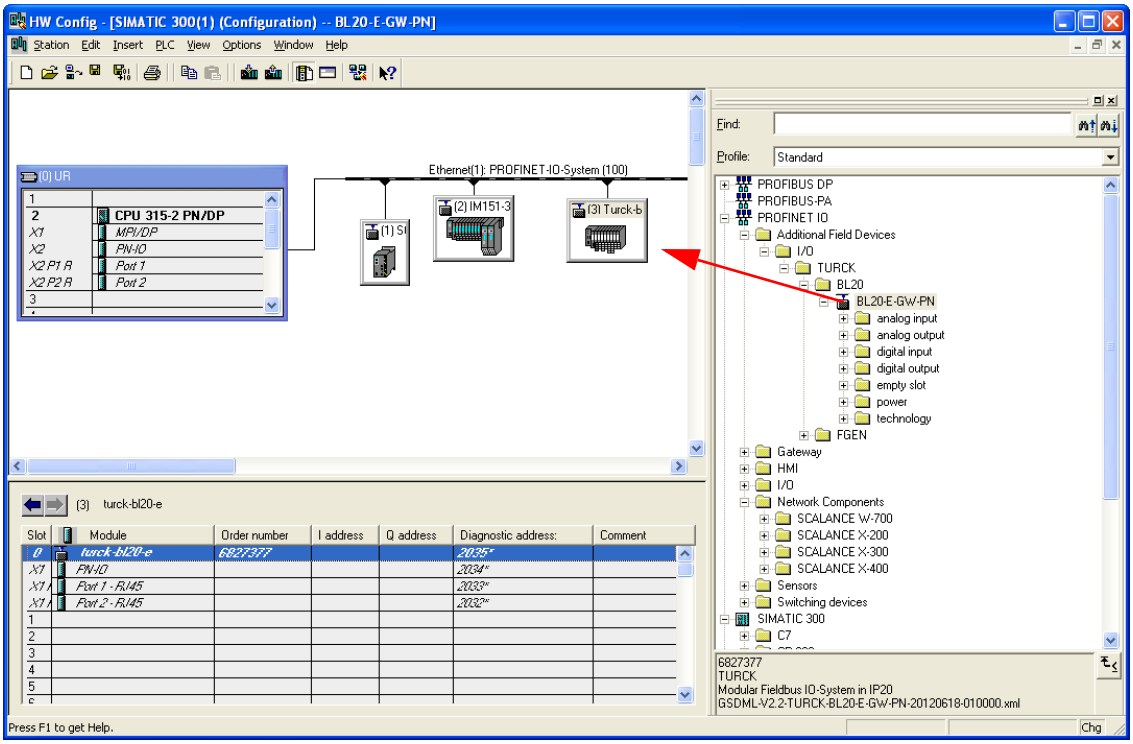
Add BL20 gateway

Now, the BL20-gateway is selected from the Hardware Catalog and added to the configuration

- BL20-E-GW-PN,
  - Device name: not assigned, yet
  - IP-address: not assigned, yet

1 Select the gateway under "PROFINET IO → Additional Field Devices→ I/O → TURCK → BL20" and add it to the Ethernet-network.

Figure 5-10: Select BL20 gateway



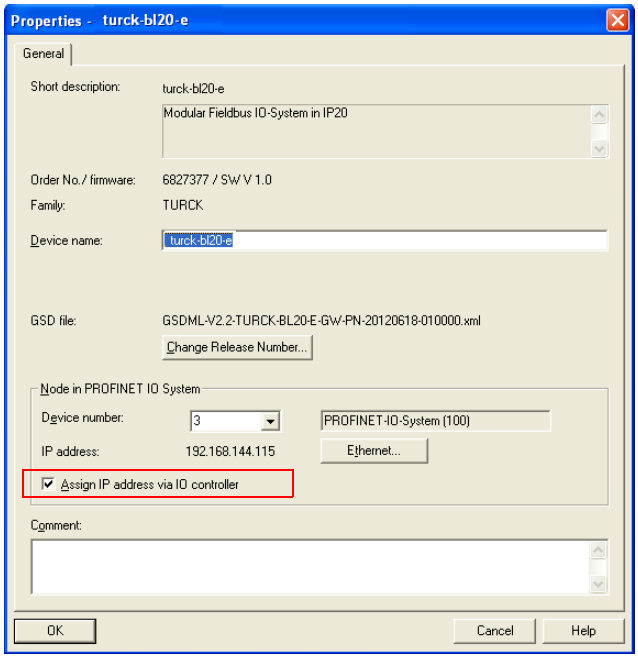
2 A double-click on the gateway-symbol opens the dialog "Properties TURCK".

3 Enter the gateway's device name in this dialog.

Note

When being operated for the first time, the default-device name of the TURCK BL20 gateways for PROFINET is "turck -bl20-e".

Figure 5-11: Dialog: Properties TURCK



Note

In PROFINET, the connected device is not identified by it's IP address, but recognized and addressed by it's device name.
The selection of a device name for a special IO device can thus be compared to the setting of the PROFIBUS address for a DP slave.

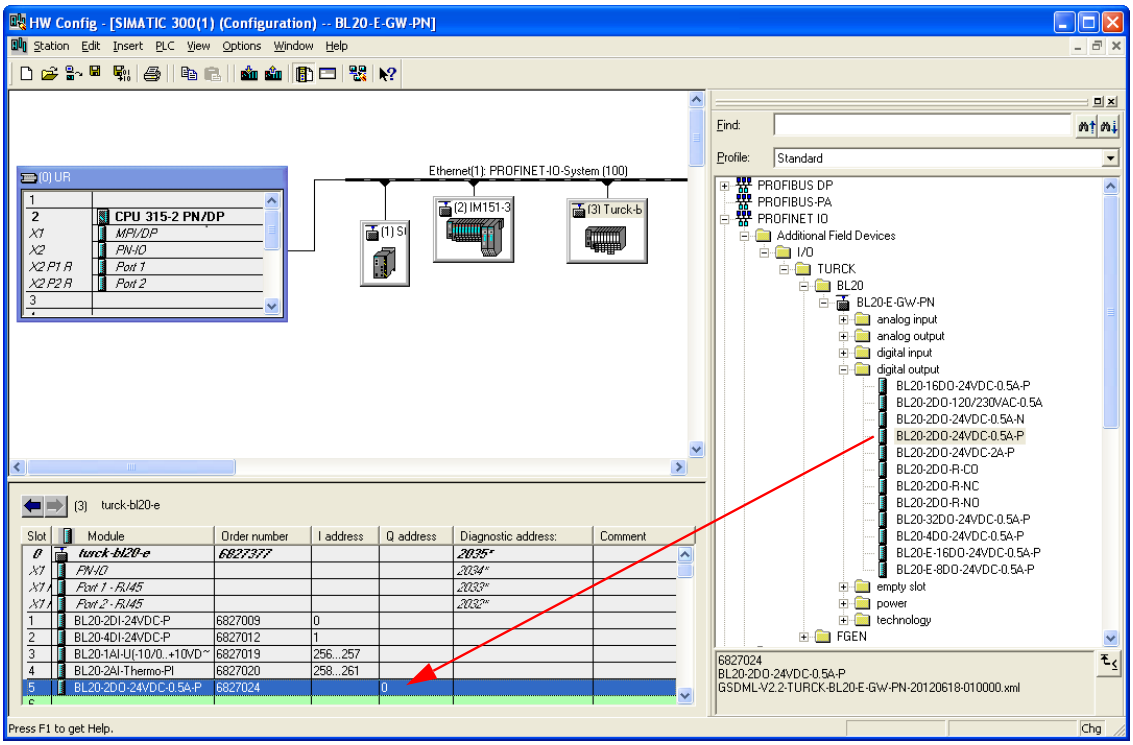
Note

When storing the device name or the IP address or when resetting the gateway to the default values, the GW-LED switches to orange. During this time, the gateway's voltage supply must not be interrupted. In case of a power failure, faulty data will be stored in the gateway.

Configuring the BL20-station

After the assignment of the device name, the I/O modules, which are connected to the BL20 gateway, are added to the station. They have to be selected from the Hardware Catalog in the same order as they appear physically in the station.

Figure 5-12: Add I/O-modules to the station Add a station



1 Save your hardware configuration via "Station → Save and Compile"

2 and download it to the PLC via "PLC → Download..." command.

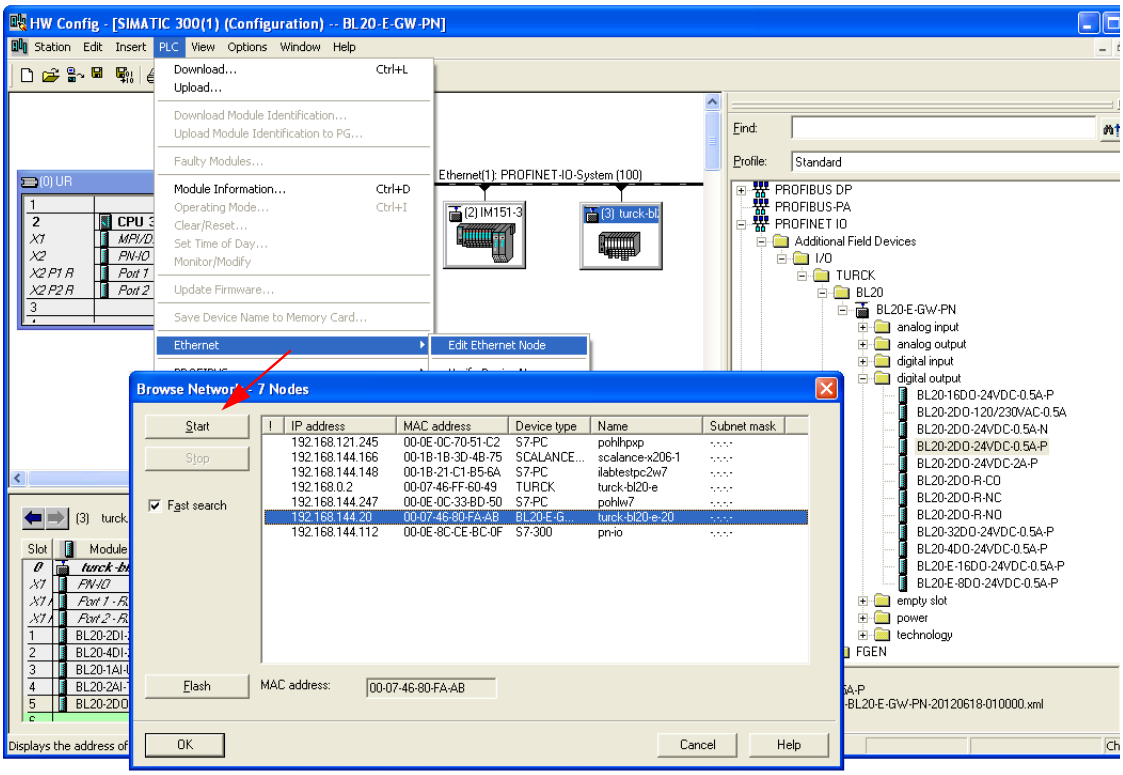
The hardware configuration is completed.

5.1.7 Scanning the network for PROFINET nodes

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

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

Figure 5-13: Configure Ethernet node



2 Browse the network for active network nodes identified by means of their MAC address, by using the button "Browse" in the field "Ethernet node".
All PROFINET nodes found in the network answer the command sending their MAC address and their device name.

3 Select a node and close the dialog with "OK".
The features of the selected node are now shown in the in the dialog "Edit Ethernet Node".

Device name assignment BL20-gateway

If necessary, the deivce name can now be changed to the needs of the application.

In this example, the following properties are assigned to the BL20-gateway:

- Device name: turck-bl20-e-20

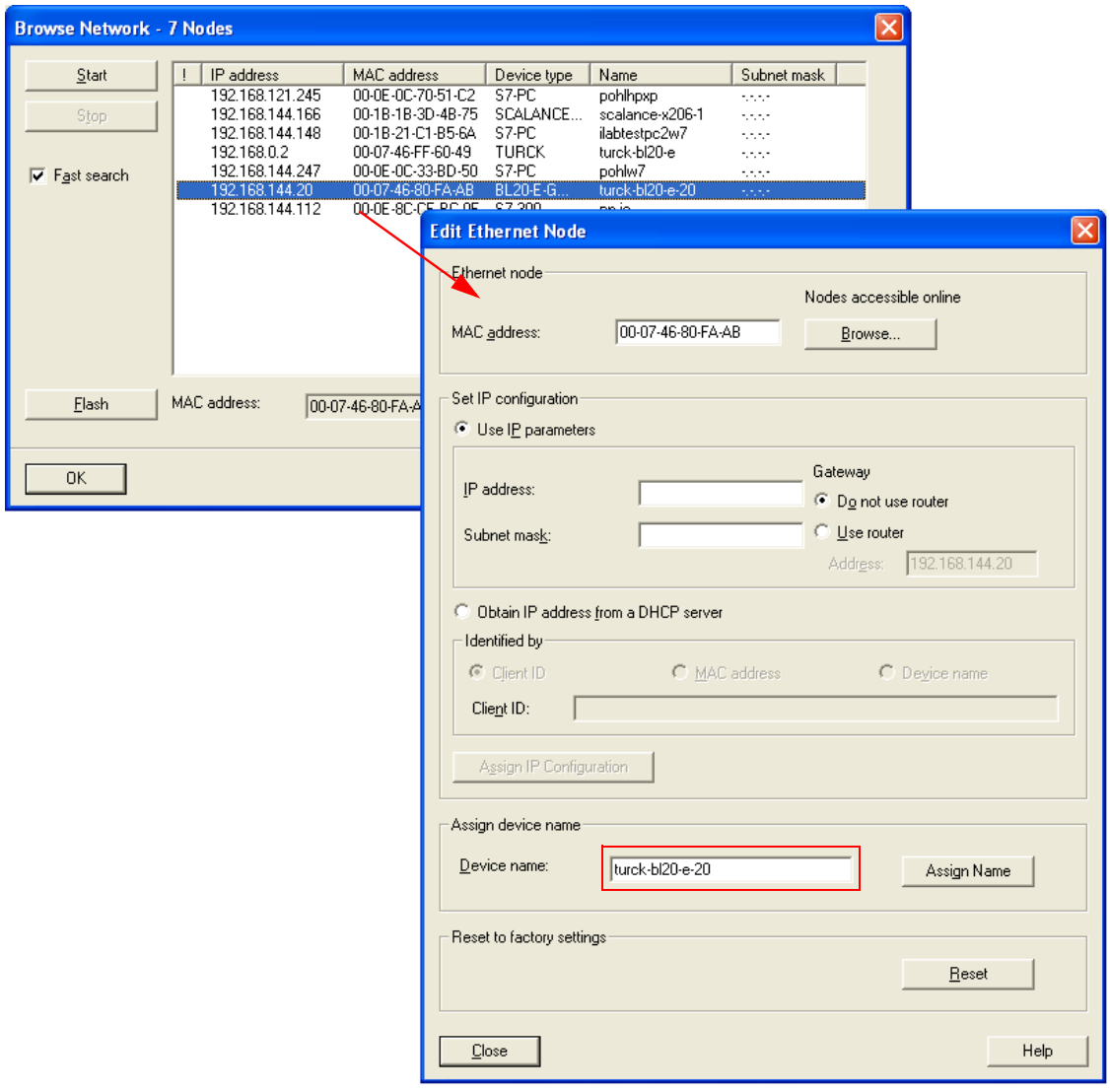


Figure 5-14: Adaptation of the Ethernet node configuration

Note

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

Please observe, that the device name assigned here has to be similar to the device name assigned to the node in the properties dialog box (see Figure 5-11: Dialog: Properties TURCK).

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

5.1.8 PROFINET neighborhood detection via LLDP

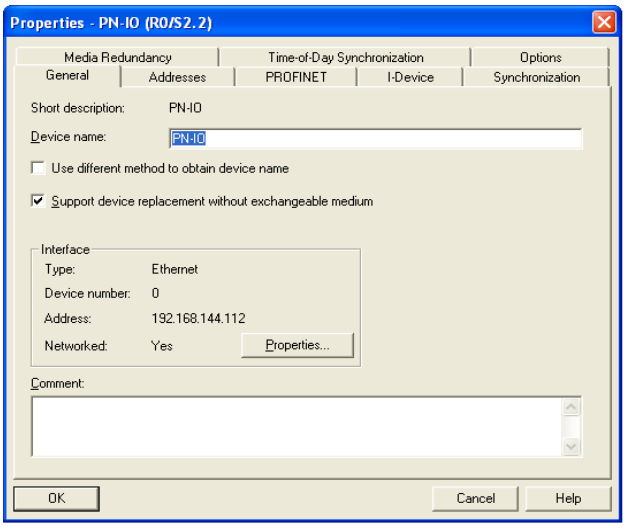
The BL20-gateways support the LLDP protocol (Link Layer Discovery Protocol) see also page 3-3.

Due to the neighborhood detection, there is no previous PROFINET name assignment (see Device name assignment BL20-gateway (page 5-12) is necessary for a new device of the same type and with an identical process data width in case of a device exchange. The device name and the IP-address will be assigned to the new device by the neighbor-device configured before (see Configuring the neighborhood detection (page 5-14)).

Necessary setting of the PROFINET-controller

The neighborhood detection without using a PC or removable media can only be executed if the function "Support device replacement without exchangeable medium" is activated within the properties of the PROFINET-controller.

Figure 5-15: Settings of the PROFINET-controller



In case of a device exchange, a new device thus not receives the device name from the removable medium or the PG but from the IO-controller.

The device name is assigned by means of the devices' port interconnections configured in the topology definition.

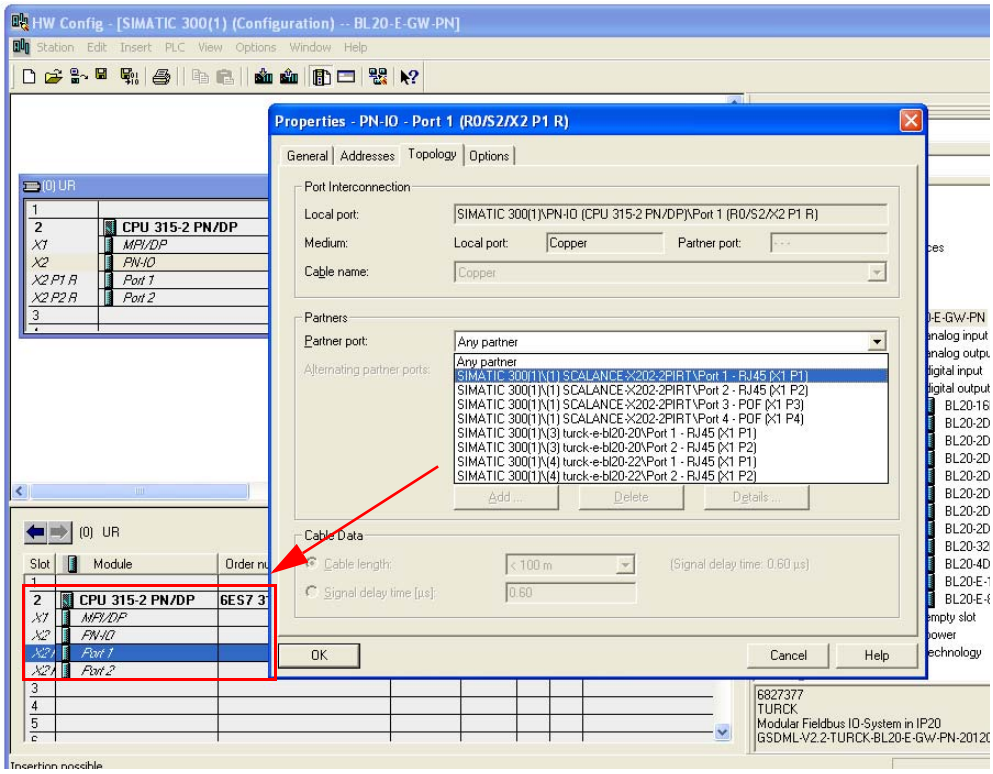
Configuring the neighborhood detection

A neighbor-port can be assigned to each Ethernet-port of a device. In case of a device exchange, this port is then used to assign the IP-address and the device name to the new device.

The definition of the partner-port is done either in the properties of the devices' Ethernet-ports or directly in the PROFINET Topology Editor (seepage 5-15).

- Partner-port definition via port-configuration.
  Selection of the port at the neighboring device to which this port is physically connected.

Figure 5-16: Partner-port definition (Example)



- Neighborhood-assignment using the Topology Editor.
  The assignment of neighboring devices is done either in the tabular or the graphical view.
  The copper ports of the devices are shown in green, the fiber-optic-ports in orange.

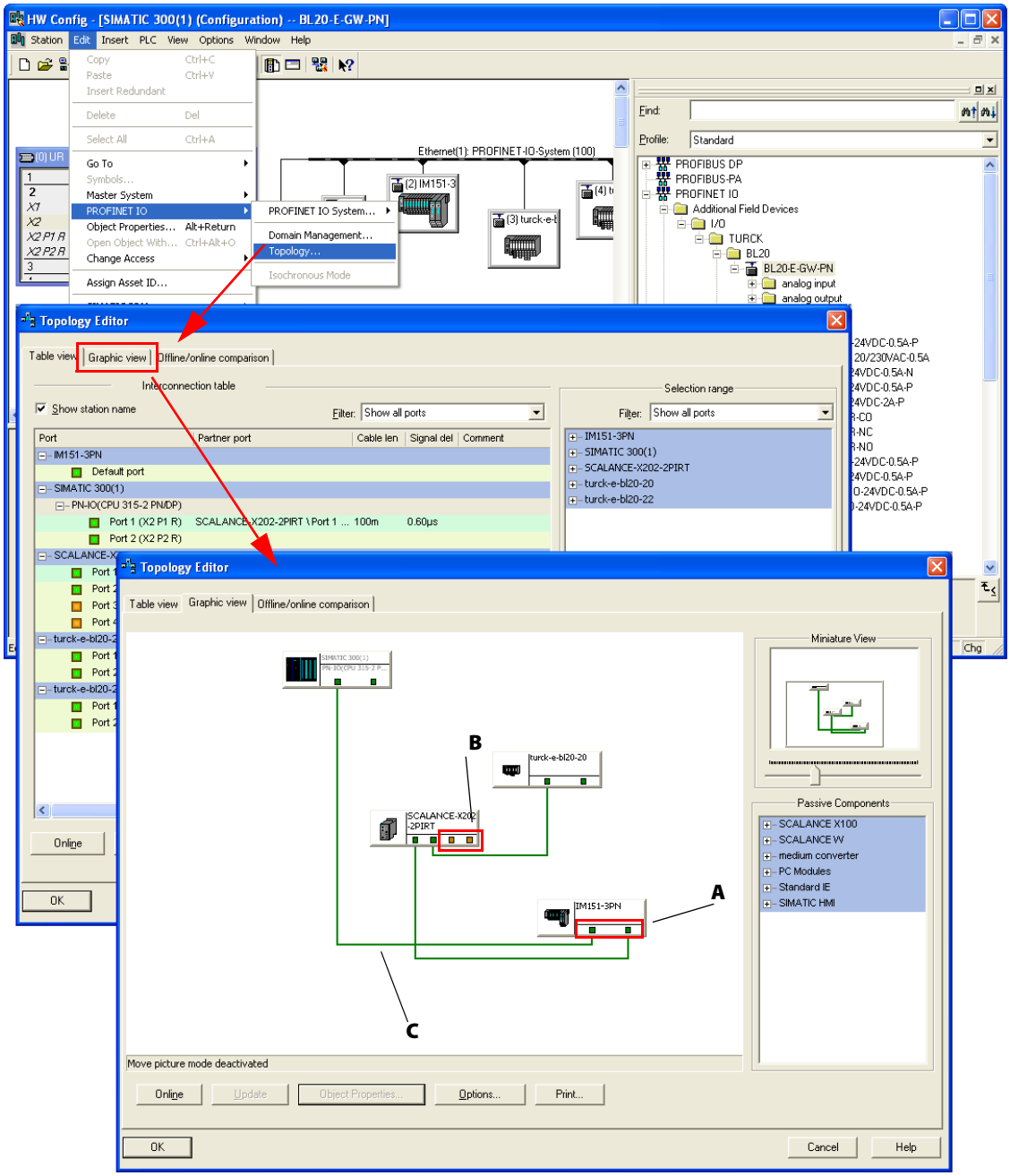


Figure 5-17: PROFINET Topology Editor

A *Example:copper port*
B *fiber optic port*
C *Example: copper-connection*

5.1.9 Online topology detection

The Step 7 software allows an offline/online comparison of the configured and the actually present topology.

1 Start the "Offline/ online comparison" in the Topology Editor using the "Start"-button in the respective tab.

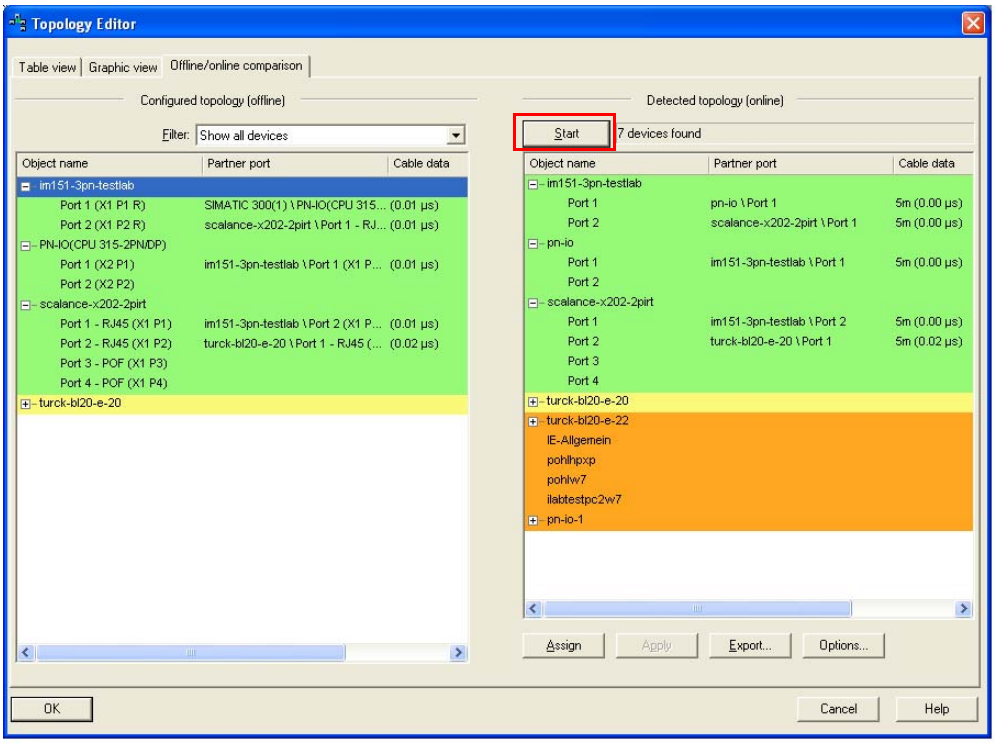


Figure 5-18: PROFINET Topology Editor Offline/ online comparison

5.2 Diagnostics with Step 7

5.2.1 Diagnostic messages in the hardware configuration

The BL20 gateways for PROFINET show gateway diagnostics and channel-specific module diagnostics in the hardware configuration of the Step 7-software.

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

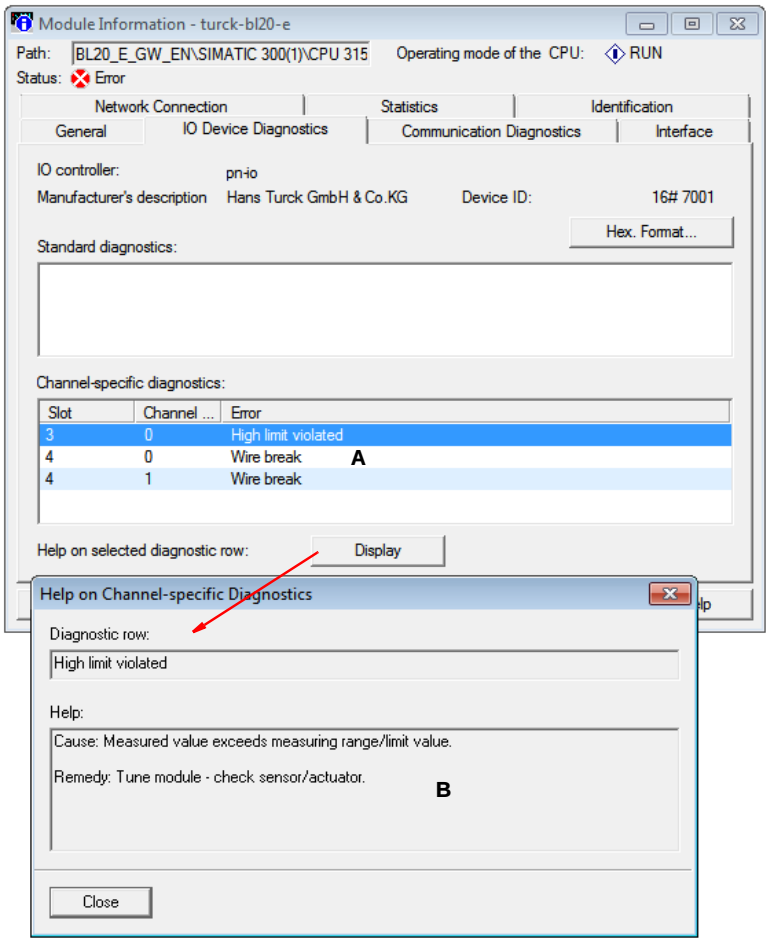


Figure 5-19: Diagnostics

A *channel-specific module diagnostics*

B *manufacturer specific help texts*

5.2.2 Diagnostic telegram with error code

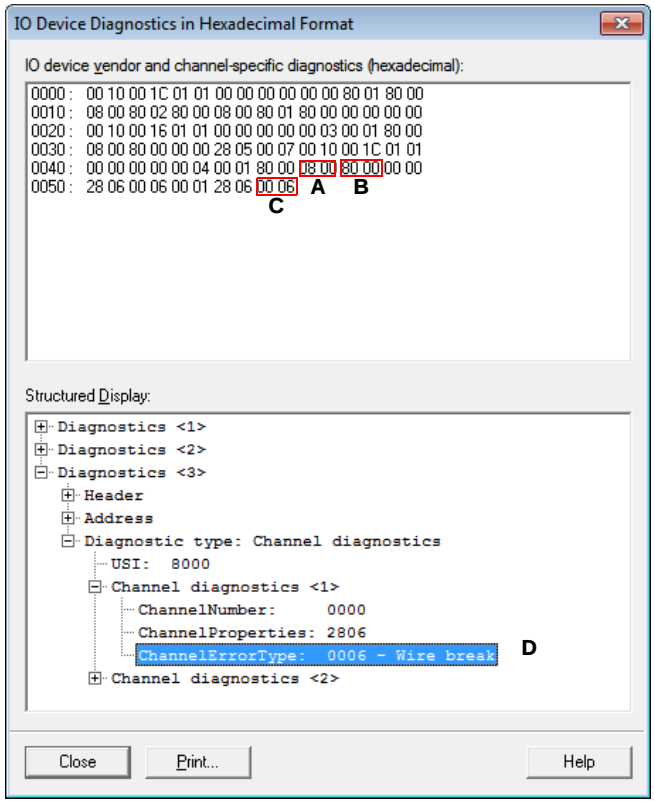


Figure 5-20: Diagnostic message

A *slot-no.*
B *subslot-no.*
C *error code*
D *plaint text diagnostic message*

5.3 Using the BL20 gateway in IRT-networks

The BL20-E-GW-PN can be used in both, RT- and IRT-networks.

The gateway has to be parameterized for operation in IRT-networks.

1. Double-click slot X1 "PN IO" of the gateway and open the dialog box "properties - PN IO (X1).
2. In the register-tab "Synchronization" switch the "Synchronization control" to "Sync slave".
3. The parameter "RT-class" is automatically set ti "IRT".
4. The device is now configured for the operation in the IRT-network.

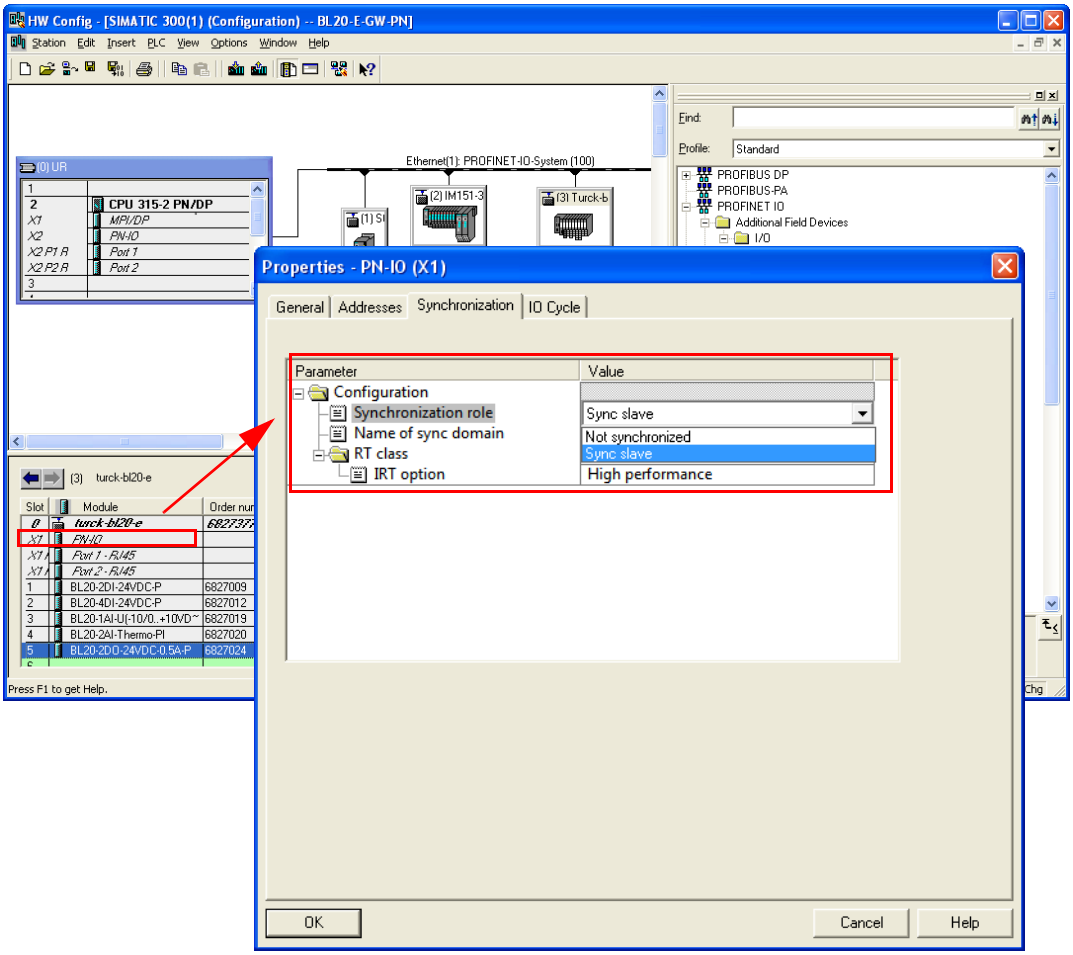


Figure 5-21: Parameterization of the gateway's RT-operation mode

6 Integration of the technology modules

6.1 Integration of the RS232-module

6.1.1 Data image

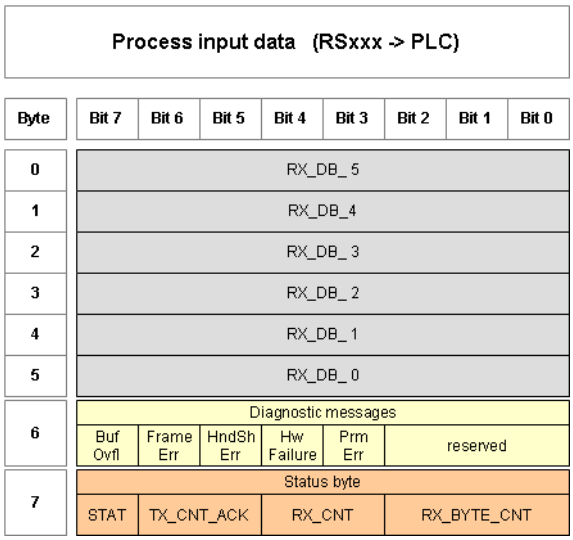
Process input data (PZDE)

Process input data is data from the connected field device that is transmitted via the BL20-1RS232 module to the PLC. The BL20-1RS232-module sends the data, received by the device, into a 128-byte receive-buffer. The module then transmits the data segmented via the module bus and the gateway to the SPS.

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

- 6 bytes are used to contain the user data.
- 1 byte contains the diagnostics data.
- 1 status byte is required to ensure trouble-free transmission of the data.

Figure 6-1: Process input data SPS



Meaning of the data bits (process input)

Table 6-1: Meaning of the data bits (process input)

Designation	Value	Description
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostic information (correspond to the diagnostic information in the diagnosis telegram). These diagnostics are always displayed and independent to the setting of the parameter „Diagnostics".
STAT	0-1	1: The communication with the data terminal equipment (DTE) is not disturbed. 0: The communication with the data terminal equipment (DTE) is disturbed. A diagnosis message is generated if the parameter "Diagnostics" is set to "0" = release. The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is a confirmation of successful acceptance of the data segment using TX_CNT.
RX_CNT	0-3	This value is transferred together with every data segment. The RX_CNT values are sequential: The RX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
RX_BYTE_CNT	0-7	Number of the valid bytes in this data segment.

Process output data (PZDA)

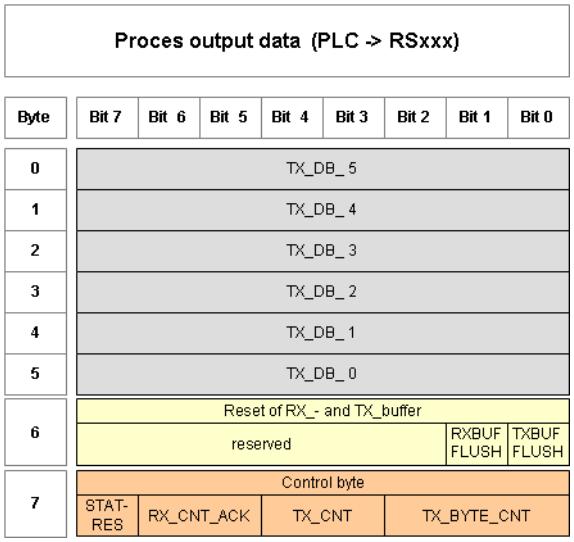
Process output data are data which are sent from the PLC via the gateway and the BL20-1RS232-module to a connected field device.

The data received from the PLC are loaded into the 64-bit transmit-buffer in the BL20-1RS232-module.

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

- 6 bytes are used to contain the user data.
- 1 byte contains, signals to start the flushing of transmit- and receive buffer.
- 1 control byte is required to ensure trouble-free transmission of the data.

Figure 6-2: Process output data SPS



Meaning of the data bits (process output)

Table 6-2: Meaning of the data bits (process output)

Designation	Value	Description
STATRES	0-1	This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the STAT bit is reset (from 0 to 1). If this bit is 0, all changes in TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. The clearing of the receive and transmit buffer by RXBUF FLUSH/TXBUF FLUSH is possible. The value 1 or the transition from 0 to 1 disables the clearing of the receive and transmit buffer by the RXBUF FLUSH/TXBUF FLUSH.
RXBUF FLUSH	0 - 1	The RXBUF FLUSH bit is used for clearing the receive buffer. If STATRES = 1: A request with RXBUF FLUSH = 1 will be ignored. If STATRES = 0: RXBUF FLUSH = 1 will clear the receive buffer.
TXBUF FLUSH	0-1	The TXBUF FLUSH bit is used for clearing the transmit buffer. If STATRES = 1: A request with TXBUF FLUSH = 1 will be ignored. If STATRES = 0: TXBUF FLUSH = 1 will clear the receive buffer.
RX_CNT_ACK	0-3	The value RX_CNT_ACK is a copy of the value RX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. RX_CNT_ACK has to be set analog to RX_CNT (in the status byte). RX_CNT_ACK is an acknowledge for the successful transmission of the data segment with RX_CNT. New data can now be received .
TX_CNT	0-3	This value is transferred together with every data segment. The TX_CNT values are sequential: The TX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
TX_BYTE_ CNT	0 - 7	Number of the valid bytes in this data segment. In PROFINET, the data segments contain a maximum number of 6 bytes of user data.

6.2 Integration of the RS485/422-module

6.2.1 Data image

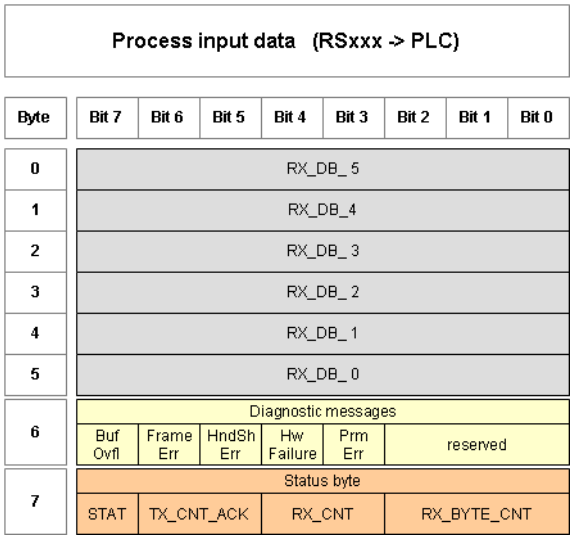
Process input data (PZDE)

The BLxx-1RS485/422-module sends the data, received by the device, into a 128-byte receive-buffer. The module then transmits the data segmented via the module bus and the gateway to the SPS.

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

- 6 bytes are used to contain the user data.
- 1 byte contains the diagnostics data.
- 1 status byte is required to ensure trouble-free transmission of the data.

Figure 6-3: Process input data SPS



Meaning of the data bits (process input)

Table 6-3: Meaning of the data bits (process input)

Designation	Value	Description
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostic information (correspond to the diagnostic information in the diagnosis telegram). These diagnostics are always displayed and independent to the setting of the parameter „Diagnostics".
STAT	0-1	1: The communication with the data terminal equipment (DTE) is not disturbed. 0: The communication with the data terminal equipment (DTE) is disturbed. A diagnosis message is generated if the parameter "Diagnostics" is set to "0" = release. The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is a confirmation of successful acceptance of the data segment using TX_CNT.
RX_CNT	0-3	This value is transferred together with every data segment. The RX_CNT values are sequential: The RX_CNT values are sequential: 00 → 01 → 10 → 11 → 00... (decimal: 0 → 1 → 2 → 3 → 0...) Errors in this sequence show the loss of data segments.
RX_BYTE_ CNT	0-7	Number of the valid bytes in this data segment. In PROFINET, the data segments contain a maximum number of 6 bytes of user data.

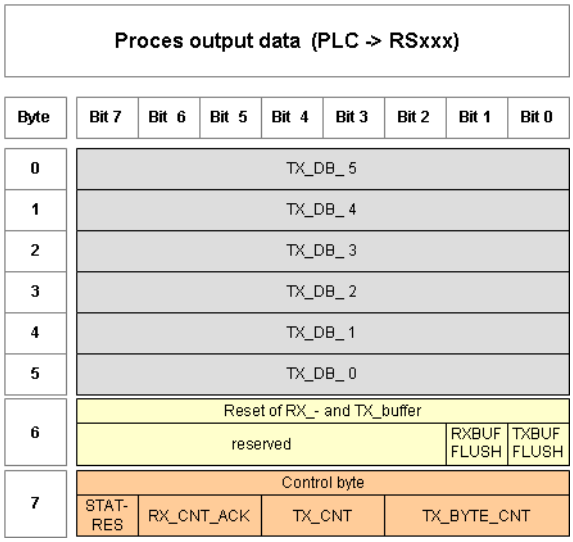
Process output data (PZDA)

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

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

- 6 bytes are used to contain the user data.
- 1 byte contains, signals to start the flushing of transmit- and receive buffer.
- 1 control byte is required to ensure trouble-free transmission of the data.

Figure 6-4: Process output data SPS



Meaning of the data bits (process output)

Table 6-4: Meaning of the data bits (process output)

Designation	Value	Description
RXBUF FLUSH	0 - 1	The RXBUF FLUSH bit is used for clearing the receive buffer. If STATRES = 0, 1 or 0 → 1: A request with RXBUF FLUSH = 1 will be ignored. If RXBUF FLUSH = 1, a rising edge 1 → 0 at STATRES clears the transmit buffer.
TXBUF FLUSH	0 -1	The TXBUF FLUSH bit is used for clearing the transmit buffer. If STATRES = 0, 1 or 0 → 1: A request with TXBUF FLUSH = 1 will be ignored. If TXBUF FLUSH = 1, a falling edge 1 → 0 at STATRES clears the transmit buffer.
STATRES	0 - 1	This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the STAT bit is reset (from 0 to 1). The clearing of the receive and transmit buffer by RXBUF FLUSH/TXBUF FLUSH is possible. If this bit is 0, all changes in TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. The value 1.0 or the transition from 0 to 1 disables the clearing of the receive and transmit buffer by the RXBUF FLUSH/TXBUF FLUSH.

RX_CNT_ACK	0 - 3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is a confirmation of successful acceptance of the data segment using TX_CNT.
TX_CNT	0 - 3	This value is transferred together with every data segment. The TX_CNT values are sequential: The TX_CNT values are sequential: 00 → 01 → 10 → 11 → 00... (decimal: 0 → 1 → 2 → 3 → 0...) Errors in this sequence show the loss of data segments.
TX_BYTE_ CNT	0 - 7	Number of the valid bytes in this data segment. In PROFINET, the data segments contain a maximum number of 6 bytes of user data.

6.3 Integration of the SSI-module

6.3.1 Data image

Process input data (PZDE)

The field input data is transferred from the connected field device to BL20-1SSI-module.

The process input data is the data that is transferred by the BL20-1SSI-module via a gateway to the PLC.

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

- 4 bytes are used for representing the data that was read from the register with the address stated at REG_RD_ADR.
- When necessary, 1 byte represents the register address of the read data and an acknowledgement that the read operation was successful.
- 1 byte can be used to transfer status messages of the SSI encoder. This byte also contains an acknowledgement that the write operation to the register was successful and indication of an active write operation.
- 1 byte contains the results of comparison operations with the SSI encoder value.
- 1 byte contains messages concerning the communication status between the BL20-1SSI module and the SSI encoder, as well as other results of comparison operations.

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

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

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

Figure 6-5: Process input data

Process input data (SSI -> PLC)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	DB_3							
1	DB_2							
2	DB_1							
3	DB_0							
	Status messages							
4	REG RD ABORT	X	REG RD ADR (MSB bis LSB)					
5	REG WR ACEPT	REG WR AKN	X	X	SSI STS3	SSI STS2	SSI STS1	SSI STS0
6	STS UP	STS DN	REL CMP2	FLAG CMP2	STS CMP2	REL CMP1	FLAG CMP2	STS CMP2
	Diagnostic messages							
7	STS STOP	X	X	ERR PARA	STS UFLW	STS OFLW	ERR SSI	SSI DIAG

Meaning of the data bits (process input)

Table 6-5: Meaning of the data bits (process input)

Designation	Value	Description
REG_RD_DATA	0 2^{32}-1	Content of the register to be read if REG_RD_ABORT=0. If REG_RD_ABORT =1, then REG_RD_DATA=0.

Table 6-5: Meaning of the data bits (process input)

Designation	Value	Description
REG_RD_ ABORT	0	The reading of the register defined in REG_RD_ADR has been accepted and executed. The content of the register can be found in the user data (REG_RD_DATA, byte 0-3).
	1	Reading of the register defined in REG_RD_ADR has not been accepted. The user data range (REG_RD_DATA Bytes 0-3) is zero.
REG_RD_ADR	0...63	Address of the register to be read. If the read operation is successful (REG_RD_ABORT = 0), the user data is located in REG_RD_DATA of the process input data (bytes 0 to 3).
REG_WR_ACEPT	0	Writing the user data from the process output to the register addressed with REG_WR_ADR in the process output could not be done.
	1	Writing the user data from the process output to the register addressed with REG_WR_ADR in the process output was successful.
REG_WR_AKN	0	No modification of the data in the register bank by process output, i.e. REG_WR = 0. A write job would be accepted with the next telegram of process output data. (handshake for data transmission to the register.)
	1	A modification of the register contents by a process output was initiated, i.e. REG_WR = 1 → chapter „Process output (PZDA)“. A write job would not be accepted with the next telegram of process output data.
SSI_STS3	0	These four bits transfer the status bits of the SSI encoder with the status messages of the SSI module. With some SSI encoders, the status bits are transferred together with the position value.
	1	
SSI_STS2	0	
	1	
SSI_STS1	0	
	1	
SSI_STS0	0	
	1	
STS_UP (LED UP)	0	The SSI encoder values are decremented or the values are constant.
	1	The SSI encoder values are incremented.

Table 6-5: Meaning of the data bits (process input)

Designation	Value	Description
STS_DN (LED DN)	0	The SSI encoder values are incremented or the values are constant.
	1	The SSI encoder values are decremented.
REL_CMP2	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP2)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ REG_CMP2)
FLAG_CMP2	0	Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP2) since the last reset.
	1	The contents of the registers match (REG_SSI_POS) = (REG_CMP2). This marker must be reset with CLR_CMP1 = 1 in the process output data.
STS_CMP2	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP2)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP2)
REL_CMP1	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP1)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) ≥ (REG_CMP1)
FLAG_CMP1	0	Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP1) since the last reset.
	1	The contents of the registers match (REG_SSI_POS) = (REG_CMP1). This marker must be reset with CLR_CMP1 = 1 in the process output data.
STS_CMP1	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP1)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP1)

Table 6-5: Meaning of the data bits (process input)

Designation	Value	Description
STS_STOP	0	The SSI encoder is read cyclically.
	1	Communication with the SSI encoder is stopped as STOP = 1 (process output) or ERR_PARA = 1.
ERR_PARA	0	The parameter set of the module has been accepted.
	1	Operation of the module is not possible with the present parameter set.
STS_UFLW	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_LOWER_LIMIT)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT)
STS_OFLW	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≤ (REG_UPPER_LIMIT)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT)
ERR_SSI	0	SSI encoder signal present.
	1	SSI encoder signal faulty. (e.g. due to a cable break).
SSI_DIAG	0	No enabled status signal is active (SSI_STSx = 0).
	1	At least one enabled status signal is active (SSI_STSx = 1)

Process output data (PZDA)

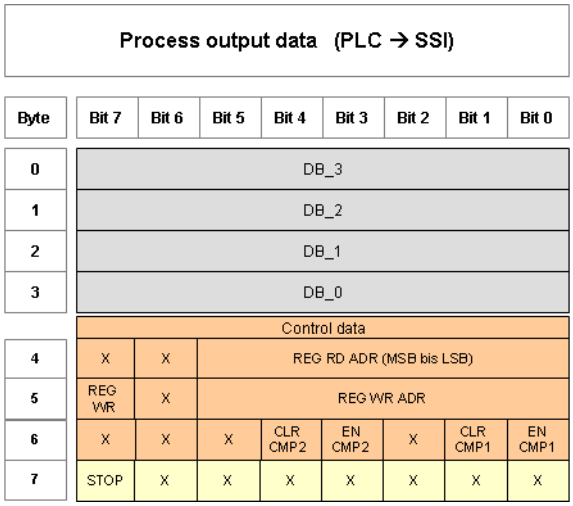
Field output data is output from an BL20-1SSI-module to a field device.

The process output data is the data that is transferred by the PLC via a gateway to the BL20-1SSI module.

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

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

Figure 6-6: Process output data



Meaning of the data bits (process output)

Table 6-6: Meaning of the data bits (process output)

Designation	Value	Description
REG_WR_DATA	0 2^{32}-1	Value which has to be written to the register with the address REG_WR_ADR.
REG_RD_ADR	0...63	Address of the register which has to be read. If the reading was successful (REG_RD_ABORT = 0), the user data can be found in REG_RD_DATA in the status interface (bytes 4-7).
REG_WR	0	Default status, i.e. there is no request to overwrite the content of the register with the address stated at REG_WR_ADR with REG_WR_DATA. Bit REG_WR_AKN (→ chapter process input (PZDE)“) is reset (0).
	1	Request to overwrite the content of the register with address REG_WR_ADR with REG_WR_DATA.
REG_WR_ADR	0...63	Address of the register, which has to be written with REG_WR_DATA.
CLR_CMP2	0	Default status, i.e. no reset of FLAG_CMP2 active.
	1	Reset of FLAG_CMP2 active.
EN_CMP2	0	Default status, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 always have the value 0, irrespective of the actual SSI encoder value.
	1	Comparison active, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 always have a value based on the result of the comparison with the SSI encoder value.
CLR_CMP1	0	Default status, i.e. reset of FLAG_CMP1 not active.
	1	Reset of FLAG_CMP1 active.
EN_CMP1	0	Default status, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 always have the value 0, irrespective of the actual SSI encoder value.
	1	Comparison active, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 always have a value based on the result of the comparison with the SSI encoder value.
STOP	0	Request to read the SSI encoder cyclically
	1	Request to interrupt communication with the encoder

6.4 Integration of the SWIRE-module BL20-E-1-SWIRE

The module can be integrated if the gateway firmware is at least Version 1.51.

6.4.1 Data image

Process input

The field input data is transferred from the connected SWIRE-BUS to the BL20-E-1SWIREmodule. The process input data is the data that is transferred by the BL20-E-1SWIREmodule via a gateway to the PLC. The transfer is carried out in 8-byte format. 4 bits are reserved for each SWIRE slave. The following information can be transferred:

- Contactor coil on/off
- Motor-protective circuit-breaker off or tripped/ on
- Status of the slave o.k./diagnostics message present

Table 6-7: Data structure

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	SWIRE Slave 2				SWIRE Slave 1			
2	SWIRE Slave 4				SWIRE Slave 3			
3	SWIRE Slave 6				SWIRE Slave 5			
4	SWIRE Slave 8				SWIRE Slave 7			
5	SWIRE Slave 10				SWIRE Slave 9			
6	SWIRE Slave 12				SWIRE Slave 11			
7	SWIRE Slave 14				SWIRE Slave 13			
8	SWIRE Slave 16				SWIRE Slave 15			

The data of SWIRE slave 1 is the data of the first physical slave on the SWIRE bus. he remaining slaves are assigned in consecutive order accordingly. The meaning of the data of an SWIRE slave depends on the product concerned.

The meaning of the data of an SWIRE slave depends on the product concerned.

Table 6-8: Process input data with SWIRE-DIL

Bit 7	Bit 6	Bit 5	Bit 4
SDx / free	free	PKZSTx	SIx

The following table shows the meaning of the data bits:

Table 6-9: Data bits

Design.	Status	Comment		
SIx		Switch status, relay x		
		SIx supplies the switch status of the contactor coil of the SWIRE bus slave as a feedback signal. SIx makes it possible to check whether the set switch status was executed by a mechanical connection. This must take into account the time delay between the setting of an output, a mechanical execution and the subsequent feedback signal.		
	0	off	Off	Contactor coil is switched off
	1	on	On	Contactor coil is switched on
PKZSTx		Switch status, PKZ x		
	0	off	Off	The motor-protective circuit breaker is off or has tripped
	1	on	On	The motor-protective circuit breaker is switched on
SDx		Communication error, slave x		
		Setting the NDDIAG parameter copies the slave diagnostics message (input byte 1/bit 3) to the feed-back interface. The information is provided as status information in the PLC for the user.		
	0	ON LINE	ON LINE	Status of slave x:
	1	OFF LINE	OFF LINE	Status of slave x: diagnostics available

Process output

Field output data is output from an BL20-E-1SWIRE module to a field device. The process output data is the data that is transferred by the PLC via a gateway to the BL20-E-1SWIRE module. The transfer is carried out in 8-byte format. 4 bits are reserved for each SWIRE slave. The following information is transferred:

- Switch status of contactor coil on/off

Table 6-10: Data structure

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	SWIRE Slave 2				SWIRE Slave 1			
2	SWIRE Slave 4				SWIRE Slave 3			
3	SWIRE Slave 6				SWIRE Slave 5			
4	SWIRE Slave 8				SWIRE Slave 7			
5	SWIRE Slave 10				SWIRE Slave 9			
6	SWIRE Slave 12				SWIRE Slave 11			
7	SWIRE Slave 14				SWIRE Slave 13			
8	SWIRE Slave 16				SWIRE Slave 15			

The data of SWIRE slave 1 is the data of the first physical slave on the SWIRE bus. he remaining slaves are assigned in consecutive order accordingly. The meaning of the data of an SWIRE slave depends on the product concerned.

Meaning of the 4-bit process output data on an SWIRE-DIL device:

Table 6-11: Process output data with SWIRE-DIL

Bit 7	Bit 6	Bit 5	Bit 4
free	free	free	SOx

The following table shows the meaning of the data bits:

Table 6-12: Data bits

Design.	Status	Comment		
SOx		relay x relay x		
		SOx is transferred as the switch status of the contactor coil from the SWIRE bus master to the appropriate SWIRE bus slave.		
	0	off	Off	Contactor not switched on
	1	on	On	Contactor switched on

Diagnostics

Table 6-13: Diagnostic data SWIRE

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	GENERAL$_{ERR}$	U$_{SWERR}$	free	COM$_{ERR}$	free	RDY$_{ERR}$	free	SW$_{ERR}$
Byte 2	free	U$_{AUXERR}$	TYP$_{ERR}$	free	PKZ$_{ERR}$	free	SD$_{ERR}$	free
TYP$_{ERR}$ field								
Byte 3	TYP$_{ERR}$S8	TYP$_{ERR}$S7	TYP$_{ERR}$S6	TYP$_{ERR}$S5	TYP$_{ERR}$S4	TYP$_{ERR}$S3	TYP$_{ERR}$S2	TYP$_{ERR}$S1
Byte 4	TYP$_{ERR}$ S16	TYP$_{ERR}$ S15	TYP$_{ERR}$ S14	TYP$_{ERR}$ S13	TYP$_{ERR}$ S12	TYP$_{ERR}$ S11	TYP$_{ERR}$ S10	TYP$_{ERR}$S9
Slave diagnostics bit field								
Byte 5	SD$_{ERR}$S8	SD$_{ERR}$S7	SD$_{ERR}$S6	SD$_{ERR}$S5	SD$_{ERR}$S4	SD$_{ERR}$S3	SD$_{ERR}$S2	SD$_{ERR}$S1
Byte 6	SD$_{ERR}$S16	SD$_{ERR}$S15	SD$_{ERR}$S14	SD$_{ERR}$S13	SD$_{ERR}$S12	SD$_{ERR}$S11	SD$_{ERR}$S10	SD$_{ERR}$S9
PKZ field								
Byte 7	PKZ$_{ERR}$S8	PKZ$_{ERR}$S7	PKZ$_{ERR}$S6	PKZ$_{ERR}$S5	PKZ$_{ERR}$S4	PKZ$_{ERR}$S3	PKZ$_{ERR}$S2	PKZ$_{ERR}$S1
Byte 8	PKZ$_{ERR}$ S16	PKZ$_{ERR}$ S15	PKZ$_{ERR}$ S14	PKZ$_{ERR}$ S13	PKZ$_{ERR}$ S12	PKZ$_{ERR}$ S11	PKZ$_{ERR}$ S10	PKZ$_{ERR}$S9

The following table shows the meaning of the diagnostic bits:

Table 6-14: Meaning of the diagnostic bits

Design.	Value	Meaning	
Byte 1			
SW_{ERR}	SWIRE MASTER		
	The configuration was accepted according to the parameter setting and the SWIRE bus is in data exchange mode.		
	0	Data exchange	The bus is in data exchange mode
	1	Offline	The configuration was not accepted, the bus does not switch to data exchange mode. (SW LED flashing)
RDY_{ERR}	SPS SLAVE		
	Parameter setting is faulty. The ACTUAL configuration was accepted according to the SET configuration and the data exchange with the higher-level is o.k.		
	0	Data exchange	The bus is in data exchange mode
	1	Offline	The configuration was not accepted, the bus does not switch to data exchange mode. (SW LED Rdy flashing)
COM_{ERR}	Communication SWIRE		
	A communication error is present, such as a slave is no longer reached, its internal timeout has elapsed or communication is faulty. The master cannot carry out data exchange with at least one slave.		
	0	OK	No error present.
	1	faulty	An error is present.
U_{SWERR}	Voltage U_{SW}		
	Voltage fault in U_{SW}, voltage (17 VDC) for supplying the SWIRE slaves		
	0	OK	No error present.
	1	under voltage	An error is present.
$GENERAL_{ERR}$	Error message		
	The creation of a function block shows that systems/function blocks for the general checking of a slave for any diagnostics messages present only check the first byte.		
	0	none	No diagnostics message present
	1	present	One/several diagnostics messages present
Byte 2			

Table 6-14: Meaning of the diagnostic bits

Design.	Value	Meaning	
SD_{ERR}	Communication SWIRE slave		
	If the parameter SD_{ERR}A is set for group diagnostics, this bit indicates an error as soon as only one slave on the bus sets its SD error bit.		
	0	OK	No error is present or diagnostics function has been deactivated via the parameter setting.
	1	faulty	An error is present.
PKZ_{ERR}	Overcurrent protective circuit-breaker		
	If the parameter PKZ_{ERR}A is set for group diagnostics, this bit indicates an error as soon as only one PKZ of a slave has tripped.		
	0	OK	No PKZ error is present or diagnostics function has been deactivated via the parameter setting.
	1	tripping	At least one PKZ has tripped.
Byte 2			
TYP_{ERR}	configuration		
	If the TYP_{ERR} parameter is set for group diagnostics, this bit indicates an error as soon as the ACTUAL configuration of a slave does not match the SET configuration for this position.		
	0	OK	The ACTUAL configuration fully matches the SET configuration or diagnostics function has been deactivated via the parameter.
	1	faulty	The actual configuration does not fully match set configuration.
U_{AUXERR}	Voltage U_{AUX}		
	If the U_{AUXERR}A parameter is activated, $_{AUXERR}$ will generate an error message as soon as the power supply goes below the level at which the function of the relays is not guaranteed.		
	0	OK	Contactor supply voltage is o.k. (> 20 VDC) or diagnostics function has been deactivated via this parameter.
	1	under voltage	Contactor supply voltage is not o.k. (< 18 VDC).

Table 6-14: Meaning of the diagnostic bits

Design.	Value	Meaning	
Byte 3.4			
$TYP_{ERR}Sx$	Device configuration, slave x		
	Info field for the individual indication of a configuration error as error message. If the $TYP_{INFO}A$ parameter has been set for single diagnostics, this bit field indicates the error, as soon as the ACTUAL configuration of the slave was not accepted and is therefore not enabled for data exchange. The diagnostics LED of the slave flashes.		
	0	OK	No configuration error is present and the slave is in data exchange mode or diagnostics function has been deactivated via the parameter setting.
	1	incorrect	Configuration error present and the slave is NOT in data exchange mode.
Byte 5.6			
$SD_{ERR}Sx$	Communication, slave x		
	Info field for the individual indication of the release of the slave diagnostics as error message. If the $SD_{INFO}A$ is set for single diagnostics, this bit field indicates the error as soon as the slave diagnostic message of the slave Sx is triggered.		
	0	OK	No error is present or diagnostics function has been deactivated via the parameter setting.
	1	Offline	A diagnostics message is present.
Byte 7.8			
$PKZ_{ERR}Sx$	Overcurrent protective circuit-breaker, slave x		
	Info field for the individual indication of the tripping a motor-protective circuit-breaker (PKZ) as error message. If the $PKZ_{INFO}A$ is set for single diagnostics, this bit field indicates the error as soon as the PKZ of the slave Sx has tripped.		
	0	OK	The PKZ of the slave has not tripped or diagnostics function has been deactivated via the parameter setting.
	1	tripped	The PKZ of the slave has tripped.

Note

The error messages U_{AUXERR}, TYP_{ERR}, $TYP_{ERR}Sx$, PKZ_{ERR}, $PKZ_{ERR}Sx$, SD_{ERR} and $SD_{ERR}Sx$ can be deactivated by a respective parameterization.

Parameters

Parameters consist of data that has to be sent to the module so that it can operate correctly in the application concerned.

Table 6-15: Parameters SWIRE

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	reserved	free	free	MC	MNA	configuration	Disable Cfg	free
Byte 2	free	U_{AUXERR}	TYP_{ERR}	TYP_{INFO}	PKZ_{ERR}	PKZ_{INFO}	SD_{ERR}	SD_{INFO}
Byte 3	reserved							
Byte 4	Life guarding time							
Byte 5	$SD_{DIAG}S8$	$SD_{DIAG}S7$	$SD_{DIAG}S6$	$SD_{DIAG}S5$	$SD_{DIAG}S4$	$SD_{DIAG}S3$	$SD_{DIAG}S2$	$SD_{DIAG}S1$
Byte 6	SD_{DIAG} S16	SD_{DIAG} S15	SD_{DIAG} S14	SD_{DIAG} S13	SD_{DIAG} S12	SD_{DIAG} S11	SD_{DIAG} S10	$SD_{DIAG}S9$
Byte 7	reserved							
Byte 8	reserved							
Byte 9 - 24	Type designation slave 1 - 16							

The following table shows the meaning of the parameter bits:

Table 6-16: Module parameters

A *default setting*

Parameter name	**Value**	
Byte 1		
Disable Cfg	Disabling of the acceptance of the physically present configuration as ACTUAL configuration on manual push button actuation.	
	0 = inactive **A**	The physically present configuration of the SWIRE bus is only accepted as the ACTUAL configuration by pressing the CFG button. The comparison with the SET configuration is then carried out.
	1 = active	The physically present configuration is automatically accepted as the ACTUAL configuration and then compared with the SET configuration.
configuration	PLC configuration check The configuration check parameter enables a comparison of the set and actual configuration based on the device ID.	
	0 = active **A**	Configuration check based on device ID. Only SWIRE slaves with a device ID completely matching the set configuration are accepted on the bus.
	1 = disabled	All slaves are mapped in 4Bit INPUT/ 4Bit OUTPUT without checking the device ID.
Byte 1		

Table 6-16: Module parameters

A *default setting*

Parameter name	Value	
MNA active/ passive	Configuration check If the ACTUAL configuration of the SWIRE bus does not match the SET configuration, the master only exchanges data with the correctly configured and functional slaves.	
	0 = Bus based **A**	No data exchange with a slave with an incomplete / incorrect configuration.
	1 = Slave based	The bus also goes into operation with the correctly configured slaves even if the configuration is incomplete. All slaves detected by the daisy chain configuration with a position that matches the set configuration are started up. Slaves that do not match the set configuration are inactive.
MC	Moeller conformance (from version VN 01-04) Behavior of the BL20-E-1SWIRE in accordance with SWIRE Conformance criteria.	
	inactive **A**	Default behavior
	active	The BL20-E-1SWIRE master responds according to the Moeller SWIRE Conformance criteria. For detailed information please read the manual for the IO-modules (D300717).
SD_{INFO}	Slave error field Activate slave diagnostics info field SDERRSx. As soon as a slave on the bus clears its PKZ bit, this is indicated as an individual error depending on the parameter setting.	
	active	Single diagnostics is activated
	inactive	Single diagnostics is not activated
SD_{ERR}	Group error - slave error Activate slave diagnostics SDERR. Activate slave diagnostics SDERRSx. As soon as only one slave on the bus sets its error bit, this is indicated as a group error depending on the parameter setting.	
	0 = active **A**	Group diagnostics is activated
	1 = inactive	Group diagnostics is not activated
PKZ_{INFO}	PKZ error field Activate slave diagnostics info field PKZERRSx. As soon as a slave on the bus clears its PKZ bit, this is indicated as an individual error depending on the parameter setting.	
	0 = active **A**	Single diagnostics is activated
	1 = inactive	Single diagnostics is not activated
PKZ_{ERR}	Group PKZ error field Activate slave diagnostics PKZERR. As soon as a slave on the bus clears its PKZ bit, this is indicated as an individual error depending on the parameter setting.	
	0 = active **A**	Single diagnostics is activated
	1 = inactive	Single diagnostics is not activated

Table 6-16: Module parameters

A *default setting*

Parameter name	Value	
Byte 2		
TYP_{INFO}	Configuration error field As soon as a slave on the bus does not match the set configuration and therefore cannot be started, this is indicated as an individual error depending on the parameter set.	
	0 = active **A**	Single diagnostics is activated
	1 = inactive	Single diagnostics is not activated
TYP_{ERR}	Group configuration error field Activate slave diagnostics TYPERR. As soon as only one slave on the bus is incorrectly configured, this is indicated as an error depending on the parameter setting.	
	0 = active **A**	Group diagnostics is activated
	1 = inactive	Group diagnostics is not activated
U_{AUXERR}	Error message UAUX- Activate system diagnostics UAUXERR. UAUXERR will generate an error message as soon as the power supply goes below a level at which the function of the relays is not guaranteed.	
	0 = active **A**	Error message U_{AUXERR} activated
	1 = inactive	Error message U_{AUXERR} not activated
Byte 3	reserved	
Byte 4		
Lifeguarding	0x02-0xFF 0x64 **A**	Lifeguarding time of the SWIRE slaves Setting of lifeguarding time of SWIRE slaves, timeout time up to automatic reset of the slaves in the event of communication failure. (n * 10ms) (Default 1s) 0xFF: 0xFF: Lifeguarding off
Byte 5 - 6		
$SD_{DIAG}Sx$	Input bit communication error, slave x Slave diagnostics message from Byte 1 / Bit 7 is accepted in the feedback interface as Bit 4	
	0 = active **A**	$SD_{DIAG}Sx$ is accepted
	1 = inactive	$SD_{DIAG}Sx$ is not accepted
Byte 7 - 8	reserved	
Byte 9 to 24		
Device ID, slave x	TYPE setting for the LIN slave at position x on the SWIRE bus	
	0x20	SWIRE-DIL-MTB (: 0xFF)
	0xFF	Basic setting (no slave)

6.5 Integration of the Encoder/PWM-module BL20-E-2CNT-2PWM

Detailed information about the process image of the module can be found in separate manual, D301224, „BL20 – I/O-MODULES BL20-E-2CNT-2PWM“, chapter 2)

6.6 Integration of RFID-modules BL20-2RFID-S/ -A

BL20-2RFID-S and BL20-2RFID-A (see RFID-documentation under www.turck.de)

7 Guidelines for station planning

7.1 Module arrangement

7.1.1 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.

Note

A mixed usage of gateways of the BL20 ECO and the BL20 standard product line and I/O modules of both product lines (base modules with tension clamp terminals) is possible without any problems.

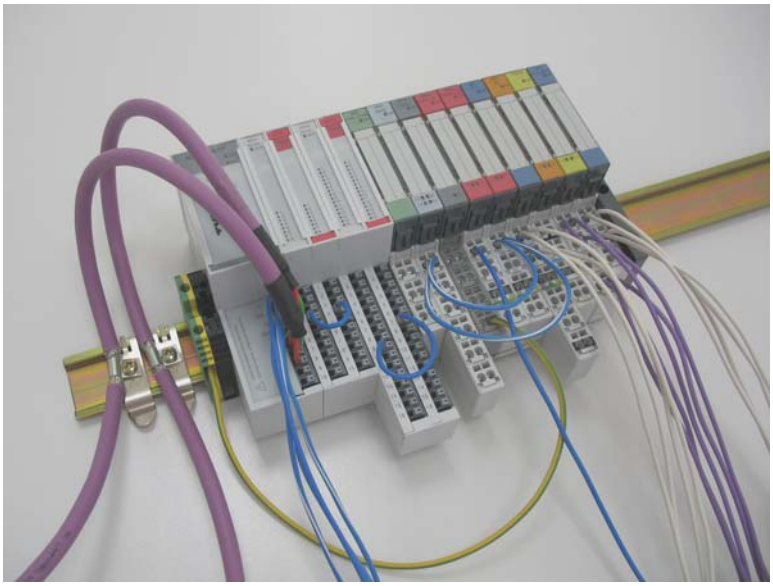


Figure 7-1: Example of a station structure with ECO gateway (here for CANopen), ECO and standard I/O modules

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.

7.1.2 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.

The power to BL20 systems is supplied from a common external source. This avoids the occurrence of potential compensating currents within the BL20 station.

7.1.3 Maximum system extension

- The station extension may not exceed the maximum number of **72 modules**.
- If the maximum sum of the modules' nominal current consumptions (see below Table 7-1: Nominal current consumptions of the BL20 modules) right to the gateway (max. sum ΣI_{MB} = **800 mA**) is reached, a Bus Refreshing module has to be used in order to provide the module bus voltage. To the right of the Bus Refreshing module, the sum of the modules' current consumptions can amount to **1,5 A**.

Attention

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

Note

If the system limits are exceeded, the software I/O-ASSISTANT 3 (FDT/DTM) generates an error message when the user activates the command "Verify station".

For the calculation of the maximum system extension, the following table contains an overview about the modules' nominal current consumptions.

Table 7-1: Nominal current consumptions of the BL20 modules

Module	Nominal current consumption at the module bus
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

Table 7-1: Nominal current consumptions of the BL20 modules

Module	Nominal current consumption at the module bus
BL20-2AI-PT/NI-2/3	45 mA
BL20-2AI-THERMO-PI	45 mA
BL20-4AI-U/I	30 mA
BL20-E-8AI-U/I-4AI-PT/NI	50 mA
BL20-2DO-24VDC-0.5A-P	32 mA
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-E-4AO-U/I	50 mA
BL20-2DO-R-NC	28 mA
BL20-2DO-R-NO	28 mA
BL20-2DO-R-CO	28 mA
BL20-1RS232	140 mA
BL20-1RS485/422	60 mA
BL20-1SSI	50 mA
BL20-2RFID-×	30 mA
BL20-E-1SWIRE	60 mA
BL20-E-2CNT-2PWM	30 mA

7.2 Power supply

7.2.1 Power supply to the gateway

The gateways BL20-E-GW-PN offer an integrated power supply (see also Power supply (page 4-8)).

7.2.2 Module bus refreshing

The number of BL20 modules, which can be supplied via the internal module bus by the gateway or a Bus Refreshing module depends on the modules' nominal current consumptions at the module bus Table 7-1: Nominal current consumptions of the BL20 modules, page 7-3).

Attention

The sum of the nominal current consumptions (see Table 7-1: Nominal current consumptions of the BL20 modules, page 7-3) of the used BL20 modules may not exceed 800 mA.
If a Bus Refreshing module is mounted, the sum of the current consumptions which follow the Bus Refreshing module must not exceed 1,5 A.

Note

The Bus Refreshing modules which are used in a station with BL20-E-GW-EC have to be combined with the base modules BL20-P3T-SBB-B or BL20-P4T-SBBC-B (tension clamp) or with the base modules BL20-P3S-SBB-B or BL20-P4S-SBBC-B (screw terminals).

With the system supply, it must be ensured that the same ground potential and ground connections are used. Compensating currents flow via the module bus if different ground potentials or ground connections are used, 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.

If the power supply from the module bus is not guaranteed, the software I/O-ASSISTANT 3 (FDT/DTM) generates an error message if the user activates the DTM "Additional functions → Verify station".

7.2.3 Creating potential groups

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

Note

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

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 modules with 24 V DC and 120/230 V AC field supply in a joint potential group.

7.2.4 C-rail (cross connection)

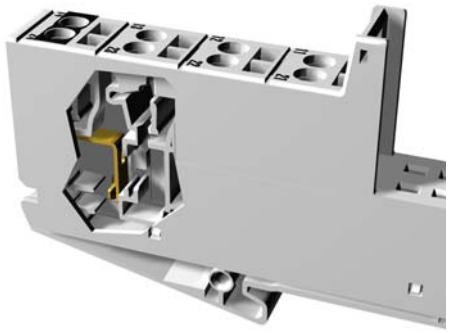
The C-rail runs through all base modules. The C-rail of the base modules for power distribution modules is mechanically separated; thus potentially isolating the adjoining supply groups.

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 7-2: C-rail (front view)

Figure 7-3: C-rail (side view)



Warning

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

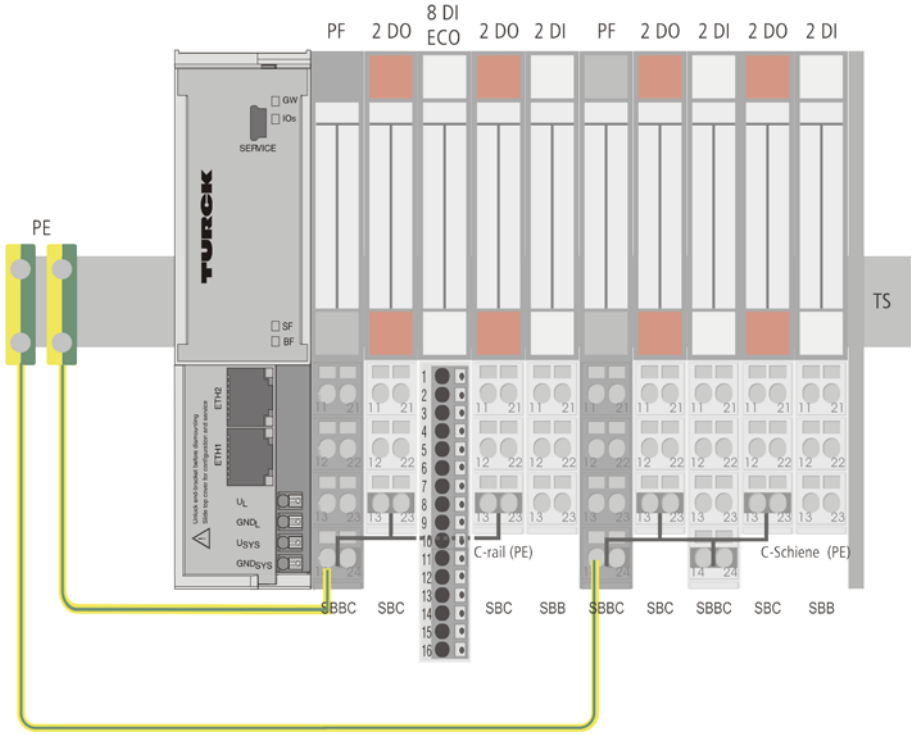
The C-rail can be used as required by the application, for example, as a protective earth (PE). In this case, the PE connection of each power distribution module must be connected to the mounting rail via an additional PE terminal, which is available as an accessory.

The C-rail is not interrupted by the modules of the BL20-ECO-products. It is connected through the modules' connection level. But, an access to the C-rail is not possible.

Note

For information about introducing a BL20 station into a ground reference system, please read chapter 7.

Figure 7-4: Using the C-rail as a protective earth



C-rails can be used for a common voltage supply (24 V DC) 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. 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.

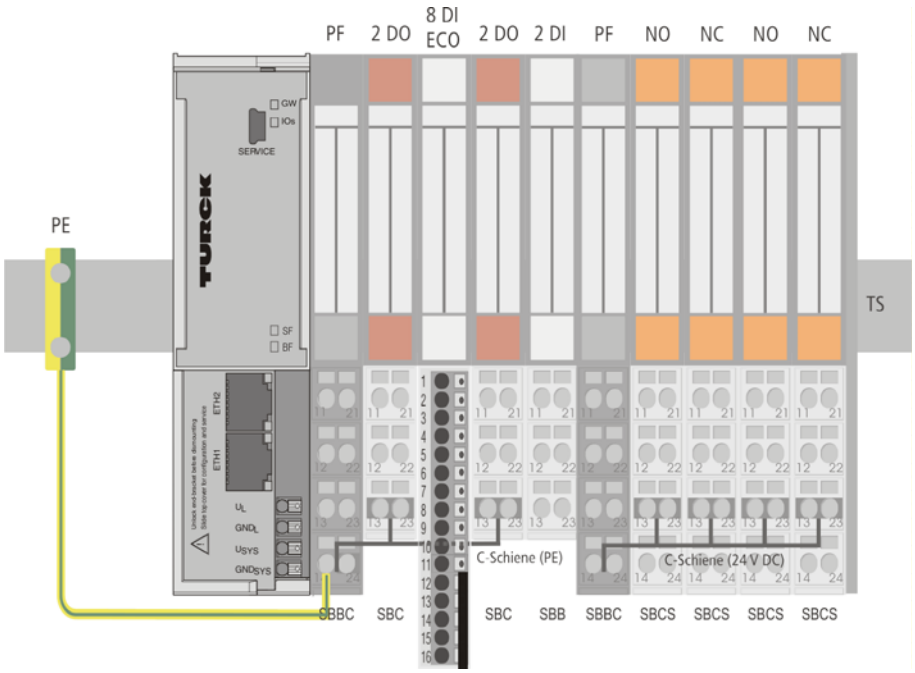


Figure 7-5: Using the C-rail as protective earth and for the power supply with relay modules

Cross-connecting relay module roots is achieved by the use of jumpers. The corresponding wiring diagram including the jumpers can be found the manuals for 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 Protecting the service interface on the gateway

During operation, the label protecting the service interface and the DIP-switches must remain in place due to EMC and ESD requirements.

7.4 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.

7.5 Extending an existing station

Attention

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

7.6 Firmware download

Firmware can only be downloaded via the service interface on the gateway using the software tool I/O-ASSISTANT 3 (FDT/DTM).

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.

Cable routing inside and outside of cabinets

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

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

Group 1:

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

Group 2:

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

Group 3:

- unshielded cables for DC and AC voltages > 400 V

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

- Group 1/Group 2

The group combinations:

Group 1/Group 3 and Group 2/Group 3

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

Cable routing outside buildings

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

Warning

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

8.1.3 Lightning protection

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

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

8.1.4 Transmission media

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

- coaxial cable
  10Base2 (thin coax),
  10Base5 (thick coax, yellow cable)
- optical fiber (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 on the available cable types can be taken from 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 with Ethernet gateway.

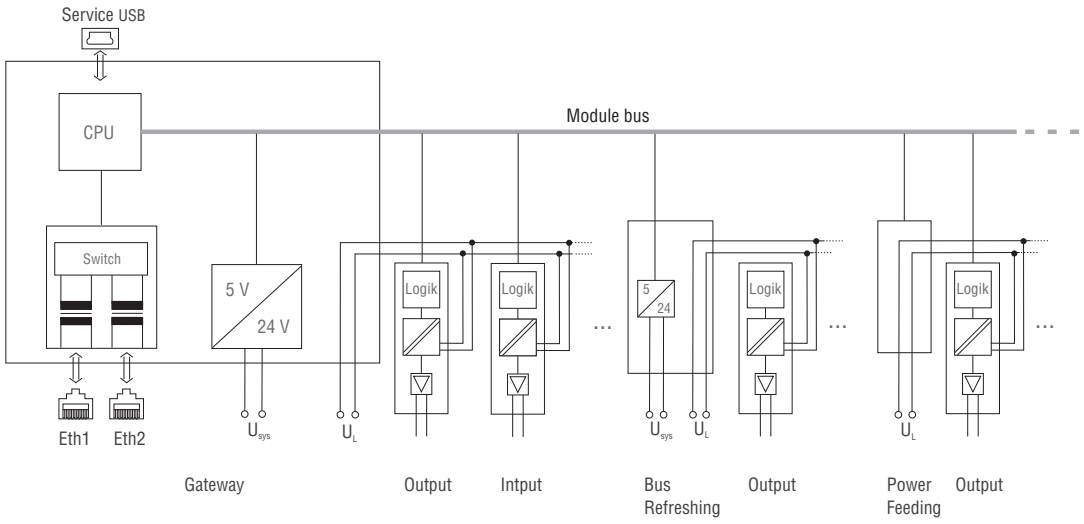


Figure 8-1: Block diagram BL20-station with PROFINET-gateway

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.

Warning

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

8.3.3 PE connection

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

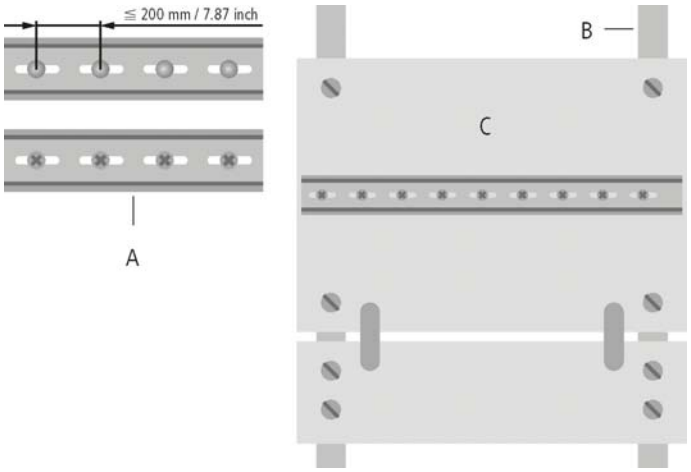
8.3.4 Earth-free operation

Observe all relevant safety regulations when operating an earthfree system.PE connection

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. Use corrosion-resistant mounting rails

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.

The insulation of the shielded data-cable should be stripped and connected to the shield rail when the system is used in stationary 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.

Note

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 if these

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

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

Warning

Never use the shield as a potential compensation.

A potential compensation cable must have the following characteristics:

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

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 atwww.turck.de.

10 Index

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.

LLDP

Abbreviation for „Link Layer Discovery Protocol“. Protocol for neighborhood detection between PROFINET nodes and thus allows the simple exchange of PROFINET network nodes without an additional engineering tool. Further information under www.profibus.com.

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant bit

M

Mass

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

Master

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

Module bus

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

MSB

Most Significant bit

P

Ping

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

PLC

Programmable Logic Controller.

Potential compensation

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

Potential free

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

Potential linked

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

Protective earth

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

R

Radiation coupling

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

Reaction time

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

Reference potential

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

Repeater

Amplifier for signals transmitted via a bus.

Root-connecting

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

RS 485

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

S

Serial

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

Setting parameters

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

Shield

Conductive screen of cables, enclosures and cabinets.

Shielding

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

Short-circuit proof

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

Station

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

T

TCP

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

Terminating resistance

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

To ground

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

Topology

Geometrical structure of a network or the circuitry arrangement.

U

UDP

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

Unidirectional

Working in one direction.

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