TURCK

Industrial
Automation

BL67 –

USER MANUAL FOR PROFIBUS-DP

Version 4.1, edition 09/06

Safety Notes!

Before starting the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.

- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

Table of Contents

About this Manual

Documentation Concept

This manual contains all information about the PROFIBUS-DP-gateway of the BL67-system.

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

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

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

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

General Information

Attention

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

Prescribed Use

Warning

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

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

Notes Concerning Planning /Installation of this Product

Warning

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

Description of Symbols Used

Warning

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

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

Attention

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

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

Note

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

List of Revisions

In comparison to the previous manual edition (11/05), the following changes/ revisions have been made:

Table 1: List of revisions

Chapter	Subject/ Description	new	changed
Chap. 5	Corrections in the data image of the technology modules		X

Note

The publication of this manual renders all previous editions invalid.

1 BL67 Philosophy

The Basic Concept

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

BL67 offers modules for practically all applications:

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

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

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

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

Note

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

Flexibility

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

Convenient Handling

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

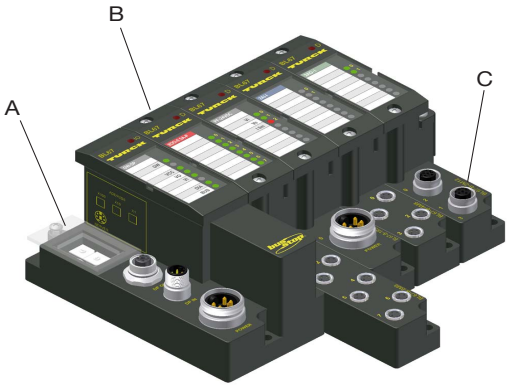
The gateway and the base modules are snapped onto a mounting rail or are directly mounted onto a mounting plate. The electronic modules are plugged onto the appropriate base modules.

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

BL67 Components

Figure 1:
BL67 station PROFIBUS-DP

A *PBDP-Gateway*
B *electronic module*
C *base module*



Gateways

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

Figure 2:
BL67 gateway for PROFIBUS-DP

Electronic Modules

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

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

Figure 3: electronic module

Power Feeding Modules

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

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

Note

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

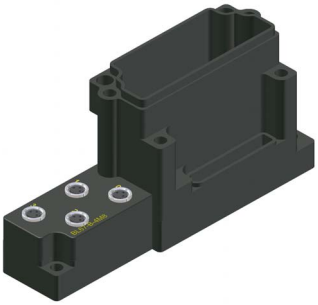
Base Modules

The field wiring is connected to the base modules.

These are available in the following connection variations:

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

Figure 4: example of a base module

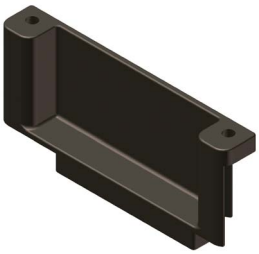


End Plate

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

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

Figure 5: end plate



2 PROFIBUS-DP

Decentralized Periphery

Optimized for high speed, PROFIBUS-DP is designed especially for communication between automation control systems and decentralized periphery devices. It can be used to replace cost-intensive, parallel signal transmission from digital and analogue sensors and actuators.

PROFIBUS-DP is based on DIN 19245 Part 1 and Part 4. During the course of the European fieldbus standardization, PROFIBUS-DP has been included in the European fieldbus standard EN 50170.

Topology

PROFIBUS-DP communicates via a shielded twisted pair cable according to the RS485 standard. The network topology represents a linear structure with active bus termination on both ends.

Maximum System Extension

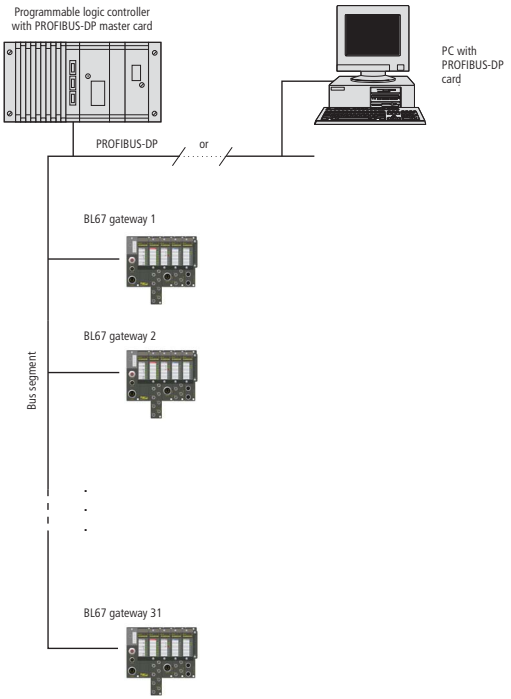
A bus line consists of at least a PLC or PC, which takes on the function of a PROFIBUS-DP master, as well as a gateway, which controls the communication of the various BL67 modules.

Each BL67-gateway is a passive node (slave) in the PROFIBUS-DP-structure and occupies one fieldbus address.

Maximum System Extension without Repeaters

Without a repeater, a PROFIBUS-DP line can consist of a maximum of 31 BL67 stations and a master.

Figure 6: Maximum system extension without repeaters



Attention

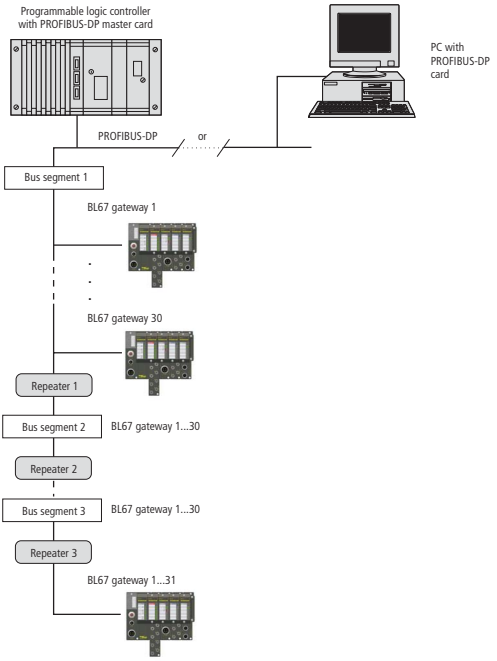
A maximum number of 32 stations on the bus must not be exceeded without a repeater.

The bus addresses 001 to 125 can be set using the 3 decimal rotary coding-switches on the gateway. A direct allocation of addresses via the bus is not possible.

Maximum System Extension with Repeaters

The maximum bus length lies between 100 meters at a transmission speed of 12 Mbaud and 1200 meters at a transmission speed of 9 600 baud. The maximum bus length can be extended by using repeaters.

Figure 7: Maximum system extension with repeaters



Attention

With repeaters, a PROFIBUS-DP system can consist of a master (PLC or PC) plus a maximum of 30 gateways per bus segment. The maximum number of all possible stations is manufacturer specific and is for example, at its limit with 121 BL67 gateways and three repeaters. The maximum number of 125 bus stations must not be exceeded.

Maximum Distances / Bus Lengths with and without Repeaters

Table 2: Maximum distance between two stations/bus length; cable type A (DIN 19 245, Part 3)

Baud rate (kbps)	Max. distance between two stations / cable type A (DIN 19245, Part 3)	
	max. length of a bus line without repeater (m)	max. bus length with 3 repeaters (m)
9.6	1200	4800
19.2	1200	4800
93.75	1200	4800
187.5	1000	4000
500	400	1600
1 500	200	800
3 000	100	400
6 000	100	400
12 000	100	400

Cable Type

The cable type recommended in the PROFIBUS-DP standard DIN 19245 Part 3 is cable type A which has to meet the following parameters.

Table 3: Parameters of cable Type A

Parameters	**Cable type A (DIN 19245 Part 3)**
Characteristic impedance	135 to 165 Ω (3 to 20 MHz)
Distributed capacitance	< 30 nF/km
Loop resistance	< 110 Ω/km
Wire diameter	> 0.64 mm
Wire cross-section	> 0.34 mm^2
Terminating resistor	220 Ω

Mixed Usage With Other Station Types

In addition to BL67 gateways, it is possible to integrate other station types (for example, TURCK-PROFIBUS-DP modules like BL20 or *piconet*®, or devices from third party manufacturers which have been certified according to DIN 19 245 Part 3). This means that PROFIBUS-DP systems are extremely flexible and can be used in the most difficult industrial environments.

3 BL67-Gateway for PROFIBUS-DP

Introduction

This chapter contains a description of BL67 gateways for the standardized fieldbus PROFIBUS-DP. The chapter is divided up as follows: a description of functions, general and specific technical data, a description of addressing and status displays, and parameter assignment.

Furthermore, this chapter contains information about the diagnosis and parameterbyte description of the BL67 I/O modules. Depending on the fieldbus used, this description is different and therefore bus specific.

Function

The BL67 gateway enables BL67 modules to operate on PROFIBUS-DP. The gateway is the connection between the BL67 modules and the PROFIBUS-DP master. It regulates the process data between the
I/O level and the fieldbus, and generates diagnostic data for the higher-level master. Information is made available to the software tool I/O-ASSISTANT via the service interface.

Note

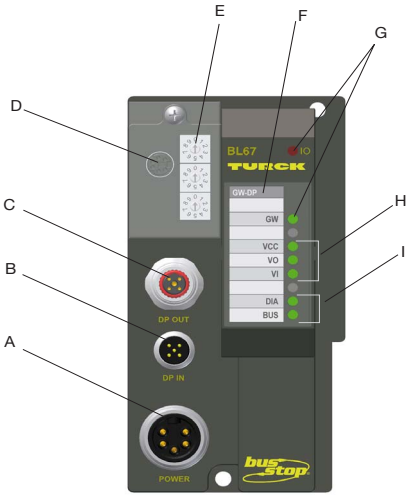
BL67 gateways can only be used as slaves.

The BL67-gateway for PROFIBUS-DP is available with a maximum baud rate of 12 MBaud.

WAIT_PRM

When the BL67 gateway has the “WAIT_PRM” status, it is not possible to check the parameters in the parameter telegram of the PROFIBUS-DP master due to the large number of module combinations and module variants. This check is performed after successful configuration by the PROFIBUS-DP master in the context of the configuration.

Figure 8:
BL67 gateway for PROFIBUS-DP

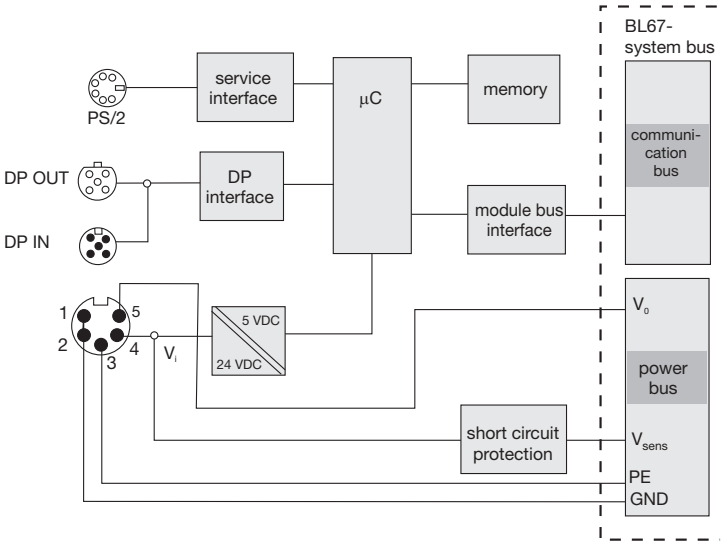


- **A** *Power supply*
- **B** *DP-IN*
- **C** *DP-OUT*
- **D** *Service-interface*
- **E** *rotary coding switches*
- **F** *Designation*
- **G** *Module bus LEDs*
- **H** *LEDs for voltage supply*
- **I** *PBDP-LEDs*

Structure Diagram

The BL67 gateway has the following structure:

Figure 9: gateway structure



Technical Data

Table 4: Technical data for gateway PBDP

Supply voltage		
System supply V_I (U_B)	24 V DC	used to generate the galvanically isolated module bus supply
Permissible range	18 to 30 V DC	
Field supply V_O (U_L)	24 V DC	
Permissible range	18 to 30 V DC	
I_{sys}	650 mA	current consumption CPU + module bus at maximum system extension
I_{MB}	max. 1,5 A	maximum output current of module bus supply
I_{VI}	max. 4 A	short-circuit and overload protection of the sensor supply from gateway or power feeding module
Isolation voltages		
U_{RS} (PROFIBUS-DP/ service interface)	0 V DC	
U_{DP} (PROFIBUS-DP/ module bus)	0 V DC	
U_{sys} (V_O/ V_I to U_{sys})	1000 V DC	

field bus/(V_I/ V_O)	500 V_{eff}
V_I/ V_O	no
(V_I/ V_O**1**)/(V_I/ V_O**2**), with PF module for ptential isolation	500 V_{eff}
field bus/ (V_I/ V_O**2**)	500 V_{eff}
Ambient conditions	
Ambient temperature	
– $t_{Ambient}$	0 to +55 °C /32 to 131 °F
– t_{Store}	- 25 to +85 °C / - 13 to 185 °F
Relative humidity	according to IEC 61131-2
Climatic tests	according to IEC 61131-2
Noxious gas	according to IEC 68068-42/43
Resistance to vibration	according to IEC 61131-2
Protection class	according to IEC 60529 IP67
Shock resistant	according to IEC 61131-2
Topple and fall/ free fall	according to IEC 61131-2
Emitted interference	
High-frequency, radiated	according to EN 55011, Class A
Immunity to interference	
Static electricity	according to IEC 61131-2
Electromagnetic HF fields	according to IEC 61131-2
Fast transients (Burst)	according to IEC 61131-2
Conducted interferences induced by HF fields	according to IEC 61000-4-6 10 V Criteria A

A *I/O-line-length ≤ 30 m*	High energy transients (Surge) **A** voltage supply	according to IEC 61000-4-5 0,5 kV CM, 12 Ω/ 9 µF 0,5 kV DM, 2 Ω/ 18 µF Criteria B

Reliability

Operational life MTBF	min. 120000 h
Electronics modules pull/ plug cycles	20
Dimensions	
Width x length x height (mm/inch)	64,5 x 145,0 x 77,5 / 2,54 x 5,71 x 3,05
Diagnostic interface	PS/2-female connector

Warning

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

Connection Options

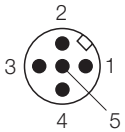
Fieldbus Connections

M12-Connection

Reverse keyed M12 x 1 connectors are provided for gateway communication via the PROFIBUS-DP fieldbus.

- M12 x 1 male connector for the incoming bus cable:

Figure 10: PBDP male connector



- M12 x 1 female connector for the outgoing bus cable:

Figure 11: PBDP-female connector

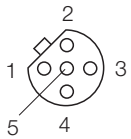


Table 5: PIN assignment of the M12 x 1 connectors

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

Note

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

Fieldbus Termination

The gateway offers no possibility for terminating the fieldbus.

Note

The fieldbus termination has to be realized via a connector with integrated terminating resistor (e.g. RSS4.5-PDP-TR, Order-No.: 6601590 for passive or PDP-TRA, Order-No.: 6825346 for active termination).

Power Supply via 7/8''

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

Figure 12: power supply via 7/8“ male connector

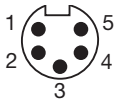


Table 6: PIN assignment of the 7/8'' power supply connector

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

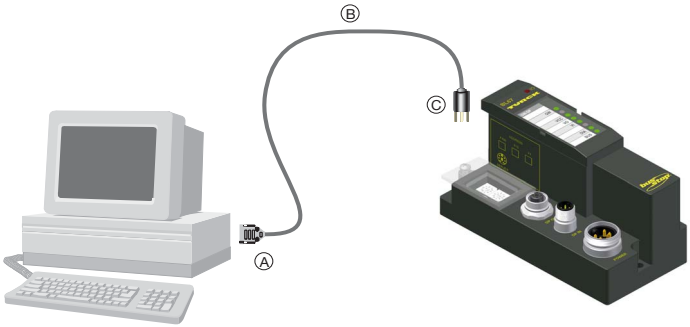
Service Interface Connection

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

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

Connection with I/O-ASSISTANT-Connection Cable

Figure 13: BL67-gateway connected to PC via special cable



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

Figure 14: PS/2 male connector on the connection cable to the gateway (top view)

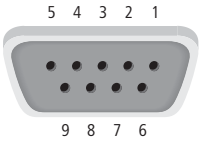


Figure 15: 9-pole SUB-D female connector on the cable for connecting to PC (top view)

Connection Using Commercially Available Cables

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

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

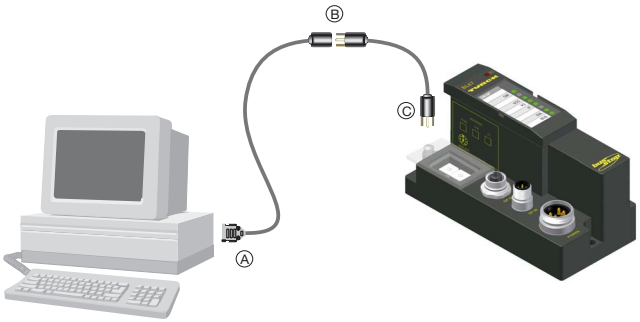


Figure 16: Connection between PC and BL67 gateway via commercially available cable

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

The following two cables are necessary:

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

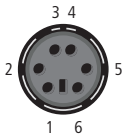
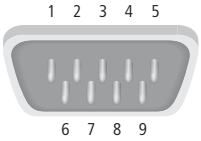


Figure 17: PS/2 female connector on the gateway (top view)

Figure 18: 9-pole SUB-D male connector on PC (top view)



Pin assignment

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

Table 7: Pin assignment when using PS/2 cable and adapter

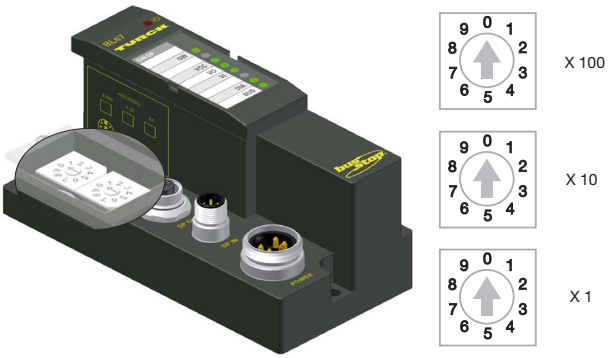
A *not supported by all adapter cables.*

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

Address Setting

BL67 gateway addressing on PROFIBUS-DP is performed via the three decimal rotary coding-switches. These switches are positioned next to the service interface.

Figure 19: Decimal coding switches for address setting



Attention

A maximum of 126 addresses (000 to 125) can be allocated. Each address may be allocated only once in the entire bus structure.

The bus addresses 000, 126 and 127 must not be allocated.

Note

It is not necessary to address the internal module bus.

Attention

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

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

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

Setting Parameters

Gateway Parameters

BL67 gateways for PROFIBUS-DP require 5 parameter bytes. These describe exclusively the behavior of the gateway itself. The first three parameters are defined by the PROFIBUS-DP standard.

Description and Allocation of Gateway Parameters

The texts in the columns “Parameter name“ and “Meaning“ correspond to those determined in the GSD files (Electronic Device Data Sheets), which are described in Chapter 4.

Table 8: Gateway parameters

A *default settings*

Byte/ Parameter name	**Value**	**Meaning**
Bytes 0-2: **Reserved**		**0x00, 0x00, 0x00**, 0x00, 0x00
Byte 3: **Module bus station**		0x00, 0x00, 0x00, **0x00**, 0x00
Bit 0 and 1: Outputs module exchange		
00	output 0 **A**	The gateway switches the outputs of modules to “0”. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules (with the exception of analog output modules) to “0”. Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to “0” or to a default value, or to maintain the original values. The non-configured analog output modules set their outputs to “0”.

Table 8: Gateway parameters

A *default settings*

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 maintain the original values. The non-configured analog output modules maintain their current output settings.
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.
Bit 2 and 3: Outputs module exchange error		
00	output 0 **A**	The gateway switches the outputs of the modules to “0”. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules (with the exception of analog output modules) to “0”. Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to “0” or to a default value, or maintain the original values. The non-configured analog output modules set their outputs to “0”.

Table 8: Gateway parameters

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 maintain the original values. The non-configured analog output modules maintain their current output settings.
11	exchange process data	The gateway carries on exchanging process data with the other module bus stations. No error information is transmitted.
Bit 4 and 5: Outputs fieldbus error		
00	output 0 **A**	The gateway switches the outputs of the modules to “0”. No error information is transmitted.
01	output substitute value	The gateway switches the outputs of all modules (with the exception of analog output modules) to “0”. Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to “0” or to a default value, or maintain the original values. The non-configured analog output modules set their outputs to “0”.

A *default settings*

Table 8: Gateway parameters

A *default settings*

Byte/ Parameter name	**Value**	**Meaning**
11	Hold current value	The gateway maintains the actual output settings of all modules (with the exception of analog output modules). Error information is transmitted to the analog output modules. Depending on their configuration, these modules set their outputs either to “0” or to a default value, or maintain the original values. The non-configured analog output modules maintain their current output settings.
Byte 4: **Gateway**		0x00, 0x00, 0x00, 0x00, **0x00**
Bit 0: Integer data format		
0	LSB first	Data is converted to INTEL format (standard format).
1	MSB first	16-bit data are transmitted with the high and low bytes reversed. This parameter influences the process data!
Bit 1: Diagnostics from modules		
0	activate **A**	Diagnostic messages from the module bus stations are made known to the fieldbus master as extended diagnostics.

Table 8: Gateway parameters

A *default settings*

Byte/ Parameter name	Value	Meaning
1	deactivate	Diagnostic messages from the module bus stations will not be displayed. A station diagnostic is not automatically generated along with module diagnostics.
Bit 2: V_O diagnostics		
0	activate **A**	The monitoring function for the field supply V_O (from gateway and power feeding modules) is activated. If this parameter is set but the parameter „Diagnostics from modules“ (see bit 1) deactivated, then only the voltage supply at the gateway is monitored. A monitoring of the voltage supply at the power feeding module is not realized.
1	deactivate	
Bit 3: Station configuration		
0	do not allow changes **A**	When commissioning the BL67 station, the actual list of modules must match exactly the module list planned in the configuration software of the master.

Table 8: Gateway parameters

A *default settings*

Byte/ Parameter name	Value	Meaning
1	allow changes	When the BL67 station is put into operation by the fieldbus master, the actual list of modules can differ slightly from the list of modules planned in the configuration software of the master: – Free slots exist in the actual configuration where modules have been planned. These free slots are reserved for the planned modules. – Modules are mounted in the actual configuration where free slots have been planned. These modules will be ignored by the gateway.
Bit 4: I/O-ASSISTANT ForceMode		
0	release **A**	I/O-ASSISTANT can set the force mode.
1	block	I/O-ASSISTANT cannot set the force mode, if the station was parameterized by the DP master.
Bit 5: Gateway diagnostics		
0	device related diagnostics **A**	The „device related diagnostic format“ is used: 2 bytes gateway diagnostics + diagnostic bytes for all modules of the station which are capable for diagnostic

Table 8: Gateway parameters

A *default settings*

Byte/ Parameter name	Value	Meaning
1	dev./identifier/ channel-diagn.	The device, identifier and channel related diagnostic format according to PROFIBUS standard is used: 2 bytes gateway diagnostic + 1 diagnostic bit for each connected module + active diagnostic blocks for the modules of the station which are capable for diagnostic

Module Parameters

The texts in the columns “Parameter names“ and “Meaning“ correspond to those determined in the GSD files (Electronic Device Data Sheets), which are described in Chapter 4.

Description and Allocation of Module Parameters

Parameters: BL67-4DI-PD

Table 9: Parameter BL67-4DI-PD

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
n **B**	0	Input filter 0	0 = deactivate **A** 1 = activate
	...		
	3	Input filter 3	
n + 1	0	Digital input 0	0 = normal **A** 1 = inverted
	...		
	3	Digital input 3	
n + 2	0	Operation Mode Group A	0 = normal **A** 1 = open-circuit monitoring
	1	Operation Mode Group B	

Parameters: BL67-8DI-PD

Table 10: Parameter BL67-8DI-PD

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
n **B**	0	Input filter 0	0 = deactivate **A** 1 = activate
	...		
	7	Input filter 7	
n + 1	0	Digital input 0	0 = normal **A** 1 = inverted
	...		
	7	Digital input 7	
n + 2	0	Operation Mode Group A	0 = normal **A** 1 = open-circuit monitoring
	...		
	3	Operation Mode Group D	

Parameters: BL67-2AI-I

Table 11: Parameters BL67-2AI-I

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
– Channel 0			
n **B**	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	Diagnostic	0 = release **A** 1 = block
	3	Channel	0 = activate **A** 1 = deactivate
– Channel 0			
n + 1	assignment similar to byte n = channel 0		

Parameters: BL67-2AI-V

Table 12: Parameters BL67-2AI-V

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
– Channel 0			
n **B**			
	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	Diagnostic	0 = release **A** 1 = block
	3	Channel	0 = activate **A** 1 = deactivate
– Channel 1			
n + 1	assignment similar to byte n = channel 0		

Parameters: BL67-2AI-PT

Table 13: Parameters BL67-2AI-PT

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
– Channel 0			
n **B**	0	measurement mode	0 = 2-wire **A** 1 = 3-wire
n + 1	0	Mains suppression	0 = 50 Hz **A** 1 = 60 Hz
	1	Value representation	0 = Integer (15 bit + sign) **A** 1 = 12 bit (left-justified)
	2	Diagnostic	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
n + 2	assignment similar to byte n = channel 0		
n + 3	assignment similar to byte n + 1 = channel 0		

Parameters: BL67-2AI-TC

Table 14: Parameters BL67-2AI-TC

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

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

Parameters: BL67-4AI-V/I

Table 15: Parameters BL67-4AI-V/I

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
– Channel 0			
n **B**	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	Diagnostic	0 = release **A** 1 = block
	3	Channel	0 = activate **A** 1 = deactivate
	4	Operation mode	0 = voltage **A** 1 = current
– Channel 1			
n + 1	assignment similar to byte n = channel 0		
– Channel 2			
n + 2	assignment similar to byte n = channel 0		
– Channel 3			
n + 3	assignment similar to byte n = channel 0		

Parameters: BL67-16DO-0.1A-P

Table 16: Parameters BL67-16DO-0.1A-P

A *default setting*

Byte	Bit	Parameter	Value/ Meaning
n	7 to 0	Open circuit	0000 = 0 mA 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA **A**
	15 to 8	Overcurrent/ short-circuit	0000 = 0 mA **A** 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA
n + 1	0	Overcurrent monitoring	0 = deactivate 1 = activate **A**
	1	Open circuit monitoring	0 = deactivate **A** 1 = activate

Parameters: BL67-2AO-I

Table 17:n Parameters BL67-2AO-I

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
– Channel 0			
n **B**	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	Channel K1	0 = activate **A** 1 = deactivate
n + 1		Substitute value A1	The substitute value will be transmitted if the respective parameters of the gateway have been set to „output substitute value“.
n + 2			
– Channel 1			
n + 3	assignment similar to byte n = channel 0		
n + 4 to n + 5	assignment similar to byte n + 1 and n + 2		

Parameters: BL67-2AO-V

Table 18:n Parameters BL67-2AO-V

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
– Channel 0			
n **B**	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)
n + 1		Substitute value A1	The substitute value will be transmitted if the respective parameters of the gateway have been set to „output substitute value“.
n + 2			
– Channel 1			
n + 3	assignment similar to byte n = channel 0		
n + 4 to n + 5	assignment similar to byte n + 1 and n + 2		

Parameters: BL67-4DI4DO-PD

Table 19: Parameters BL67-4DI4DO-PD

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
n **B**	0	Input filter 1	0 = deactivate **A** 1 = activate
	...		
	3	Input filter 4	
n + 1	0	Digital input 1	0 = normal **A** 1 = inverted
	...		
	3	Digital input 3	
n + 2	0	Output on overcurrent 1	0 = automatic recovery**A** 1 = controlled recovery
	...		
	3	Output on overcurrent 4	

Parameters: BL67-8XSG-PD

Table 20: Parameters BL67-XSG-PD

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

Byte	Bit	Parameter	Value/ Meaning
n **B**	0	Input filter 1	0 = deactivate **A** 1 = activate
	...		
	7	Input filter 8	
n + 1	0	Digital input 1	0 = normal **A** 1 = inverted
	...		
	7	Digital input 8	
n + 2	0	Output on overcurrent 1	0 = automatic recovery **A** 1 = controlled recovery
	...		
	7	Output on overcurrent 8	
n + 3	0	Output 1	0 = deactivate **A** 1 = activate
	...		
	7	Output 3	

Parameters: BL67-1RS232

Table 21: Parameters BL67-1RS232

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

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

Byte	Bit	Parameter	Value/ Meaning
n + 3	3 to 0	data rate	0000 = reserved 0001 = 300 bps 0010 = 600 bps 0011 = 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 1101 = reserved 1110 = reserved 1111 = reserved
	4 to 5	reserved	
	6	Disable ReducedCtrl	1 Constant setting: The diagnostic messages are mapped into byte 6 of the process input data (independent of „diagnostic“) Byte 7 contains the status byte, user data are displayed in bytes 0 - 5.
	7	Diagnostic	0 = release 1 = block **A**

Parameters: BL67-1RS485/422

Table 22: Parameters BL67-1RS485/422

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

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

Byte	Bit	Parameter	Value/ Meaning
n + 3	3 to 0	data rate	0000 = reserved 0001 = 300 bps 0010 = 600 bps 0011 = 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 1101 = reserved 1110 = reserved 1111 = reserved
	4	Select RS485	0 = Parameterization as RS422 1 = Parameterization as RS485
	5	reserved	
	6	Disable ReducedCtrl	1 Constant setting: The diagnostic messages are mapped into byte 6 of the process input data (independent of „diagnostic“) Byte 7 contains the status byte, user data are displayed in bytes 0 - 5.
	7	Diagnostic	0 = release 1 = block **A**

Parameters: BL67-1SSI

Table 23: Parameters BL67-1SSI

A *default setting*
B ***n = 0*** → *module description acc. to type* ***n = 1*** → *standard module description*

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

Parameters: BL67-1CVI

Table 24: Parameters BL67-1CVI

A *default setting*
n = 0 → *module description acc. to type*
n = 1 → *standard module description*

Byte	Bit	Parameter	Value/ Meanign
n **B**	0	Node 1	0 = deactivate **A** 1 = activate
	1	Guarding	0 = deactivate **A** 1 = activate
	4,3,2	Input Bits	000 = 0 Bit **A** 001 = 4 Bit 010 = 8 Bit 011 = 12 Bit 100 = 16 Bit 101 = 24 Bit 110 = 32 Bit
	7,6,5	Ouput Bits	000 = 0 Bit **A** 001 = 4 Bit 010 = 8 Bit 011 = 12 Bit 100 = 16 Bit 101 = 24 Bit 110 = 32 Bit
n + 1		Assignment similar to byte n for node 2.	
...	...		
n + 7		Assignment similar to byte n for node 8.	
n + 8		Guarding Time [0,1s]	Setting the Guard-Time in steps of 100 ms (Values 0 to 255); Default 3 = 300 ms
n + 9		Life Time Factor	Factor which defines how often a node is allowed not to answer a request or to exceed the Guard-Time (values 0 to 255); default = 3

Byte	Bit	Parameter	Value/ Meaning
n + 10	2, 1, 0	Data rate	000 = 1000 kbps 001 = 500 kbps 010 = 250 kbps 011 = 125 kbps **A** 100 = 50 kbps 101 = 20 kbps 111 = 10 kbps
	3	Terminating resistor	0 = deactivate **A** 1 = activate
...		reserved	

Module Description in the Electronic Device Data Sheets (GSD)

BL67 gateways are integrated into PROFIBUS structures using electronic device data sheets (GSD).

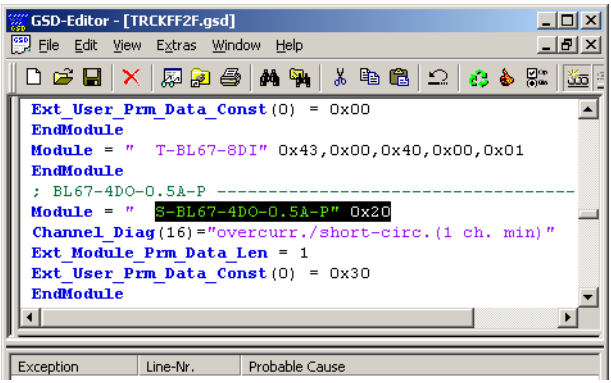
Each individual module is supplied with a means of identification in the standard electronic device data sheet, making various forms of identification possible.

Standard Module Description

The configured module list is displayed with standard identification (general identification format), exception: empty slots and modules without process data are displayed in a special identification format. Modules cannot be unmistakably identified using this identification.

Advantage: Replacement modules need not be of an identical type to be accepted by the BL67 gateway. This means that “related” modules with identical process data lengths can be used. Thus, it is possible to exchange a 4 DO 24 V DC module with **0.5A** with a 4 DO 24 V DC module with **2A**. This form of module identification achieves, amongst other things, a higher measure of flexibility for process, parameter and diagnostic data.

Figure 20:
Standard description of the digital input module BL67-4DO-0.5A

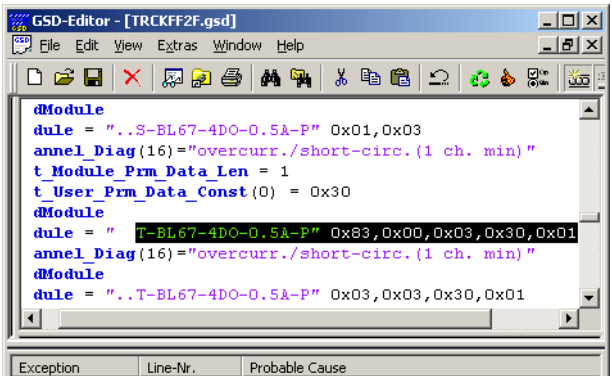


Module Description According to Type.

The configured module list is displayed with extended identification (special identification format), which makes an exact identification of

modules possible. The BL67 gateway accepts replacement modules only of an identical type.

Figure 21: Description according to type of the digital input module BL67-4DO-0.5A



Options by the descriptions of modules

- **Typified module description:** Special identification format: 3 manufacturer-specific bytes
- **Standard module description:** Standard identification: length identification in the GSD file

Table 25: Optional module description

	Typified	Standard
Identification of individual modules by PROFIBUS-DP master and gateway	✓	
Plug/pull of identical modules	✓	✓
Plug/pull of module types with identical process data lengths, described by means of PROFIBUS-DP identification		✓
Plug/pull of module types with differing process data lengths, described by means of PROFIBUS-DP identification		

Example of a PROFIBUS-DP Configuration

The module description according to type is used in the following description of the process, configuration and parameter setting data.

Example of a station configuration:

- Module A: 4DI
- Module B: 4DI
- Module C: 4DI
- Module D: 8 DI
- Module E: 2 AI-I
- Module F: 2 AO-I
- Module G: 4 DO-0.5A

System Description

Process data are displayed in INTEL format. The Motorola representation can be set using the gateway parameters.

Table 26: Parameter configuration data

Module	Input byte address	Output byte address	Byte (bit 7...→ ... bit 0)
A	0		A3, A2, A1, A0
B	1		B3, B2, B1, B0
C	2		C3, C2, C1, C0
D	3		D7, D6, ..., D1, D0
E_1	4		E7, E6, ... E1, E0
E_2	5		E15, E14, ... E9, E8
E_3	6		E23, E22, ... E17, E16
E_4	7		E31, E30, ... E25, E24
F_1		0	F7, F6, ... F1, F0
F_2		1	F15, F14, ... F9, F8
F_3		2	F23, F22, ... F17, F16
F_4		3	F31, F30, ... F25, F24
G		4	G3, G2, G1, G0

Parameter Configuration Data

1 Module bus station A: Not configurable

2 Module bus station B: Not configurable

3 Module bus station C: Not configurable

4 Module bus station D: Not configurable

5 Module bus station E (per channel):

- bit 0 = 0: Current mode: 0...20 mA
- bit 0 = 1: Current mode: 4...20 mA

- bit 1 = 0: Value representation: integer (15 bit + sign)
- bit 1 = 1: Value representation: 12 bit (left-justified)

6 Module bus station F (per channel):

- bit 0 = 0: Current mode: 0...20 mA
- bit 0 = 1: Current mode: 4...20 mA
- bit 1 = 0: Value representation: integer (15 bit + sign)
- bit 1 = 1: Value representation: 12 bit (left-justified)
- Signed Integer: Substitute value A1

7 Module bus station G: Not configurable

Diagnostic Data

1 Module A: No diagnostic data available

2 Module B: No diagnostic data available

3 Module C: No diagnostic data available

4 Module D: No diagnostic data available

5 Module E:

- bit 0: Measurement value range error
- bit 1: Open circuit

6 Module F: No diagnostic data available

7 Module G:

- bit 0: Overcurrent (short circuit channel 0)
- bit 1: Overcurrent (short circuit channel 1)
- bit 2: Overcurrent (short circuit channel 2)
- bit 3: Overcurrent (short circuit channel 3)

Status Indicators/Diagnostic Messages Gateway

The gateway transmits the following diagnostics: the status of the BL67 station, the communication via the internal module bus, the communication to PROFIBUS-DP and the status of the gateway.

Diagnostic messages are displayed in two ways:

- via individual LEDs
- via the software of the respective fieldbus master (for example, PLC)

Diagnostic Messages via LEDs

Every BL67 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IOs**
- 2 LEDs for PROFIBUS-DP communication (fieldbus LEDs): **DIA** and **Bus**
- 3 LEDs for monitoring the voltage supply (system, $\mathbf{V}_{CC}$/ inputs, $\mathbf{V}_{I}$/ outputs, $\mathbf{V}_{O}$).

Table 27: LED indicators

LED	Status	Meaning	Remedy
GW	OFF	CPU not supplied.	
	Green	Firmware active, gateway ready to operate and transmit	-
	Green, flashing, 1 Hz	Firmware not active.	– If LED “**IOs**“ red → firmware download necessary
	Green, flashing, 4 Hz	Firmware active, gateway hardware defect.	– Replace the gateway.

Table 27: LED indicators

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

Table 27: LED indicators

LED	Status	Meaning	Remedy
	Red and LED "**GW**" off	Controller is not ready, V_{CC} level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in – gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.
	Red flashing, 1 Hz	Non-adaptable modification of the physically connected station.	– Compare the planned BL67 station with the physical station. – Check the physical station for defective or incorrectly fitted electronics modules.
	Red flashing, 4 Hz	no module bus communication	– At least one module has to be plugged and has to be able to communicate with the gateway.
	Red/ green flashing, 1 Hz	Adaptable modification of the physically connected station; data transfer possible	– Check the physical station for pulled or new but not planned modules.
V_{CC}	-	CPU not supplied	– Check the system supply at the gateway.
	Green	Module bus and CPU running	-

Table 27: LED indicators

LED	Status	Meaning	Remedy
V_O	Green	Supply of outputs ok.	– Check the wiring at the gateway and the voltage supply.
	Green flashing, 1 Hz	undervoltage V_O, System running	– Check the system supply at the gateway
	Green flashing, 4 Hz	Overvoltage V_O, System running	
	Off	No voltage supply.	
V_I	Green	sensor supply ok.	–
	Green, flashing, 1Hz	undervoltage V_I, system running	– Check the wiring of the voltage supply at the gateway
	Green, flashing, 4Hz	Overvoltage V_I, system running	
	Red	Short circuit or overload at sensor supply → sensor supply is switched off	– Automatic restart when debugging.
	Off	No voltage supply.	– Check the wiring of the voltage supply at the gateway

Table 27: LED indicators

LED	Status	Meaning	Remedy
DIA	Off	Gateway not transmitting diagnostic.	–
	Red	Gateway is generating statistical diagnostic; no communication with the master.	– Check the individual electronics modules on the station for diagnostic messages. – Check the diagnostic messages using the PLC software.
	Red flashing, 1 Hz	Gateway transmitting extended diagnostic.	– Check the individual electronics modules on the station for diagnostic messages. – Check the diagnostic messages using the PLC software.
Bus	Off	No voltage supply	– Wait for the firmware-download to be completed. – After firmware-download: hardware-error, replace the gateway.
	Green	Communication between gateway and PROFIBUS-DP master is error free.	–

Table 27: LED indicators

LED	Status	Meaning	Remedy
	Red	Bus error detected by the gateway.	– Check if the field bus address of the station in the project of the PLC software is the same as the address set at the module. – If the gateway is the last module in the bus topology, check that the PROFIBUS-DP has been terminated with a terminating resistor. – Check if the PROFIBUS-DP connector or the direct wiring connections are fitted correctly. All connections must be correctly and securely fitted. – Check the cable to the PROFIBUS-DP master for damage and correct fitting. – Check if the correct baud rate has been set in the PLC master. – Compare the station engineering with the existing list of modules.
	Red, flashing, 1 Hz	A PROFIBUS-DP address which must not be used is set at the gateway	– Check the address set at the gateway. The addresses 000 and addresses > 125 must not be set. See also Section “Address Setting“, Page 3-15.

Diagnostic Messages via the Software

The diagnostic messages are displayed in the corresponding software of the PROFIBUS-DP master as diagnostic bytes. For the meaning of the individual diagnostic bits, please refer to the Section “Diagnosis“ in this chapter.

Diagnosis

BL67 offers 2 possibilities for the representation of diagnostic information:

- device related diagnosis:
  diagnosis-header
  + 2 byte gateway-diagnosis
  + maximum of 61 byte module diagnosis
- device-/ identifier-/ channel-specific diagnosis:
  diagnosis-header
  + **device related** diagnosis → 2 byte gateway diagnosis
  + **identifier related** diagnosis → 1 diagnosis bit for each possible module (64 bit = 8 byte)
  + **channel specific** diagnosis → active diagnosis blocks (3 byte per error message of the connected modules).

Note

The mode of diagnosis evaluation is determined via the gateway parameter „gateway diagnostics“ (parameter-byte 4, bit 5).

Device Related diagnosis

According to PROFIBUS-DP standards, the diagnosis telegram of the device related diagnosis is structured as follows:

Byte 1 to Byte 6	PROFIBUS-DP diagnosis according to DP standards
Device Related Diagnosis	
Byte 7	**Header** Besides the information that the following diagnosis is a device related diagnosis (bit 6 and bit 7 = „00“), the header also contains information about the length of the diagnosis telegram (maximum length = 64 byte). The header byte is included in the telegram length (1 byte header + 2 byte gateway diagnosis + max. 61 byte module diagnosis).
Byte 8 and Byte 9	gateway diagnosis: Byte 8, bit 0 shows, for example, if another module in the station sends diagnosis information (bit 0 = 1), or not (bit 0 = 0).

Byte 10 to Byte 61	Byte 10	First diagnosis byte of the 1. module capable for diagnosis in the station. (Depending on the module and the number of possible diagnosis bytes, further diagnosis bytes of the same module may follow.)
	Byte 11 to Byte 64	Further device related diagnostic information. Modules with 1 byte diagnosis data occupy 1 byte, Modules with multiple bytes of diagnosis data occupy a respective number of diagnosis bytes.

Note

The modules which are capable for diagnosis occupy in all cases the diagnosis bytes assigned to them, even if no actual diagnosis message is present.
In this case the bits in the diagnosis bytes are all = “0“.

Device-/ identifier - and channel specific diagnosis

The diagnosis telegram of this diagnosis evaluation contains all 3 possible diagnosis representations. The channel specific diagnosis information is only shown if diagnosis messages are actually present.

Byte 1 to 6	PROFIBUS-DP-diagnosis according to DP standards
Device Related Diagnosis	
Byte 7	**Header** Besides the information that the following diagnosis is a device related diagnosis (bit 6 and bit 7 = „00“), the header also contains information about the length of the diagnosis telegram (maximum length = 64 byte). The header byte is included in the telegram length (1 byte header + 2 byte gateway diagnosis + max. 61 byte module diagnosis).
Byte 8 and Byte 9	gateway diagnosis: Byte 8, bit 0 shows, for example, if another module in the station sends diagnosis information (bit 0 = 1), or not (bit 0 = 0).

Identifier specific diagnosis		
Byte 10 to 18	Byte 10	**Header** Besides the information that the following diagnosis is a identifier related diagnosis (bit 6 and bit 7 = „01“), the header also contains information about the length of the identifier related part of the diagnosis telegram.It always has 9 bytes (9 bytes = 1 byte header + 8 bytes for the maximum number of 64 possible modules).
	Byte 11	Shows possible diagnosis messages of the **modules 0 to 7**. Module 0 is the first module following the gateway. The module position is indicated by the position of the bit which is set in this byte. Example.: 0000_0**1**00 → error at module 2
	Byte 12	Shows possible diagnosis messages of **module 8 to 15**.
	...	
	Byte 18	Shows possible diagnosis messages of **module 56 to 63**.
Channel related diagnosis: (per module 3 bytes: 1 byte header + 1 byte channel description + 1 byte diagnosis) → “Channel specific diagnosis messages“		
Byte 19 to max. Byte 52	Byte 19	**Header** Defines the channel related diagnosis with bit 6 and bit 7 = „10“. In addition to that, the header shows for which module the actual diagnosis message is valid.
	Byte 20	Bit 0 to bit 5 contain the channel number. Bit 6 and bit 7 define, if the channel is an input or an output channel: 01 = input, 10 = output, 11 = in- and output
	Byte 21	Bit 5 to bit 7 define, if the module is a bit-, byte- or word-oriented module: 001 = bit-oriented 010 = 2 bit-oriented 011 = 4 bit-oriented 110 = word-oriented 111 = double word-oriented

Description of the Gateway Diagnosis Bits

The texts in the column “Diagnostics“ correspond to those determined in the GSD files (Electronic Device Data Sheets), which are described in Chapter 4.

Table 28: Gateway diagnostic bits

Diag. data record	Bit	Designation	Meaning
0		**PROFIBUS**	
	0...5	Identification of DP diagnostic length (1...64 Byte)	Defined by the PROFIBUS-DP standard.
	6...7	DP diagnostic type	Defined by the PROFIBUS-DP standard.
1		**Gateway warnings**	
	0	Module diagnostics available	
			0 = No module bus station is signaling a diagnostic. **1** = At least one module bus station with diagnostic function is signaling a diagnostic.
	1	reserved	

Table 28: Gateway diagnostic bits

Diag. data record	Bit	Designation	Meaning
	2	reserved	
	3	Station configuration changed	
			0 = The actual list of modules matches the configuration set in the configuration software of the corresponding fieldbus master. **1** = The actual list of modules has been altered in such a manner, that process data can still be exchanged with the module bus stations which are at present connected to the module bus. The constellation of the module bus station that is set in the configuration software (CheckConfig-Cmd) of the corresponding fieldbus master serves as a reference.

Table 28: Gateway diagnostic bits

Diag. data record	Bit	Designation	Meaning
	4	undervoltage field supply V_O	
			0 = field supply V_O is within the permissible range **1** = field supply V_O is not within the permissible range
	5	reserved	-
	6	undervoltage field supply V_I	
			0 = field supply V_I is within the permissible range **1** = field supply V_I is not within the permissible range
	7	Overcurrent/ Short circuit I_I	
			0 = current I_I is within the permissible range **1** = current I_I is not within the permissible range
2		**Gateway errors**	
	0...1	reserved	-
	2	Module bus error	
			0 = Communication with the module bus station on the module bus is possible. **1** = Communication with the module bus station on the module bus is not possible.

Table 28: Gateway diagnostic bits

Diag. data record	Bit	Designation	Meaning
	3	Master configuration error	
			0 = The actual list of modules matches the configuration set in the configuration software of the corresponding fieldbus master. **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. The constellation of the module bus station, set in the configuration software of the corresponding fieldbus master serves as a reference.

Table 28: Gateway diagnostic bits

Diag. data record	Bit	Designation	Meaning
	4	reserved	
	5	Station configuration error	
			0 = The gateway has prepared the station's configuration to be read out. **1** = The gateway could not prepare the station's configuration to be read out.
	6	I/O-ASSISTANT Force Mode active	
			0 = The fieldbus master can access the parameter, diagnostics and process data of the module bus stations. **1** = The force mode has been activated via the service interface (by I/O-ASSISTANT). This separates the fieldbus master from the outputs of the module bus stations. No process data exchange is taking place from the fieldbus master to the output modules.
	7	reserved	

Note

Up to 61 bytes of module-specific diagnostic errors can follow.

Module diagnosis

Device related diagnosis messages

BL67-PF-24VDC

Table 29: BL67-PF-24VDC

Diagnosis byte	Bit	Diagnosis
n	0	undervoltage V_I
	1	undervoltage V_O
	2	overcurrent I_I (short-circuit I_I)

BL67-4DI-PD

Table 30: BL67-4DI-PD

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent sensor 1 (sensor supply A)
	1	overcurrent sensor 2 (sensor supply B)
	2	overcurrent sensor 3 (sensor supply C)
	3	overcurrent sensor 4 (sensor supply D)
n + 1	0	open circuit K1(channel 0 and 2)
	1	open circuit K2 (channel 1 and 3)

BL67-8DI-PD

Table 31: BL67-8DI-PD

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent sensor 1 (sensor supply A)
	1	overcurrent sensor 2 (sensor supply B)
	2	overcurrent sensor 3 (sensor supply C)
	3	overcurrent sensor 4 (sensor supply D)
n + 1	0	open circuit K1(channel 0 and 4)
	1	open circuit K2 (channel 1 and 5)
	2	open circuit K3 (channel 2 and 6)
	3	open circuit K4 (channel 3 and 7)

BL67-2AI-I

Table 32: BL67-2AI-I

Diagnosis byte	Bit	Diagnosis
n (ch. 0)	0	measurement value range error **A**
	1	open circuit
n + 1 (ch. 1)	0	measurement value range error **A**
	1	open circuit

A *Only in the measurement range 4 to 20 mA*

BL67-2AI-V

Table 33: BL67-2AI-V

Diagnosis byte	Bit	Diagnosis
n (ch. 0)	0	measurement value range error
n + 1 (ch. 1)	0	measurement value range error

BL67-2AI-PT

Table 34: BL67-2AI-PT

Diagnosis byte	Bit	Diagnosis
n (ch. 0)	0	measurement value range error **A** (underflow diagnosis only in temperature measurement ranges)
	1	open circuit
	2	short-circuit **B** (only in temperature measurement ranges)
n + 1 (ch. 1)	0 to 7	see channel 0

A *threshold: 1 % of the positive measurement range end value*

B *threshold: 5 Ω (loop resistance)*

BL67-2AI-TC

Table 35: BL67-2AI-TC

Diagnosis byte	Bit	Diagnosis
n	0	measurement value range error **A**
	1	open circuit (only in temperature measurement ranges)
	2	No PT1000 sensor (cold junction compensation)
	3 to 7	reserved
n + 1 (ch. 1)	0 to 7	see channel 0

A *threshold: 1 % of the positive measurement range end value*

BL67-4AI-V/I

Table 36: BL67-4AI-V/I

Diagnosis byte	Bit	Diagnosis
n (ch. 0)	0	measurement value range error
n + x (ch. 1 to 3)	0	measurement value range error

BL67-4DO-0.5A-P

Table 37: BL67-4DO-0.5A-P

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent (short-circuit channel 0)
	...	...
	3	overcurrent (short-circuit channel 3)

BL67-4DO-2A-P

Table 38: BL67-4DO-2A-P

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent (short-circuit channel 0)
	...	...
	3	overcurrent (short-circuit channel 3)

BL67-8DO-0.5A-P

Table 39: BL67-8DO-0.5A-P

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent (short-circuit channel 0)
	...	...
	7	overcurrent (short-circuit channel 7)

BL67-16DO-0.1A-P

Table 40: BL67-8DO-0.5A-P

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent (short-circuit channel 0)
	...	...
	7	overcurrent (short-circuit channel 7)
n + 1	0	overcurrent (short-circuit channel 8)
	...	...
	7	overcurrent (short-circuit channel 15)

BL67-4DO-2A-N

Table 41: BL67-4DO-2A-N

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)

BL67-8DO-0.5A-N

Table 42: BL67-8DO-0.5-N

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent (short-circuit channel 0)
	1	overcurrent (short-circuit channel 1)
	2	overcurrent (short-circuit channel 2)
	3	overcurrent (short-circuit channel 3)
	4	overcurrent (short-circuit channel 4)
	5	overcurrent (short-circuit channel 5)
	6	overcurrent (short-circuit channel 6)
	7	overcurrent (short-circuit channel 7)

BL67-4DI4DO-PD

Table 43: BL67-4DI4DO-PD

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent sensor 1 (sensor supply A)
	1	overcurrent sensor 2 (sensor supply B)
	2	overcurrent sensor 3 (sensor supply C)
	3	overcurrent sensor 4 (sensor supply D)
n + 1	0	overcurrent K1
	1	overcurrent K2
	2	overcurrent K3
	3	overcurrent K4

BL67-8XSG-PD

Table 44: BL67-8XSG-PD

Diagnosis byte	Bit	Diagnosis
n	0	overcurrent sensor 1 (sensor supply A)
	1	overcurrent sensor 2 (sensor supply B)
	2	overcurrent sensor 3 (sensor supply C)
	3	overcurrent sensor 4 (sensor supply D)
n + 1	0	overcurrent K1
	1	overcurrent K2
	2	overcurrent K3
	3	overcurrent K4
	4	overcurrent K5
	5	overcurrent K6
	6	overcurrent K7
	7	overcurrent K8

BL67-1RS232

Table 45: BL67-1RS232

Diagnosis byte	Bit	Diagnosis
n	3	parameterization error
	4	hardware failure
	5	data flow control error
	6	frame error
	7	buffer overflow

BL67-1RS485/422

Table 46: BL67-1RS485/422

Diagnosis byte	Bit	Diagnosis
n	3	parameterization error
	4	hardware failure
	5	data flow control error
	6	frame error
	7	buffer overflow

BL67-1SSI

Table 47: BL67-1SSI

Diagnosis byte	Bit	Diagnosis
n	0	SSI group diagnostics
	1	open circuit
	2	sensor value overflow
	3	sensor value underflow
	4	parameterization error

BL67-1CVI

Table 48: Diagnosedaten BL67-1CVI

Diagnosis byte	Bit	Diagnosis
n	0 to 3	DiagNode1 (see Table 49:)
	4 to 7	DiagNode 2 (see Table 49:)
...	...	...
n + 3	0 to 3	DiagNode 7 (see Table 49:)
	4 to 7	DiagNode 8 (see Table 49:)
n + 4		DiagCVI (see Table 50:)
n + 5		reserved

Table 49: Diagnostic data CANopen node (DiagNode x)

Bit	Name
0	Emergencies transmitted since module start
1	Node hat Emergencies gemeldet
2	Communication error transmitted since module start/ Guard Time
3	Communication error/Guard Time timeout

Table 50: Global diagnostic data CVI module (DiagCVI)

Bit	Name
0	Emergencies transmitted since module start
1	Node address not within permissible range (1-8)
2	Overcurrent VC (valve power supply)
3	Overcurrent VE (valve electronic power supply)

Channel specific diagnosis messages

BL67-PF-24VDC

Table 51: BL67-PF-24VDC

Value (dec.)	Diagnosis
16	undervoltage V_I
17	undervoltage V_O
18	overcurrent I_I (short-circuit I_I)

BL67-4DI-PD

Table 52: BL67-4DI-PD

Value (dec.)	Diagnosis
16	overcurrent sensor 1 (sensor supply A)
17	overcurrent sensor 2 (sensor supply B)
18	overcurrent sensor 3 (sensor supply C)
19	overcurrent sensor 4 (sensor supply D)
24	open circuit K1(channel 0 and 2)
25	open circuit K2 (channel 1 and 3)

BL67-8DI-PD

Table 53: BL67-8DI-PD

Value (dec.)	Diagnosis
16	overcurrent sensor 1 (sensor supply A)
17	overcurrent sensor 2 (sensor supply B)
18	overcurrent sensor 3 (sensor supply C)
19	overcurrent sensor 4 (sensor supply D)
24	open circuit K1(channel 0 and 4)
25	open circuit K2 (channel 1 and 5)
26	open circuit K3 (channel 2 and 6)
27	open circuit K4 (channel 4 and 7)

BL67-2AI-I

Table 54: BL67-2AI-I

Value (dec.)	Diagnosis
16	measurement value range error **A**
17	open circuit

A *Only in the measurement range 4 to 20 mA*

BL67-2AI-V

Table 55: BL67-2AI-U

Value (dec.)	Diagnosis
16	measurement value range error **A**

BL67-2AI-PT

Table 56: BL67-2AI-PT

Value (dec.)	Bit	Diagnosis
16	0	measurement value range error **A** (undeflow diagnosis only in temperature measurement ranges)
17	1	open circuit
18	2	short-circuit **B** (only in temperature measurement ranges)

A *threshold: 1 % of the positive measurement end value*

B *threshold: 5 Ω (loop resistance)*

BL67-2AI-TC

Table 57: BL67-2AI-TC

Value (dec.)	Diagnosis
16	measurement value range error **A**
17	open circuit (only in the temperature measurement ranges)
18	No PT1000 sensor (cold junction compensation)

A *threshold: 1 % of the positive measurement end value*

BL67-4AI-V/I

Table 58: BL67-4AI-V/I

Value (dec.)	Diagnosis
16	measurement value range error

BL67-4DO-0.5A-P

Table 59: BL67-4DO-0.5A-P

Value (dec.)	Diagnosis
16	overcurrent (short-circuit channel 0)

BL67-4DO-2A-P

Table 60: BL67-4DO-2A-P

Value (dec.)	Diagnosis
16	overcurrent (short-circuit channel 0)

BL67-8DO-0.5A-P

Table 61: BL67-8DO-0.5A-P

Value (dec.)	Diagnosis
16	overcurrent (short-circuit channel 0)

BL6716DO-0.1A-P

Table 62: BL67-16DO-0.1A-P

Value (dec.)	Diagnosis
16	channel diagnosis (depending on parameterization) Short-circuit or/and open circuit – byte 0, bit 0 to 7 = channel 0 to 7 – byte 1, bit 0 to 7 = channel 8 to 15

BL67-4DO-2A-N

Table 63: BL67-4DO-2A-N

Value (dec.)	Diagnosis
16	overcurrent (short-circuit channel 0)

BL67-8DO-0.5A-N

Table 64: BL67-8DO-0.5-N

Value (dec.)	Diagnosis
16	overcurrent (short-circuit channel 0)

BL67-4DI4DO-PD

Table 65: BL67-4DI4DO-PD

Value (dec.)	Diagnosis
16	overcurrent sensor 1
17	overcurrent sensor 2
18	overcurrent sensor 3
19	overcurrent sensor 4
24	overcurrent K1
25	overcurrent K2
26	overcurrent K3
27	overcurrent K4

BL67-8XSG-PD

Table 66: BL67-8XSG-PD

Value (dec.)	Diagnosis
16	overcurrent sensor 1
17	overcurrent sensor 2
18	overcurrent sensor 3
19	overcurrent sensor 4
24	overcurrent K1
25	overcurrent K2
26	overcurrent K3
27	overcurrent K4
28	overcurrent K5
29	overcurrent K6
30	overcurrent K7
31	overcurrent K8

BL67-1RS232

Table 67: BL67-1RS232

Value (dec.)	Diagnosis
19	parameterization error
20	hardware failure
21	data flow control error
22	frame error
23	buffer overflow

BL67-1RS485/422

Table 68: BL67-1RS485/422

Value (dec.)	Diagnosis
19	parameterization error
20	hardware failure
22	frame error
23	buffer overflow

BL67-1SSI

Table 69: BL67-1SSI

Value (dec.)	Diagnosis
16	SSI group diagnostics
17	open circuit
18	sensor value overflow
19	sensor value underflow
20	parameterization error

4 Connections to Automation Devices

Introduction

This chapter contains detailed information on how to connect a BL67 station to higher-level automation devices, for example, programmable logic controllers (PLC) on PROFIBUS-DP.

PROFIBUS-DP is based on DIN 19 245, Parts 1 and 3, and has been integrated into the European fieldbus standard EN 50 170.

Note

BL67 gateways can only be used as slaves on PROFIBUS-DP. Gateways have no master function.

All manufacturers of control systems offer plug-in network cards for their PLCs, to which BL67 gateways can easily be connected. Furthermore, it is possible to use a PC as a master if it has an appropriate PC PROFIBUS card.

Please refer to the respective manuals supplied by manufacturers for detailed information concerning individual control systems and automation devices.

Connections to the Siemens Simatic S7 PLC are described.

Attention

The network and PC cards must comply with standards defined in PROFIBUS-DP DIN 19 245, Part 3.

Note

The designations used in this manual for programmable logic controllers and software programs are registered and protected trademarks belonging to the respective manufacturer.

Addressing

Each BL67 gateway is assigned an address on PROFIBUS-DP. A maximum of 125 addresses (001 to 125) can be assigned on PROFIBUS-DP. It is not permitted to assign an address more than once in the entire bus structure. The PROFIBUS-DP address is set by using the decimal rotary coding-switches on the gateway.

Attention

PROFIBUS-DP addresses 000, 126 and 127 are reserved. It is not permitted to assign them.

When used as a PROFIBUS-DP station, the BL67 gateway can be placed at any point in the bus structure. If the BL67 gateway is the first or last station in the bus structure, then the fieldbus must be terminated using a terminating resistor. This guarantees trouble-free communication for the entire bus.

Attention

If a BL67 gateway is the first or last station in the bus structure, then a special bus connector with either an integrated or switchable bus terminating resistor must be used.

Electronic Device Data Sheets (GSD)

BL67 gateways are integrated into PROFIBUS structures using electronic device data sheets (GSD). Each individual module is supplied with a means of identification in the standard electronic device data sheet, which makes various forms of identification possible.

- **Standard module description**

Modules cannot be unmistakably identified using this identification.

- **Module description according to type**

The configured list of modules is displayed with extended identification (special identification format), which makes an exact identification of modules possible. The BL67 gateway accepts modules exchanged only with modules of an identical type.

Note

Please read Chapter 3, Section “Module Description in the Electronic Device Data Sheets (GSD)“, Page 3-40.

Electronic Data Sheet File

Note

Please note that for GSD files (extension *.gsd) the default language is English.

The GSD file “TRCKFF2F.gsd” for the BI67 gateway contains for a multitude of applications sufficient data and options for projecting, configuring, setting parameters and diagnostics of your BL67 stations, as well as further functions, for example, the grouping of BL67 modules of the same type to blocks. The aim of creating these blocks is to save configuration bytes and at the same time increase the amount of parameters and process data transmitted via the internal module bus.

Note

The respective actual versions of the GSD file “TRCKFF2F.gsd” are available directly from Turck. It is also possible to gain updates by downloading the files from the PROFIBUS User Organization’s homepage: www.profibus.com or from the Turck homepage: www.turck.com.

GSD file via I/O-ASSISTANT

A tailor-made GSD file can be generated for corresponding facility structures with the assistance of I/O-ASSISTANT from Turck.

I/O-ASSISTANT generates on demand an adapted GSD file according to the current structure of the BL67 station. This GSD file must be subsequently transmitted to the PLC and configuration software of the PROFIBUS-DP master.

You can find a short description of I/O-ASSISTANT’s functions in the manual „BL67 I/O-modules“ (TURCK-Documentation- no.: German D300570/ English D300529).
Please refer to the Online Help supplied with I/O-ASSISTANT for a detailed description of its operation and functions.

Compressing Module Process Data

The compression of process data of modules of the same type (standard module description, **S**-BL67...) or of identical type (module description according to type, **T**-BL67...) serves essentially to reduce the number of configuration bytes as well as to compress data to be transmitted, leading to a more rapid communication between the fieldbus master and the individual BL67 modules.

Compressed modules are added as multiple blocks or as follow-up modules during the engineering phase:

- Multiple blocks (module description according to type, identified in the GSD file by “2*T-BL67...“):
  only 1 process data byte per multiple block

Attention

There are no plans for the use of multiple module blocks which exceed the limit of 1 byte process data (“3*T-BL67...” and “4*T-BL67...” with modules with 4 DI or 4 DO).

- Follow-up modules (module descriptions according to type or standard, identified in the GSD file by “..S-BL67...“ or “..T-BL67...“); their process data bits are added to the process data of the 1. module in the respective block, until the limit of 1 byte per process data is reached.

Attention

The total of the process data lengths of all modules grouped to a block must not exceed 1 byte.

The required number of process data bytes is calculated from the number of process data of the individual modules and the type of description.

Example 1:

This example shows the number of process data bytes for the following module combination:

- 1. module: BL67-4DO-**0.5A**-P
- 2. module: BL67-4DO-**2A**-P
- 3. module: BL67-4DO-**0.5A**-P

Tabelle 70: Number or process data bytes for 3 modules BL67-4DO-xx

Module description	**Module-No.**			**Total of process data bytes**
	1	**2**	**3**	
Not compressed	1	1	1	3
Compressed: standard description	1	0	1	2
Compressed: description according to type	1	0	1	2

Example 2:

This example shows the number of process data bytes for the following module combination:

- 1. module: BL67-4DO-**0.5A**-P
- 2. module: BL67-4DO-**2A**-P
- 3. module: BL67-4DO-**2A**-P
- 4. module: BL67-4DO-**0.5A**-P
- 5. module: BL67-4DO-**0.5A**-P

Tabelle 71: Number of process data bytes for 5 modules BL67-4DO-xx

Module description	**Module-No.**					**Total of process data bytes**
	1	**2**	**3**	**4**	**5**	
Not compressed	1	1	1	1	1	5 Bytes
Compressed: standard description	1	0	1	0	1	3 Bytes
Compressed: description according to type	1	1	0	1	0	3 Bytes
Compressed: description according to type, multiple module blocks	1	1	0	1	0	3 Bytes

Example of Compressing Module Process Data

When using modules that are grouped together by the software, certain conditions have to be met. These are explained by the following example:

Station configuration:

Table 72: Stations configuration of the example station

Module	
GW	Gateway PBDP
A	BL67-4DI-24VDC-P
B	BL67-8DI-24VDC-P
C	BL67-4DI-24VDC-P
D	BL67-4DI-24VDC-P
E	BL67-4DI-24VDC-P
F	BL67-2AO-I
G	BL67-4DO-0.5A-P
H	BL67-4DO-0.5A-P
I	BL67-4DO-0.5A-P
J	BL67-4DI-24VDC-P
K	BL67-2AI-V
L	BL67-4DO-2A-P

An overview of possible configuration options for the depicted BL67 station are shown in the following tables.

The entries in the columns “Module (*)” and “Module (**)” mean:

- Module (*)
  Order of modules: non compressed/compressed (module block)
- Module (**)
  Order of modules in the module block (when using compressed modules); modules which belong together are colored grey

Table 73: Example of creating a block of I/O modules with standard module description

Module		**Standard module description**		
Order of non-compressed modules	Type	Designation of GSD file	Module (*)	Module (**)
GW	Gateway			
A	4 DI	S-BL67-4DI-...	1	
B	8 DI	S-BL67-8DI-...	2	
C	4 DI	S-BL67-4DI-...	3	1
D	4 DI	..S-BL67-4DI-...	3	2
E	4 DI	S-BL67-4DI-...	4	1
F	2AO-I	S-BL67-2AO-I-...	5	
G	4DO	S-BL67-4DO-...	6	1
H	4DO	..S-BL67-4DO-...	6	2
I	4DO	S-BL67-4DO-...	7	3
J	4DI	..S-BL67-4DI-...	4	4
K	2AI-V	S-BL67-2AI-V	8	
L	4DO	..S-BL67-4DO-.2A..	7	4

Figure 22:
Use of standard module description in a Siemens PLC system

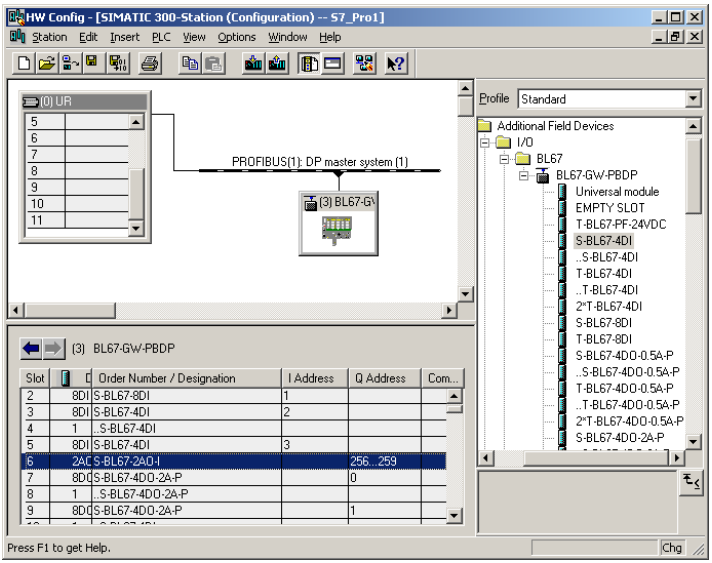
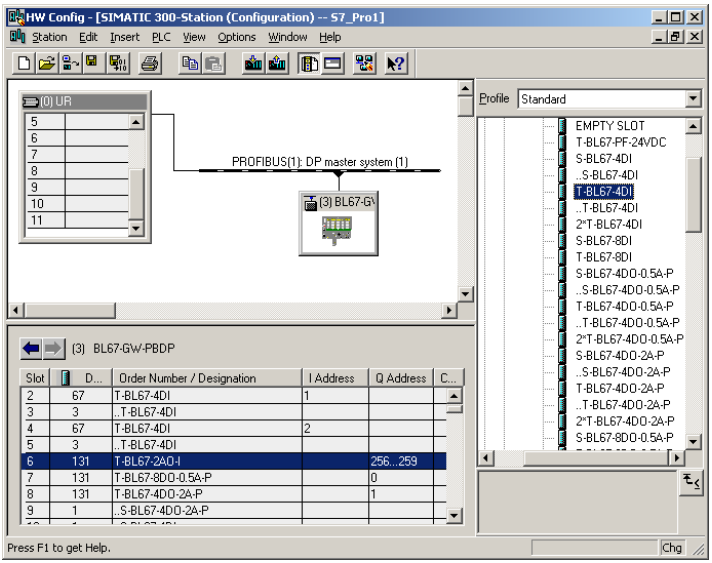


Table 74: Example of creating a block of I/O modules with module description according to type

Module		**Standard module description**		
Order of non-compressed modules	Type	Designation of GSD file	Module (*)	Module (**)
GW	Gateway			
A	4 DI	T-BL67-4DI-...	1	
B	8 DI	T-BL67-8DI-...	2	
C	4 DI	T-BL67-4DI-...	3	1
D	4 DI	..T-BL67-4DI-...	3	2
E	4 DI	T-BL67-4DI-...	4	1
F	2AO-I	T-BL67-2AO-I-...	5	
G	4DO	2* T-BL67-4DO-0.5A	6	1
H	4DO		6	2
I	4DO	T-BL67-4DO-0.5A	7	
J	4DI	..T-BL67-4DI-...	4	2
K	2AI-V	T-BL67-2AI-V	8	
L	4DO	T-BL67-4DO-2A...	10	

Figure 23:
Use of module description according to type in a Siemens PLC system



General notes

Input and output modules are considered separately as multiple blocks. This means, if on the physical station a number of input modules is followed by a number of output modules and these are again followed by more input modules, the software groups the two multiple blocks of input modules into one multiple block of modules.

Note

The order of the modules in the process data blocks does not always match the order of the modules on the physical station.

Attention

It is not permitted for the total of the process data lengths of all the modules grouped to a module block to exceed 1 Byte.

The follow-up modules can be used in both the standard module description and in the description according to type.

Note

Exception: Multiple modules (“2*T-BL67...”) cannot be used as follow-up modules.

When modules are plugged onto planned empty slots, the communication of the fieldbus master depends on the gateway parameter “Station configuration” (please refer to the Chapter 3, Section “Setting Parameters“, Page 3-16).

- Parameter value “Do not allow changes” (default):
  The station does not go online. An error message is generated.
- Parameter value “Allow changes”:
  The modules are ignored by the fieldbus master. They can only be operated via I/O-ASSISTANT (please refer to the manual „BL67-I/O modules“, TURCK Documentation-No.: German: D300570,/ English: D300529).

The maximum station extension can only be achieved with non-compressed standard module description. The reason being the maximum possible number of configuration bytes.

Standard Module Description

During the configuration process, each process data of the different modules of a block is assigned a specific bit position in the corresponding data byte.

In the example:

The following overview illustrates the bit structure of a process data byte for 2 compressed modules BL67-4DI-24VDC-P:

Table 75: Bit structure

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Ch. 4	Ch. 3	Ch. 2	Ch. 1	Ch. 4	Ch. 3	Ch. 2	Ch. 1
Module 2				Module 1			

Due to this assignment, electronic modules can only be exchanged with modules with identical process data lengths.

The first follow-up module must have the same process data length as the “original” module.

Note

The option of creating blocks of modules can be decisively influenced during configuration of an BL67 station.

Module Description According to Type

If the original module is identified according to type, all follow-up modules can have different process data lengths. The description according to type guarantees the unmistakable identification of the electronic module.

The grouping into blocks can be carried out with the help of “multiple modules” to save configuration bytes. For example, the modules G and H can be described as the module with the identification “2*T-BL67...”

The following overview illustrates the various packing options:

Table 76: Number of configuration bytes, depending upon the method of compression

Compression method	Module description	Configuration bytes			
		Modules			
		G	H	I	Total
Standard description	S-BL67-.../ ..S-BL67-... S-BL67-...	1	2	1	4 Bytes
Description according to type	T-BL67-.../ ..T-BL67-... T-BL67-.../	5	4	5	14 Bytes
Description according to type, multiple block	2*T-BL67... T-BL67-.../	5		5	10 Bytes

Note

It should be noted, when using “multiple modules” that this option is only available for modules mounted next to each other. This means, in contrast to the agreements reached above, it is not possible to consider modules that are not mounted next to one another as blocks.

Connection to a Siemens S7 PLC

The software SIMATIC Manager 5.0.2.0 from Siemens is used to configure the connection of a BL67 gateway with a Siemens S7 PLC.

Reading-in the GSD File

The GSD files for BL67 must be read into the software before you can begin with the initial configuration. There are two procedures possible for reading-in the files:

Reading-in the GSD Files before Starting the Software

- Copy the GSD files “TRCKFF2F.gsd” for the BL67 gateway into the “Step7\S7data\GSD” directory.
- Copy the icon files (*.bmp) into the “Step7\S7data \S7data\NSBMP” directory.
- Start the „SIMATIC Manager“ software.
- The BL67 gateways will automatically be entered into the hardware overview following correct installation of the files. The hardware overview can be accessed using the ‹Insert → Hardware Catalog› command

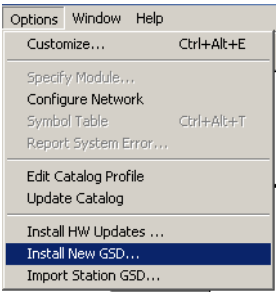
Reading-in the GSD Files after Starting the Software

Proceed as follows to read-in the above GSD files, if you have already started the software.

- Create a new or open an existing project.
- Open the hardware configuration software.

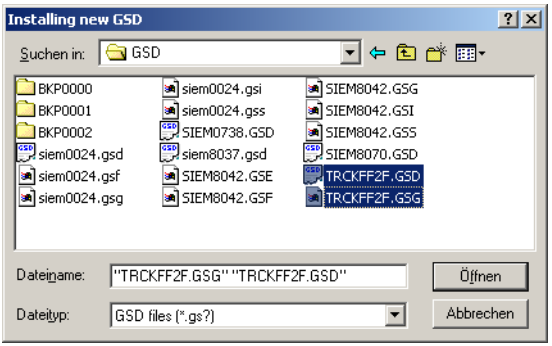
- Copy the required GSD file using the ‹Options → Install New *.GSD Files...› command.

*Figure 24: Inserting a new GSD file using ‹Options → Install New *.GSD Files...›*



- Select the GSD file from the corresponding source directory.

Figure 25: Selecting the GSD file from the corresponding directory



- The GSD files are listed as separate entries in the hardware catalog following correct installation.

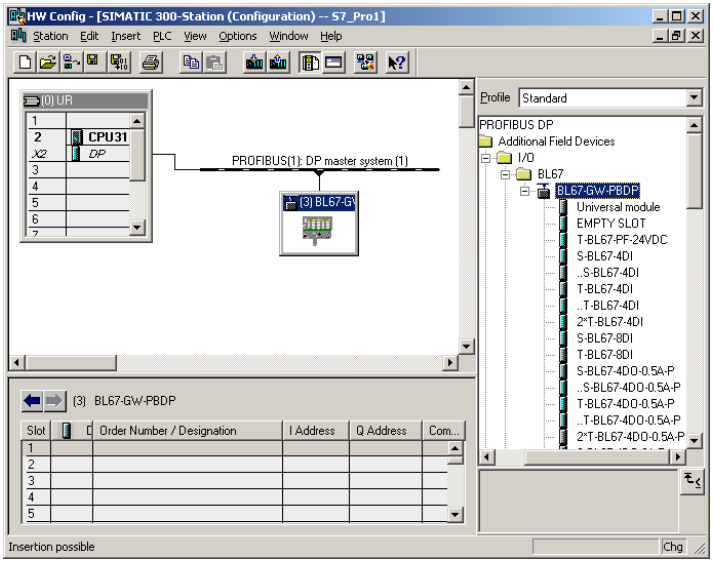
Note

The exact configuration procedure can be found in the operators manual, which is supplied with the software.

Selecting the BL67 Gateway as a Slave

To insert a BL67 station as a slave, select the required entry from the hardware catalog.

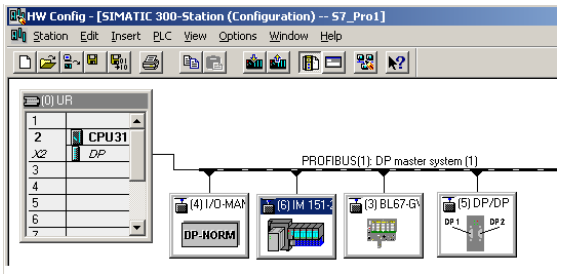
Figure 26: Inserting a BL67 station as a slave



Example of a Mixed Usage Configuration

You can extend the fieldbus structure as you wish in the manner described above; thereby, mixed structures are possible using PROFIBUS devices from third-party manufacturers.

Figure 27: Fieldbus structure with mixed usage

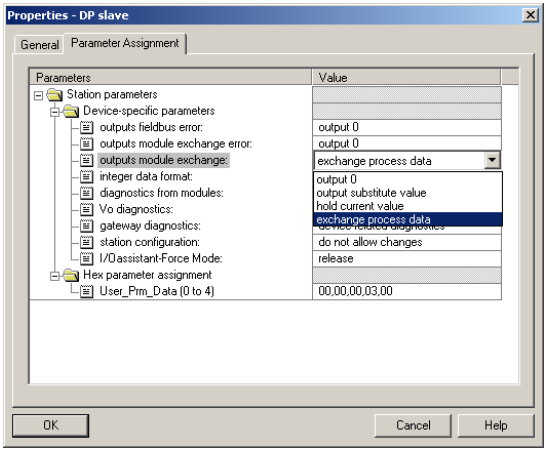


Setting Gateway Parameters

To set the gateway parameters, double-click the corresponding

BL67 station. In the window which opens, click the “Assigning Parameters” button to open the dialog box where you can set the gateway parameters.

Table 77: Setting the parameters of the BL67 gateway



The parameters are displayed in text form by default. You can switch to the hexadecimal form by using the “Hex. Parameters...” button. You can find an assignment table for hexadecimal to text descriptions of the individual parameters in the “Appendix“.

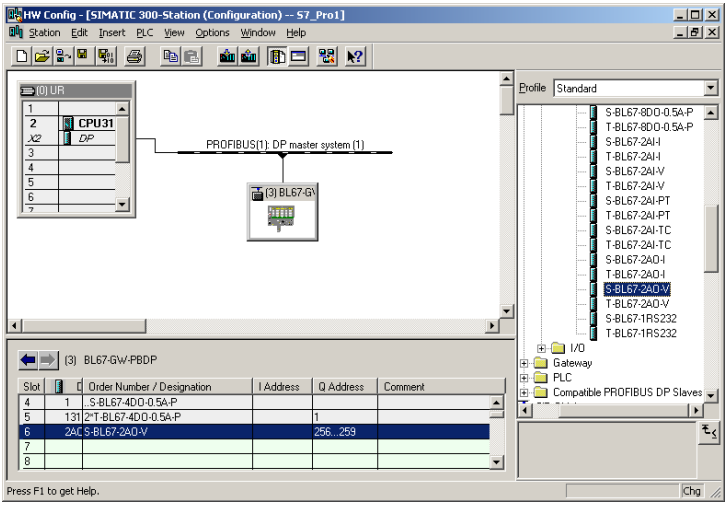
Double-click a parameter or click the “Modify Value...” button to open the dialog box with the relevant options for setting the parameters.

The meaning of the gateway parameters are described in the Chapter 3, Section “Setting Parameters“.

Configuring the BL67 Station

To configure your BL67 station, place the required module into the list of the corresponding station from the hardware catalog using the drag-and-drop feature. The list is opened by clicking on the appropriate BL67 station.

Figure 28: Selecting a BL67 module



Setting Parameters for BL67 Modules

If BL67 modules are entered whose parameters can be set, it is possible to open the dialog box with the relevant options by double-clicking the corresponding module.

The parameters of the individual BL67 modules are described in Chapter 3, Section “Module Parameters“ and in Chapters 2 to 8 of the manual “BL67- I/O modules“ (TURCK Documentation-No.: German: D300572/ English D300529).

Error Diagnostics (Station Diagnostics) when Connected to a Siemens S7 PLC

SIMATIC Manager's diagnostic functions are described in the manual, which is supplied with the software by Siemens.

Information concerning individual module diagnostics can be found in Chapter 3, Section "Diagnosis" and in Chapters 2 to 8 of the manual "BL67- I/O modules" (TURCK Documentation-No.: German: D300572/ English D300529).

Diagnostic options for gateways are described in Chapter 3.

Function Blocks for S7

In the appendix of this manual you can find a detailed description of the S7 functions blocks for the BL67 technology modules (e.g. BL67-1RS232).

Diagnostic Messages in the PLC

The diagnostic messages are indicated as diagnostic bytes in the software of the corresponding PROFIBUS-DP master. Please refer to Table 28: and Table 29: to Table 80: in Chapter 3 of this manual for the meaning of the gateway's diagnostic bytes and those of the connected modules.

Based on an example station taken from the section “Electronic Device Data Sheets (GSD)“, the following will illustrate how the diagnostic bytes of the modules in the controller software are displayed.

Table 78: Diagnostic bytes of the example station

Module		Number of diagnostic bytes	Diagnostic bytes in PROFIBUS-DP
GW	BL67-GW-DP	3	7 to 9
A	BL67-4DI-24VDC-P	-	-
B	BL67-8DI-24VDC-P	-	-
C	BL67-4DI-24VDC-P	-	-
D	BL67-4DI-24VDC-P	-	-
E	BL67-4DI-24VDC-P	-	-
F	BL67-2AO-I	-	-
G	BL67-4DO-0.5A-P	1	10
H	BL67-4DO-0.5A-P	1	11
I	BL67-4DO-0.5A-P	1	12
J	BL67-4DI-24VDC-P	-	-
K	BL67-2AI-V	1	13
L	BL67-4DO-0.5A-P	1	14

Those modules that do not transmit diagnostic bytes do not appear in the diagnostic evaluation of the PROFIBUS-DP master. Those modules, which are capable of diagnostics, appear in the order in which they are plugged within the station.

Table 79: Description and meaning of the diagnostic bytes

Module		Meaning	Diag. Byte
		Status of station (Header according to PROFIBUS-DP standards)	Byte 1
		Status of station (Header according to PROFIBUS-DP standards)	Byte 2
		Status of station (Header according to PROFIBUS-DP standards)	Byte 3
		Address of diagnostic master (Header according to PROFIBUS-DP standards)	Byte 4
		Identity-number high byte (Header according to PROFIBUS-DP standards)	Byte 5
		Identity-number low byte (Header according to PROFIBUS-DP standards)	Byte 6
GW	BL67-GW-DP	Gateway diagnostic byte 0 (Length recognition and type of DP diagnostic)	Byte 7
GW	BL67-GW-DP	Gateway diagnostic byte 1 (gateway warning)	Byte 8
GW	BL67-GW-DP	Gateway diagnostic byte 2 (gateway error)	Byte 9
G	BL67-4DO-0.5A-P	Module diagnostic	Byte 10
H	BL67-4DO-0.5A-P	Module diagnostic	Byte 11

I	BL67-4DO-0.5A-P	Module diagnostic	Byte 12
K	BL67-2AI-V	Module diagnostic	Byte 13
L	BL67-4DO-0.5A-P	Module diagnostic	Byte 14

The diagnostic information can be queried for diagnostic evaluation by using certain configuration tools or via special manufacturer-specific function block units.

The Siemens S7 PLC (PROFIBUS-DP Master) evaluates the diagnostic information from the PROFIBUS-DP slaves with a special function block, which can be obtained directly from Siemens.

Example of Diagnostics with a Siemens S7-400 PLC

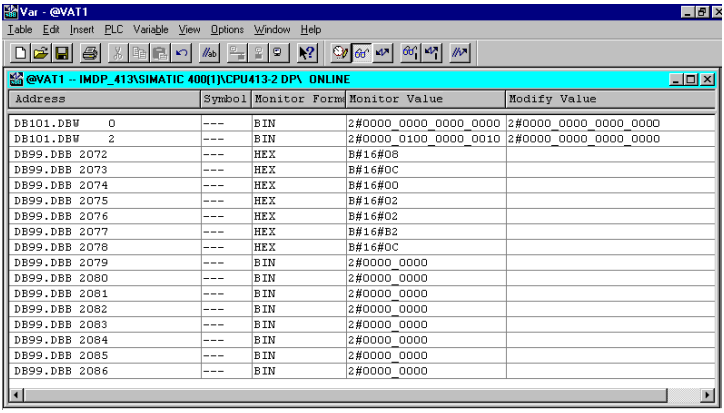
The software STEP 7, version 5.0.2.0 from Siemens, is used in our example to describe diagnostic messages in the PLC (S7-400). The make-up of the station corresponds to the BL67 station described in the Section „Connection to a Siemens S7 PLC” in this chapter.

Note

The „device related diagnostic format“ is used in this example.

The variables table VAT1 is used to display the diagnostic messages:

Figure 29: Diagnostics description in the software STEP 7 - table of variables VAT1



Address	Symbol	Monitor Form	Monitor Value	Modify Value
DB101.DBW 0	---	BIN	2#0000_0000_0000_0000	2#0000_0000_0000_0000
DB101.DBW 2	---	BIN	2#0000_0100_0000_0010	2#0000_0000_0000_0000
DB99.DBB 2072	---	HEX	B#16#08	
DB99.DBB 2073	---	HEX	B#16#0C	
DB99.DBB 2074	---	HEX	B#16#00	
DB99.DBB 2075	---	HEX	B#16#02	
DB99.DBB 2076	---	HEX	B#16#02	
DB99.DBB 2077	---	HEX	B#16#B2	
DB99.DBB 2078	---	HEX	B#16#0C	
DB99.DBB 2079	---	BIN	2#0000_0000	
DB99.DBB 2080	---	BIN	2#0000_0000	
DB99.DBB 2081	---	BIN	2#0000_0000	
DB99.DBB 2082	---	BIN	2#0000_0000	
DB99.DBB 2083	---	BIN	2#0000_0000	
DB99.DBB 2084	---	BIN	2#0000_0000	
DB99.DBB 2085	---	BIN	2#0000_0000	
DB99.DBB 2086	---	BIN	2#0000_0000	

Note

The function block unit FB99, which is available from Siemens, has to be programmed in the PLC program before using the variables table VAT1. DB99 is used here as the instance DB.

The operands in the left column have the following meaning:

Table 80: Operands legend

Operand	Status value	Meaning
DB101.DBW	0	PLC-internal information
DB101.DBW	2	PLC-internal information
DB99.DBB 2072	B#16#08	Station status byte
DB99.DBB 2073	B#16#0C	Station status byte
DB99.DBB 2074	B#16#00	Station status byte 3
DB99.DBB 2075	B#16#02	Address of diagnostic master
DB99.DBB 2076	B#16#02	Identity-number high byte
DB99.DBB 2077	B#16#B2	Identity-number low byte
DB99.DBB 2078	B#16#0C	Gateway diagnostic byte 0 (Length recognition and type of DP diagnostic)
DB99.DBB 2079	2#0000_0000	Gateway diagnostic byte 1 (gateway warning)
DB99.DBB 2080	2#0000_0000	Gateway diagnostic byte 2 (gateway error)
DB99.DBB 2081	2#0000_0000	Diagnostic byte module 1
DB99.DBB 2082	2#0000_0000	Diagnostic byte module 2
DB99.DBB 2083	2#0000_0000	Diagnostic byte module 3
DB99.DBB 2084	2#0000_0000	Diagnostic byte module 4
DB99.DBB 2085	2#0000_0000	Diagnostic byte module 5
DB99.DBB 2086	2#0000_0000	Diagnostic byte module 6
DB99.DBB 2087	2#0000_0000	Diagnostic byte module 7
DB99.DBB 2088	2#0000_0000	Diagnostic byte module 8
DB99.DBB 2089	2#0000_0000	Diagnostic byte module 9

The in grey highlighted operands correspond to the standard header of PROFIBUS-DP standards. The diagnostic bits and bytes for the gateway and the BL67 modules are described in chapter 2.

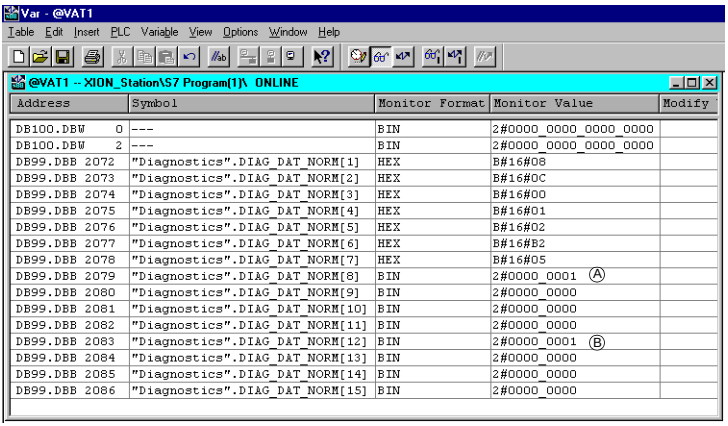
The representation of the diagnostic messages in the table VAT1 is updated following a renewed diagnosis.

Diagnostic messages were provoked for the following examples:

- Short circuit in a digital output module
- Planned but not plugged I/O module

Short-Circuit in a Digital Output Module

Figure 30: Diagnosis when a short-circuit occurs in an output module



Address	Symbol	Monitor Format	Monitor Value	Modify
DB100.DBW 0	---	BIN	2#0000_0000_0000_0000	
DB100.DBW 2	---	BIN	2#0000_0000_0000_0000	
DB99.DBB 2072	"Diagnostics".DIAG_DAT_NORM[1]	HEX	B#16#08	
DB99.DBB 2073	"Diagnostics".DIAG_DAT_NORM[2]	HEX	B#16#0C	
DB99.DBB 2074	"Diagnostics".DIAG_DAT_NORM[3]	HEX	B#16#00	
DB99.DBB 2075	"Diagnostics".DIAG_DAT_NORM[4]	HEX	B#16#01	
DB99.DBB 2076	"Diagnostics".DIAG_DAT_NORM[5]	HEX	B#16#02	
DB99.DBB 2077	"Diagnostics".DIAG_DAT_NORM[6]	HEX	B#16#B2	
DB99.DBB 2078	"Diagnostics".DIAG_DAT_NORM[7]	HEX	B#16#05	
DB99.DBB 2079	"Diagnostics".DIAG_DAT_NORM[8]	BIN	2#0000_0001 Ⓐ	
DB99.DBB 2080	"Diagnostics".DIAG_DAT_NORM[9]	BIN	2#0000_0000	
DB99.DBB 2081	"Diagnostics".DIAG_DAT_NORM[10]	BIN	2#0000_0000	
DB99.DBB 2082	"Diagnostics".DIAG_DAT_NORM[11]	BIN	2#0000_0000	
DB99.DBB 2083	"Diagnostics".DIAG_DAT_NORM[12]	BIN	2#0000_0001 Ⓑ	
DB99.DBB 2084	"Diagnostics".DIAG_DAT_NORM[13]	BIN	2#0000_0000	
DB99.DBB 2085	"Diagnostics".DIAG_DAT_NORM[14]	BIN	2#0000_0000	
DB99.DBB 2086	"Diagnostics".DIAG_DAT_NORM[15]	BIN	2#0000_0000	

A Gateway diagnostic byte 1, bit 0 “Module diagnostics available“

B Diagnostic byte module 3 (BL-4DO-0.5A-P), bit 0 “Overload“

In this example, a short-circuit in channel 1 of a digital output module was provoked. As a result, the “DIA“ LED on the gateway indicated that the gateway was generating an extended diagnosis by flashing red. The LED’s “D“ and “0“ of the digital output module lit up red.

The normal status was restored to the LED indicators by repairing the short-circuit.

Note

The default settings for the gateway parameters set all outputs to zero (please refer to Chapter 3, Section “Setting Parameters“, Page 3-16).
It is not possible to diagnose any short-circuits which may arise if modules planned for a station are not plugged.
For this reason, it is recommended to set the corresponding gateway parameters to “Exchange process data“.

Planned but not Plugged I/O Module

Figure 31: Diagnosis with a not-plugged BL67 I/O module

Var - @VAT1

Table Edit Insert PLC Variable View Options Window Help

@VAT1 -- XION_Station\S7 Program(1)\ ONLINE

Address	Symbol	Monitor Format	Monitor Value	Modify
DB100.DBW 0	---	BIN	2#0000_0000_0000_0000	
DB100.DBW 2	---	BIN	2#0000_0000_0000_0000	
DB99.DBB 2072	"Diagnostics".DIAG_DAT_NORM[1]	HEX	B#16#08	
DB99.DBB 2073	"Diagnostics".DIAG_DAT_NORM[2]	HEX	B#16#0C	
DB99.DBB 2074	"Diagnostics".DIAG_DAT_NORM[3]	HEX	B#16#00	
DB99.DBB 2075	"Diagnostics".DIAG_DAT_NORM[4]	HEX	B#16#01	
DB99.DBB 2076	"Diagnostics".DIAG_DAT_NORM[5]	HEX	B#16#02	
DB99.DBB 2077	"Diagnostics".DIAG_DAT_NORM[6]	HEX	B#16#B2	
DB99.DBB 2078	"Diagnostics".DIAG_DAT_NORM[7]	HEX	B#16#05	
DB99.DBB 2079	"Diagnostics".DIAG_DAT_NORM[8]	BIN	2#0000_1000 Ⓐ	
DB99.DBB 2080	"Diagnostics".DIAG_DAT_NORM[9]	BIN	2#0000_0000	
DB99.DBB 2081	"Diagnostics".DIAG_DAT_NORM[10]	BIN	2#0000_0000	
DB99.DBB 2082	"Diagnostics".DIAG_DAT_NORM[11]	BIN	2#0000_0000	
DB99.DBB 2083	"Diagnostics".DIAG_DAT_NORM[12]	BIN	2#0000_0000	
DB99.DBB 2084	"Diagnostics".DIAG_DAT_NORM[13]	BIN	2#0000_0000	
DB99.DBB 2085	"Diagnostics".DIAG_DAT_NORM[14]	BIN	2#0000_0000	
DB99.DBB 2086	"Diagnostics".DIAG_DAT_NORM[15]	BIN	2#0000_0000	

A Gateway diagnostic byte 1, bit 3 “Station configuration changed“

In this example, a planned BL67 module was pulled. As a result, the “IOs” LED on the gateway indicated an acceptable change to the physical constellation of the module bus station by flashing alternately red/green. The flashing red “DIA” LED indicated that the gateway was generating an extended diagnosis.

The normal status was restored by replugging the pulled electronic module.

5 Integration of BL67 Technology Modules

Integration of the RS232 Module

Data Image

Process Input data (PDin)

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

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

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

Figure 32: Data image PLC input data

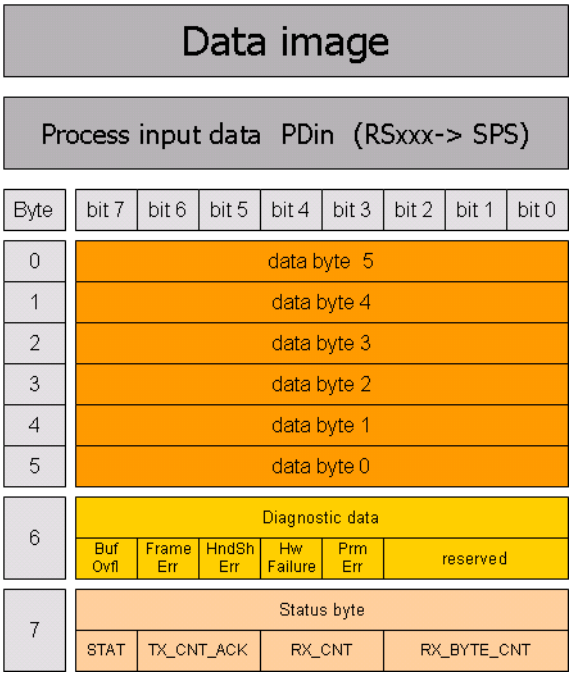


Table 81: Meaning of the data bits (process input)

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

Process Output Data (PDout)

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

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

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

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

Figure 33: Process output data

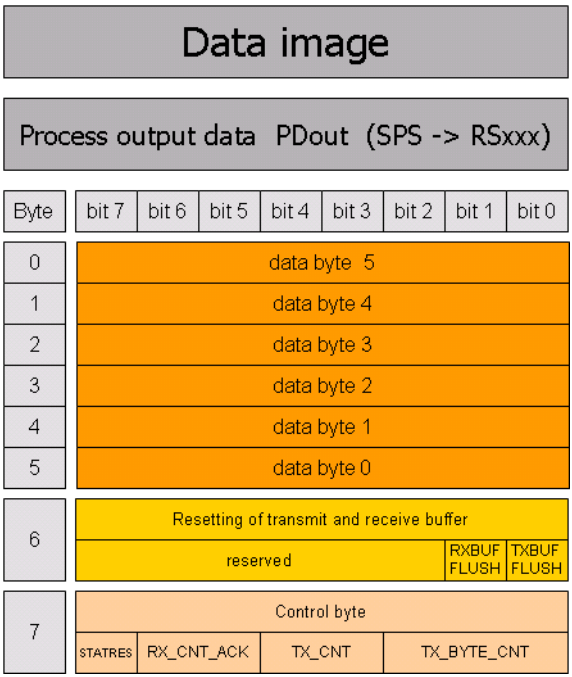


Table 82: Meaning of the data bits (process output)

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

RX_CNT_ACK	0-3	The value RX_CNT_ACK is a copy of the value RX_CNT. TX_CNT has been transmitted together with the last data segment of the process input data. TX_CNT_ACK is an acknowledge for the successful transmission of the data segment with RX_CNT.
TX_CNT	0-3	This value is transferred together with every data segment. The TX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
TX_BYTE_CNT	0 - 7	Number of the valid user data in this data segment. In PROFIBUS-DP, the data segments contain a maximum number of 6 bytes of user data.

Integration of the RS485/422 Module

Data Image

Process Input data (PDin)

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

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

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

Figure 34: Data image PLC input data

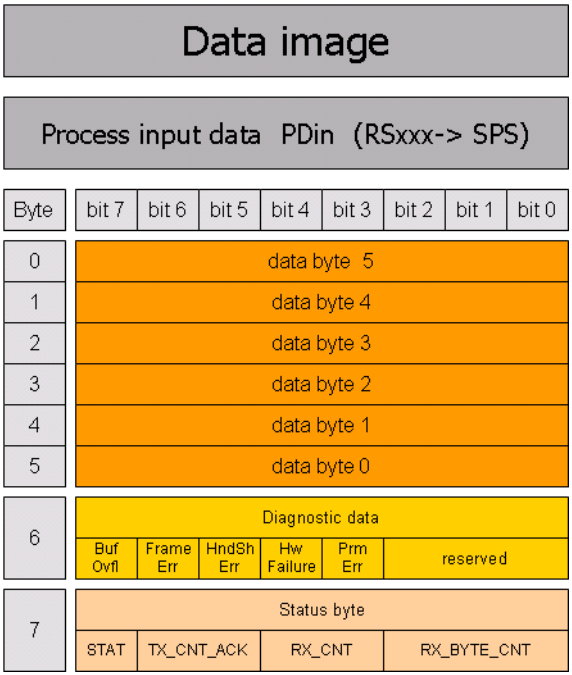


Table 83: Meaning of the data bits (process input)

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

Process Output Data (PDout)

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

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

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

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

Figure 35: Process output data

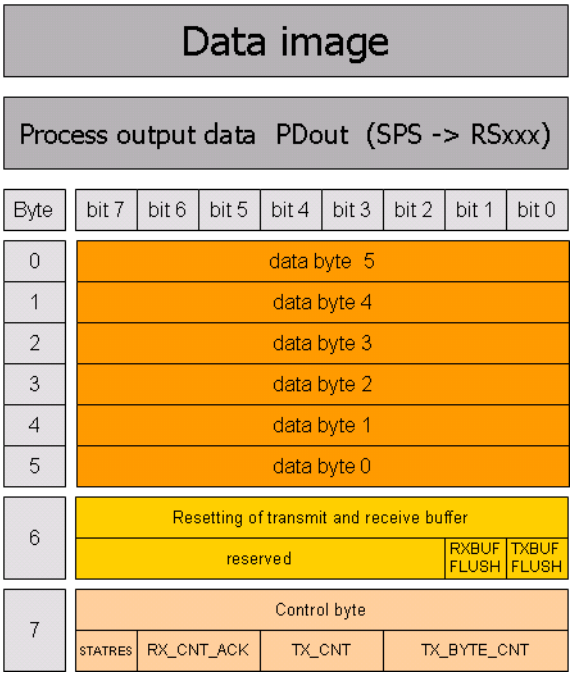


Table 84: Meaning of the data bits (process output)

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

RX_CNT_ACK	0-3	The value RX_CNT_ACK is a copy of the value RX_CNT. TX_CNT has been transmitted together with the last data segment of the process input data. TX_CNT_ACK is an acknowledge for the successful transmission of the data segment with RX_CNT.
TX_CNT	0-3	This value is transferred together with every data segment. The TX_CNT values are sequential: 00->01->10->11->00... (decimal: 0->1->2->3->0...) Errors in this sequence show the loss of data segments.
TX_BYTE_CNT	0 - 7	Number of the valid user data in this data segment. In PROFIBUS-DP, the data segments contain a maximum number of 6 bytes of user data.

Integration of the SSI Module

Data image

Process input data (PDin)

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

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

This is transferred in an 8 byte format as follows:

- 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 BL67-1SSI 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.

Abbildung 36: Process input data

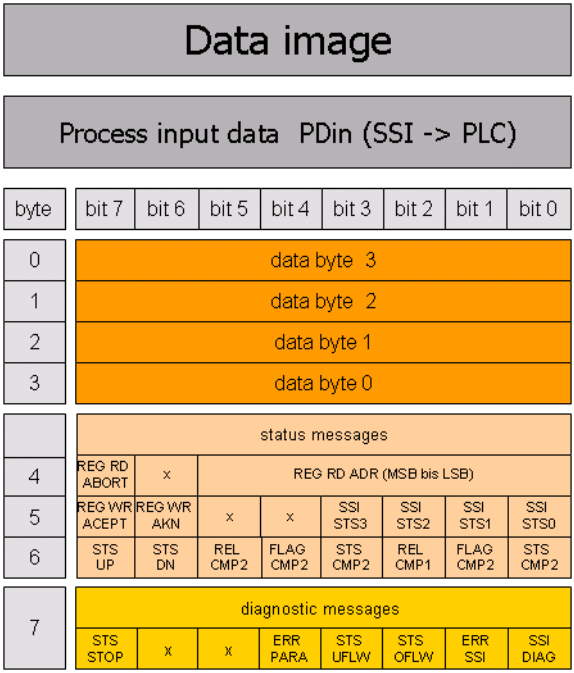


Tabelle 85: Meaning of the data bits (process input)

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

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

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

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

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

Process output data (PDout)

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

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

This is transferred in an 8 byte format as follows:

- 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.

Abbildung 37: Process output data

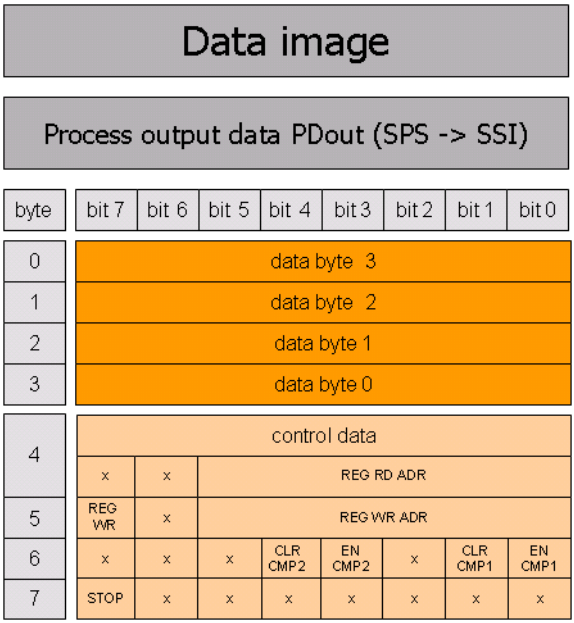


Tabelle 86: Meaning of the data bits (process output)

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

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

6 Guidelines for Station Planning

Module Arrangement

Random Module Arrangement

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

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

Complete Planning

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

Attention

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

Maximum System Extension

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

The limit placed on the maximum possible number of channels is based on the number of bytes of the process data, diagnostics, parameters as well as the configuration bytes of the BL67 modules, these being limited by the field controller used in the BL67 station.

The following are maximum possible bytes available in a BL67 station:

- Process data bytes: 176 Bytes
- Diagnostic bytes: 64 Bytes
  (61 Bytes module diagnostics + 3 Bytes gateway diagnostics)
- Parameter bytes: 117 Bytes
  (115 Bytes module parameters + 2 Bytes gateway parameters)
- Configuration bytes: 176 Bytes

Further limitations are imposed by the method of data description (standard or according to type) or by the method of module description (compressed or not compressed).

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

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

- The transmission to PROFIBUS-DP is supported only until the maximum possible 61 diagnostic bytes is reached. The diagnostics of the following modules are not taken in to consideration.

Table 87: Maximum system extension, process data dependent

A *limited due to the current consumption (100 mA) on the module bus (5 V)*

Module type	**maximum number**	
	Channels	Modules
BL67-4DI-P	128	32
BL67-8DI-P	256	32
BL67-4DO-xA-P	128	32
BL67-8DO-0.5A-P	256	32
BL67-2AI-I	64	32
BL67-2AI-V	64	32
BL67-2AI-PT	46	23
BL67-2AI-TC	64	32
BL67-2AO-I	32	16
BL67-2AO-V	32	16
BL67-1RS232	15 **A**	15 **A**

Note

The modules' maximum nominal current consumption on the module bus (5 V) of 1.5 A must not be exceeded.
The maximum number of RS232-modules in a station is **not** limited by PROFIBUS-DP regulations but by the high current consumption of the module on the module bus.

The following overview shows the maximum possible number of channels, taking in to consideration the number of module-specific diagnostic bytes.

Table 88: Maximum system extension, process and diagnostic data dependent

Module type	**maximum number**	
	Channels	Modules
BL67-4DI-P	128	32
BL67-8DI-P	256	32
BL67-4DO-xA-P	128	32
BL67-8DO-0.5A-P	256	32
BL67-2AI-I	60	30
BL67-2AI-V	60	30
BL67-2AI-PT	46	23
BL67-2AI-TC	60	30
BL67-2AO-I	32	16
BL67-2AO-V	32	16
BL67-1RS232	15	15

The following tables offer an overview of the process data, diagnostic, parameter and configuration bytes of the individual modules.

Table 89: Overview of process data and diagnostic bytes

BL67-Module	Process data bytes		Diagnostic bytes
	Not compressed	Compressed as follow-up	
Gateway	-	-	2
BL67-PF-24VDC	-	-	1
BL67-4DI-P	1	0	0
BL67-8DI-P	1	-	0
BL67-2AI-I	4	-	2
BL67-2AI-V	4	-	2
BL67-2AI-PT	4	-	2
BL67-2AI-TC	4	-	2
BL67-4DO-0.5A-P	1	0	1
BL67-4DO-2A-P	1	0	1
BL67-8DO-0.5A-P	1	-	1
BL67-2AO-I	4	-	0
BL67-2AO-V	4	-	0
BL67-1RS232	8 Input / 8 Output	-	1

Table 90: Overview of the parameter and configuration bytes

A *With compressed module description as follow-up module 2 bytes*

B *With compressed module description as follow-up module 4 bytes*

BI67-Module	Module description			
	Standard		According to type	
	param. bytes	config. bytes	param. bytes	config. bytes
Gateway	5	0	5	0
BL67-PF-24VDC	-	-	0	4
BL67-4DI-P	1	1 **A**	0	5 **B**
BL67-8DI-P	1	1	0	5
BL67-2AI-I	3	1	1	5
BL67-2AI-V	3	1	1	5
BL67-2AI-PT	5	1	4	5
BL67-2AI-TC	3	1	2	5
BL67-4DO-0.5A-P	1	1 **A**	0	5 **B**
BL67-4DO-2A-P	1	1 **A**	0	5 **B**
BL67-8DO-0.5A-P	1	1	0	5
BL67-2AO-I	7	1	6	5
BL67-2AO-V	7	1	6	5
BL67-1RS232	5	1	4	6

The bytes of the modules can be described in a compressed form, depending on the description of the modules in the GSD files. Examples can be found in Chapter 4.

Attention

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

Note

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

Overview of the process data, diagnostic, parameter and configuration bytes based on an example

The following offers an overview of the different bytes of an example station:

- Module A: 4DI
- Module B: 4DI
- Module C: 4DI
- Module D: 8 DI
- Module E: 2 AI-I
- Module F: 2 AO-I
- Module G: 4 DO-0.5A

Table 91: Overview of the process data and diagnostic bytes of the example station (standard module description)

A *module available in not compressed module description only*

BL67-module	Process data bytes		Diagnostic bytes
	not compressed	compressed	
Gateway	-	-	2
BL67-4DI-P	1	1	0
BL67-4DI-P	1	0	0
BL67-4DI-P	1	1	0
BL67-8DI-P	1	1 **A**	0
BL67-2AI-I	4	4 **A**	2
BL67-2AO-I	4	4 **A**	0
BL67-4DO-0.5A	1	1	1
Total	**13**	**12**	**5**

Table 92: Overview of the parameter and configuration bytes of the example station

A *not compressed*
B *compressed, no blocks*

BL67-Module	**Standard module description**			**Module description according to type**		
	param. bytes	config. bytes		param. bytes	config. bytes	
		U **A**	G **B**		U **A**	G **B**
Gateway	5	0	0	5	0	0
BL67-4DI-P	1	1	-	0	5	-
BL67-4DI-P	1	1	2	0	5	4
BL67-4DI-P	1	1	-	0	5	-
BL67-8DI-P	1	1	-	0	5	-
BL67-2AI-I	3	1	-	2	5	-
BL67-2AO-I	7	1	-	6	5	-
BL67-4DO-0.5A	1	1	-	0	5	-
Sum	**20**	**7**	**8**	**13**	**35**	**34**

Creating Potential Groups

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

Plugging and Pulling Electronic Modules

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

Attention

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

Extending an Existing Station

Attention

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

Firmware Download

Firmware can be downloaded via the service interface on the gateway using the software tool I/O-ASSISTANT. 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.

7 Guidelines for Electrical Installation

General Notes

General

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

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

Cable Routing

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

Cable Routing Inside and Outside of Cabinets

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

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

Group 1:

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

Group 2:

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

Group 3:

- unshielded cables for DC and AC voltages > 400 V

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

Group 1/Group 2

The group combinations:

Group 1/Group 3 and Group 2/Group 3

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

Cable Routing Outside Buildings

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

Warning

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

Lightning Protection

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

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

Transmission Cables

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

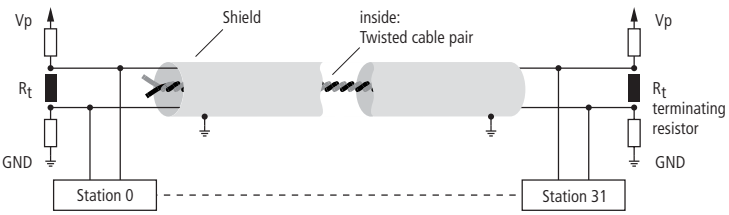
Table 93: Parameter of cable type A

Parameter	Cable A (DIN 19245, part 3)
Characteristic impedance	35 to 165 (3 to 20 MHz) 100 to 130 (f >100 kHz)
Capacitance per unit length	< 30 nF/km
Loop resistance	< 110 Ω/km
Wire diameter	> 0.64 mm
Wire cross-section	> 0.34 mm^2
Terminating resistor	220 Ω

Attention

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

Figure 38: Representation of a PROFIBUS-DP cable



Cable Types

Turck offers a variety of cable types for fieldbus lines as premoulded or bulk cables with different M12-connectors.

The ordering information for the available cable types can be found in the BL67 catalog.

Potential Relationships

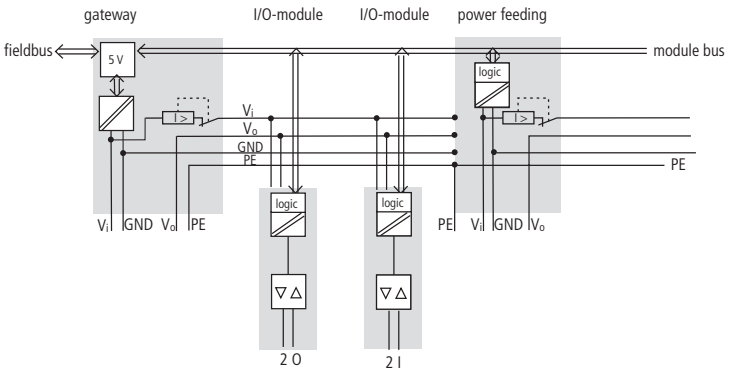
General

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

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

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

Figure 39: Block diagram of the BL67 station for PROFIBUS-DP



Electromagnetic Compatibility (EMC)

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

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

Ensuring Electromagnetic Compatibility

The EMC of BL67 modules is guaranteed when the following basic rules are adhered to:

- Correct and large surface grounding of inactive metal components.
- Correct shielding of cables and devices.
- Proper cable routing – correct wiring.
- Creation of a standard reference potential and grounding of all electrically operated devices.
- Special EMC measures for special applications.

Grounding of Inactive Metal Components

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

- In the areas of screw connections, the painted, anodized or isolated metal components must be freed of the isolating layer. Protect the points of contact against rust.
- Connect all free moving groundable components (cabinet doors, separate mounting plates, etc.) by using short bonding straps to large surface areas.

- Avoid the use of aluminum components, as its quick oxidizing properties make it unsuitable for grounding.

Warning

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

PE Connection

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

Earth-Free Operation

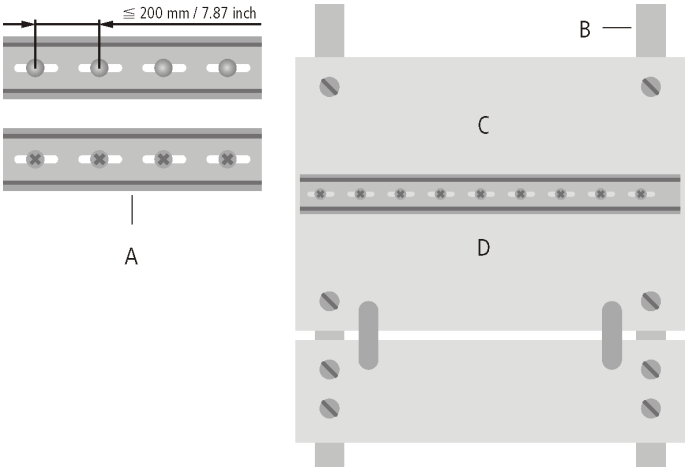
Observe all relevant safety regulations when operating an earthfree system.

Mounting Rails

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

Figure 40:
Mounting options

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



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

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

Shielding of cables

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

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

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

Attention

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

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

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

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

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

Note

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

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

Potential Compensation

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

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

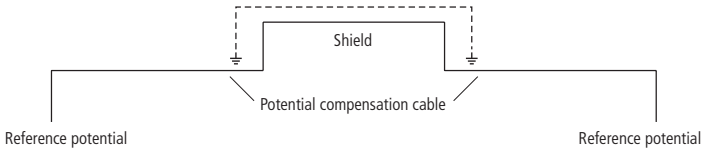
A potential-compensation cable must be routed to the potential compensation.

Warning

Never use the shield as a potential compensation.

Connection A				Connection B	
B	3	0 ----------	0	3	B
	5	0	0	5	
A	8	0 ----------	0	8	A

Figure 41: potential compensation



A potential compensation cable must have the following characteristics:

- Low impedance. In the case of compensation cables that are routed on both sides, the compensation line impedance must be considerably smaller than that of the shield connection (max. 10 % of shield connection impedance).
- Should the length of the compensation cable be less than 200 m, then its cross-section must be at least 16 mm^2 / 0.025 $inch^2$. If the cable length is greater than 200 m, then a cross-section of at least 25 mm^2 / 0.039 $inch^2$ is required.

- The compensation cable must be made of copper or zinc coated steel.
- The compensation cable must be connected to the protective conductor over a large surface area and must be protected against corrosion.
- Compensation cables and data cables should be routed as close together as possible, meaning the enclosed area should be kept as small as possible.

Switching Inductive Loads

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

Protection against Electrostatic Discharge (ESD)

Attention

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

8 Apendix

Function Blocks for S7

Function blocks are available for the data transfer between the technology modules and the Siemens PLC S7.

Function Blocks for BL67-1RSxxx

The function blocks FBSENDRSxxx, FBRECVRSxxx and FBSRRSxxx control the data transfer between the PLC and the BL67-1RSxxx module. The transmission is realized in 8 byte format, 2 bytes contain control data and 6 bytes contain user data.

The memory area for the transmit-data and the receive-data in the Siemens PLC S7 are not fixed and can be chosen by the user.

Depending on the PLC's performance, up to 65536 data bytes can be transmitted during one transmission cycle.

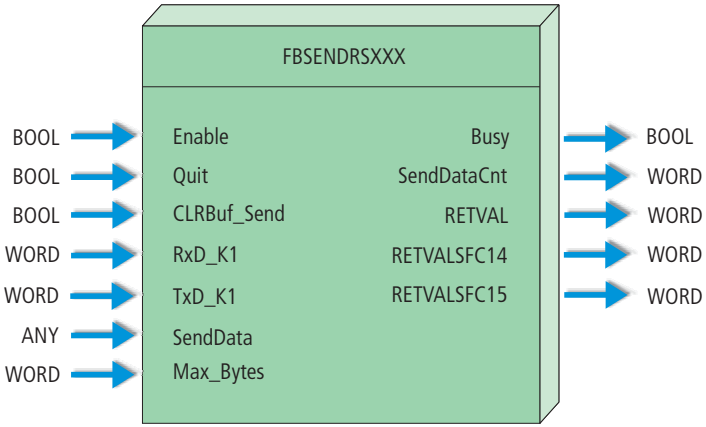
for the consistent data transfer, the system function blocks SFC14 and SFC15 from Siemens are used.

The transmission of the values is transparent. The meaning of the error numbers can be found in the manual for the control software from Siemens.

Transmit Function Block FBSENDRSxxx

The software block FBSENDRSxxx is a handling block only used to transmit data to the BL67-1RS232 module.

Figure 42: Transmit function block FBSENDRSxxx



Input variables

Table 94: Input variables of FBSENDRSxxx

Variable	Meaning
Enable	1: The transmission of data is released. 0: The transmission of data is blocked.
Quit	1: The error messages are reset (Acknowledge of errors) The communication is stopped. 0: If error messages have occurred, they remain valid.
CLRBuf_Send	1: Flushing the transmit-buffer is planned. Flushing is always executed successfully, if: Enable = 0 and Quit = 1 0: No influence on the module's function.
RxD_K1	Start address of the module's 8-byte input address range. The software SIMATIC STEP 7 assigns the address ranges to the different modules. The „Hardware-Configuration“ of the software shows the address ranges chosen by the user. The addresses are set in the WORD format (2 Bytes). Example: The decimal number 258 has to be transmitted as the hexadecimal code W#16#102.

	TxD_K1	Start address of the module's 8-byte output address range. The software SIMATIC STEP 7 assigns the address ranges to the different modules. The „Hardware-Configuration“ of the software shows the address ranges chosen by the user. The addresses are set in the WORD format (2 Bytes). Example: The decimal number 258 has to be transmitted as the hexadecimal code W#16#102.
	SendData	Start address for storing the transmit-data. (inputs, outputs, flags, data blocks etc.).
	Max_Bytes	Maximum number of bytes that have to be sent (max. 65536 bytes).

Output variables

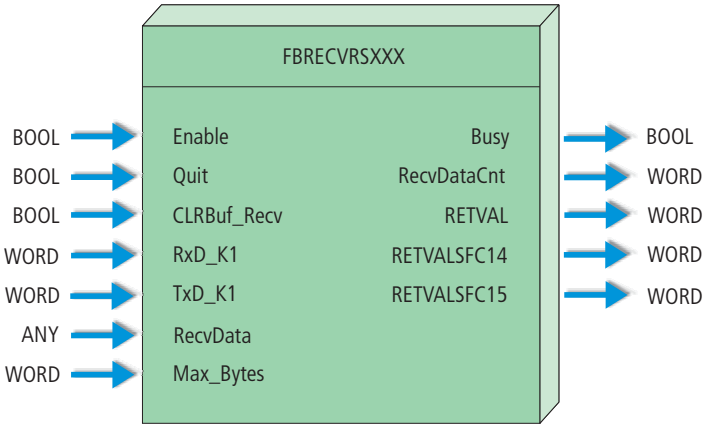
Table 95: Output variables of FBSENDRSxxx

Variable	Meaning
Busy	1: Data are actually transmitted. 0: No data transmitted at the moment.
SendDataCnt	Number of the transmitted data (max. 65536).
RETVAL	Return value of the function (status o error code) – 0 → no error – 8010h → communication error: hardware error – 8020h → communication error: error in data flow – 8040h → communication error: error in telegram frame – 8080h → communication error: buffer-overflow of the module – 8300h → variable error: wrong parameter „SendData“ – 8301h → variable error: wrong data type of parameter „SendData“ – 8302h → variable error: wrong length of parameter „SendData“
RETVALSFC14	see Siemens software manual
RETVALSFC15	see Siemens software manual

Receive Function Block FBRECVRSxxx

The software block FBRECVRSxxx is a handling block only used to receive data from the BL67-1RS232 module.

Figure 43: Receive function block FBRECVRSxxx



input variables

Table 96: Input variables of FBRECVRSxxx

Variable	Meaning
Enable	1: The receive of data s released. 0: The receive of data s blocked.
Quit	1: The error messages are reset (Acknowledge of errors) The communication is stopped. 0: If error messages have occurred, they remain valid.
CLRBuf_Recv	1: Flushing the receive-buffer is planned. Flushing is always executed successfully, if: Enable = 0 and Quit = 1 0: No influence on the module's function.
RxD_K1	Start address of the module's 8-byte input address range. The software SIMATIC STEP 7 assigns the address ranges to the different modules. The „Hardware-Configuration“ of the software shows the address ranges chosen by the user. The addresses are set in the WORD format (2 Bytes). Example: The decimal number 258 has to be transmitted as the hexadecimal code W#16#102.

	TxD_K1	Start address of the module's 8-byte output address range. The software SIMATIC STEP 7 assigns the address ranges to the different modules. The „Hardware-Configuration“ of the software shows the address ranges chosen by the user. The addresses are set in the WORD format (2 Bytes). Example: The decimal number 258 has to be transmitted as the hexadecimal code W#16#102.
	RecvData	Start address for storing the receive-data. (inputs, outputs, flags, data blocks etc.).
	Max_Bytes	Maximum number of bytes that have to be received (max. 65536 bytes).

Output variables

Table 97: Output variables FBRECVRSxxx

Variable	Meaning
Busy	1: Data are received actually. 0: No data are received at the moment.
RecDataCnt	Number of the received data (max. 65536).
RETVAL	Return values of the function (status or error code) – 0 → no error – 8010h → communication error: hardware error – 8020h → communication error: error in data flow – 8040h → communication error: error in telegram frame – 8080h → communication error: buffer overflow of the module – 8300h → variable error: wrong parameter „RecData“ – 8301h → variable error: wrong data type of parameter „RecData“ – 8302h → variable error: wrong length of parameter „RecData“
RETVALSFC14	see Siemens software manual
RETVALSFC15	see Siemens software manual

Transmit and Receive Function Block FBSRRSxxx

The function block FBSRRSxxx is a handling block for simultaneous transmission and receive of data from the BL67-1RS232 module.

Figure 44: Transmit/ receive function block FBSRRSxxx

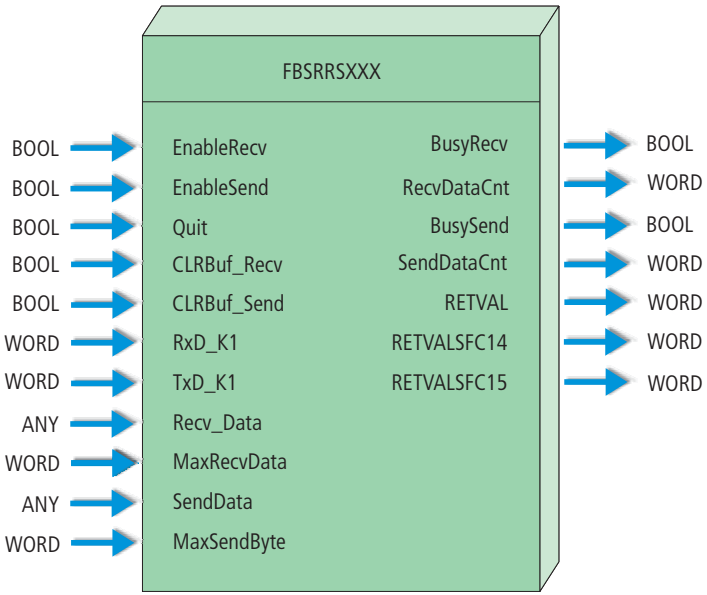


Table 98: input variables of FBSRRSxxx

Variable	Meaning
EnableRecv	1: The receive of data is released. 0: The receive of data is blocked.
EnableSend	1: The transmission of data is released. 0: The transmission of data is blocked.
Quit	1: The error messages are reset (Acknowledge of errors) The communication is stopped. 0: If error messages have occurred, they remain valid.
CLRBuf_Recv	1: Flushing the receive-buffer is planned. Flushing is always executed successfully, if: EnableRecv = 0 and Quit = 1 0: No influence on the module's function.
CLRBuf_Send	1: Flushing the transmit-buffer is planned. Flushing is always executed successfully, if: EnableSend = 0 and Quit = 1 0: No influence on the module's function.
RxD_K1	Start address of the module's 8-byte input address range. The software SIMATIC STEP 7 assigns the address ranges to the different modules. The „Hardware-Configuration“ of the software shows the address ranges chosen by the user. The addresses are set in the WORD format (2 Bytes). Example: The decimal number 258 has to be transmitted as the hexadecimal code W#16#102.

	TxD_K1	Start address of the module's 8-byte output address range. The software SIMATIC STEP 7 assigns the address ranges to the different modules. The „Hardware-Configuration“ of the software shows the address ranges chosen by the user. The addresses are set in the WORD format (2 Bytes). Example: The decimal number 258 has to be transmitted as the hexadecimal code W#16#102.
	RecvData	Start address for storing the receive-data. (inputs, outputs, flags, data blocks etc.).
	MaxRecvBytes	Maximum number of bytes that have to be received (max. 65536 bytes).
	SendData	Start address for storing the transmit-data. (inputs, outputs, flags, data blocks etc.).
	MaxSendBytes	Maximum number of bytes that have to be sent (max. 65536 bytes).

Table 99: output variables of FBSRRSxxx

Variable	**Meaning**
BusyRecv	1: Data are received actually. 0: No data are received at the moment.
RecvDataCnt	Number of the received data (max. 65536).
BusySend	1: Data are actually transmitted. 0: No data transmitted at the moment.
SendDataCnt	Number of the transmitted data (max. 65536).

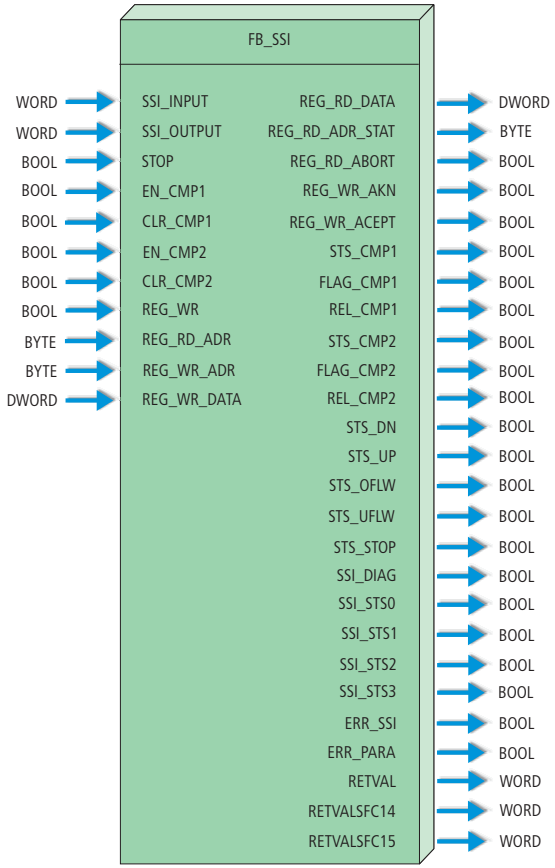
	RETVAL	Return values of the function (status or error code) – 0000h → no error – 8010h → communication error: hardware error – 8020h → communication error: error in data flow – 8040h → communication error: error in telegram frame – 8080h → communication error: buffer overflow of the module – 8100h → variable error: wrong parameter „RecvData“ – 8101h → variable error: wrong data type of parameter „RecvData“ – 8102h → variable error: wrong length of parameter „RecvData“ – 8200h → variable error: wrong parameter „SendData“ – 8201h → variable error: wrong data type of parameter „SendData“ – 8202h → variable error: wrong length of parameter „SendData“
	RETVALSFC14	see Siemens software manual
	RETVALSFC15	see Siemens software manual

Function block for BL67-1SSI

The function block that was created for the SIMATIC S7 PLC system (Siemens) enables the data bytes to be exchanged between the PLC and the BL67-1SSI module, and provides in particular access to the register interface.

The system function blocks SFC14 and SFC15 from Siemens are used in order to ensure consistent data exchange. The return values are transferred transparently, and the meaning of the error numbers can be obtained from the manual “System software for S7-300/ 400”.

Figure 45:
FB_SSI



Input variables

Tabelle 100: Input variables of FB_SSI

Variable	Meaning
SSI_INPUT	Start address for the 8-byte input address range of the BL67-1SSI module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
SSI_OUTPUT	Start address for the 8-byte output address range of the BL67-1SSI module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102
STOP	**0**: Request to read the SSI encoder cyclically **1**: Request to interrupt communication with the encoder.
EN_CMP1	**0**: Default status, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 always have the value 0, irrespective of the actual SSI encoder value. **1**: Comparison active, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 have a value based on the result of the comparison with the SSI encoder value.
CLR_CMP1	**0**: Default status, i.e. reset of FLAG_CMP1 not active. **1**: Reset of FLAG_CMP1 active.

Variable	Meaning
EN_CMP2	**0**: Default status, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 always have the value 0, irrespective of the actual SSI encoder value. **1**: Comparison active, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 have a value based on the result of the comparison with the SSI encoder value.
CLR_CMP2	**0**: Default status, i.e. reset of FLAG_CMP2 not active. **1**: Reset of FLAG_CMP2 active.
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 (output variable) is reset from 1 to 0 if necessary. **1**: Request to overwrite the content of the register with the address stated at REG_WR_ADR with REG_WR_DATA.
REG_RD_ADR	Address of the register to be read.
REG_WR_ADR	Address of the register to be written with REG_WR_DATA.
REG_WR_DATA	Value to be written to the register with the address stated at REG_WR_ADR.

Output variables

Tabelle 101: Output variables FB_SSI

Variable	Meaning
REG_RD_DATA	Read data at the register with the address stated at REG_RD_ADR if access is successful (REG_RD_ABORT = 0).
REG_RD_ADR_STAT	Return the register address for the read data REG_RD_DATA.
REG_RD_ABORT	**1**: Reading of register with the address stated at REG_RD_ADR ould not be executed successfully. The operation was aborted. **0**: Reading of register with the address stated at REG_RD_ADR was executed successfully. The read data is shown at REG_RD_DATA.
REG_WR_AKN	**1**: Writing of the register was requested with REG_WR = 1 in the previous cycle. Another write request with REG_WR = 1 is not accepted. This value returns to 0 when REG_WR = 0. **0**: A write request with REG_WR = 1 is accepted. This value then changes to 1. A further write request is ignored.
REG_WR_ACEPT	**1**: Writing of register with the address stated at REG_WR_ADR was executed successfully. **0**: Writing of register with the address stated at REG_WR_ADR was not executed successfully.
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)

Variable	Bedeutung
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 bit CLR_CMP1 = 1.
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)
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)
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 bit CLR_CMP2 = 1.
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)
STS_DN	**0**: The SSI encoder values are incremented or the SSI encoder values are constant. **1**: The SSI encoder values are decremented.

Variable	Meaning
STS_UP	**0**: The SSI encoder values are decremented or the SSI encoder values are constant. If STS_DN = 0 at the same time, this means that the SSI encoder has stopped. **1**: The SSI encoder values are incremented.
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)
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_STOP	**0**: The SSI encoder is read cyclically. **1**: Communication with the SSI encoder is stopped as STOP = 1.
SSI_DIAG	**0**: No enabled status signal active: SSI_STSx = 0 or no status messages of the SSI encoder present. **1**: At least one enabled status signal is active: SSI_STSx = 1
SSI_STS0	These four bits transfer the status bits of the SSI encoder with the tatus messages of the SSI module. With some SSI encoders, the status bits are transferred together with the position value.
SSI_STS1	
SSI_STS2	
SSI_STS3	
ERR_SSI	**0**: SSI encoder signal present. **1**: SSI encoder signal faulty. (e.g. due to a cable break).

Variable	Meaning
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.
RETVAL	Return value of the function (status or error code) **0**: Everything OK. No error **8xxxh**: Error Formal operands
RETVALSFC14	See manual “System software for S7-300/ 400, SFC14”
RETVALSFC15	See manual “System software for S7-300/ 400, SFC15”

Nominal Current Consumption of Modules at PROFIBUS-DP

Table 102: nominal current consumptions of the modules at PROFIBUS-DP

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

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

Note

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

Parameter Gateway – Assignment in Hexadecimal Format

Parameter 4

Table 103: Parameter 4 Outputs module exchange

A *Default-settings*

Outputs module exchange

Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold current value	Exchange process data	Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold current value	Exchange process data
00	X				0F				X
01		X			10	X			
02			X		11		X		
03				X	12			X	
04	X				13				X
05		X			14	X			
06			X		15		X		
07				X	16			X	
08	X				17				X
09		X			18	X			
0A			X		19		X		
0B				X	1A			X	
0C	X				1B				X
0D		X			1C	X			
0E			X		1D		X		

A *Default-settings*

Outputs module exchange

Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold Current Value	Exchange Process Data	Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold Current Value	Exchange Process Data
1E			X		27				X
1F				X	28	X			
20	X				29		X		
21		X			2A			X	
22			X		2B				X
23				X	2C	X			
24	X				2D		X		
25		X			2E			X	
26			X		2F				X

Table 104: Parameter 4 Outputs module exchange error

A *Default-settings*

Outputs module exchange error

Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold current value	Exchange process data	Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold current value	Exchange process data
00	X				0F				X
01	X				10	X			
02	X				11	X			
03	X				12	X			
04		X			13	X			
05		X			14		X		
06		X			15		X		
07		X			16		X		
08			X		17		X		
09			X		18			X	
0A			X		19			X	
0B			X		1A			X	
0C				X	1B			X	
0D				X	1C				X
0E				X	1D				X

A *Default-settings*

Outputs module exchange error

Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold current value	Exchange process data	Parameter im hexadecimal format	Output 0 **A**	Output substitute value	Hold current value	Exchange process data
1E				X	27		X		
1F				X	28			X	
20	X				29			X	
21	X				2A			X	
22	X				2B			X	
23	X				2C				X
24		X			2D				X
25		X			2E				X
26		X			2F				X

Table 105: Parameter 4 Outputs fieldbus error

A *Default-settings*

Outputs fieldbus error

Parameter in hexadecimal format	Output 0**A**	Output substitute value	Hold current value	Parameter in hexadecimal format	Output 0**A**	Output substitute value	Hold current value
00	X			12		X	
01	X			13		X	
02	X			14		X	
03	X			15		X	
04	X			16		X	
05	X			17		X	
06	X			18		X	
07	X			19		X	
08	X			1A		X	
09	X			1B		X	
0A	X			1C		X	
0B	X			1D		X	
0C	X			1E		X	
0D	X			1F		X	
0E	X			20			X
0F	X			21			X
10		X		22			X
11		X		23			X

A *Default-settings*

Outputs fieldbus error

Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold Current Value	Parameter in hexadecimal format	Output 0 **A**	Output substitute value	Hold Current Value
20			X	28			X
21			X	29			X
22			X	2A			X
23			X	2B			X
24			X	2C			X
25			X	2D			X
26			X	2E			X
27			X	2F			X

Parameter 5

Table 106: Parameter 5 Integer Data format

A *Default-settings*

Integer Data format

Parameter in hexadecimal format	LSB first **A**	MSB first	Parameter in hexadecimal format	LSB first **A**	MSB first	Parameter in hexadecimal format	LSB first **A**	MSB first
00	X		0B		X	16	X	
01		X	0C	X		17		X
02	X		0D		X	18	X	
03		X	0E	X		19		X
04	X		0F		X	1A	X	
05		X	10	X		1B		X
06	X		11		X	1C	X	
07		X	12	X		1D		X
08	X		13		X	1E	X	
09		X	14	X		1F		X
0A	X		15		X			

Table 107: Parameter 5 Diagnostics all Modules

A *Default-settings*

Diagnostics all Modules

Parameter in hexadecimal format	activate **A**	deactivate	Parameter in hexadecimal format	activate **A**	deactivate	Parameter in hexadecimal format	activate **A**	deactivate
00	X		0B		X	16		X
01	X		0C	X		17		X
02		X	0D	X		18	X	
03		X	0E		X	19	X	
04	X		0F		X	1A		X
05	X		10	X		1B		X
06		X	11	X		1C	X	
07		X	12		X	1D	X	
08	X		13		X	1E		X
09	X		14	X		1F		X
0A		X	15	X				

Table 108: Parameter 5 V_O diagnostics

A *Default-settings*

V_O diagnostics

Parameter in hexadecimal format	activate **A**	deactivate	Parameter in hexadecimal format	activate **A**	deactivate	Parameter in hexadecimal format	activate **A**	deactivate
00	X		0B	X		16		X
01	X		0C		X	17		X
02	X		0D		X	18	X	
03	X		0E		X	19	X	
04		X	0F		X	1A	X	
05		X	10	X		1B	X	
06		X	11	X		1C	X	
07		X	12	X		1D	X	
08	X		13	X		1E		X
09	X		14		X	1F		X
0A	X		15		X			

Table 109: Parameter 5 Station configuration

A *Default-settings*

Station configuration

Parameter in hexadecimal format	Do not allow changes **A**	Allow changes	Parameter in hexadecimal format	Do not allow changes **A**	Allow changes	Parameter in hexadecimal format	Do not allow changes **A**	Allow changes
00	X		0B		X	16	X	
01	X		0C		X	17	X	
02	X		0D		X	18		X
03	X		0E		X	19		X
04	X		0F		X	1A		X
05	X		10	X		1B		X
06	X		11	X		1C		X
07	X		12	X		1D		X
08		X	13	X		1E		X
09		X	14	X		1F		X
0A		X	15	X				

Table 110: Parameter 5 I/Oassistant Force- Mode

A *Default-settings*

I/O*assistant* Force-Mode

Parameter in hexadecimal format	Release **A**	block	Parameter in hexadecimal format	Release **A**	lock	Parameter in hexadecimal format	Release **A**	block
00	X		0B	X		16		X
01	X		0C	X		17		X
02	X		0D	X		18		X
03	X		0E	X		19		X
04	X		0F	X		1A		X
05	X		10		X	1B		X
06	X		11		X	1C		X
07	X		12		X	1D		X
08	X		13		X	1E		X
09	X		14		X	1F		X
0A	X		15		X			

Conversion Table Decimal to Hexadecimal

Table 111: Decimal - hexadecimal

decimal	hexadecimal	decimal	hexadecimal	decimal	hexadecimal	decimal	hexadecimal
001	01	022	16	043	2B	064	40
002	02	023	17	044	2C	065	41
003	03	024	18	045	2D	066	42
004	04	025	19	046	2E	067	43
005	05	026	1A	047	2F	068	44
006	06	027	1B	048	30	069	45
007	07	028	1C	049	31	070	46
008	08	029	1D	050	32	071	47
009	09	030	1E	051	33	072	48
010	0A	031	1F	052	34	073	49
011	0B	032	20	053	35	074	4A
012	0C	033	21	054	36	075	4B
013	0D	034	22	055	37	076	4C
014	0E	035	23	056	38	077	4D
015	0F	036	24	057	39	078	4E
016	10	037	25	058	3A	079	4F
017	11	038	26	059	3B	080	50
018	12	039	27	060	3C	081	51
019	13	040	28	061	3D	082	52
020	14	041	29	062	3E	083	53
021	15	042	2A	063	3F	084	54

decimal	hexadecimal	decimal	hexadecimal	decimal	hexadecimal	decimal	hexadecimal
85	55	096	60	107	6B	118	76
086	56	097	61	108	6C	119	77
087	57	098	62	109	6D	120	78
088	58	099	63	110	6E	121	79
089	59	100	64	111	6F	122	7A
090	5A	101	65	112	70	123	7B
091	5B	102	66	113	71	124	7C
092	5C	103	67	114	72	125	7D
093	5D	104	68	115	73		
094	5E	105	69	116	74		
095	5F	106	6A	117	75		

Ordering Information

Table 112: Ordering information

Article	Description	Ident-Number
Manuals		
PROFIBUS-DP	Description of the BL67 gateway for the connection to PROFIBUS-DP	D300570 (German) D300529 (English)
DeviceNet	Description of the BL67 gateway for the connection to DeviceNet	D300528 (English)
I/O modules	Description of the bus-independent BL67 I/O modules	D300572 (German) D300527 (English)
Catalogs		
BL67-Catalog	System description and ordering information for BL67 and Accessories	D300574 (German) D300575 (English)
compact catalog	Catalog for sensors interface- and fieldbus technologies	D900210 (German, English, French)

9 Glossary

A

Acknowledge

Acknowledgment of a signal received.

Active metal component

Conductor or conducting component that is electrically live during operation.

Address

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

Addressing

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

Analog

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

Automation device

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

B

Baud

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

Baud rate

Unit of measurement for measuring data transmission speeds in bps.

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 BL20's internal module bus. The bits and bytes are converted by the BL20 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 BL20's internal module bus to the counter module. The commands and signals directed to the counter module are converted by the BL20 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

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.

GSD

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

H

Hexadecimal

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

HW gate

A hardware release, which is controlled via the digital input on the module. This release is configured as a function of the digital input. It is set by change of edge from 0-1 at the input, and reset by a change change of edge 1-0.
The hardware release is called “HW gate“ in the controller and parameters.

Hysteresis

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

I

I/O

Input/output.

Impedance

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

Inactive metal components

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

Inductive coupling

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

Intelligent modules

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

L

Laod value

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

Latch-retrigger function

This function saves the current internal counter content of the electronic module at the digital input when there is a change of status, and the count procedure is “retriggered“. That means, the current internal counter content is saved at the point in time the change of status occurs. The counter is subsequently reloaded with the load value and then continues to count.

Lightning protection

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

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant Bit

M

Mass

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

Master

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

Master/slave mode

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

Module bus

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

MSB

Most Significant Bit

Multi-master mode

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

N

Namur

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

O

Overhead

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

P

PLC

Programmable Logic Controller.

Potential compensation

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

Potential free

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

Potential linked

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

PROFIBUS-DP

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

PROFIBUS-DP address

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

PROFIBUS-DP master

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

PROFIBUS-DP slave

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

Protective earth

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

R

Radiation coupling

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

Reaction time

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

Reference potential

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

Repeater

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.

SUB-D connector

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

SW gate

A software release, which has to be controlled via the control bit SW_GATE. The software release can only be set by means of a change of edge (from 0-1) of the control bit SW_GATE. Resetting of this bit resets the software release. The software release is called “SW gate“ in the controller.

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.

UART

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

Unidirectional

Working in one direction.

10 Index

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Industrial
Automation

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