PROFINET Gateway

LB/FB Remote I/O System

Manual

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1 Introduction

1.1 Purpose of the Instructions

These instructions describe the basics of LB/FB remote I/O systems. The instructions include the following information:

- Information about planning the I/O modules used
- Information about commissioning an LB/FB remote I/O system
- Information about the I/O modules
- Information about the gateway's display and diagnostics
- Information about troubleshooting the LB/FB remote I/O system

1.2 Other Documentation

The documentation of the LB/FB remote I/O system consists of the following parts:

- This software manual
- Hardware manual for the LB/FB remote I/O system
- Configuration instructions for commissioning the LB/FB remote I/O system
- Instruction manuals for the components in use
- Datasheets for the components in use

The documentation may comprise the following parts, if applicable:

- EC-type-examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Other documents

1.3 Target Group

The manual is intended for users with basic knowledge of automation technology.

1.4 Registered Trademarks

PROFINET®: trademark of PROFIBUS Nutzerorganisation e.V. (PNO)

SIMATIC, TIA Portal: trademarks of SIEMENS AG

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1.5 Symbols Used

This document contains information that you must observe to prevent faults.

Warning messages

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Information messages

Note

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

1 Basics of the LB/FB Remote I/O Systems

LB/FB remote I/O systems are signal modification devices that act as an interface for signals between field devices and process control systems. The I/O modules are mounted on the prefabricated backplanes using slots. Gateways are available for various standard buses and form the interface between the I/O modules and the process control system. Power supplies are used to power the I/O modules and gateways.

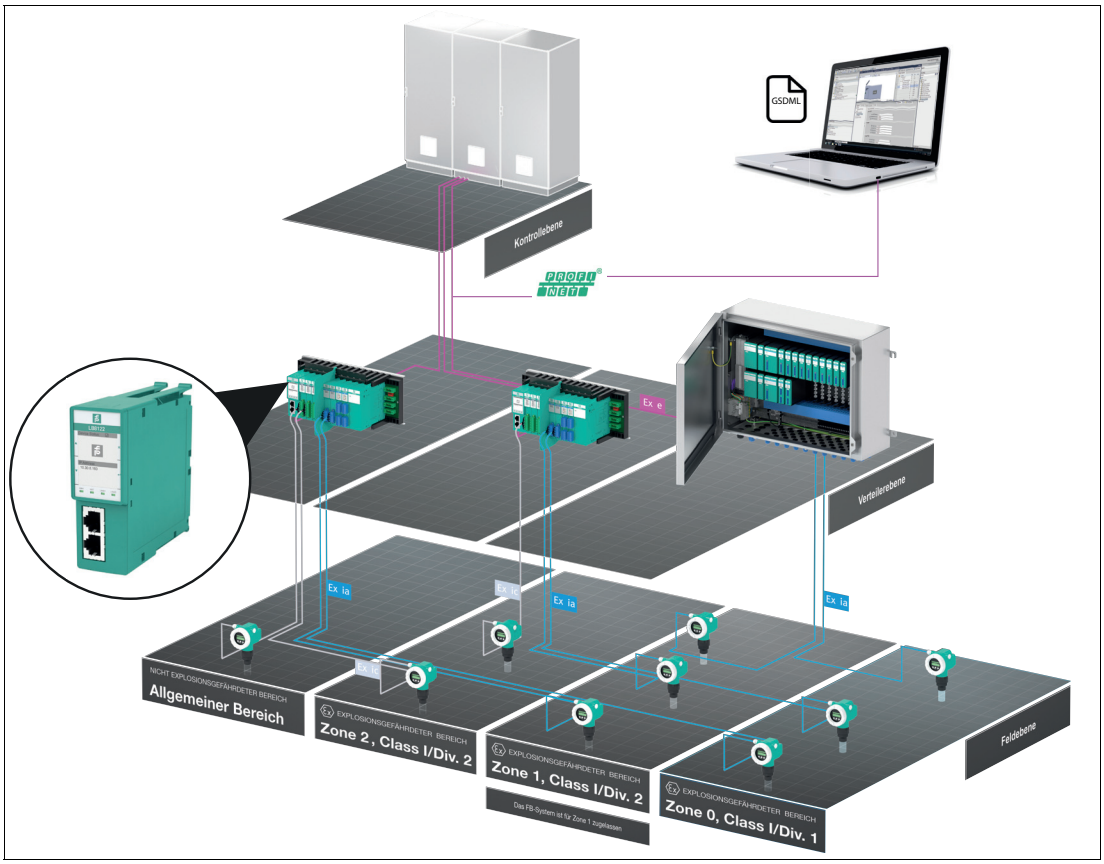

Figure 1.1 Structure of an automation system

The figure above shows a schematic view of the configuration software and the following 3 levels:

- Control level
- Distribution level
- Field level

Control level

The process is controlled and monitored by a process control system or PLC. The control system or PLC retrieves the data and distributes control commands in the cyclic data traffic.

Distribution level

LB/FB remote I/O systems are located at the distribution level. LB/FB remote I/O systems transfer process data from the non-hazardous or hazardous area by connecting digital and analog sensors and actuators to the control system via a bus interface.
I/O modules are part of the LB/FB remote I/O system. They record data and output signals for process intervention purposes. The following types of I/O modules are available:

- Digital input/digital output
- Valve driver
- Analog input/analog output
- Voltage input
- Temperature input

- Frequency input
- Counter input
- Relay output

PROFINET is a standard for transferring data between the LB/FB remote I/O system and the control system. PROFINET connects an LB/FB remote I/O system to a control system. The PROFINET connection is marked in purple in the figure above.

Field level

Field devices are technical devices and are located at the field level outside switch cabinets or control rooms. Field devices can be actuators (e.g., valves) or sensors (e.g., ultrasonic sensors) and are connected to the corresponding I/O modules.

Configuration software

A configuration program can be used to configure the LB/FB remote I/O system and parameterize the channels. For configuration and parameterization, it is possible, to connect a computer with configuration software to the PROFINET network, for example. Examples of configuration software include the Siemens TIA Portal or Siemens STEP 7.

Commissioning

Commissioning includes the integration of the LB/FB remote I/O system into a PROFINET network and the configuration of the LB/FB remote I/O system. The IP address and name of the gateway are required for commissioning. The gateway can be addressed by a control panel in the LB/FB remote I/O system after the name has been assigned via the configuration software.

Diagnosis

The bus system reports diagnostic information to the control system. In the event of a fault, fault data and diagnostic data are transmitted via cyclic and acyclic data traffic.

Output shutdown

The output shutdown enables bus-independent shutting down of all or selected I/O modules within the LB/FB remote I/O system. This function requires the use of appropriately equipped backplanes and I/O modules with shutdown input.
Basics and further information about output shutdown can be found in the Functional Safety Remote I/O LB/FB Devices manual.

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Starting up an LB/FB remote I/O system

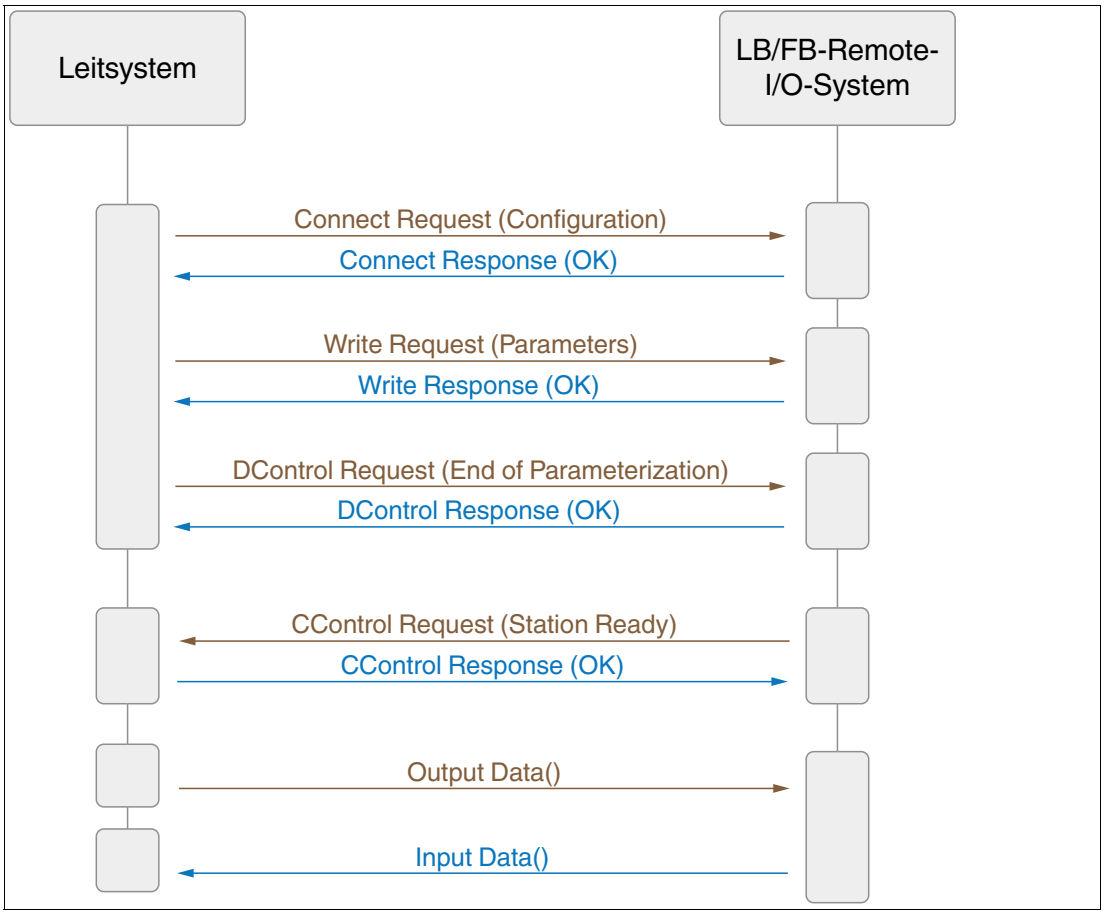

Figure 1.2 Starting up an LB/FB remote I/O system

Starting up an LB/FB remote I/O system comprises the following steps:

- Connect Request (Configuration)/Connect Response (OK)
- Write Request (Parameters)/Write Response (OK)
- DControl Request (End of Parameterization)/DControl Response (OK)
- CControl Request (Station Ready)/CControl Response (OK)
- Output Data()/Input Data()

The control system sends a request to the LB/FB remote I/O system to establish a connection (Connect Request (Configuration)). With this request, the control system sends the configuration data (e.g., number and position of I/O modules) to the LB/FB remote I/O system. The LB/FB remote I/O system confirms that the connection is established (Connect Response (OK)).

In the next step, the control system sends the parameters from commissioning to the LB/FB remote I/O system (Write Request (Parameters)). As soon as the LB/FB remote I/O system has received the parameters, the LB/FB remote I/O system acknowledges receipt of the parameters (Write Response (OK)). Since all parameters do not always fit in one message, multiple messages can be sent.

After the control system has sent all parameters to the LB/FB remote I/O system, the control system sends the message "DControl Request (End of Parameterization)." With this message, the control system informs the LB/FB remote I/O system that parameterization is complete. When all parameters have been received by the LB/FB remote I/O system, the LB/FB remote I/O system sends the message "DControl Response (OK)" to the control system.

In the next step, the LB/FB remote I/O system sends a message to the control system, indicating that the LB/FB remote I/O system is ready for data exchange (CControl Request (Station Ready)). The control system then sends the response (CControl Response (OK)) to the LB/FB remote I/O system.

Cyclic data exchange of input and output data is now running continuously. The input data are recorded in the process and sent to the control system by the LB/FB remote I/O system. The output data are sent to the LB/FB remote I/O system by the control system. The output data are used to influence the process.

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3 Cybersecurity Information

The LB/FB PROFINET gateway is secure for the area of application defined here in accordance with IEC 62443-4-1. The operator must implement the measures defined in this section to ensure the secure operation and protection of the device while online.

Security context

The LB/FB PROFINET gateway and associated I/O modules are intended for use in an automation network. This is a secure network with known and trusted participants that is separated (physically or logically) from the company network.

A firewall must be configured so that only defined ports are forwarded to other subnets.

The device uses the following ports:

- Ports 49152, 34962, 34964, 53248 for PROFINET
- Port 5094 and port 20004 for HART IP
- Port 161 for SNMP
- Port 25062 PFDCP (Pepperl+Fuchs-specific services, HART-IP DTM via PACTware)
- Port 68 DHCP client
- Port for redundant communication via TCP (to be considered in downstream zones)

To avoid losing packets, we recommend limiting network utilization to < 5 % of the bandwidth. We recommend operating the gateway behind a switch.

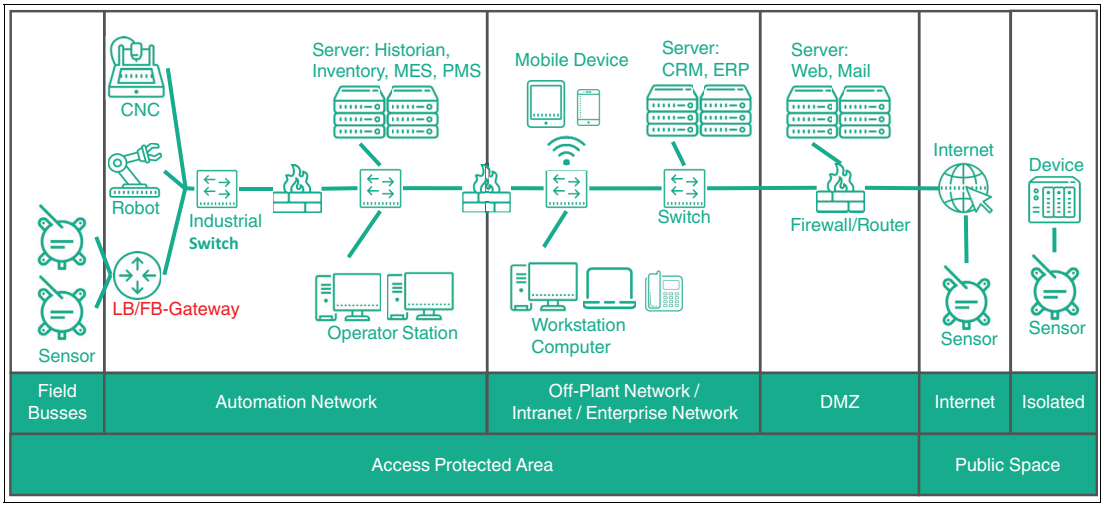

Figure 3.1 Exemplary illustration of the LB/FB gateway in a plant

The device must be operated in a lockable switch cabinet or in a space that can only be accessed by authorized personnel. Otherwise, there is a risk that some of the device settings may be adjusted via the display without authentication or that the security-critical web server may be activated.

The following measures must be implemented on the device for commissioning:

- Hardening: *None*
- Integration (into other systems): *None*
- Additional security layers: *None*
- Special security functions: *None*
- Recommendation for security-related tools: *None*

The following measures must be implemented on the device for operation:

- Additional security layers: *None*
- Special security functions: *None*
- Recommendation for security-related tools: *None*
- Servicing and management: Check the website regularly for the release of security advisories and subscribe to the RSS feed: https://www.pepperl-fuchs.com/global/en/29079.htm.

The following measures must be implemented on the device for decommissioning:

- User access data: *None*
  The device does not contain any user access data (e.g., passwords).
- Configuration: The configuration data is stored on the device.
  - When the device is taken out of operation, it must be physically destroyed to wipe the configuration data.
- Further operating data: *None*
- Log data (history, historical data, error data): The log data is stored on the device. This includes the identification of inserted Pepperl+Fuchs I/O module device data
  - When the device is taken out of operation, it must be physically destroyed to wipe the log data.

Requirements for user roles to ensure cybersecure operation

There are no specific cybersecurity-related instructions for the user to operate this device.

User account privileges and rights

The device does not contain any user-specific account privileges and rights.

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4 System Limits

The maximum number of I/O modules per LB/FB remote I/O system is determined by the following factors:

Slots on the backplane

Different backplane systems are available for the LB/FB remote I/O system. The backplane systems differ in the number of slots available, among other things. Up to 46 slots are available for an LB system and up to 40 slots are available for an FB system. Additional information about slots on the backplane can be found in the hardware manual of the LB or FB remote I/O system.

Width of the I/O modules

The number of slots required by a module depends on the width of the respective module. Modules with a narrow design require 1 slot and modules with a wide design require 2 slots.

Number of I/O module channels

The number of available channels depends on the selected I/O module type. I/O modules with up to 4 channels are available for processing analog process values and with up to 8 channels for digital process values.

Maximum size of transferable data

The data telegrams for the transmission of cyclic input and output data are limited to 1436 bytes (Protocol Data Units (PDU), 1440 bytes—4 bytes status/assignment data) and must therefore not exceed the maximum transferable data length.

The available bytes for the exchange of cyclic output data are sufficient.

For cyclic input data, the limit to a maximum of 1436 bytes is an appropriate restriction. The limit of 1436 bytes cannot be reached with the actual I/O data of the channels. The limit value can be reached or exceeded by adding HART auxiliary variables during cyclic data exchange.

When calculating the data volume (see table below), consider the size of the IO Producer Status (IOPS). The IOPS shows the status for each channel and thus the validity of the data and is 1 byte.

In various ways, the configuration programs check whether the maximum transferable size has been violated. The Siemens TIA Portal configuration program uses the GSDML file to determine the maximum transferable size. If the maximum size is exceeded, the TIA Portal reports an error message during compilation.

Example

Without HART auxiliary variables

With 7 bytes, analog channels occupy the most space in the data telegram. A narrow I/O module provides a maximum of 4 analog channels. The resulting maximum data volume of an I/O module (without HART auxiliary variables) is therefore 28 bytes. For an LB remote I/O system with a maximum of 46 slots, this results in a maximum data volume of 1288 bytes. The unoccupied bytes are freely available and can be used for the transmission of HART auxiliary variables during cyclic data exchange.

Example

With maximum number of HART auxiliary variables

Up to 4 HART auxiliary variables can be recorded and integrated into the cyclic data exchange process via each HART-compatible I/O channel. If all possible auxiliary variables are selected for a 4-channel I/O module, the space requirements for cyclic data exchange increases to 100 bytes per I/O module. Therefore, if only I/O modules with the maximum data volume (100 bytes) are used, the maximum number of configurable I/O modules reduces to 14.

The data volume of the various I/O modules is summarized in the table below and is further explained in the corresponding sections of the module description. The configuration program usually checks the total data volume automatically.

Data volume cyclic input data I/O modules/channels

Module type	Data per channel in bytes						No. of channels	Data volume per I/O module in bytes	Comment
	Alarm status	Process value 1	Process value 2	IOPS	IOCS	Total			
LB1x01 FB1x01	1	-	-	1	-	2	2	**4**	-
LB1x02 FB1x02	1	-	-	1	-	2	3	**6**	-
LB1x03 Cntr FB1x03 Cntr	2	4	-	1	1	8	1	**8**	The counter also has cyclic output data
LB1x03 Cntr/Freq FB1x03 Cntr/Freq	3	4	4	1	1	13	1	**13**	The counter also has cyclic output data
LB1x03 Freq FB1x03 Freq	3	4	-	1	-	8	1	**8**	-
LB1x08/9 FB1x08/9	1	-	-	1	-	2	8	**16**	-
LB2x01-17 FB2x01-17	1	-	-	1	1	3	1	**7**	DO channel (I/O module has 1 DO and 2 DI channels)
	1	-	-	1	-	2	2		DI channel (I/O module has 1 DO and 2 DI channels)
LB3x01/2/3 FB3x01/2/3	2	4	-	1	-	7	1	**7**	-
LB3x04/5/6 FB3x04/5/6	2	4	-	1	-	7	4	**28**	-
LB4x01/2/3 FB4x01/2/3	1	4	-	1	1	7	1	**7**	-
LB4x04/5/6 FB4x04/5/6	1	4	-	1	1	7	4	**28**	-
LB5x01/2/6 FB5x01/2/6	2	4	-	1	-	7	1	**7**	-
LB5x04/5 FB5x04/5	2	4	-	1	-	7	4	**28**	-
LB6x01 FB6x01	1	-	-	1	1	3	2	**6**	-
LB6x05/10-15 FB6x05/10-15	1	-	-	1	1	3	4	**12**	-
LB6x06/8 FB6x06/8	1	-	-	1	1	3	8	**24**	-
LB6x16/17 1Ch FB6x16/17 1Ch	1	-	-	1	1	3	1	**3**	6x16/17 1-channel
LB6x16/17 2Ch FB6x16/17 2Ch	1	-	-	1	1	3	2	**6**	6x16/17 2-channel

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Module type	Data per channel in bytes						No. of channels	Data volume per I/O module in bytes	Comment
	Alarm status	Process value 1	Process value 2	IOPS	IOCS	Total			
LB7x04 AO FB7x04 AO	1	4	-	1	1	7	4	**28**	AO-AI-DO-DI can be mixed as required
LB7x04 AI FB7x04 AI	2	4	-	1	-	7	4	**28**	AO-AI-DO-DI can be mixed as required
LB7x04 DO FB7x04 DO	1	-	-	1	1	3	4	**12**	AO-AI-DO-DI can be mixed as required
LB7x04 DI FB7x04 DI	1	-	-	1	-	2	4	**8**	AO-AI-DO-DI can be mixed as required

Data volume cyclic input data HART submodules

Module type	Data per channel in bytes							Comment
	Dev status	PV value	SV value	TV value	QV value	IOPS	Total	
HART Dyn Var Pv	1	4	-	-	-	1	**6**	-
HART Dyn Var Pv Sv	1	4	4	-	-	1	**10**	-
HART Dyn Var Pv Sv Tv	1	4	4	4	-	1	**14**	-
HART Dyn Var Pv Sv Tv Qv	1	4	4	4	4	1	**18**	-
HART Dyn Var Sv	1	4	-	-	-	1	**6**	-
HART Dyn Var Sv Tv	1	4	4	-	-	1	**10**	-
HART Dyn Var Sv Tv Qv	1	4	4	4	-	1	**14**	-

Available power

The LB/FB remote I/O system is supplied via the system's own power supplies. Depending on the type of power supply, number of power supplies, operating location (hazardous area) and supply concept (e.g., power supply redundancy), a corresponding power is available to supply the system components (gateways and I/O modules). The available power limits the expansion possibilities of the LB/FB remote I/O system and can mean that not all slots on the backplane are usable when using I/O modules with high power consumption.

Note

When planning your LB/FB remote I/O system, check the load situation and, in the event of an overload, reduce the number of I/O modules or, if possible, increase the available power with an additional power supply. Refer to the respective datasheets for the required performance data. For systems with power supply redundancy, the available power is reduced by the power value of a power supply.

1 Commissioning the LB/FB Remote I/O System

The LB/FB remote I/O system is commissioned or adapted using configuration software such as the TIA Portal or STEP 7. To do this, device configuration is performed in the configuration software. The device configuration is an offline process that is completed without a connection to the control panel (PLC). A new project is created in the configuration software and an LB/FB remote I/O system is configured, whereby the exact structure of the LB/FB remote I/O system is simulated in the software project by selecting the I/O modules from the hardware catalog. After configuration, the device is parameterized. Parameterization includes setting the device characteristics such as the addresses or stipulating the communication characteristics. The I/O addresses are used, for example, to define where each binary or analog signal can be read in or out. When device configuration is complete, the configuration data is compiled in a format that the control panel can understand and is loaded into the control panel. Various test functions can be called up in your configuration software in online mode for troubleshooting and to output variable states.

GSDML file

The GSDML file is a device description file. It contains all the data required for configuration in the configuration software and for data exchange. The GSDML file is used to replicate the gateway and I/O modules in the project in the configuration software.

Configuration

Configuration of the LB/FB remote I/O system includes the configuration of components consisting of the gateway and the I/O modules. For this purpose, individual I/O modules from the hardware catalog are added to the hardware configuration. Hardware configuration enables the hardware components used to be simulated in the configuration software.

Parameterization

After configuration, the parameters of the I/O modules (channels) can be set. In so doing, the behavior of the I/O modules (channels) is defined.

Device name and IP address

The gateway communicates with the control panel. The gateway properties must be defined to be able to configure the gateway. These properties include the device name and the IP address. The gateway can only be addressed by a control panel in the LB/FB remote I/O system after the name has been assigned via the configuration program.

Each PROFINET device must have an IP network address to establish an application relationship. There are various ways to manage these IP network addresses, e.g., using a DHCP server, or via the gateway display or TCP protocol using the control panel or other software. The IP address cannot be changed while a PROFINET connection is active ("NET" network status LED lights up green).

Refer to the configuration instructions for more information on commissioning an LB/FB remote I/O system.

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6 Properties of the Gateway

The gateway is the link between the I/O modules and the control system. The gateway converts the protocol of the system bus integrated in the backplane into the protocol of the higher-level bus system. The gateway is located at the left-hand end of the backplane.

The gateway can be operated directly via the touch screen on the front. Basic settings such as the IP address can be set directly on the gateway. In addition, the device status is displayed using the 4 LEDs below the touch screen. The 2 Ethernet interfaces on the front connect the device to the Ethernet network.

Caution!

Fault in the plant

Changing the device data changes the device function.

Before entering new device data, make sure the plant is not endangered by changing the device data.

6.1 Media Redundancy Protocol (MRP)

The gateway has an integrated switch that ensures operation of the network at any time on the basis of the Media Redundancy Protocol (MRP).

Note

MRP-capable switches

In an MRP ring, devices may only be connected to a port of an MRP-capable switch. If non-MRP-capable switches are used, the connection may fail.

Note

Watchdog time for using the MRP function

Note that the watchdog time for the cyclic data traffic must at least bridge the time required by the MRP function for troubleshooting. Set the watchdog time for the LB/FB Remote I/O system to ≥ 256 ms.

6.2 S2 System Redundancy

For applications with higher demands on system availability, the gateway supports PROFINET S2 system redundancy according to PNO spec. (PNO Doc. 7.122) when used in a PROFINET network. This means that the gateway can establish an application relationship (AR) to two PROFINET controllers simultaneously. The primary connection (primary AR) is used for data exchange, the second is used as a backup (backup AR). It is switched to when required.

Redundant PROFINET controllers that support this function are required for configuring and operating S2 system redundancy. S2 system redundancy is configured in the PROFINET controllers (for more detailed information, please refer to the documentation of your controller manufacturer).

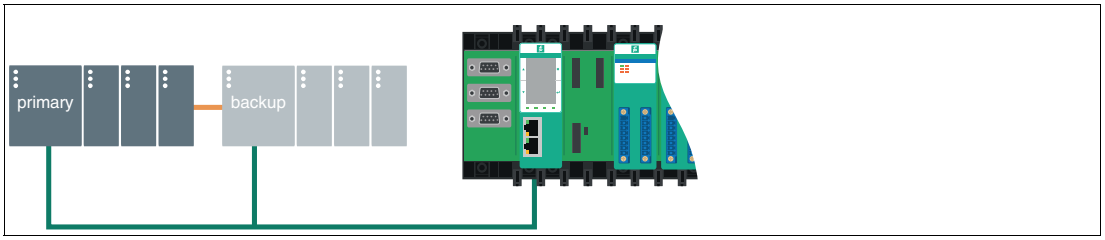

Figure 6.1 Schematic drawing S2 system redundancy

6.3 Shared Device

The PROFINET shared device (PN-SD) is a technology that enables a LB/FB remote IO system to be connected to more than one controller (PLC) at the same time. This allows multiple controllers to access the same field devices connected to the remote IO system without having to duplicate the field devices.

In the LB/FB remote IO system, the input and output signals of the field devices are forwarded to the controller via I/O modules. Normally, each I/O module is connected to only one controller. If another controller wants to access the same LB/FB remote IO system, additional I/O modules must be added. PN-SD technology allows multiple controllers to access the same LB/FB remote IO system simultaneously.

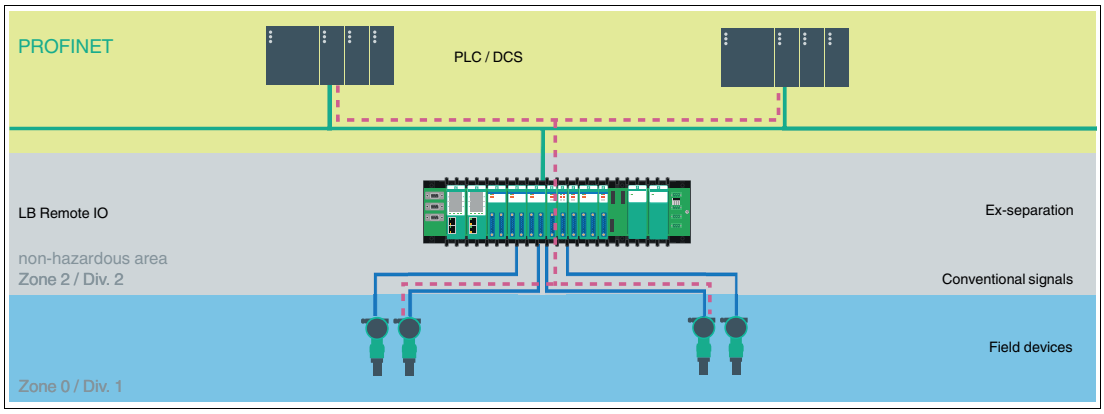

Figure 6.2 Principle sketch shared device topology

Note

For more information on using the shared device, we recommend reading the manual for the respective controller.

6.4 Dynamic Reconfiguration

Dynamic reconfiguration (DR) is a PROFINET function that enables real-time network configuration changes to be made without shutting down or restarting the network or connected devices. For example, I/O modules can be replaced during operation.

Implementing dynamic reconfiguration (DR) in a PROFINET network necessitates special requirements to ensure smooth and uninterrupted operation. Some of the key requirements for DR support are:

- System redundancy (SR): The network must be able to detect failures of a controller or other network components and automatically switch to redundant systems to ensure continuous operation.
- The LB/FB remote IO system and the controller must allow multiple application relations (AR) (an application relation is the connection rule for communication between the device and the controller.) To perform a DR operation, the network must be able to dynamically reconfigure all ARs without losing data or affecting the operation of the connected devices.
- The GSDML file must support both dynamic reconfiguration (DR) and system redundancy (SR).

The following example shows the replacement of the originally used 4-channel AI LB3105 in slots 1 and 2 with a 1-channel AI LB3x02 and an 8-channel DI LB1x09. Data exchange is still active with the original configuration (green arrow).

Note

Before removing a channel, it is recommended to set the channel to a defined state (DO: Off; AO; 0 mA).

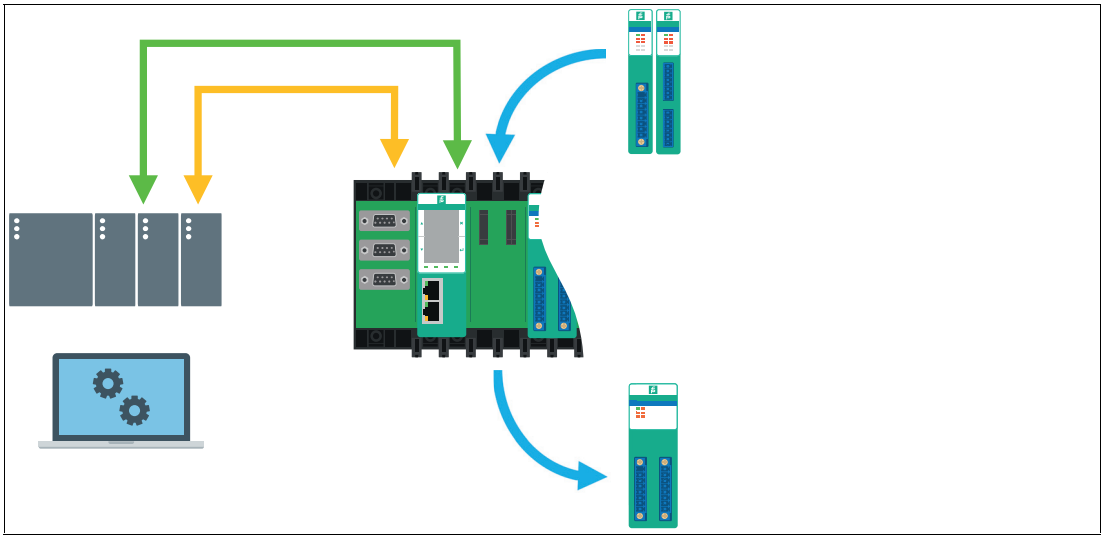

Figure 6.3 Example of dynamic reconfiguration

Note

Module LB7x04 and FB7x04

Before making changes to a channel of the LB7x04 or FB7x04 modules, it is recommended to set the channel to a defined state (DO: Off; AO: 0 mA).

Note

For more information on using dynamic reconfiguration, we recommend reading the manual for the respective controller.

6.5 User Interface

The user interface is a touch-sensitive display (touch screen). The functions are selected by tapping the buttons. The functions are contained in menus that the user can switch between. Depending on which menu is open, the same location on the user interface has a different function.

Note

Property damage due to improper use!

Touching the surface of the touch screen with sharp or pointed objects and sudden contact with hard objects can significantly shorten the service life of the user interface or lead to the total failure of the user interface.

- Always touch the surface of the touch screen carefully and not with sharp or pointed objects.

6.6 Operating and Display Elements

The figure below shows the operating and display elements on the display. The operating elements are used to navigate the menu tree. The LEDs provide different information about the current device status.

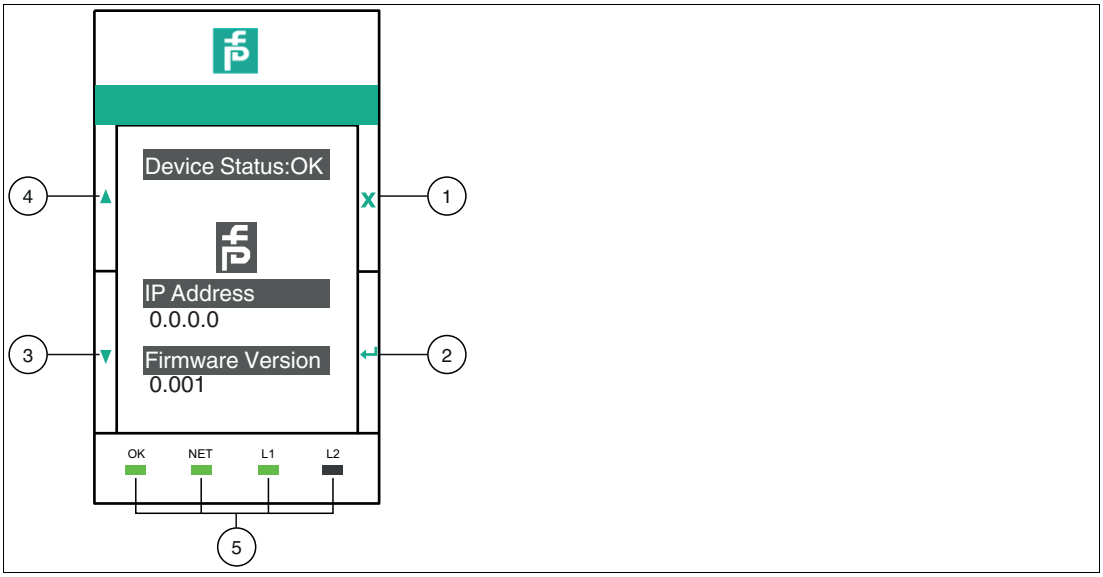

Figure 6.4 Operating and Display Elements

The gateway has the following operating and display elements:

Item	Meaning
1	Navigate back one level
2	Confirm selection
3	Navigate down

Item	Meaning
4	▲ Navigate up
5	OK: module status NET: network status L1: connection status port 1 L2: connection status port 2

The different statuses of the 4 LEDs have the following meanings:

LED	State	Meaning
OK Module status	Off	No power supply
	Green on	Error-free normal operation (network/PROFINET status is not indicated by this LED (network/PROFINET status see NET LED))
	Red flashing	Major recoverable fault: Channel Error (LFD-/Range-/Parameter-/Power-Supply-/ GW_OverTemp-/GW_UnderTemp-Fault)
	Red on	Major unrecoverable fault: Backplane Error
	Flashing green and red alternately	Self-test
	Orange flashing	Locating the PROFINET user via flashing LED
NET Network status	Off	No power supply or no IP address detected
	Green on	PROFINET connection is established
	Green flashing	No PROFINET connection available
	Red flashing	Connection timeout: PROFINET connection was interrupted by an error (e.g. timeout due to cable break).
	Flashing green and red alternately	Self-test
L1/L2 Connection status (port 1/2)	Off	No connection signal detected (e.g. in case of cable break)
	Green flashing	Connection established

Symbols

The symbols listed below conform to the NAMUR 107 standard.

Symbol	Meaning
	Maintenance required
	Out of specification
	Check function
	Failure
	Diagnostics active

6.7 Operating Concept

The 4 operating elements located at the edge of the screen are used for operation purposes. For some sequences of actions, it is necessary to switch between the menus. Numerical values must be entered in some menus. To do so, proceed as follows:

Touch display

The touch display is divided into four touch areas. Each operating element is selected using the four touch areas.

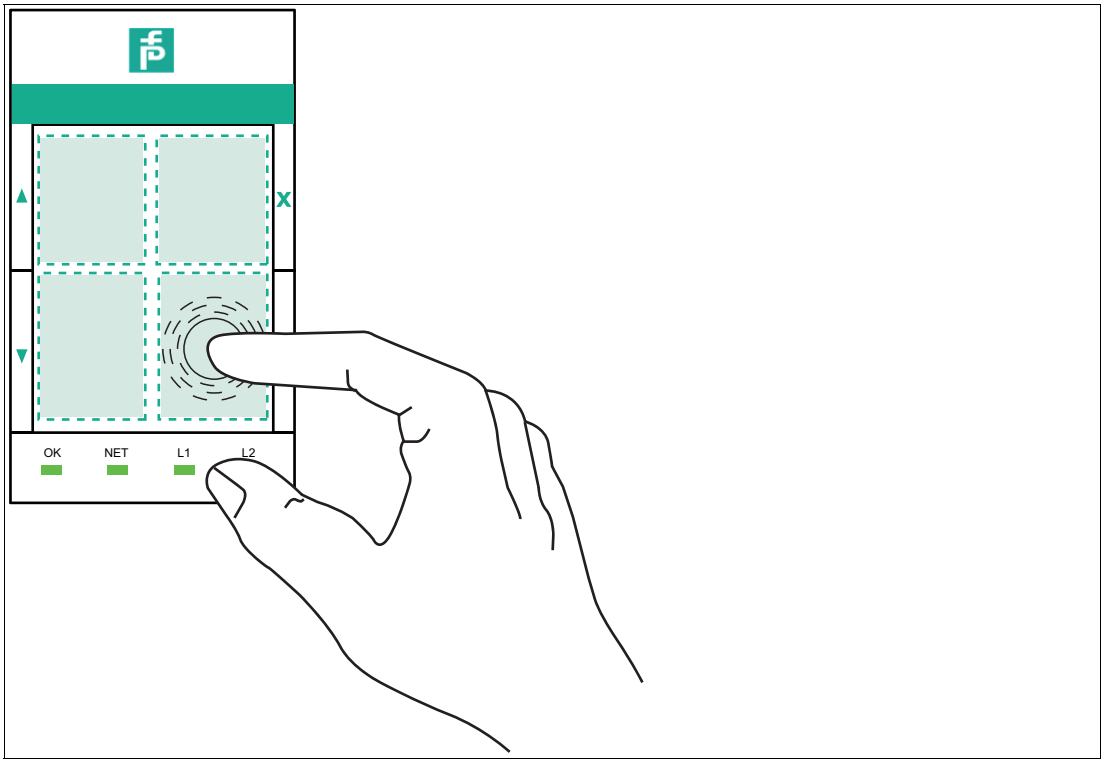

Figure 6.5 Touch display

Calling up menus

The start window is displayed after switching on. Tap the display to access the **Main Menu**. To call up the **Parameter** menu, for example, proceed as follows:

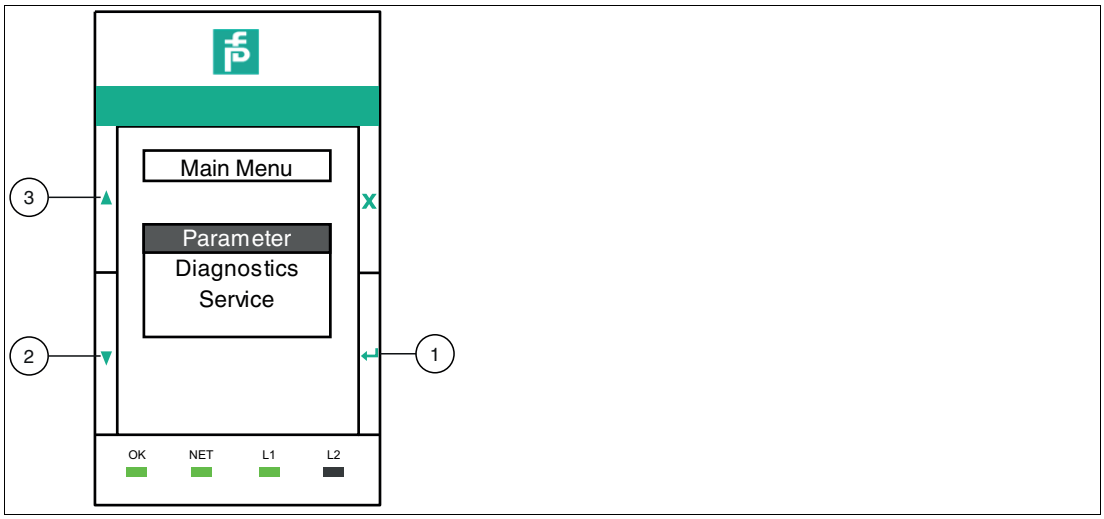

Figure 6.6 Call up menu

1. Press the **up arrow** (3) or **down arrow** (2) touch area until the desired menu is reached. The selected menu is highlighted with a gray box.
2. Confirm your selection by tapping the **Confirm** touch area (1).

   ↳ The **Parameters** menu opens. The submenus of the **Parameters** menu are shown on the display.

Entering a numerical value

Numerical values, such as the IP address, must be entered in some menus. To enter the numerical values via the user interface, proceed as follows:

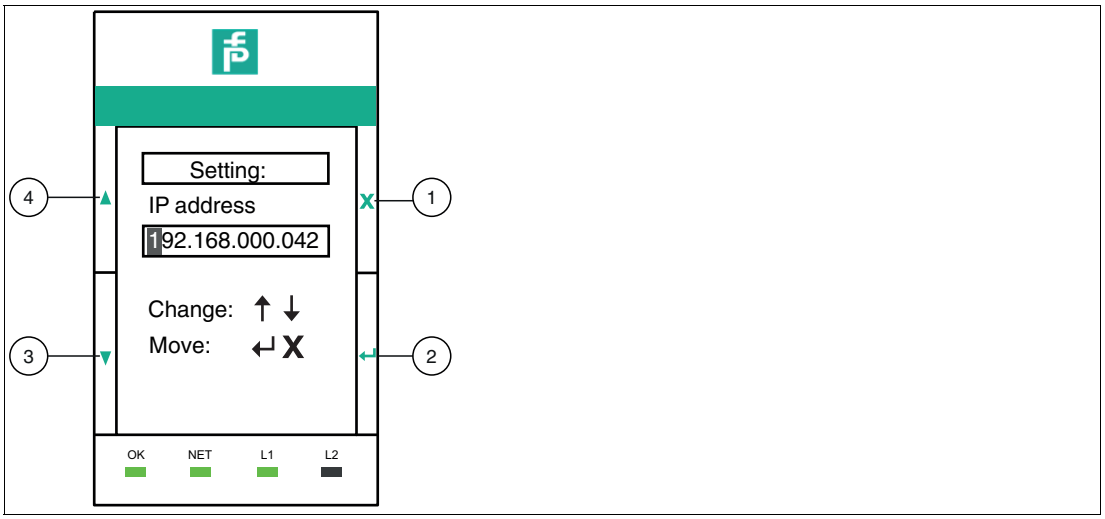

Figure 6.7 Entering a numerical value

1. Use the **up arrow** (4) or **down arrow** (3) touch area to navigate to the number field. In our example, to the input field for the IP address.

   ↳ You are in a number field as soon as the first digit is highlighted with a gray box.

2. Tap the **up arrow** (4) or **down arrow** (3) touch area to select a numerical value.

3. Confirm your selection by tapping the **Confirm** (2) touch area.

   ↳ The gray box skips to the next number field.

   Note

   If you are in the first number field and tap the **Back** (1) touch area, you exit the menu and jump back one menu level. The settings are not adopted.

4. Repeat steps 2 and 3 until the desired number combination has been entered.

6.8 Structure of Menus

The gateway displays the home screen after switching on. This displays the device status, IP address, and firmware version. Tap on the home screen to access the main menu.

In the following chapter, the menu structure is shown in the form of a flow diagram. The individual rectangles represent the menus. Each menu level begins with the main menu and is displayed down to the lowest menu level. The lowest menu level is outlined in bold.

The following chapter contains more detailed information about the menus.

6.8.1 Parameter Settings

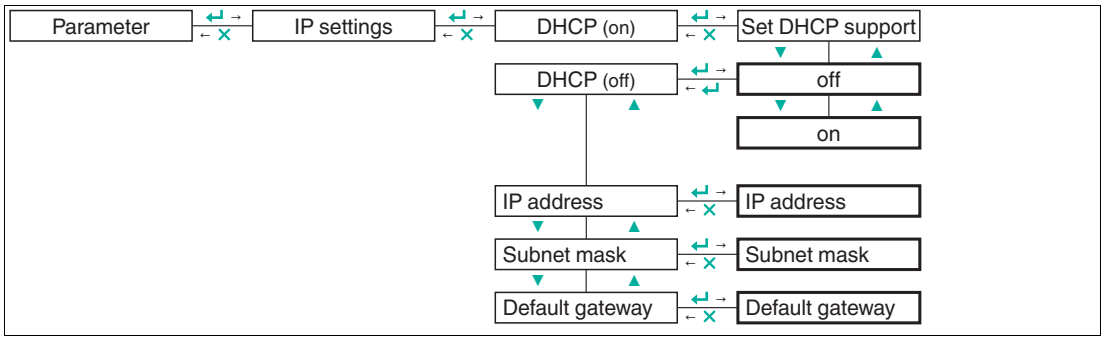

Figure 6.8 Parameters menu tree

The table below describes the lowest menu level from the **Parameters** main menu.

Menu	Description
Set DHCP support	Switch DHCP support on or off
IP address	Setting the IP address
Subnet mask	Setting the subnet mask
Default getway	Setting the gateway's default IP address

Note

Parameter Change via Display

Parameteränderungen, die über das Display des Gateways vorgenommen werden, werden zusätzlich nur flüchtig gespeichert und ca. 5 Sekunden nach der letzten Änderung zusammen persistent abgespeichert. Vermeiden Sie deshalb ein unmittelbares Abschalten des Gateways nach einer Parameteränderung über das Display.

Parameter changes that are made via the gateway display are additionally only stored volatilely and are persistently stored together approx. 5 seconds after the last change. Therefore, avoid switching off the gateway immediately after a parameter change via the display.

6.8.2 Diagnostic Settings

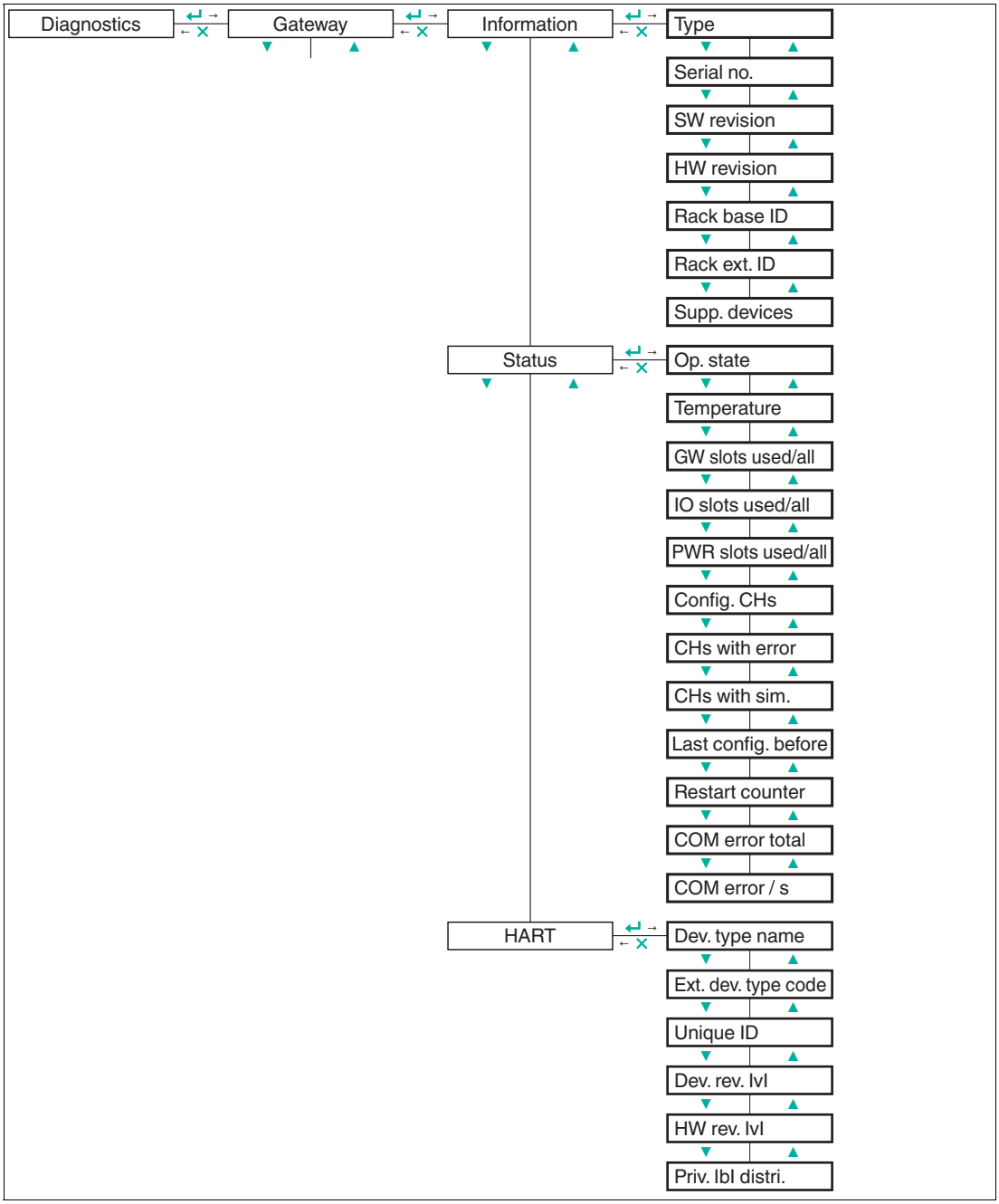

Figure 6.9 Diagnostics menu tree part 1

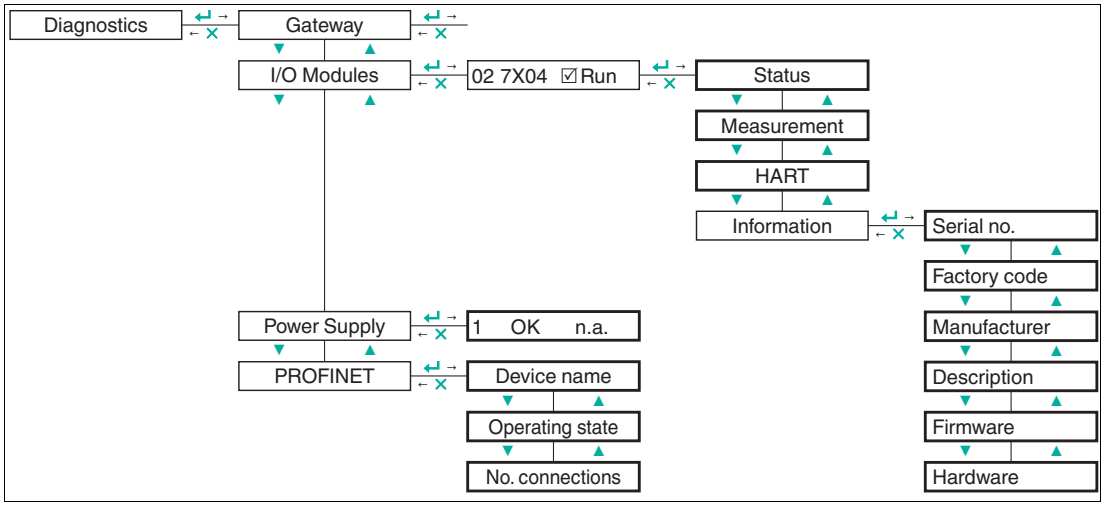

Figure 6.10 Diagnostics menu tree part 2

The table below describes the lowest menu level from the **Diagnostics** main menu.

Menu	Description
Type	Gateway item description (device type)
Serial no.	Gateway serial number
SW revision	Gateway software package version
HW revision	Hardware version
Rack base ID	Identification of the base backplane (e.g., 9022)
Rack ext. ID	Identification of the extension backplane (e.g., 9024)
Supp. devices	Indicates from which product line (P+F, OEM) I/O modules are supported (e.g., 00 = P+F)
Op. state	Operating status (e.g., Running)
Temperature	Processor temperature
GW slots used/all	Number of gateway slots in use/number of gateway slots available
IO slots used/all	Number of I/O module slots in use/number of I/O module slots available
PWR slots used/all	Number of power supply slots in use/number of power supply slots available
Config. CHs	Number of configured I/O channels
CHs with error	Number of channels with error
CHs with sim.	Number of simulated channels
Last config. before	Time elapsed since last configuration
Restart counter	Restart counter
COM error total	Communication error counter (internal communication)
COM error / s	Display of communication errors per second (internal communication)
Dev. type name	Device name (LB/FB GATEWAY)
Ext. dev. type code	The device type code (0x5DD4) corresponding to the device name is displayed here (enumeration list (see HART specification))
Unique ID	HART long address
Dev. rev. lvl	HART device revision
HW. rev. lvl	Hardware revision

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Menu	Description
Priv. lbl distri.	Reseller name
Status	The status of the individual channels is displayed in the form of a table
Measurement	Measured value display of a channel
HART	List of HART data
Serial no.	I/O module serial number (if the module supports the reading out of the serial number)
Factory code	Factory code (e.g., 0 = P+F)
Manufacturer	Manufacturer name
Description	Module name (e.g., 7104 A)
Firmware	Module software version
Hardware	Module hardware version
1 OK n.a.	Indicates the plugged in power supplies (Ch = NT slot, Avbl (available - /OK), type n.a. (not available))
Device name	PROFINET Device Name
Operating state	Operating status (communication): Linked, Ready
No. connections	Number of PROFINET connections

6.8.3 Service Settings

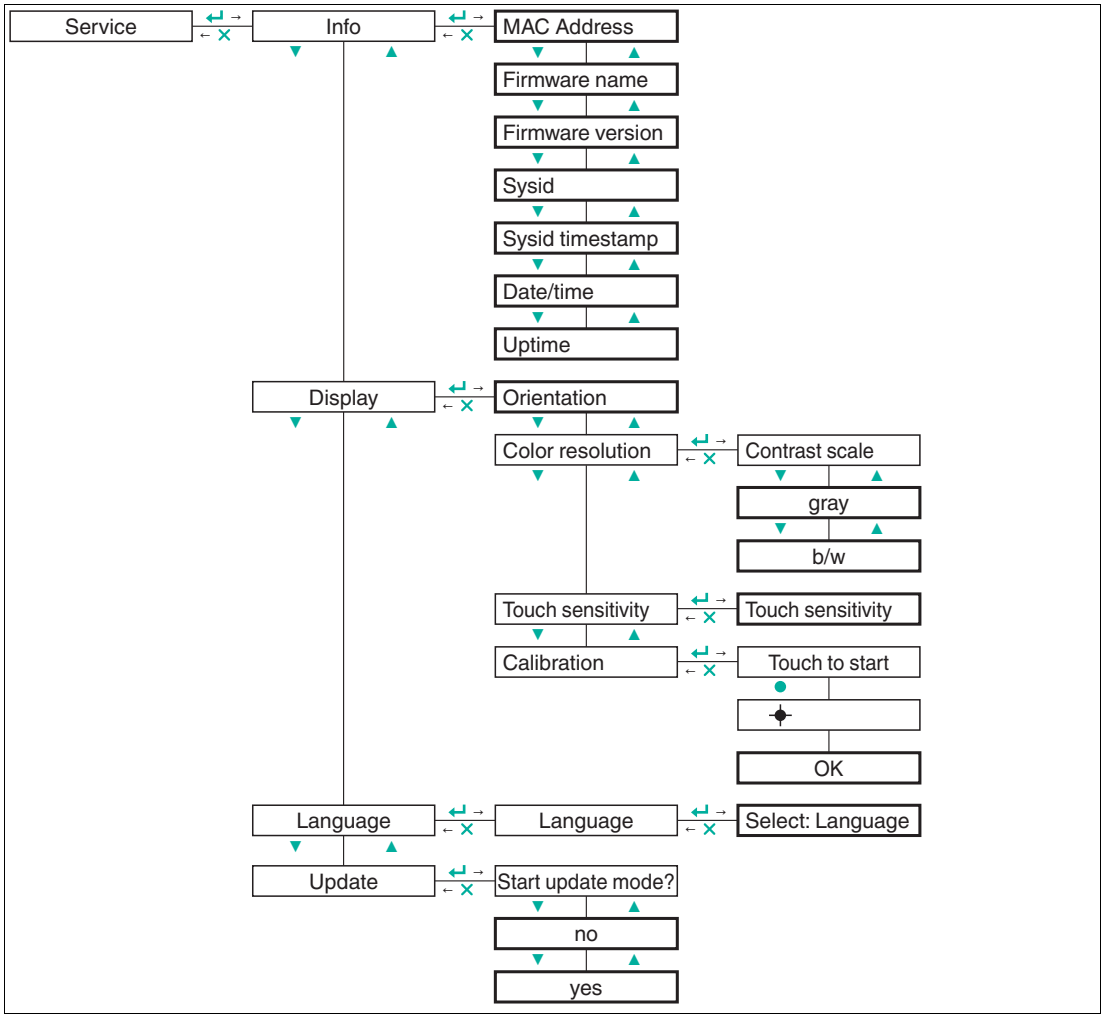

Figure 6.11 Service menu tree

The table below describes the lowest menu level from the **Service** main menu.

Menu	Description
MAC address	A unique hardware address that identifies the gateway in a network
Firmware name	Gateway firmware name in the format vx.y.z (e.g., v0.2.19)
Firmware version	GW firmware version in the format x.y Build z (e.g., 0.002 Build 019)
Sysid	-
Sysid timestamp	-
Date/time	Date and time (up-to-date if the time server is reachable)
Uptime	Time elapsed since last restart
Orientation	Horizontal display orientation
Contrast scale	Contrast can be set to two levels (display in grayscale or black/white (high contrast))
Touch sensitivity	Sets the touch duration from when a corresponding event is triggered (setting between 3 (high sensitivity) and 7 (lower sensitivity))
Calibration	Display calibration

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Menu	Description
Select: Language	Language selection
Start update mode?	Start firmware update (see chapter 6.9)

6.9 Firmware Update

The firmware update allows you to use the latest software developments. To install the firmware update, proceed as follows:

Performing a firmware update

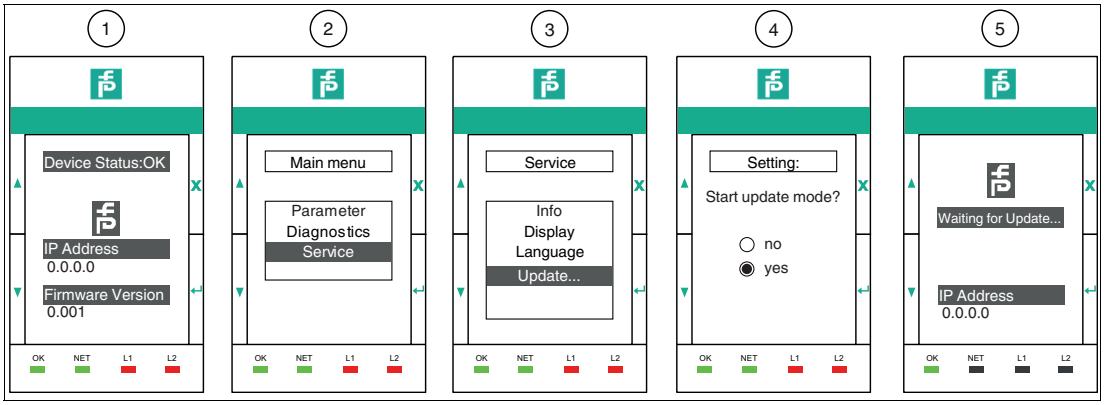

Figure 6.12 Firmware Update

1. Make sure that the gateway is inserted into the first slot from the left on the backplane.
2. Make sure that the power supply is present (24 VDC). At least one power supply must be plugged into the backplane.
3. Connect the gateway to a network (DHCP server).
4. The gateway displays the home screen after switching on (1). Tap on the home screen to access the main menu (2).
5. Tap the **down arrow** on the display until you reach the **Service** menu (2).
   ↳ The selected menu is highlighted with a gray box.
6. Confirm your selection by tapping the **confirmation button**.
   ↳ The **Service** menu (3) opens. The submenus of the **Service** menu are shown on the display.
7. Tap the **up arrow** on the display until you reach the **Update** menu (3).
8. Confirm your selection by tapping the **confirmation button**.
   ↳ The **Setting** menu (4) opens. The query **Start update mode?** is shown on the display.
9. Tap the **down arrow** on the display until you reach the **yes** option (4).
10. Confirm your selection by tapping the **confirmation button**.
    ↳ The gateway restarts.

Note

For a successful restart, make sure that no PROFINET communication is active. Disconnect the PROFINET control panel or the Ethernet connection.

11. When restarting, make sure that there is an Ethernet connection.
12. After a successful restart, Figure 5 appears on the display.
13. Open your Internet browser.
14. Enter the IP address displayed on the gateway into the address field of the Internet browser and confirm the entry with the Enter key on your keyboard.

    ↳ The gateway's update page opens.
15. Select the update file.

    ↳ The update process starts automatically. After successful installation, the gateway starts automatically.

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7 I/O Modules

7.1 Configuring the I/O Modules

The occupied slots on the backplane are represented in the configuration software by the "configuration table." The configuration table has as many lines as I/O modules are plugged into the backplane.

All GSDML-based configurations use narrow I/O modules. Narrow I/O modules require 1 slot on the backplane. Wide I/O modules require 2 slots and are considered as narrow I/O modules in the configuration software.

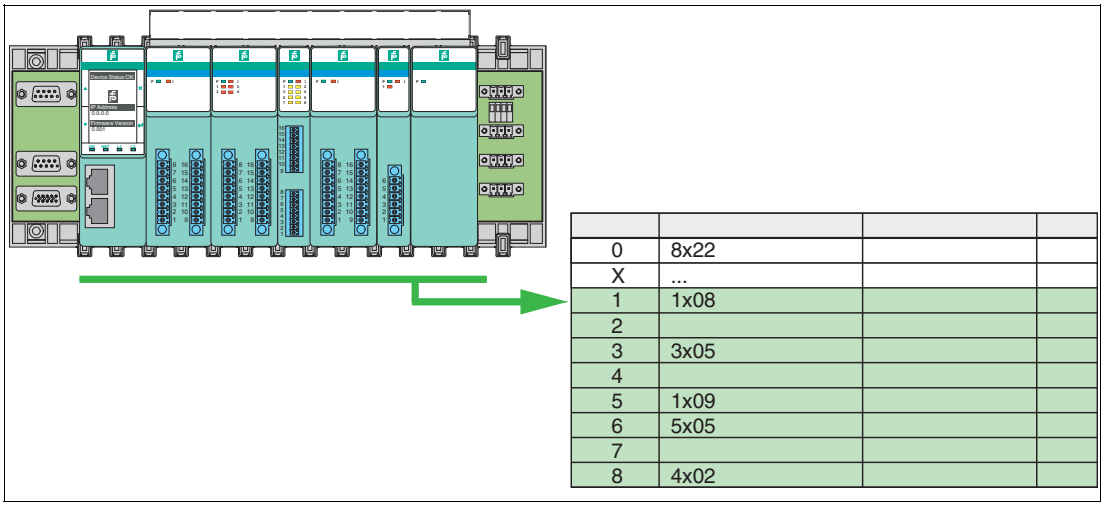
When adding a wide I/O module to the configuration table in the configuration software, make sure that the line below is left blank.

The table below shows an example of how narrow and wide I/O modules occupy slots on the backplane.

Example for a backplane assignment

Slot	I/O module	Description
0	LB8122.1.EL, FB8222.1.EL	Gateway
1+2	LB1108A, FB1208B*	DI, 8-CH, wide
3+4	LB3105A2, FB3205B*	AI, 4-CH, wide
5	LB1109A, FB1209B*	DI, 8-CH, narrow
6+7	LB5105A, FB5205B*	TI, 4-CH, wide
8	LB4102A2, FB4202B*	AO, 1-CH, narrow

The figure below shows an example implementation of an actual configuration in the configuration table.



0	8x22		
X	...		
1	1x08		
2			
3	3x05		
4			
5	1x09		
6	5x05		
7			
8	4x02		

Figure 7.1 Hardware configuration

7.2 Parameterization of the I/O Modules

The I/O modules form part of the LB/FB remote I/O system. I/O modules are used to record measured values and to output signals for process intervention purposes. Use the parameterization by the configuration software of the I/O modules to define the following:

- You define the measuring behavior of the I/O modules that process output signals.
- You define the behavior of the I/O modules that emit output signals.

Depending on the I/O module, various aspects of the I/O modules can be parameterized. These aspects include, for example, the following:

- Substitute values in case of a fault
- Line fault detection
- Measuring method
- Measuring range scaling
- Alarms
- Filter for inputs
- Filter for outputs
- Sensor

Parameter Validation

In addition to the parameter validations by the configuration software, the gateway checks the received parameter set of the single input/output channels. If the gateway detects an implausible parameterization (e.g. "Low Signal" (start of measuring range) ≥ "High Signal" (end of measuring range)), the affected channel will not be put into operation and reported as faulty. In addition to the error markings in the online view of the configuration software interface, a corresponding diagnostic interrupt is also triggered in the event of parameter errors. In the I/O module diagnosis view of the display, affected channels are also marked as faulty.

7.2.1 Setting Substitute Values for Fault Occurrences

In the event of a fault, I/O modules can accept defined substitute values, e.g., in the event of a failure in bus communication or a line fault in the sensor circuit.

Substitute Values for Inputs

The control panel is responsible for the creation of substitute values for the inputs. Therefore, the control panel must continue processing the input data appropriately.

Substitute Values for Outputs

The LB/FB remote I/O system has a 2-stage substitute value concept. The substitute value function is available for analog and digital outputs. The substitute value function can be set for digital outputs using the following parameters:

- **State**
- **Duration (s)**
- **Final State**

The substitute value function can be set for analog outputs using the following parameters:

- **State**
- **Value**
- **Duration (s)**
- **Final State**
- **Final Value**

The figure below shows how the substitute value function works using the example of a digital output. This figure is a simplified representation of the signal flow. The figure only contains elements that are relevant to the sensing principle of the substitute value function.

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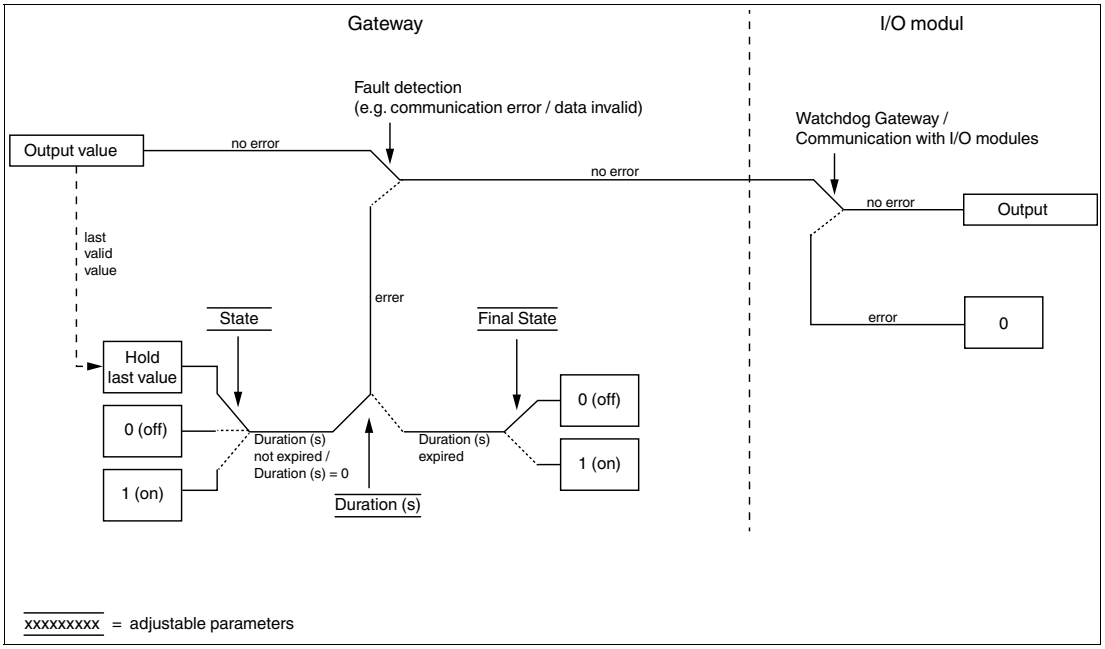

Figure 7.2 Data flow from gateway to binary output

The output value sent by the control system is checked and processed by the gateway. If there are no faults, the output channel (output) runs through the substitute value function with no change. The output value can be issued via the corresponding output channel. The last output value checked as valid is stored in the gateway and is available for the "Hold Last Value" substitute value option.

The first stage of the substitute value strategy takes effect if the gateway detects a fault related to an output value (e.g., output data invalid, fieldbus communication error). In this stage, the substitute value ("Hold Last Value," "Off," or "On") is sent to the corresponding output channel of the I/O module. The substitute value is defined with the **State** parameter. The value of the **Duration (s)** parameter determines whether and when the 2nd stage of the substitute value strategy is to be activated. If the value is "0," the 2nd stage of the substitute value strategy is not activated. The substitute value resulting from the 1st stage is still output. If the value is greater than "0," the 2nd stage of the substitute value strategy is activated after the time span has elapsed. The substitute value ("Off" or "On") defined by the **Final State** parameter is then transferred to the corresponding output channel.

As soon as the gateway no longer detects any output value-related faults, the output value is transferred directly to the output channel again. If a fault reoccurs, the process for determining the substitute value starts again.

Regardless of the substitute value strategy in the gateway, each output module checks the communication between itself and the gateway. If a communication error (watchdog) occurs, the I/O module sets all channels to the substitute value "0."

Due to the 2-stage substitute value concept, it is possible to treat short-term faults differently to longer-lasting faults. For example, it is possible to define that, in the event of a fault, an output will continue to operate for 2 seconds with the last valid value. The output is only switched off by means of the substitute value "0" if faults persist for a longer time. For this application example, the parameters of a digital output channel must be set as follows:

- **State** = Hold Last Value
- **Duration (s)** = 2 seconds
- **Final State** = 0 (Off)

7.2.2 Setting Line Fault Detection

Most I/O modules have a line fault detection function that can recognize a lead breakage or a short circuit.

If digital I/O modules are used, for example with a mechanical contact, an additional resistor circuit must be installed to ensure that the line fault detection function can work correctly. Using the additional resistor circuit, the electronics can distinguish between a closed switch and a short circuit.

The line fault detection function of the analog I/O modules is based on a current measurement. An additional resistor circuit is not required.

Refer to the relevant datasheets for more information on line fault detection.

7.2.3 Setting the Measuring Method

Settings can be configured for the measuring method. For example, it is possible to set whether the I/O module detects and processes the counting direction or direction of rotation (**Direction Detection**). It is also possible to set how often a pulse is counted (**Predivider**).

7.2.4 Setting the Measuring Range Scaling

During scaling, the process measured values are converted into readable values. With the help of scaling, process values can be adapted according to your processing (e.g., transfer measuring range in percent).

Note

Resolution

Regardless of the transmission format on the bus system, the data within the LB/FB remote I/O system are processed as 12 bit values (0 ... 4095).

The 12 bit value range represents the following ranges:

- Underrange (< 625)
- Measured value (625 ... 3125)
- Overrange (> 3125)

Assuming the parameterized measuring range is scaled to the value range 0 ... 100 %. This results in a resolution of 0.04 % of the measuring range for the specified internal mapping (2500 steps).

7.2.5 Setting Alarms

Alarms are part of the acyclic data traffic and are generated by the gateway. If certain events occur in the process or in the LB/FB remote I/O system, alarms are reported to the control system. If an event subject to an alarm occurs in the process, a process alarm is reported. If an event occurs in the LB/FB remote I/O system, a diagnostic alarm is reported. Parameters can be used to set the alarm behavior. For example, a process alarm can be set for the following cases:

- The measured value falls below or exceeds the permitted measuring range (**Range Alarms Active** parameter).
- The measured value falls below or exceeds the defined limits of the measuring range (**Limit Alarms Active** parameter). These limits can be set in the following parameters:
  - **Low Alarm Limit**
  - **Low Low Alarm Limit**
  - **High Alarm Limit**
  - **High High Alarm Limit**

If the respective measuring range or limits are exceeded or not reached, the corresponding alarm bit is set in the cyclic data.

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7.2.6 Setting the Filter for Analog Inputs

The filter (Trend Filter Mode) for damping the signal can be activated if the input signals fluctuate.

The following options can be set:

- The input value slowly approaches the measured value (Ramp Filter).
- First-order delay element (PT1)

7.2.7 Setting the Filter for Digital Inputs

Use the filter for digital inputs to set the on and off delays. To filter out short pulses, define the on delay using the **On Delay (ms)** parameter. To extend short pulses, define the off delay using the **Off Delay (ms)** parameter.

7.2.8 Setting the Filter for Outputs

You can set whether output values are changed gradually for the outputs. Use the **Rate (Units/s)** parameter to specify the rate at which the output value is changed.

When the output value in the control system is changed, the value transmitted to the field device is gradually adapted to the new output value at the speed defined by the parameter.

7.2.9 Adjusting the Sensor

Settings can be applied to the sensor used for RTD, thermocouple, and voltage converters.

For example, the following settings can be applied:

- Sensor type (**Sensor**)
- Measuring method (**Wiring Mode**)
- Cold junction (**CJC mode**)

7.3 Properties of the I/O Modules

The following sections describe the properties of the I/O modules.

The sections are structured as follows:

- Information about functions of the I/O module with block diagram
- Information about parameterization of the I/O module
- Information about data transfer and the structure of cyclic input and output data
- Information about alarms

7.3.1 LB1x01, FB1x01 Digital Input

7.3.1.1 Functional Description

Versions

- LB1001, digital input, non-intrinsically safe
- FB1301, digital input, increased safety terminals
- LB1101, digital input, intrinsically safe
- FB1201, digital input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Suitable sensors: mechanical contacts, NAMUR proximity sensors, 2-wire initiators
- Number of channels: 2

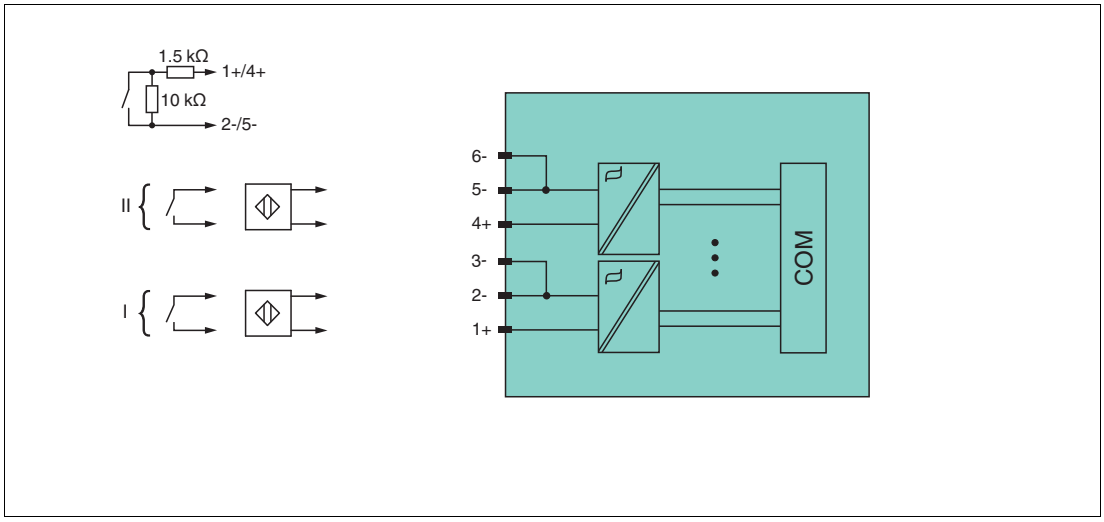

Figure 7.3 Block diagram LB1x01, FB1x01

Note

Refer to the corresponding datasheet and instruction manual for further information.

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7.3.1.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000

7.3.1.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Input

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	Current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.1.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart from some bus system-specific alarms, the I/O module LB1x01, FB1x01 digital input does not support alarms.

7.3.2 LB1x02, FB1x02 Digital Input

7.3.2.1 Functional Description

Versions

- LB1002, digital input, non-intrinsically safe
- FB1302, digital input, increased safety terminals
- LB1102, digital input, intrinsically safe
- FB1202, digital input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Suitable sensors: mechanical contacts, NAMUR proximity switches, 2-wire initiators
- Number of channels: 3

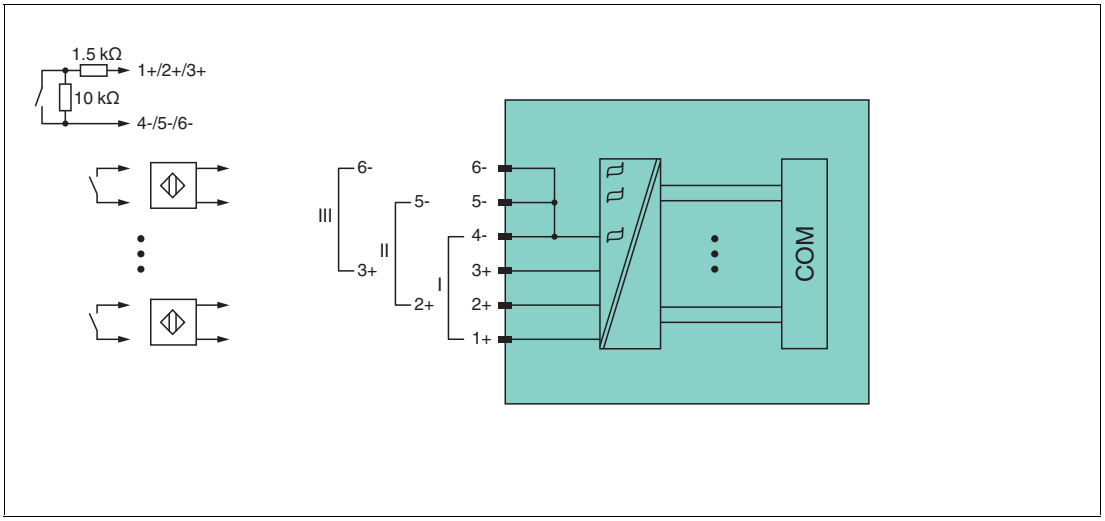

Figure 7.4 Block diagram LB1x02, FB1x02

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.2.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000

7.3.2.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

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Structure of Cyclic Input Data—Digital Input

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	Current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.2.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart from some bus system-specific alarms, the I/O module LB1x02, FB1x02 digital input does not support alarms.

7.3.3 LB1x03, FB1x03 Frequency/Counter Input

7.3.3.1 Functional Description

Versions

- LB1003, frequency/counter input, non-intrinsically safe
- FB1303, frequency/counter input, increased safety terminals
- LB1103, frequency/counter input, intrinsically safe
- FB1203, frequency/counter input, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Suitable sensors: frequency, counter, direction of rotation, NAMUR proximity sensors, 2-wire initiators, mech. contacts
- Number of channels: 1
  - Channel 1 for frequency measurement or pulse counting
  - Additional input for direction of rotation detection, e.g., for rotating machines, or counting direction, e.g., up or down. The additional input is not a separate channel.

Note

Bandwidth limitation

The bandwidth of 15 kHz is not suitable for bouncing contacts. In this case, select a model with a bandwidth of 400 Hz.

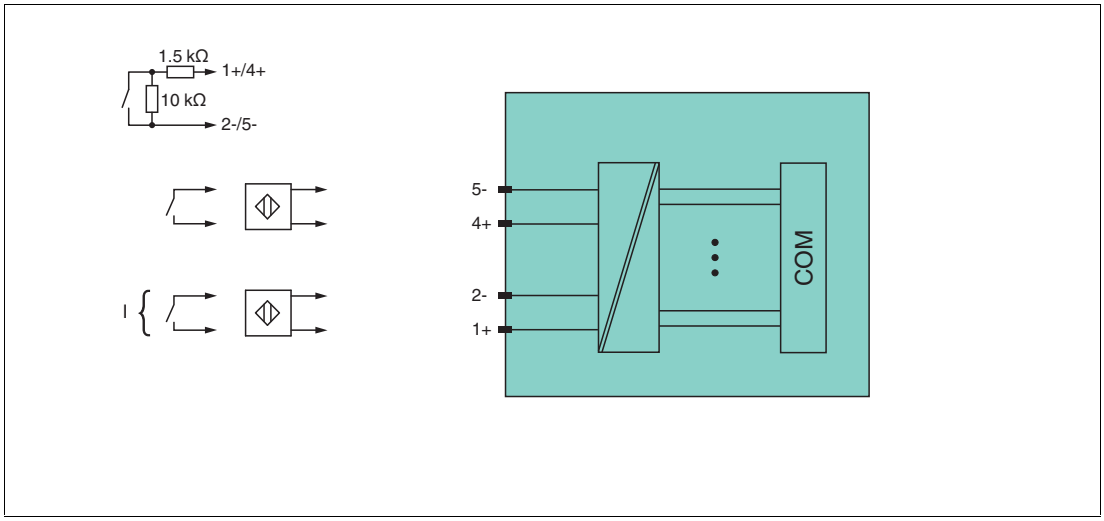

Figure 7.5 Block diagram LB1x03, FB1x03

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.3.2 Direction Detection

The second input is used to determine the direction of rotation from the phase shift between the two incoming pulses.

If the direction detection has not been specified in the parameter settings, then the pulse count is incremented. If the direction detection has been specified in the parameter settings, the I/O module processes the field signals as follows:

- The counter increments the incoming pulses if the direction input is logic `0`.
- The counter decrements the incoming pulses if the direction input is logic `1`.

The master detects the counting direction of the 32-bit counter by comparing the count values of successive cycles. For the 12-bit counter, a direction bit is transmitted.

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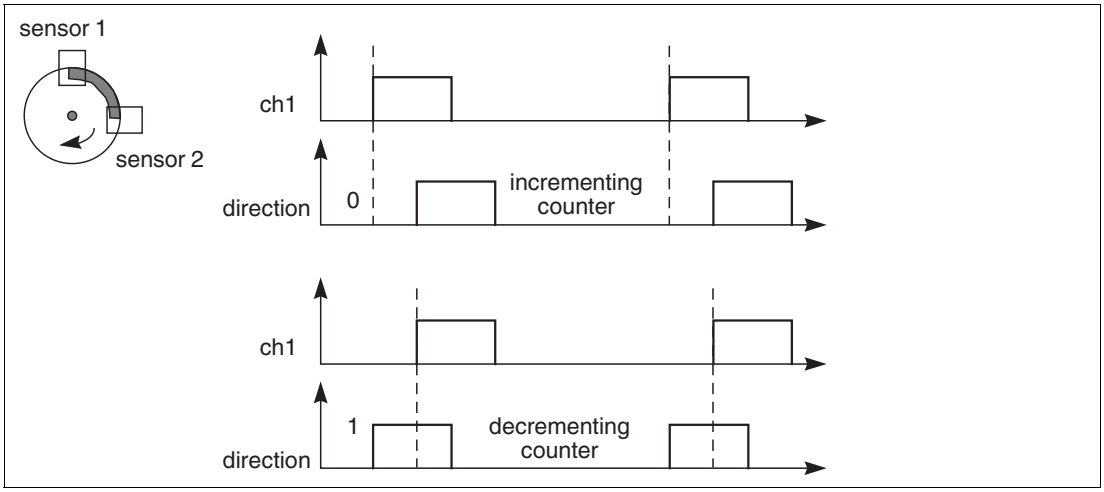

Figure 7.6 Direction detection

7.3.3.3 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The function of an I/O module can be defined by assigning one or more channels (submodules) to it. The I/O module 1x03 provides the channels listed below. Parameters can be used to adjust these channels:

- "Counter Input" channel with preset parameters for a counting function
- "Frequency Input" Channel with Preset Parameters for Frequency Measurement
- "Frequency/Counter Input" channel with preset parameters for the frequency measurement/counting function

The following tables provide an overview of these channels and which parameters can be selected on them.

"Counter Input" channel with preset parameters for a counting function

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Direction Detection	This parameter is used to define whether the I/O module detects and processes the counting direction or direction of rotation. Default setting: Off	Off On

Parameter	Description	Possible values
Predivider	This parameter is used to define how often the pulse is counted. For example, if you enter "5," every fifth pulse is counted. Default setting: 1	0 ... 65535
Rollover at Preset	This parameter is used to define whether the counter value is automatically reset when a specified counter value is reached. For example, if the value 1000 has been set as the default, the counter counts to 999 and then starts again from 0. Default setting: Off	Off On

"Frequency Input" Channel with Preset Parameters for Frequency Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Direction Detection	This parameter is used to define whether the I/O module detects and processes the counting direction or direction of rotation. Default setting: Off	Off On
Frequency Range	Use this parameter to define the start of the measuring range and the end of the measuring range for scaling data. For example, if **0 Hz to 50 Hz** is selected, 0 Hz corresponds to 0 % on the scale and 50 Hz corresponds to 100 % on the scale. Default setting: 10 kHz	1 Hz 2 Hz 5 Hz 10 Hz 20 Hz 50 Hz 100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 15 kHz
Scaling		
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 10,000	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

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Parameter	Description	Possible values
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 10 Parameter validation: The following condition must be fulfilled so that no error is displayed. The LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: The gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 10,000
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 10,000

"Frequency/Counter Input" channel with preset parameters for the frequency measurement/counting function

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Direction Detection	This parameter is used to define whether the I/O module detects and processes the counting direction or direction of rotation. Default setting: Off	Off On
Frequency Range	Use this parameter to define the start of the measuring range and the end of the measuring range for scaling data. With a mapping of 0 % ... 100 %, 0 Hz corresponds to 0 % on the scale and 40 Hz corresponds to 100 % on the scale. Default setting: 40 Hz	1 Hz 2 Hz 5 Hz 10 Hz 20 Hz 40 Hz
Rollover at Preset	This parameter is used to define whether the counter value is automatically reset when a specified counter value is reached. For example, if the value 1000 has been set as the default, the counter counts to 999 and then starts again from 0. Default setting: Off	Off On
Scaling		
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 40	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

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Parameter	Description	Possible values
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: The following condition must be fulfilled so that no error is displayed. The LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: The gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 40
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 40

7.3.3.4 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Output Data—"Counter Input"

Byte.Bit	Designation	Data type	Description
0	CounterValue	Real	The current measured value
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	Result of line fault detection
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present
4.5	ShortCircuit	-	A short circuit is present
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Status extended	Byte	-
5.0	Done	-	The counter in counter sensors has reached the cyclic output value that the commissioning engineer defined
5.1	Rollover	-	The counter limit has been reached and the counter is automatically reset
5.2	Rollunder	-	Zero crossing of the counter value has taken place
5.3	Direction	-	The result of direction detection: 0 = up/1 = down
5.4	Reserved	-	-
5.5	Reserved	-	-
5.6	Reserved	-	-
5.7	Reserved	-	-

Structure of Cyclic Output Data—"Counter Input"

Byte.Bit	Designation	Data type	Description
0	PresetValue	Real	-
4	Flags	Byte	-
4.0	Reserved	-	-
4.1	Reset	-	-
4.2	RolloverAck	-	-
4.3	RollunderAck	-	-
4.4	Reserved	-	-
4.5	Reserved	-	-
4.6	Reserved	-	-
4.7	Reserved	-	-

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Structure of Cyclic Input Data—"Frequency Input"

Byte.Bit	Designation	Data type	Description
0	FrequencyValue	Real	The current frequency value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	The result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Status extended	Byte	-
5.0	Reserved	-	-
5.1	Reserved	-	-
5.2	Reserved	-	-
5.3	Direction	-	The result of direction detection: 0 = up/1 = down
5.4	Reserved	-	-
5.5	Reserved	-	-
5.6	Reserved	-	-
5.7	Reserved	-	-
6	Alarms	Byte	-
6.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
6.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
6.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
6.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
6.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
6.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
6.6	Reserved	-	-
6.7	Reserved	-	-

Structure of Cyclic Input Data—"Frequency/Counter Input"

Byte.Bit	Designation	Data type	Description
0	CounterValue	Real	-
4	FrequencyValue	Real	The current frequency value.
8	Status	Byte	-
8.0	Reserved	-	-
8.1	Fault	-	-
8.2	LineFault	-	The result of line fault detection.
8.3	Reserved	-	-
8.4	OpenWire	-	A lead breakage is present.
8.5	ShortCircuit	-	A short circuit is present.
8.6	Reserved	-	-
8.7	Reserved	-	-
9	Status extended	Byte	-
9.0	Done	-	-
9.1	Rollover	-	-
9.2	Rollunder	-	-
9.3	Direction	-	The result of direction detection: 0 = up/1 = down
9.4	Reserved	-	-
9.5	Reserved	-	-
9.6	Reserved	-	-
9.7	Reserved	-	-
10	Alarms	Byte	-
10.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
10.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
10.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
10.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
10.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
10.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
10.6	Reserved	-	-
10.7	Reserved	-	-

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Structure of Cyclic Output Data—"Frequency/Counter Input"

Byte.Bit	Designation	Data type	Description
0	PresetValue	Real	-
4	Flags	Byte	-
4.0	Reserved	-	-
4.1	Reset	-	-
4.2	RolloverAck	-	-
4.3	RollunderAck	-	-
4.4	Reserved	-	-
4.5	Reserved	-	-
4.6	Reserved	-	-
4.7	Reserved	-	-

7.3.3.5 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB1x03, FB1x03 frequency/counter input supports the following alarms:

Counter Input

- Done: The counter has reached the cyclic output value that the commissioning engineer defined during parameterization of the I/O modules.
- RollOver: The counter limit has been reached and the counter is automatically reset.
- RollUnder: Zero crossing of the counter value has taken place.

Frequency Input

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

Counter/Frequency Input

- Done: The counter has reached the cyclic output value that the commissioning engineer defined during parameterization of the I/O modules.
- RollOver: The counter limit has been reached and the counter is automatically reset.
- RollUnder: Zero crossing of the counter value has taken place.
- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

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7.3.4 LB1x08...1x09, FB1x08...1x09 NAMUR Digital Input

7.3.4.1 Functional Description

Versions

- LB1008/LB1009, digital input, non-intrinsically safe
- FB1308, digital input, increased safety terminals
- LB1108/LB1109, digital input, intrinsically safe
- FB1208/FB1209, digital input, intrinsically safe

Features

- LB1x08/FB1x08 occupies 2 slots on the backplane
  LB1x09/FB1x09 occupies 1 slot on the backplane
- Suitable sensors: frequency, counter, direction of rotation, NAMUR proximity sensors, 2-wire initiators, mech. contacts
- Number of channels: 8
- Suitable sensors: mechanical contacts, NAMUR proximity sensors The FB1308/LB1009 I/O module can also read active inputs with 24 V or 5 VDC. This does not apply to I/O modules LB1008, LB1108/LB1109, and FB1208/FB1209.

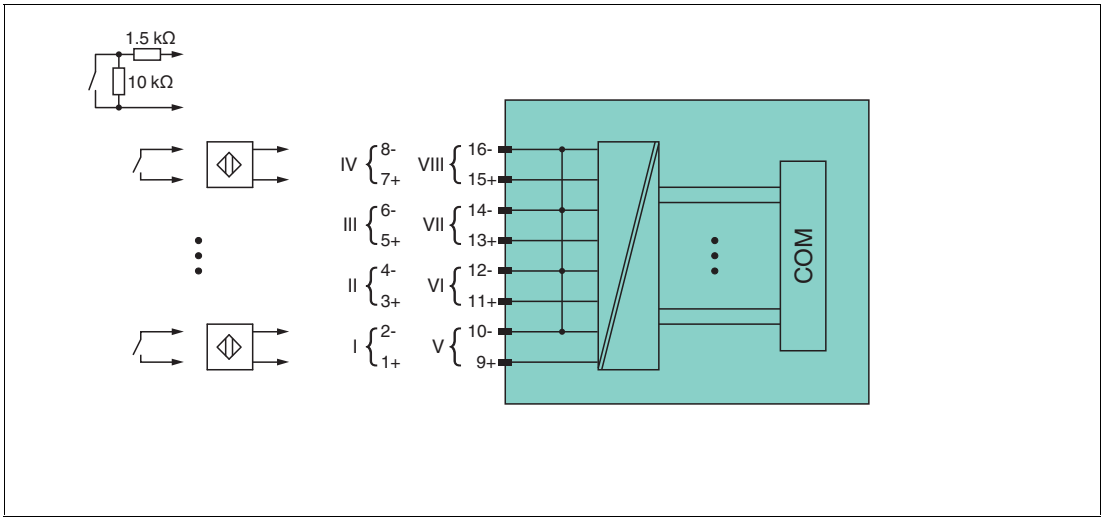

Figure 7.7 Block diagram LB1x08...1x09, FB1x08...1x09

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.4.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000

7.3.4.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

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Structure of Cyclic Input Data—Digital Input

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	The current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	The result of line fault detection.
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.4.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart from PROFINET-specific alarm types, no alarm types are available for the I/O module LB1x08...1x09, FB1x08...1x09 NAMUR digital input.

7.3.5 LB1x08...1x09 5 V, FB1x08...1x09 5 V Digital Input

7.3.5.1 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

Parameter	Description	Possible values
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000
Explosion Protection Information		
Ex Information	This parameter is used to confirm that you are familiar with the special explosion protection regulations. The channel cannot be used if the query is not confirmed. Default setting: Please confirm you read the special Ex conditions in the manual Parameter validation: The gateway checks whether the confirmation for the channel is present. If this is not the case, the channel would not be put into operation and would be displayed as faulty in the system.	Please confirm you read the special Ex conditions in the manual I read the special Ex conditions in the manual

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7.3.5.2 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	The current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	The result of line fault detection.
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.5.3 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart from PROFINET-specific alarm types, no alarm types are available for the I/O module LB1x08...1x09 5 V, FB1x08...1x09 5 V digital input.

7.3.6 LB1x08...1x09 24 V, FB1x08...1x09 24 V Digital Input

7.3.6.1 Functional Description

Versions

- LB1008/LB1009, digital input, non-intrinsically safe
- FB1308, digital input, increased safety terminals
- LB1108/LB1109, digital input, intrinsically safe
- FB1208/FB1209, digital input, intrinsically safe

Features

- LB1x08/FB1x08 occupies 2 slots on the backplane
  LB1x09/FB1x09 occupies 1 slot on the backplane
- Suitable sensors: frequency, counter, direction of rotation, NAMUR proximity sensors, 2-wire initiators, mech. contacts
- Number of channels: 8
- Suitable sensors: mechanical contacts, NAMUR proximity sensors The FB1308/LB1009 I/O module can also read active inputs with 24 V or 5 VDC. This does not apply to I/O modules LB1008, LB1108/LB1109, and FB1208/FB1209.

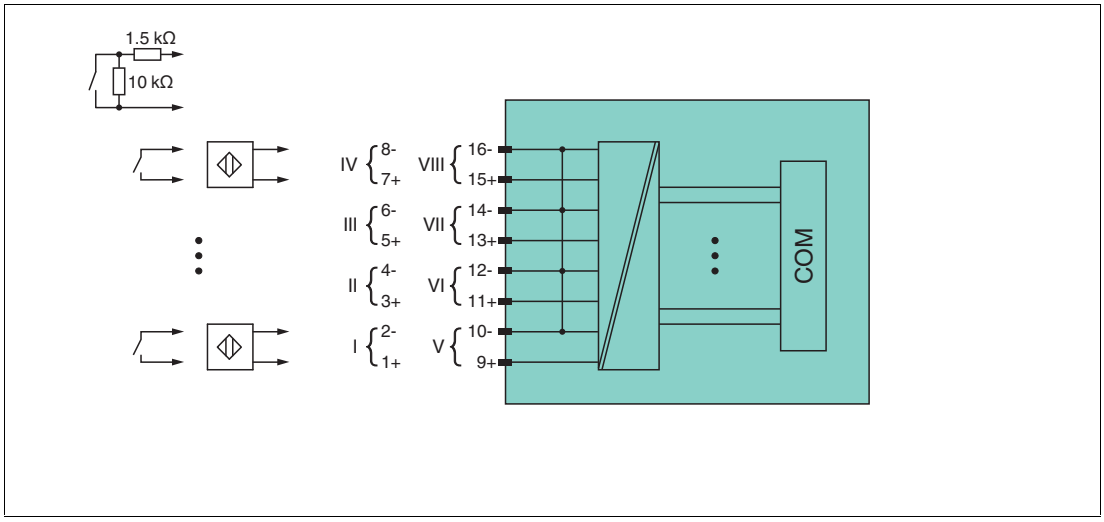

Figure 7.8 Block diagram LB1x08...1x09, FB1x08...1x09

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.6.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

Parameter	Description	Possible values
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000
Explosion Protection Information		
Ex Information	This parameter is used to confirm that you are familiar with the special explosion protection regulations. The channel cannot be used if the query is not confirmed. Default setting: Please confirm you read the special Ex conditions in the manual Parameter validation: The gateway checks whether the confirmation for the channel is present. If this is not the case, the channel would not be put into operation and would be displayed as faulty in the system.	Please confirm you read the special Ex conditions in the manual I read the special Ex conditions in the manual

7.3.6.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	The current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	The result of line fault detection.
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.6.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart from PROFINET-specific alarm types, no alarm types are available for the I/O module LB1x08...1x09 24 V, FB1x08...1x09 24 V digital input.

7.3.7 LB2x01...2x17, FB2x01...2x17 Digital Output with Position Feedback

7.3.7.1 Functional Description

Versions

- LB20*, digital output with position feedback, non-intrinsically safe
  Versions available with bus-independent shutdown input
- LB21*, digital output with position feedback, intrinsically safe
  Versions available with bus-independent shutdown input
- FB22*, digital output with position feedback, intrinsically safe
  Versions available with bus-independent shutdown input

Features

- Occupies 1 slot on the backplane
- Number of channels
  - 1 output channel
  - 2 input channels, e.g., for position feedback

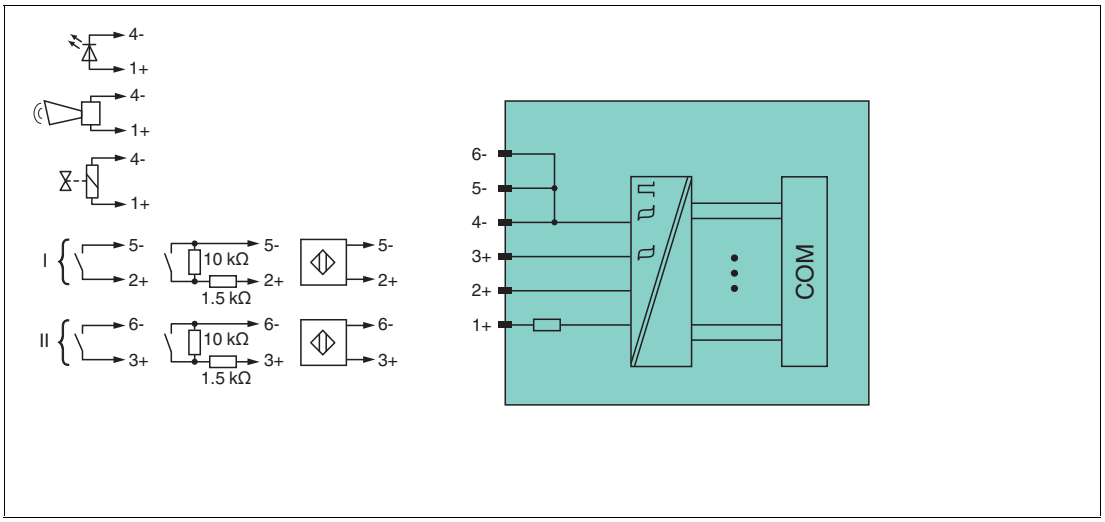

Figure 7.9 Block diagram LB2x01...2x17, FB2x01...2x17 (1-channel)

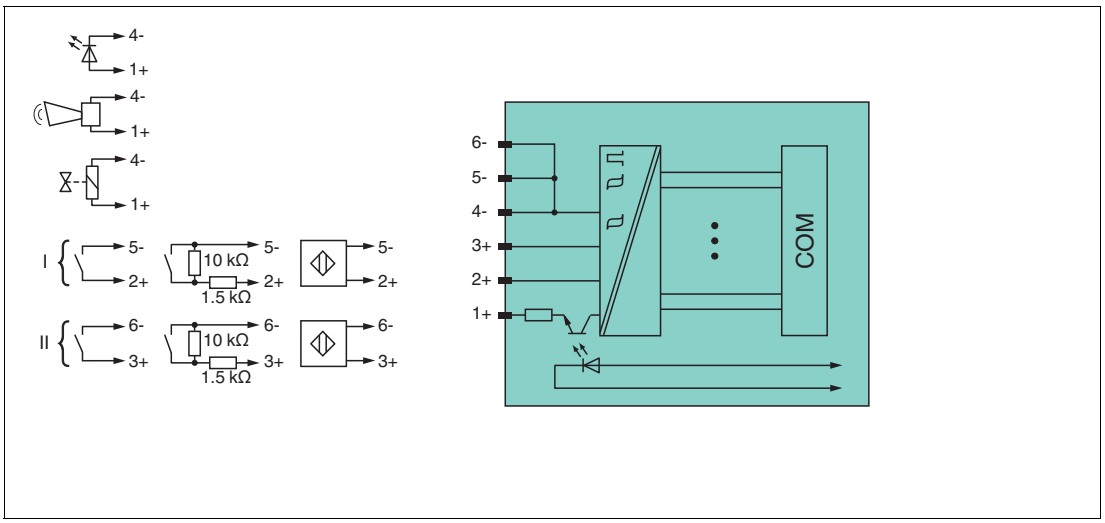

Figure 7.10 Block diagram LB2101 ... LB2113, FB22* with shutdown input

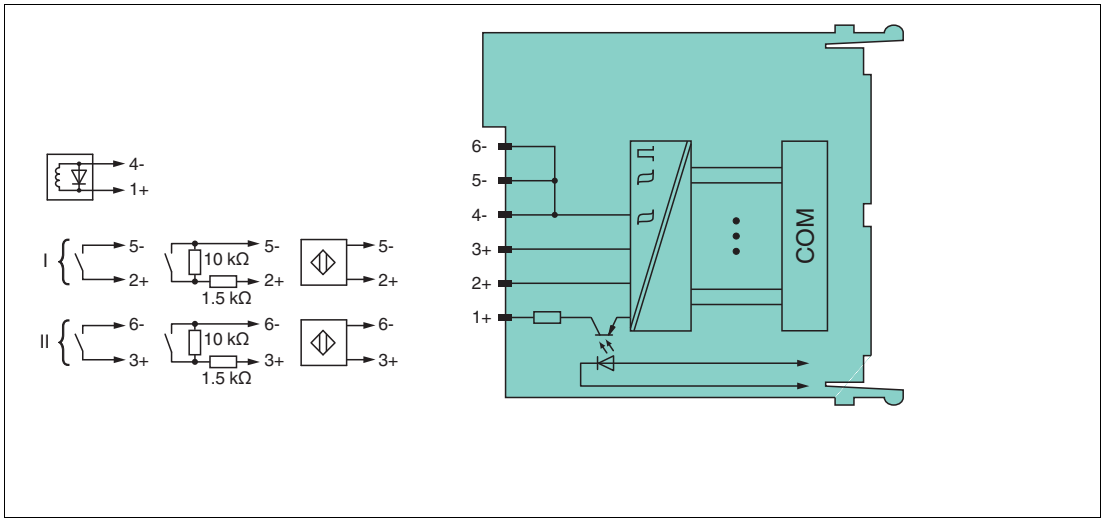

Figure 7.11 Block diagram: LB2*16, FB2216, LB2*17, FB2217 with shutdown input

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.7.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The I/O module has 1 output channel to drive the valve and 2 input channels to feed back the valve position. Parameters can be used to adjust these channels.

The following tables provide an overview of these channels and which parameters can be selected on them.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: Off	Off On Hold
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 7200

Parameter	Description	Possible values
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

"Digital Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000

7.3.7.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Status	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Line Fault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	Current measured value.
0.0	Value	-	-
0.1	Reserved	-	-
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

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Structure of Cyclic Input Data—Digital Input

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	Current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.7.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The input channels of the I/O module LB2x01...2x17, FB2x01...2x17 do not support alarms.

The output channel of the I/O module supports the following alarm:

LFD: a lead breakage or a short circuit is present.

7.3.8 LB3x01, FB3x01 Transmitter Power Supply, Input Isolator

7.3.8.1 Functional Description

Versions

- LB3101, transmitter power supply, input isolator, intrinsically safe
- FB3201, transmitter power supply, input isolator, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

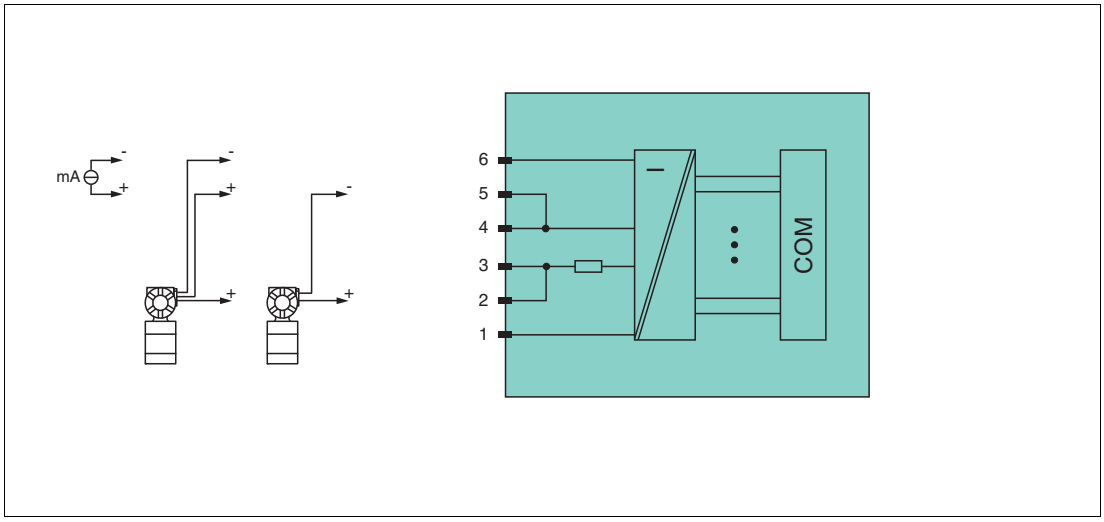

Figure 7.12 Block diagram LB3101, FB3201

2-wire transmitter
Supply circuit: 2/3+, 4/5-

3-wire transmitter
Supply circuit: 2/3+, 6-
Measuring circuit: 4/5+, 6-

4-wire transmitter (powered externally)
Measuring circuit: 4/5+, 6-

Input resistance at terminals 5 and 6: 15 Ω

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.8.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Lead Breakage Limit (mA)	This parameter is used to define the threshold value for lead breakage detection, e.g., 1 mA. When the electric current falls below this value, the Line Fault Detection signals a lead breakage. Default setting: 1.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Short Circuit Limit (mA)	This parameter is used to define the threshold value for short-circuit detection, e.g., 21 mA. When the electric current exceeds this value, the Line Fault Detection function reports a short circuit. Default setting: 21.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0

Parameter	Description	Possible values
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On

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Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1.0 Parameter validation: the following condition must be fulfilled so that no error is displayed. The LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

7.3.8.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	The current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	The result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

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7.3.8.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB3x01, FB3x01 transmitter power supply unit, input isolator supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.9 LB3x02...3x03, FB3x02...3x03 HART Transmitter Power Supply, Input Isolator

7.3.9.1 Functional Description

Versions

- LB3002, HART transmitter power supply, input isolator, non-intrinsically safe
- FB3302, HART transmitter power supply, input isolator, increased safety terminals Terminals 3 and 4 are not passed through in this I/O module.
- LB3102, HART transmitter power supply, input isolator, intrinsically safe
- FB3202, HART transmitter power supply, input isolator, intrinsically safe
- LB3103, HART transmitter power supply, input isolator, intrinsically safe
- FB3203, HART transmitter power supply, input isolator, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

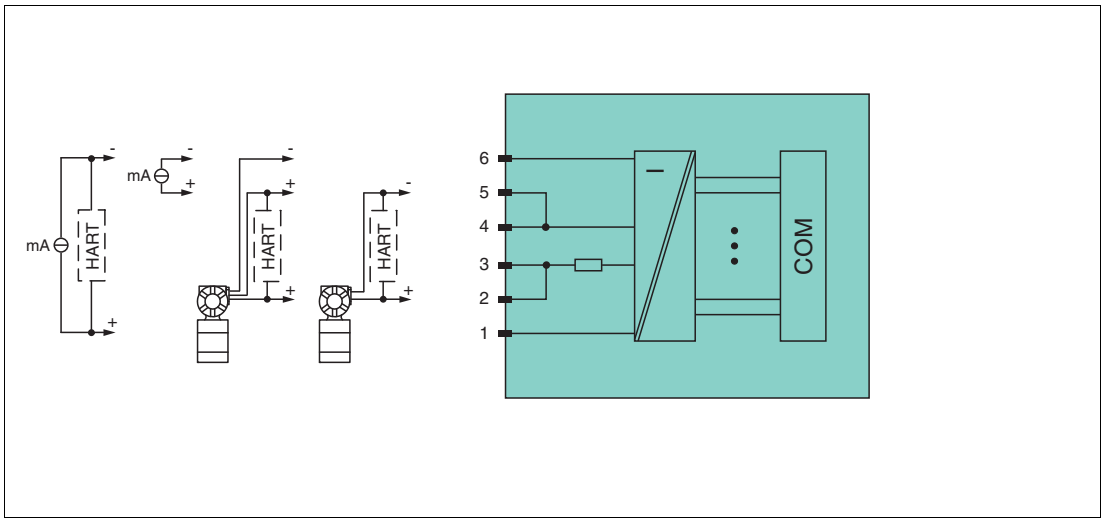

Figure 7.13 Block diagram LB3*02, LB3103, FB3*02, FB3203

2-wire transmitter (HART)
Supply circuit: 2/3+, 4/5-

3-wire transmitter (HART)
Supply circuit: 2/3+, 6-
Measuring circuit: 4/5+, 6-

4-wire transmitter (externally powered)
Measuring circuit: 4/5+, 6-
HART measuring circuit: 1+, 6-

Input resistance at terminals 5 and 6: 15 Ω
Input resistance at terminals 1 and 6 (HART): 236 Ω

The transmitter power supply supplies 2-wire and 3-wire transmitters.

Note

Refer to the corresponding datasheet and instruction manual for further information.

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7.3.9.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Lead Breakage Limit (mA)	This parameter is used to define the threshold value for lead breakage detection, e.g., 1 mA. When the electric current falls below this value, the Line Fault Detection signals a lead breakage. Default setting: 1.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Short Circuit Limit (mA)	This parameter is used to define the threshold value for short-circuit detection, e.g., 21 mA. When the electric current exceeds this value, the Line Fault Detection function reports a short circuit. Default setting: 21.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0

Parameter	Description	Possible values
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On

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Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1.0 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
HART		
Hart	Use this parameter to activate or deactivate HART communication to the channel. If no HART-compatible device is connected, select **Off** from the drop-down list. The gateway does not attempt to communicate with the HART-compatible device. Since communication with HART-compatible devices requires a lot of time, this time is saved. Default setting: On	Off On

7.3.9.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.

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Byte.Bit	Designation	Data type	Description
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

Structure of HART Auxiliary Variables

Detailed information about the structure of HART auxiliary variables, see chapter 7.3.29.

7.3.9.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB3x02...3x03, FB3x02...3x03 HART transmitter power supply, input isolator supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.10 LB3x04, FB3x04 Transmitter Power Supply, Input Isolator

7.3.10.1 Functional Description

Versions

- LB3104, transmitter power supply, input isolator, intrinsically safe
- FB3204, transmitter power supply, input isolator, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

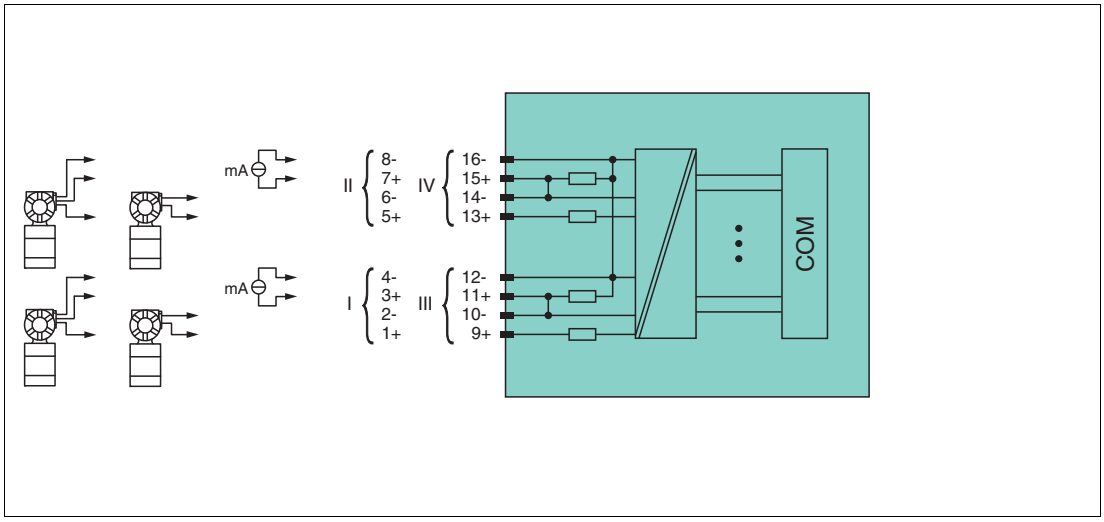

Figure 7.14 Block diagram LB3104, FB3204

2-wire transmitter
Supply circuit: channel I 1+, 2-, channel II 5+, 6-, channel III 9+, 10-, channel IV 13+, 14-

3-wire transmitter
Supply circuit: channel I 1+, 4-, channel II 5+, 8-, channel III 9+, 12-, channel IV 13+, 16-
Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

4-wire transmitter (powered externally)
Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

Input resistance: 15 Ω (channel I: 3, 4; channel II: 7, 8; channel III: 11, 12; channel IV: 15, 16)

The transmitter power supply supplies 2-wire transmitters.

Note

Refer to the datasheet and instruction manual for further information.

7.3.10.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Lead Breakage Limit (mA)	This parameter is used to define the threshold value for lead breakage detection, e.g., 1 mA. When the electric current falls below this value, the Line Fault Detection signals a lead breakage. Default setting: 1.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Short Circuit Limit (mA)	This parameter is used to define the threshold value for short-circuit detection, e.g., 21 mA. When the electric current exceeds this value, the Line Fault Detection function reports a short circuit. Default setting: 21.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0

Parameter	Description	Possible values
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On

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Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1.0 Parameter validation: the following condition must be fulfilled so that no error is displayed. The LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

7.3.10.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	The current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	The result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

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7.3.10.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB3x04, FB3x04 transmitter power supply, input isolator supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.11 LB3x05...3x07, FB3x05...3x07 HART Transmitter Power Supply, Input Isolator

7.3.11.1 Functional Description

Versions

- LB3005, HART transmitter power supply, input isolator, non-intrinsically safe
- FB3305, HART transmitter power supply, input isolator, increased safety terminals
- LB3105, HART transmitter power supply, input isolator, intrinsically safe
- FB3205, HART transmitter power supply, input isolator, intrinsically safe
- LB3006, HART transmitter power supply, non-intrinsically safe
- LB3106, HART transmitter power supply, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable field devices: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.

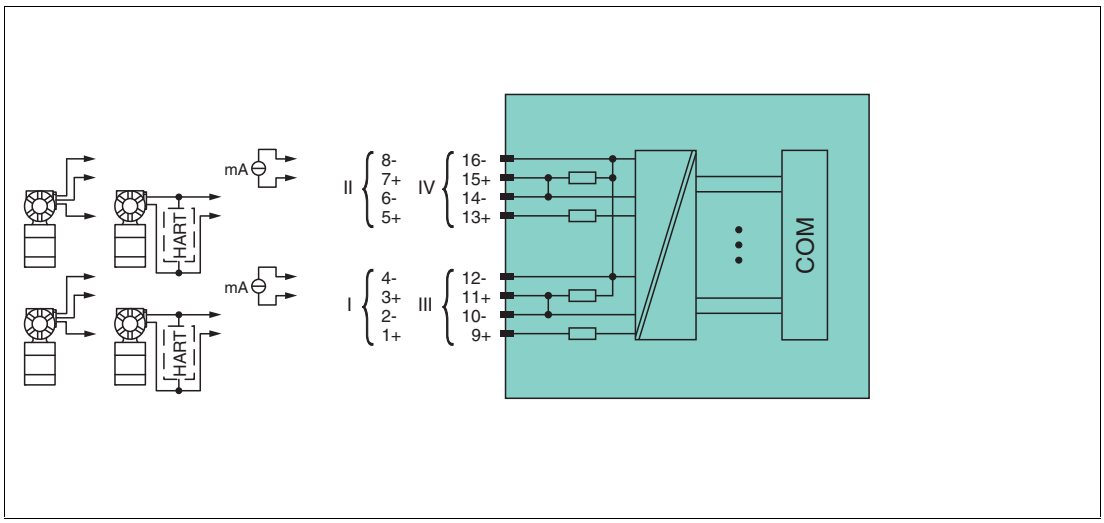

Figure 7.15 Block diagram LB3*05, FB3*05

2-wire transmitter (HART)
Supply circuit: channel I 1+, 2-, channel II 5+, 6-, channel III 9+, 10-, channel IV 13+, 14-

3-wire transmitter
Supply circuit: channel I 1+, 4-, channel II 5+, 8-, channel III 9+, 12-, channel IV 13+, 16-
Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

4-wire transmitter (powered externally)
Measuring circuit: channel I 3+, 4-, channel II 7+, 8-, channel III 11+, 12-, channel IV 15+, 16-

Input resistance: 15 Ω (channel I: 3, 4; channel II: 7, 8; channel III: 11, 12; channel IV: 15, 16)

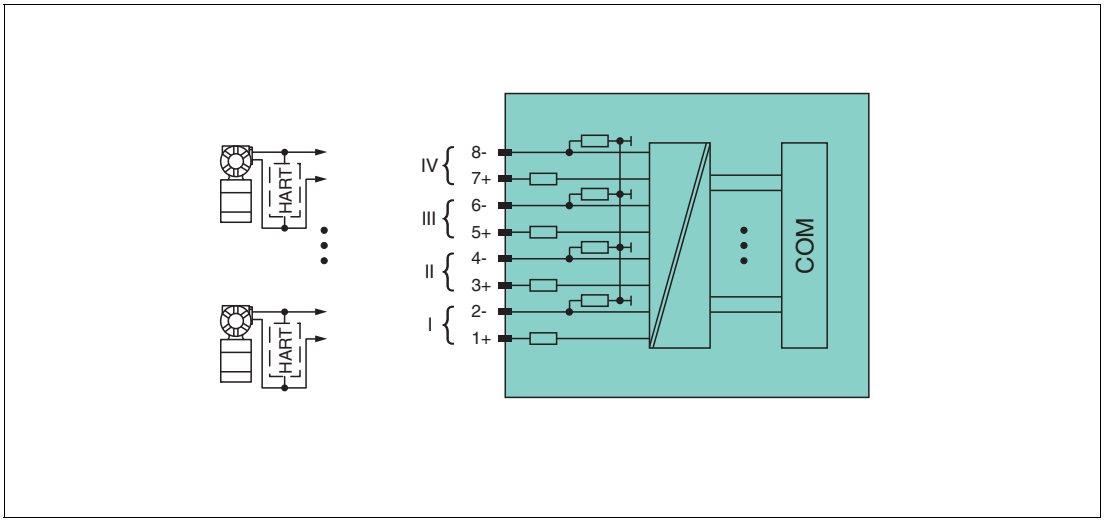

Figure 7.16 Block diagram LB3*06

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.11.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Lead Breakage Limit (mA)	This parameter is used to define the threshold value for lead breakage detection, e.g., 1 mA. When the electric current falls below this value, the Line Fault Detection signals a lead breakage. Default setting: 1.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0

Parameter	Description	Possible values
Short Circuit Limit (mA)	This parameter is used to define the threshold value for short-circuit detection, e.g., 21 mA. When the electric current exceeds this value, the Line Fault Detection function reports a short circuit. Default setting: 21.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)

Parameter	Description	Possible values
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1.0 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

Parameter	Description	Possible values
HART		
Hart	Use this parameter to activate or deactivate HART communication to the channel. If no HART-compatible device is connected, select **Off** from the drop-down list. The gateway does not attempt to communicate with the HART-compatible device. Since communication with HART-compatible devices requires a lot of time, this time is saved. Default setting: On	Off On

7.3.11.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.

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Byte.Bit	Designation	Data type	Description
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

Structure of HART Auxiliary Variables

Detailed information about the structure of HART auxiliary variables, see chapter 7.3.29.

7.3.11.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB3x05...3x06, FB3x05...3x06 HART transmitter power supply, input isolator supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.12 LB4x01, FB4x01 Analog Output

7.3.12.1 Functional Description

Versions

- LB4101, output isolator, intrinsically safe
- FB4201, output isolator, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: proportional valves, I/P converters, local indicators

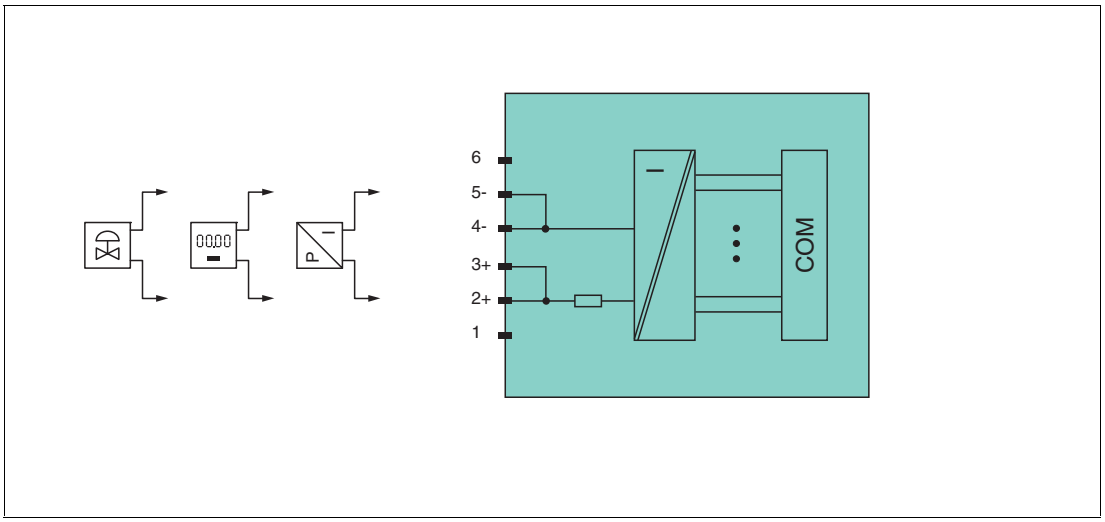

Figure 7.17 Block diagram LB4101, FB4*01

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.12.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Output" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

Parameter	Description	Possible values
Min Current (mA)	This parameter is used to define a minimum current. If a minimum current is defined, the I/O module ignores all values transmitted by the control system that are below the minimum current. Instead, the I/O module outputs the minimum current. To disable the function, enter the value "0." If no minimum current has been defined, communication is not established with HART-compatible devices. For this reason, note that a minimum current is required for communication with HART-compatible devices. Default setting: 0.8	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4	0.0 ... 26.0
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Lower Limit Value	This parameter is used to define lower limits for analog output values. The start of the measuring range is defined in the **Low Signal (mA)** parameter. If the start of the measuring range is not reached, the I/O module outputs at least the value from this parameter. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Upper Limit Value	This parameter is used to define upper limits for analog output values. If the end of the measuring range specified in the **High Signal (mA)** parameter is exceeded, the I/O module outputs at most the value from this parameter. Default setting: 22 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Value	This parameter is used to define the output value in case of a fault. This parameter only applies to an analog output. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: tlhe following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final Value	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output Ramping		
Active	This parameter is used to define whether output values are only changed in rates. If **Off** is selected, the value that is transmitted via the bus system is output. Default setting: Off	Off On
Rate (Units/s)	Use this parameter to define the rate used to change the output value. This rate refers to the measurement ranges defined using the **Lower Scale** and **Upper Scale** parameters. Default setting: 1	0.001 ... $1.00000 * 10^{10}$

7.3.12.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Output

Byte.Bit	Designation	Data type	Description
0	ReadBackValue	Real	The read back output value
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	The result of line fault detection
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present
4.5	ShortCircuit	-	A short circuit is present
4.6	Reserved	-	-
4.7	Reserved	-	-

Structure of Cyclic Output Data—Analog Output

Byte.Bit	Designation	Data type	Description
0-3	Value	Real	The output value.

7.3.12.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB4x01, FB4x01 output isolator supports the following alarm:

- Invalid: a value in the determined input data is invalid.

7.3.13 LB4x02, FB4x02 HART Output Isolator

7.3.13.1 Functional Description

Versions

- LB4002, HART output isolator, non-intrinsically safe
- FB4302, HART output isolator, increased safety terminals
  Versions with bus-independent shutdown input are available
- LB4102, HART output isolator, intrinsically safe
  Versions with bus-independent shutdown input are available
- FB4202, HART output isolator, intrinsically safe
  Versions with bus-independent shutdown input are available

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable field devices: proportional valves, I/P converters, local indicators

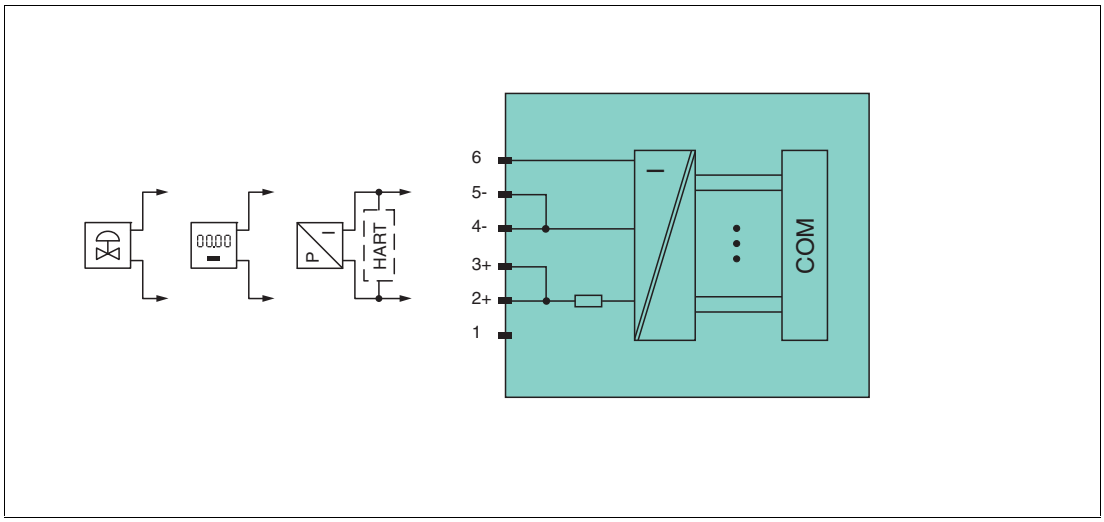

Figure 7.18 Block diagram LB4*02, FB4*02 without shutdown input

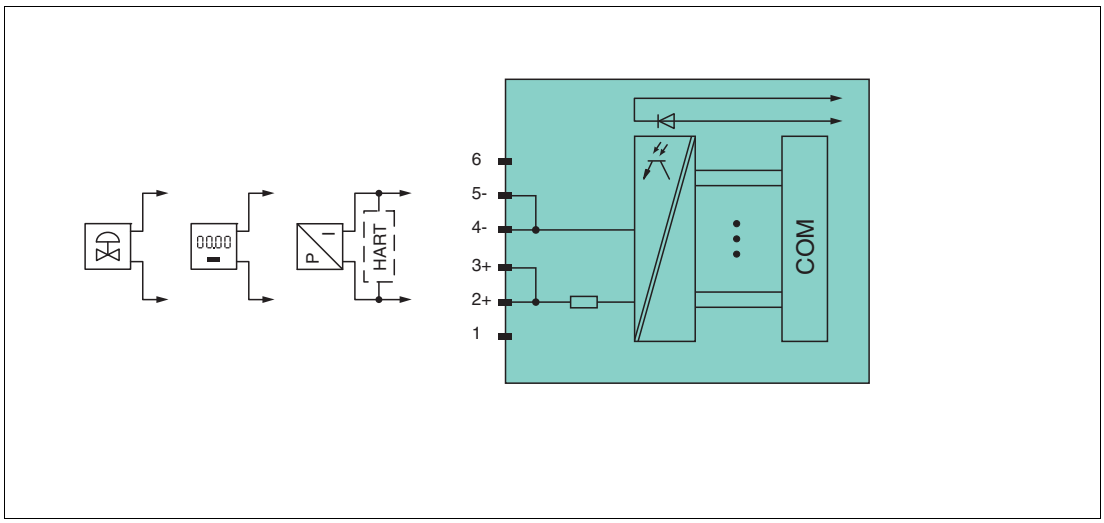

Figure 7.19 Block diagram LB4*02, FB4*02 with shutdown input

Note

Refer to the corresponding datasheet and instruction manual for further information.

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7.3.13.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Output" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Min Current (mA)	This parameter is used to define a minimum current. If a minimum current is defined, the I/O module ignores all values transmitted by the control system that are below the minimum current. Instead, the I/O module outputs the minimum current. To disable the function, enter the value "0." If no minimum current has been defined, communication is not established with HART-compatible devices. For this reason, note that a minimum current is required for communication with HART-compatible devices. Default setting: 0.8	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4	0.0 ... 26.0
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20	0.0 ... 26.0
Lower scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Lower Limit Value	This parameter is used to define lower limits for analog output values. The start of the measuring range is defined in the **Low Signal (mA)** parameter. If the start of the measuring range is not reached, the I/O module outputs at least the value from this parameter. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Limit Value	This parameter is used to define upper limits for analog output values. If the end of the measuring range specified in the **High Signal (mA)** parameter is exceeded, the I/O module outputs at most the value from this parameter. Default setting: 22 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Value	This parameter is used to define the output value in case of a fault. This parameter only applies to an analog output. Default setting: 0	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final Value	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: 0	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output Ramping		

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Parameter	Description	Possible values
Active	This parameter is used to define whether output values are only changed in rates. If **Off** is selected, the value that is transmitted via the bus system is output. Default setting: Off	Off On
Rate (Units/s)	Use this parameter to define the rate used to change the output value. This rate refers to the measurement ranges defined using the **Lower Scale** and **Upper Scale** parameters. Default setting: 1	0.001 ... 1.0000 * 10^{10}
HART		
Hart	Use this parameter to activate or deactivate HART communication to the channel. If no HART-compatible device is connected, select **Off** from the drop-down list. The gateway does not attempt to communicate with the HART-compatible device. Since communication with HART-compatible devices requires a lot of time, this time is saved. Default setting: On	Off On

7.3.13.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Output

Byte.Bit	Designation	Data type	Description
0	ReadBackValue	Real	Read back output value
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	Result of line fault detection

Byte.Bit	Designation	Data type	Description
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present
4.5	ShortCircuit	-	A short circuit is present
4.6	Reserved	-	-
4.7	Reserved	-	-

Structure of Cyclic Output Data—Analog Output

Byte.Bit	Designation	Data type	Description
0-3	Value	Real	The output value

Structure of HART Auxiliary Variables

Detailed information about the structure of HART auxiliary variables, see chapter 7.3.29.

7.3.13.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB4x02, FB4x02 HART output isolator supports the following alarm:

- Invalid: a value in the determined input data is invalid.

7.3.14 LB4x04, FB4x04 Output Isolator

7.3.14.1 Functional Description

Versions

- LB4104, output isolator, intrinsically safe
- FB4204, output isolator, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable field devices: proportional valves, I/P converters, local indicators

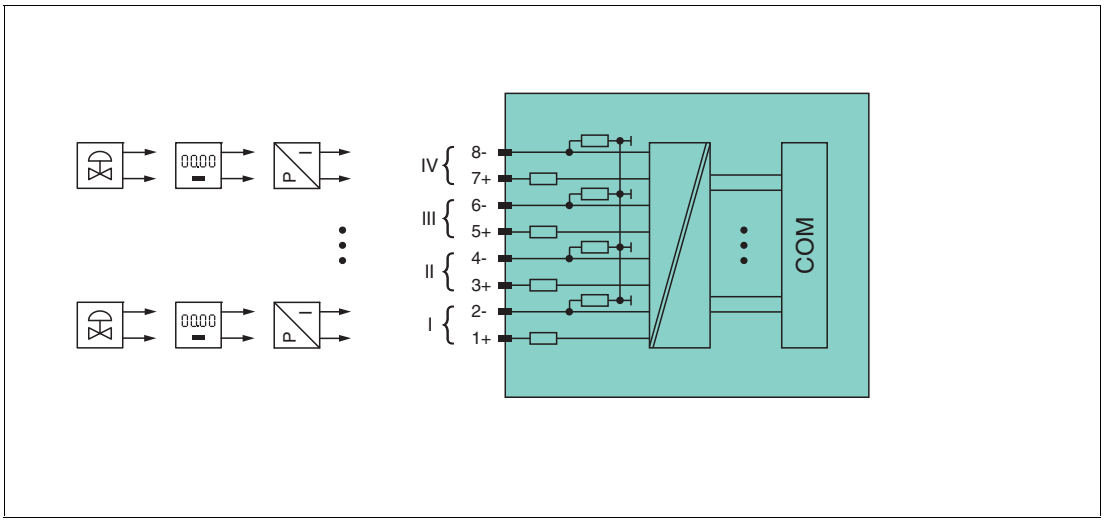

Figure 7.20 Block diagram LB4104, FB4204

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.14.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Output" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

Parameter	Description	Possible values
Min Current (mA)	This parameter is used to define a minimum current. If a minimum current is defined, the I/O module ignores all values transmitted by the control system that are below the minimum current. Instead, the I/O module outputs the minimum current. To disable the function, enter the value "0." If no minimum current has been defined, communication is not established with HART-compatible devices. For this reason, note that a minimum current is required for communication with HART-compatible devices. Default setting: 0.8	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4	0.0 ... 26.0
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Lower Limit Value	This parameter is used to define lower limits for analog output values. The start of the measuring range is defined in the **Low Signal (mA)** parameter. If the start of the measuring range is not reached, the I/O module outputs at least the value from this parameter. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Upper Limit Value	This parameter is used to define upper limits for analog output values. If the end of the measuring range specified in the **High Signal (mA)** parameter is exceeded, the I/O module outputs at most the value from this parameter. Default setting: 22 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Value	This parameter is used to define the output value in case of a fault. This parameter only applies to an analog output. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: tlhe following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final Value	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output Ramping		
Active	This parameter is used to define whether output values are only changed in rates. If **Off** is selected, the value that is transmitted via the bus system is output. Default setting: Off	Off On
Rate (Units/s)	Use this parameter to define the rate used to change the output value. This rate refers to the measurement ranges defined using the **Lower Scale** and **Upper Scale** parameters. Default setting: 1	0.001 ... $1.00000 * 10^{10}$

7.3.14.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Output

Byte.Bit	Designation	Data type	Description
0	ReadBackValue	Real	The read back output value
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	The result of line fault detection
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present
4.5	ShortCircuit	-	A short circuit is present
4.6	Reserved	-	-
4.7	Reserved	-	-

Structure of Cyclic Output Data—Analog Output

Byte.Bit	Designation	Data type	Description
0-3	Value	Real	The output value.

7.3.14.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB4x04, FB4x04 output isolator supports the following alarms:

- LFD: a lead breakage or a short circuit is present.
- Invalid: a value in the determined input data is invalid.

7.3.15 LB4x05...4x06, FB4x05...4x06 HART Output Isolator

7.3.15.1 Functional Description

Versions

- LB4005, HART output isolator, non-intrinsically safe
  Versions available with bus-independent shutdown input
- FB4305, HART output isolator, increased safety terminals
  Versions available with bus-independent shutdown input
- LB4105, HART output isolator, intrinsically safe
  Versions available with bus-independent shutdown input
- FB4205, HART output isolator, intrinsically safe
  Versions available with bus-independent shutdown input
- LB4106, HART output isolator, intrinsically safe
  Versions available with bus-independent shutdown input

Features

- LB4*05, FB4*05 occupies 2 slots on the backplane
- LB4106 occupies 1 slot on the backplane
- Number of channels: 4
- Suitable field devices: proportional valves, I/P converters, local indicators

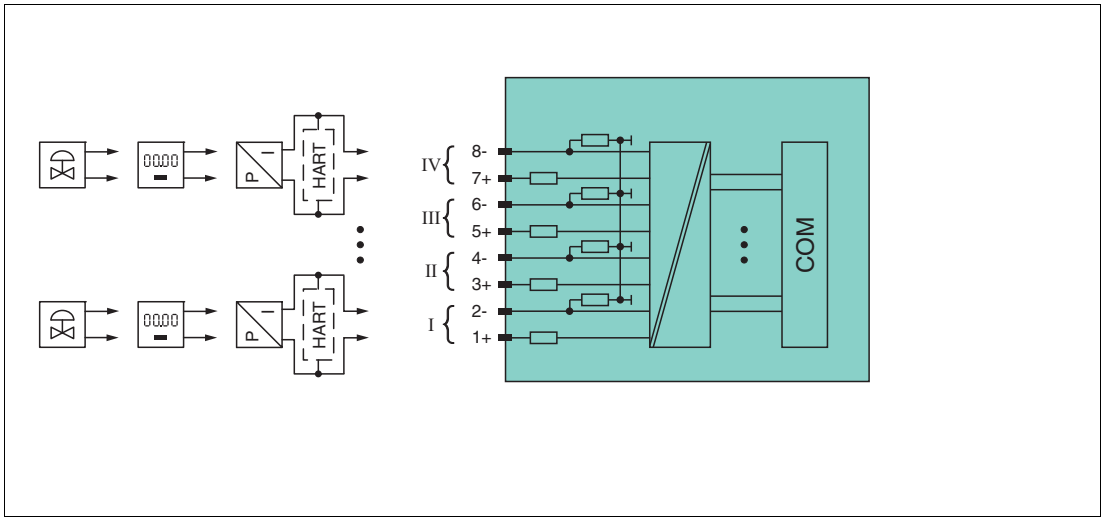

Figure 7.21 Block diagram LB4*05, FB4*05 without shutdown input

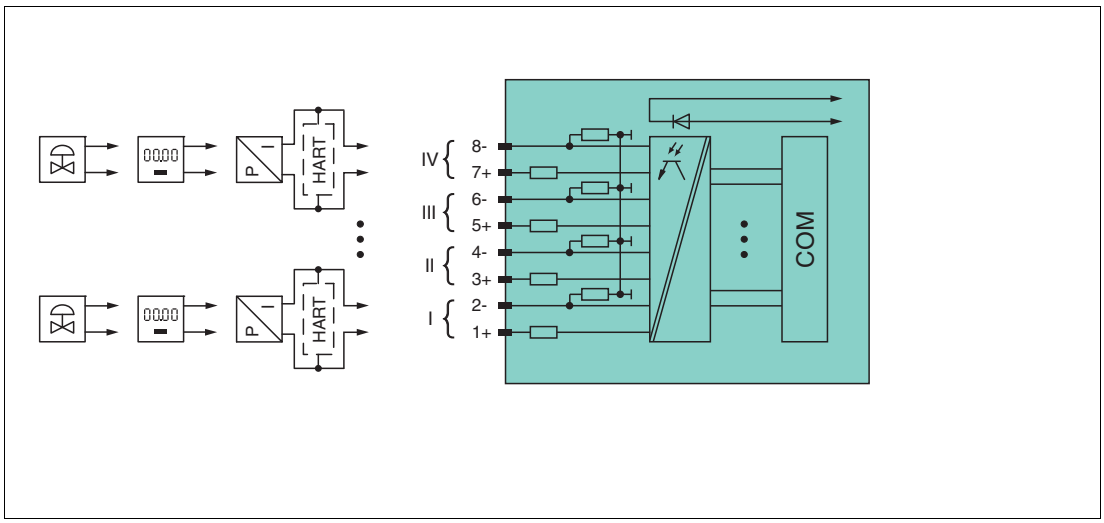

Figure 7.22 Block diagram LB4*05, FB4*05 with shutdown input

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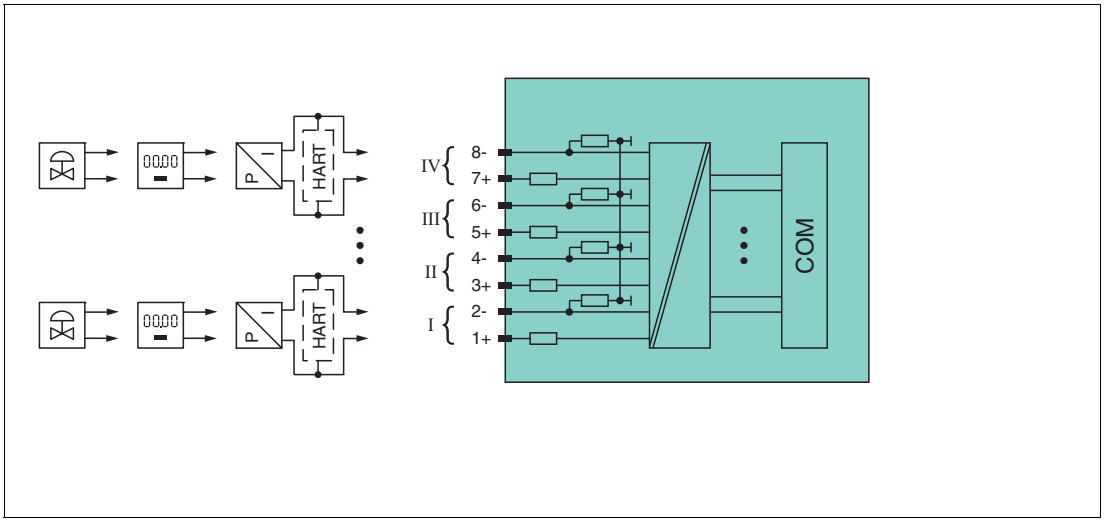

Figure 7.23 Block diagram LB4106 without shutdown input

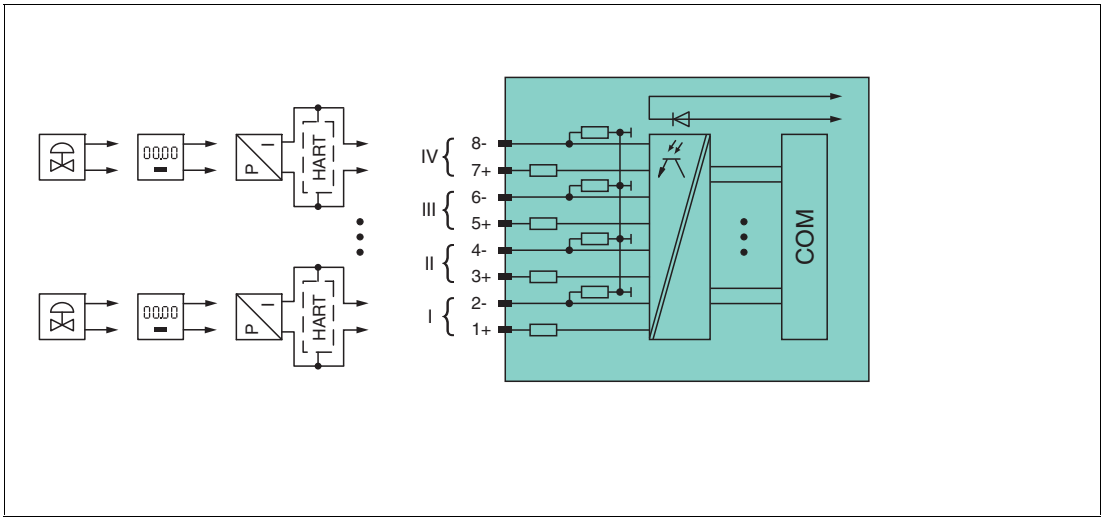

Figure 7.24 Block diagram LB4106 with shutdown input

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.15.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Analog Output" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Min Current (mA)	This parameter is used to define a minimum current. If a minimum current is defined, the I/O module ignores all values transmitted by the control system that are below the minimum current. Instead, the I/O module outputs the minimum current. To disable the function, enter the value "0." If no minimum current has been defined, communication is not established with HART-compatible devices. For this reason, note that a minimum current is required for communication with HART-compatible devices. Default setting: 0.8	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4	0.0 ... 26.0
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20	0.0 ... 26.0
Lower scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

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Parameter	Description	Possible values
Lower Limit Value	This parameter is used to define lower limits for analog output values. The start of the measuring range is defined in the **Low Signal (mA)** parameter. If the start of the measuring range is not reached, the I/O module outputs at least the value from this parameter. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Limit Value	This parameter is used to define upper limits for analog output values. If the end of the measuring range specified in the **High Signal (mA)** parameter is exceeded, the I/O module outputs at most the value from this parameter. Default setting: 22 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Value	This parameter is used to define the output value in case of a fault. This parameter only applies to an analog output. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final Value	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output Ramping		
Active	This parameter is used to define whether output values are only changed in rates. If **Off** is selected, the value that is transmitted via the bus system is output. Default setting: Off	Off On

Parameter	Description	Possible values
Rate (Units/s)	Use this parameter to define the rate used to change the output value. This rate refers to the measurement ranges defined using the **Lower Scale** and **Upper Scale** parameters. Default setting: 1	0.001 ... 1.0000 * 10^{10}
HART		
Hart	Use this parameter to activate or deactivate HART communication to the channel. If no HART-compatible device is connected, select **Off** from the drop-down list. The gateway does not attempt to communicate with the HART-compatible device. Since communication with HART-compatible devices requires a lot of time, this time is saved. Default setting: On	Off On

7.3.15.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Output

Byte.Bit	Designation	Data type	Description
0	ReadBackValue	Real	Read back output value
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	Result of line fault detection
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present
4.5	ShortCircuit	-	A short circuit is present
4.6	Reserved	-	-
4.7	Reserved	-	-

Structure of Cyclic Output Data—Analog Output

Byte.Bit	Designation	Data type	Description
0-3	Value	Real	The output value

Structure of HART Auxiliary Variables

Detailed information about the structure of HART auxiliary variables, see chapter 7.3.29.

7.3.15.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB4x05...4x06, FB4x05...4x06 HART output isolator supports the following alarms:

- LFD: a lead breakage or a short circuit is present.
- Invalid: a value in the determined input data is invalid.

7.3.16 LB5x01, FB5x01 RTD Signal Converter

7.3.16.1 Functional Description

Versions

- LB5001, RTD signal converter, non-intrinsically safe
- LB5101, RTD signal converter, intrinsically safe
- FB5201, RTD signal converter, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable sensors: 2, 3, and 4-wire connection, resistance thermometer, slide-wire sensor up to 400 Ω

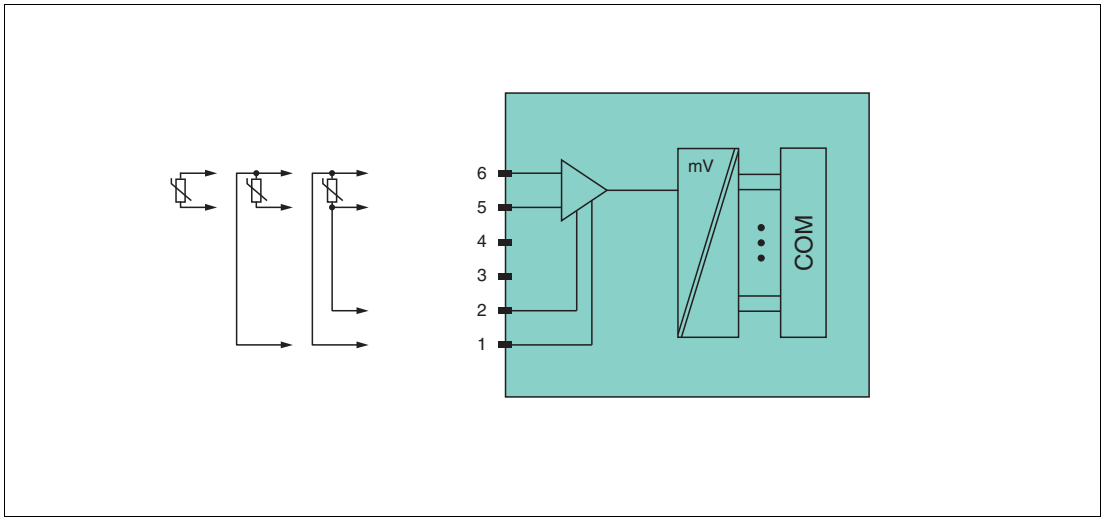

Figure 7.25 Block diagram LB5*01, FB5201

2-wire connection: 5, 6

3-wire connection: 1, 5, 6

4-wire connection: 1, 2, 5, 6

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.16.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The function of an I/O module can be defined by subordinating one or more channels (submodules) to it. The I/O module 5x01 provides the channels listed below. Parameters can be used to adjust these channels.

- "RTD/Resist. Input predefined" channel with preset parameters
- "Resist. Input user defined" channel with preset parameters for resistance measurement
- "RTD Input user defined" Channel with Preset Parameters for RTD Measurement

The tables below provide an overview of these parameter interfaces.

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"RTD/Resist. Input predefined" channel with preset parameters

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: Pt100: 0 °C ... +100 C°	0.0 ohm ... 50.0 ohms 0.0 ohm ... 100.0 ohms 0.0 ohm ... 200.0 ohms 0.0 ohm ... 400.0 ohm Pt100: 0 °C ... +50 °C Pt100: 0 °C ... +100 °C Pt100: 0 °C ... +200 °C Pt100: 0 °C ... +500 °C Pt100: -200 °C ... +850 °C Pt100: -200 °C ... +300 °C Pt100: +300 °C ... +850 °C Pt100: +30 °F ... +130 °F Pt100: +30 °F ... +220 °F Pt100: +30 °F ... +400 °F Pt100: +30 °F ... +940 °F Pt100: -330 °F ... +1570 °F Pt100: -330 °F ... +580 °F Pt100: +570 °F ... +1570 °F Pt100: 270 K ... 330 K Pt100: 270 K ... 380 K Pt100: 270 K ... 480 K Pt100: 270 K ... 780 K Pt100: 70 K ... 1130 K Pt100: 70 K ... 580 K Pt100: 570 K ... 1130 K
Wiring Mode	This parameter is used to define the measurement method. Here 2, 3, or 4-wire circuits can be selected. If a 2-wire circuit is to be selected, enter the line resistance in the **Line Resistance (2 wire only)(chm)** parameter. Default setting: 2 wire	2 wire 3 wire 4 wire
Line Resistance (2 wire only)(ohm)	Use this parameter to define the line resistance. This parameter can only be defined if a 2-wire circuit ("2 wire") has been selected in the **Wiring Mode** parameter. To compensate for the measurement error, enter the resistance value of the connection line. Default setting: 0	0 ... 100

Parameter	Description	Possible values
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

"Resist. Input user defined" Channel with Preset Parameters for Resistance Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	0 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used.	Cannot be changed
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered. Default setting: Ohm	Ohm Percent of Range User defined scaling

Parameter	Description	Possible values
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-400 ... 10,000
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 100 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-400 ... 10,000
Wiring Mode	This parameter is used to define the measurement method. Here 2, 3, or 4-wire circuits can be selected. If a 2-wire circuit is to be selected, enter the line resistance in the **Line Resistance (2 wire only)(chm)** parameter. Default setting: 2 wire	2 wire 3 wire 4 wire
Line Resistance (2 wire only)(Ohm)	Use this parameter to define the line resistance. This parameter can only be defined if a 2-wire circuit ("2 wire") has been selected in the **Wiring Mode** parameter. To compensate for the measurement error, enter the resistance value of the connection line. Default setting: 0	0 ... 100
Scaling		
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 100	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

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Parameter	Description	Possible values
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Ohm	Ohm Percent of Range User defined scaling
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

"RTD Input user defined" Channel with Preset Parameters for RTD Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used.	Cannot be changed
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered. Default setting: Ohm	Ohm Percent of range User defined scaling

Parameter	Description	Possible values
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-400 ... 10,000
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 100 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-400 ... 10,000
Wiring Mode	This parameter is used to define the measurement method. Here 2, 3, or 4-wire circuits can be selected. If a 2-wire circuit is to be selected, enter the line resistance in the **Line Resistance (2 wire only)(chm)** parameter. Default setting: 2 wire	2 wire 3 wire 4 wire
Line Resistance (2 wire only)(Ohm)	Use this parameter to define the line resistance. This parameter can only be defined if a 2-wire circuit ("2 wire") has been selected in the **Wiring Mode** parameter. To compensate for the measurement error, enter the resistance value of the connection line. Default setting: 0	0 ... 100
Scaling		
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Ohm	Ohm Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 100	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	– 3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

7.3.16.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Temperature Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.

Byte.Bit	Designation	Data type	Description
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

7.3.16.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB5x01, FB5x01 RTD signal converter supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.17 LB5x02, FB5x02 Thermocouple Signal Converter

7.3.17.1 Functional Description

Versions

- LB5002, thermocouple converter, non-intrinsically safe
- LB5102, thermocouple converter, intrinsically safe
- FB5202, thermocouple converter, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Suitable sensors: thermocouple types U, B, E, T, K, S, R, L, J, N, pallaplat and mV sensors

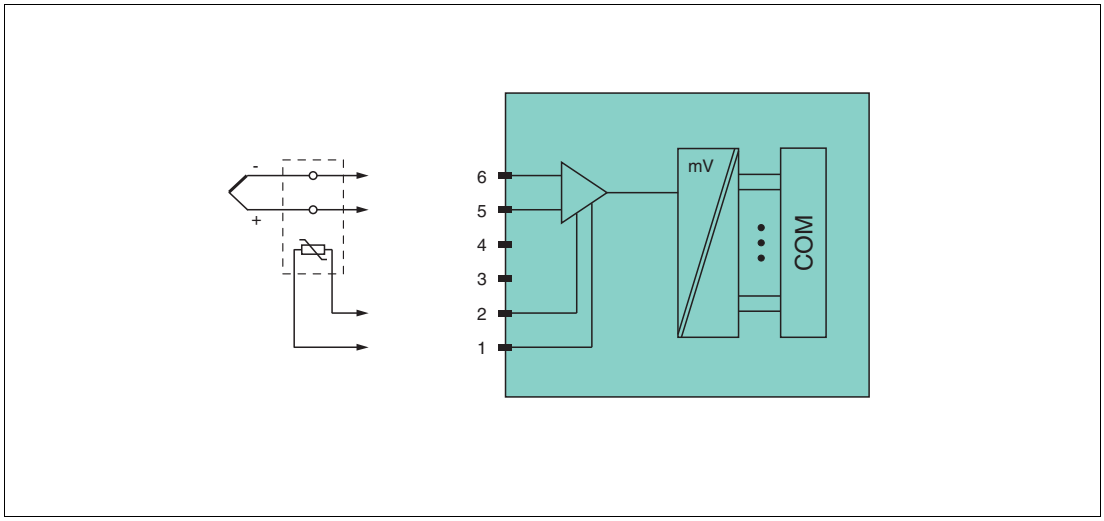

Figure 7.26 Block diagram LB5*02, FB5202

Cold junctions: 1, 2

Thermocouple: 5+, 6-

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.17.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The function of an I/O module can be defined by subordinating one or more channels (submodules) to it. The I/O module 5x02 provides the channels listed below. Parameters can be used to adjust these channels.

- The "Predefined" channel with preset parameters
- The "TC User defined" channel with preset parameters for thermocouple measurement
- The "MV User defined" channel with preset parameters for millivolt measurement

The following tables provide an overview of these channels and which parameters can be selected on them.

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"Predefined" Channel with Preset Parameters

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		

Parameter	Description	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: TC_U: -200 °C ... +200 °C	-65.0 mV ... +75.0 mV 0 mV ... +75.0 mV 0 mV ... +50.0 mV 0 mV ... +25.0 mV TC_U: -200 °C ... +600 °C TC_U: -200 °C ... +200 °C TC_U: 0 °C ... +400 °C TC_U: +200 °C ... +600 °C TC_B: 0 °C ... +1800 °C TC_B: 0 °C ... +900 °C TC_B: 450 °C ... +1350 °C TC_B: 900 °C ... +1800 °C TC_E: -270 °C ... +1000 °C TC_E: -270 °C ... +360 °C TC_E: +50 °C ... +680 °C TC_E: +360 °C ... +1000 °C TC_T: -270 °C ... +400 °C TC_T: -270 °C ... +60 °C TC_T: -100 °C ... +230 °C TC_T: +60 °C ... +400 °C TC_K: -200 °C ... +1370 °C TC_K: -200 °C ... +500 °C TC_K: +150 °C ... +850 °C TC_K: +500 °C ... +1370 °C TC_S: 0 °C ... +1760 °C TC_S: 0 °C ... +900 °C TC_S: 0 °C ... +900 °C TC_S: +900 °C ... +1750 °C TC_R: -50 °C ... +1750 °C TC_R: -50 °C ... +900 °C TC_R: +450 °C ... +1350 °C TC_R: +900 °C ... +1750 °C TC_L: -200 °C ... +900 °C TC_L: -200 °C ... +350 °C TC_L: +75 °C ... +625 °C TC_L: +350 °C ... +900 °C TC_J: -210 °C ... +1200 °C TC_J: -210 °C ... +500 °C TC_J: +150 °C ... +850 °C TC_J: +500 °C ... +1200 °C TC_N: -200 °C ... +1350 °C TC_N: -200 °C ... +600 °C TC_N: +200 °C ... +1000 °C TC_N: +600 °C ... +1350 °C TC_U: -330 °F ... +1120 °F TC_U: -330 °F ... +400 °F TC_U: +30 °F ... +760 °F TC_U: +390 °F ... +1120 °F

Parameter	Description	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: TC_U: -200 °C ... +200 °C	TC_B: +30 °F ... +3280 °F TC_B: +30 °F ... +1660 °F TC_B: +840 °F ... +2470 °F TC_B: +1650 °F ... +3280 °F TC_E: -460 °F ... +1840 °F TC_E: -460 °F ... +680 °F TC_E: +120 °F ... +1260 °F TC_E: +680 °F ... +1840 °F TC_T: -460 °F ... +760 °F TC_T: -460 °F ... +140 °F TC_T: -150 °F ... +450 °F TC_T: +140 °F ... +760 °F TC_K: -330 °F ... +2500 °F TC_K: -330 °F ... +940 °F TC_K: +300 °F ... +1570 °F TC_K: +930 °F ... +2500 °F
CJC mode	This parameter is used to select between an internal and external cold junction. With an internal cold junction (if **Internal** is selected), the terminal temperature in the I/O module is measured and the thermal voltages are determined at the terminals for the correction calculation. With an external cold junction (if **External** is selected), the thermal voltages at the terminals are canceled out by the use of the external cold junction. However, with this measurement method, the measured voltage must be adjusted for the thermal voltage of the external cold junction. To determine the thermal voltage of the external cold junction, the temperature of the cold junction (in the **CJC temperature** parameter) must be known. Default setting: Internal	Internal External
CjC Temperature	This parameter is used to define the temperature of the external cold junction. The temperature is required to correct the data. Default setting: 0	-400 ... 500
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		

Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	0.0 ... 100.0
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

"TC User defined" Channel with Preset Parameters for Thermocouple Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used. Default setting: TC U	TC U TC B TC E TC T TC K TC S TC R TC L TC J TC N
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered. Default setting: Celsius	Celsius Fahrenheit Kelvin
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-500.0 ... 10,000.0

Parameter	Description	Possible values
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 100 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-500.0 ... 10,000.0
CJC mode	This parameter is used to select between an internal and external cold junction. With an internal cold junction (if **Internal** is selected), the terminal temperature in the I/O module is measured and the thermal voltages are determined at the terminals for the correction calculation. With an external cold junction (if **External** is selected), the thermal voltages at the terminals are canceled out by the use of the external cold junction. However, with this measurement method, the measured voltage must be adjusted for the thermal voltage of the external cold junction. To determine the thermal voltage of the external cold junction, the temperature of the cold junction (in the **CJC temperature** parameter) must be known. Default setting: Internal	Internal External
CjC Temperature	This parameter is used to define the temperature of the external cold junction. The temperature is required to correct the data. Default setting: 0	-400 ... 500
Scaling		
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Celsius	Celsius Fahrenheit Kelvin Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 100	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		

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Parameter	Description	Possible values
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Off	Off Ramp Filter PT1
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

"MV User defined" Channel with Preset Parameters for Millivolt Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used.	Cannot be changed
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered.	Cannot be changed
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 0 mV. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-75.0 ... 75.0
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 75 mV. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 75 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-75.0 ... 75.0
Scaling		

2023-05

Parameter	Description	Possible values
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Millivolt	Millivolt Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 75	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Off	Off Ramp Filter PT1
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 75
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 75

7.3.17.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-

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Byte.Bit	Designation	Data type	Description
4.4	OpenWire	-	A lead breakage is present.
4.5	Reserved	-	-
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

7.3.17.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB5x02, FB5x02 thermocouple signal converter supports the following alarms:

- LFD: a lead breakage or a short circuit is present.
- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.18 LB5x04, FB5x04 RTD Signal Converter

7.3.18.1 Functional Description

Versions

- LB5004, RTD converter, non-intrinsically safe
- LB5104, RTD converter, intrinsically safe
- FB5204, RTD converter, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable sensors: 2, 3, and 4-wire connection, resistance thermometer, slide-wire sensor

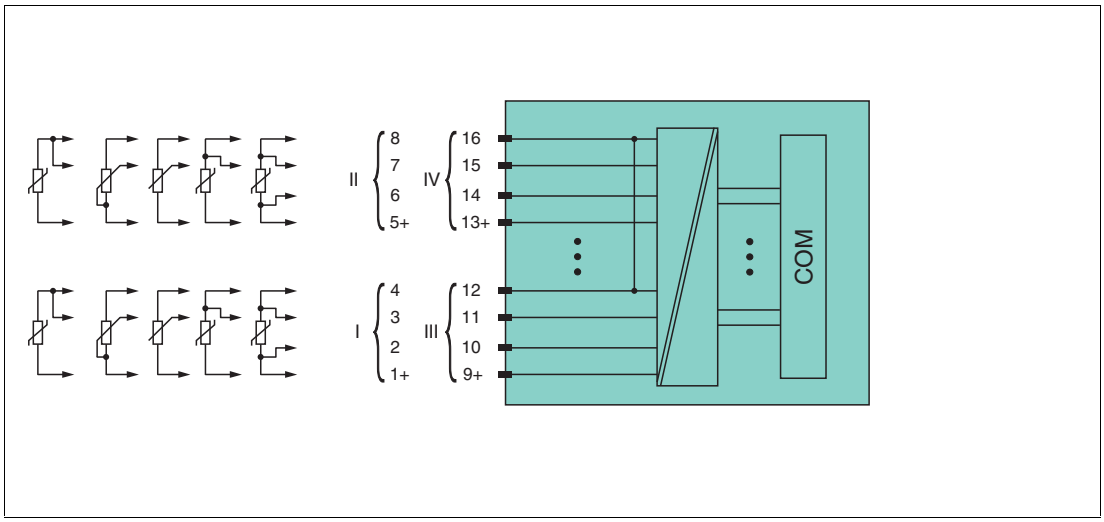

Figure 7.27 Block diagram LB5*04, FB5204

Channel I: resistance/potentiometer input 1 ... 4

Channel II: resistance/potentiometer input 5 ... 8

Channel III: resistance/potentiometer input 9 ... 12

Channel IV: resistance/potentiometer input 13 ... 16

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.18.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The function of an I/O module can be defined by subordinating one or more channels (submodules) to it. The I/O module 5x04 provides the channels listed below. Parameters can be used to adjust these channels.

- The "RTD/resist. Input predefined" channel with preset parameters
- The "RTD Input predefined" channel with preset parameters
- The "Resist. Input predefined" channel with preset parameters

The following tables provide an overview of these channels and which parameters can be selected on them.

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"RTD/Resist. Input predefined" channel with preset parameters

Parameter	Data type	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		

Parameter	Data type	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: Pt100: 0 °C ... +100 °C	0.0 ohm ... 50.0 ohms 0.0 ohm ... 100.0 ohms 0.0 ohm ... 200.0 ohms 0.0 ohm ... 500.0 ohms 0.0 ohm ... 1000.0 ohms 0.0 ohm ... 5000.0 ohms 0.0 ohm ... 10,000.0 ohms Pt100: 0 °C ... +50 °C Pt100: 0 °C ... +100 °C Pt100: 0 °C ... +200 °C Pt100: 0 °C ... +500 °C Pt100: -200 °C ... +850 °C Pt100: -200 °C ... +300 °C Pt100: +300 °C ... +850 °C Pt200: 0 °C ... +50 °C Pt200: 0 °C ... .+100 °C Pt200: 0 °C ... +200 °C Pt200 0 °C ... +500 °C Pt200: -200 °C ... +850 °C Pt200: -200 °C ... +300 °C Pt200: +300 °C ... +850 °C Pt500: 0 °C ... +50 °C Pt500: 0 °C ... +100 °C Pt500: 0 °C ... +200 °C Pt500: 0 °C ... +500 °C Pt500: -200 °C ... +850 °C Pt500: -200 °C ... +300 °C Pt500: +300 °C ... +850 °C Pt1000: 0 °C ... +50 °C Pt1000: 0 °C ... +100 °C Pt1000: 0 °C .. .+200 °C Pt1000: 0 °C ... +500 °C Pt1000: -200 °C ... +850 °C Pt1000: -200 °C ... +300 °C Pt1000: +300 °C ... +850 °C Ni100: 0 °C ... +50 °C Ni100: 0 °C ... +100 °C Ni100: 0 °C ... +150 °C Ni100: 0 °C ... +200 °C Ni100: -50 °C ... +50 °C Ni100: 0 °C ... +150 °C Ni100: -70 °C ... +230 °C Ni500: 0 °C ... +50 °C Ni500: 0 °C ... +100 °C Ni500: 0 °C ... +150 °C Ni500: 0 °C ... +200 °C Ni500: -50 °C ... +50 °C Ni500: -50 °C ... +150 °C Ni500: -70 °C ... +230 °C Ni1000: 0 °C ... +50 °C Ni1000: 0 °C ... +100 °C Ni1000: 0 °C ... +150 °C Ni1000: 0 °C ... +200 °C Ni1000: -50 °C ... +50 °C Ni1000: -50 °C ... +150 °C Ni1000: -70 °C ... +230 °C Pt100: +30 °F ... +130 °F Pt100: +30 °F ... +220 °F Pt100: +30 °F ... +400 °F Pt100: +30 °F ... +940 °F

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Parameter	Data type	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: Pt100: 0 °C ... +100 °C	Pt100: -330 °F ... +1570 °F Pt100: -330 °F ... +580 °F Pt100: +570 °F ... +1570 °F Pt200: +30 °F ... +130 °F Pt200: +30 °F ... +220 °F Pt200: +30 °F ... +400 °F Pt200: +30 °F ... +940 °F Pt200: -330 °F ... +1570 °F Pt200: -330 °F ... +580 °F Pt200: +570 °F ... +1570 °F Pt500: +30 °F ... +130 °F Pt500: +30 °F ... +220 °F Pt500: +30 °F ... +400 °F Pt500: +30 °F ... +940 °F Pt500: -330 °F ... +1570 °F Pt500: -330 °F ... +580 °F Pt500: +570 °F ... +1570 °F Pt1000: +30 °F ... +130 °F Pt1000: +30 °F ... +220 °F Pt1000: +30 °F ... +400 °F Pt1000: +30 °F ... +940 °F Pt1000: -330 °F ... +1570 °F Pt1000: -330 °F ... +580 °F Pt1000: +570 °F ... +1570 °F Ni100: +30 °F ... +130 °F Ni100: +30 °F ... +220 °F Ni100: +30 °F ... +310 °F Ni100: +30 °F ... +400 °F Ni100: -60 °F ... +130 °F Ni100: -60 °F ... +310 °F Ni100: -100 °F ... +450 °F Ni500: +30 °F ... +130 °F Ni500: +30 °F ... +220 °F Ni500: +30 °F ... +310 °F Ni500: +30 °F ... +400 °F Ni500: -60 °F ... +130 °F Ni500: -60 °F ... +310 °F Ni500: -100 °F ... +450 °F Ni1000: +30 °F ... +130 °F Ni1000: +30 °F ... +220 °F Ni1000: +30 °F ... +310 °F Ni1000: +30 °F ... +400 °F Ni1000: -60 °F ... +130 °F Ni1000: -60 °F ... +310 °F Ni1000: -100 °F ... +450 °F Pt100: 270 K ... 330 K Pt100: 270 K ... 380 K Pt100: 270 K ... 480 K Pt100: 270 K ... 780 K Pt100: 70 K ... 1130 K Pt100: 70 K ... 580 K Pt100: 570 K ... 1130 K Pt200: 270 K ... 330 K Pt200: 270 K ... 380 K Pt200: 270 K ... 480 K Pt200: 270 K ... 780 K Pt200: 70 K ... 1130 K Pt200: 70 K ... 580 K Pt200: 570 K ... 1130 K Pt500: 270 K ... 330 K

Parameter	Data type	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: Pt100: 0 °C ... +100 °C	Pt500: 270 K ... 380 K Pt500: 270 K ... 480 K Pt500: 270 K ... 780 K Pt500: 70 K ... 1130 K Pt500: 70 K ... 580 K Pt500: 570 K ... 1130 K Pt1000: 270 K ... 330 K Pt1000: 270 K ... 380 K Pt1000: 270 K ... 480 K Pt1000: 270 K ... 780 K Pt1000: 70 K ... 1130 K Pt1000: 70 K ... 580 K Pt1000: 570 K ... 1130 K Ni100: 270 K ... 330 K Ni100: 270 K ... 380 K Ni100: 270 K ... 430 K Ni100: 270 K ... 480 K Ni100: 220 K ... 330 K Ni100: 220 K ... 430 K Ni100: 200 K ... 510 K Ni500: 270 K ... 330 K Ni500: 270 K ... 380 K Ni500: 270 K ... 430 K Ni500: 270 K ... 480 K Ni500: 220 K ... 330 K Ni500: 220 K ... 430 K Ni500: 200 K ... 510 K Ni1000: 270 K ... 330 K Ni1000: 270 K ... 380 K Ni1000: 270 K ... 430 K Ni1000: 270 K ... 480 K Ni1000: 220 K ... 330 K Ni1000: 220 K ... 430 K Ni1000: 200 K ... 510 K
Wiring Mode	This parameter is used to define the measurement method. Here 2, 3, or 4-wire circuits can be selected. If a 2-wire circuit is to be selected, enter the line resistance in the **Line Resistance (2 wire only)(chm)** parameter. Default setting: 2 wire	2 wire 3 wire 4 wire
Line Resistance (2 wire only)(ohm)	Use this parameter to define the line resistance. This parameter can only be defined if a 2-wire circuit ("2 wire") has been selected in the **Wiring Mode** parameter. To compensate for the measurement error, enter the resistance value of the connection line. Default setting: 0	0 ... 100
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)

Parameter	Data type	Possible values
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

"RTD Input predefined" Channel with Preset Parameters

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used. Default setting: Pt100	Pt100 Pt200 Pt500 Pt1000 Ni100 Ni500 Ni1000
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered. Default setting: Celsius	Celsius Fahrenheit Kelvin
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0	-400 ... 1000
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 100	-400 ... 10,000
Wiring Mode	This parameter is used to define the measurement method. Here 2, 3, or 4-wire circuits can be selected. If a 2-wire circuit is to be selected, enter the line resistance in the **Line Resistance (2 wire only)(chm)** parameter. Default setting: 2 wire	2 wire 3 wire 4 wire

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Parameter	Description	Possible values
Line Resistance (2 wire only)(ohm)	Use this parameter to define the line resistance. This parameter can only be defined if a 2-wire circuit ("2 wire") has been selected in the **Wiring Mode** parameter. To compensate for the measurement error, enter the resistance value of the connection line. Default setting: 0	0 ... 100
Scaling		
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Celsius	Celsius Fahrenheit Kelvin Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 100	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

Parameter	Description	Possible values
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

"RTD Input user defined" Channel with Preset Parameters for RTD Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		

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Parameter	Description	Possible values
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used.	Cannot be changed
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered. Default setting: Ohm	Ohm Percent of range User defined scaling
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-400 ... 10,000
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 100 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-400 ... 10,000
Wiring Mode	This parameter is used to define the measurement method. Here 2, 3, or 4-wire circuits can be selected. If a 2-wire circuit is to be selected, enter the line resistance in the **Line Resistance (2 wire only)(chm)** parameter. Default setting: 2 wire	2 wire 3 wire 4 wire
Line Resistance (2 wire only)(Ohm)	Use this parameter to define the line resistance. This parameter can only be defined if a 2-wire circuit ("2 wire") has been selected in the **Wiring Mode** parameter. To compensate for the measurement error, enter the resistance value of the connection line. Default setting: 0	0 ... 100
Scaling		

Parameter	Description	Possible values
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Ohm	Ohm Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 100	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On

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Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

7.3.18.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Temperature Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

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7.3.18.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB5x04, FB5x04 RTD signal converter supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.19 LB5x05, FB5205 Thermocouple Signal Converter

7.3.19.1 Functional Description

Versions

- LB5005, thermocouple converter, non-intrinsically safe
- LB5105, thermocouple converter, intrinsically safe
- FB5205, thermocouple converter, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- Suitable sensors: thermocouple types U, B, E, T, K, S, R, L, J, N, pallaplat and mV sensors

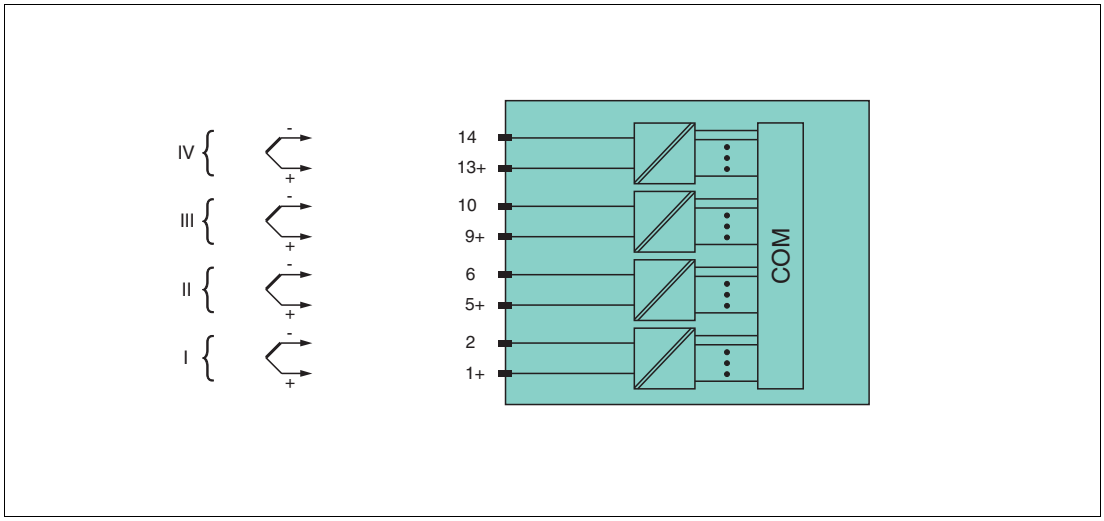

Figure 7.28 Block diagram LB5*05, FB5205

Channel I: 1+, 2-; channel II: 5+, 6-; channel III: 9+, 10-; channel IV: 13+, 14-

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.19.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The function of an I/O module can be defined by subordinating one or more channels (submodules) to it. The I/O module 5x05 provides the channels listed below. Parameters can be used to adjust these channels.

- The "Predefined" channel with preset parameters
- The "TC User defined" channel with preset parameters for thermocouple measurement
- The "MV User defined" channel with preset parameters for millivolt measurement

The following tables provide an overview of these channels and which parameters can be selected on them.

"Predefined" Channel with Preset Parameters

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		

Parameter	Description	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: TC_U: -200 °C ... +200 °C	-65.0 mV ... +75.0 mV 0 mV ... +75.0 mV 0 mV ... +50.0 mV 0 mV ... +25.0 mV TC_U: -200 °C ... +600 °C TC_U: -200 °C ... +200 °C TC_U: 0 °C ... +400 °C TC_U: +200 °C ... +600 °C TC_B: 0 °C ... +1800 °C TC_B: 0 °C ... +900 °C TC_B: 450 °C ... +1350 °C TC_B: 900 °C ... +1800 °C TC_E: -270 °C ... +1000 °C TC_E: -270 °C ... +360 °C TC_E: +50 °C ... +680 °C TC_E: +360 °C ... +1000 °C TC_T: -270 °C ... +400 °C TC_T: -270 °C ... +60 °C TC_T: -100 °C ... +230 °C TC_T: +60 °C ... +400 °C TC_K: -200 °C ... +1370 °C TC_K: -200 °C ... +500 °C TC_K: +150 °C ... +850 °C TC_K: +500 °C ... +1370 °C TC_S: 0 °C ... +1760 °C TC_S: 0 °C ... +900 °C TC_S: 0 °C ... +900 °C TC_S: +900 °C ... +1750 °C TC_R: -50 °C ... +1750 °C TC_R: -50 °C ... +900 °C TC_R: +450 °C ... +1350 °C TC_R: +900 °C ... +1750 °C TC_L: -200 °C ... +900 °C TC_L: -200 °C ... +350 °C TC_L: +75 °C ... +625 °C TC_L: +350 °C ... +900 °C TC_J: -210 °C ... +1200 °C TC_J: -210 °C ... +500 °C TC_J: +150 °C ... +850 °C TC_J: +500 °C ... +1200 °C TC_N: -200 °C ... +1350 °C TC_N: -200 °C ... +600 °C TC_N: +200 °C ... +1000 °C TC_N: +600 °C ... +1350 °C TC_U: -330 °F ... +1120 °F TC_U: -330 °F ... +400 °F TC_U: +30 °F ... +760 °F TC_U: +390 °F ... +1120 °F

Parameter	Description	Possible values
Sensor/Range/Unit	This parameter is used to define a combination of a sensor, measuring range, and temperature unit. For example, if **Pt: 0** °C to 200 °C is selected, a combination of **sensor** and a measuring range between 0 °C and 200 °C has been selected. Default setting: TC_U: -200 °C ... +200 °C	TC_B: +30 °F ... +3280 °F TC_B: +30 °F ... +1660 °F TC_B: +840 °F ... +2470 °F TC_B: +1650 °F ... +3280 °F TC_E: -460 °F ... +1840 °F TC_E: -460 °F ... +680 °F TC_E: +120 °F ... +1260 °F TC_E: +680 °F ... +1840 °F TC_T: -460 °F ... +760 °F TC_T: -460 °F ... +140 °F TC_T: -150 °F ... +450 °F TC_T: +140 °F ... +760 °F TC_K: -330 °F ... +2500 °F TC_K: -330 °F ... +940 °F TC_K: +300 °F ... +1570 °F TC_K: +930 °F ... +2500 °F
CJC mode	This parameter is used to select between an internal and external cold junction. With an internal cold junction (if **Internal** is selected), the terminal temperature in the I/O module is measured and the thermal voltages are determined at the terminals for the correction calculation. With an external cold junction (if **External** is selected), the thermal voltages at the terminals are canceled out by the use of the external cold junction. However, with this measurement method, the measured voltage must be adjusted for the thermal voltage of the external cold junction. To determine the thermal voltage of the external cold junction, the temperature of the cold junction (in the **CJC temperature** parameter) must be known. Default setting: Internal	Internal External
CjC Temperature	This parameter is used to define the temperature of the external cold junction. The temperature is required to correct the data. Default setting: 0	-400 ... 500
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0

Parameter	Description	Possible values
Alarms		
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	0.0 ... 100.0
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

"TC User defined" Channel with Preset Parameters for Thermocouple Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used. Default setting: TC U	TC U TC B TC E TC T TC K TC S TC R TC L TC J TC N
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered. Default setting: Celsius	Celsius Fahrenheit Kelvin
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-500.0 ... 10,000.0

Parameter	Description	Possible values
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 100 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-500.0 ... 10,000.0
CJC mode	This parameter is used to select between an internal and external cold junction. With an internal cold junction (if **Internal** is selected), the terminal temperature in the I/O module is measured and the thermal voltages are determined at the terminals for the correction calculation. With an external cold junction (if **External** is selected), the thermal voltages at the terminals are canceled out by the use of the external cold junction. However, with this measurement method, the measured voltage must be adjusted for the thermal voltage of the external cold junction. To determine the thermal voltage of the external cold junction, the temperature of the cold junction (in the **CJC temperature** parameter) must be known. Default setting: Internal	Internal External
CjC Temperature	This parameter is used to define the temperature of the external cold junction. The temperature is required to correct the data. Default setting: 0	-400 ... 500
Scaling		
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Celsius	Celsius Fahrenheit Kelvin Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 100	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		

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Parameter	Description	Possible values
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Off	Off Ramp Filter PT1
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100

"MV User defined" Channel with Preset Parameters for Millivolt Measurement

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD Off Delay	This parameter is used to suppress a flood of reports if there is a loose contact. Define the minimum time that must elapse before a line fault is reported. If an error disappears and returns within this period, it is not reported as "good" in the meantime. Default setting: 1	1 ... 10
Sensor		
Sensor	Select the sensor that is connected to the I/O module. Depending on the sensor, the right linearization is automatically used.	Cannot be changed
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered.	Cannot be changed
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 0 mV. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-75.0 ... 75.0
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 75 mV. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 75 Parameter validation: the following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	-75.0 ... 75.0
Scaling		

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Parameter	Description	Possible values
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters. Default setting: Millivolt	Millivolt Percent of range User defined scaling
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 75	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Off	Off Ramp Filter PT1
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 75
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 75

7.3.19.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-

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Byte.Bit	Designation	Data type	Description
4.4	OpenWire	-	A lead breakage is present.
4.5	Reserved	-	-
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

7.3.19.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB5x05, FB5205 thermocouple signal converter supports the following alarms:

- LFD: a lead breakage or a short circuit is present.
- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.20 LB5x06, FB5206 Voltage Converter

7.3.20.1 Functional Description

Versions

- LB5006, voltage converter, non-intrinsically safe
- LB5106, voltage converter, intrinsically safe
- FB5206, voltage converter, intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 1
- Input 0 V ... 10 V

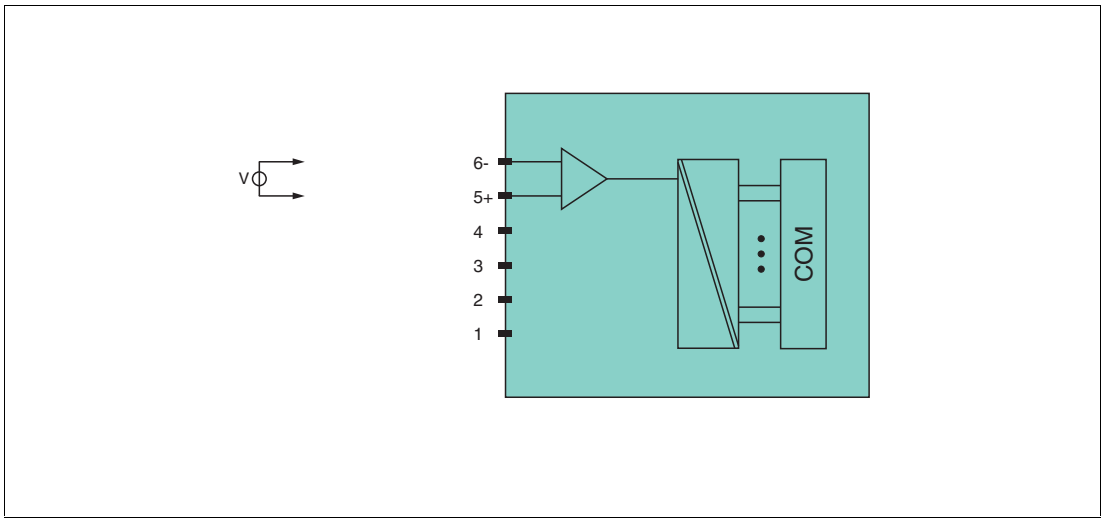

Figure 7.29 Block diagram LB5*06, FB5206

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.20.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The function of an I/O module can be defined by subordinating one or more channels (submodules) to it. The I/O module 5x06 provides the channels listed below. Parameters can be used to adjust these channels.

- The "Voltage Input predefined" channel with preset parameters
- The "Voltage Input user defined" channel with preset parameters for voltage converters

The following tables provide an overview of these channels and which parameters can be selected on them.

"Voltage Input predefined" Channel with Preset Parameters

Parameter	Description	Possible values
Sensor		
Sen- sor/Range/Unit	With this parameter you define the measuring range of the voltage input. Default setting: 0 V...+10 V	0 V ... +1 V 0 V ... +2 V 0 V ... +5 V 0 V ... +10 V
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 10
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 10

Parameter	Description	Possible values
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

"Voltage Input user defined" Channel with Preset Parameters for Voltage Converters

Parameter	Description	Possible values
Sensor		
Unit (sensor)	This parameter is used to define the unit in which the parameters for the sensor (e.g., **Low Range** and **High Range**) and, if necessary, the cold junction temperature (**CJC Temperature** parameter) are entered.	Cannot be changed
Low Range	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 0 V. To ensure correct scaling, in addition to this parameter define the following parameters: **High Range**, **Upper Scale**, and **Lower Scale**. Default setting: 0 Parameter validation: The following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	0.0 ... 10.0
High Range	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 10 V. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Range**, **Upper Scale**, and **Lower Scale**. Default setting: 10 Parameter validation: The following condition must be fulfilled so that no error is displayed: the parameter "Low Range" must be smaller than the parameter "High Range" and the signal value must be within the range of the sensor.	0.0 ... 10.0
Scaling		

Parameter	Description	Possible values
Scaling	Use this parameter to select the unit to which the measured value is to be scaled. If the **User defined scaling** option has been selected, the measured value is scaled depending on the **Lower scale (user defined)** and **Upper scale (user defined)** parameters.	Cannot be changed
Lower Scale (User defined)	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale (User defined)	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 10	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On

Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 10
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 10

7.3.20.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data detected from the LB/FB remote I/O system).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Temperature Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	-
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-

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Byte.Bit	Designation	Data type	Description
4.4	OpenWire	-	A lead breakage is present.
4.5	Reserved	-	-
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

7.3.20.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB5x06, FB5206 voltage converter supports the following alarms:

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

7.3.21 LB6101, FB6301 Relay Contact Output

7.3.21.1 Functional Description

Versions

- LB6101, relay contact output, non-intrinsically safe
- FB6301, relay contact output, wire ends for connection to separate increased safety terminal

Features

- Occupies 1 slot on the backplane
- Number of channels: 2
- LB6101
  - Switching voltage: 24 VDC/VAC (30 V max.)/230 VAC, 60 V (UL)
  - Switching current: 1 ADC/AAC resistive load
  - Switching power: 30 VA/30 W/230 VA, 60 W (UL)
- FB6301
  - Switching voltage: 24 VDC/230 VAC
  - Switching current: 1 ADC/AAC resistive load
  - Switching power: 30 W, 230 VA resistive load

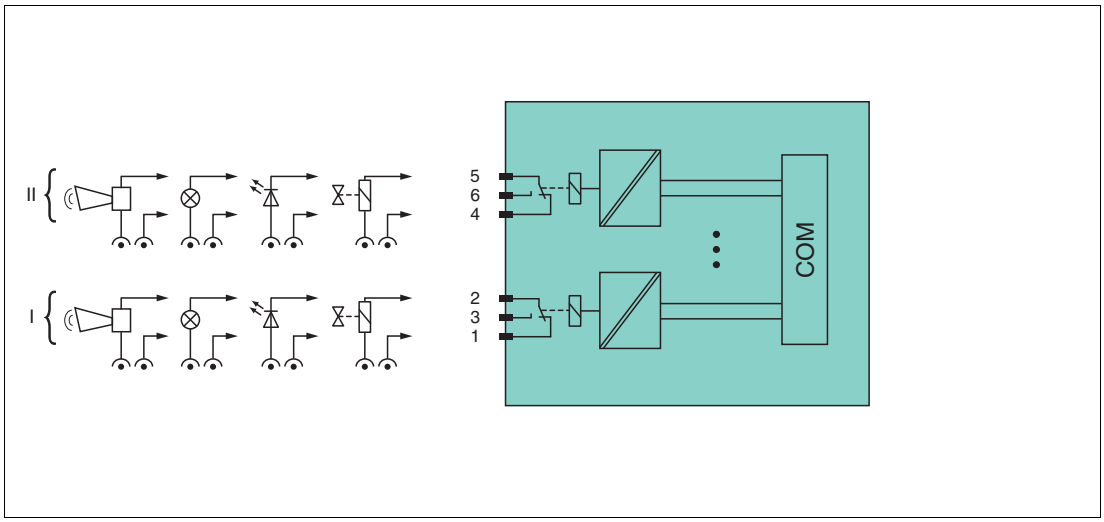

Figure 7.30 Block diagram LB6101, FB6301

LB6101: channel I: 1-2 NC, 3; channel II: 4-5 NC, 6

FB6301: wire ends 1 (white), 2 (brown), 3 (green), 4 (yellow), 5 (gray), 6 (pink), observe color marking or numbering

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.21.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On

7.3.21.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Flags	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	-
0.0	Value	-	Current measured value
0.1	Reserved	-	Fault
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.21.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart from some bus system-specific alarms, the I/O module LB6101, FB6301 relay contact output does not support alarms.

7.3.22 LB6005, FB6305 Relay Contact Output

7.3.22.1 Functional Description

Versions

- LB6005, relay contact output, non-intrinsically safe
- FB6305, relay contact output, wire ends for connection to separate increased safety terminal

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- LB6005
  - Switching voltage: DC: 30 V, AC: 230 V, 60 V (UL)
  - Switching current: 1 ADC/AAC resistive load
  - Switching power: 30 W, AC: 250 VA , 60 W (UL)
- FB6305
  - Switching voltage: DC: 30 V, AC: 230 V
  - Switching current: 1 ADC/AAC resistive load
  - Switching power: 30 W, AC: 250 VA

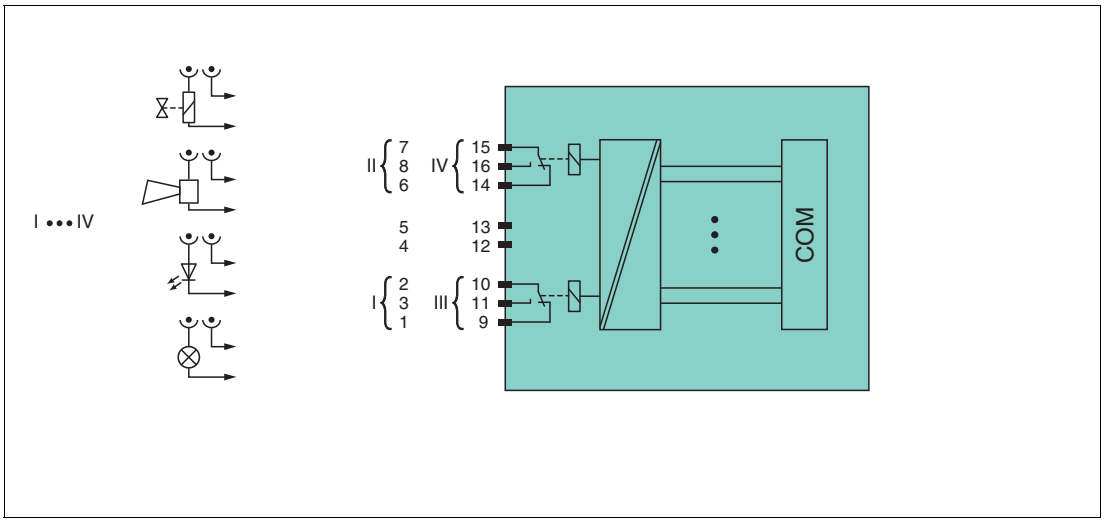

Figure 7.31 Block diagram LB6005, FB6305

LB6005: channel I: 1-2 NC, 3; channel II: 6-7 NC, 8; channel III: 9-10 NC, 11; channel IV: 14-15 NC, 16

FB6305: wire ends 1/9 (white), 2/10 (brown), 3/11 (green), 4/12 (yellow), 5/13 (gray), 6/14 (pink), 7/15 (blue), 8/16 (red), observe color marking or numbering

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.22.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On

7.3.22.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Flags	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	-
0.0	Value	-	Current measured value
0.1	Reserved	-	Fault
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.22.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart for some bus system-specific alarms, the I/O module LB6005, FB6305 relay contact output does not support alarms.

7.3.23 LB6006, FB6306 Relay Contact Output

7.3.23.1 Functional Description

Versions

- LB6006, relay contact output, non-intrinsically safe
- FB6306, relay contact output, increased safety terminals

Features

- Occupies 2 slots on the backplane
- Number of channels: 8
- Switching voltage: 24 VDC/VAC
- Switching current: 1 ADC/AAC resistive load
- Switching power: 30 VA/30 W

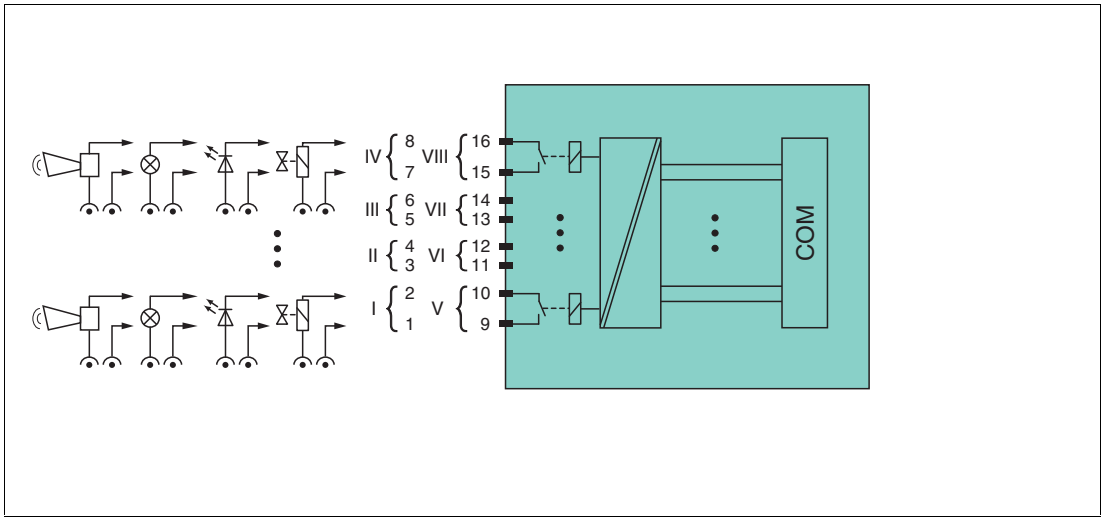

Figure 7.32 Block diagram LB6006, FB6306

Connection: channel I: 1-2 NO; channel II: 3-4 NO; channel III: 5-6 NO; channel IV: 7-8 NO; channel V: 9-10 NO; channel VI: 11-12 NO; channel VII: 13-14 NO; channel VIII: 15-16 NO

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.23.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined

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Parameter	Description	Possible values
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On

7.3.23.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Flags	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	-
0.0	Value	-	Current measured value
0.1	Reserved	-	Fault
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.23.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

Apart for some bus system-specific alarms, the I/O module LB6006, FB6306 relay contact output does not support alarms.

7.3.24 LB6x08, FB6x08 Digital Output with Shutdown Input

7.3.24.1 Functional Description

Versions

- LB6008, digital output, non-intrinsically safe
  Versions available with bus-independent shutdown input
- FB6308, digital output with shutdown input, increased safety terminals
- LB6108, digital output with shutdown input, intrinsically safe
- FB6208, digital output with shutdown input, intrinsically safe

Features

- Occupies 2 slots on the backplane
- Number of channels: 8
- Switching capacity: 20 VDC/8 mA

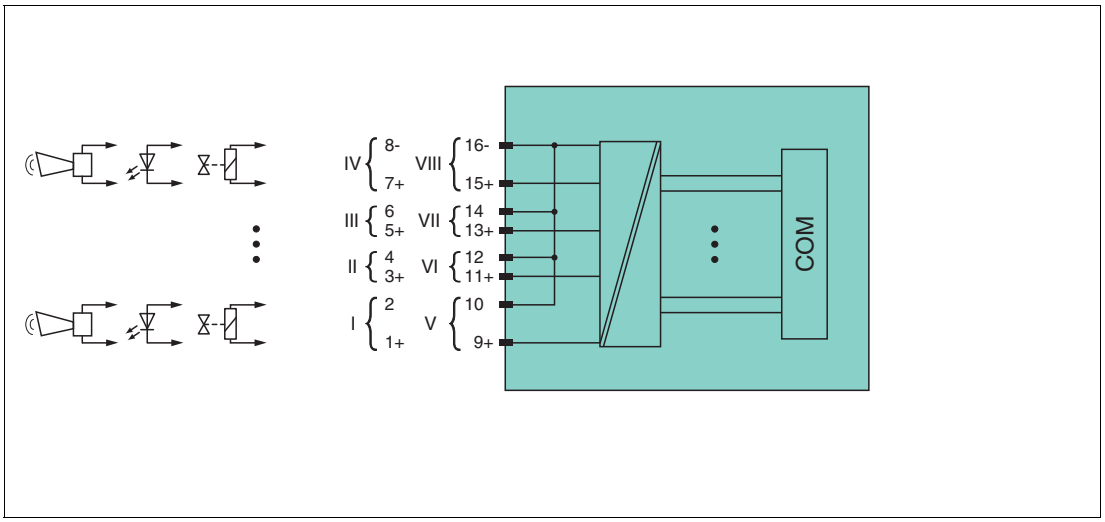

Figure 7.33 Block diagram LB6x08, FB6x08 (8-channel)

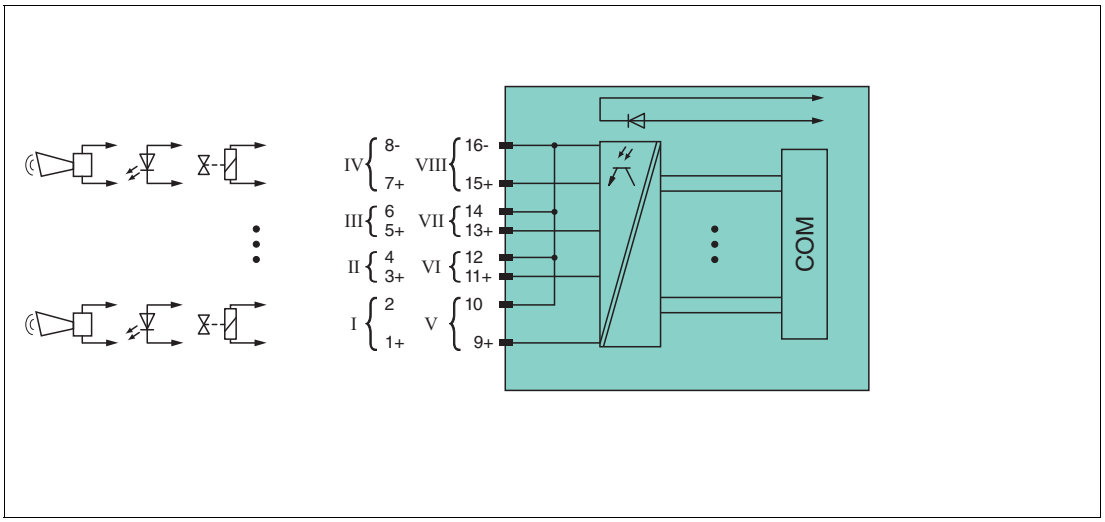

Figure 7.34 Block diagram LB6*08, FB6*08 with shutdown input

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.24.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: Off	Off On Hold
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 7200
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

7.3.24.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

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The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Status	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Line Fault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	Current measured value.
0.0	Value	-	-
0.1	Reserved	-	-
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.24.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The output channel of the I/O module LB6x08, FB6x08 digital output with shutdown input supports the following alarm:

- LFD: a lead breakage or a short circuit is present.

7.3.25 LB6x10...6115, FB6210...6215 Digital Output

7.3.25.1 Functional Description

Versions

- LB6010, digital output, non-intrinsically safe
  Versions available with bus-independent shutdown input
- LB6110 ... LB6115, digital output, intrinsically safe
  Versions available with bus-independent shutdown input
- FB6210 ... FB6215, digital output, intrinsically safe
  Versions available with bus-independent shutdown input

Features

- Occupies 2 slots on the backplane
- Number of channels: 4
- The electrical data of the versions differ

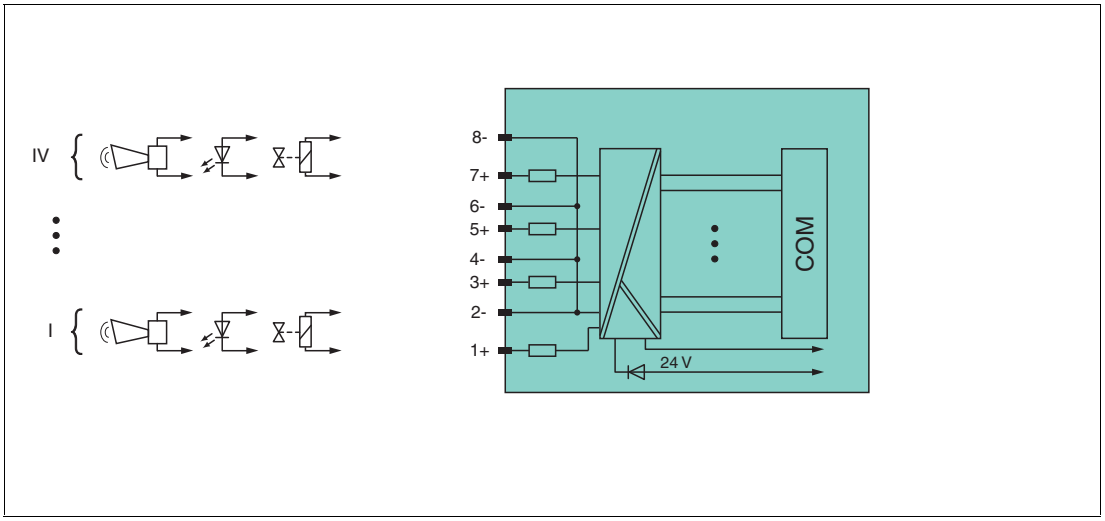
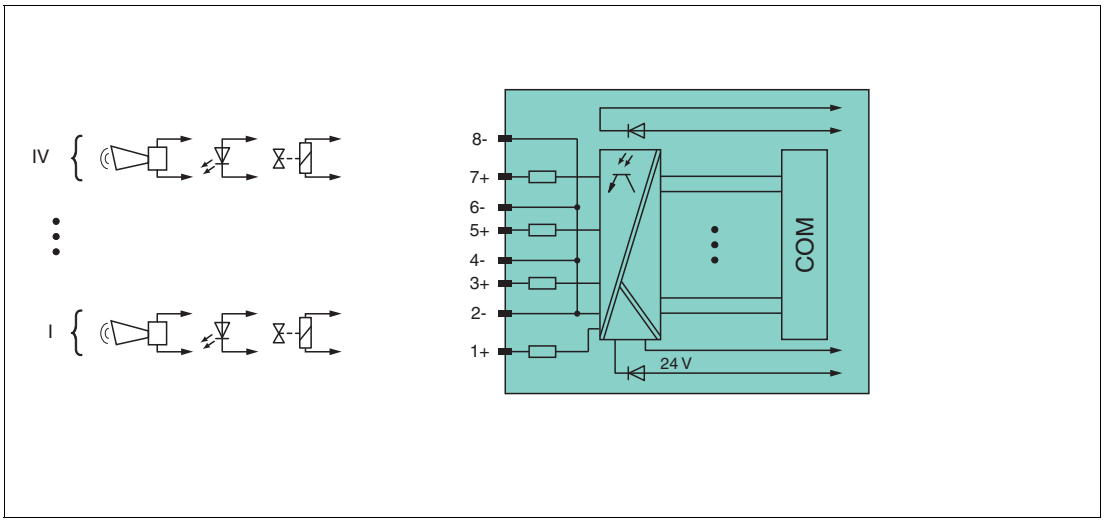


Figure 7.35 Block diagram LB6*1*, FB621* without shutdown input



Block diagram LB6*1*, FB621* with shutdown input

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.25.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: Off	Off On Hold
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 7200
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

7.3.25.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

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The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Status	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Line Fault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	Current measured value.
0.0	Value	-	-
0.1	Reserved	-	-
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.25.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB6x10...6115, FB6210...6215 digital output supports the following alarm:

- LFD: a lead breakage or a short circuit is present.

7.3.26 LB6x16...6x17, FB6216...6217 Digital Output with Shutdown Input

7.3.26.1 Functional Description

Versions

- LB6016, LB6017, digital output, non-intrinsically safe, with bus-independent shutdown input
- LB6116, LB6117, digital output, intrinsically safe, with bus-independent shutdown input
- FB6216, FB6217, digital output, intrinsically safe, with bus-independent shutdown input

Features

- Occupies 1 slot on the backplane
- Number of channels: 2 (parallel operation possible)
- The electrical data of the versions differ

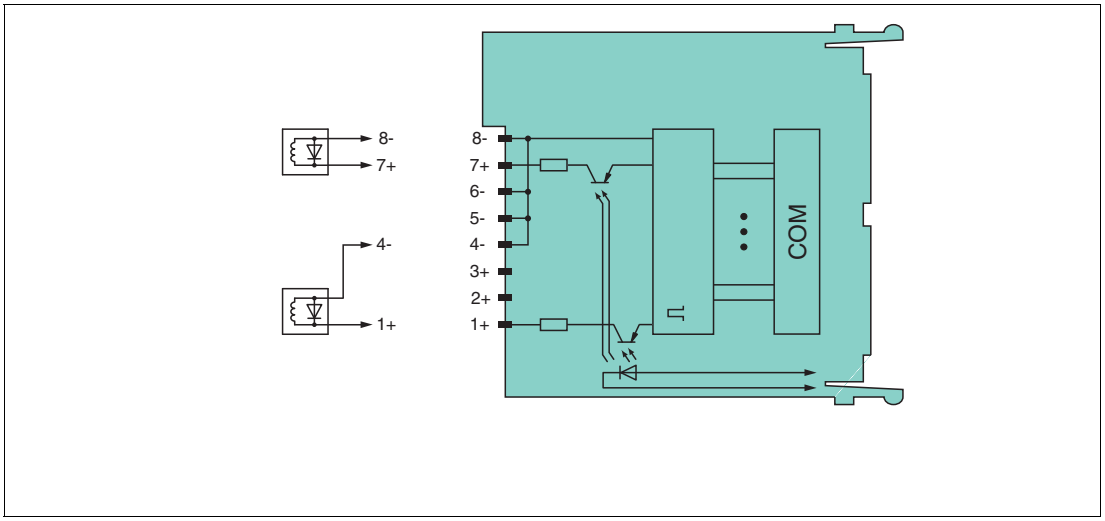

Figure 7.36 Block diagram: LB6*16, FB6216, LB6*17, FB6217 with shutdown input

The digital output with switch-on input has 2 independent channels. The digital output with shutdown input can control solenoid valves, sounders, or LEDs.

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.26.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: Off	Off On Hold

Parameter	Description	Possible values
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 7200
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

7.3.26.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Status	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Line Fault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	Current measured value.
0.0	Value	-	-
0.1	Reserved	-	-
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.26.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The digital output of the I/O module LB6x16...6x17, FB6216...6217 supports the following alarm:

- LFD: a lead breakage or a short circuit is present.

7.3.27 LB6x16...6x17, FB6x16...6x17 Digital Output—Combined

7.3.27.1 Functional Description

Versions

- LB6016, LB6017, digital output, non-intrinsically safe, with bus-independent shutdown input
- LB6116, LB6117, digital output, intrinsically safe, with bus-independent shutdown input
- FB6216, FB6217, digital output, intrinsically safe, with bus-independent shutdown input

Features

- Occupies 1 slot on the backplane
- Number of channels: 2 (parallel operation possible)
- The electrical data of the versions differ

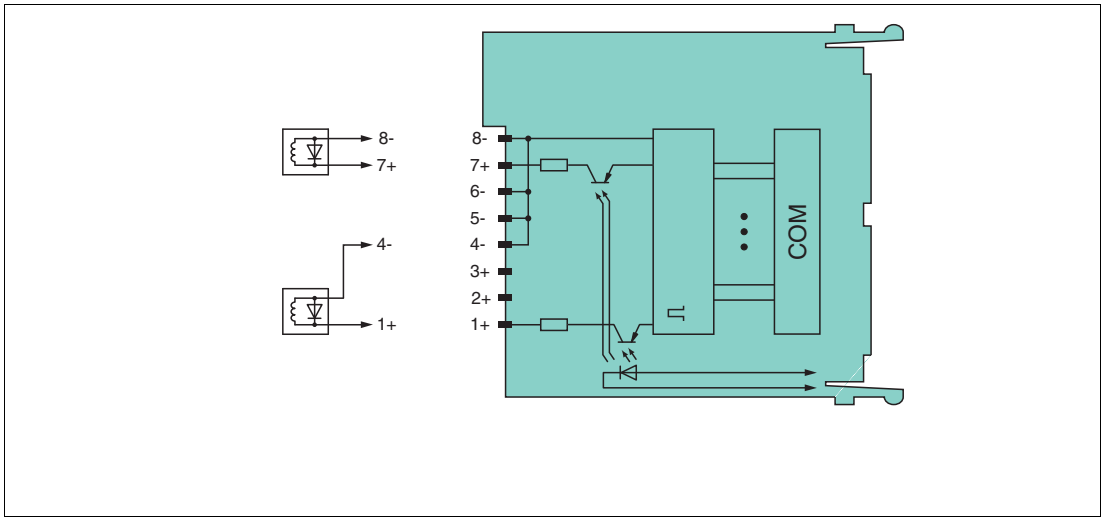

Figure 7.37 Block diagram: LB6*16, FB6216, LB6*17, FB6217 with shutdown input

Note

Refer to the corresponding datasheet and instruction manual for further information.

7.3.27.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The following table provides an overview of the parameters that can be selected on the channel.

"Digital Output" Channel

Parameter	Description	Possible values
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: Off	Off On Hold

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Parameter	Description	Possible values
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 7200
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

7.3.27.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Status	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault
0.2	Line Fault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	Current measured value.
0.0	Value	-	-
0.1	Reserved	-	-
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

7.3.27.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The I/O module LB6x16...6x17, FB6x16...6x17 digital output—combined supports the following alarm:

- LFD: a lead breakage or a short circuit is present.

7.3.28 LB7x04, FB7x04 Universal Input/Output

7.3.28.1 Functional Description

Versions

- LB7004, Universal Input/Output (HART), non-intrinsically safe
- FB7304, Universal Input/Output (HART), increased safety terminals
- LB7104, Universal Input/Output (HART), intrinsically safe
- FB7204, Universal Input/Output (HART), intrinsically safe

Features

- Occupies 1 slot on the backplane
- Number of channels: 4
- Channels can be set as analog input (HART), analog output (HART), digital input or digital output.
  - Suitable sensors for analog inputs: pressure, differential pressure, filling level, flow rate, and temperature converters, etc.
  - Suitable sensors for analog outputs: proportional valves, I/P converters, local indicators
  - Suitable field devices for digital inputs: mech. contacts and optocouplers
  - Suitable field devices for digital outputs: solenoid valves, acoustic sensors, and LEDs (line fault detection can be disabled)

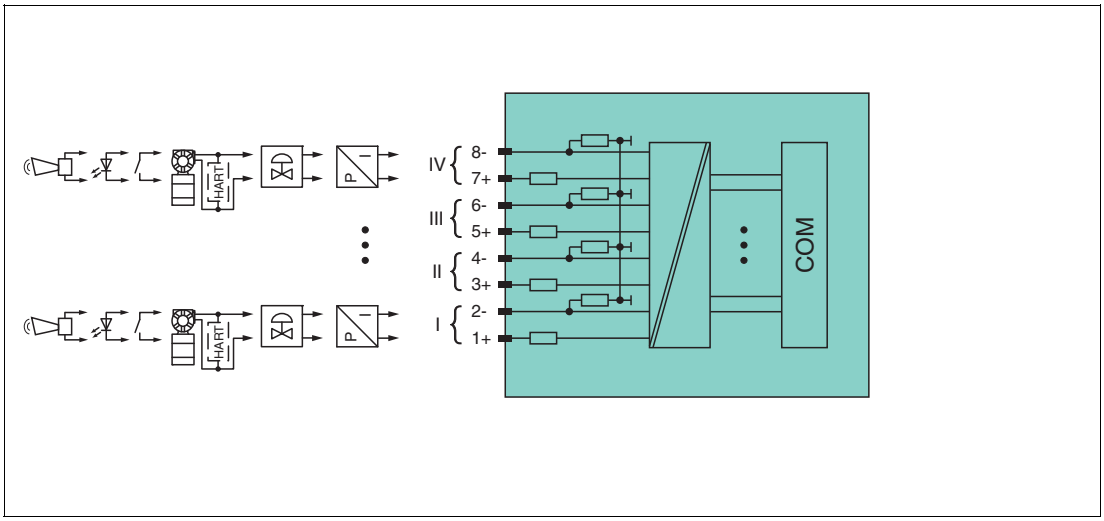

Figure 7.38 Block diagram LB7*04, FB7*04

Note

The connection assignment and other technical data can be found on the relevant datasheet.

7.3.28.2 Parameterization

Depending on the manufacturer of the control system, the user interfaces of the configuration software offer different options for displaying and setting the parameters. The user interfaces of the configuration software differ in their appearance and use.
The GSDML file contains a defined parameter set. The GSDML file determines which parameters are displayed on the software interfaces.

The channels of the I/O module can be operated in 4 different operating modes. Parameters are available for each operating mode. The different operating modes are:

- As analog input (AI)
- As analog output (AO)
- As digital input (DI)
- As digital output (DO)

The following tables provide an overview of these channels and which parameters can be selected on them.

"Analog Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Lead Breakage Limit (mA)	This parameter is used to define the threshold value for lead breakage detection, e.g., 1 mA. When the electric current falls below this value, the Line Fault Detection signals a lead breakage. Default setting: 1.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Short Circuit Limit (mA)	This parameter is used to define the threshold value for short-circuit detection, e.g., 21 mA. When the electric current exceeds this value, the Line Fault Detection function reports a short circuit. Default setting: 21.0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Lead Breakage Limit" parameter must be smaller than the "Short Circuit Limit" parameter.	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter and the parameter value must be positive.	0.0 ... 26.0

Parameter	Description	Possible values
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 26.0
Lower Scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Trend Filter		
Trend Filter Mode	This parameter is used to define the rate of change of the input value in the event of a change to data. Default setting: Deactivated	Deactivated Ramp Filter (% per s) PT1 (Time Constant in s)
Trend Filter Value	This parameter is used to define the filter selected in the **Trend Filter Mode** parameter. Set the Ramp Filter to the maximum change in % (from the measuring range) per second. For the PT1 filter, define the time constant in seconds. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the Trend Filter Value current input/temperature input must be positive.	0.0 ... 1000.0
Alarms		
Range Alarms Active	Use this parameter to define an alarm if the measured value exceeds or falls below the measuring range. If **On** is selected, an alarm bit (in the cyclic data) is set and an alarm (in the acyclic data) is transmitted. Default setting: Off	Off On
Limit Alarms Active	Use this parameter to define an alarm if the limits for the measurement are reached or undershot. If **On** is selected, an alarm bit (in the cyclic data) is set and a process alarm (in the acyclic data) is transmitted. Use the following parameters to define the limit values: **High High Alarm Limit**, **High Alarm Limit**, **Low Low Alarm Limit**, and **Low Alarm Limit**. Default setting: Off	Off On

Parameter	Description	Possible values
Alarm Dead Band	This parameter is used to define a value for an alarm to be canceled. This value indicates how far the measured value must move from the alarm limit in the event of an alarm. Default setting: 1.0 Parameter validation: the following condition must be fulfilled so that no error is displayed. the LO value and deadband must be smaller than the high alarm value. Otherwise the channel is reported as faulty and is not put into operation (parameter error).	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Low Low Alarm Limit	Use this parameter to define a limit value for the alarm. If this limit value is undershot, an alarm bit is set in the cyclic data and an alarm is transmitted to the control system. The alarm only takes effect if an alarm has been activated in the **Limit Alarms Active** parameter. Parameter validation: the gateway checks the order of the alarm limits. The following condition must be met for no error to be displayed: Low Low < Low < High < High High. If one of the parameters is not set correctly, the channel with the error will not work.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
Low Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 0
High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
High High Alarm Limit		-3.4028^{38} ... 3.4028^{38} (32 bit; Real) Default setting: 100
HART		
Hart	Use this parameter to activate or deactivate HART communication to the channel. If no HART-compatible device is connected, select **Off** from the drop-down list. The gateway does not attempt to communicate with the HART-compatible device. Since communication with HART-compatible devices requires a lot of time, this time is saved. Default setting: On	Off On

"Analog Output" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On

Parameter	Description	Possible values
Min Current (mA)	This parameter is used to define a minimum current. If a minimum current is defined, the I/O module ignores all values transmitted by the control system that are below the minimum current. Instead, the I/O module outputs the minimum current. To disable the function, enter the value "0." If no minimum current has been defined, communication is not established with HART-compatible devices. For this reason, note that a minimum current is required for communication with HART-compatible devices. Default setting: 0.8	0.0 ... 26.0
Scaling		
Low Signal (mA)	Use this parameter to define the start of the measuring range for scaling the data. This parameter indicates the value equivalent to 0 % on the scale, e.g., 4 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **High Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 4	0.0 ... 26.0
High Signal (mA)	Use this parameter to define the end of the measuring range for scaling data. This parameter indicates the value equivalent to 100 % on the scale, e.g., 20 mA. To ensure correct scaling, define the following parameters in addition to this parameter: **Low Signal (mA)**, **Upper Scale**, and **Lower Scale**. Default setting: 20	0.0 ... 26.0
Lower scale	This parameter is used to define the lower limit of the measuring range (start of measuring range). Default setting: 4	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Upper Scale	This parameter is used to define the upper limit of the measuring range (end of measuring range). Default setting: 20	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Lower Limit Value	This parameter is used to define lower limits for analog output values. The start of the measuring range is defined in the **Low Signal (mA)** parameter. If the start of the measuring range is not reached, the I/O module outputs at least the value from this parameter. Default setting: 0 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)

Parameter	Description	Possible values
Upper Limit Value	This parameter is used to define upper limits for analog output values. If the end of the measuring range specified in the **High Signal (mA)** parameter is exceeded, the I/O module outputs at most the value from this parameter. Default setting: 22 Parameter validation: the following condition must be fulfilled in order for no error to be displayed: the "Low Signal" parameter must be smaller than the "High Signal" parameter.	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: User defined	Hold last Value User defined
Value	This parameter is used to define the output value in case of a fault. This parameter only applies to an analog output. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 60,000
Final Value	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: 0	-3.4028^{38} ... 3.4028^{38} (32 bit; Real)
Output Ramping		
Active	This parameter is used to define whether output values are only changed in rates. If **Off** is selected, the value that is transmitted via the bus system is output. Default setting: Off	Off On
Rate (Units/s)	Use this parameter to define the rate used to change the output value. This rate refers to the measurement ranges defined using the **Lower Scale** and **Upper Scale** parameters. Default setting: 1	0.001 ... $1.0000 * 10^{10}$

Parameter	Description	Possible values
HART		
Hart	Use this parameter to activate or deactivate HART communication to the channel. If no HART-compatible device is connected, select **Off** from the drop-down list. The gateway does not attempt to communicate with the HART-compatible device. Since communication with HART-compatible devices requires a lot of time, this time is saved. Default setting: On	Off On

"Digital Input" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
Measurement		
Inverted	This parameter is used to invert signals, e.g., to turn a logical 1 into a 0. To enable the parameter, select **On** from the drop-down list. Default setting: Off	Off On
Input Filter		
On Delay (ms)	With this parameter, use the on delay to filter out short pulses. Enter a value in ms to shorten a signal change from **0** to **1**.  Default setting: 0	0 ... 60,000
Off Delay (ms)	With this parameter, use the off delay to extend short pulses. Enter a value in ms to extend a signal change from **1** to **0**.  Default setting: 0	0 ... 60,000

"Digital Output" Channel

Parameter	Description	Possible values
Line Fault		
Line Fault Detection	This parameter is used to define whether the field-side connection is monitored. If **On** has been selected and a line fault occurs, the fault is signaled by an error bit in the cyclic data exchange process (e.g., OpenWire = 1). The fault state is additionally reported by a diagnostic alarm (acyclic data). Default setting: Off	Off On
LFD On Delay	Use this parameter to define how long a fault stays in the queue before it is reported. Default setting: Off	Off On
Output State in Fault Mode		
State	This parameter is used to define how the output value should behave in case of a fault. Default setting: Off	Off On Hold
Duration (s)	Use this parameter to define how long the output channel should remain in the state that has been defined in the **State** and **Value** parameters. Once this period of time has elapsed, the output channel goes into the final fault state (**Final value**). To keep the output channel in the defined state, specify the value "0." Default setting: 0 Parameter validation: the following condition must be met in order for no error to be displayed: the replacement value must not remain in the state for more than ≤ 7200 s.	0 ... 7200
Final State	This parameter is used to define the status of the output channel once the time specified in the **Duration (s)** parameter has elapsed. Default setting: Off	Off On

7.3.28.3 Data Transfer

Input data are transferred cyclically via the bus system depending on the update rate. The update rate is defined in a parameter in the gateway.

The measured value is transferred within the cyclic data as a 32 bit floating point figure. In addition to the measured value, additional bytes are transmitted for diagnostic, status, and alarm information.

The IO Producer Status (IOPS) shows the validity of the data for each input channel. Consider the size of the IOPS when calculating the data volume. The IOPS requires 1 byte. If a module fails or a configured module is not present, the IOPS is marked as "bad." In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy. A lead breakage or short circuit at an input does not affect the IOPS.

The IO Consumer Status (IOCS) shows for each output channel whether the gateway was able to process the data. Consider the size of the IOCS when calculating the data volume. The IOCS requires 1 byte. If a module fails or a configured module is not available, and if a lead breakage or short circuit occurs at an output, the IOCS is marked as "bad."
The control system monitors the cyclic data exchange and issues an error message in the event of irregularities (e.g., no new data from the LB/FB remote I/O system detected).

Regardless of the selected parameter interface, the cyclic data are transferred according to the tables below.

Structure of Cyclic Input Data—Analog Input

Byte.Bit	Designation	Data type	Description
0	Value	Real	Current measured value.
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	Result of line fault detection.
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present.
4.5	ShortCircuit	-	A short circuit is present.
4.6	Reserved	-	-
4.7	Reserved	-	-
5	Alarms	Byte	-
5.0	OverRange	-	The measured value has exceeded the upper limit of the permitted measuring range.
5.1	UnderRange	-	The measured value has fallen below the lower limit of the permitted measuring range.
5.2	HighHighAlarm	-	Use the **High High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.
5.3	HighAlarm	-	Use the **High Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has exceeded this limit value.

Byte.Bit	Designation	Data type	Description
5.4	LowAlarm	-	Use the **Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.5	LowLowAlarm	-	Use the **Low Low Alarm Limit** parameter to define a limit value for an alarm. If this bit is set, the measured value has fallen below this limit.
5.6	Reserved	-	-
5.7	Reserved	-	-

Structure of Cyclic Input Data—Analog Output

Byte.Bit	Designation	Data type	Description
0	ReadBackValue	Real	Read back output value
4	Status	Byte	-
4.0	Reserved	-	-
4.1	Fault	-	Fault
4.2	LineFault	-	Result of line fault detection
4.3	Reserved	-	-
4.4	OpenWire	-	A lead breakage is present
4.5	ShortCircuit	-	A short circuit is present
4.6	Reserved	-	-
4.7	Reserved	-	-

Structure of Cyclic Output Data—Analog Output

Byte.Bit	Designation	Data type	Description
0-3	Value	Real	The output value

Structure of Cyclic Input Data—Digital Input

Byte.Bit	Designation	Data type	Description
0	ValueAndStatus	Byte	-
0.0	Value	-	Current measured value.
0.1	Fault	-	Fault
0.2	LineFault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	OpenWire	-	A lead breakage is present.
0.5	ShortCircuit	-	A short circuit is present.
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Input Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Status	Byte	-
0.0	Value	-	Current measured value
0.1	Fault	-	Fault

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Byte.Bit	Designation	Data type	Description
0.2	LineFault	-	Result of line fault detection
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of Cyclic Output Data—Digital Output

Byte.Bit	Designation	Data type	Description
0	Value	Byte	-
0.0	Value	-	Current measured value
0.1	Reserved	-	-
0.2	Reserved	-	-
0.3	Reserved	-	-
0.4	Reserved	-	-
0.5	Reserved	-	-
0.6	Reserved	-	-
0.7	Reserved	-	-

Structure of HART Auxiliary Variables

Detailed information about the structure of HART auxiliary variables, see chapter 7.3.29.

7.3.28.4 Alarms

Certain events (e.g., line faults, measuring range limits exceeded or not reached) are reported to the control system via acyclic data traffic. These events include line faults or measuring range limits not being reached.
This acyclic data traffic concerns alarms. The possible alarms depend on the module type. The bus system specification is used to define some alarms, e.g., the short circuit alarm. These bus system-specific alarms are not listed in this manual. For further information on bus system-specific alarms, see the bus system specification.

The HART I/O modules of the LB- and FB-system support the following alarms:

Alarms - analog input

- HiHi: The measured value has exceeded the limit defined in the **High High Alarm Limit** parameter.
- Hi: The measured value has exceeded the limit defined in the **High Alarm Limit** parameter.
- Lo: The measured value has fallen below the limit defined in the **Low Alarm Limit** parameter.
- LoLo: The measured value has fallen below the limit defined in the **Low Low Alarm Limit** parameter.

Alarms - analog output

- LFD: a lead breakage or a short circuit is present.
- Invalid: a value in the determined input data is invalid.

7.3.29 HART Auxiliary Variables

With PROFINET, it is possible to evaluate and process additional information besides the actual measuring signal that is output in the main variable. This additional information is then output accordingly via the HART auxiliary variables.

Some HART field devices (sensors), such as pressure transducers, provide such additional information. Depending on the measurement type, the sensor or electronics temperature, for example, is provided in the auxiliary variables in addition to the actual process value (e.g., pressure, flow rate, or fill level).

For each channel with activated HART functionality, a maximum of four HART variables supported by the connected field device are read cyclically. Up to 4 HART variables can be configured:

- HART primary variable (PV): 1st auxiliary variable
- HART secondary variable (SV): 2nd auxiliary variable
- HART tertiary variable (TV): 3rd auxiliary variable
- HART quaternary variable (QV): 4th auxiliary variable

HartPv

Byte.Bit	Designation	Data type	Description
0	PvValue	Real	1st auxiliary variable
4	FieldDeviceStatus	Byte	Device status
4.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
4.1	PvOutOfLimits	-	Main variable outside the range
4.2	AnalogOutputSaturated	-	Analog output current saturated
4.3	AnalogOutputFixed	-	Fixed analog output current
4.4	MoreStatusAvailable	-	Additional status information available
4.5	ColdStart	-	Startup (cold start)
4.6	ConfigurationChanged	-	Configuration changed
4.7	FieldDeviceMalfunction	-	Device error

HartPvSv

Byte.Bit	Designation	Data type	Description
0	PvValue	Real	1st auxiliary variable
4	SvValue	Real	2nd auxiliary variable
8	FieldDeviceStatus	Byte	Device status
8.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
8.1	PvOutOfLimits	-	Main variable outside the range
8.2	AnalogOutputSaturated	-	Analog output current saturated
8.3	AnalogOutputFixed	-	Fixed analog output current
8.4	MoreStatusAvailable	-	Additional status information available
8.5	ColdStart	-	Startup (cold start)
8.6	ConfigurationChanged	-	Configuration changed
8.7	FieldDeviceMalfunction	-	Device error

HartPvSvTv

Byte.Bit	Designation	Data type	Description
0	PvValue	Real	1st auxiliary variable
4	SvValue	Real	2nd auxiliary variable
8	TvValue	Real	3rd auxiliary variable
12	FieldDeviceStatus	Byte	Device status
12.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
12.1	PvOutOfLimits	-	Main variable outside the range
12.2	AnalogOutputSaturated	-	Analog output current saturated
12.3	AnalogOutputFixed	-	Fixed analog output current
12.4	MoreStatusAvailable	-	Additional status information available
12.5	ColdStart	-	Startup (cold start)
12.6	ConfigurationChanged	-	Configuration changed
12.7	FieldDeviceMalfunction	-	Device error

HartPvSvTvQv

Byte.Bit	Designation	Data type	Description
0	PvValue	Real	1st auxiliary variable
4	SvValue	Real	2nd auxiliary variable
8	TvValue	Real	3rd auxiliary variable
12	QvValue	Real	4th auxiliary variable
16	FieldDeviceStatus	Byte	Device status
16.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
16.1	PvOutOfLimits	-	Main variable outside the range
16.2	AnalogOutputSaturated	-	Analog output current saturated
16.3	AnalogOutputFixed	-	Fixed analog output current
16.4	MoreStatusAvailable	-	Additional status information available
16.5	ColdStart	-	Startup (cold start)
16.6	ConfigurationChanged	-	Configuration changed
16.7	FieldDeviceMalfunction	-	Device error

HartSv

Byte.Bit	Designation	Data type	Description
0	SvValue	Real	2nd auxiliary variable
4	FieldDeviceStatus	Byte	Device status
4.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
4.1	PvOutOfLimits	-	Main variable outside the range
4.2	AnalogOutputSaturated	-	Analog output current saturated
4.3	AnalogOutputFixed	-	Fixed analog output current
4.4	MoreStatusAvailable	-	Additional status information available
4.5	ColdStart	-	Startup (cold start)
4.6	ConfigurationChanged	-	Configuration changed
4.7	FieldDeviceMalfunction	-	Device error

HartSvTv

Byte.Bit	Designation	Data type	Description
0	SvValue	Real	2nd auxiliary variable
4	TvValue	Real	3rd auxiliary variable
8	FieldDeviceStatus	Byte	Device status
8.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
8.1	PvOutOfLimits	-	Main variable outside the range
8.2	AnalogOutputSaturated	-	Analog output current saturated
8.3	AnalogOutputFixed	-	Fixed analog output current
8.4	MoreStatusAvailable	-	Additional status information available
8.5	ColdStart	-	Startup (cold start)
8.6	ConfigurationChanged	-	Configuration changed
8.7	FieldDeviceMalfunction	-	Device error

HartSvTvQv

Byte.Bit	Designation	Data type	Description
0	SvValue	Real	2nd auxiliary variable
4	TvValue	Real	3rd auxiliary variable
8	QvValue	Real	4th auxiliary variable
12	FieldDeviceStatus	Byte	Device status
12.0	NonPvOutOfLimits	-	Auxiliary variable outside of the limits
12.1	PvOutOfLimits	-	Main variable outside the range
12.2	AnalogOutputSaturated	-	Analog output current saturated
12.3	AnalogOutputFixed	-	Fixed analog output current
12.4	MoreStatusAvailable	-	Additional status information available
12.5	ColdStart	-	Startup (cold start)
12.6	ConfigurationChanged	-	Configuration changed
12.7	FieldDeviceMalfunction	-	Device error

1 Diagnosis

1.1 Gateway

The gateway detects faults on the following components:

- Backplane
- Gateway
- I/O module
- Channel
- Power supply

Cyclic and acyclic data traffic

If the gateway detects a fault, it transmits fault data and diagnostic data via cyclic and acyclic data traffic. The gateway transmits fault bits and alarm bits via cyclic data traffic. The gateway uses the PROFINET alarm function via acyclic data traffic. Alarms are reported when events in the LB/FB remote I/O system or in the process occur and disappear again.

The following alarm types are sent via acyclic data traffic:

- Diagnostic alarms
  Diagnostic alarms relate to faults in LB/FB remote I/O system components, e.g., wire break on one of the channels.
  Diagnostic alarms are transmitted with one of the following priorities: "Fault," "Maintenance required," or "Maintenance demanded." "Fault" has the highest priority. An alarm with "Fault" priority results in a "bad" data set status. This status is the IO Producer Status (IOPS). The data of this "bad" IOPS are marked as faulty and cannot be used by the control system. In such cases, the control system must continue processing the faulty input data appropriately in accordance with its substitute value strategy.
- Process alarms
  Process alarms relate to measured values in the process. The limits of measuring ranges are defined during parameterization of the channels (submodules) in the configuration software. For example, it is possible to define that the gateway should report a process alarm to the control system if the measured value of a temperature sensor exceeds 30 °C. For more information about the parameterization of I/O modules, .
- Pull alarms
  The gateway transmits pull alarms when an I/O module is pulled out of the backplane.
- Plug alarms
  The gateway transmits plug alarms if an I/O module is plugged into the backplane.

Alarms are generated by the gateway and reported to the control system. If the gateway reports an alarm, the alarm is always acknowledged by the control system. Organization blocks (OB) are available in the configuration software for further processing of alarms. The organization blocks are triggered by alarms. For more information about organization blocks, refer to the Siemens AG user documentation.

If you are connecting configuration software to the PROFINET network, you can access diagnostic information about faults online.

The following figure illustrates cyclic and acyclic data traffic.

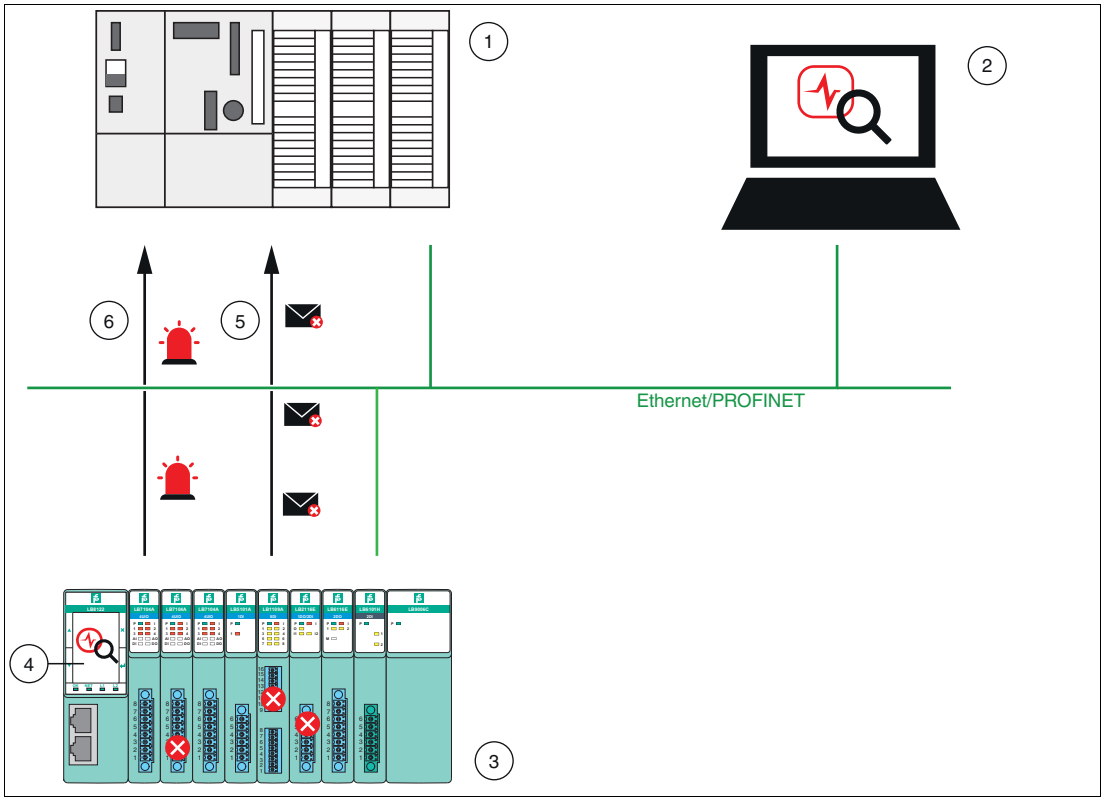

Figure 1.1 Diagnostic information

Item	Description
1	Control system
2	Configuration software
3	LB/FB remote I/O system
4	Gateway diagnosis
5	Cyclic data: fault bits and alarm bits
6	Acyclic data: alarms

For further information on the error and alarm bits in cyclic data, see chapter .

1.2 LED Indicator

Fault elimination is supported by a series of LEDs on the gateway and the I/O modules.

Gateway
4 LEDs on the front of the gateway provide information about the current device status and the status of data exchange.
Information about the meaning of the LEDs on the gateway see chapter .

I/O modules
The I/O modules have diagnostic LEDs that visualize the status of fieldbus communication and the states of the physical connection.
Refer to the respective datasheets of the I/O modules for the meaning of the LEDs.

9 Troubleshooting

9.1 Communication Errors

If there is a communication error, go through the following checklist and take any relevant action.

Fault	Action(s)
Communication error	• Check that the cable connections are intact and that all communication components are adequately powered. • Check that the parameterized IP address settings and the device name (Profinet device name) in the configuration software match the settings of the LB/FB remote I/O system. • Check that the current settings from the configuration software have already been loaded into the control panel. • Check the network topology and network association (network mask). • Check that the right GSDML file is being used.
A new LB/FB remote I/O system will not work in a network in which other LB/FB remote I/O systems are already in operation	• Check that the parameterized IP address settings and the device name (Profinet device name) in the configuration software match the settings of the LB/FB remote I/O system.
The control panel cannot find the LB/FB remote I/O system in the network	• Check that the gateway is plugged in correctly and supplied with sufficient power. • Check the communication status using the gateway LEDs, see chapter 6.6. • Check the network topology and network association (network mask)
Channel errors reported	• If no I/O module has yet been installed in the configuration kit or in the LB/FB remote I/O system, this is not an error. The gateway has checked whether any configured I/O modules are available. Install the I/O modules. • Check that all configured I/O modules have been plugged in correctly. • Check that all channels with line fault detection are wired correctly. You can obtain information about channel errors via: Alarm signal and diagnostic message Diagnostics indicator in the display LEDs on the I/O modules
No HART communication	• Check that the I/O module in use supports the HART protocol. Firmware version 3 or higher. • Check that the HART function is activated via the corresponding channel parameter (HART on/off). • Check that a loop current required for HART communication is flowing. • Check that the connected HART device is using the short address 0.

Fault	Action(s)
LB/FB extension unit not working	• Check that the wires on the base unit and extension unit are connected correctly.

9.2 Faults Indicated by LEDs

Fault elimination is supported by a series of LEDs on the gateway, the I/O modules, and the power supply. You can find a description of the LED display in the datasheets of the respective modules. The datasheets can be downloaded from our website https://www.pepperl-fuchs.com.

Download datasheet

1. Enter the product name in the **Product/Keyword** search box and click on the **Search** magnifying glass icon.

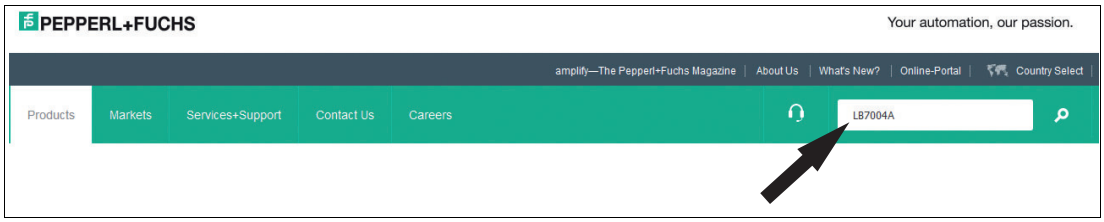

Figure 9.1 Keyword search

↳ The search results are displayed.

2. Select your product from the list of search results.

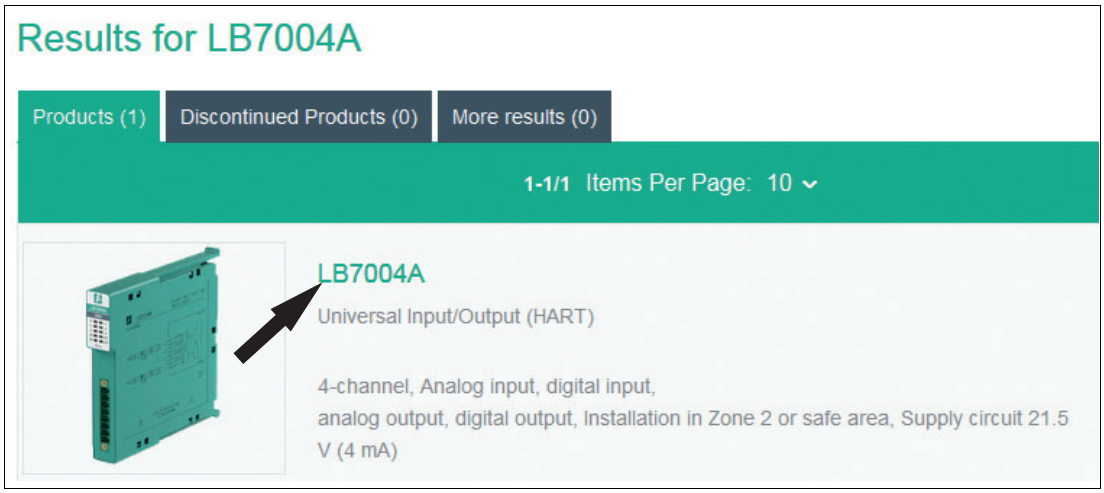

Figure 9.2 Search results

↳ The project detail page opens.

3. Click on the **Download PDF** button in the product information list. It is possible to select one of the available languages directly next to the **Download PDF** button.

Figure 9.3 Download datasheet

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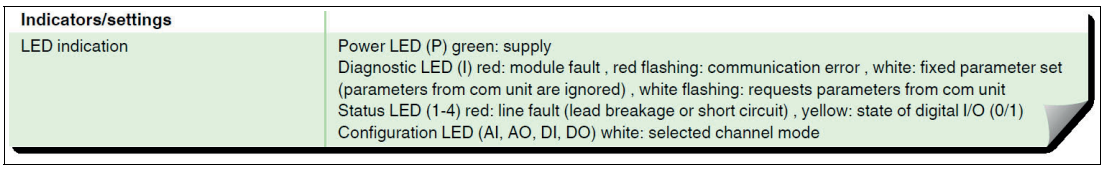
↳ The datasheet opens in PDF format.

4. Scroll down the datasheet until the **Indicators/settings** feature is visible. Information about the LED display of your module can be found here.



Indicators/settings	
LED indication	Power LED (P) green: supply Diagnostic LED (I) red: module fault , red flashing: communication error , white: fixed parameter set (parameters from com unit are ignored) , white flashing: requests parameters from com unit Status LED (1-4) red: line fault (lead breakage or short circuit) , yellow: state of digital I/O (0/1) Configuration LED (AI, AO, DI, DO) white: selected channel mode

Figure 9.4 LED indicator

Note

Depending on the load, the output circuit may show a lead breakage due to overload. With solenoid valves, this can result in their input resistance being outside the lead breakage detection range. Connect a high resistance resistor in parallel to improve the function.

If short-circuit detection is triggered with booster valves, the charging capacitor may be the cause of the error. Place a low resistance resistor in series to correct this behavior. If necessary, deactivate line fault detection.

9.3 Signal Faults

Fault	Action(s)
No signal change when the parameters are changed	• Check whether the I/O module is in operation. • Check whether the change has already been loaded into the control panel/remote I/O system.
Faulty signal	• Check whether there is a short circuit or lead breakage within the circuit. • Check that the field devices and sensors are working properly. • If necessary, replace the I/O module. • Check the transmission path to the I/O module.
All signals of a LB/FB remote I/O system are faulty	• Check whether the power supply is working properly. • Check the network connection using the gateway's link LEDs, see chapter 6.6. • Check the network communication using the "NET: network status" gateway LED and, if necessary, with the help of a protocol analyzer, see chapter 6.6.
Output module switches off or to substitute values	• Check whether the communication connection has been interrupted. The selected communication timeout may be too small. The timeout value should be a multiple of the cycle time. • Communication with the gateway is interrupted. • Check that the I/O module is plugged into the backplane properly. • Check whether the control panel is transmitting invalid output data (IOPS = BAD).
Input channel delivers no data	Check that the I/O module is plugged into the backplane properly. • Communication with the gateway is interrupted. • Check whether the affected channel is operating properly (diagnostics, e.g., via display, no parameter error/line fault (IOPS = BAD).
I/O module works fine in a certain slot but not in another	• Check that the connector is in good order on the faulty slot and that the I/O module pins are not bent. • If necessary, do not continue to use the slot.
Data occasionally incorrect	• Check whether the measured value is being distorted by external influences. • Check that the shielding is intact.
Signal does not change	• Check whether the substitute value is active, since there is no bus communication. • Check whether there is a line fault.
Channel error messages (e.g., LFD) are not transmitted.	• Check whether the corresponding monitoring function has been switched on. If not, activate it.
No input/output data	• Check that the right I/O module is connected and is ready for operation. • Check that the analog input/output scaling is compatible with the system requirements. • Check that the wiring is in order.

Fault	Action(s)
I/O module reported to be faulty	• Check that the right I/O module is plugged in. • Check that the green LED on the I/O module is lit and that the I/O module is correctly plugged in.
I/O module/channel error	• Check that the green LED on the I/O module is lit. If not, there is no contact with the backplane or the fuse is faulty. If all the I/O modules in a segment have failed, the fault is in the power supply or the backplane. • Using the display, check the I/O module diagnostic information.

Fault	Action(s)
All I/O modules of an expansion backplane fail	• Check that the power supply is working properly. • Check that the extension wiring is correct and intact.

9.4 Faults and their Effects

In the following, the consequences of the following faults are listed.

Fault	Diagnosis	Consequence(s)
Power supply failed	• The control panel receives an error message if this has been parameterized.	• For systems without power supply redundancy, the LB/FB remote I/O system can be undersupplied. The undersupply can lead to malfunctions or even complete failure. • Power supply redundancy allows the LB/FB remote I/O system to continue to operate normally in the event of a power supply failure.
Bus communication failed	The control panel detects the failure.	The outputs adopt substitute values provided this has been preconfigured.
Gateway or voltage failed	The control panel detects the loss of communication with the LB/FB remote I/O system and initiates the set measures.	The outputs are without voltage or enter the "safe state" (off).
I/O module failed	• The control panel receives corresponding diagnostic information from the LB/FB remote I/O system.	• The input signals are identified as faulty and must be processed by the control panel in accordance with the desired substitute value strategy.
Incorrect I/O module	• The control panel receives a message indicating that the planned I/O module could not be commissioned.	• The I/O module does not go into operation. All input data are identified as faulty. The control panel is responsible for the appropriate substitute value strategy. • The I/O module does not go into operation. All outputs remain in the initialization state (off) and cannot be changed. • I/O modules that receive parameters from the gateway for their operation signal the absence of parameter data through a flashing LED, see chapter 6.6.
I/O module missing or has been removed	• The control panel receives a message indicating that the planned module is not available.	• The corresponding data of the missing I/O module are identified as invalid. The control panel is responsible for the appropriate substitute value strategy.

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Fault	Diagnosis	Consequence(s)
Module-specific errors		
Line fault in the input module/channel	• The control panel receives a corresponding LFD error message. The data from the channel are identified as invalid.	• An LFD error is indicated by a red LED on the corresponding I/O module (see description of the relevant I/O module) • The gateway transmits the input data it currently receives from the I/O module. The data is identified as invalid due to the line fault. The control panel is responsible for the appropriate substitute value strategy. • Temperature inputs only return to normal operation once the error has been corrected and the LFD delay has lapsed.
Line fault in the output module/channel	• The control panel receives a corresponding LFD error message.	• An LFD error is indicated by a red LED on the corresponding I/O module (see description of the relevant I/O module)

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