OPERATING INSTRUCTIONS

UE4155 PROFIsafe

Bus Node

GB

SICK
Sensor Intelligence.

Contents

Contents

1 About this document

Please read this chapter carefully before working with this documentation and the UE4155 bus node.

1.1 Function of this document

These operating instructions are designed to address *the technical personnel of the machine manufacturer* or *the machine operator* in regards to safe mounting, installation, configuration, electrical installation, commissioning, operation and regular examination of the UE4155 bus node.

These operating instructions do *not* provide instructions for operating machines on which the bus node is, or will be, integrated. Information on this is to be found in the appropriate operating instructions of the machine.

1.2 Target group

These operating instructions are addressed to *planning engineers*, *developers* and the *operators* of plant and systems which are to be protected by one or several protective devices in connection with the UE4155 bus node. It also addresses people who integrate the UE4155 into a machine/system, initialise its use, or who are in charge of servicing and testing the device.

1.3 Scope

Note These operating instructions are applicable to the bus nodes UE4155 with one of the following type-label entries in the *Operating Instructions* field: 8010172, 8010172 Q572 or 8010172 TF82. This document is part of SICK part number 8010172 (operating instructions “Bus node UE4155 PROFIsafe” in all available languages).

These operating instructions are original operating instructions.

You will require Version 2.10 or higher of the CDS (Configuration & Diagnostic Software) in order to configure and diagnose these devices. To determine the version of your software version, select the **Module Info...** option in the **?** menu.

1.4 Depth of information

These operating instructions contain the following information about the UE4155 bus nodes:

- installation and mounting
- electrical installation
- putting into operation and configuration
- integration into other protective devices (examples of circuits)
- care and maintenance
- fault, error diagnosis and troubleshooting
- part numbers
- conformity and approval

Planning and using protective devices such as the UE4155 also require specific technical skills which are not detailed in this documentation.

When operating the UE4155, the national, local and statutory rules and regulations must be observed.

Please consult the PROFIBUS specification “PROFIsafe – Profile for Safety Technology on PROFIBUS DP and PROFINET IO”, version 2.4 for more information about the PROFIBUS protocol.

Note From firmware version 1.40 „PROFIsafe – Profile for Safety Technology“, version 2.00 is supported (compatible with version 1.30).

Note We also refer you to the SICK homepage on the Internet at: www.sick.com

Here you will find information on:

- sample applications
- a list of frequently asked questions about the UE4155
- these operating instructions in different languages for viewing and printing

1.5 Abbreviations

CDS SICK Configuration & Diagnostic Software = software for the configuration of the UE4155

EFI Enhanced function interface = safe SICK device communication

ESPE Electro-sensitive protective equipment, e.g. SICK C4000 safety light curtain

FPLC Fail-safe programmable logic controller

GSD Generic station description. Is required to configure the PROFIBUS network for every PROFIBUS user. Is included within the scope of delivery of the UE4155 bus node

OSSD Output signal switching output

PROFIBUS Process Fieldbus = an open communication protocol in accordance with DIN EN 61 158-3 and DIN EN 61 784 part 1 and part 5-3 for deployment in the entire field

PROFIsafe Profile for safety-related data transmission via the PROFIBUS network

SDL Safety data link = SICK safety interface (connection for OSSDs and EFI)

UE4100 All bus nodes of the UE4100 family.

1.6 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Refer to notes for special features of the device.

○, ● **Red**, ☼ **Red** The UE4155 has multicolour LED displays. LED symbols indicate the status of an LED on the UE4155:

○ The LED is off.
● **Red** The LED turns red.
☼ **Red** The LED flashes red.

➢ Take action ... Instructions for taking action are shown by an arrow. Carefully read and follow the instructions for action.

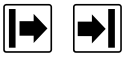
WARNING

Warning!

A warning notice indicates an actual or potential risk or health hazard. They are designed to help you to prevent accidents.

Carefully read and follow the warning notices!

Software notes show the location in the CDS (Configuration & Diagnostic Software) where you can make the appropriate settings and adjustments.



Sender and receiver

In drawings and diagrams, symbol ▣ denotes the sender and symbol ▣ denotes the receiver of an electro-sensitive protective equipment.

Trademark

Intelliface is a registered trademark of SICK AG.

2 On safety

This chapter deals with your own safety and the safety of the equipment operators.

➢ Please read this chapter carefully before starting to work with the UE4155 or with machinery protected by the UE4155 in connection with other safety components.

2.1 Qualified safety personnel

The UE4155 bus node and the components connected to it may only be assembled, operated and maintained by qualified safety personnel. Qualified safety personnel are defined as persons who

- due to their specialist training and experience have adequate knowledge of the power-driven equipment to be checked

and

- have been instructed by the responsible machine owner in the operation of the machine and the current valid safety guidelines

and

- are sufficiently familiar with the applicable official health and work safety regulations, directives and generally recognized engineering practice (e.g. DIN standards, VDE stipulations, engineering regulations from other EC member states) that they can assess the work safety aspects of the power-driven equipment

and

- have access to these operating instructions and have read them.

As a rule these are qualified safety personnel from the ESPE manufacturer or also persons who have been appropriately trained at the ESPE manufacturer, are primarily involved in checking ESPE and are allocated the task by the organisation operating the ESPE.

2.2 Applications of the device

The UE4155 bus node is a decentralized input/output module to integrate safety components into the PROFIsafe safety-bus system via IP 67 connection technology. It can be used in accordance with the following standards:

- IEC 61508 up to SIL3
- EN 62061 up to SILCL3
- EN ISO 13849-1 up to category 4 or Performance Level e

The degree of safety actually attained (Performance Level or SIL claim limit) depends on the external circuit, the design of the wiring, the parameter configuration, the selection of the control switches and their placement on the machine.

In the United States of America the bus node is approved in accordance with UL 508 and UL 1998, type NRNT (control equipment, switching amplifiers).

You may only use the UE4155 as a PROFIsafe Slave in connection with an FPLC[1)].

[1)] Corresponding control facilities are offered by Siemens, for example, with its modules S7-300F and S7-400F.

2.3 Correct use

The UE4155 bus node must be used only as defined in chapter 2.2 “Applications of the device”. It must be used only by qualified personnel and only on the machine/system where it has been installed and initialised by qualified safety personnel in accordance with these operating instructions.

If the device is used for any other purposes or modified in any way — also during mounting and installation — any warranty claim against SICK AG shall become void.

2.4 General safety notes and protective measures

WARNING

Pay attention to the safety notes!

Please observe the following procedures in order to ensure the correct and safe use of the UE4155 bus node.

- The national/international legislative provisions apply to the installation and use of the bus node and the safety components connected to it, e.g. a safety light curtain or components fitted with contacts; these legislative provisions apply also to the commissioning and recurring technical examinations, in particular:
  - Machine Directive 2006/42/EC
  - EMC Directive 2004/108/EC
  - Work Equipment Directive 89/655/EEC
  - the work safety regulations/safety rules
  - other relevant health and safety regulations

  Manufacturers and operators of the machine with which the bus node is used are responsible for obtaining and observing all applicable safety regulations and rules.
- The notes in these operating instructions (e.g. on use, mounting, installation or integration into the existing machine controller) must be observed.
- The test procedures in the operating instructions of all connected components must be observed.
- Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must therefore check the effectiveness of the protective device.

  The person who makes the change is also responsible for the correct protective function of the device. When making configuration changes, please always use the password hierarchy provided by SICK to ensure that only authorised persons make changes to the configuration. The SICK service team is available to provide assistance if required.
- The tests must be carried out by specialist safety personnel or specially qualified and authorised personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- The operating instructions must be made available to the operator of the machine where the UE4155 bus node is fitted.
- The external voltage supply of the device must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204.
- When using the bus node in accordance with the requirements in UL 508, the power supply must permit “use in class-2 circuits”. No current may be allowed to flow that is > 8 A.

2.5 Sound environmental performance

The UE4155 bus node is constructed in such a way that it adversely affects the environment as little as possible. It uses only a minimum of power and natural resources.

➢ At work, always act in an environmentally responsible manner.

2.5.1 Disposal

Unusable or irreparable devices should always be disposed as per the applicable national regulations on waste disposal (e.g. European waste code 16 02 14).

Notes We would be pleased to be of assistance on the disposal of this device. Contact your local SICK representative.

2.5.2 Separation of materials

➢ Send the separated parts for recycling as appropriate (see Tab. 1).

Tab. 1: Overview on disposal by components

Components	Disposal
Product	Electronic recycling
Packaging	
Cardboard, paper	Paper/cardboard recycling
Polyethylene packaging	Plastic recycling

3 Product description

This chapter contains information about the special properties of the UE4155 and describes the construction and operating principles of the device.

➢ Please read this chapter before mounting, installing and commissioning the device.

3.1 Special properties of the UE4155

- 8 × 2 field-signal connections to connect active and passive safety components up to category 4 according to EN ISO 13849-1
- easy configuration and diagnosis with the aid of Windows-based CDS software (Configuration & Diagnostic Software)
- offline configuration of the systems with out FPLC is possible
- support for PROFIBUS DP V1:
  - cyclic communication with DP-Master Class 1 (central control)
  - acyclic communication with DP-Master Class 2 (configuration and diagnosis tool)
- support for PROFIsafe V1.20 10/2002
- From firmware version 1.40: Support for PROFIsafe V2.00 (compatible with 1.30)
- 2 SDL connections to connect active SICK safety components
- configuration and diagnosis of all the components connected to the SDL connection via the configuration connection of the UE4155

In addition, data can be written to the SDL devices via the process image of the FPLC. You will find an operating description in the operating instructions for the related SDL device. You can also extend the functions of the UE4155 bus node with the aid of the CDS by adding what are referred to as function packages. Function packages make it possible to use specific functions of the devices connected to the bus node. Moreover, you obtain preconfigured applications in connection with the connected devices. You can find more information about this in the operating instructions of the relevant function package.

Note The functions of the bus node with function package UE4100 for C4000 Standard/Advanced activated in the CDS can only be used in conjunction with the Safety Light Curtain C4000 that has the following entry on the type label in the *Software version* field: “3.00” or higher.

You can find the ordering information for the function packages in chapter 11.2 “Accessories” on page 64.

3.2 Operating principle of the device

3.2.1 PROFIBUS DP principle

PROFIBUS DP is an open communication protocol in accordance with DIN EN 61158-3 and DIN EN 61784 part 1 and part 5-3 for deployment in the entire field. It enables cyclic and acyclic data exchange between the control, the *PROFIBUS DP master* and connected components, the *PROFIBUS DP slaves*.

The PROFIBUS DP master communicates with the PROFIBUS DP slaves via “telegrams”. Various telegrams are defined in the PROFIBUS DP, e.g. for requesting status information (cyclic communication) or for transmitting configuration data (acyclic communication).

The UE4155 is physically connected to the PROFIBUS DP by a shielded two-wire copper conductor using IP 67 connection technology.

PROFIsafe

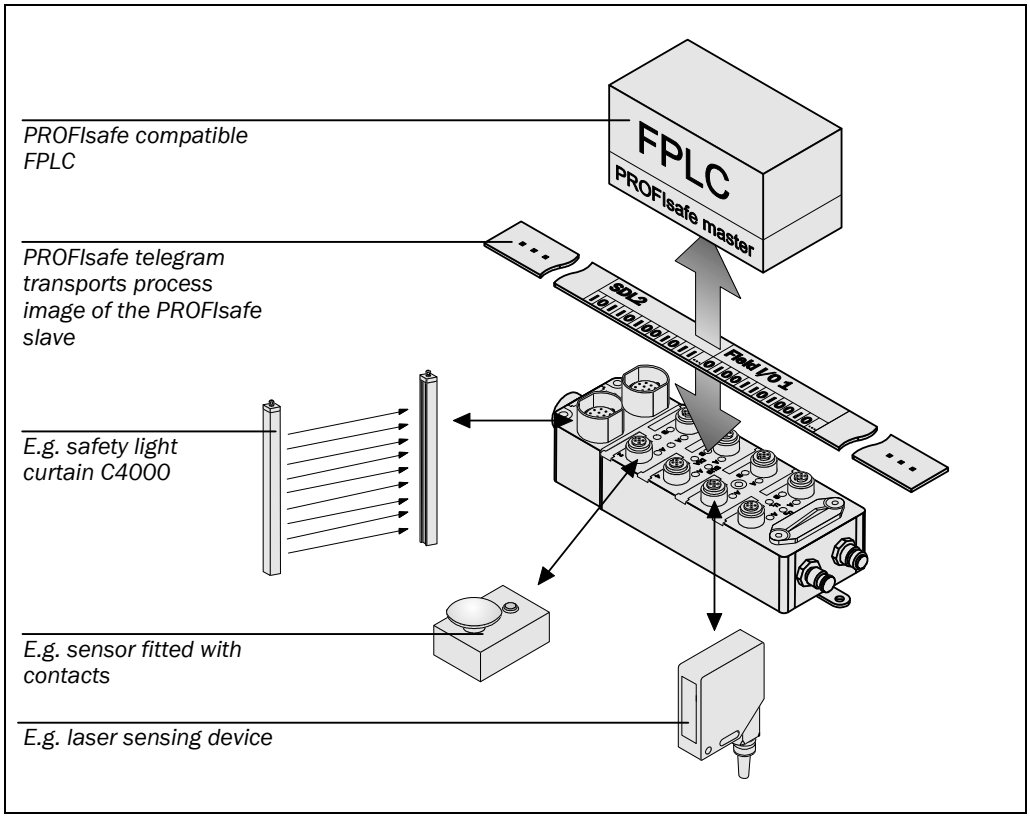
PROFIsafe is an extension of the PROFIBUS DP protocol for safety technology. In the case of PROFIsafe, the communication between the PROFIsafe users (“failsafe DP standard slaves”) and the PROFIsafe master is protected against transmission errors and changes. The UE4155 is a PROFIsafe device according to “PROFIsafe — Profile for Safety Technology”, V1.20 10/2002. This is why the UE4155 constantly expects a PROFIsafe master and does not establish any communications with unsafe PROFIBUS DP masters.

Note You can find more information about PROFIBUS and PROFIsafe on the Internet at www.profibus.com.

3.2.2 The principle of the bus node

The UE4155 bus node is a PROFIsafe slave. It collects the electrical signals from the components connected to the UE4155 to form what is known as a *process image*. It sends this to the PROFIsafe master in the form of a *PROFIsafe telegram*. The PROFIsafe master copies the input data of the from the PROFIsafe telegram into the FPLC process image. The FPLC evaluates the input process image. It then places the calculated output values into the output process image. The PROFIsafe master transmits these output data to the bus nodes in a PROFIsafe telegram.

Fig. 1: Working principle of the UE4155 bus node



The UE4155 transforms the incoming telegrams from the FPLC into electrical signals that the connected components can process, e.g. by ...

- switching a non-safety-related output.
- addressing specific functions of the connected devices.

The following advantages are to be had by using the UE4155 bus node:

- cost-savings on purchase: The components to be connected do not have to have their own PROFIBUS slave.
- improved use of PROFIBUS capacity: Only one PROFIBUS slave is necessary for several components of an application.
- integration of *all* the functions of present and future SICK safety components with an SDL interface without loss of functionality
- lower cost of wiring on the PROFIBUS side as several components are connected as a PROFIBUS user

3.2.3 Device construction

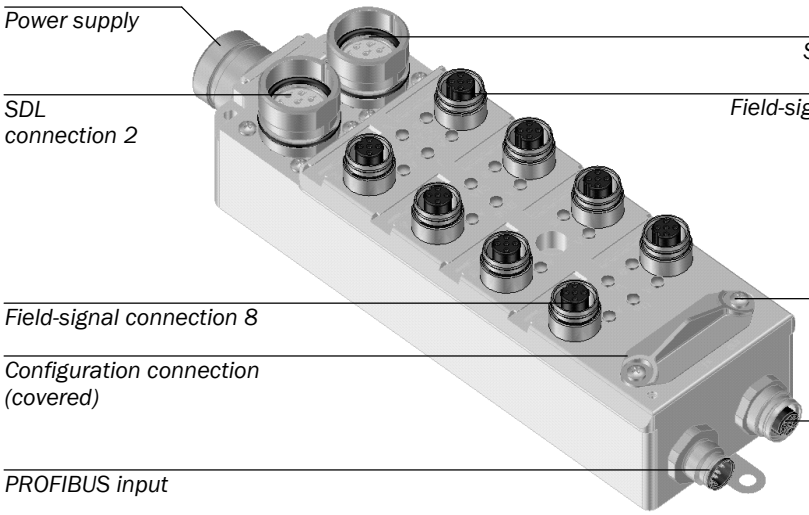


Fig. 2: Construction of the UE4155 bus node

Tab. 2: Connections of the UE4155 bus node

Connection	Function	See also
Power supply	Common voltage supply for UE4155 and the safety components connected to the SDL and field-signal connections	Chapter 5.1 on page 28
SDL connections	To connect safety components to SICK device communication and/or OSSDs	Chapter 3.5.3 on page 21
Field-signal connections	To connect OSSDs and passive components, e.g. switches fitted with contacts to voltage-free contacts 1 field-signal connection = 2 channels (2 safety inputs and 2 outputs) Connections can be shared by a two-way splitter	Chapter 3.5.1 on page 17
Configuration connection	To directly connect a PC to the SICK CDS in order to configure the system	Chapter 8.4ff. on page 42
PROFIBUS connection	Input and output according to PROFIBUS specification	Chapter 5.4 on page 31

Please refer to chapter 10 “Technical specifications” on page 55 for the data sheet.
A dimensional drawing is included on page 61.

3.3 Examples of range of use

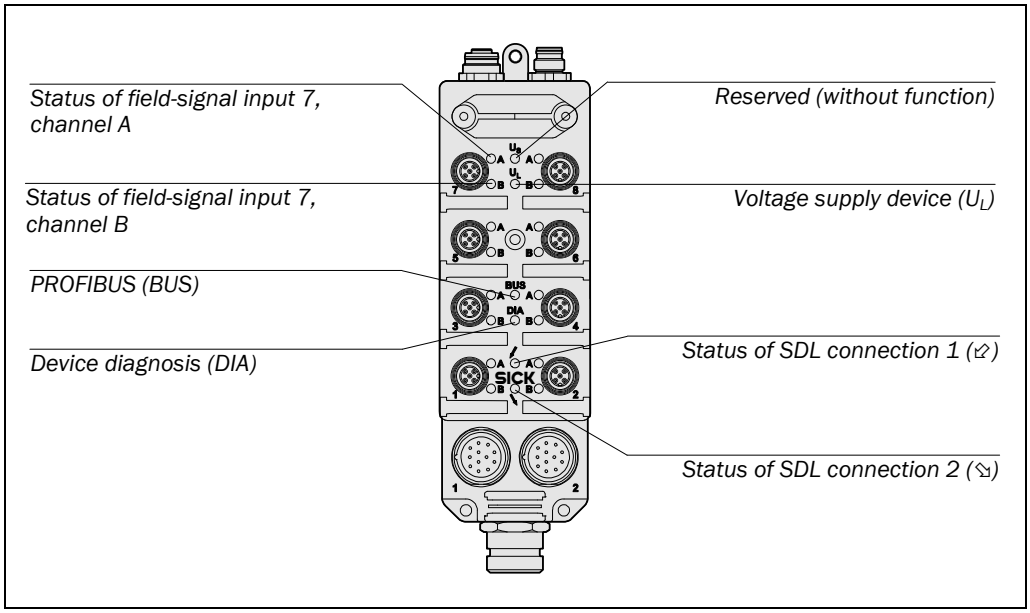
The following overview lists examples of several possible uses of the UE4155 in connection with various safety components. More detailed examples are contained in chapter 6 “Examples of circuits” starting on page 33.

- Door unit:
  The combination of inputs and outputs of access protection units (e.g. C4000, S3000), signal lamps and status indicators, reset button, emergency stop pushbutton and door switch
- Muting applications:
  The combination of inputs and outputs of ESPE, muting sensors, muting lamps, swing doors, reset button, start, bypass, emergency stop
- Protecting turntables:
  The combination of inputs and outputs of access protection units (e.g. C4000, S3000), limit switches, locking devices and emergency stop pushbutton

3.4 Status indicators

The UE4155 bus node has multicolour operational status indicators, one of each for the PROFIBUS, the diagnosis and each SDL connection, and two of each for each field-signal connection. Take note of the displays of the connected devices when the device is operational.

Fig. 3: Status indicators of the UE4155 bus node



Tab. 3: Status indicators of the UE4155 bus node

Display		Meaning
U_S		Reserved
U_L	○	No supply voltage
	● **Red**	Internal supply voltage too low or firmware is being updated
	● **Green**	Voltage supply OK
BUS	○	PROFIBUS is working but safety communication is inactive. No PROFIsafe master was detected.
	● **Green**	PROFIBUS is working with PROFIsafe, safety communication is active
	☼ **Green**	Acknowledgement by user mandatory
	● **Red**	General PROFIBUS error, no communication is possible
	☼ **Red**	Not a valid PROFIBUS configuration
DIA	○	Device ready for operation
	● **Red**	Configuration is being transferred or was not concluded
	☼ **Red**	1 Hz: System error (lock-out) ½ Hz (75 % on, 25 % off): Field-signal connection error)
A and B	○	Field-signal connection A or B is inactive
	● **Yellow**	Field-signal connection A or B is active
	● **Red**	Overload at field-signal connection output A or B
⇖ and ⇘	○	Device communication at connection SDL1 (⇖) or SDL2 (⇘) is OK. The switching outputs (OSSDs) of the connected devices are off.
	● **Yellow**	Both switching outputs (OSSD1 and OSSD2) of the connected device are active.
	☼ **Red**	Device-communication error at SDL connection

3.5 Configurable functions

This section describes the functions of the UE4155 bus node which are selectable via software. Chapter 6 “Examples of circuits” on page 33 describes several typical applications that you can realise with the aid of the functions described below.

WARNING

Test the protective device after any changes!

Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must therefore check the effectiveness of the protective device. To this end, please observe the notes in chapter 7.3.4 “General acceptance of the bus node” on page 38.

The person who makes the change is also responsible for the correct protective function of the device. When making configuration changes, please always use the password hierarchy provided by SICK to ensure that only authorised persons make changes to the configuration. The SICK service team is available to provide assistance if required.

When starting to configure the device, you may save an application name with a maximum of 22 characters. Use this function as a “memory jog”, e.g. to describe the application of the current device configuration. Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **General**.

3.5.1 Functions of the field-signal connections

The field-signal connections are suitable for connecting:

- safety components fitted with contacts, e.g. an emergency stop pushbutton or a safety door switch with or without a locking device
- components fitted with contacts, e.g. control switches or key-operated switches
- switching outputs (OSSDs) of active safety sensors, e.g. C2000, M2000, C4000, S3000, among others
- active sensors, e.g. single-beam photoelectric switches, muting devices

Note

It is **only** permitted to connect a muting lamp **to channel A of field-signal connections 7 and 8**, as only their outputs have fault monitoring.

WARNING

Make regular checks of the components fitted with contacts!

When connecting components with contacts to the bus node, which are only occasionally activated, you must take organisational measures to safeguard that any fault in these components will be detected, e.g. by means of monthly manual checks (corresponds to category 4 according to EN ISO 13849-1).

Use the outputs of the field-signal connections only for components that are not essential for safety!

The outputs of the field-signal connections are not permitted to be used for switching off agents that may jeopardize the situation. This is why you may only use the outputs to control lamps, locking devices, etc. or to supply sensors, etc.

A cut-off signal at the input must be available for at least two PROFIBUS cycles!

You must safeguard this as early as the design phase by selecting components that are suitable for this. A cut-off signal that is available from one sensor on the field-signal input for only one cycle will not be detected by the FPLC under certain circumstances.

Every field-signal connection on the UE4155 has two safe inputs and two standard outputs. You can configure these inputs and outputs in different ways:

- Single-channel: The two channels of the field-signal connection have entirely separate configurations.
- Two-channel: Channels A and B of the field-signal connections are interdependent. Details can be found in chapter 3.5.2 “Two-channel selection of the field-signal connections” on page 19ff.

In addition to the type of connection, you can also configure the following parameters for an input/output:

Tab. 4: Field-signal input/output parameters that can be set

Parameter	Description
Output (Out A, Out B)	You can configure one of the following signals on the output: • Permanently 24 V, e.g. as voltage supply • Permanently 0 V (Out) • FPLC output signal • test signal for safety components fitted with contacts, e.g. an emergency stop pushbutton • field-signal connections 7 and 8 only: monitoring a muting lamp • signal bit of an SDL-compatible component on the SDL connection (bit set = 24 V)
Safety input (In A, In B)	You can pass on the input signal as follows: • to the FPLC safety input • to the safety input of a device connected to the SDL connection[2)]
Input delay [ms]	Delay (5–90 ms) between the detection of the signal change and the effective evaluation of the input signal Application: Several unintentional brief signal changes occur when opening or closing a component fitted with contacts as the result of the bouncing. In order for the bounce of the components fitted with contacts not to influence the evaluation in the bus node, you must set the input delay time longer than the bounce time of the components fitted with contacts. If you read in a contact without bounce time via the safety input, e.g. the switching output (OSSD) of a light grid/light curtain, you must set the input delay to **Inactive** in order to safeguard immediate signal processing.

WARNING

Check the response time of the protective device!

The configured input delays increase the response time of the protective device. You must take these times into account when calculating the response time of the protective device (see chapter 10.2 “Response time” on page 57).

Deactivate unused sections of the field-signal connections!

- If you are not using an input of a field-signal connection, you must configure the safety input of the corresponding channel with the aid of the CDS to **Off**.
- If you are not using an output of a field-signal connection, you must configure the output of the corresponding channel to **Static off**.

If a signal is still present on an input or output configured in this way, the bus node detects this as an error status.

Note

The bus node monitors the bounce time on each input and detects if the bounce time exceeds the input delay time set.

Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **I/O** of the appropriate system. The CDS online help for UE4155 contains more detailed information about the individual parameters.

[2)] Only in connection with the corresponding function package to the UE4155.

The electrical connection to the field-signal connections is described in chapter 5.3 “Field-signal connections M12 × 5 + FE” of this document on page 30. Examples can be found in chapter 6 “Examples of circuits” on page 33.

Routing

When configuring the outputs of a field-signal connection as an output signal, you must establish the source of these signals in the bus node. This setting is called *Routing*.

SICK offers special function packages for the bus nodes in connection with SICK safety components on the SDL connection. With the appropriate function package, you can ...

- route field signals to a particular signal bit of a device on the SDL connection, i.e. to a connected ESPE.
- pick up a signal bit from a device on one of the SDL connections and place it on an output signal, e.g. the *Reset required* signal bit of an ESPE.

Note If you route the input of a field-signal connection directly onto the signal bit of an SDL connection, the FPLC can no longer modify this signal bit of the SDL connection.

The operating instructions of the function package contain information about the signal bits of the corresponding device that can be routed.

Test-signal allocation

In the case of test signals, you must establish which bus-node input is to expect the test signals when the device is operating. You will usually use the input of the same channel. However, you can also use the input of a different field-signal connection (e.g. when connecting a operating mode selector switch with more than two settings).

3.5.2 Two-channel selection of the field-signal connections

In the case of two-channel selection, both input and output channels A and B of the field-signal connection are interdependent. Possible selections:

- equivalent: switching contacts with the same states
- complementary: switching contacts with different states (cf. Tab. 5).

Notes

- In the case of the two-channel selection, the bus node transfers the result of the evaluation of both inputs in the status bit of input A.
- If the input signal changes from the *active* status into a different one, for safety reasons the bus node immediately switches the corresponding input in the process image to 0 (cf. Tab. 5).

Monitoring the discrepancy time

The discrepancy time is the maximum period in the case of the two-channel selection, within which both the inputs of the field-signal connection may have an inadmissible status without the bus node detecting an error. Discrepancy time monitoring commences when the status of an input changes. The bus node detects an error when both inputs of the field-signal connection do not have the same or opposite statuses at the end of the discrepancy time.

If you have set the discrepancy time to **Inactive**, the bus node does not generate an error when the status of only one input changes.

If an error occurs ...

- the bus node transfers failsafe values to the PROFIsafe telegram. This value is 0 for both inputs.
- the bus node sets the *discrepancy-time overrun* diagnosis bit of the field-signal connection.

Tab. 5 clarifies the connection.

Tab. 5: Input signals and process image at the end of the discrepancy time

Two-channel selection	Input signal			Process image		Discrepancy-time overrun diagnosis bit
	In A	In B	Status	In A	In B	
Equivalent	0	0	Inactive	0	0	0
	0	1	Discrepant	0	0	1
	1	0	Discrepant	0	0	1
	1	1	Active	1	0	0
Complementary	0	0	Discrepant	0	0	1
	0	1	Inactive	0	0	0
	1	0	Active	1	0	0
	1	1	Discrepant	0	0	1

Notes

- For the duration of the set discrepancy time, the bus node does not transfer any other signal changes of the field-signal connection to the PROFIsafe telegram, nor does it route this to other connections.
- When the input status changes from **Inactive** to **Active**, the discrepancy time delays the change in the process image.
- In order to delete a discrepancy-time error, you must reset both inputs to their **Inactive** status.

3.5.3 Functions of the SDL connection

The SDL connection contains the safe SICK device communication (EFI), two inputs for OSSDs and the voltage supply for the sensor. The connections are suitable e.g. for the senders and receivers of a SICK safety light curtain. You can also connect devices to the SDL connection that do not have safe SICK device communications, if these devices have tested semiconductor switching outputs (OSSDs).

- If you connect devices to the SDL connections with safe SICK device communication, the bus node makes the device information available in two different ways:
  - for the FPLC in the PROFIsafe telegram
  - for devices on the field-signal connections as signal sources (“routing”)

  The UE4155 bus node can read the data of the safe SICK device communication and write process data to the devices via safe SICK device communication.
- If you connect devices with OSSDs that do not have safe SICK device communication, the bus node only makes the information from the OSSDs available in the PROFIsafe telegram.

Reading the OSSD status at the SDL connection

You can read the OSSD status at an SDL connection in two ways:

- Via the safe SICK device communication: Devices with safe SICK device communication transfer the OSSD status to the bus nodes as software information. This makes the information from the FPLC available in the process image.
- Directly via the OSSD inputs as “hardware OSSDs”: This means there is no processing time necessary for safe SICK device communication, and that the signal therefore reaches the PROFIsafe telegram faster.

Note The way in which the bus node reads the OSSD status influences the system response time (see chapter 10.2 “Response time” on page 57).

For devices on the SDL connection that do not have safe SICK device communication, you **must** activate the **Read hardware OSSD** option with the aid of the CDS: Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **SDL**, **Read hardware OSSD** option of the appropriate system.

3.6 Selection principles

This chapter is intended for production engineers who need information about the electronic interfaces and their internal circuitry to realise their applications.

Note All the circuit elements of the bus node with the exception of the field-signal outputs are protected from a reversal of the voltage supply.

3.6.1 Field-signal inputs

You may use the field-signal inputs to read the statuses of the following types of outputs that supply electrical power:

- contacts at 24 V, e.g. from components with contact outputs that are driven by an allocated field-signal output
- tested 24-V-PNP-semiconductor-switching outputs, e.g. from SICK C2000/M2000, C4000, S3000, among others
- untested 24-V-PNP-semiconductor-switching outputs, e.g. photoelectric switches

Properties

- 8 × 2 field-signal inputs
- safe status is 0 V (idle)
- inputs at 0 V that draw current
- characteristic according to IEC 61131-2, type 2
- each input has its own status display ● **Yellow**
- input delay (“debouncing”) is configurable (see chapter 3.5.1 “Functions of the field-signal connections” on page 17)

Possible error detection

The self-test in the bus node detects when a field-signal input cannot return to the safe status owing to an internal error. Furthermore, the bus node can identify the following errors:

- discrepancy in the case of two-channels (see chapter 3.5.2 on page 19)
- cross-circuit on test signals from other field-signal outputs of the bus node

You must take further measures to detect external errors, as described in the sections below.

Safe reading of contacts at 24 V

In order to detect errors outside the bus node, the corresponding contacts of field-signal outputs of the bus node must be fed with test signals. Because every field-signal output uses a different test signal, you must establish at the configuration stage which field-signal output the contact must use to obtain its test signal.

In a corresponding configuration the bus node can detect an external short-circuit to other test signals, to 24 V or to ground.

Reading PNP outputs safely

When connecting testable sensors, the FPLC must use a test cycle to detect possible errors. The FPLC initiates the test cycle and awaits a cut-off. If no cut-off occurs, the FPLC must place the equipment in the safe status.

However, self-monitoring sensors must themselves use test signals to detect the falsification of their switching outputs and carry out the cut-off themselves. The field-signal inputs of the bus node filter these test signals out again.

WARNING

No leakage current may be allowed to flow in the case of an error!

Ensure that under no circumstances (even in the event of an error) no leakage current may flow from the outputs of the connected sensor, which can set the field-signal input to “1” (see chapter 10 “Technical specifications” on page 55).

3.6.2 Field-signal outputs

You can use the field-signal outputs as:

- power supply for sensors (**Static on**)
- drivers for field-signal inputs to read contacts (**Test signals**)
- FPLC output (**Output signal**)

Properties

- 8 × 2 Field-signal outputs
- output providing electrical power from U_V
- pull-down resistance to 0 V
- short-circuit protected
- there is an overload display for every field-signal output ● **Red**
- suppression diode integrated for approx. ±40 V. No external freewheeling diode is required in the case of an inductive load. At full load (700 mA) and switching actuations of 2 Hz the load inductance must not be above 1.5 Henry.

Note

If you only use the outputs to provide electrical power (option **Output** = Static on), it is permitted to switch channels A and B of a field-signal connection in parallel, in order to double output power (switching pins 1 and 5 in parallel)

- possible error detection:
  - overload
  - short-circuit to 0 V
  - short-circuit on other test signals

WARNING

The following connection errors can result in the destruction of the bus node:

- external voltage on an output, which is higher than U_V. This also applies when the output is switched off (**Static off**)
- reversal of the supply voltage with simultaneous short-circuit of the output lines
- reversal of the supply voltage on the simultaneous connection of polarised freewheeling diodes to the output lines

Reverse polarisation changes the behaviour of the field signal outputs!

On the reversal of the supply voltage, current is applied to components connected to the field signal output in reverse, that is the bus node activates the outputs instead of deactivating them.

3.6.3 SDL connections

- overload display for the power supply output by ● **Red**
- OSSD inputs
  - status display by ● **Yellow**
  - inputs at 0 V that draw current
- safe SICK device communication

Possible error detection

The self-test in the bus node detects when an OSSD input cannot return to the safe status owing to an internal error. Furthermore, the bus node can identify the discrepancy of the OSSD inputs.

You must take further measures to detect external errors.

Reading data safely

The OSSD inputs on the SDL connections enable the PNP outputs of a self-monitoring sensor to be read safely. The sensor itself must detect the falsification of its switching outputs with the aid of test signals and execute the cut-off. The OSSD inputs of the bus node filter these test signals out again.

WARNING

No leakage current may be allowed to flow in the case of an error!

Ensure that under no circumstances (even in the event of an error) any leakage current may flow from the outputs of the connected sensor, which can set the OSSD inputs of the SDL connection to “1” (see chapter 10 “Technical specifications” on page 55).

4 Installation and mounting

This chapter describes the preparation and completion of the installation of the UE4155 bus node. The installation and mounting requires two steps:

- selection of a suitable assembly location
- assembly with the aid of three fixing screws (not contained in the delivery)

4.1 Selecting the assembly location

The UE4155 bus node is a decentralised component. Select a suitable assembly location in the immediate vicinity of the equipment on the basis of the following criteria:

- close to the equipment, short distance for wiring to all components to be connected
- flat assembly surface to enable the housing to be assembled without becoming distorted
- grounded assembly surface in order to ground the PROFIBUS screening
- device's diagnostic LEDs can be inspected, simple device exchange
- protected in order to prevent any removal or breakage of the connecting wires by personnel or equipment
- adequately sized terminal compartment for the power supply, the SDL connecting wires and the field connections (see chapter 10.5 "Dimensional drawing bus node UE4155" on page 61)
- with respect to vibrational and impact load, temperature and humidity, suitable in accordance with the data in chapter 10.1 "Data sheet" on page 55

4.2 Mounting the device

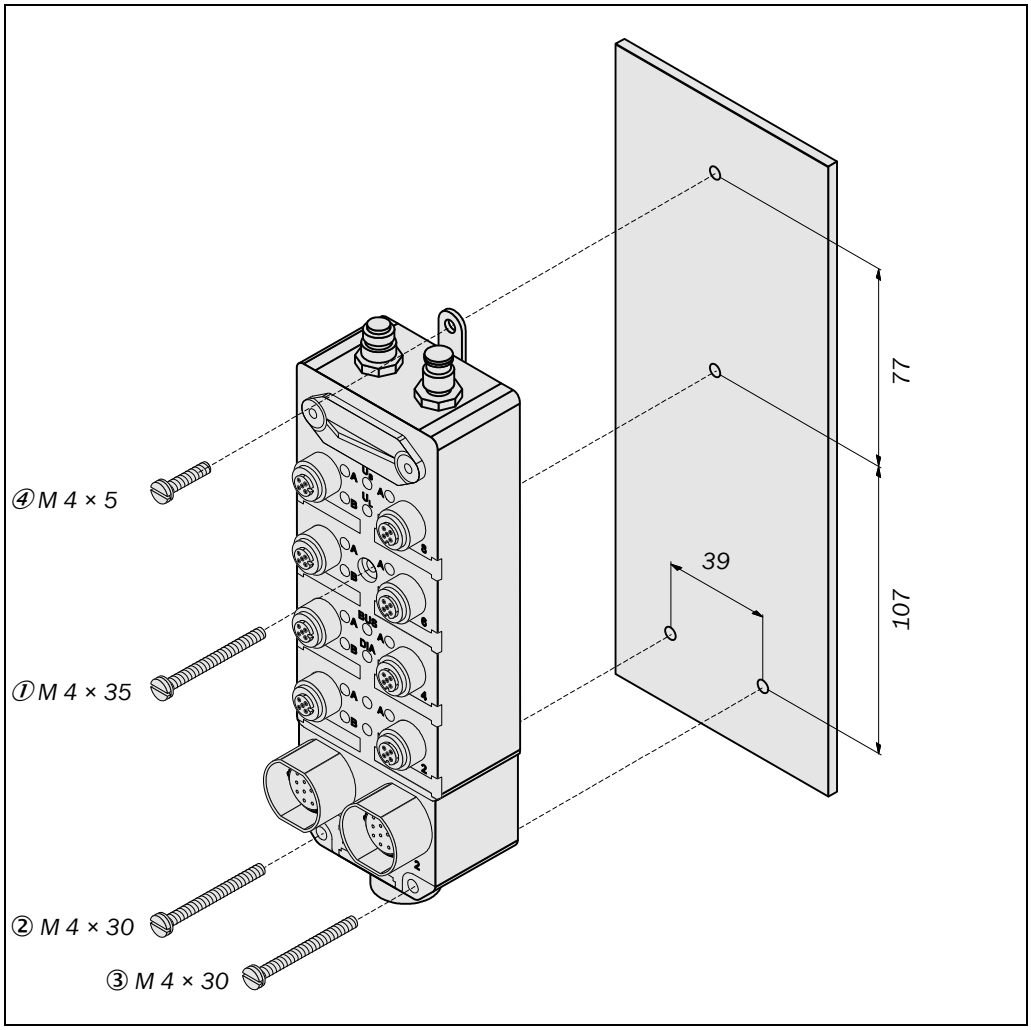
WARNING

Protect the device from being tampered with!

- Take suitable measures to ensure that the device cannot be tampered with and that any objects or persons passing by the device cannot damage any connections.

  Suitable measures may include for example: installation of a protective hood to cover the device and connections.

Fig. 4: Installing the UE4155 (mm)



Note The bolts shown in the diagram are not included with the delivery.

- First install the cylinder head bolts M4 × 35 designated as ① and align the housing.
- Then install the cylinder head bolts M4 × 30 designated as ② and ③.
- Finally secure the PROFIBUS screen using the cylinder head bolts M4 × 5 designated as ④.

5 Electrical installation

WARNING

Switch the entire machine/system off line!

While you are connecting the UE4155 or linking it to other devices, the equipment might be activated inadvertently.

➢ Ensure that the entire machine/system is disconnected during the electrical installation.

Notes

- The UE4155 bus node meets the interference suppression requirements (EMC) for industrial use (interference suppression class A). When used in residential areas it can cause interference.
- To safeguard the resistance to disruptions, functional earthing FE must be connected.
- The device is configured for Protection class III. The voltage supply must therefore be provided with a safety extra-low voltage.
- The external voltage supply must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204.
- When using the bus node in accordance with the requirements in UL 508, the power supply must permit “use in class-2 circuits”. No current may be allowed to flow that is > 8 A.
- In principle, it is permitted to make all connections only when the power supply is switched off. The configuration connection, however, may be connected/disconnected with the system on line.
- Always protect unused connections by using the protective caps which can be obtained as accessories (see chapter 11.2 “Accessories” on page 62). The bus node will otherwise no longer comply with Enclosure rating IP 67.
- Only connect all devices to the bus node radially. This will exclude earth and/or ground circuits. If you operate several devices on the bus node or use a separate power supply for connected devices, you must prevent earth and/or ground circuits from occurring as the result of the connection.

WARNING

Test the wiring after any activities have been carried out on the bus node!

Because the bus node has several connections of a similar structural nature, these may result in incorrect cut-off paths, for example if connection plugs are confused.

➢ Mark all connecting wires and connection plugs unambiguously to avoid confusion.

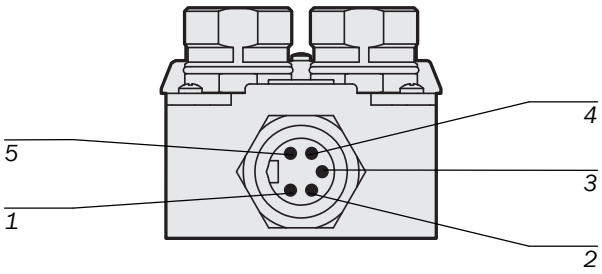
➢ Test the wiring again after any maintenance or other activities have been carried out on the bus node.

5.1 Power supply (7/8"-connection)

Notes

- Ensure that the maximum power consumption of the UE4155, including all connected components, does not exceed 9 A.
- Safeguard the power supply of the bus node using a 10 A F fuse.

Fig. 5: Power-supply pin assignment (7/8" connection)



Tab. 6: Power-supply pin assignment (7/8" connection)

Pin	Signal	Description
1	–	Not assigned
2	GND	0 V DC (voltage supply)
3	FE	Functional earthing
4	U_V	24 V DC (power supply)
5	–	Not assigned

5.2 SDL connections M23 × 12

The bus node has two identical SDL connections. The SDL connections are provided in the first place to connect SICK safety components with safe SICK device communication (EFI), e.g.:

- safety light curtain C4000
- safety laser scanner S3000

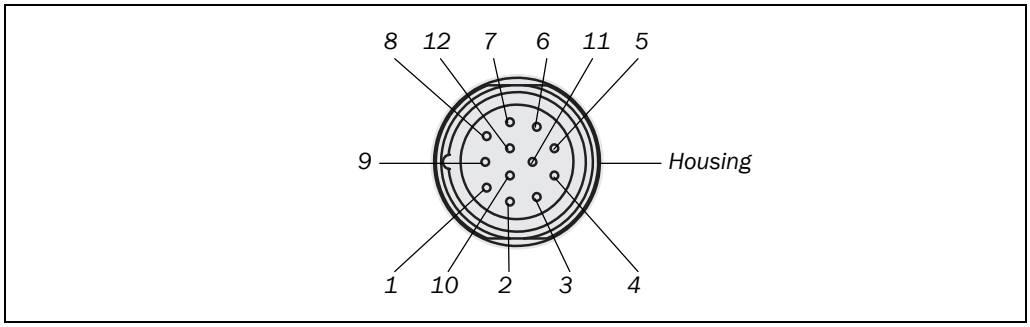
Furthermore, the SDL connections contain two inputs for the switching outputs (OSSDs) of the protective device. You can also operate devices without the enhanced function interface on the related pins if these have self-testing semiconductor output signal switching devices (OSSDs), e.g. SICK C2000, M2000, C4000 or S3000. However, it is not possible to configure or diagnose these devices via the UE4155.

WARNING

No parallel connection of the OSSDs to the bus node and to a second load!

If you connect OSSD signals from an SDL device to the bus node as **Hardware OSSDs**, then you must never connect the ESPE OSSD outputs to a second load in parallel. The protective function is otherwise no longer guaranteed.

Fig. 6: Pin assignment of SDL connection M23 × 12



Note You can obtain suitable preconfigured connecting wires from SICK (see 11.2 “Accessories” on page 62).

Tab. 7: Pin assignment of SDL connection M23 × 12

Pin	Wire colour C4000	Wire colour S3000	Signal	Description
1	Brown	Brown	U_V	24 V DC (voltage supply of the ESPE)
2	Blue	White	GND	0 V DC (voltage supply of the ESPE)
3	Grey	Grey	$OSSD1_{In}$	Input for OSSD1 of the ESPE
4	Pink	Pink	$OSSD2_{In}$	Input for OSSD2 of the ESPE
5	Red	–		Not assigned
6	Yellow	–		Not assigned
7	White	–		Not assigned
8	Red/blue	–		Not assigned
9	Black	Grün	EFI_A	Device communication with ESPE
10	Purple	Gelb	EFI_B	Device communication with ESPE
11	Grey/pink	–		Not assigned
12	Green	–	FE	Functional earthing
Housing	–	–	FE	Functional earthing

5.3 Field-signal connections M12 × 5 + FE

The UE4155 bus node has eight identical field-signal connections. However, field-signal connections 7 and 8 also have fault monitoring in output Out A (see below).

Notes

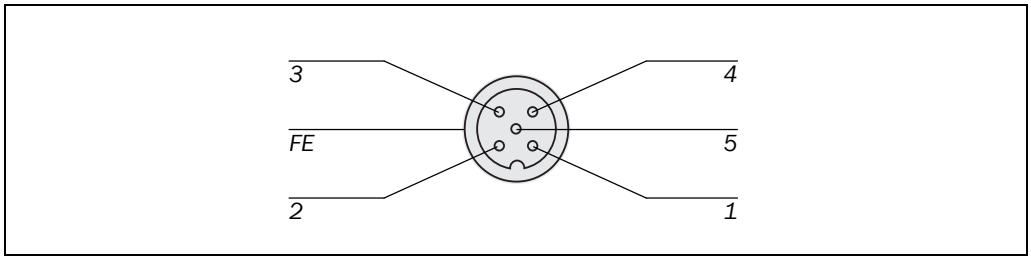
- The inputs of the field-signal connections are compatible with the Type-2 digital inputs described in DIN EN 61131-2[3)].
- If you only use the outputs to provide electrical power (option **Output** = Static on), it is permitted to switch channels A and B of a field-signal connection in parallel, in order to double output power (switching pins 1 and 5 in parallel).

WARNING

Take care when installing protected cables!

If an output serves several inputs, e.g. when connecting to an operating mode switch, the cable that you install must be protected. There is otherwise a risk of a cross-circuit within a cable that the bus node cannot detect in this case.

Fig. 7: Pin assignment of field-signal connections M12 × 5 + FE



Tab. 8: Pin assignment of field-signal connections M12 × 5 + FE

Pin	Wire colour	Signal	Description
1	Brown	Out A	Testable PNP output A
2	White	In A	Testable input A, input drawing power on GND
3	Blue	GND	0 V DC (power supply)
4	Black	In B	Testable input B, input drawing power on GND
5	Grey	Out B	Testable PNP output B
FE	Screen	FE	Functional earthing

Connection of a muting lamp

Field-signal connections 7 and 8 also have fault monitoring in output Out A. This can be used by the bus node e.g. to monitor a muting lamp. In the case of the wire being removed or a missing connection, the bus node sets the status bit of corresponding input In A to indicate an error. The error must then be evaluated in the FPLC.

Permissible lamps are, for example:

- SICK display lamp (part no. 2017768)
- SICK LED-muting lamp (part no. 2019909)
- lamp 24 V/4 W

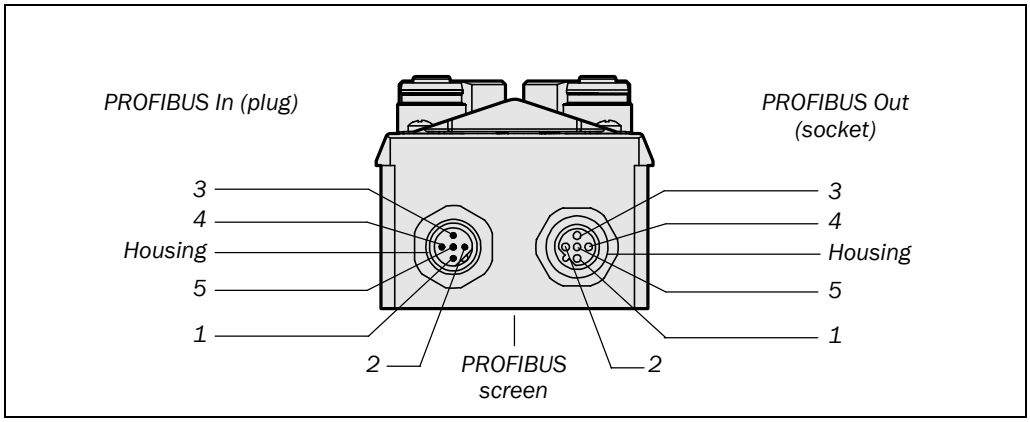
To activate fault monitoring, you must configure channel A of the field-signal connection accordingly. Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **I/O 7** or **I/O 8**, **Output** = muting lamp.

[3)] Type-1 digital input: Suitable for signal originating from electromechanical switching devices such as relay points, pushbuttons, switches, etc.
Type-2 digital input: Suitable for signals from Type-1 devices as well as from semiconductor circuits.

5.4 PROFIBUS connection (plug and socket)

When connecting the bus node to the PROFIBUS, please take account of the “Installation Guideline for PROFIBUS-FMS/DP”. You can obtain the document under Order No. 2112 from PROFIBUS International or from the regional PROFIBUS organisation in your own country.

Fig. 8: Pin assignment of the PROFIBUS connection (plug and socket)



Tab. 9: Pin assignment of the PROFIBUS connection (plug and socket)

Pin	Wire colour	PROFIBUS In (plug)	PROFIBUS Out (socket)
1		Not assigned	5 V DC (power supply for the terminating network)
2	Green	Line A (RxD/TxD-N)	Line A (RxD/TxD-N)
3		Not assigned	0 V DC (power supply for the terminating network)
4	Red	Line B (RxD/TxD-P)	Line B (RxD/TxD-P)
5		PROFIBUS screen	PROFIBUS screen
Housing		PROFIBUS screen	PROFIBUS screen

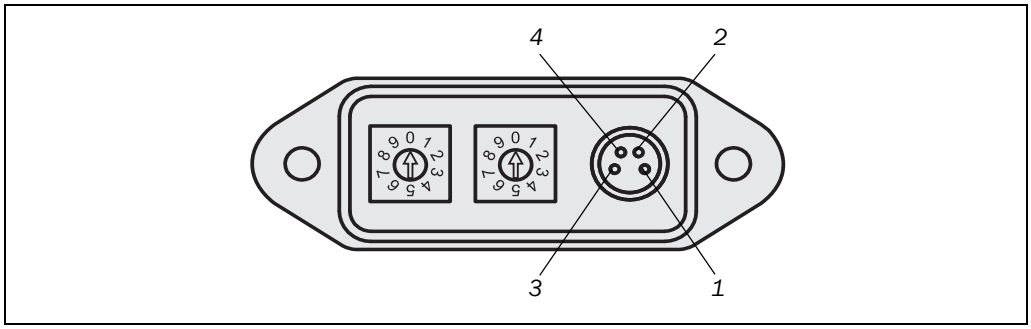
Notes

- The PROFIBUS connections use RS-485 transmission technology at a transmission speed of up to 12 MBaud.
- The PROFIBUS requires a unique PROFIBUS address for each bus user. It is not sufficient to make the electrical connections alone. Chapter 8.3 “PROFIBUS configuration of the bus node” on page 40 describes how to adjust the device addresses.

5.5 Configuration connection M8 × 4

The configuration connection is located alongside the PROFIBUS address switches beneath the protective cap on the top of the bus node.

Fig. 9: Pin assignment configuration connection M8 × 4



Tab. 10: Pin assignment configuration connection M8 × 4

Pin	UE4155	PC-side RS-232-D-Sub (9-pin)
1	Not assigned	Not assigned
2	RxD	Pin 3
3	0 V DC (power supply)	Pin 5
4	TxD	Pin 2

Notes

- Touch a grounded piece of metal, e.g. a radiator, in order to discharge any electrostatic charge you may have, before placing the configuration cable on the configuration connector. Electrostatic charge can damage the electronics in the bus node.
- Always remove the connector from the configuration connection when you have concluded the configuration.
- Screw the device's protection cap back onto the device after you have finished configuring it. The bus node will otherwise no longer comply with the conditions of the enclosure rating.

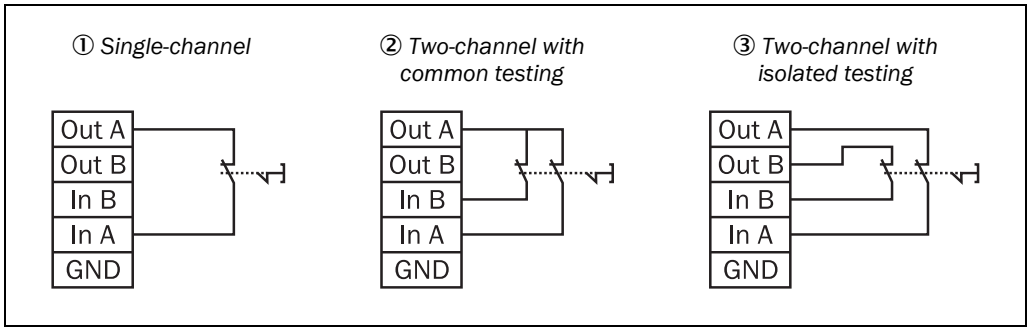
6 Examples of circuits

You can realise numerous applications on the field-signal connections. This chapter describes several typical circuits and their associated configurations.

6.1 Emergency stop, safety door

Depending on the category required, you can realise the emergency stop using a single channel (Fig. 10, ①), two channels with common testing (②) or two channels with isolated testing (③).

Fig. 10: Example of the emergency stop circuit



Notes

- The classification of components fitted with contacts (e.g. safety door switches and emergency stops) into a category according to EN ISO 13849-1 depends both on the connection type (single-channel/dual-channel) and on the execution (single/redundant, testing type). You must therefore always select the appropriate switching element for the required category and connection layout.
- In the case of single-channel switching (①) you can use the second input/output (In B and Out B) for a different application. With the aid of a two-way splitter, you can also, for example, drive two separate emergency-stop buttons from category 2 according to EN ISO 13849-1 on one field-signal connection (see chapter 11.2 “Accessories” on page 63).

- For this application, you must configure the outputs (Out) used as **Test signals** and the safety input (In) as **Signal input**.
- In the case of a two-channel connection with common testing (②) the test-signal allocation of the unused test signal does not have any role to play for this application. However, a test signal is present on the signal destination if the test-signal allocation is set incorrectly.

6.2 Electro-sensitive protective equipment (ESPE) with output signal switching device (OSSD)

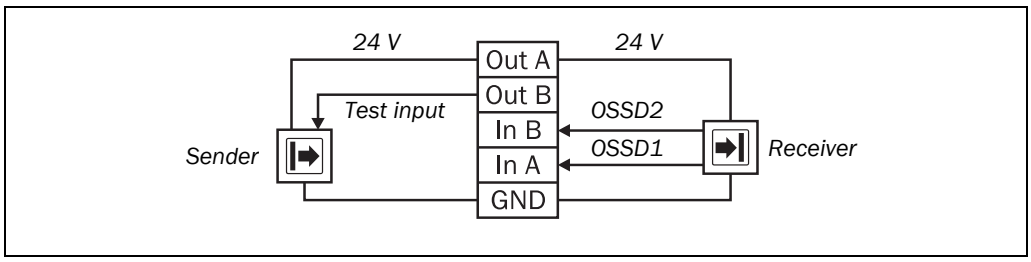


Fig. 11: Example of a circuit for electro-sensitive protective equipment on the field-signal connection

In the connection of electro-sensitive protective equipment (ESPE), senders (▣) and receivers (▣) can be considered as a system's inputs and outputs. Senders and receivers use the same power supply (output Out A, static 24 V). You can use output Out B to test the sender, alternatively as an output signal from the FPLC or assigned Static 24 V. The switching outputs of the receiver are present on inputs In A and In B.

Notes

- The functional earth of the ESPE is normally provided via the screened field-signal connections. However, the functional earth cannot be looped via the two-way splitter. In this case, you must mount the ESPE that the ESPE housing is earthed on the machine support.
- In order to meet the requirements for category 4 according to EN ISO 13849-1, the ESPE must have two tested semiconductor switching outputs and its own short-circuit detection. In the case of single-channel switching outputs only category 2 can be realised for this type of connection.
- If a test input is connected to the ESPE, this must be executed as an input that draws current.

6.3 Muting sensor untested

Suitable muting sensors are e.g. reflective photoelectric proximity switches, reflective photoelectric switches, one-beam photoelectric switches and magnetic proximity sensors.

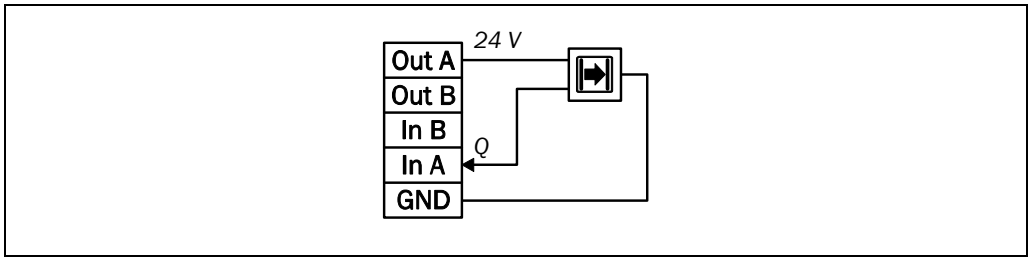
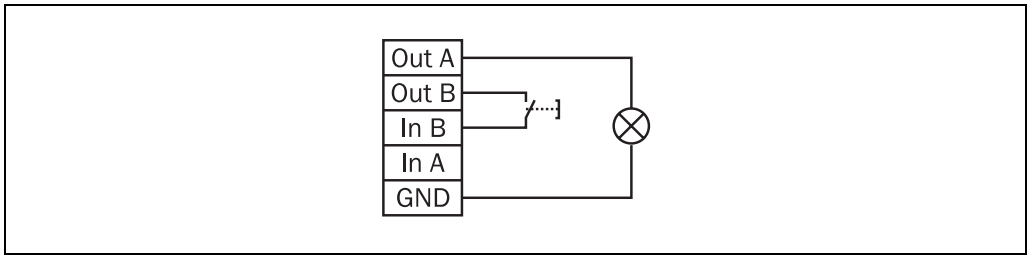


Fig. 12: Example of a circuit for an untested Muting-Sensor

6.4 Control switch with indicator display

You can in principle connect control switches to the field-signal connection such as components fitted with contacts. This enables you to carry out all the usually functions of the control switches, e.g. startup, reset or restart.

Fig. 13: Example of a circuit for a control switch with indicator display

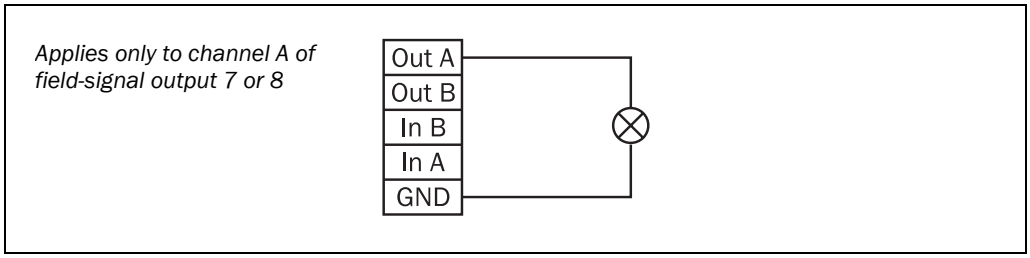


You must configure the indicator-display output (in Fig. 13: Out A) as an **Output signal**.

6.5 Muting lamp

Note It is only permitted to connect a muting lamp to channel A of field-signal outputs 7 and 8, as only these outputs have fault monitoring.

Fig. 14: Connection of a muting lamp



To activate fault monitoring, you must configure channel A of the field-signal output accordingly. Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **I/O 7** or **I/O 8**, **Output** = muting lamp.

Note In the event of an error in the muting lamp (defective or not connected), the bus node sets the status bit of the input In A.

7 Commissioning

WARNING

Commissioning requires a thorough check by qualified safety personnel!

Before operating a system in which you have deployed the UE4155 bus node, it must be checked and approved by qualified safety personnel. This applies to both initial commissioning and retrofitting. Please read the notes in chapter 2 “On safety” on page 9.

Commissioning requires the following steps:

- planning (see unten)
- programming and configuration (page 37)
- technical commissioning with the overall acceptance of the application (page 37)

7.1 Planning

All the available functions of your application can be linked within the FPLC program. This is why you must decide at the planning stage which concrete safety components you wish to use in your application.

It is not sufficient, for example, to establish that a safety light curtain will be required. You must decide which type is to be used from which manufacturer and which functions of the device you wish to use.

- ➢ Use your specification document to determine the concrete devices that you wish to deploy on the bus node. Start with the devices on the SDL connections. Then compile a planning schedule of the subsystem for these devices.
- ➢ From the previous decisions select the concrete field devices you require to control the SDL devices, e.g. a particular reset button or a suitable type of operating mode selector switch.
- ➢ Establish the concrete types of all other field devices and the performance of their functions for your application.

In Appendix 12.1 on page 65 you will find a “Planning table for the configuration” that explains the initial planning schedule of the bus-node application.

If you use SICK devices on the SDL connections, it may be useful to create a corresponding “project” in the CDS as early as the planning phase. At that stage you can use the dialogue to establish the available functions and the necessary parameters of the corresponding devices and you can print out a configuration draft.

7.2 Programming and configuration

After the planning phase is concluded and you have the necessary devices available, you can undertake the two next steps:

- configuration of the application (see chapter 8 “Configuration” on page 39)
- programming the FPLC

The FPLC program accesses the inputs and outputs of the bus node via the process images (see Appendix 12.2 on page 67). Please note: If you directly control individual bits of an SDL connection with the aid of a function package (accessories) via “cross-routing”, the FPLC does not have write access to these bits of the SDL connection.

You also obtain more information about possible programming errors by evaluating the diagnostics data of the bus node (see section 9.7 “PROFIBUS diagnostics” on page 54) as well as with the aid of the CDS (see section 9.8 “Extended diagnostics” on page 54).

Note If you connect the CDS to the bus node via the PROFIBUS, it is possible, for example, for Siemens Step 7 and SICK CDS to be active simultaneously. This facilitates current testing and correction during the programming phase.

7.3 Technical commissioning

7.3.1 Sequence for commissioning subsystems

When commissioning the entire system, you must exclude errors occurring in the subsystems by means of an appropriate sequence during commissioning.

- ➢ First commission the devices on the SDL connections and test their system performance.
- ➢ Then commission the devices on the individual field-signal connections and test the routing of information to the required outputs.
- ➢ Do not commission the bus node until the subsystem performance is safe and as required.

7.3.2 Offline commissioning

There are also limited options for commissioning the bus nodes without operational PROFIBUS communication to the FPLC. In this “offline commissioning” you can use the following functions and/or configure the following connections:

- routing from the SDL connections to the field-signal connections and vice versa
- monitoring the status of the SDL connections
- generating the process image
- diagnosis of all data up to the PROFIBUS interface with the aid of the CDS

It is, however, not possible to simulate dataflows from the FPLC to the field-signal connections and the SDL connections. Here, the bus node always transmits failsafe values during offline commissioning.

7.3.3 System self-test after switching on

Immediately after the power supply is switched on, The UE4155 bus node carries out the following steps automatically:

- internal self-test
- loading the stored configuration
- testing whether the loaded configuration is appropriate for the connected devices

Note The system will not start to operate if the above steps could not be performed successfully. In the event of an error, one or more displays on the bus node turn ● **Red** and the bus node only transmits failsafe values (see chapter 9 “Fault diagnosis” on page 46).

7.3.4 General acceptance of the bus node

You may only start operating the system when the general acceptance of the bus node was successful. Only qualified personnel with the appropriate training are to carry out the general acceptance procedure for the bus node.

The general acceptance comprises the following test points:

- ➢ Check whether the switching of the components to the field-signal connections complies with the requisite Performance Level according to EN ISO 13849-1.
- ➢ Check the devices connected to the SDL connections in accordance with the test procedures from the corresponding operating instructions.
- ➢ Mark all connecting wires and connection plugs on the bus node unambiguously to avoid confusion. Because the bus node has several connections of a similar construction, you must ensure that disconnected connecting wires are not reconnected to the wrong connection.
- ➢ Check the bus-node configuration. Check the signal paths and the correct incorporation into the FPLC safety program.
- ➢ Check the correct data transfer from the field-signal connections and/or from the devices to the SDL connection to the FPLC and vice versa.
- ➢ Check the FPLC program.
- ➢ Completely verify the safety functions of the entire system.
- ➢ Fully document the configuration of the entire system, the individual devices, the FPLC program and the result of the safety check.

8 Configuration

This chapter systematically describes the necessary steps for configuring the UE4155 bus node and its integration into the application.

8.1 Delivery status

In its delivery status the bus node is configured as follows:

- field-signal connections:
  - selection: **Single-channel**
  - output: **Static off**
  - safety input: **Off**
  - input delay: **Inactive**
  - discrepancy time: **Inactive**
- SDL connections:
  - no device expected
  - read hardware OSSD: both **Inactive**
- PROFIBUS:
  - PROFIBUS address: **0** (on the PROFIBUS address switch of the bus node)
  - PROFIsafe address: **0**

8.2 Overview

Reserve an adequate amount of time for the planning and integration and for the configuration of the bus node. Consider that you may endanger people's lives if you make an error in the planning and configuration.

The following requirements must be met before the bus node can be configured:

- The application must have already been fully planned. The planning must contain, among other things:
  - a detailed safety analysis of the planned application
  - a full setup of all requisite devices, their connections and the signals supplied by or required by these devices
- The bus node must be connected to the power supply (see chapter 5.1 "Power supply (7/8"-connection)" on page 28).
- The safety components must be electrically connected to the bus node. Read chapter 5 "Electrical installation" on page 27 to this end as well as the corresponding chapters of the operating instructions of the devices that you wish to connect to the bus node.

There are five main steps to the subsequent configuration of the UE4155 bus node, which will be described in the following chapters:

- PROFIBUS configuration of the bus node, if this has not already been carried out
- Restore the configuration connection to the bus node
- Configuration of devices connected to the bus node
- Configuration of the bus-node inputs and outputs
- Setting the PROFIsafe address

When these steps are complete, the system is in principle ready for operation. However, it is necessary to program the FPLC before operation can commence. This step should start

in parallel with the planning phase and cannot generally be concluded until the bus node has been configured successfully.

Recommendation Chapter 12.1 on page 65 contains a planning table for the configuration. Use a printout or a copy of the planning table to plan and document the bus-node configuration.

8.3 PROFIBUS configuration of the bus node

8.3.1 Loading the generic station description (GSD)

Before configuring the PROFIBUS for the bus node for the first time, you must load the generic station description of the bus node into the hardware catalogue of the hardware-configuration program for the PROFIBUS.

- Insert the CD-ROM “CDS — Configuration & Diagnostic Software” contained in the package into the CD-ROM drive of the notebook/PC, on which you have installed the PROFIBUS manager of your FPLC.

  The generic station descriptions for the different bus nodes can be found on CD-ROM in the directories “\UE4100\GSG“ (German) and “\UE4100\GSD“ (English).
- Following the instructions of the online help or in the user manual of the PROFIBUS manager, for loading the generic station description.

The bus node then appears for example by using the SIMATIC manager (Siemens) in the hardware catalogue under **PROFIBUS DP** in subgroup **I/O**.

8.3.2 Adding the bus node to the hardware configuration

To evaluate the bus-node data in the FPLC, you must ...

- add the bus node to the hardware configuration.
- set identical values for the PROFIBUS address in the PROFIBUS manager and on the bus node (see chapter 8.4.1 on page 42).

The procedure associated with this depends on the hardware-configuration program of the FPLC you are using. On this topic, please also read the documentation for the corresponding program.

8.3.3 Establishing the starting address in the process image

The starting address determines the location of the PROFIBUS process image at which the data supplied from the bus node arrive at the FPLC. The input and output process image of bus node UE4155 is 10 bytes in size. A detailed representation of the process images is contained in Appendix 12.2 “Process images” on page 67.

8.3.4 Carrying out the PROFIsafe configuration in the FPLC hardware-configuration program

The parameters to be set depend on the connected field device. If necessary, you must modify the values for the bus node preassigned by the hardware-configuration program. General parameters for the PROFIsafe configuration are:

Tab. 11: PROFIsafe parameters to be set

Parameter	Meaning	Setting
F_Check_SeqNr	Influences the consistency check (CRC calculation) of the PROFIsafe telegram	Check/No check[4)]
F_SIL	Bus-node safety class (SIL1 to SIL3)	Depending on application
F_CRC_Length	Anticipated length of the CRC checksum in the PROFIsafe telegram	2 Byte CRC
F_Par_Version	Implemented PROFIsafe version. You cannot change this parameter.	0
F_Source_Add	PROFIsafe source address. Must be unique in combination with the PROFIsafe destination address and is assigned automatically	1 to 65534
F_Dest_Add	PROFIsafe destination address. Must be unique in combination with the PROFIsafe source address and is assigned automatically. Note: The PROFIsafe address of the bus node must correspond to this value (see chapter 8.6 on page 45).	1 to 65534
F_WD_Time	Monitoring time (“Watchdog time”) for the cyclic service. If no valid PROFIsafe telegram is exchanged between the bus node and the FPLC within the set monitoring time, both will proceed to the safe status, i.e. they assign themselves failsafe values. The monitoring time should be sufficiently long to tolerate minor delays in communication. In the event of an error, however, it must not unnecessarily delay the system response of the bus node or that of the FPLC.	Depending on the application from 1 to 65535 ms

Recommendation Invoke the FPLC safety program cyclically and with the highest priority. In this way you will prevent the overall response time from becoming longer.

The planning manuals of the PROFIBUS manager and the PROFIsafe profile that you have deployed contain more information on the definition and mode of operation of the PROFIsafe parameters.

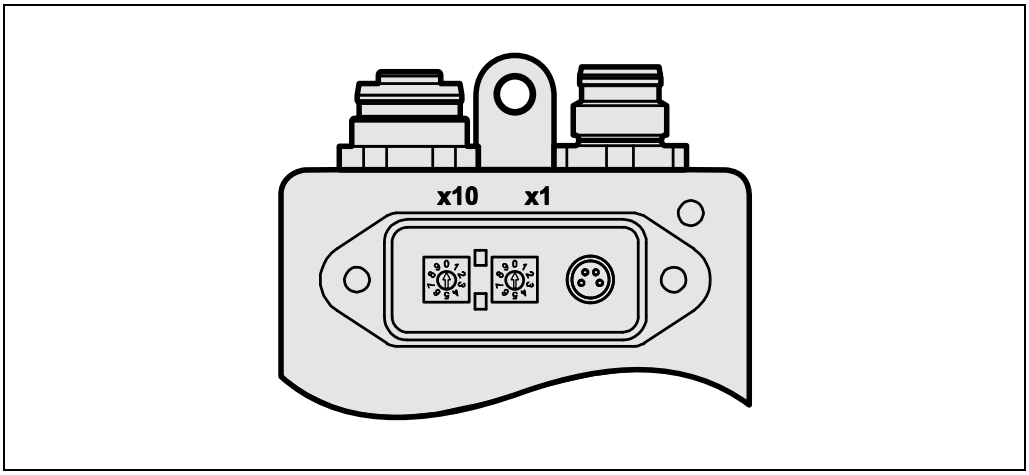
[4)] The setting depends on the FPLC being used. The setting for a Siemens FPLC must be “No check” here.

8.4 Restore the configuration connection to the bus node

8.4.1 Set the PROFIBUS address

In order that the FPLC can detect and address the bus node for the first time, you must first set the PROFIBUS address of the bus node on the device in accordance with the PROFIBUS planning.

Fig. 15: Setting the PROFIBUS address on the UE4155



The lefthand switch determines the tens digits of the PROFIBUS address, the righthand switch determines the units digits.

Example

PROFIBUS address: 14 ⇨ Lefthand switch (× 10): 1 Righthand switch (× 1): 4

Notes

- You can only set PROFIBUS addresses between 0 and 99 with the aid of the address switch. The factory setting of the bus node is PROFIBUS address 0.
- To set the address switch to 01, the bus node uses PROFIBUS address 126.
- Hardware address 02 is reserved and should not be used.
- Alternatively, you can use the CDS to configure the PROFIBUS address. Set both the address switches of the bus node to 0. It is only possible to assign PROFIBUS addresses from 3 to 125 using the CDS on the basis of this hardware setting.

8.4.2 Connection of the Configuration & Diagnostic Software

You can connect the Configuration & Diagnostic Software (CDS) to the bus node in different ways and/or to the devices connected to the bus node with safe SICK device communication.

Tab. 12: Connection options for the Configuration & Diagnostic Software (CDS)

Connection of the CDS	Limitation	Suitable for
Directly to the configuration connection (RS-232) of the UE4155	Access to the bus node and to devices on the SDL connection that have safe SICK device communication	Offline commissioning or if the configuration is to be made spacially close to the system. Configuration of the PROFIBUS address
On the configuration connection of a device with safe SICK device communication, which is linked to the SDL connection	Access to the field-signal connections and only to the SDL connection, via which the CDS is connected to the bus node, as well as to all the devices linked to this connection[5)]	If on-site commissioning is required for the configuration and the device cannot be viewed from the bus node, as, for example, teaching in the protective field of a safety laser scanner
Via the PROFIBUS acyclic channel as a master class-2 tool	Access to bus node and devices with safe SICK device communication on the SDL connection. No configuration of the PROFIBUS address	Remote bus-node configuration and monitoring. Configuration of replacement devices

WARNING

Take organisational measures for protection during the configuration!

During the configuration, ensure that no dangerous states may occur in the system or in that part of the system which is being monitored by the devices connected to the bus node.

The bus node only transmits failsafe values during the configuration, i.e. it sets all the bits in the process image to 0. Furthermore, the status bit *FV_active* (failsafe value) of the PROFIsafe telegram is also set.

Configuration via the bus-node configuration connection

To configure the bus node, you need:

- CDS (Configuration & Diagnostic Software) on CD-ROM
- user manual for CDS on CD-ROM
- PC/Notebook/Siemens programming device (PG) with Windows NT 4/2000 Professional/XP/Vista and a serial interface (RS-232). PC/Notebook/PG not included.
- connecting cable for the connection between PC and UE4155 (SICK-part no. 6021195)

Before configuring the device, please read the user manual for the CDS (Configuration & Diagnostic Software) and use the online help function of the program.

[5)] The access to the bus node via the SDL interface is not possible if the CDS is connected to a C4000 sender.

Configuration via the PROFIBUS

You can link the CDS to the bus node via the PROFIBUS. In this way, the communication with the bus node is realised via the acyclic PROFIBUS service.

You need the following to configure the bus node visa the PROFIBUS:

- a communication processor, e.g. Siemens CP with the master class-2 function
- a PROFIBUS cable for the hardware connection to the PROFIBUS
- the PROFIBUS communication driver function package for the CDS (see “Accessories” on page 63)

You connect the CDS to the bus node via the PROFIBUS as follows:

➢ Manually set the hardware PROFIBUS address on the bus node to the address that you have allocated for the bus node in the hardware configuration program.

➢ Install the communication processor.

➢ Allocate the “PROFIBUS communication processor“ interface to the access point of application “CP_L2_1“.

➢ Connect the communication processor to the PROFIBUS.

➢ Start the CDS.

➢ In the **Extras**, **Communication connection** menu of the CDS activate the **PROFIBUS protocol** option and set the bus-node PROFIBUS address under **Connection**.

8.5 Configuration of devices connected to the bus node

You must create a unique project in the CDS for each bus node. Within the project you then allocate the bus node to the devices connected to the SDL connections.

If you are using function packages, the CDS can conduct plausibility tests of the entire system. For example, it can test whether the number of the operating modes selected in the bus node also corresponds to the number configured in the SDL device.

Add devices with safe SICK device communication: Device symbol **UE4100 PROFIsafe**, **SDL1** and/or **SDL2**, context menu **Add device...**. Follow the configuration wizard.

➢ First configure the devices connected to the SDL connections. To this end, follow the notes in the operating instructions of the relevant device.

Recommendation

If you have connected devices that have the safe SICK device communication to the SDL connection of the bus node, then you must configure them from the bus node. To this end you establish a connection from the CDS to the bus node. This will enable you to import an already existing configuration of the connected device into the bus-node project or load one directly from the device with the aid of the CDS.

➢ Then configure the devices connected to the field-signal connections.

➢ Test the function of each connected device individually before testing the bus-node configuration. It is otherwise more difficult to attribute a malfunction to a device or to the bus node.

Notes

- If the device on the SDL connection needs data from the bus node or from the FPLC, but the bus node has not yet been finally configured, the device can report an error on the SDL connection. If necessary, you should give priority to configuring the bus node or programming the FPLC in order to test the configuration of the device on the SDL connection.
- The UE4155 bus node monitors the configuration of the devices on the SDL connection. If you reconfigure or exchange this, then you should ...
  - modify the configuration of the bus node, if necessary, and
  - at least transfer the configuration to the bus node once more.

In the event of an error message from a device on the SDL connection, always also read the diagnostics data of the bus node. This will provide additional information for resolving the error.

8.6 Setting the PROFIsafe address

In order for you to operate the bus node as a PROFIsafe user, this must have a PROFIsafe address. The PROFIsafe address must correspond to the appropriate setting in the FPLC hardware-configuration program.

You can set the PROFIsafe address in the bus node as follows:

➢ Start the hardware-configuration program.

➢ In the PROFIBUS configuration of the bus node, read the value of parameter **F_Dest_Add** (cf. Tab. 11 on page 41).

➢ Transfer the value you have read as the PROFIsafe address to the bus-node configuration with the aid of the CDS.

Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **General**, option **PROFIsafe address (F_Dest_Add)**.

8.7 Configuration of the bus-node inputs and outputs

➢ Configure the field-signal and SDL connections as planned with the aid of the CDS. Chapter 3.5 “Configurable functions” on page 16 as well as the online help on the CDS contain detailed information on the interaction of the individual settings.

Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Edit**, file card **I/O** of the corresponding field-signal connection.

➢ Transfer the configuration to the bus node as described in the CDS online help.

Notes

➢ If necessary, remove the connector from the configuration connection when you have concluded the configuration.

➢ Screw the device’s protection cap back onto the device after you have finished configuring it. The bus node will otherwise no longer comply with enclosure rating.

9 Fault diagnosis

This chapter describes how to identify and remedy errors and malfunctions during the operation of the bus node.

9.1 What to do in case of faults

WARNING

Cease operation if the cause of the malfunction has not been clearly identified!

Stop the machine if you cannot clearly identify or allocate the error and if you cannot safely remedy the malfunction.

Note Some error messages of the bus node are caused by connected devices.

- Carry out a diagnosis of the bus node with the aid of the CDS.
- In the case of errors, always check whether one or more connected devices display an error.
- If necessary, consult the documentation of the device that is displaying an error in order to resolve it.

9.2 SICK Support

If you cannot remedy an error with the help of the information provided in this chapter, please contact your local SICK representative.

9.3 Error displays of the LEDs

This chapter explains the meaning of the error displays of the LEDs and how to respond. Please refer to section “Status indicators” on page 15 for a description.

Tab. 13: Error displays of the LEDs

Display		Possible cause	Remedying the error
U_L	○	No voltage supply	➢ Check the voltage supply and activate, if necessary.
	● **Red**	Internal voltage supply too low or firmware is being updated	➢ Check the voltage supply if necessary.
BUS	○	PROFIBUS communication has been established with the FPLC, but the safety communication is still inactive. The FPLC safety program has not yet been started.	➢ Ensure that a PROFIsafe master has been deployed. ➢ Check the status of the safety program.
	☼ **Green**	Acknowledgement by user mandatory. The FPLC has detected an error on the side of the bus node and has deactivated the bus node.	➢ Check the bus-node PROFIBUS diagnostics data. ➢ Resolve any errors. ➢ Then acknowledge that the error has been remedied.
	● **Red**	General PROFIBUS error, no communication is possible	➢ Check the PROFIBUS connecting cable. ➢ Check that the PROFIBUS address corresponds to that in the FPLC and on the bus node.
	☼ **Red**	Not a valid PROFIBUS configuration	➢ Check that the PROFIsafe addresses correspond to those in the FPLC and on the bus node.

Display		Possible cause	Remedying the error
DIA	● **Red**	Configuration incomplete or configuration being transferred	➢ The display goes off automatically once the configuration has been successfully transferred. If the display does not go off: ➢ Check the system configuration with the aid of the CDS (Configuration & Diagnostic Software). ➢ Re-transfer the corrected configuration to the system.
	☼ **Red**	1 Hz: System error (lock-out)	➢ Check the device status using the diagnostics function of the CDS. ➢ Resolve any errors. ➢ Briefly disconnect the bus node from the supply voltage. ➢ Exchange the bus node if the problem persists.
		½ Hz (75 % on, 25 % off): Field-signal connection error or passivated by FPLC	➢ Check the communication with the FPLC. If there is no PROFIsafe connection, the bus node is passive. ➢ Check the connecting cables to the field-signal inputs for short-circuit. ➢ With the aid of the CDS check the configuration of the field-signal inputs. Each connected input must also be configured. ➢ Check the discrepancy time of the sensors. The configured values may have been exceeded. ➢ Check the PROFIBUS diagnostics data (See chapter 12.3 on page 70). ➢ Rectify the error, operate the related sensors to delete the error and acknowledge the bus node status in the FPLC.
A and B	○	Field-signal connection A or B is inactive	➢ Check the connecting cable. ➢ Check the function of the connected devices. ➢ Check the parameter setting of the output. It is possible that the sensor has no voltage supply or the switch is not being tested.
	● **Red**	Overload at field-signal connection output A or B	➢ Check the connection cables for short-circuits or cross-circuits. ➢ Check the sensor.

Display		Possible cause	Remedying the error
⇙ and ⇘	● Red	Voltage supply overload of the SDL connection	➢ Check the power consumption of the device connected to the SDL. ➢ Check the connecting cable.
	☼ Red	Device-communication error at SDL connection	➢ Device not connected. Check the connecting cable. ➢ No device-parameter values have been set for the SDL connection. Configure this with the aid of the CDS (Configuration & Diagnostic Software).

9.4 Additional error displays of the 7-segment display of the C4000

If you operate the safety light curtain C4000 on the SDL connection on a UE4155 and evaluate and control the EFI communication in a suitable manner using the FPLC, then the C4000 has additional functions. This section explains the meaning of the additional error displays of the 7-segment display and how to respond to the messages. You can find a description of the 7-segment display in the chapter titled “Status indicators” of the “C4000 Standard/Advanced Safety Light Curtain” operating instructions.

Tab. 14: Additional error displays of the 7-segment display of the C4000

Display	Possible cause	Remedying the error
P.	A device connected via EFI reports a malfunction	➢ Carry out a fault diagnosis of the device connected with the C4000 (here: the UE4155).
A.↻8.	Bus node configuration is incorrect	➢ Configure the bus node with the aid of the CDS. ➢ Check the connection from the C4000 to the bus node.
C.↻5.	Several operating modes configured, but none selected	➢ Check the connection and the function of the operating mode selector switch. ➢ Check the connection for the operating mode selector switch on the bus node or in the FPLC. ➢ Check the configuration of the operating mode selector switch in the bus node or in the FPLC.
C.↻6.	Several operating modes selected simultaneously	➢ Check the connection and the function of the operating mode selector switch. ➢ Check the connection for the operating mode selector switch on the bus node or on the FPLC for short-circuiting.

Display	Possible cause	Remedying the error
C↻7	Un-configured operating mode selected	➢ Configure the operating mode set on the operating mode selector switch, or ensure that this operating mode cannot be selected.
C↻8	Key-operated pushbutton for bypass malfunctioning or invalid configuration	➢ Check whether the configuration of the key-operated pushbutton for bypass in the CDS matches the electrical connection. ➢ Check the function of the key-operated pushbutton for bypass and replace it if necessary. ➢ Ensure that both contacts on the key-operated pushbutton for bypass are pressed within 2 seconds.
C↻9	Short-circuit at the operating mode selector switch	➢ Check the operating-mode inputs of the bus node or the FPLC for short-circuiting with 24 V.
● **Red**	Light path is free and configuration is correct but the C4000 still does not turn green. The C4000 expects data from the bus node or from the FPLC.	➢ Check whether an error or lock-out has occurred in the bus node or the FPLC. ➢ The PROFIsafe communication between bus node and FPLC is still not established (see chapter 9.3 “Error displays of the LEDs” on page 47). ➢ Check the C4000 information status with the aid of the CDS (device symbol **UE4100 PROFIsafe**, context menu **Diagnosis**, **I/O-Monitor**).

9.5 Additional error displays of the 7-segment display of the S3000

If you operate the safety laser scanner S3000 on the SDL connection on a UE4155 and evaluate and control the EFI communication in a suitable manner using the FPLC, then the S3000 has additional functions. This section explains the meaning of the additional error displays of the 7-segment display and how to respond to the messages. You can find a description of the 7-segment display in the chapter titled “Status indicators” of the “Safety Laser Scanner S3000” operating instructions.

Tab. 15: Additional error displays of the 7-segment display of the S3000

Display	Possible cause	Remedying the error
3	Initialisation of the device or Waiting for the end of the initialisation of a second device connected to the EFI interface	➢ The display goes out automatically when the UE4155 and the S3000 have been initialised and the PROFIsafe communication to the FPLC has been established. If the display 3 does not go off: ➢ Check whether the connected device (here: the UE4155) is operational. ➢ Check the cabling. If no partner device is connected: ➢ Check the system configuration with the aid of the CDS. Re-transfer the corrected configuration to the S3000.
E ↻ 4	A device connected via EFI is malfunctioning.	➢ Check the connected device and the connection.
L ↻ 4	A device connected via EFI or the connection to the device is defective or disrupted.	➢ Check the connected device and the connection to this device.
P	A device connected via EFI reports a malfunction.	➢ Carry out a fault diagnosis of the device connected with the S3000 (here: the UE4155).
n ↻ 1	Input signal for an undefined monitoring case	➢ Check the path travelled by the vehicle. Or:
n ↻ 2	Incorrect sequence in the case of switchover for the items being monitored or a device connected via EFI reports a malfunction.	➢ Check the operating process of the monitored machine or system. ➢ If necessary, check the configuration of the items being monitored with the aid of the CDS.
n ↻ 3	Incorrect control of the control inputs	➢ Check the control of the digital control inputs.

9.6 System performance in the case of malfunctions in connected devices

9.6.1 Fault with respect to the safety-related communication of FPLC

If no safety-related communication takes place to the higher-level FPLC ...

- the bus node switches off all outputs controlled by the FPLC;
- the bus node signals an I/O error to the device connected to the SDL connection;
- an error message appears on the 7-segment display of the connected SDL device (also refer to the operating instructions of the connected device).

After the communication error to the higher-level FPLC has been fixed, the whole process image of the bus node remains deactivated because the error status bit has been set (the bus node is kept in a passive state)

WARNING

Program an error acknowledgement!

➢ Ensure that the FPLC program uses error acknowledgement. The FPLC program may not acknowledge the error until it has been resolved.

The bus node automatically deletes the I/O error as soon as the FPLC acknowledges the error. Valid I/O data are then exchanged again with the device connected to the SDL connection.

9.6.2 Error in connected components

When the bus node recognizes an error in a connected component, e.g. a device error on the SDL connection or a sensor error on a field signal connection, the behaviour of the bus node depends on its firmware version (see type label).

WARNING

Program an error acknowledgement!

➢ Ensure that the FPLC program uses error acknowledgement. The FPLC program may not acknowledge the error until it has been resolved.

Tab. 16: Response of the bus node in the event of errors of connected components

Firmware version of the bus node	How does the bus node respond?	When is the error information deleted?
< 1.05	• The bus node transmits failsafe safety information to the FPLC, i.e. the corresponding bits in the process image are set to logical "0". • The bus node sets the error status bit of the PROFIsafe message and deactivates the whole process image (the bus node is kept in a passive state). • The bus node generates a PROFIBUS diagnosis message.	The bus node deletes the error-status information and the PROFIBUS diagnostic message automatically, as soon as the error has been resolved. Valid I/O data in the process image are then again sent to the FPLC.
≥ 1.05	• The bus node remains operational. • The bus node transmits failsafe status information to the FPLC, i.e. it sets the bits corresponding to the input in the process image to “0“. • The bus node generates a PROFIBUS diagnosis message.	The bus node deletes the error-status information and the PROFIBUS diagnostic message automatically, as soon as the error has been resolved. Valid I/O data in the process image are then again sent to the FPLC.

9.7 PROFIBUS diagnostics

The bus node supports the request of diagnostic information. You can read out the diagnostic functions (slave diagnosis) with the aid of the standard-user program of the FPLC.

Chapter 12.2 “Process images” on page 67 contains a detailed representation of the process images of the bus node. The process images of the devices connected to the SDL connection are documented in the operating instructions of the corresponding function package.

9.8 Extended diagnostics

The CDS software supplied with the device (Configuration & Diagnostic Software) includes extended diagnostic options. It allows you to narrow down the problem if the error is non-specific or if you experience usage downtime problems. Detailed information to be found ...

- in the online help for the CDS (Configuration & Diagnostic Software).
- in the user manual for the CDS.

10 Technical specifications

10.1 Data sheet

Tab. 17: Technical specifications UE4155

	Minimum	Typical	Maximum
General system data			
Safety integrity level[6]	SIL3 (IEC 61508)		
SIL claim limit[6]	SILCL3 (EN 62061)		
Category	Category 4 (EN ISO 13849-1)		
Performance Level[6]	PL e (EN ISO 13849-1)		
PFHd (mean probability of a dangerous failure per hour)	1.3×10^{-9}		
T_M (mission time)	20 years (EN ISO 13849-1)		
Field-signal inputs			
Input voltage[7] HIGH	11 V	24 V	28.8 V
Input current HIGH	6 mA	12 mA	15 mA
Input voltage LOW	–28.8 V	0 V	8 V
Input current LOW	–1 mA	0 mA	3 mA
Input delay (configurable)	0 ms		90 ms
Test pulse data Test pulse rate Test pulse width Duty cycle	 95 %	 	 500 1/s 700 µs
Field-signal outputs			
Switched-on Output voltage HIGH (without load)	U_V		
Switching current	0 mA		700 mA
Minimum current for fault monitoring on field-signal connections 7 and 8[8]	7 mA	20 mA	40 mA
Peak current in the case of a short-circuit			2.4 A
Internal resistance			0.5 Ω
Switched-off Internal resistance (at 0 V)		 23 kΩ	

[6] For detailed information on the exact design of your machine/system, please contact your local SICK representative.
[7] As per IEC 61 131-2, type 2.
[8] Only when the connection is configured as an output for a muting lamp.

	Minimum	Typical	Maximum
SDL connections			
Power supply			
Current			1.4 A
Internal resistance			0.3 Ω
OSSD inputs			
Input voltage HIGH	13 V	24 V	28.8 V
Input current HIGH	1.8 mA	6 mA	8 mA
Input voltage LOW	–17 V		12 V
Input current LOW	–6 mA		1.6 mA
Test pulse data			
Test pulse rate			500 1/s
Test pulse width			700 µs
Duty cycle	95 %		
Discrepancy time	3 ms		6 ms
PROFIBUS connection			
Baud rate	9.6 kBit/s		12 MBit/s
Address range	3		125
Ident number	071A hex		
Operating data			
Supply voltage U_V at device[9)]	19.2 V	24 V	28.8 V
Residual ripple[10)]			5 V_{ss}
Power consumption through power-supply connection			9 A
Power consumption			3.8 W
Power-up delay after connecting the supply voltage		2–10 s	
Operating temp.	0 °C		+55 °C
Storage temperature	–25 °C		+70 °C (≤24 h)
Air humidity (non-dewing)	15 %		95 %
Rigidity	10 g, 10...300 Hz acc. to EN 60068-2-6		
Shock resistance	25 g, 6 ms acc. to EN 60068-2-29		
Protection class	III (EN 61140)		
Enclosure rating	IP 67 (EN 60529)		
Housing dimensions	See chapter 10.5 “Dimensional drawing bus node UE4155” on page 61		
Weight	620 g		

9) The external voltage supply must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60204-1.
10) Within the limits of U_V.

10.2 Response time

The response time of the bus node cannot be equated with the overall response time of the system. When considering the response time, you should instead calculate the response time on the individual signal paths (e.g. from the field-signal connection or SDL connection to the FPLC). The individual signals may have a different significance when considering the safety aspects of the entire system.

The response time of the entire system depends, among other things, upon ...

- the response time of the devices connected to the bus node.
- the device-specific transfer time (only when safe SICK-device communication is used on the SDL connection).
- the configured input delays of the safety inputs.
- the processing time in the bus node.
- the monitoring time for the cyclic service in the PROFIBUS.
- the processing time in the FPLC.

With the aid of the following calculation schedules you can calculate the response time on a signal path up to the hand-over of the information on the PROFIBUS output of the bus node.

You can find information for calculating the overall response time in the documentation of the FPLC that you are using. You can find information for calculating the (sub-)response time of the devices connected to the bus node in the corresponding operating instructions.

Notes for users of a Siemens FPLC

If you are using a Siemens FPLC, you will require the following data for calculating the "maximum response time" of the overall system:

Tab. 18: Data for calculating the "maximum response time" of the overall system

Siemens term	SICK term	Description
Discrepancy time	Discrepancy time	0 ms (see chapter 3.5.2 "Monitoring the discrepancy time" on page 20)
Max. response time if no error occurs Max. response time in the event of an error	Response time	Please refer to the tables below.
Max. acknowledgement response time	Internal processing time	6 ms

You can calculate the response time from a field-signal input to the PROFIBUS connection as follows:

➢ You can calculate the response time of the device connected to the field-signal connection in accordance with the corresponding operating instructions.

➢ Fill out the following table to determine the total response time for this signal path:

Tab. 19: Calculate the response time of a field-signal input

Line	Required detail	Time
1	Response time of the connected device	+ _____ ms
2	Set input delay	+ _____ ms
3	Internal processing time of the bus node	+ 6 ms
4	**Response time of the field-signal input**	**= _____ ms**

You can calculate the response time of the EFI interface (safe SICK device communication) on the SDL connection to the PROFIBUS connection as follows:

- ➢ You can calculate the response time of the device connected to the SDL connection in accordance with the corresponding operating instructions.
- ➢ Contact SICK to request the device-specific transfer time of the safe SICK-device communication, if this is not indicated in Tab. 20, line 2.
- ➢ Fill out the following table to determine the total response time for this signal path:

Tab. 20: Calculate the response time of the EFI interface to the PROFIBUS connection

Line	Required detail	Time
1	Response time of the connected device	+ _____ ms
2	When using the safe SICK-device communication[11]: • C4000: 4 ms • M4000: 4 ms • S3000: 21 ms • S300: 21 ms	+ _____ ms
3	Internal processing time of the bus node	+ 6 ms
4	**Response time of the SDL connection**	**= _____ ms**

You can calculate the response time of the hardware OSSD of the SDL connection to the PROFIBUS connection as follows:

- ➢ You can calculate the response time of the device connected to the SDL connection in accordance with the corresponding operating instructions.
- ➢ Fill out the following table to determine the total response time for this signal path:

Tab. 21: Calculate the response time of the hardware OSSDs

Line	Required detail	Time
1	Response time of the connected device	+ _____ ms
2	Internal processing time of the bus node	+ 6 ms
3	**Response time hardware OSSD**	**= _____ ms**

[11] The data correspond to their status when this document was compiled. Please contact SICK directly for data concerning other SICK devices.

10.3 Calculation of the input delay t_d for muting in conjunction with a M4000

Note The following information only applies to applications where an M4000 Advanced is operated on the SDL connection of the UE4155 **and** the muting sensors are connected via PROFIsafe.

When using muting in conjunction with an M4000 a minimum distance *L* between the recognized object and the M4000 must be calculated. To calculate the minimum distance *L* the input delay t_d of UE4155 is required.

How to calculate the input delay t_d:

➢ Please also observe the information on the arrangement of muting sensors in the operating instructions of the M4000 multiple light beam safety device in the chapter “Arrangement of muting sensors“.

You can route the signals of the muting sensors to M4000 in two ways:

- Connection of the muting sensors via the FPLC (see Tab. 22)
- Connection of the muting sensors to UE4155 bus node PROFIsafe, cross routing (see Tab. 23). This requires function package UE4100 for M4000.

Tab. 22: Calculation of the input delay t_d when connecting the muting sensors via the FPLC

Line	Required detail	Time
1	The muting sensor switches via the FPLC. The information of the muting sensors is available at the bus nodes. The following times must be totalled among others: • response time and processing time of the muting sensor • processing time of the input card • bus communication of the input card ⇨ FPLC • processing time of the FPLC • FPLC bus communication ⇨ of the bus node (Worst case conditions apply to all these parameters.)	+ _____ ms
2	Internal processing time of the bus node	+ 6 ms
3	**Total = input delay t_d**	**= _____ ms**

Tab. 23: Calculation of the input delay t_d if the muting sensors are connected to UE4155

Line	Required detail	Time
1	Longest set input delay of all field signal inputs to which a muting sensor is connected	+ _____ ms
2	Internal processing time of the bus node	+ 6 ms
3	**Total = input delay t_d**	**= _____ ms**

10.4 Advancement for the monitoring case switching of a connected S3000

Note The following information only applies for applications in which you operate an S3000 safety laser scanner on the SDL connection on the UE4155.

If the S3000 switches between several monitoring cases, then you must advance the timing for the switching.

WARNING

Define the timing for the switching such that the S3000 already detects a person in the protective field before the dangerous state occurs!

Note that at the time of the switching there may be a person in the protective field. Only by means of switching in the correct time frame (i.e. *before* the hazard occurs at this point for the person) is protection provided.

- If you operate the control inputs for switching the S3000 using the bus node, then you must advance the timing for the switching by 0.5 times the basic response time of the S3000.
- If you have configured an input delay for the control inputs on the S3000, then you must also advance the timing for the switching by the input delay configured.

Tab. 24: Advancement for the switch timing on a S3000

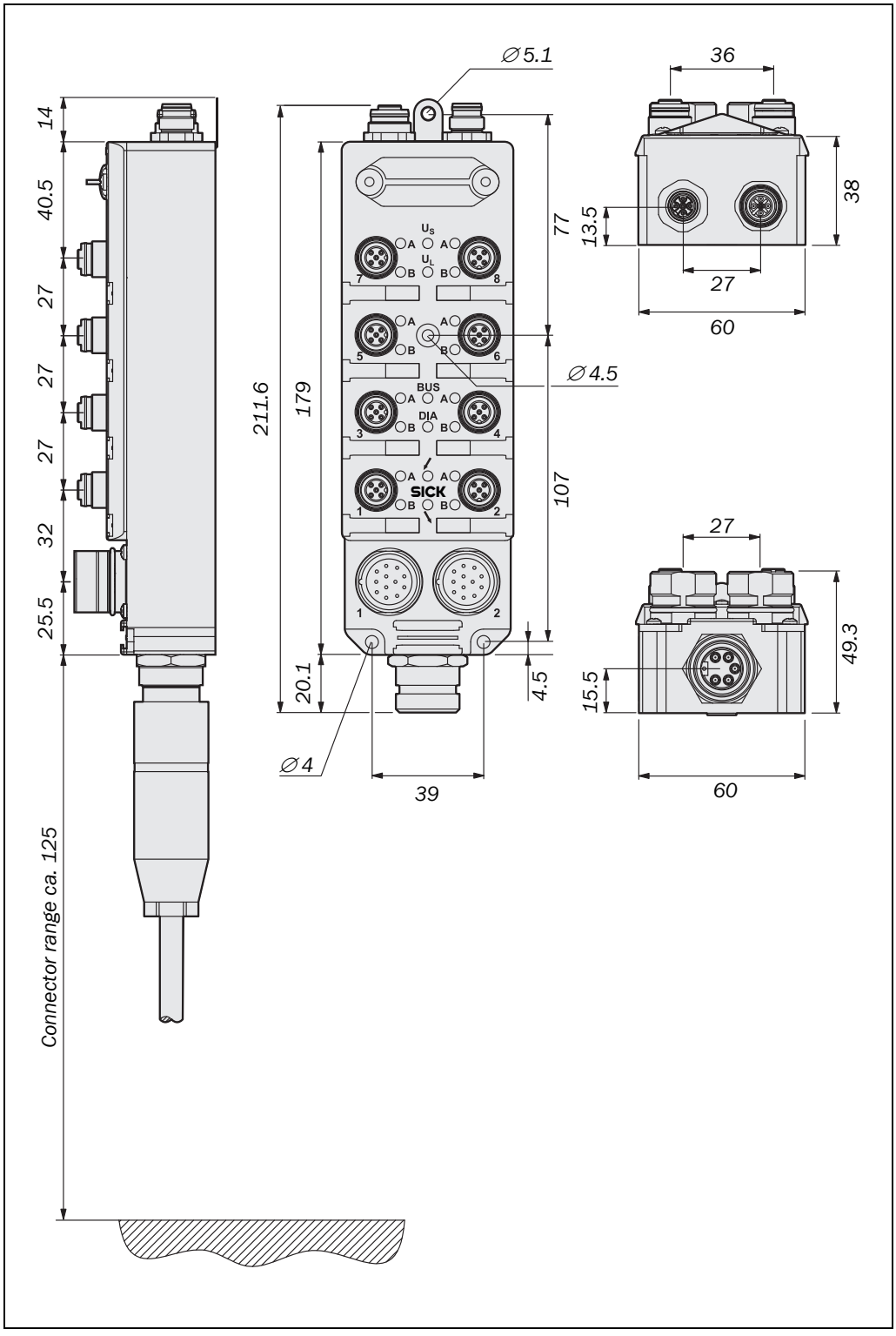
Line	Required detail	Time
1	Processing time PROFIsafe (information for switching is present at the bus node)	+ _____ ms
2	Internal processing time of the bus node	+ 6 ms
3	Basic response time S3000 × 0.5 (= 30 or 60 ms)	+ _____ ms
4	Input delay of the control inputs for the S3000	+ _____ ms
5	Response time of the bus node as per Tab. 20 or Tab. 21 (see chapter 10.2).	+ _____ ms
6	**Required advancement for the switch timing**	**= _____ ms**

Note The time required calculated here for advancing the timing for switching includes only the time to the provision of the information on the bus node's PROFIBUS output.

Detailed information on the switching of the monitoring case is included in the operating instructions "S3000 Safety Laser Scanner".

10.5 Dimensional drawing bus node UE4155

Fig. 16: Dimensional drawing bus node UE4155 (mm)



11 Ordering information

11.1 Bus node

Tab. 25: Part number bus node UE4155

Part	Part number
UE4155 bus node (type code UE4155-01BC700)	1024057

11.2 Accessories

Tab. 26: Part numbers, accessories

Part	Part number
SDL connections	
Connection plug M23 × 12, crimped, for wire cross-section 0.08–0.82 mm²	6024742
Connecting wires for bus node on Hirschmann cable socket M26 × 11 + FE (e.g. to connect the safety light curtain C4000). Wire cross-section 12 × 0.75 mm²	
Plug straight/socket straight, 2.5 m	2029131
Plug straight/socket straight, 5 m	2025634
Plug straight/socket straight, 10 m	2025635
Plug straight/socket straight, 15 m	2025636
Connection cable (e.g. for the connection of the Safety Laser Scanner S3000). Wire cross-section 6 × 0.75 mm²	
Plug straight/stripped, 2.5 m	2029337
Plug straight/stripped, 5 m	2029338
Plug straight/stripped, 10 m	2029339
Plug straight/stripped, 15 m	2029340
Protective cap M23 for SDL connection	5310774

Part	Part number
Field-signal connections	
Plug M12 × 5, screwed, for wire cross-section max. 0.75 mm²	
Plug straight, screened	6024741
Plug straight	6022083
Plug angled	6022082
Plug M12 × 5 with connecting wires, shielded, stripped	
Plug straight, 2 m	6024860
Plug straight, 5 m	6024861
Plug straight, 10 m	6024862
Plug M12 × 5 with connecting wires, unshielded, stripped	
Plug straight, 2 m	6026133
Plug straight, 5 m	6026134
Plug straight, 10 m	6026135
Two-way splitter M12 × 5 for the simultaneous connection of, e.g., two emergency-stop buttons (single-channel) on one field-signal connection	6024744
Protective cap M12 for field-signal connection, 10 pieces	5309189
PROFIBUS connection	
Plug M12 × 5, straight, B-coded, screwed, for wire cross-section max. 0.75 mm²	6021354
Socket M12 × 5, straight, B-coded, screwed, for wire cross-section max. 0.75 mm²	6021353
Plug M12 × 4, with terminating resistor, straight, B-coded	6021156
Power supply	
Socket 7/8" × 5 with screw lock, straight, screwed, for wire cross-section max. 1.5 mm²	6024745
CDS (Configuration & Diagnostic Software)	
CDS (Configuration & Diagnostic Software) on CD-ROM including online documentation and operating instructions in all available languages	2032314
Connection cable M8 × 4/D-Sub 9-pin (DIN 41642); for connecting the configuration interface and the serial interface of the PC	
2 m	6021195
8 m	2027649

Part	Part number
Function packages	
Function package UE4100 for C4000 (only in connection with UE4155)	2026871
Expands the number of CDS functions when operating the bus node with safety light curtain C4000. Enables cross-routing of field-signal connections to the SDL connections	
Function package UE4100 for S3000 (only in connection with UE4155)	2026872
Expands the number of CDS functions when operating the bus node with safety laser scanner S3000. Enables cross-routing of field-signal connections to the SDL connections	
Function package UE4100 for I/O	2026873
Expands the number of CDS functions by adding predefined applications for the field-signal inputs	
Function package PROFIBUS communication driver	2026874
Enables the configuration and diagnosis of the bus node and of the connected SDL devices via the acyclic services of the PROFIBUS (CDS connection as a master class 2)	
Other accessories	
Designation plates in the 9 × 20 mm frame, 40 pieces	5310775

12 Annex

12.1 Planning table for the configuration

Use a printout or a copy of the following planning table to plan and document the bus-node configuration. You can read out and document the final configuration of the bus node with the aid of the CDS:

Device symbol **UE4100 PROFIsafe**, context menu **Configuration draft**, **Display**.

Tab. 27: Planning table for the bus-node configuration

Criterion	Configuration		Notes
General			
Project name			Free text. Useful for the placement of the safety planning in the entire project. Can also be stored in the CDS
Application name			The application name designates the configuration within the CDS.
Locale name			Record useful data for the spatial placement of the bus node.
PROFIBUS			
PROFIBUS address			Must be unique within the PROFIBUS network. Valid values are integers between 3 and 125.
PROFIsafe address (F_Dest_Add)			Allocated by higher-level hardware configuration program. Must be unique within the PROFIBUS network. Valid values are integers between 1 and 65 534.
Initial address in the FPLC process image	Input process image: _____ Output process image: _____		Copy this value from the PROFIBUS hardware-configuration program.
SDL connections			
Description	SDL1:	SDL2:	For example “access protection robot 2” or reference to a different planning tool
Connected device			Designation and serial number for the unique identification of the device
Subproject			Optional: Name or additional information for the placement of the device in the overall planning
Other connected sensors (Guests)			Optional: Device designation and serial number. You can use a two-way splitter to work around the voltage supply of the SDL connection e.g. for a C4000 sender so that SDL connection 2 remains unoccupied.
Read hardware OSSD	☐ Active ☐ Not active	☐ Active ☐ Not active	When this function is activated, there is a device-dependent reduction in response time because the bus node copies the OSSD status information from the hardware input instead of from the safe SICK-device communication of the device.
Process-image length	16 bit	16 bit	The sub-process images are located in the following sequence in the bus-node process image: Field-signal connections 1 through 8 each with channel A and B, SDL1, SDL2.

Criterion	**Configuration**		**Notes**
Field-signal connection ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8			
Application	Channel A:	Channel B:	Description of the connected devices and their purpose
Connection	☐ Single-channel ☐ Two-channel equivalent ☐ Two-channel complementary		The connection depends, among other things, on the category according to EN ISO 13849-1 which is to be achieved.
Output	☐ Static off ☐ Static on	☐ Static off ☐ Static on	Static on = 24 V Static off = 0 V Test signals = defined test impulse Signal output: The output can only be configured for a single-channel connection as a signal output. Bit set = 24 V
	☐ Test signal to the field-signal connection ___, channel ___	☐ Test signal to the field-signal connection ___, channel ___	
	☐ Signal output ☐ From FPLC ☐ To SDL ___, function _____	☐ Signal output ☐ From FPLC ☐ To SDL ___, function _____	
Safety input	☐ Off	☐ Off	If the input is unused, you must configure it to “Off”.
	☐ Signal input ☐ To FPLC ☐ To SDL ___, function _____	☐ Signal input ☐ To FPLC ☐ To SDL ___, function _____	
Input delay	☐ Inactive ☐ _____ ms	☐ Inactive ☐ _____ ms	Delay time between the last signal change and the re-reading of the safety input. Maximum of 90 ms is permitted.
Discrepancy time	☐ Inactive ☐ _____ ms		Only relevant for a two-channel connection. Limits the time during which the plausibility of the two-channel connection after a signal switch may be violated.
Process image	Length: 2 bit		The sub-process images are located in the following sequence in the bus-node process image: Field-signal connections 1 through 8 each with channel A and B, SDL1, SDL2.

12.2 Process images

12.2.1 Process-image structure of the UE4155 PROFIsafe

Tab. 28: Process-image structure of the UE4155 PROFIsafe

	Area	Position	Description
Input signals from the bus node to the FPLC	Field-signal connections	Bytes 0–1	2 × 8 bit (boolean)
	SDL connection 1	Bytes 2–3	2 × 8 bit (boolean)
	SDL connection 2	Bytes 4–5	2 × 8 bit (boolean)
	PROFIsafe header	Bytes 6–9	Reserved for PROFIsafe data
Output signals from the FPLC to the bus node	Field-signal connections	Bytes 0–1	2 × 8 bit (boolean)
	SDL connection 1	Bytes 2–3	2 × 8 bit (boolean)
	SDL connection 2	Bytes 4–5	2 × 8 bit (boolean)
	PROFIsafe header	Bytes 6–9	Reserved for PROFIsafe data

12.2.2 Process images of the field-signal connections

Input signals of the field-signal connections to the FPLC

Position (Byte/Bit)	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Field-signal connection	4		3		2		1	
Description	In B	In A	In B	In A	In B	In A	In B	In A
Position (Byte/Bit)	**1.7**	**1.6**	**1.5**	**1.4**	**1.3**	**1.2**	**1.1**	**1.0**
Field-signal connection	8		7		6		5	
Description	In B	In A	In B	In A	In B	In A	In B	In A

Tab. 29: Process image of the input signals from the field-signal connections to the FPLC

Output signals from the FPLC to the field-signal connections

Position (Byte/Bit)	**0.7**	**0.6**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**
Field-signal connection	4		3		2		1	
Description	Out B	Out A	Out B	Out A	Out B	Out A	Out B	Out A
Position (Byte/Bit)	**1.7**	**1.6**	**1.5**	**1.4**	**1.3**	**1.2**	**1.1**	**1.0**
Field-signal connection	8		7		6		5	
Description	Out B	Out A	Out B	Out A	Out B	Out A	Out B	Out A

Tab. 30: Process image of the output signal from the FPLC to the field-signal connections

12.2.3 Process images of the SDL connections

Notes

- The process images of the SDL connections are all two bytes in length. Their structure depends on the device, which is connected to the corresponding SDL connection. To this end, please read the operating instructions of the UE4155 function package for the device in question.
- Please consult the operating instructions of the corresponding device when using device-specific functions.

Input signals from the SDL connection to the FPLC

Address SDL1	**2.7**	**2.6**	**2.5**	**2.4**	**2.3**	**2.2**	**2.1**	**2.0**
Address SDL2	**4.7**	**4.6**	**4.5**	**4.4**	**4.3**	**4.2**	**4.1**	**4.0**
C4000 Standard/Advanced	Reset required	RESET (signal is present)	Status signal output (ADO)	Reserved	OSSD of guest 2 green	OSSD of guest 1 green	Host OSSD green	OSSD (output signal sw. device) green[12)]
M4000 Advanced	Reset required	RESET (signal is present)	Status signal output (ADO)	Reserved	Additional signal C1 or Belt stop	Muting lamp Off/On	Muting status	OSSD (output signal sw. device) green[12)]
S3000	Reset required	RESET (signal is present)	Simultaneously monitored area[13)]		Used monitored area		Warning field free [14)]	OSSD (output signal sw. device) green[12)]
			Warning field free [14)]	Protective field free [14)]	Warning field free [14)]	Protective field free [14)]		
S300	Reset required	RESET (signal is present)	Reserved	Reserved	Used monitored area		Warning field free [14)]	OSSD (output signal sw. device) green[12)]
					Warning field free [14)]	Protective field free [14)]		
Address SDL1	**3.7**	**3.6**	**3.5**	**3.4**	**3.3**	**3.2**	**3.1**	**3.0**
Address SDL2	**5.7**	**5.6**	**5.5**	**5.4**	**5.3**	**5.2**	**5.1**	**5.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
M4000 Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
S3000	Status of the monitored-case inputs on the S3000[15)]							
	In D2	In D1	In C2	In C1	In B2	In B1	In A2	In A1
S300	Status of the monitored-case inputs on the S300[15)]							
	Reserved	Reserved	Reserved	Reserved	In B2	In B1	In A2	In A1

Tab. 31: Process image of the input signals from the SDL connection to the FPLC

[12)] Depending on the configuration of the bus node either the OSSD status read in via the hardware OSSD inputs or the status received via SICK device communication is entered (see section “Reading the OSSD status at the SDL connection“ on page 21).

[13)] ⚠ **Warning:** The return value depends on the firmware version of the used S3000:

	Return value	
S3000 firmware version	**Simultaneously monitored area defined**	**Simultaneously monitored area not defined**
Controller ≥ 2.26 and Interface ≥ 1.00	Status of the protective field/warning field	Permanently 1 (protective field/warning field free)
Controllers < 2.26 and Interface < 1.00		Permanently 0 (protective field/warning field free)

[14)] ⚠ **Warning:** When an S3000 is used whose firmware version of the **controller < 2.26** and firmware version of the **interfaces < 1.00**, only evaluate this bit in the FPLC together with the passive status of UE4155!
Reason: The bit operations for these devices are inverted (see above). The bit has the value 1 if a dangerous state has been detected. The bit has the value 0 if no dangerous state has been detected. However, the bit can also have the value 0 due to erroneous communication. For this reason, the passive status of UE4155 must always be monitored as well (for example for Siemens Step 7: variable PASS_OUT in the data block F-IO).

[15)] In A1 to In D2 are the static control signals directly at the S3000 and S300.

Output signal from the FPLC to the SDL connection

Notes

- The following applies to the output signal in Tab. 32: When, in the bus node, a cross-routing has been configured from a field-signal input directly to the corresponding input signal of the C4000, then the cross-routing takes priority over the FPLC output signal. I.e. the bus node does not route the corresponding output signal from the FPLC on to the SDL connection.
- In order to write data from the FPLC to the SDL connection, you require a UE4155 bus node. You will find an operating description in the operating instructions for the SDL device.

Address SDL1	**2.7**	**2.6**	**2.5**	**2.4**	**2.3**	**2.2**	**2.1**	**2.0**
Address SDL2	**4.7**	**4.6**	**4.5**	**4.4**	**4.3**	**4.2**	**4.1**	**4.0**
C4000 Standard/Advanced	Reserved	Activate teach-in	Operating mode switching					
			6	5	4	3	2	1
M4000 Advanced	Reserved	Status muting lamp	Reset/Override or Reset	Override or Additional signal C1 or Belt stop	Muting sensors			
					B2	B1	A2	A1
S3000	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
S300	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Address SDL1	**3.7**	**3.6**	**3.5**	**3.4**	**3.3**	**3.2**	**3.1**	**3.0**
Address SDL2	**5.7**	**5.6**	**5.5**	**5.4**	**5.3**	**5.2**	**5.1**	**5.0**
C4000 Standard/Advanced	Bypass channel 2	Bypass channel 1	Reserved	Reserved	Reserved	Top dead centre (MCC-TDC)	Bottom dead centre (MCC-BDC)	Run-on monitoring (SCC)
M4000 Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
S3000	S3000 monitoring case switching							
	In D2	In D1	In C2	In C1	In B2	In B1	In A2	In A1
S300	S300 monitoring case switching							
	Reserved	Reserved	Reserved	Reserved	In B2	In B1	In A2	In A1

Tab. 32: Process image of the output signals from the FPLC to the SDL connection

12.3 Diagnostics data

The diagnostics data of the UE4155 bus node start at byte 12 of the diagnostic telegram. The structure of the diagnostic telegram complies with PROFIBUS DP V1.

The diagnostics data comprise 50 bytes. Please refer to the tables below for the relevant distribution.

Note The list of diagnosis messages in the hardware configuration tool first lists the general errors and then ever more detailed diagnostics messages. The diagnosis messages at the beginning of the list cannot be fixed without the diagnosis messages at the end.

Tab. 33: Structure of the diagnostics data of the UE4155

Area	Position	Details
Station status	Bytes 0–2	
PROFIBUS address of the PROFIBUS master	Byte 3	
Ident number	Bytes 4–5	Chapter 10.1 on page 56ff.
DP V1 diagnostics header	Bytes 6–9	
PROFIsafe diagnostics byte	Bytes 10	Cf. Tab. 34
Diagnostics data bus node	Bytes 11–15	Cf. Tab. 35
Diagnostics data of field-signal connections	Bytes 16–25	Cf. Tab. 36
Diagnostics data of the 1st device on SDL connection 1 (Host)	Bytes 26–29	Cf. Tab. 37
Diagnostics data of the 2nd device on SDL connection 1 (Guest 1)	Bytes 30–33	Cf. Tab. 38
Diagnostics data of the 3rd device on SDL connection 1 (Guest 2)	Bytes 34–37	Cf. Tab. 39
Diagnostics data of the 1st device on SDL connection 2 (Host)	Bytes 38–41	Cf. Tab. 40
Diagnostics data of the 2nd device on SDL connection 2 (Guest 1)	Bytes 42–45	Cf. Tab. 41
Diagnostics data of the 3rd device on SDL connection 2 (Guest 2)	Bytes 46–49	Cf. Tab. 42

12.3.1 PROFIsafe diagnostics byte

Address	10.7	10.6	10.5	10.4	10.3	10.2	10.1	10.0
PROFIsafe diagnostics byte (decimal value)	64 The F address provided by the firmware does not match the parameter **F_Dest_Add**. 65 The parameter **F_Dest_Add** has the value 0x0000 or 0xFFFF. 66 The parameter **F_Source_ Add** has the value 0x0000 or 0xFFFF. 67 The parameter **F_WD_Time** has the value 0 ms. 68 The value of the parameter **F_SIL** exceeds the SIL value for the firmware.				69 The parameter **FCRC_Length** does not match the values generated. 70 Incorrect version of the F-parameter set 71 CRC1 error 72 Reserved (do not use nor sample number) 73 Reserved (do not use nor sample number) 74 Reserved (do not use nor sample number)			

Tab. 34: Detection-related diagnostics

12.3.2 Diagnostics data of the bus node

Address	**11.7**	**11.6**	**11.5**	**11.4**	**11.3**	**11.2**	**11.1**	**11.0**
Bus node	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Address	**12.7**	**12.6**	**12.5**	**12.4**	**12.3**	**12.2**	**12.1**	**12.0**
Bus node	Reserved	Reserved	Reserved	Configuration required	Reboot	New configuration detected	Operational status of the bus node 00: Operation 01: Initialisation or configuration required 10: Configuration mode 11: Lock-out	
Address	**13.7**	**13.6**	**13.5**	**13.4**	**13.3**	**13.2**	**13.1**	**13.0**
PROFIBUS	Reserved	Reserved	Reserved	Field-signal connection error	PROFIsafe I/O error	PROFIBUS network incorrectly configured	Error in PROFIBUS communication	PROFIBUS address changed
Address	**14.7**	**14.6**	**14.5**	**14.4**	**14.3**	**14.2**	**14.1**	**14.0**
SDL1	SDL device reboot	New configuration detected	Error in connected devices	SDL device unconfigured or configuration incorrect	OSSD error	Communication error	Safe communication error	Overload
Address	**15.7**	**15.6**	**15.5**	**15.4**	**15.3**	**15.2**	**15.1**	**15.0**
SDL2	SDL device reboot	New configuration detected	Error in connected devices	SDL device unconfigured or configuration incorrect	OSSD error	Communication error	Safe communication error	Overload

Tab. 35: Diagnostics data of the bus node

12.3.3 Diagnostics data of the field-signal connections

Address	**16.7**	**16.6**	**16.5**	**16.4**	**16.3**	**16.2**	**16.1**	**16.0**
Field-signal input 1	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**17.7**	**17.6**	**17.5**	**17.4**	**17.3**	**17.2**	**17.1**	**17.0**
Field-signal input 2	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**18.7**	**18.6**	**18.5**	**18.4**	**18.3**	**18.2**	**18.1**	**18.0**
Field-signal input 3	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**19.7**	**19.6**	**19.5**	**19.4**	**19.3**	**19.2**	**19.1**	**19.0**
Field-signal input 4	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**20.7**	**20.6**	**20.5**	**20.4**	**20.3**	**20.2**	**20.1**	**20.0**
Field-signal input 5	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**21.7**	**21.6**	**21.5**	**21.4**	**21.3**	**21.2**	**21.1**	**21.0**
Field-signal input 6	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**22.7**	**22.6**	**22.5**	**22.4**	**22.3**	**22.2**	**22.1**	**22.0**
Field-signal input 7	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**23.7**	**23.6**	**23.5**	**23.4**	**23.3**	**23.2**	**23.1**	**23.0**
Field-signal input 8	T_{Out} B		In B		T_{Out} A		In A	
	Overload	Reserved	Input incorrectly configured	Test-error at the input	Overload	Reserved	Input incorrectly configured	Test-error at the input
Address	**24.7**	**24.6**	**24.5**	**24.4**	**24.3**	**24.2**	**24.1**	**24.0**
Diagnostics	Discrepancy time overflow[16] Field-signal input ...							
	8	7	6	5	4	3	2	1
Address	**25.7**	**25.6**	**25.5**	**25.4**	**25.3**	**25.2**	**25.1**	**25.0**
Diagnostics	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Tab. 36: Diagnostics data of the field-signal connections

[16] In the case of the set discrepancy-time overrun of the diagnosis bit, the status bits for In A and In B are assigned failsafe values.

12.3.4 Diagnostics data of devices on the SDL connections

The diagnostics data of the SDL connections are twelve bytes in length for each connection. Their structure depends on the device which is connected to the corresponding SDL connection. To this end, please read the operating instructions of the UE4155 function package for the device in question.

Diagnostics data of the 1st device on SDL connection 1 (Host)

Address	**26.7**	**26.6**	**26.5**	**26.4**	**26.3**	**26.2**	**26.1**	**26.0**
C4000 Standard/Advanced	Reserved	Contamination	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
M4000 Advanced								
S3000								
S300								
Address	**27.7**	**27.6**	**27.5**	**27.4**	**27.3**	**27.2**	**27.1**	**27.0**
C4000 Standard/Advanced	Emergency Stop status	Selected operating mode of the C4000 (000 = none, 001–110 = 1–6)			Operational status of the device 00: Operation 01: Initialisation 10: Configuration mode 11: Lock-out		Device error	Reserved
M4000 Advanced	Reserved	Reserved	Reserved	Reserved				
S3000	Status of the monitored-case inputs on the S3000							
	In B2	In B1	In A2	In A1				
S300	Reserved	Reserved	Reserved	Reserved				
Address	**28.7**	**28.6**	**28.5**	**28.4**	**28.3**	**28.2**	**28.1**	**28.0**
C4000 Standard/Advanced	Reserved	Reserved	Diagnostics protective field 00: Error 01: Invalid PSDI interruption 10: Valid PSDI interruption 11: No object/no PSDI interruption		Reserved	Teach-in active	Reserved	Teach-in key-operated switch operated
M4000 Advanced			Reserved	Reserved		Reserved		Reserved
S3000					Status of the monitored-case inputs on the S3000			
					In D2	In D1	In C2	In C1
S300					Reserved	Reserved	Reserved	Reserved
Address	**29.7**	**29.6**	**29.5**	**29.4**	**29.3**	**29.2**	**29.1**	**29.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Status bypass	Reserved
M4000 Advanced							Reserved	
S3000								
S300								

Tab. 37: Diagnostics data of the 1st device on SDL connection 1 (Host)

Diagnostics data of the 2nd device on SDL connection 1 (Guest 1)

Address	**30.7**	**30.6**	**30.5**	**30.4**	**30.3**	**30.2**	**30.1**	**30.0**
C4000 Standard/Advanced	Reserved	Contamination	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Address	**31.7**	**31.6**	**31.5**	**31.4**	**31.3**	**31.2**	**31.1**	**31.0**
C4000 Standard/Advanced	Reserved	Selected operating mode of the C4000 (000 = none, 001–110 = 1–6)			Operational status of the device 00: Operation 01: Initialisation 10: Configuration mode 11: Lock-out		Device error	Reserved
Address	**32.7**	**32.6**	**32.5**	**32.4**	**32.3**	**32.2**	**32.1**	**32.0**
C4000 Standard/Advanced	Reserved	Reserved	Diagnostics protective field 00: Error 01: Invalid PSDI interruption 10: Valid PSDI interruption 11: No object/no PSDI interruption		Reserved	Teach-in active	Reserved	Teach-in key-operated switch operated
Address	**33.7**	**33.6**	**33.5**	**33.4**	**33.3**	**33.2**	**33.1**	**33.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Tab. 38: Diagnostics data of the 2nd device on SDL connection 1 (Guest 1)

Diagnostics data of the 3rd device on SDL connection 1 (Guest 2)

Address	**34.7**	**34.6**	**34.5**	**34.4**	**34.3**	**34.2**	**34.1**	**34.0**
C4000 Standard/Advanced	Reserved	Contamination	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Address	**35.7**	**35.6**	**35.5**	**35.4**	**35.3**	**35.2**	**35.1**	**35.0**
C4000 Standard/Advanced	Reserved	Selected operating mode of the C4000 (000 = none, 001–110 = 1–6)			Operational status of the device 00: Operation 01: Initialisation 10: Configuration mode 11: Lock-out		Device error	Reserved
Address	**36.7**	**36.6**	**36.5**	**36.4**	**36.3**	**36.2**	**36.1**	**36.0**
C4000 Standard/Advanced	Reserved	Reserved	Diagnostics protective field 00: Error 01: Invalid PSDI interruption 10: Valid PSDI interruption 11: No object/no PSDI interruption		Reserved	Teach-in active	Reserved	Teach-in key-operated switch operated
Address	**37.7**	**37.6**	**37.5**	**37.4**	**37.3**	**37.2**	**37.1**	**37.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Tab. 39: Diagnostics data of the 3rd device on SDL connection 1 (Guest 2)

Diagnostics data of the 1st device on SDL connection 2 (Host)

Address	**38.7**	**38.6**	**38.5**	**38.4**	**38.3**	**38.2**	**38.1**	**38.0**
C4000 Standard/Advanced	Reserved	Contami-nation	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
M4000 Advanced								
S3000								
S300								
Address	**39.7**	**39.6**	**39.5**	**39.4**	**39.3**	**39.2**	**39.1**	**39.0**
C4000 Standard/Advanced	Emergency Stop status	Selected operating mode of the C4000 (000 = none, 001–110 = 1–6)			Operational status of the device 00: Operation 01: Initialisation 10: Configuration mode 11: Lock-out		Device error	Reserved
M4000 Advanced	Reserved	Reserved	Reserved	Reserved				
S3000	Status of the monitored-case inputs on the S3000							
	In B2	In B1	In A2	In A1				
S300	Reserved	Reserved	Reserved	Reserved				
Address	**40.7**	**40.6**	**40.5**	**40.4**	**40.3**	**40.2**	**40.1**	**40.0**
C4000 Standard/Advanced	Reserved	Reserved	Diagnostics protective field 00: Error 01: Invalid PSDI interruption 10: Valid PSDI interruption 11: No object/no PSDI interruption		Reserved	Teach-in active	Reserved	Teach-in key-operated switch operated
M4000 Advanced			Reserved	Reserved		Reserved		Reserved
S3000					Status of the monitored-case inputs on the S3000			
					In D2	In D1	In C2	In C1
S300					Reserved	Reserved	Reserved	Reserved
Address	**41.7**	**41.6**	**41.5**	**41.4**	**41.3**	**41.2**	**41.1**	**41.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Status bypass	Reserved
M4000 Advanced							Reserved	
S3000								
S300								

Tab. 40: Diagnostics data of the 1st device on SDL connection 2 (Host)

Diagnostics data of the 2nd device on SDL connection 2 (Guest 1)

Address	**42.7**	**42.6**	**42.5**	**42.4**	**42.3**	**42.2**	**42.1**	**42.0**
C4000 Standard/Advanced	Reserved	Contamination	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Address	**43.7**	**43.6**	**43.5**	**43.4**	**43.3**	**43.2**	**43.1**	**43.0**
C4000 Standard/Advanced	Reserved	Selected operating mode of the C4000 (000 = none, 001–110 = 1–6)			Operational status of the device 00: Operation 01: Initialisation 10: Configuration mode 11: Lock-out		Device error	Reserved
Address	**44.7**	**44.6**	**44.5**	**44.4**	**44.3**	**44.2**	**44.1**	**44.0**
C4000 Standard/Advanced	Reserved	Reserved	Diagnostics protective field 00: Error 01: Invalid PSDI interruption 10: Valid PSDI interruption 11: No object/no PSDI interruption		Reserved	Teach-in active	Reserved	Teach-in key-operated switch operated
Address	**45.7**	**45.6**	**45.5**	**45.4**	**45.3**	**45.2**	**45.1**	**45.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Tab. 41: Diagnostics data of the 2nd device on SDL connection 2 (Guest 1)

Diagnostics data of the 3rd device on SDL connection 2 (Guest 2)

Address	**46.7**	**46.6**	**46.5**	**46.4**	**46.3**	**46.2**	**46.1**	**46.0**
C4000 Standard/Advanced	Reserved	Contamination	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Address	**47.7**	**47.6**	**47.5**	**47.4**	**47.3**	**47.2**	**47.1**	**47.0**
C4000 Standard/Advanced	Reserved	Selected operating mode of the C4000 (000 = none, 001–110 = 1–6)			Operational status of the device 00: Operation 01: Initialisation 10: Configuration mode 11: Lock-out		Device error	Reserved
Address	**48.7**	**48.6**	**48.5**	**48.4**	**48.3**	**48.2**	**48.1**	**48.0**
C4000 Standard/Advanced	Reserved	Reserved	Diagnostics protective field 00: Error 01: Invalid PSDI interruption 10: Valid PSDI interruption 11: No object/no PSDI interruption		Reserved	Teach-in active	Reserved	Teach-in key-operated switch operated
Address	**49.7**	**49.6**	**49.5**	**49.4**	**49.3**	**49.2**	**49.1**	**49.0**
C4000 Standard/Advanced	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Tab. 42: Diagnostics data of the 3rd device on SDL connection 2 (Guest 2)

12.4 EC declaration of conformity

Fig. 17: EC declaration of conformity (page 1)

SICK

TYPE: UE4155	Ident-No.: 9151306

EC declaration of conformity **en**
The undersigned, representing the following manufacturer herewith declares that the product is in conformity with the provisions of the following EC directive(s) (including all applicable amendments), and that the respective standards and/or technical specifications have been applied.

EG-Konformitätserklärung **de**
Der Unterzeichner, der den nachstehenden Hersteller vertritt, erklärt hiermit, dass das Produkt in Übereinstimmung mit den Bestimmungen der nachstehenden EG-Richtlinie(n) (einschließlich aller zutreffenden Änderungen) ist, und dass die entsprechenden Normen und/oder technischen Spezifikationen zur Anwendung gelangt sind.

ЕС декларация за съответствие **bg**
Подписалият, който представя долуспоменатия производител, обявява, че продуктът съответва на разпоредбите на долуизброените директиви на ЕС (включително на всички действащи изменения) и че отговаря на съответните норми и/или технически спецификации за приложение.

ES prohlášení o shodě **cs**
Níže podepsaný, zastupující následujícího výrobce, tímto prohlašuje, že výrobek je v souladu s ustanoveními následující(ch) směrnice (směrnic) ES (včetně všech platných změn) a že byly použity odpovídající normy a/nebo technické specifikace.

EF-overensstemmelseserklæring **da**
Undertegnede, der repræsenterer følgende producent erklærer hermed at produktet er i overens-stemmelse med bestemmelserne i følgende EF-direktiv(er) (inklusive alle gældende ændringer) og at alle tilsvarende standarder og/eller tekniske specifikationer er blevet anvendt.

ΕΕ-Δήλωση συμμόρφωσης **el**
Ο Υπογράφων, εκπροσωπών τον ακόλουθο κατασκευαστή δηλώνει με το παρόν έγγραφο ότι το προϊόν συμμορφώνεται με τους όρους της (των) ακόλουθης (-ων) Οδηγίας (-ών) της ΕΕ (συμπεριλαμβανομένων όλων των εφαρμοζόμενων τροποποιήσεων) και ότι έχουν εφαρμοστεί τα αντίστοιχα πρότυπα και/ή οι τεχνικές προδιαγραφές.

Declaración de conformidad CE **es**
El abajo firmante, en representación del fabricante indicado a continuación, declara que el producto es conforme con las disposiciones de la(s) siguiente(s) directiva(s) de la CE (incluyendo todas las modificaciones aplicables) y que las respectivas normas y/o especificaciones técnicas han sido aplicadas.

EÜ vastavusdeklaratsioon **et**
Allakirjutanu, kes esindab järgmist tootjat, kinnitab käesolevaga, et antud toode vastab järgneva(te) EÜ direktiivi(de) sätetele (kaasa arvatud kõikidele asjakohastele muudatustele) ja et on kohaldatud vastavaid nõudeid ja/või tehnilisi kirjeldusi.

EY-vaatimustenmukaisuusvakuutus **fi**
Allekirjoittanut, joka edustaa alla mainittua valmistajaa, vakuuttaa täten, että tuote on seuraavan (-ien) EU-direktiivin (-ien) vaatimusten mukainen (mukaan lukien kaikki sovellettavat muutokset) ja että vastaavia standardeja ja teknisiä erittelyjä on sovellettu.

Déclaration CE de conformité **fr**
Le soussigné, représentant le constructeur ci-après, déclare par la présente que le produit est conforme aux exigences de la (des) directive(s) CE suivantes (y compris tous les amendements applicables) et que les normes et/ou spécifications techniques correspondantes ont été appliquées.

EK megfelelőségi nyilatkozat **hu**
Alulírott, az alábbi gyártó képviseletében ezennel kijelenti, hogy a termék megfelel az alábbi EK-irányelv(ek) követelményeinek (beleértve azok minden vonatkozó módosítását) és kijelenti hogy a megfelelő szabványokat és/vagy műszaki előírásokat alkalmazta.

EB-samræmisyfirlýsing **is**
Undirritaður, fyrir hönd framleiðandans sem nefndur er hér að neðan, lýsir því hér með yfir að varan er í samræmi við ákvæði eftirtalinna EB-tilskipana (að meðtöldum öllum breytingum sem við eiga) og að varan er í samræmi við viðeigandi staðla og/eða tækniforskriftir.

Dichiarazione CE di conformità **it**
Il sottoscritto, rappresentante il seguente costruttore dichiara qui di seguito che il prodotto risulta in conformità a quanto previsto dalla(e) seguente(i) direttiva(e) comunitaria(e) (comprese tutte le modifiche applicabili) e che sono state applicate tutte le relative norme e/o specifiche tecniche.

EB atitikties deklaracija **lt**
Pasirašiusysis, atstovaujantis šiam gamintojui deklaruoja, kad gaminys atitinka šios (-ių) EB direktyvos (-ų) reikalavimus (įskaitant visus taikytinus keitinius) ir kad buvo taikomi antrajame puslapyje nurodyti standartai ir (arba) techninės specifikacijos.

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Fig. 18: EC declaration of conformity (page 2)

SICK

TYPE: UE4155	Ident-No.: 9151306

EK atbilstības deklarācija **lv**
Apakšā parakstījusies persona, kas pārstāv zemāk minēto ražotāju ar šo deklarē, ka izstrādājums atbilst zemāk minētajai (-ām) EK direktīvai (-ām) (ieskaitot visus atbilstošos grozījumus) un ka izstrādājumam ir piemēroti attiecīgie standarti un/vai tehniskās specifikācijas.

EG-verklaring van overeenstemming **nl**
Ondergetekende, vertegenwoordiger van de volgende fabrikant, verklaart hiermee dat het product voldoet aan de bepalingen van de volgende EG-richtlijn(en) (inclusief alle van toepassing zijnde wijzigingen) en dat de overeenkomstige normen en/of technische specificaties zijn toegepast.

EF-samsvarserklæring **no**
Undertegnede, som representerer nedennevnte produsent, erklærer herved at produktet er i samsvar med bestemmelsene i følgende EU-direktiv(er) (inkludert alle relevante endringer) og at relevante normer og/eller tekniske spesifikasjoner er blitt anvendt.

Deklaracja zgodności WE **pl**
Niżej podpisany, reprezentujący następującego producenta niniejszym oświadcza, że wyrób jest zgodny z postanowieniami następujących dyrektyw WE (wraz z odnośnymi poprawkami) oraz, że zastosowano odpowiednie normy i/lub specyfikacje techniczne.

Declaração CE de conformidade **pt**
O abaixo assinado, que representa o seguinte fabricante, declara deste modo que o produto está em conformidade com as disposições da(s) seguinte(s) directiva(s) CE (incluindo todas as alterações aplicáveis) e que foram aplicadas as respectivas normas e/ou especificações técnicas.

Declaraţie de conformitate CE **ro**
Semnatarul, în calitate de reprezentant al producătorului numit mai jos, declară prin prezenta că produsul este în conformitate cu prevederile directivelor CE enumerate mai jos (inclusiv cu toate modificările aferente) şi că s-au întrunit normele şi/sau specificaţiile tehnice corespunzătoare.

ES vyhlásenie o zhode **sk**
Dolu podpísaný zástupca výrobcu týmto vyhlasuje, že výrobok je v súlade s ustanoveniami nasledujúcej (nasledujúcich) smernice (smerníc) ES (vrátane všetkých platných zmien) a že sa použili príslušné normy a/alebo technické špecifikácie.

Izjava ES o skladnosti **sl**
Podpisani predstavnik spodaj navedenega proizvajalca izjavljam, da je proizvod v skladu z določbami spodaj navedenih direktiv ES (vključno z vsemi ustreznimi spremembami) in da so bili uporabljeni ustrezni standardi in/ali tehnične specifikacije.

EG-försäkran om överensstämmelse **sv**
Undertecknad, som representerar nedanstående tillverkare, försäkrar härmed att produkten överensstämmer med bestämmelserna i följande EU-direktiv (inklusive samtliga tillämpliga tillägg till dessa) och att relevanta standarder och/eller tekniska specifikationer har tillämpats.

AB-Uygunluk Beyanı **tr**
Aşağıdaki üreticiyi temsil eden imza sahibi böylelikle, ürünün aşağıdaki AB-Yönergesinin(lerin) direktifleri ile (tüm ilgili değişiklikleri kapsayacak şekilde) uyumlu olduğunu ve ilgili normların ve/veya teknik spesifikasyonların uygulandığını beyan eder.

Directives used:	MAS-DIRECTIVE	2006/42/EC
	EMC-DIRECTIVE	2004/108/EC
	SAFETY OF MACHINERY; ELECTRICAL EQUIPMENT	EN 60204- 1
	ELECTRONIC EQUIPMENT FOR USE IN POWER	EN 50178
	SAFETY-RELATED PARTS OF CONTROL SYSTEMS	EN 13849- 1
	FUNCTIONAL SAFETY	EN 62061
	SAFETY-RELATED PARTS OF CONTROL SYSTEMS	EN 61496- 1 + A1
	FUNCTIONAL SAFETY OF ELECTRICAL	IEC61508-1 to -7

Product: **UE4155**

You can obtain the EC declaration of conformity with the standards used at: **www.sick.com** , search: 9151306

2009-11-11

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Date

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Birgit Knobloch
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12.5 Checklist for the manufacturer

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Checklist for the manufacturer/supplier for the installation of the UE4155 PROFIsafe bus node

The information for the points listed below must at least be available the first time the equipment is commissioned. They depend on the application the requirements of which must be verified by the manufacturer/supplier.

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

1. Have the safety rules and regulations been observed in compliance with the directives/ standards applicable to the machine? Yes ☐ No ☐
2. Are the applied directives and standards listed in the declaration of conformity? Yes ☐ No ☐
3. Does the protective device fulfil the required PL/SILCL and PFHd according to EN ISO 13849-1/EN 62061 and the type according to EN 61496-1? Yes ☐ No ☐
4. Are the required protective measures against electric shock in effect (protection class)? Yes ☐ No ☐
5. Has the protective function been checked in compliance with the test notes of this documentation? In particular: Yes ☐ No ☐
   - function test of the transmitter, sensor type and actors connected to the bus node
   - cut-off path test
6. Are there safeguards that the bus node will be subject to thorough testing of its safety functions each time its configuration has been changed? Yes ☐ No ☐

This checklist does not replace the initial commissioning nor the regular inspection by qualified safety personnel.

12.6 List of tables

12.7 List of illustrations

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