# COMPACT*plus-s*

**Sicherheits-Lichtvorhänge und Mehrstrahl-Sicherheits-Lichtschranke**
**Funktionspaket „Standard“**
Anschluss- und Betriebsanleitung

**Safety Light Curtains and Multiple Light Beam Safety Devices**
**Function Package “Standard”**
Installation and Operating Instructions

607010 – 01/04 – A001 

## About this Connecting and Operating Instructions Manual

This installation and operating instructions manual contains information on the proper use and effective application of COMPACT*plus-s* Safety Light Curtains and Multiple light beam safety devices. It is included with delivery.

All the information contained herein, in particular the safety notes, need to be carefully observed.

This connecting and operating instructions manual must be stored carefully. It must be available for the entire operating time.

Notes regarding safety and warnings are marked by this symbol  .

Notes regarding important pieces of information are marked by the symbol ⓘ.

**Leuze lumiflex GmbH + Co. KG is not liable for damages caused by improper use. Knowledge of the connecting and operating instructions is an element of proper use.**



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## Contents

# 1 General

COMPACT*plus* Safety Light Curtains, Multiple Light Beam Safety Devices and Transceivers are type 4 **A**ctive **O**pto-electronic **P**rotective **D**evices (AOPD) in accordance with EN/IEC 61496-1 and prEN/IEC 61496-2. COMPACT*plus* represents an extension of the tried, tested and proven COMPACT series and is optically and mechanically, with the exception of the connection cap, compatible with this series. All versions have start/restart interlock that can be selected and deselected, plus the contactor monitoring function and a number of additional functions. They have a variety of signal outputs, LEDs and 7-segment displays.

The devices are delivered as standard with semiconductor outputs and cable screws. The receiver can be optionally delivered with relay outputs, AS-i Safety connection and plug connectors or connection to a safety bus. Protective Akkalit screens for protection against welding sparks are also optionally available.

In order to offer an optimal solution for each specific application, the devices of the COMPACT*plus* series are available with different ranges of functionality.

**Overview of function packages:**

**COMPACT*plus-s***
Safety light curtains and multiple light beam safety devices with the “Standard” function package for standard tasks with switchable internal start/restart interlock and contactor monitoring (EDM) function and an optional 2-channel contact-based safety circuit.

**COMPACT*plus-b***
Safety light curtains with the “Blanking” function package with additional functions fixed and/or floating blanking of beams plus reduced resolution of the protective field.

**COMPACT*plus-m***
Safety light curtains, multiple light beam safety devices and transceivers with the “Muting” function package for bridging the safety device for a limited period, with, for example, proper material transport through the protective field.

**COMPACT*plus-i***
Safety light curtains with the “Initiation” function package for the cycle control of a production machine to not only protect with the safety device, but rather to also provide safety-relevant control.

## 1.1 Certifications

**Company**

Leuze lumiflex GmbH & Co. KG in D-82256 Fürstenfeldbruck has a certified quality assurance system in compliance with ISO 9001.

**Products**

COMPACT*plus-s* Safety Light Curtains and Multiple Light Beam Safety Devices are developed and produced in compliance with applicable European guidelines and standards.

EC prototype test in accordance with
EN IEC 61496 Part 1 and Part 2
by:
TÜV PRODUCT SERVICE GmbH, IQSE
Ridlerstrasse 65
D-80339 Munich

## 1.2 Symbols and terms

**Symbols used:**

| | |
|---|---|
|  | Warning sign – This symbol indicates possible dangers.<br>Please pay especially close attention to these instructions! |
| ⓘ | Notes on important information. |
| ➢ | A note, which also refers to a course of action, provides information about special attributes or describes set-up procedures. |
|  | Symbols of the COMPACT*plus* Transmitter<br>General transmitter symbol<br><br>Transmitter not active<br>Transmitter active |

**Table 1.2-1:** Symbols

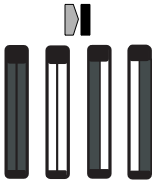
| | |
|---|---|
|  | Symbols of the COMPACT*plus* Receiver<br>General receiver symbol<br>The receiver's active protective field is not free, outputs in OFF state<br>Receiver's active protective field free, outputs in ON state<br>Receiver's active protective field not free, outputs still in ON state<br>Receiver's active protective field free, outputs in OFF state |
|  | Signal output<br>Signal input<br>Signal input and/or signal output |

**Table 1.2-1:** Symbols

**Terms used:**

| | |
|---|---|
| Access guarding | Requires person detection, example: Chapter 3.2.3 |
| AOPD | Active opto-electronic protective device<br>(**A**ctive **O**pto-electronic **P**rotective **D**evice) |
| AOPD response time | Time between penetration in the active protective field of the AOPD and the actual switching off of the OSSDs. |
| AutoReset | When an error indication occurs, caused, for example, by faulty external wiring, the AOPD attempts to start again. If the error no longer exists, the AOPD returns to the normal state. |
| AutoScan | Devices with a low number of beams automatically use multiple evaluation for increasing availability. |
| Contactor monitoring (EDM) | The EDM function monitors the normally closed contacts of downstream positive-guided contactors and relays. |
| CP | COMPACT*plus* consists of a transmitter and a receiver |
| CPR | COMPACT*plus* Receiver |
| CPR-s | COMPACT*plus* Receiver with “Standard” function package |
| CPT | COMPACT*plus* Transmitter |
| DoubleScan | Multiple evaluation, switching off only after the same beam has been interrupted in two consecutive scans. DoubleScan influences the response time! |
| EDM | Contactor monitoring (**E**xternal **D**evice **M**onitoring) |
| FS | Factory setting (value of a parameter that can be changed with SafetyLab with ex-factory delivery) |
| MagnetKey | Additional components of the CPR-s for constant display of an error indication. |
| MultiScan | Multiple evaluation: Beams must be interrupted in several consecutive scans, before the receiver switches OFF. MultiScan influences the response time! |
| Optional safety circuit | 2-Channel contact-based safety circuit that can be connected directly to the local interface; after activation, it interrupts the same dangerous movement as the receiver does with penetration in the protective field. |

**Table 1.2-2:** Terms

| | |
|---|---|
| OSSD1<br>OSSD2 | Safety-related switch output<br>**O**utput **S**ignal **S**witching **D**evice |
| Perimeter guarding | Requires person detection, example: Chapter 3.2 |
| S/RS interlock | Start/restart interlock |
| Safeguarding danger areas | Requires finger detection in the foot/leg area, example: Chapter 3.2.1 |
| Safeguarding danger points | Requires finger or hand detection, example: Chapter 3.2.2 |
| SafetyLab | Diagnostics and Parameterization Software (optional) |
| Scan | All beams, beginning with the synchronization beam, are pulsed by the transmitter in cycles one after the other. |
| Start/restart interlock | Prevents automatic start after supply voltage is switched on; after the protective field has been penetrated; or after the optional safety circuit has been reset. |

**Table 1.2-2:** Terms

## 1.3 Naming system for COMPACT*plus*

### 1.3.1 Safety Light Curtains – Basic Design/Host

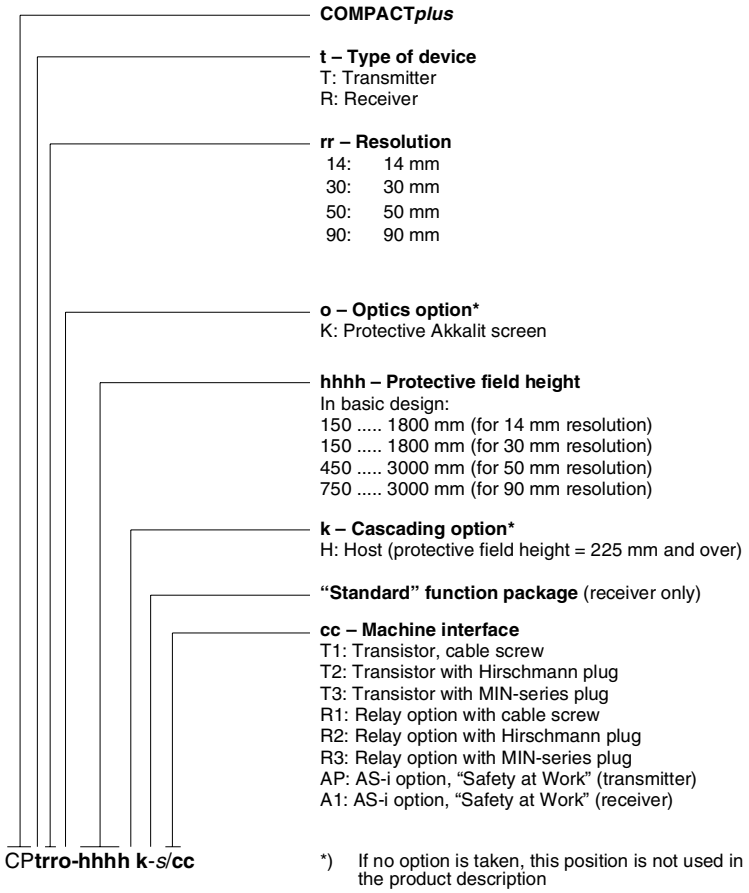



**Fig. 1.3-1:** Naming system for COMPACT*plus-s* Safety Light Curtains - Basic Design/Host

### 1.3.2 Safety Light Curtains – Guests

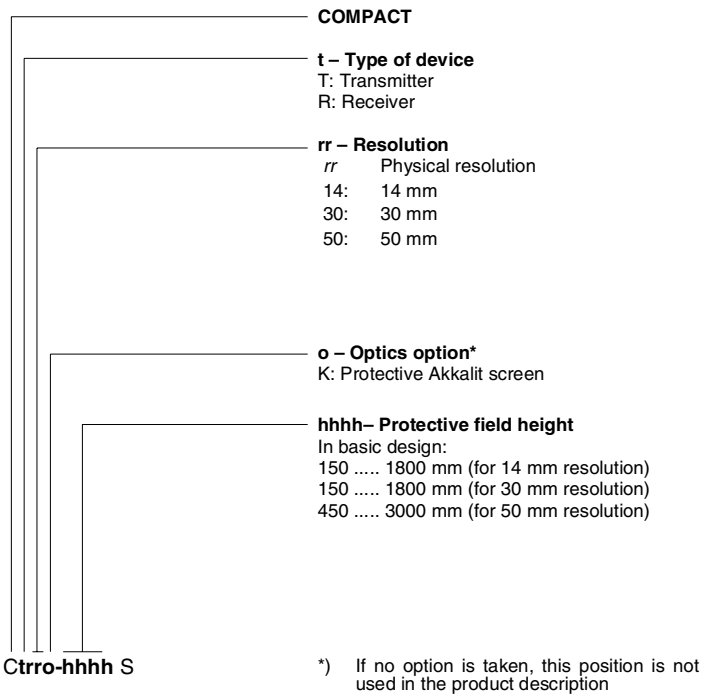



**Fig. 1.3-2:** Naming system for COMPACT Guests

### 1.3.3 Multiple Light Beam Safety Devices

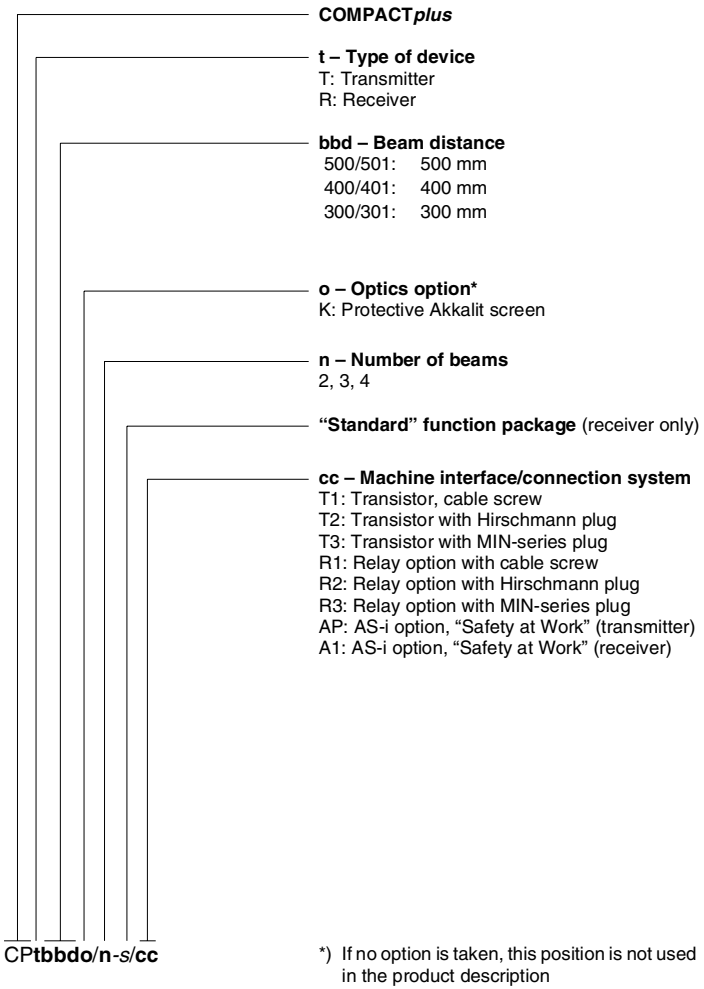



**Fig. 1.3-3:** Naming system for COMPACT*plus-s* Multiple Light Beam Safety Devices

**Examples:**
COMPACT*plus-s* Safety Light Curtain in basic design, without options

| **CPT14-1500/T1** | | **CPR14-1500-s/T1** | |
|---|---|---|---|
| COMPACT*plus* | Safety Light Curtain | COMPACT*plus-s* | Safety Light Curtain |
| Device type: | Transmitter | Device type: | Receiver |
| Physical resolution: | 14 mm | Physical resolution: | 14 mm |
| Detection range: | 6 m | Detection range: | 6 m |
| Height of protective field: | 1500 mm | Height of protective field: | 1500 mm |
| Design type: | Basic design | Design type: | Basic design |
| | | Function package: | Standard |
| | | Safety output: | 2 Semiconductor OSSD |
| Connection system: | Cable screw | Connection system: | Cable screw |

**Table 1.3-1:** Example 1, selection of safety light curtain

COMPACT*plus-s* Safety Light Curtain in host/guest design combination with options

| **CPT30K-1200H/T2** | | **CPR30K-1200H-s/R2** | |
|---|---|---|---|
| COMPACT*plus* | Safety Light Curtain | COMPACT*plus-s* | Safety Light Curtain |
| Device type: | Transmitter | Device type: | Receiver |
| Physical resolution: | 30 mm | Physical resolution: | 30 mm |
| Detection range: | 18 m | Detection range: | 18 m |
| Optics option: | Protective Akkalit screen | Optics option: | Protective Akkalit screen |
| Height of protective field | 1200 mm | Height of protective field: | 1200 mm |
| Design type: | Host | Design type: | Host |
| | | Function package: | Standard |
| | | Safety output: | Relay OSSDs, 2 normally open contacts |
| Connection system option: | Hirschmann plug | Connection system option: | Hirschmann plug |
| **CT50K-750S** | | **CT50K-750S** | |
| COMPACT | Safety light curtain | COMPACT | Safety light curtain |
| Device type: | Transmitter | Device type: | Receiver |
| Physical resolution: | 50 mm | Physical resolution: | 50 mm |
| Detection range: | 18 m | Detection range: | 18 m |
| Optics option: | Protective Akkalit screen | Optics option: | Protective Akkalit screen |
| Height of protective field | 750 mm | Height of protective field: | 750 mm |
| Design type: | Guest with 250 mm connection cable | Design type: | Guest with 250 mm connection cable |

**Table 1.3-2:** Example 2, selection of safety light curtain

COMPACT*plus-s* Multiple Light Beam Safety Device in basic design

| **CPT400/3/T1** | | **CPR400/3-s/T1** | |
|---|---|---|---|
| COMPACT*plus* | Multiple Light Beam Safety Device | COMPACT*plus-s* | Multiple Light Beam Safety Device |
| Device type: | Transmitter | Device type: | Receiver |
| Beam distance: | 400 mm | Beam distance: | 400 mm |
| Detection range: | 18 m | Detection range: | 18 m |
| Number of beams: | 3 | Number of beams: | 3 |
| | | Function package: | Standard |
| | | Safety output: | 2 Semiconductor OSSD |
| Connection system: | Cable screw | Connection system: | Cable screw |

**Table 1.3-3:** Example 3, selecting a multiple light beam safety device

COMPACT*plus-s* Multiple Light Beam Safety Device with options, protective Akkalit screen and AS-i connection

| **CPT501K/2/AP** | | **CPR501K/2-s/A1** | |
|---|---|---|---|
| COMPACT*plus* | Multiple Light Beam Safety Device | COMPACT*plus-s* | Multiple Light Beam Safety Device |
| Device type: | Transmitter | Device type: | Receiver |
| Beam distance: | 500 mm | Beam distance: | 500 mm |
| Detection range: | 70 m | Detection range: | 70 m |
| Number of beams: | 2 | Number of beams: | 2 |
| Option: | Protective Akkalit screen | Option: | Protective Akkalit screen |
| | | Function package: | Standard |
| | | Safety output: | AS-i “Safety at Work” |
| Connection system option: | M12, 3-pin | Connection system option: | M12, 5-pin |

**Table 1.3-4:** Example 4, selecting a multiple light beam safety device

# 2 Safety notes

## 2.1 Dangers where safety notes are not observed!

These products have been developed and manufactured with stringent application of recognized technical regulations. The protective function of these devices can, however, be impaired if the devices are used improperly or are not used for the specified purpose. Such instances can jeopardize the health and lives of the personnel operating the machinery.

## 2.2 Operating conditions and proper use

The applicable requirements for machine safety apply when using COMPACT*plus-s* Safety Light Curtains and Multiple Light Beam Safety Devices, in particular:

- Machine Directive 98/37/EC and
- Machine Utilization Directive 89/655/EEC,

and the corresponding applicable national regulations.

It is the responsibility of the manufacturer and the operator of the machine or equipment on which the optical safety device is installed to observe these rules and regulations. The local authorities in charge (e.g. health and safety at work authorities) are available to answer questions concerning safety. The following conditions for use must be observed:

The installation, electrical connection and parameterization, and the required test before initial operation and regular tests must only be carried out by specialist personnel and the results must be transparently documented. A part of this competence is knowledge of the safety notes contained in these operating instructions. Special safety notes for the electrical connection can be found in Chapter 7.

The operating instructions must be included with the documentation of the machine on which the safety device is installed so that they are available for the operator at all times. The owner/provider of the machinery must ensure that the operator is instructed by an experienced specialist.

Applicable for all uses given below: Access to the danger point when using COMPACT*plus* must only be possible through the protective field. A safety distance must be maintained between the protective field and the danger point or points. This is calculated using the formulas in the specific machine-related European C standards or in the general B1 standard EN 999. The respective resolution and response time of COMPACT*plus* must also be taken into consideration, as must its location and the stopping time of the machine. You will find calculation examples for determining safety distances in Chapter 6.1.

However, COMPACT*plus* are **not** suitable as safety devices if it can be expected that objects could be projected from the machine or hot or dangerous liquids could splash out. They are also not suitable for machines with long stopping times. **Leuze lumiflex** provides suitable door-interlock switches (safety switches) for such cases, both with and without guard interlocking.

COMPACT*plus-s* meets the requirements of safety category 4 in compliance with EN 954-1. To keep this level of safety, all subsequent elements of the safety chain up to stopping the dangerous movement must be set up in accordance with the requirements of safety category 4.

### 2.2.1 COMPACT*plus-s* Safety Light Curtains with a resolution of 14 mm to 40 mm

are used to protect hazardous places, preferably in a vertical position. Depending on the resolution selected they can detect:

| Device type | Physical resolution | Detection at maximum resolution for persons age 14 and over | Detection range | Preferred area of application |
|---|---|---|---|---|
| CPT14-.. / CPR14-.. | 14 mm | Finger | 0 to 6 m | Safeguarding danger points |
| CPT30-.. / CPR30-.. | 30 mm | Hand/arm | 0 to 18 m | Safeguarding danger points |

**Table 2.2-1:** COMPACT*plus-s* Safety Light Curtains for protecting danger points

### 2.2.2 COMPACT*plus-s* Safety Light Curtains with a resolution of > 40 mm

are preferably used for safeguarding dangerous areas. In a predominantly horizontal position, the presence of people within the protective field is then continuously monitored.

| Device type | Physical resolution | Detection at maximum resolution for persons age 14 and over | Detection range | Preferred area of application |
|---|---|---|---|---|
| CPT50-.. / CPR50-.. | 50 mm | From the foot upwards | 0 to 18 m | Safeguarding danger areas |
| CPT90-.. / CPR90-.. | 90 mm | From the thigh upwards | 0 to 18 m | Safeguarding danger areas |

**Table 2.2-2:** COMPACT*plus-s* Safety Light Curtains for protecting dangerous areas

Safety light curtains with a resolution of > 40 mm are **not** suitable for protection of danger points for which finger, hand or arm resolution is required. The correct choice for this are the COMPACT*plus* Safety Light Curtains with 14 mm or 30 mm resolution.

### 2.2.3 COMPACT*plus-s* Multiple Light Beam Safety Devices

are preferably used in a vertical position for access and perimeter guarding of dangerous areas. They only detect the human body during the access action. When one or more beams are interrupted by a person, the machine control unit must go into safe interlock.

**The start/restart interlock function is therefore obligatory for access and perimeter guarding!** The start button to release the start/restart interlock must be positioned here outside the danger area in such a way, that it cannot be reached from inside the danger area, and a full overview of the complete danger area must be possible from its location.



| Device type | Number of beams | Detection | Detection range | Preferred area of application |
|---|---|---|---|---|
| CPT 300/4- / CPR 300/4- | 4 | Persons | 0 to 18 m | Access and perimeter guarding |
| CPT 400/3- / CPR 400/3- | 3 | Persons | 0 to 18 m | Access and perimeter guarding |
| CPT 500/2- / CPR 500/2- | 2 | Persons | 0 to 18 m | Access and perimeter guarding |

| Device type | Number of beams | Detection | Detection range | Area of application |
|---|---|---|---|---|
| CPT 301/4- / CPR 301/4- | 4 | Persons | 6 to 70 m | Access and perimeter guarding |
| CPT 401/3- / CPR 401/3- | 3 | Persons | 6 to 70 m | Access and perimeter guarding |
| CPT 501/2- / CPR 501/2- | 2 | Persons | 6 to 70 m | Access and perimeter guarding |

**Table 2.2-3:** COMPACT*plus-s* Multiple Light Beam Safety Devices for access and perimeter guarding

Multiple light beam safety devices are designed for detecting people during the access to danger areas. They are **not** suitable for protecting danger points for which finger, hand or arm detection is required. The correct choice for this are COMPACT*plus* Safety Light Curtains with 14 mm or 30 mm resolution.

They are **not** suitable for danger area protection where the presence of people in the area between the safety device and the danger point must be continuously monitored. The correct choice for this are COMPACT*plus* Safety Light Curtains with 50 mm or 90 mm resolution, or if the application allows safety category 3 according to EN 954-1, the area scanner ROTOSCAN may be an alternative solution. Information about ROTOSCAN is available from our sales centers and partners or on the Internet at: **www.leuze.de**.

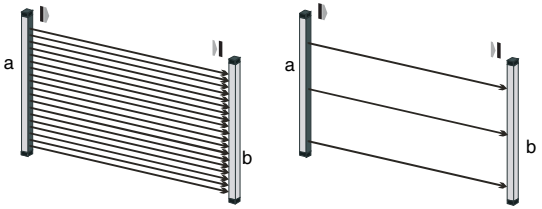
# 3 System design and possible uses

## 3.1 The opto-electronic protective device

**Mode of operation**

COMPACT*plus-s* consists of a CPT transmitter and a CPR-s receiver. Starting with the first beam (synchronization beam) immediately after the display panel, the transmitter pulses beam for beam in rapid succession. The synchronization between transmitter and receiver is performed optically.






a = Transmitter
b = Receiver

**Fig. 3.1-1:** Principle of the opto-electronic protective device

The CPR-s receiver recognizes the specially formed pulse bundles of the transmitter beams and opens the corresponding receiver elements in sequence in the same rhythm. A protective field is consequently formed in the area between the transmitter and receiver, the height of which depends on the geometrical dimensions of the optical safety device, the width of which depends on the distance selected between the transmitter and receiver within the permissible detection range.

To improve the availability under difficult environmental conditions, it can be useful to wait after a beam interruption has been detected if this interruption is still present in the next scan(s), before the receiver switches the OSSDs off. This type of evaluation is called “MultiScan Mode” and it influences the receiver response time.

If MultiScan is active, it works scan-related or beam-related, i.e. the receiver switches

- ➢ to the OFF state regardless of which of the beams is affected, as soon as a defined number of consecutive scans (Hx) have been interrupted (scan-related).
- ➢ to the OFF state as soon as one and the same beam has been interrupted during a defined number of consecutive scans (Hx) (beam-related).

The number of scans used is briefly displayed on the 7-segment display of the receiver (Hx) with start after power-on. The resulting response time is subsequently displayed with tx xx, whereby the response time x xx is displayed in milliseconds.

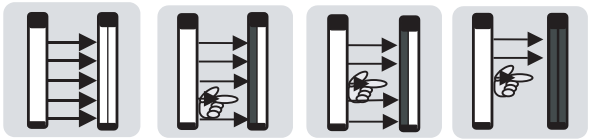


**Fig. 3.1-2:** Example: MultiScan, scan-related, MultiScan factor H = 3

In the factory setting, scan-related MultiScan applies with the following MultiScan factors (AutoScan mode):

- Light curtains (8..240 beams): H = 1
- Multiple light beam devices (2, 3 or 4 beams): H = 7

The values for the MultiScan factor can be selected within limits with SafetyLab.

An increase in the MultiScan factor causes an extension of the response time and makes a recalculation of the safety distance necessary in accordance with Chapter 6.1!

Basic functions such as start/restart interlock or contactor monitoring (EDM) and a series of additional functions can be optionally assigned to the receiver so that there is generally no need for a downstream safety interface.

## 3.2 Application examples

### 3.2.1 Safeguarding danger points: CP-s with 14 or 30 mm resolution

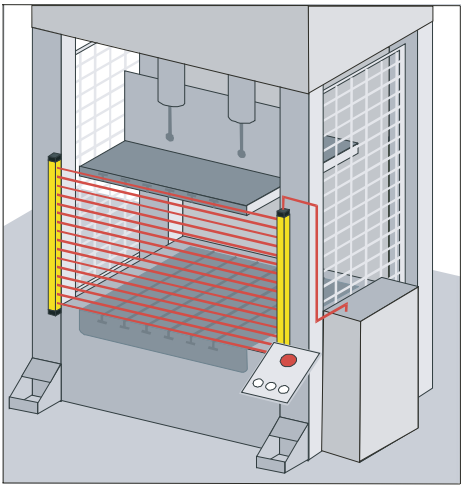


**Fig. 3.2-1:** COMPACT*plus-s* Safety Light Curtain – Application for a press

### 3.2.2 Safeguarding danger areas: CP-s with 50 mm resolution

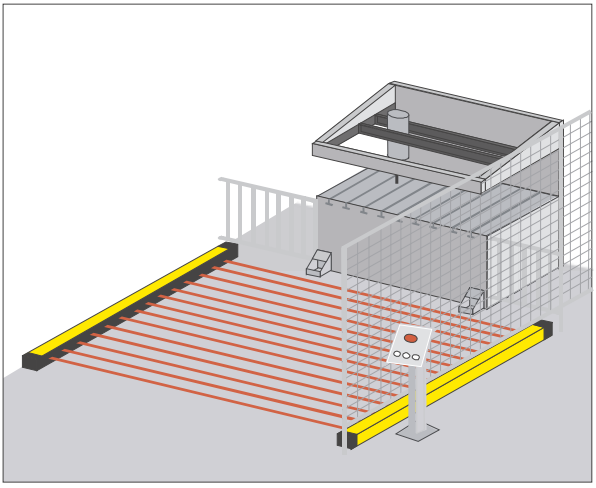


**Fig. 3.2-2:** COMPACT*plus-s* Safety Light Curtain – Application for a routing machine

### 3.2.3 Access guarding: 2, 3 or 4 beams

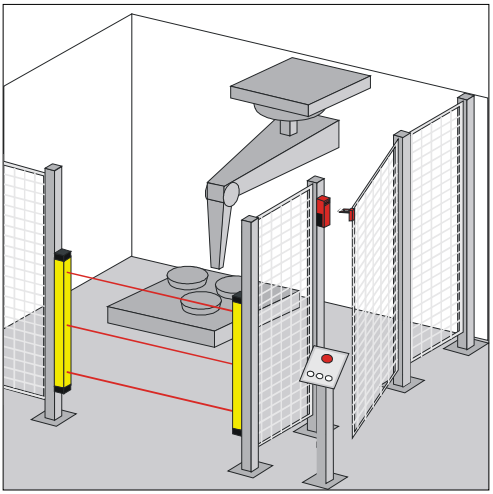


**Fig. 3.2-3:** COMPACT*plus-s* Multiple Light Beam Safety Device guards an access

### 3.2.4 Perimeter guarding: 2, 3 or 4 beams

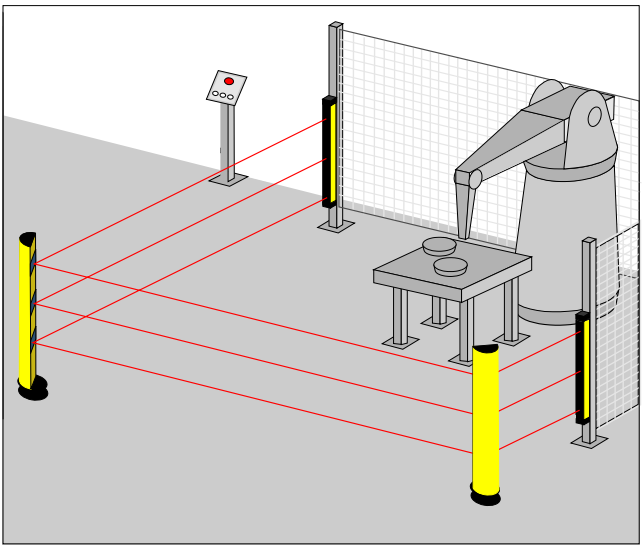


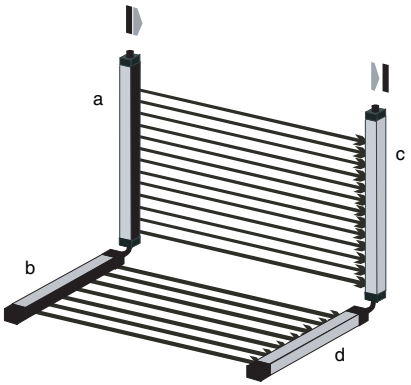
**Fig. 3.2-4:** COMPACT*plus-s* Multiple Light Beam Safety Device with 2 mirror columns

## 3.3 Optics option: Protective Akkalit screens for protection against welding sparks

If COMPACT*plus* is to be used in places exposed to welding sparks, we recommend ordering transmitters and receivers with protective Akkalit screens. Protective Akkalit screens are less sensitive to welding sparks than the standard front screens.

## 3.4 Cascading option

To implement multiple linked protective fields, COMPACT*plus* Safety Light Curtains can be cascaded one after the other via plug-in cable connections. This allows devices with different physical resolutions to be combined with each other.




a = CPT transmitter, Host (H)
b = CT transmitter, Guest (S)
c = CPR-s receiver, Host (H)
d = CR receiver, Guest (S)

**Fig. 3.4-1:** Structure of a cascaded system

Cascading devices makes it possible to implement adjacent protective fields, for rear area protection without any additional expense for control and connection, for example. The host system is responsible here for all processor tasks, displays and the receiver-side interfaces to the machine and control devices.

The following limits must be observed:

- The height of the protective field for the first light curtain (host) must be at least 225 mm.
- It should be noted that the required detection range of the cascaded system must fall within the maximum detection range of all individual components.
- The number of beams of all components must not exceed 240. For the number of beams n, for the individual components, please refer to the tables in Chapter 12.
- The cables between the individual components are part of the guest. The standard length is 250 mm. The connection to the host is made with an M12 plug.

## 3.5 Deflecting mirror as accessory

Several sides of a danger point or a danger area can be protected using deflection mirrors. The maximum width of the protective field is reduced by approximately 15% per mirror.

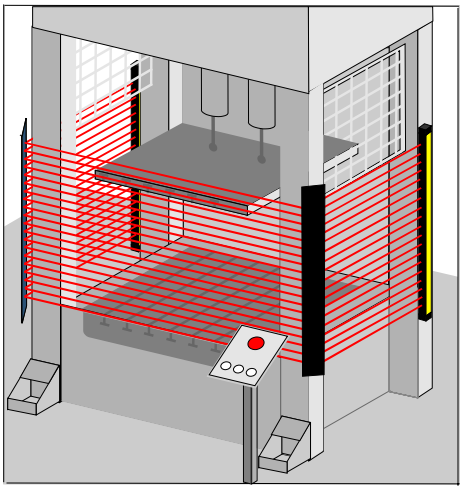


**Fig. 3.5-1:** Example: Multiple-side protection of a danger point using deflection mirrors.



# 4 “Standard” function package

## 4.1 Parameterizable functions of CPT transmitter

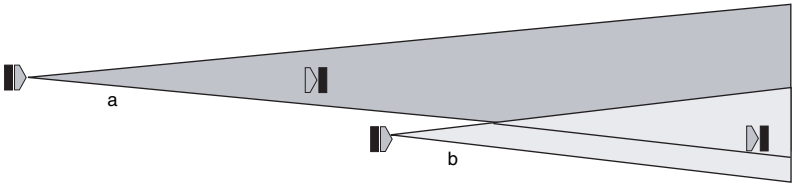
### 4.1.1 Transmission channel

The infrared beams are modulated with specially shaped pulse bundles so that they are distinct from ambient light and undisturbed operation is consequently ensured. Sparks from welding or warning lights from passing forklifts do not have any effect on the protective field.

If two protective fields are located directly next to each other for two adjacent machines, measures must, however, be implemented so that the optical safety devices do not affect each other.

Both transmitters should first be assembled back to back so that the beams radiate in opposite directions. It is consequently impossible for them to affect each other.

Another possible way to suppress mutual influences is to switch one of the two safety devices from transmission channel 1 to 2, thereby switching them to differently formed pulse bundles. This option can then be selected when more than two optical safety devices are arranged next to each other.




a = AOPD “A”, Transmission channel 1
b = AOPD “B”, transmission channel 2, not affected by AOPD “A”

**Fig. 4.1-1:** Transmission channel selection

The change from transmission channel 1 (factory setting) to 2 must be made both on the transmitter and the receiver of the optical safety device in question. You will find more detailed information in Chapter 8.

## 4.2 Parameterizable basic functions of CPR-s receiver

### 4.2.1 Transmission channel

When delivered, both the receiver and the transmitter are set to transmission channel 1 (C1). If the corresponding transmitter is switched to transmission channel 2, the receiver must also be set to transmission channel 2 (C2). See Chapter 8 for more information.

### 4.2.2 Start/restart interlock

When delivered, the start/restart interlock of the COMPACT***plus-s*** is **not** activated!

The start/restart interlock function prevents the safety circuits from being released automatically when the machine is turned on or the power supply is restored after a power outage. The receiver only switches to the ON state by pressing and releasing the start button within a time window.

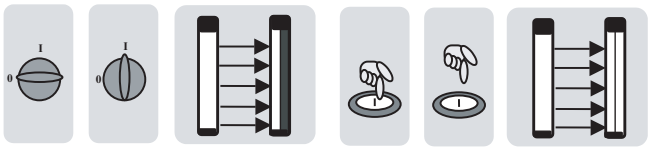


**Fig. 4.2-1:** Start/restart interlock function with supply voltage power-on

If the protective field is entered or an optional safety circuit is activated, the start/restart interlock function ensures that the receiver also remains in the OFF state after the protective field has been freed. The receiver will then not be switched back to the ON state until the start button is pressed and released again within a time window of 0.1 to 4 seconds (FS).

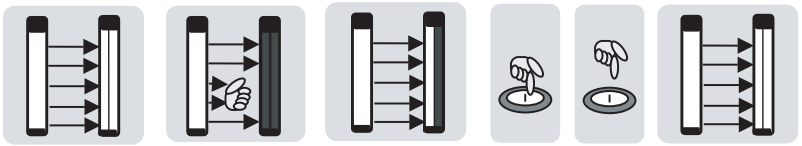


**Fig. 4.2-2:** Start/restart interlock function after interrupting the protective field

Without the start/restart interlock, the receiver outputs immediately switch to the ON state after the machine has been turned on or the power supply has been restored and after the protective field has been freed! Operation of the safety device without the start/restart interlock is only permitted in a very few exceptions and under the conditions of controlling safety devices in compliance with EN 292-1 and EN 292-2. It must be especially ensured here that it is impossible to walk or slip through the optical safety device/protective field.

In the case of access and perimeter guarding applications, the start/restart interlock function is obligatory due to the fact that only access to the danger area, but not the area between the protective field and the danger points is monitored.

Before unlocking the start/restart interlock of an access protection, the operator must be absoluteley certain that nobody is inside the danger zone.

**How to activate the start/restart interlock:**

- ➢ Internally in the COMPACT*plus-s* receiver (see Chapter 8)
- ➢ or in the downstream safety interface (e.g. MSI from Leuze lumiflex)
- ➢ or in the downstream machine control unit
- ➢ or in the downstream Safety PLC.

If the internal start/restart interlock is activated as described in Chapter 8, the interlock functions are monitored dynamically. The receiver is only switched back to the ON state after the start button has been pressed and released again. Additional requirements are, of course, that the protective field be free and that any connected additional safety circuits be in the ON state.

If both the internal and a subsequent start/restart interlock are activated, the CP-s will only perform a reset function with its assigned start button.

### 4.2.3 Contactor Monitoring (EDM)

When delivered, the contactor monitoring function of the COMPACT*plus-s* is **not** activated!

The “contactor monitoring” function dynamically monitors contactors, relays or valves downstream from the COMPACT*plus*. Precondition here are switching elements with positive-guided feedback contacts (normally closed).

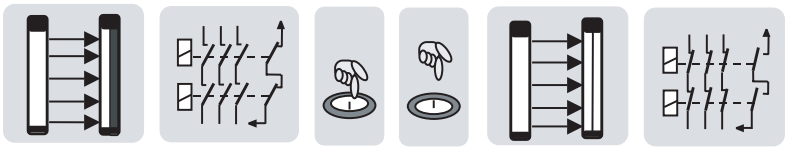


**Fig. 4.2-3:** Contactor monitoring function, combined in this example with S/RS interlock

**Activate the contactor monitoring function via:**

- ➢ The internal dynamic contactor monitoring in the receiver (see Chapter 8),
- ➢ or the external contactor monitoring of the downstream safety interface (e.g. MSI from Leuze lumiflex)
- ➢ or the contactor monitoring of the downstream safety PLC (optionally connected via a safety bus).

If the contactor monitoring is activated via a switch (see Chapter 8.3.1), it works dynamically, which means, in addition to the closed feedback circuit being checked before each switching-on of the OSSDs, it is checked to see if the feedback circuit has opened within 300 ms after release, and if it has closed again within 300 ms after the OSSD has been switched off. If this is not the case, the OSSDs return to the OFF state again after being briefly switched on. An error code appears on the 7-segment display and the receiver goes to the error locking status, from which it can only be return to normal operation with by switching the supply voltage off and back on again.

Further selection options emerge with SafetyLab and PC.

### 4.2.4 MultiScan

As already explained in Chapter 3, the receiver provides an option with MultiScan of drastically increasing the availability under difficult environmental conditions. After a beam interruption it does not switch off immediately, but rather waits to see if the interruption continues in the subsequent scan(s), before the receiver switches the OSSDs off. This factor can be set within limits with SafetyLab and with switch without PC with the factory settings H = 1 for light curtains and H = 7 for multiple light beam safety devices being double to H = 2 and H = 14. MultiScan is always performed here scan-related, which means the receiver switches to the OFF state as soon as at least one beam is interrupted during the defined number of consecutive scans (Hx).

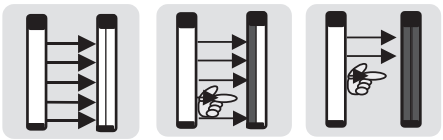


**Fig. 4.2-4:** Example: MultiScan scan-related, MultiScan factor H = 2

The number of scans used is briefly displayed on the 7-segment display of the receiver (Hx) with start after power-on, followed by the response time of the optical safety device in milliseconds.

Switching over to DoubleScan mode causes an increase in the response time. The values are shown in the tables in Chapter 12. A recalculation of the safety distance for the danger point is required in accordance with Chapter 6.1!

### 4.2.5 7-Segment display turn around

COMPACT*plus* can be mounted in any position. This allows the transmitter and receiver to operate over head, e.g. if the cable entry is required from below. While the permanent displays of the transmitter for the transmission channel C1 with 1 or C2 with 2 are still clearly legible, it may become necessary with the receiver with the double-7-segment display to turn the display around and adapt to the new installation situation.

In the factory-set COMPACT*plus* receiver state, the display for the cable entry is set from above (FS).

➢ Where required, activate the display turn around function of the receiver according to your application (see Chapter 8).

### 4.2.6 Contact-based safety circuit

COMPACT*plus* offers additional inputs for safety sensors equipped with contacts to which, for example, the following components can be connected:

- Section Emergency STOP
- Door interlock without guard interlocking with 2 normally closed contacts
- Optical safety sensors, type 4 with 2 normally open contacts

**Safety instructions for the Section Emergency STOP:**

Section Emergency STOP buttons connected to the COMPACT*plus* only affect the safety circuit that is assigned to the AOPD. It is therefore referred to as a **Section** Emergency STOP. The button's limited area of effect must be identified for the operating staff in such a way that is clearly visible.

The requirements for emergency stop equipment, including EN 60204-1 and EN 418, apply to the Section Emergency STOP system. Section Emergency STOP buttons must have an interlock mechanism. After the interlock mechanism has been released, the dangerous movement may not immediately start up again. Instead, a separate procedure for starting up is required, via the start button, for example. Operation with start/restart interlock is therefore compulsory (with COMPACT*plus* or with a downstream machine interface).

The response time from opening the first of the two contacts until switching the OSSDs is 40 ms. Added to this is the response time of the output module:

- Transistor output: + 1.6 ms
- Relay output: + 16.6 ms
- AS-i output: + 6.6 ms

With the resetting, the two contacts must close within 0.5 seconds to be able to start the working process again.

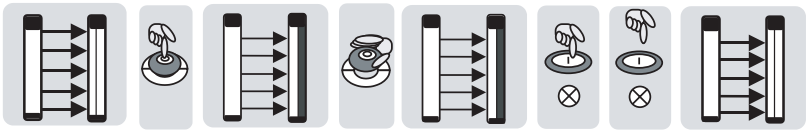


**Fig. 4.2-5:** Section Emergency STOP requires the start/restart interlock function

➢ Where required, activate the “contact-based safety circuit” function using switch S6 as described in Chapter 8.

ⓘ If the “Contact-based safety circuit” option is selected, COMPACT*plus-s* expects the usage of the corresponding inputs L3 and L4 on the local interface to release the OSSDs (see Chapter 7.1).

## 4.3 Additional functions can be set with SafetyLab

In addition to diagnostics of the protective field, the Diagnostics and Parameterization Software, SafetyLab, enables:

- Graphic representation of the beam state and the beam parameterization
- Beam distances in beam index, millimeter or inch
- Presentation of the 7-segment display, switch settings S1 to S6
- Logical switching state of all inputs and outputs and internal signals
- Internal voltage and current values
- A detailed parameterization of individual functions that go beyond the scope of the selection options with switches.

As the settings with SafetyLab could contradict the per switch settings, a priority rule becomes inevitable. In order, therefore, to allow the values set with SafetyLab to become effective, all switches must be set to the ex-factory setting L. Only then can the values marked with SW: in table 8.3.1 be overwritten by the values sent by SafetyLab. If one of the switches is not in position L, then the receiver is in an error state, which can be resolved as follows:

- Either all switches are switched back to position L → the SafetyLab settings become effective again.
- Or the receiver is reset by SafetyLab and the password to the basic setting → now the switches can be used again as described in Chapter 8.

Here is an overview of the functions that can be set with SafetyLab:

- Sensor name, application name
- Optics definition
- Transmission channel
- MultiScan mode
- Display
- Start interlock/restart interlock
- Contactor monitoring
- Optional safety circuit
- Indicating signal output

Further details on diagnostics and parameterization can be found in the user manual of the Diagnostics and Parameterization Software, SafetyLab.



# 5 Display elements

## 5.1 Status displays of the CPT transmitter

If the 7-segment transmitter display is lit, this indicates that the power supply is connected.


**Fig. 5.1-1:** Transmitter status displays

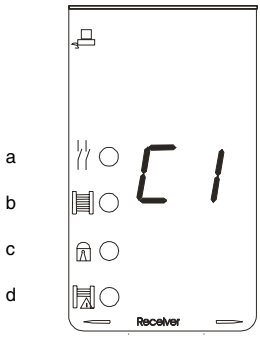
Current status of the transmitter:

| 7-Segment display | Meaning |
|---|---|
| **8.** | Hardware reset when turned on |
| **S** | Self test running (for approx. 1 s) |
| **1** | Normal operation, set to channel 1 |
| **2** | Normal operation, set to channel 2 |
| **.** | Dot next to the number: Test on, the transmitter does not supply any pulses (bridge 3 and 4 not closed) |
| **F** ⇅ **x** | F = Device fault<br>x = Fault number, alternating with “F” |

**Table 5.1-1:** Transmitter 7-segment display

## 5.2 Status displays of the CPR-s receiver

Four LEDs and two 7-segment displays report the receiver operating status.




a = LED1, red/green
b = LED2, orange
c = LED3, yellow
d = LED4, blue

**Fig. 5.2-1:** Receiver status displays

### 5.2.1 7-Segment displays

After the supply voltage is switched on, the following data appears on both 7-segment displays of the receiver:

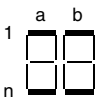
| 7-Segment display | Meaning |
|---|---|
| **88** | Hardware reset and self test after restart or power-on |
| | **Sequence of parameter displays during startup for 1 s each** |
| **1x xx** | Display of function package (1 = Standard) and x xx = firmware version |
| **Hx** | MultiScan display, scan factor<br>x = Number of scans per evaluation cycle |
| **tx**<br>**xx** | Response time of the AOPD after interruption of the active protective field<br>x xx = Response time in ms |
| | **Permanent parameter display after startup** |
| **Cx** | Transmission channel display<br>x = Transmission channel set (1 or 2) (factory setting = C1) |
| | **Temporary status displays in service mode** |
|  | Alignment display: One horizontal bar represents one beam:<br>a 1: The first beam of the basic device/host<br>a n: The last beam of the basic device/host<br>b 1: The first beam of the guest device<br>b n: The first beam of the guest device<br>Chapter 9.2 describes this process in detail. |
| | **Temporary event displays alternating with the permanent parameters display, 1 second per display** |
| **Ux** | Interlocking display via external sensor (e.g. Section Emergency STOP);<br>x = Index of the additional safety circuit |
| **Ex**<br>**xx** | Locking status display, “Malfunction”, which can be released by the user<br>x xx Fault number (e.g. no correct signal from contactor monitoring, see Chapter 11) |
| **Fx**<br>**xx** | Locking status display of “device fault”, receivers must be replaced |

**Table 5.2-1:** Receiver 7-segment display

### 5.2.2 LED displays

| LED | Color | Meaning | |
|---|---|---|---|
| LED1 | Red/ green | RED =<br>GREEN =<br>No display = | Safety outputs in the OFF state<br>Safety outputs in the ON state<br>Device without supply voltage |
| LED2 | Orange | **Operating mode with internal start/restart interlock in OFF state (LED1 red):** | |
| | | ON = | Protective field free |
| | | **Operating mode with/without internal start/restart interlock in ON state (LED1 green):** | |
| | | ON = | Weak beam indication with free protective field |

**Table 5.2-2:** Receiver LED status displays

| LED | Color | Meaning |
|---|---|---|
| LED3 | Yellow | **OFF state (LED1 red = ON):**<br>ON = Internal restart interlock locked<br>OFF = Internal restart interlock unlocked/not activated |
| LED4 | Blue | OFF = Reserved for special functions |

**Table 5.2-2:** Receiver LED status displays

# 6 Installation



In this Chapter you will find important information on installing the COMPACT*plus-s*, the effective protection of which is only guaranteed if the following installation specifications are complied with. These installation specifications are based on the respective applicable versions of European standards such as EN 999 and EN 294. It must also be ensured that the specifications applicable when using *plus* in non-European countries are observed.

Installation is dependent on the type of protection as described in Chapter 3.2 „Application examples". The situations:

- Safeguarding danger points
- Safeguarding danger areas
- Access and perimeter guarding

will therefore be considered separately in the following chapters. The applicable distance between the safety device and reflective surfaces in the environment will then be listed for all types of protection.

## 6.1 Calculating minimum distances

Light curtains can only fulfill their protective requirements if they are installed with a sufficient safety distance.

The calculation formulas for the safety distance depend on the type of protection. In the harmonized European standard EN 999, "Positioning of safety devices with regard to approach speeds of parts of the human body", the installation situations and calculation formulas for safety distance are described for the protection types named above.

The formulas for the necessary distance from reflective surfaces are determined in accordance with the European standard for "Active Opto-electronic Protective Devices (AOPD)" prEN IEC 61496-2.

### 6.1.1 Safety distance for safeguarding danger points

Safety distance calculation for a safety light curtain for safeguarding danger points with an effective resolution of 14 to 40 mm:

The safety distance “S” for safeguarding danger points can be calculated in accordance with EN 999 using the formula:

$$S\ [mm] = K\ [mm/s] \times T\ [s] + C\ [mm]$$

S = Safety distance in mm
If the result is less than 100 mm, a min. distance of 100 mm must be used.

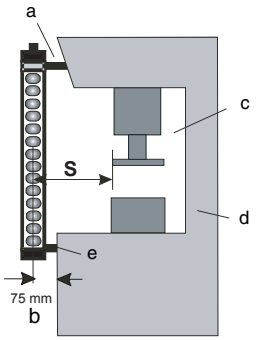
K = Approach speed in mm/s
In the close range of 500 mm, 2000 mm/s is used for the calculation. If a distance greater than 500 mm is calculated, K = 1600 mm/s may be used. However, in this case a minimum safety distance of 500 mm is applied.

T = Total time delay in seconds;
sum of:

| | |
|---|---|
| The response time of the safety device, $t_{AOPD}$, | See Chapter 12 |
| Safety interface, if any, $t_{Interface}$, | Interface technical data |
| and the machine's stopping time, $t_{Machine}$. | Technical data of the machine or stopping time measurement |

C = 8 x (d-14) in mm
Allowance depending on the depth of penetration into the protective field before turning on the AOPD

d = Resolution of the AOPD




a = Measures to prevent access from above
b = Maximum distance to prevent walking behind.
If a distance greater than 75 mm results because of the safety distance “S”, other measures must be taken against walking behind.
c = Measures to prevent access from the sides
d = Measures to prevent access from the rear
e = Measures to prevent access from below

**Fig. 6.1-1:** Safety distance “S” for safeguarding danger points

$$S\ [mm] = 2000\ [mm/s] \times (t_{AOPD} + t_{Interface} + t_{Machine})\ [s] + 8 \times (d-14)\ [mm]$$

**Calculation example for safeguarding danger points:**

A CP14-1500-s safety light curtain with transistor output is in direct use on a press with a 150 ms stopping time.

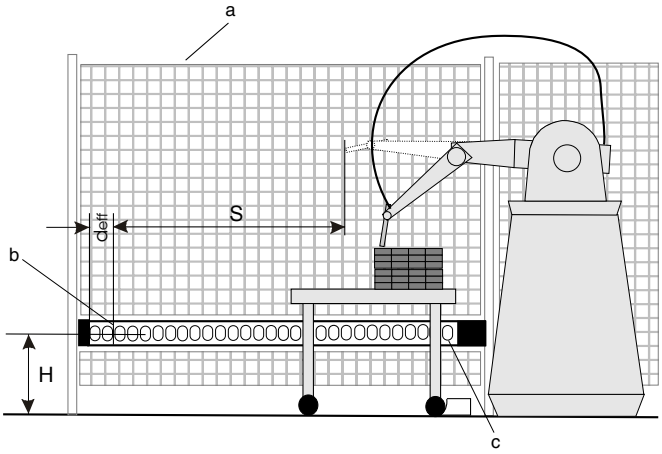
| | | | |
|---|---|---|---|
| Machine's stopping time $t_{Machine}$ | = | 150 | ms |
| Response time $t_{AOPD}$ | = | 35 | ms |
| Response time $t_{Interface}$ | = | 20 | ms |
| Resolution d, of AOPD | = | 14 | mm |
| T = 0.150 + 0.035 + 0.020 | = | 0.205 | s |
| S = 2000 x 0.205 + 8 x (14 -14) | = | 410 | mm |

Ensure with the installation that the possibility of reaching over, under or around or of walking behind the safety light curtain has been definitively ruled out.

To prevent someone from walking behind the safety equipment, the distance between the machine table and the light curtain may only be a max. 75 mm. Walking undetected behind can be prevented, for example, by mechanical barriers or with a host/guest arrangement of the safety light curtain.

### 6.1.2 Safety distance for safeguarding danger areas

Calculating the safety distance and the resolution required for a safety light curtain for safeguarding danger areas.




a = Measures to prevent access from the sides
b = Switching position: End of protective field minus effective resolution $d_{eff}$
c = Position of 1st beam

**Fig. 6.1-2:** Safety distance "S" and height "H" for safeguarding danger areas

The height of the protective field “H” above the reference plane and the resolution “d” of the AOPD have the following relationship:

| $H_{min}$ [mm] = 15 x (d - 50) [mm] | or | d [mm] = H/15 + 50 [mm] |
|---|---|---|

H = Height of the protective field above the reference plane, maximum 1000 mm
Heights equal to or less than 300 mm are considered too low to crawl under

d = Resolution of the AOPD

The safety distance “S” for safeguarding danger areas is calculated in accordance with EN 999 using the formula:

| S [mm] = K [mm/s] x T [s] + C [mm] |
|---|

S = Safety distance in mm

K = Approach speed 1600 in mm/s.

T = Total time delay in seconds;
sum of:

| | |
|---|---|
| The response time of the safety device, $t_{AOPD}$, | See Chapter 12 |
| Safety interface, if any, $t_{Interface}$, | Technical data of the interface |
| and the machine's stopping time, $t_{Machine}$. | Technical data of the machine or stopping time measurement |

C = (1200 mm – 0.4 H), but not less than 850 mm (arm length)

H = Height of the protective field above floor

| S [mm] = 1600 [mm/s] x ($t_{AOPD}$ + $t_{Interface}$ + $t_{Machine}$) [s] + (1200 – 0.4 H) [mm] |
|---|

**Calculation example for safeguarding danger areas:**

The area in front of an assembling press is to be secured.

It is decided to use CP50-xxx-s with transistor output, whereby the length of the safety device is at first not known before the calculation of the safety distance. The resolution of the series CP50 safety light curtain is 50 mm.

$H_{min}$ = 15 x (50 – 50) = 0 mm

The AOPD can therefore be set up at heights between 0 and 1000 mm. Further calculation of the safety distance "S" is based on the assumption that the light curtain is actually mounted at a height of H = 100 mm above the floor. The stopping time of the assembly press is determined at 520 ms. The length of the light curtain must be estimated in order to calculate T. A length of 2100 mm is assumed. According to table 12.2-1 this results in the value $t_{A\ AOPD}$ = 13 ms. There is no additional safety interface because the start/restart interlock and contactor monitoring are already integrated in COMPACT*plus*.

| | | | |
|---|---|---|---|
| T | = | 13 + 520 | = 533 ms |
| C | = | 1200 – 0.4 x 100<br>The calculated value is higher than the minimum value of 850 mm | = 1160 mm |
| S | = | 1600 x 0.533 + 1160 | = 2013 mm |

The first estimated protective field height of 2100 mm is sufficient, although the switching position with parallel approach at the end of the protective field is approximately the resolution value d, that is then 50 mm before the end of the protective field:

S + d = 2013 +50 mm = 2063 mm

→ Selection is therefore made for COMPACT*plus* CP50-2100-s.

What would be the result if instead of AutoScan mode the DoubleScan mode is selected?

In table 12.2-2, the response time 25 ms is given for CP50-21000-s in DoubleScan mode. The recalculated safety distance is therefore:

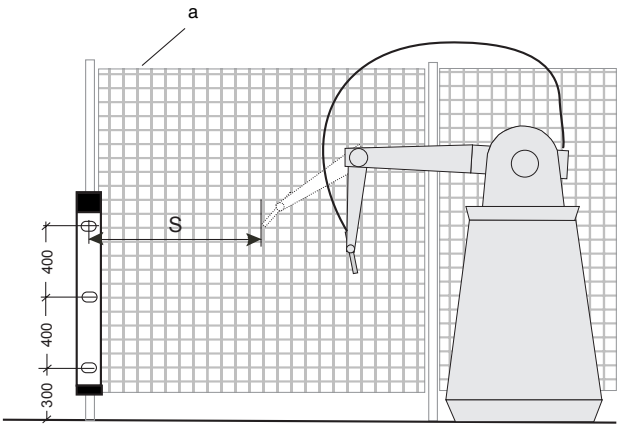
| | | | |
|---|---|---|---|
| T | = | 25 + 520 | = 545 ms |
| C | = | 1200 – 0.4 x 100<br>The calculated value is higher than the minimum value of 850 mm | = 1160 mm |
| S | = | 1600 x 0.545 + 1160 | = 2032 mm |
| S + d = | | 2032 +50 mm | = 2082 mm |

In this example with the use of CP50-2100-s, the safety distance for given switching position 50 mm before the end of the protection field is also sufficient. With the same expenditure as AutoScan, DoubleScan mode offers more “immunity” against interference, as an interruption must occur in two consecutive scans to switch the machine off. Switching to DoubleScan mode is described in Chapter 8.

### 6.1.3 Beam heights and safety distance for access and perimeter guarding

Determination of beam heights above reference level and calculation of the safety distance of COMPACT*plus-s*, Multiple Light Beam Safety Devices.






a = Measures to prevent access from the sides

**Fig. 6.1-3:** Beam heights and safety distance “S” for access and perimeter guarding

**Beam heights for access and perimeter guarding in accordance with EN 999:**

| Version | Number of beams | Beam distance in mm | Beam heights above reference level in mm |
|---|---|---|---|
| CP30x/4-s | 4 | 300 mm | 300, 600, 900, 1200 |
| CP40x/3-s | 3 | 400 mm | 300, 700, 1100 |
| CP50x/2-s | 2 | 500 mm | 400, 900 |

**Table 6.1-1:** Beam heights above reverence level depending on the number of beams

**Calculation formula for safety distance “S” in accordance with EN 999:**

The safety distance “S” for access and perimeter guarding is calculated in compliance with EN 999 using the formula:

$$S\ [mm] = K\ [mm/s] \times T\ [s] + C\ [mm]$$

S = Safety distance in mm

K = Approach speed 1600 in mm/s.

T = Total time delay in seconds;
sum of:
The response time of the safety device, $t_{AOPD}$, of the MSI safety interface, $t_{Interface}$, and the machine's stopping time, $t_{Machine}$.

See Chapter 12
Technical data of the interface
Technical data of the machine
or stopping time measurement

C = 850 mm (arm length)

$$S\ [mm] = 1600\ [mm/s] \times (t_{AOPD} + t_{Interface} + t_{Machine})\ [s] + 850\ [mm]$$

**Calculation example for access and perimeter guarding**

A robot with a stopping time of 250 ms is to be protected with a CP400/3-s multiple light beam safety device. The beam heights are determined at 300, 700 and 1100 mm.

According to table 12.2-4, the response time of the AOPD is 19 ms. An additional interface is not required as CP400/3-s is already equipped with internal start/restart interlock and contactor monitoring.

| | | | |
|---|---|---|---|
| T | = | 19 +250 | = 269 ms |
| C | = | 850 mm | = 850 mm |
| S | = | 1600 x 0.269 + 850 | = 1281 mm |

In the AutoScan mode (factory setting), the response time for CP400/3-s is 19 ms, the MultiScan factor is H = 7. In table 12.2-5, the response time for DoubleScan mode (H = 14) is given as 36 ms. The safety distance is therefore calculated as:

| | | | |
|---|---|---|---|
| T | = | 36 + 250 | = 286 ms |
| C | = | 850 mm | = 850 mm |
| S | = | 1600 x 0.286 + 850 | = 1308 mm |

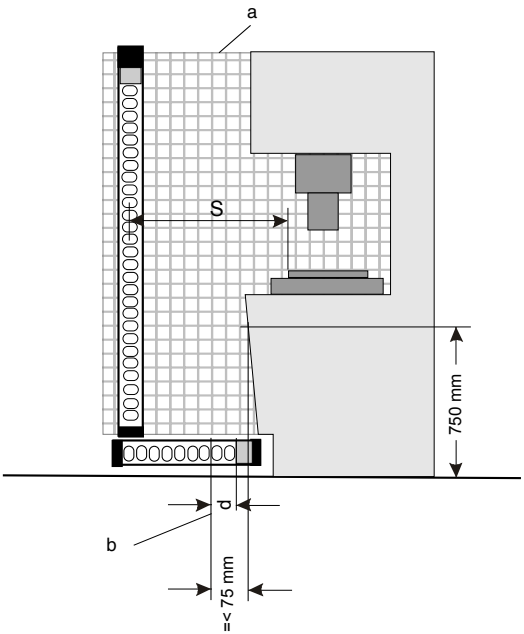
The small increase in the required safety distance of 27 mm is distinctly smaller than the greater interference “immunity”, as with H = 14, the safety circuit is only switched off after the 14th successively interrupted protective field. Parts such as matchwood or welding sparks, that occur within 33 ms of the protective field, are consequently guaranteed not to cause an unintentional switching off.

It must be ensured when using access and perimeter guarding that the start/restart interlock is active and that there is no possibility of unlocking from inside the danger area.

### 6.1.4 Switching position at the end of the protective field

While the switching position of the first beam (synchronization beam) is positioned just next to the display panel, the switching position at the end of the protective field depends on the resolution of the light curtain.

The determination of the position of the switching point is important in all cases of rear area protection, e.g. in host/guest applications and/or with danger point protection with parallel approach to the protective field.




a = Measures to protect access from the sides
b = Switching position: End of protection field minus resolution d

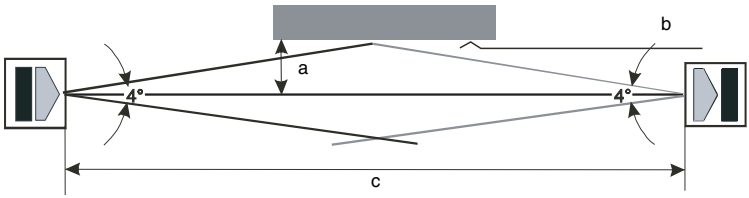
**Fig. 6.1-4:** Example: Host/guest application

The presence of a person between the safety device and machine table must be definitively detected. Therefore the distance between the switching point of the safety device and the machine table (at a height of 750 mm) must not exceed 75 mm.

The same applies if a danger point is protected with a light curtain that is mounted horizontally or inclined up to 30° and the end of the protective field points toward the machine.

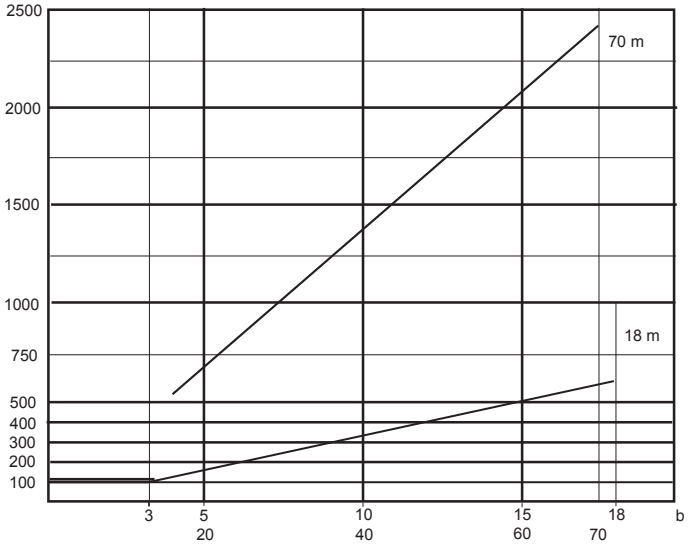
### 6.1.5 Minimum distance from reflective surfaces

Reflective surfaces near optical safety devices can indirectly deflect the transmitter's beams into the receiver. This can cause non-recognition of an object in the protective field! All reflective surfaces and objects (material containers, cans, etc.) must therefore be kept at a minimum distance “a” from the protective field. The minimum distance “a” is dependent on the distance “c” between the transmitter and the receiver.




a = Distance
b = Reflective surface
c = Protective field width

**Fig. 6.1-5:** Minimum distances to reflective surfaces




a = Distance [mm]
b = Protective field width [m]

**Fig. 6.1-6:** Minimum distance from reflective surfaces depending on protective field width

## 6.2 Mounting notes

Special notes on mounting a COMPACT*plus* Safety Light Curtain for safeguarding**danger points:**

- ➢ Ensure that it is impossible to reach under, over, around or walk behind the safety light curtain.
- ➢ Observe the maximum distance between machine table and protective field of 75 mm, with reference to a table height of 750 mm. If this is not possible because the safety distance is too big, a mechanical barrier or a host/guest arrangement must be provided.
- ➢ Observe the minimum required distance to reflective surfaces.

Special notes on mounting a COMPACT*plus* Safety Light Curtain for safeguarding **danger areas**:

- ➢ The resolution determines the minimum height of the protective field above the floor. The calculation formula can be found in Chapter 6.1.2.
- ➢ Ensure that the maximum height of the protective field above the reference plane of 1000 mm is not exceeded and only heights equal to or less than 300 mm are considered impossible for an adult to crawl under (also see EN 999).
- ➢ It must not be possible to step into the danger area from the sides. Suitable hard guards must be provided.
- ➢ When assembling, ensure that it is impossible to pass onto the housings of the optical components (thereby allowing entrance into the danger area).

  ⓘ Positioning behind corresponding cutouts on the hard guards on the sides prevents stepping onto transmitter or receiver housings.
- ➢ Consider the position of the last light beam before the machine. It must not be possible to stand undetected between this light beam and the machine. See Chapter 6.1.4.

Special notes on mounting a COMPACT*plus* Multiple Light Beam Safety Device for **access or perimeter guarding**:

- ➢ Consider the heights of beams in accordance with table 6.1-1. In the case of 2-beam safety light devices the lower beam is 400 mm above the reference level; with 3 and 4-beam multiple light beam safety devices, 300 mm above the reference level.
- ➢ If safety light curtains are used as access guarding, the lowest light beam must also be set at 300 mm above the reference plane. The top light beam and therefore the protective field height are determined by the requirements in accordance with EN 294.
- ➢ Calculate the safety distance in accordance with Chapter 6.1.3.
- ➢ Access and perimeter guarding must only be operated with start/restart interlock function. Activate the internal start/restart interlock function or the start/restart interlock function of a downstream safety interface and check the effectiveness.
- ➢ Ensure while installing the start button, that it must only be impossible to press this button from inside the danger area. Make sure, that from the location of the button there is a complete overview over the danger area.

## 6.3 Mechanical mounting

ⓘ For setting functions using switches, it is best to do so before installation, as the transmitter and/or receiver should be opened in as clean a room as feasibly possible. It is therefore recommended that the necessary settings be made before starting installation (Chapters 4 and 8).

What should generally be taken into consideration during installation?

- ➢ Ensure that transmitter and receiver are mounted on an even surface at the same height.
- ➢ When mounting, use screws that can only be loosened by a tool.
- ➢ Fix the transmitter and receiver in position so that they cannot be shifted. Securing against turning is particularly important in the close range below a protective field width of 0.3 m for devices with 6 m detection range, 0.8 m for devices with 18 m detection range and 6 m for devices with 70 m detection range for safety reasons.
- ➢ The connections of transmitter and receiver must be pointing in the same direction.
- ➢ The safety distance between the protective field and the danger point must be observed.
- ➢ Ensure that access to the danger point/danger area is only possible through the protective field. Additional access points must be protected separately (e.g. by hard guards, additional light curtains or doors with locking devices).

### 6.3.1 Standard mounting

Four standard mounting brackets (with sliding nuts and screws) are included in the delivery. If the shock and vibration load mentioned in the technical data is exceeded, swiveling brackets with shock absorbers must be used.

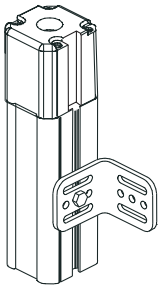


**Fig. 6.3-1:** Standard mounting bracket

### 6.3.2 Option: Mounting with swiveling brackets

Four swiveling brackets with shock absorbers can be ordered optionally. They are not included in the delivery. The swivel angle is ± 4 °.

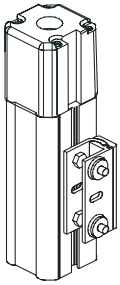


**Fig. 6.3-2:** Swiveling mounting bracket with shock absorber



## 7 Electrical connection

- The electrical connection must be performed by experienced personnel. Knowledge of all safety notes contained in these operating instructions is part of this competence.
- The external supply voltage of 24V DC ± 20% must guarantee safe isolation from the mains voltage and be able to bridge a power outage period of at least 20 ms for devices with transistor outputs. **Leuze lumiflex** offers suitable power supplies (see list of accessories in the Appendix). The power supply selected must not supply any other parts of the machine with power other than the safety components connected. It must supply at least 1 A. Transmitters and receivers must be fused against overcurrent (see Chapter 7.2 and Chapter 12).
- It is vital during the electrical installation that the power of the machine or system to be protected is switched off locked, so that the dangerous movements cannot be started up again unintentionally.
- Basically both safety switch outputs OSSD1 and OSSD2 must be looped into the work circuit of the machine. Relay contacts must be protected externally according to the technical data, Chapter 12.1.6, in order to prevent the contacts from welding together.
- Signal outputs may not be used for switching safety-relevant signals.
- The start button for unlocking the restart interlock must be mounted in such a way that it cannot be reached from the danger zone and the entire danger zone is fully visible from its installation position.

- It is vital during the electrical installation that the power of the machine or system to be protected is switched off locked, so that the dangerous movements cannot be started up again unintentionally.
- It must additionally be ensured with devices with safety-related relay outputs that the voltage feed to the relay contacts is also interrupted and secured against restarting. If this is not observed, the **danger of electric shock** from the adjacent voltages arises when opening devices!

All COMPACT*plus* receivers have a local interface and a machine interface. Optional local control elements and/or sensors can be connected to the local interface via an M12 connection. The cables required for this are listed as accessories in Chapter 13.2 and are not included in the delivery.

The machine interface is available in the following design types:

| **Design type** | **Transmitter interface** | **Machine interface Receiver** | |
|---|---|---|---|
| | **Connection system** | **OSSD outputs** | **Connection system** |
| /T1 | MG cable screw, M20x1.5 (standard) | Transistor | MG cable screw, M20x1.5 |
| /T2 | Hirschmann plug, 11-pin+FE | Transistor | Hirschmann plug, 11-pin+FE |
| /T3 | MIN-series plug, 3-pin | Transistor | MIN-series plug, 7-pin |
| /R1 | With transmitter /T1 | Relay | MG cable screw M25 x 1.5 |
| /R2 | With transmitter /T2 | Relay | Hirschmann plug, 11-pin+FE |
| /R3 | With transmitter /T3 | Relay | MIN-series plug, 12-pin |
| /A1 | M12 plug, 3-pin /AP | AS Interface “Safety at Work” | M12 plug, 5-pin |

**Table 7.0-1:** Machine interface selection table

Information on connecting further interface versions can be found, if required, on an attached data sheet or in additional connecting and operating instructions.

## 7.1 Receiver – Local Interface

One characteristic of all COMPACT*plus* receivers is the 8-pin local device socket in the connection cap. This makes it possible to have short cables leading to components in the immediate vicinity of the optical safety device. In the COMPACT*plus-s* version, the start button and the optional 2-channel safety circuit, e.g. for a safety door locking without guard interlocking can be connected.

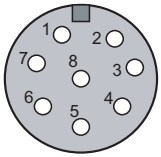
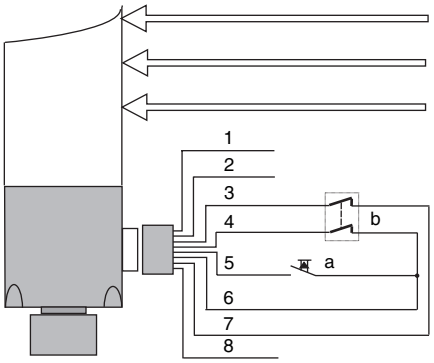



**Fig. 7.1-1:** Receiver – Local interface, M12x8-pin device socket

| Pin | Color | Assignment | | **Inputs/outputs** (FS) can be differently arranged via SafetyLab |
|---|---|---|---|---|
| 1 | White | ⇐ | L1, local input | Free |
| 2 | Brown | ⇐ | L2, local input | Free |
| 3 | Green | ⇐ | L3, local input | Contact-based sensor contact 1 |
| 4 | Yellow | ⇐ | L4, local input | Contact-based sensor contact 2 |
| 5 | Gray | ⇔ | L5, local input | RST-L, local start button |
| 6 | Pink | ⇒ | Local output | +24V DC |
| 7 | Blue | ⇒ | Local output | 0V DC |
| 8 | Red | ⇒ | Local output | FE, functional earth |

**Table 7.1-1:** Receiver – Local interface, local cable connector assignment




1 to 8 = PIN number of the local connection socket
a = Start button
b = Optional safety circuit

**Fig. 7.1-2:** Connection example, local interface

## 7.2 Standard: Machine interface T1, MG cable screw M20x1.5

### 7.2.1 Transmitter interface /T1

The terminal field for the transmitter connection cable is located inside the connection cap.

➢ After you have loosened the 4 fixing screws, pull the connection cap out in as straight a direction as possible. Use insulated conductor sleeves.

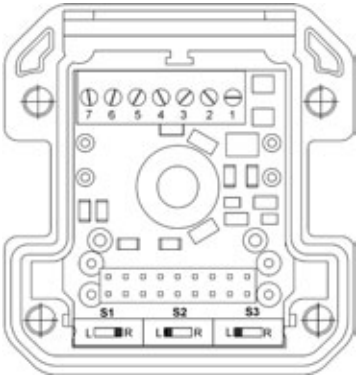



**Fig. 7.2-1:** Transmitter connection cap removed, terminal field inside view

| Terminal | Assignment | | Inputs/outputs | |
|---|---|---|---|---|
| 1 | ⇐ | Supply voltage | +24V DC | |
| 2 | ⇐ | Supply voltage | 0V DC | |
| 3 | ⇒ | Test out | jumper to 4 | Jumper set in factory |
| 4 | ⇐ | Test in | jumper to 3 | |
| 5 | | RS485 + | | |
| 6 | | RS485 – | | |
| 7 | ⇐ | Functional earth, shield | FE | |

**Table 7.2-1:** Transmitter interface /T1 – terminal field connection assignment

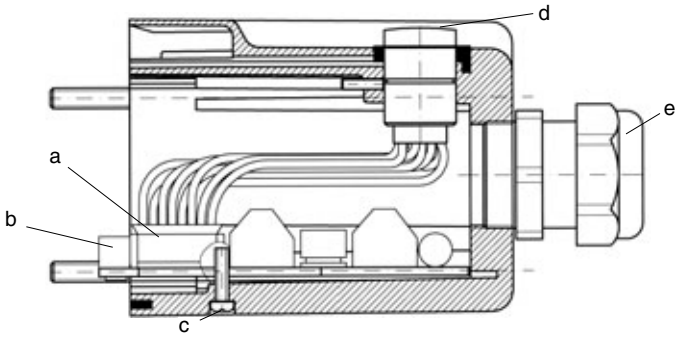
### 7.2.2 Receiver machine interface /T1

The receiver has safety-related transistor outputs.

The connecting circuit board with the terminal field for the machine interface connection cable fixed with the M20x1.5 cable screw is located inside the connection cap.

➢ After you have loosened the 4 fixing screws, pull the connection cap out in as straight a direction as possible.

➢ Loosen the fixing screw on the rear side of the connection cap and slightly pull out the connecting circuit board.




| | | | | | |
|---|---|---|---|---|---|
| a | = | Plug connection to the local interface | c | = | Fixing screw |
| b | = | Connecting circuit board | d | = | Local interface |
| | | | e | = | Cable screw M20x1.5 |

**Fig. 7.2-2:** Receiver cap /T1 removed, view from the side

➢ Loosen the plug connection for the cable to the local interface, M12 8-pin.

➢ Pull the circuit board out completely, the connecting terminals are now free.

➢ Use insulated conductor sleeves.

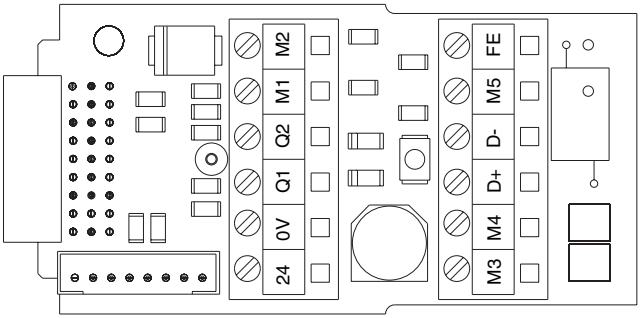
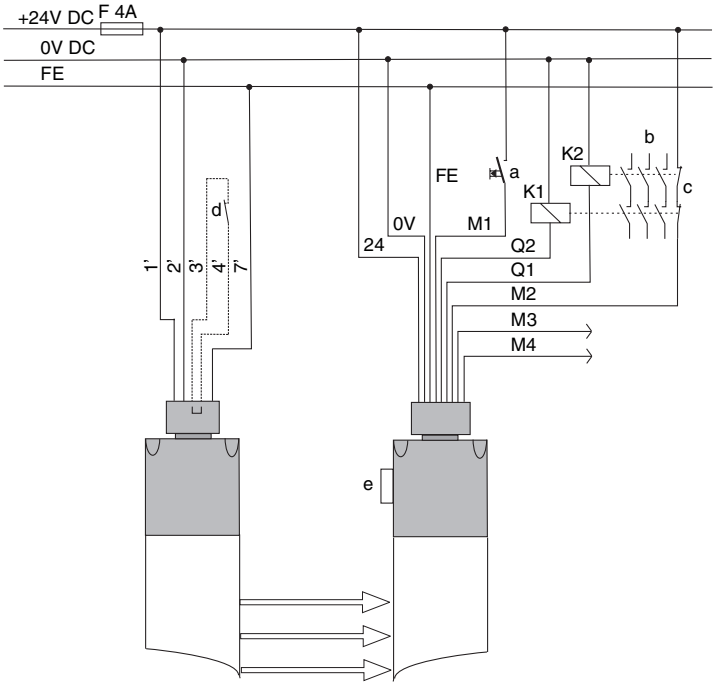



**Fig. 7.2-3:** Receiver machine interface /T1, terminal field

| Terminal | Assignment | | Inputs/outputs<br>M1 .. M5 (FS), can be differently arranged via SafetyLab |
|---|---|---|---|
| 24 | ⇐ | Supply voltage | +24V DC |
| 0V | ⇐ | Supply voltage | 0V DC |
| Q1 | ⇒ | Output | OSSD1, transistor output |
| Q2 | ⇒ | Output | OSSD2, transistor output |
| M1 | ⇐ | M1 input | RST_M, machine interface start button* |
| M2 | ⇐ | M2 input | EDM, contactor monitoring against +24V DC |
| M3 | ⇒ | M3 input/output | Active protective field free/ready for unlocking |
| M4 | ⇒ | M4 input/output | Collective malfunction/dirt signal |
| D+ | ⇔ | Reserved | |
| D- | ⇔ | Reserved | |
| M5 | | M5 input/output | Free |
| FE | ⇐ | Functional earth, shield | FE |

*) Machine interface start button; same effect in FS as the start button on L5 of the local interface

**Table 7.2-2:** Receiver machine interface /T1, terminal field connection assignment




a = Start button
b = Release circuits
c = EDM, feedback contacts contactor monitoring
d = Optional: External test, if factory-set jumper is removed
e = Local connection socket
1' to 4',7' = Transmitter terminal field numbers

ⓘ Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.
The safety-related transistor outputs carry out the spark extinction. With devices with transistor outputs, it is therefore not necessary to use the spark extinction elements recommended by contactor/valve manufacturers etc. (RC modules, varistors or recovery diodes). These extend the delay times of inductive switching elements.

**Fig. 7.2-4:** Connection example machine interface /T1 – MG cable screw M20x1.5

## 7.3 Option: Machine interface /T2, Hirschmann plug, M26 11-pin+FE

The COMPACT*plus-s* /T2 device design is equipped to connect both the transmitter and receiver machine interface with a 12-pin Hirschmann plug. This has no effect on the option of connecting local control elements or additional sensor equipment to the M12x8-pin local interface, as described in Chapter 7.1. The cable socket in straight or angled version incl. crimp contacts is available as an accessory. Ready prepared connection cables in different lengths are also available.

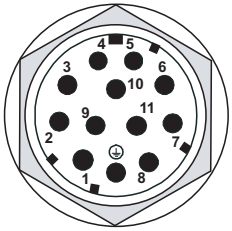



**Fig. 7.3-1:** Transmitter and receiver machine interface /T2 (view of the pins)



### 7.3.1 Transmitter interface /T2

| Pin | Wire colors CB-8N-xxxxx-11G/W | Assignment | | Inputs/outputs | |
|---|---|---|---|---|---|
| 1 | Brown | ⇐ | Supply voltage | +24V DC | |
| 2 | Pink | ⇐ | Supply voltage | 0V DC | |
| 3 | Blue | ⇒ | Test out | External jumper to 4 | Factory setting: **No** internal jumper set |
| 4 | Gray | ⇐ | Test in | External jumper to 3 | |
| 5 | Black | ⇔ | Reserved | | |
| 6 | Orange | | Reserved | | |
| 7 | Red | | Reserved | | |
| 8 | Purple | | Reserved | | |
| 9 | White | | RS485 + | | |
| 10 | Beige | | RS485 - | | |
| 11 | Clear | | Reserved | | |
| ⏚ | Green/yellow | ⇐ | Functional earth, shield | FE | |

**Table 7.3-1:** Transmitter interface /T2, Hirschmann cable socket connection assignment

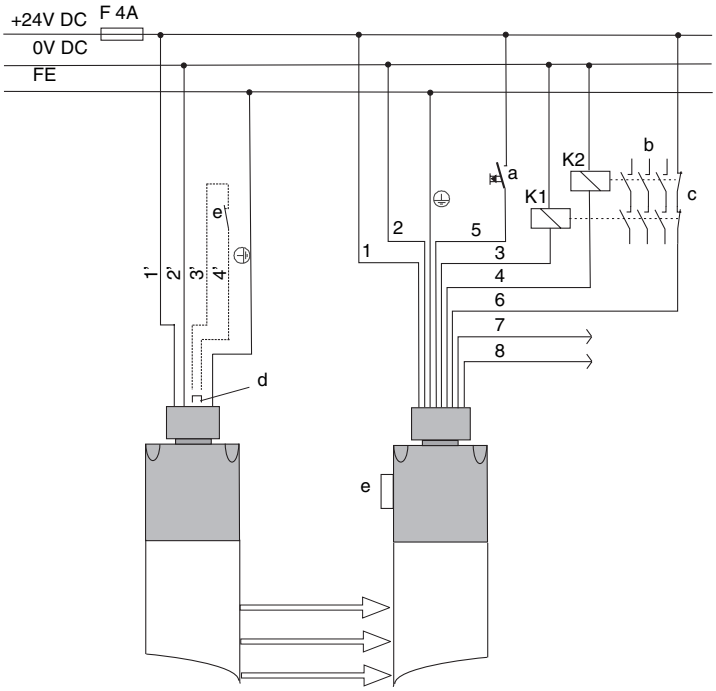
### 7.3.2 Receiver machine interface /T2

The receiver has safety-related transistor outputs.

| Pin | Wire colors CB-8N-xxxxx-11G/W | Assignment | | Inputs/outputs M1 .. M5 (FS), can be differently arranged via SafetyLab |
|---|---|---|---|---|
| 1 | Brown | ⇐ | Supply voltage | +24V DC |
| 2 | Pink | ⇐ | Supply voltage | 0V DC |
| 3 | Blue | ⇒ | Output | OSSD1, transistor output |
| 4 | Gray | ⇒ | Output | OSSD2, transistor output |
| 5 | Black | ⇐ | M1 input | RST_M, machine interface start button* |
| 6 | Orange | ⇐ | M2 input | EDM, contactor monitoring against +24V DC |
| 7 | Red | ⇔ | M3 input/output | Active protective field free/ready for unlocking |
| 8 | Purple | ⇔ | M4 input/output | Collective malfunction/dirt signal |
| 9 | White | | Reserved | |
| 10 | Beige | | Reserved | |
| 11 | Clear | ⇔ | M5 input/output | Free |
| ⏚ | Green/yellow | ⇐ | Functional earth, shield | FE |

*) Machine interface start button; same effect in FS as the start button on L5 of the local interface

**Table 7.3-2:** Receiver machine interface /T2, Hirschmann cable socket connection assignment




a = Start button
b = Release circuits
c = EDM, feedback contacts contactor monitoring
d = Optional: External test, if factory-set jumper is removed
e = Local connection socket
1‘ to 4‘, ⏚ = Pin numbers, Hirschmann plug, transmitter
1 to 8, ⏚ = Pin numbers, Hirschmann plug, receiver

ⓘ Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.
The safety-related transistor outputs carry out the spark extinction. With devices with transistor outputs, it is therefore not necessary to use the spark extinction elements recommended by contactor/valve manufacturers etc. (RC modules, varistors or recovery diodes). These extend the delay times of inductive switching elements.

**Fig. 7.3-2:** Connection example machine interface /T2, Hirschmann plug

## 7.4 Option: Machine interface /T3, MIN-series plug

The COMPACT*plus-s*/T3 device design is equipped to connect the transmitter with a 3-pin and receiver machine interface with a 7-pin MIN-series plug. This has no effect on the option of connecting local control elements or additional sensor equipment to the M12x8-pin local interface, as described in Chapter 7.1. Connection cables are not included in the delivery.

### 7.4.1 Transmitter interface /T3

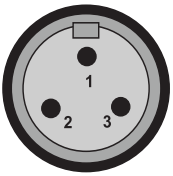



**Fig. 7.4-1:** Plug, MIN-series 3-pin – view of the plug pins of the transmitter

| Pin | Color | Assignment | | Inputs |
|---|---|---|---|---|
| 1 | Green | ⇐ | Functional earth, shield | FE |
| 2 | Black | ⇐ | Supply voltage | 0V DC |
| 3 | White | ⇐ | Supply voltage | +24V DC |

**Table 7.4-1:** Transmitter interface/T3, 3-pin MIN-series plug connection assignment

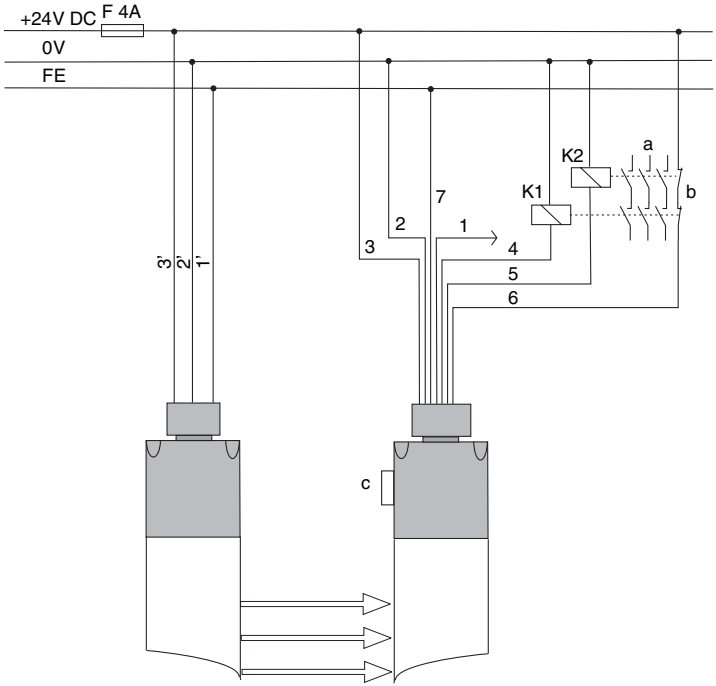
### 7.4.2 Receiver machine interface /T3

The receiver has safety-related transistor outputs.


**Fig. 7.4-2:** Receiver/transceiver machine interface /T3, MIN-series (view of the pins)

| Pin | Color | Assignment | | Inputs/outputs<br>M2, M3 (FS) can be differently arranged via SafetyLab |
|---|---|---|---|---|
| 1 | White/black | ⇒ | M3 output | Active protective field free |
| 2 | Black | ⇐ | Supply voltage | 0V DC |
| 3 | White | ⇐ | Supply voltage | +24V DC |
| 4 | Red | ⇒ | Output | OSSD1, transistor output |
| 5 | Orange | ⇒ | Output | OSSD2, transistor output |
| 6 | Blue | ⇐ | M2 input | EDM, contactor monitoring against +24V DC |
| 7 | Green | ⇐ | Functional earth, shield | FE |

**Table 7.4-2:** Receiver/transceiver machine interface /T3, connection assignment, MIN-series cable socket 7-pin




a = Release circuit
b = EDM, feedback contacts contactor monitoring
c = Local connection socket
1‘ to 3‘ = Pin numbers, 3-pin MIN-series plug, transmitter
1 to 7 = Pin numbers, 7-pin MIN-series plug, receiver/transceiver

ⓘ Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.
The safety-related transistor outputs carry out the spark extinction. With devices with transistor outputs, it is therefore not necessary to use the spark extinction elements recommended by contactor/valve manufacturers etc. (RC modules, varistors or recovery diodes). These extend the delay times of inductive switching elements.

**Fig. 7.4-3:** Connection example machine interface/T3, MIN-series plug

## 7.5 Option: Machine interface /R1, MG cable screw M20x1.5

This version of the machine interface is characterized by relay outputs and cable screws on the connection caps in the transmitter and receiver. This has no effect on the option of connecting local control elements or additional sensor equipment to the M12 8-pin local interface, as described in Chapter 7.1.

It applies with safety-related relay outputs that: The cable or cables for machine control must generally be laid with protected installation in a cable duct or with armor in such a way that cross-connections of the connection cables can be safely ruled out.

### 7.5.1 Transmitter interface /T1

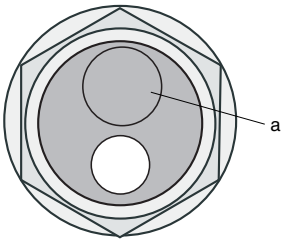
A separate transmitter for devices with safety-related relay outputs is not available. The corresponding transmitter /T1 also equipped with cable screw is used (see Chapter 7.2.1).

### 7.5.2 Receiver machine interface /R1

The design type COMPACT*plus*/R1 has 2 relay outputs (2 potential-free N/O contacts) and is equipped with a cable screw connection for connecting to the machine interface. The seal in the cable screw has an ex-factory lead-in opening. If protective extra low voltages of up to 42 V AC/DC are switched, then **one** cable with up to 12 wires can be pulled through here.

The current path via the relay contacts of the AOPD must be compulsorily protected to prevent the contacts welding in the event of an overcurrent. The fuse sizes depend on the load. They are provided in Chapter 12.1, Technical data.

For higher switching voltages of up to 250V AC, the load circuit must be separated from the voltage supply and the status signals. In this case **two** cables must be routed through the cable screw; the second lead-in opening has already been prepared and must now only be pushed through.

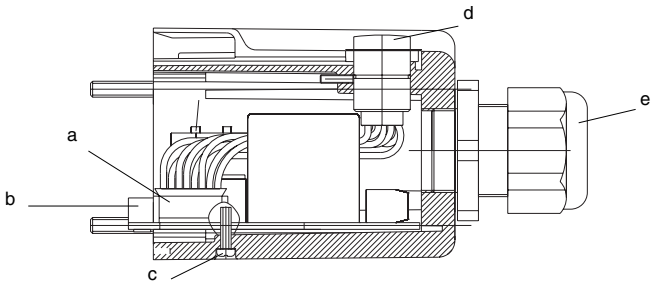



a = Just push opening through when a separate connection cable for the load circuit is to be connected.

**Fig. 7.5-1:** Cable screw M25x1.5, application prepared for connecting 2 cables

To connect:

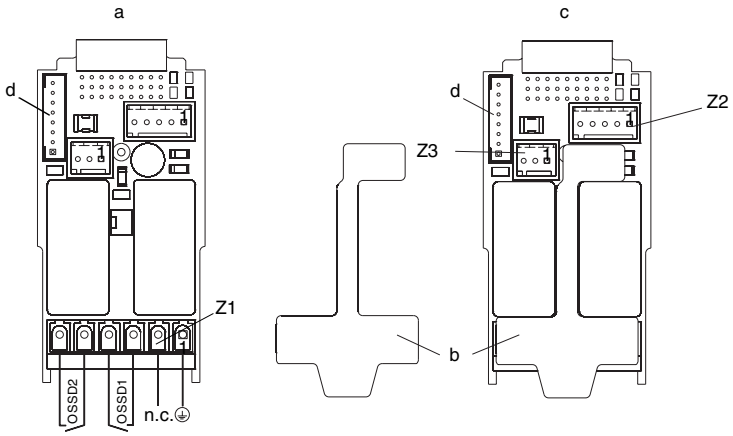
- ➢ After you have loosened the 4 fixing screws, pull the connection cap out in as straight a direction as possible.
- ➢ Loosen the fixing screw on the rear side of the connection cap and slightly pull out the connecting circuit board.
- ➢ If required, loosen the plug connection for the cable to the local interface, M12 8-pin.
- ➢ Pull the circuit board out completely, the connecting terminals are now free.
- ➢ Use insulated conductor sleeves.




a = Plug connection to the local interface
b = Connecting circuit board
c = Fixing screw
d = Local connection socket
e = Cable screw M25x1.5

**Fig. 7.5-2:** Receiver cap /R1, removed

The following relay circuit board, to which the load, signal and power supply lines must be connected, is located in the connection cap.




a = If required, pull plug d, cable to local connection socket.
Remove insulating plate b, connect load lines to Z1.
With switching voltages over 42V, use lead-in with two openings and separate cable for the load line. Connect PE to Z1-1.
b = Insert insulting plate so that an insulation is provided between load line and the other lines.
c = Connect signal and power supply line to Z2 and Z3. If PE has to be connected, the FE must not be connected to Z3-3.
d = If required, re-connect plug for cable to local connection socket again.
Z1 = Load circuit connection
Z2 = Signal connection
Z3 = Supply voltage connection

**Fig. 7.5-3:** Receiver machine interface /T1, terminal fields (terminal 1 marked accordingly)

The cable(s) is/are connected to the three terminal blocks as follows:

**Z1: Load circuit connection**

If voltages U > 42V AC/DC are to be linked up, a **separate cable** must be routed through the second opening of the MG cable screw intended for this purpose!

| Terminal | Assignment | | |
|---|---|---|---|
| Z1-1 | ⇐ | PE, protective earth, shield, to be connected with switching voltages >42V AC/DC<br>(in this case FE, functional earth connection to Z3-1 must not be connected) | |
| Z1-2 | | Free | |
| Z1-3 | ⇐ | OSSD1_A, relay 1, terminal A | Potential-free N/O contact<br>Technical data, see Chapter 12.1 |
| Z1-4 | ⇒ | OSSD1_B, relay 1, terminal B | |
| Z1-5 | ⇐ | OSSD2_A, relay 2, terminal A, | Potential-free N/O contact<br>Technical data, see Chapter 12.1 |
| Z1-6 | ⇒ | OSSD2_B, relay 2, terminal B | |

**Z2: Signal connection**

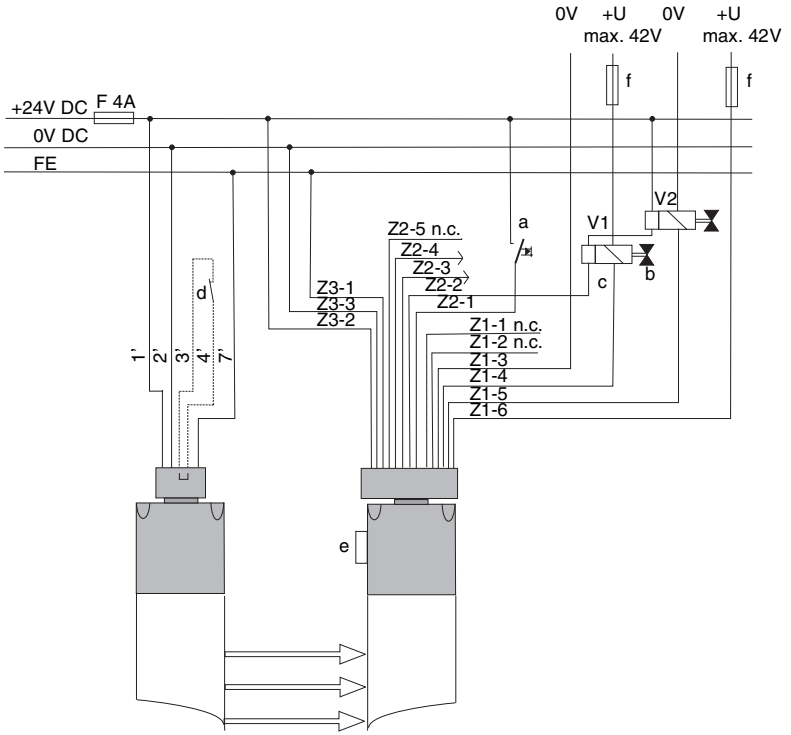
| Pin | Assignment | | Inputs/outputs<br>M1 to M5 (FS), can be differently arranged via SafetyLab |
|---|---|---|---|
| Z2-1 | ⇐ | M1 input | RST_M, machine interface start button* |
| Z2-2 | ⇐ | M2 input | EDM, contactor monitoring against +24V DC |
| Z2-3 | ⇔ | M3 input/output | Active protective field free/ready for unlocking |
| Z2-4 | ⇔ | M4 input/output | Collective malfunction/dirt signal |
| Z2-5 | ⇔ | M5 input/output | free |

*) Machine interface start button; same effect in FS as the start button on L5 of the local interface

**Z3: Supply voltage connection**

| Pin | Assignment | |
|---|---|---|
| Z3-1 | ⇐ | FE, functional earth, shield, to be connected with switching voltages up to 42V AC/DC (in this case PE, protective earth connection to Z1-1 must not be connected) |
| Z3-2 | ⇐ | Supply voltage +24V DC |
| Z3-3 | ⇐ | Supply voltage 0V DC |

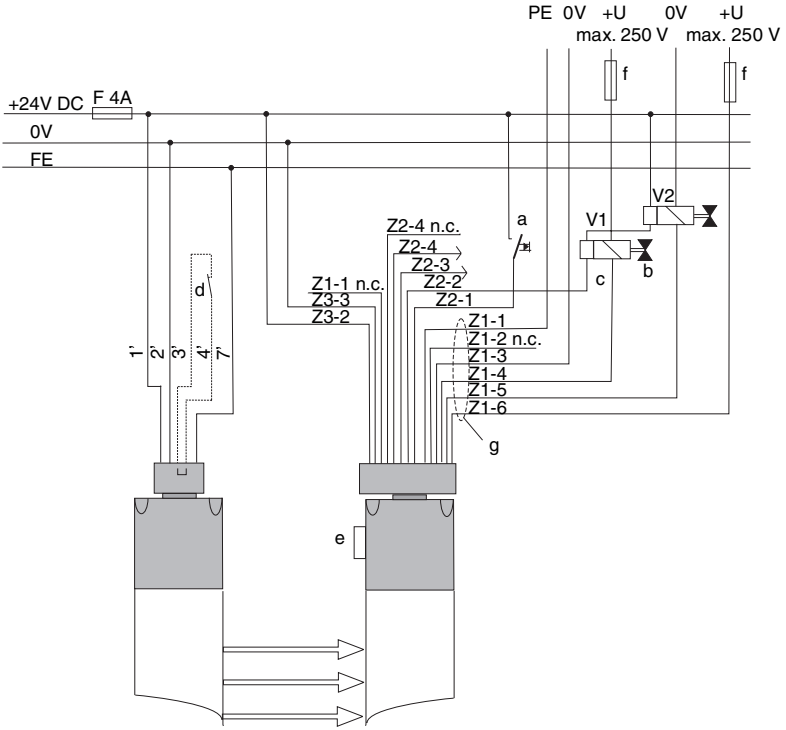
**Table 7.5-1:** Receiver machine interface /R1, terminal fields connection assignment Z1 to Z3




a = Start button
b = Release circuits, safety valves V1 and V2 must be selected in such a way that at ½ +Umax they are sure not to pull, and should they be pulled, they are sure to release! Suitable spark extinction elements must be planned parallel to the spooling of V1 and V2.
c = EDM, feedback contacts, valve monitoring
d = Optional: External test, if factory-set jumper is removed
e = Local connection socket
f = Fuse for protecting the normally open contacts, for sizes see technical data Chapter 12.1.6
Z1, Z2 and Z3
= Terminal numbers of the blocks Z1, Z2 and Z3
1‘ to 4‘, 7‘
= Transmitter terminal numbers

ⓘ The connection cables must be routed in a strong conduit so that mechanical damage is prevented.
Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.

**Fig. 7.5-4:** Connection example machine interface /R1, switching voltages up to 42V AC/DC




a = Start button
b = Release circuits, safety valves V1 and V2 must be selected in such a way that at ½ +Umax they are sure not to pull, and should they be pulled, they are sure to release! Suitable spark extinction elements must be planned parallel to the spooling of V1 and V2.
c = EDM, feedback contacts, valve monitoring
d = Optional: External test, if factory-set jumper is removed
e = Local connection socket
f = Fuse for protecting the normally open contacts, for sizes see technical data, Chapter 12.1
g = Separate cable, required with switching voltages > 42V AC/DC
Z1, Z2 and Z3
= Terminal numbers of the blocks Z1, Z2 and Z3
1‘ to 4‘, 7‘
= Transmitter terminal numbers

ⓘ The connection cables must be routed in a strong conduit so that mechanical damage is prevented.
Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.

**Fig. 7.5-5:** Connection example machine interface /R1, switching voltage over 42V AC/DC

## 7.6 Option: Machine interface /R2, Hirschmann plug, M26 11-pin+FE

The design type COMPACT*plus*/R2 has 2 relay outputs and is equipped with a Hirschmann plug, M26 11-pin+FE in the connection cap for the connection to the machine interface. This has no effect on the connection of local control elements or additional sensor equipment to the M12x8-pin local interface, as described in Chapter 7.1. The cable socket in straight or angled version incl. crimp contacts is available as an accessory. Ready prepared connection cables in different lengths are also available.

It applies with safety-related relay outputs that: The cable for machine control must generally be laid with protected installation in a cable duct or with armor in such a way that cross-connections of the connection cables can be safely ruled out.

### 7.6.1 Transmitter interface /T2

A separate transmitter for devices with safety-related relay outputs is not available. The corresponding transmitter /T2 also equipped with Hirschmann plug, M26 11-pin+FE is used (see Chapter 7.3.1)

### 7.6.2 Receiver machine interface /R2

The receiver has safety-related relay outputs.

The machine interface /R2 is suitable for switching U max. = 42V AC/DC. Only version /R1 with MG cable screw and separate connection cable is suitable for higher switching voltages. The current path via the relay contacts of the AOPD must be compulsorily protected to prevent the contacts from welding together. The respective fuse size depends on the load. It is provided in table 12.1-6.

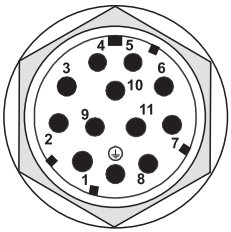


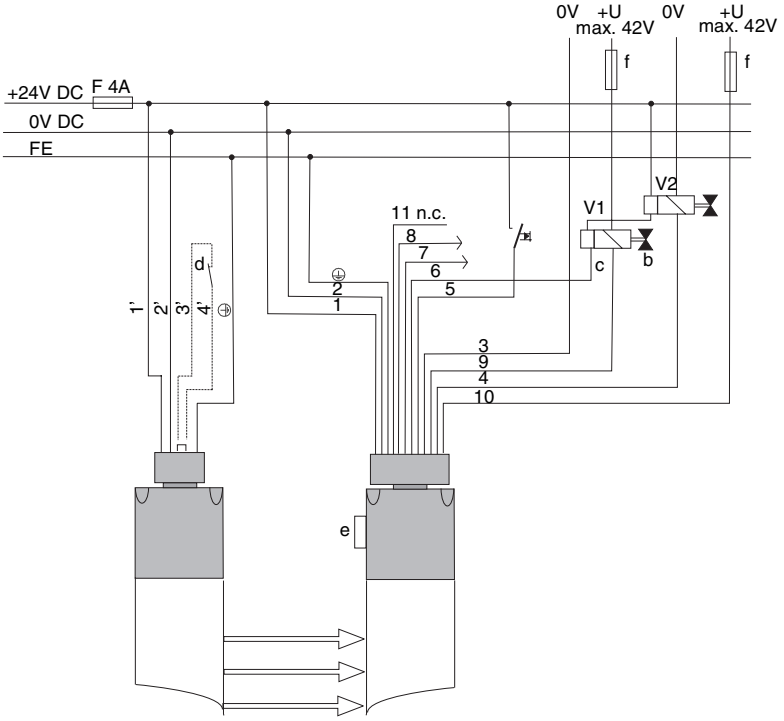

**Fig. 7.6-1:** Receiver machine interface /R2, Hirschmann plug (view of the pins)

The plug is assigned as follows:

| Pin | Wire colors CB-8N-xxxxx-11G/W | Assignment | | Inputs/outputs M1...M5 (FS), can be differently arranged via SafetyLab |
|---|---|---|---|---|
| 1 | Brown | ⇐ | Supply voltage | +24V DC |
| 2 | Pink | ⇐ | Supply voltage | 0V DC |
| 3 | Blue | ⇐ | Relay 1, terminal A<br>max. switching voltage 42 V<br>Potential-free normally open contact | OSSD1A |
| 4 | Gray | ⇐ | Relay 2, terminal A<br>max. switching voltage 42 V<br>Potential-free normally open contact | OSSD 2A |
| 5 | Black | ⇐ | M1 input | RST_M, machine interface start button* |
| 6 | Orange | ⇐ | M2 input | EDM, contactor monitoring against +24V DC |
| 7 | Red | ⇔ | M3 input/output | Active protective field free/ready for unlocking |
| 8 | Purple | ⇔ | M4 input/output | Collective malfunction/ dirt signal |
| 9 | White | ⇒ | Relay 1, terminal B | OSSD1B |
| 10 | Beige | ⇒ | Relay 2, terminal B | OSSD2B |
| 11 | Clear | ⇔ | M5 input/output | Free |
| ⏚ | Green/yellow | ⇐ | FE, functional earth, shield | |

*) Machine interface start button; same effect in FS as the start button on L5 of the local interface

**Table 7.6-1:** Receiver machine interface /R2, Hirschmann cable socket connection assignment




a = Start button
b = Release circuits, safety valves V1 and V2 must be selected in such a way that at ½ +Umax they are sure not to pull, and should they be pulled, they are sure to release! Suitable spark extinction elements must be planned parallel to the spooling of V1 and V2.
c = EDM, feedback contacts, valve monitoring
d = Optional: External test, if factory-set jumper is removed
e = Local connection socket
f = Fuse for protecting the normally open contacts, for sizes see technical data, Chapter 12.1.6
1‘ to 4‘, = Pin numbers, Hirschmann plug, transmitter
1 to 8, = Pin numbers, Hirschmann plug, receiver

ⓘ The connection cables must be routed in a strong conduit so that mechanical damage is prevented.
Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.

**Fig. 7.6-2:** Connection example machine interface /R2, Hirschmann plug

## 7.7 Option: Machine interface /R3, MIN-series plug

The design type COMPACT*plus*/R3 has 2 relay outputs and is equipped with MIN-series plug in the connection cap for the connection to the machine interface. This has no effect on the option of connecting local control elements or additional sensor equipment to the M12x8-pin local interface, as described in Chapter 7.1.

It applies with safety-related relay outputs that: The cable for machine control must generally be laid with protected installation in a cable duct or with armor in such a way that cross-connections of the connection cables can be safely ruled out.

### 7.7.1 Transmitter interface /T3

A separate transmitter for devices with safety-related relay outputs is not available. The corresponding transmitter /T3 with 3-pin MIN-series plug is used (see 7.4.1).

### 7.7.2 Receiver machine interface /R3

The receiver has safety-related relay outputs.

The machine interface /R3 is suitable for switching U max. = 42 V. Only version /R1 with MG cable screw and separate connection cable is suitable for higher switching voltages. The current path via the relay contacts of the AOPD must be compulsorily protected to prevent the contacts from welding together. The respective fuse size depends on the load. It is provided in table 12.1-6.

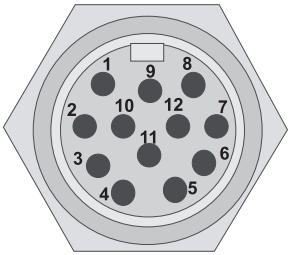


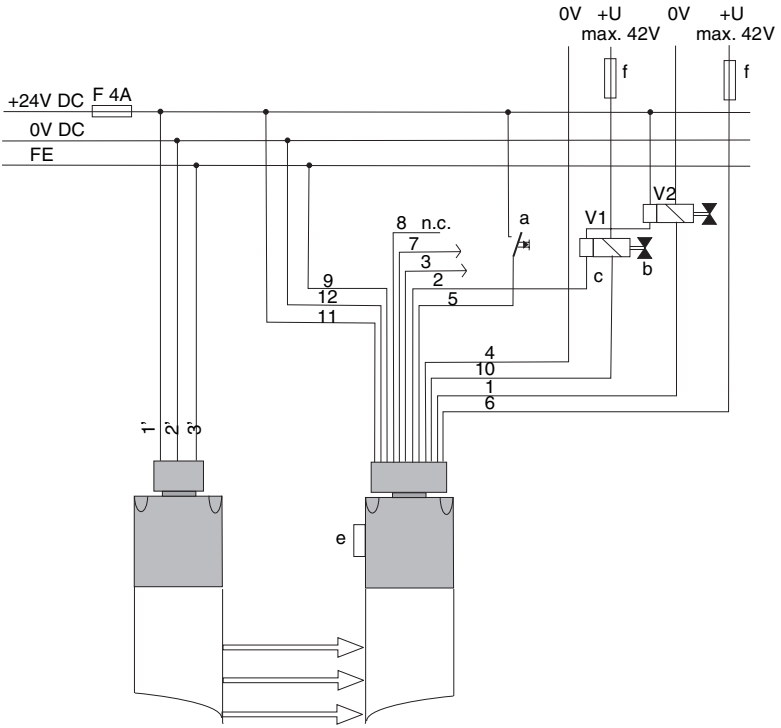

**Fig. 7.7-1:** Receiver machine interface /R3, MIN-series plug (view of the pins)

The 12-pin device plug is assigned as follows:

| Pin | Wire colors | Assignment | | Inputs/outputs<br>M1...M5 (FS), can be differently arranged via SafetyLab |
|---|---|---|---|---|
| 1 | Orange | ⇐ | Relay 2, terminal A<br>max. switching voltage 42 V; | OSSD2A |
| 2 | Blue | ⇐ | M2 input | EDM, contactor monitoring against +24V DC |
| 3 | White/black | ⇔ | M3 input/output | Active protective field free/ ready for unlocking |
| 4 | Red/black | ⇒ | Relay 1, terminal B<br>max. switching voltage 42 V | OSSD1B |
| 5 | Green/black | ⇐ | M1 input | RST_M, machine interface start button* |
| 6 | Orange/black | ⇒ | Relay 2, terminal B | OSSD2B |
| 7 | Blue/black | ⇔ | M4 input/output | Collective malfunction/dirt signal |
| 8 | Black/white | ⇔ | M5 input/output | Free |
| 9 | Green/yellow | ⇐ | FE, functional earth, shield | |
| 10 | Red | ⇐ | Relay 1, terminal A | OSSD1A |
| 11 | White | ⇐ | Supply voltage | +24V DC |
| 12 | Black | ⇐ | Supply voltage | 0V DC |

*) Machine interface start button; same effect in FS as the start button on L5 of the local interface

**Table 7.7-1:** Receiver machine interface /R3, 12-pin MIN-series cable socket connection assignment




a = Start button
b = Release circuits, safety valves V1 and V2 must be selected in such a way that at ½ +Umax they are sure not to pull, and should they be pulled, they are sure to release!
c = EDM, feedback contacts, valve monitoring
e = Local connection socket
f = Fuse for protecting the normally open contacts, for sizes see technical data, Chapter 12.1.7
1‘ to 3‘ = Pin numbers, 3-pin MIN-series plug, transmitter
1 to 12 = Pin numbers, 12-pin MIN-series plug, receiver

ⓘ Shielded connection cables are recommended for extreme electromagnetic interferences. The shield should be connected with FE on a large surface.

**Fig. 7.7-2:** Connection example machine interface /R3, MIN-series plug

## 7.8 Option: Machine interface /A1, AS-i Safety at Work

The COMPACTplus/A1 design type is equipped to connect the transmitter with a 3-pin M12 plug and the receiver machine interface on the AS-i bus system with a 5-pin M12 plug in the connection caps. This has no effect on the option of connecting local control elements or additional sensor equipment to the M12 8-pin local interface, as described in Chapter 7.1.

### 7.8.1 Transmitter interface /AP

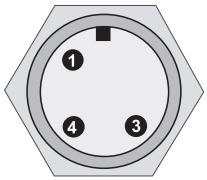
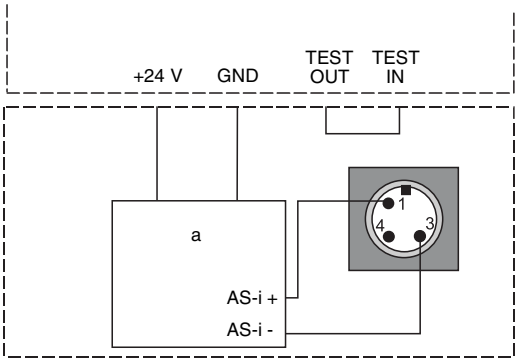



**Fig. 7.8-1:** Transmitter interface /AP, M12 3-pin device plug (view of the pins)

| Pin | Assignment |
|---|---|
| 1 | AS-i + |
| 3 | AS-i – |
| 4 | Not assigned |

**Table 7.8-1:** Transmitter interface /AP, M12 3-pin cable socket connection assignment




a = Decoupling electronics

**Fig. 7.8-2:** Transmitter interface /AP, schematic structure

### 7.8.2 Receiver machine interface /A1

It must be ensured that the supply voltage for the receiver cannot be taken from the standard AS-i line. 24V DC must be fed via pins 2 and 4 for the receiver. A suitable AS-i adapter for bus connection and 24V voltage supply, AC-PDA1/A, is available as an accessory, which feeds the separately laid AS-i data and power supply line to an M12 connection socket so that the receiver can be connected via a standard M12 extension cable with 1:1 connection.


**Fig. 7.8-3:** Receiver machine interface /A1, M12 5-pin device plug (view of the pins)

| Pin | Assignment |
|---|---|
| 1 | AS-i + |
| 2 | GND auxiliary supply |
| 3 | AS-i – |
| 4 | +24V DC auxiliary supply |
| 5 | FE, optional connection |

**Table 7.8-2:** Receiver Machine interface /A1, M12 5-pin cable socket connection assignment

The machine interface /A1 delivers the AS-i Safety at Work-specific code sequence, which the AS-i safety monitor saves and monitors permanently. Additionally, the bus master has the option via the parameter port of reading each 2-bit diagnostic data and of writing 2-bit control data. The control bits are assigned fix to the inputs M1 and M2; the diagnosis bits to the outputs M3 and M4. The meaning of the signals can be changed via the Diagnostics and Parameterization Software, SafetyLab. Set ex-factory is:

| Bit | Assignment | | Signal assignment<br>(FS), can be differently arranged via SafetyLab |
|---|---|---|---|
| 1 | ⇐ | M1 input | free |
| 2 | ⇐ | M2 input | free |
| 3 | ⇒ | M3 output | Active protective field free/ready for unlocking |
| 4 | ⇒ | M4 output | Collective malfunction/dirt signal |

**Table 7.8-3:** Receiver machine interface /A1, status signal assignment factory setting

The receiver machine interface /A1 AS-i has the following internal schematic structure. The data port and the parameter port of the AS-i chip are both shown.

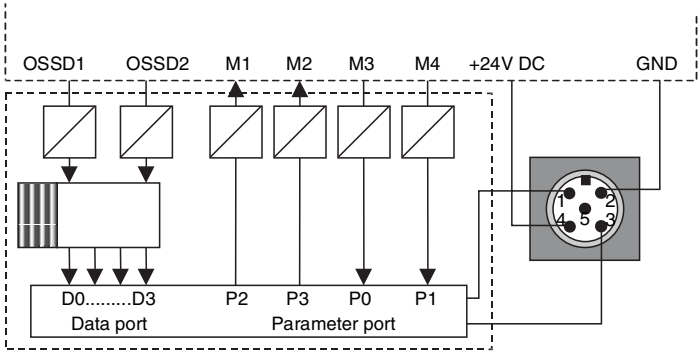



**Fig. 7.8-4:** Receiver machine interface /A1, schematic structure

The potential separated OSSD outputs control the generator for the code sequence, which supplies the cyclically changing 4 data bits as long as both OSSDs = 1. The data bits are evaluated by the safety monitor, generally, however, not by the bus master.

The parameter port, on the other hand, can only be operated by the bus master. In bits P2 and P3, it writes control information, which is transferred as M1 and M2 to the receiver. The diagnostic information supplied to M3 and M4 by the receiver is ready in P0 and P1. All parameter bits are inverted, which means, to generate a 24V DC signal at M1 and M2, P2 and P3 must = 0. In order to read M3 and M4, the master must first write 1 in P0 and P1. COMPACT*plus* overwrites this value where necessary. If 1 is still in these bits after the return reading, then a 0-signal is present at M3 and M4. If, on the other hand, a 0 is in P0 and P1, then a logical “1” (= 24 V DC) is present in M3 and M4.

### 7.8.3 Initial operation of COMPACT*plus*/AS-i, interface for the AS-i master

**Installation in AS interface/functions control:**

See also connecting and operating instructions of the AS-i safety monitor, Chapter 7 (function and initial operation).

Continue as follows:

| | |
|---|---|
| 1 | **Address the AS-i slave**<br>The addressing of the receiver is performed via the M12 device connection plug, with standard AS-i addressing devices. Each address may only be used once in an AS-i network (possible bus addresses: 1…31). |
| 2 | **Install the AS-i slave in the AS interface**<br>Connection of the COMPACT*plus*/AS-i transmitter is made via an M12 bus terminal; the COMPACT*plus*/AS-i receiver is connected via the AS-i adapter for bus connection and 24V voltage supply, AC-PDA1/A. |
| 3 | **Check the supply voltage of the sensor via the AS interface**<br>The 7-segment displays and the red LED1 light up on the COMPACT*plus*/AS-i receiver and transmitter. |
| 4 | **Check the communication between COMPACT*plus*/AS-i transmitter and COMPACT*plus*/AS-i receiver:**<br>The 7-segment displays light up on the receiver and transmitter, the green LED lights up on the receiver.<br>ⓘ COMPACT*plus*/AS-i safety light curtain may not be interrupted for the system integration, that is, with the teaching-in of the code table of the AS-i slave by the AS-i safety monitor. |
| 5 | **The initial operation and configuration of the safe AS-i slave is now carried out with the "asimon configuration and diagnosis software" of the AS-i safety monitor (see the user manual for "asimon configuration and diagnosis software").** |

**Notes for error and fault clearance:**

See Chapter 11, and connecting and operating instructions of the AS-i safety monitor, Chapter 9 (status report, error and fault clearance).

### 7.8.4 COMPACT*plus*/AS-i maintenance, interface for AS-i master

Swapping out a safety-set AS-i slave:

If a safety-set AS-i slave is defective, its replacement is also possible without PC and re-configuration of the AS-i safety monitor using the SERVICE button on the AS-i safety monitor. See also connecting and operating instructions of the AS-i safety monitor, Chapter 9.4 (replacing a defective safety-set AS-i slave).

Continue as follows:

| | |
|---|---|
| 1 | **Separate the defective AS-i slave from the AS-i line**<br>The AS-i safety monitor stops the system. |
| 2 | **Press the SERVICE button on the AS-i safety monitor** |

| | |
|---|---|
| 3 | **Install the new AS-i slave**<br>The AS-i slaves have the bus address “0” in the factory setting status. With the swop-out, the AS-i master automatically programs the replacement device with the previous bus address of the defective device. A readdressing of this replacement device to the bus address of the defective device is therefore not necessary. |
| 4 | **Check the supply voltage of the sensor via the AS interface**<br>The 7-segment displays and the red LED light up on the COMPACT*plus*/AS-i receiver and transmitter. |
| 5 | **Check the communication between COMPACT*plus*/AS-i transmitter and COMPACT*plus*/AS-i receiver/transceiver:**<br>The 7-segment displays light up on the receiver and transmitter, the green LED1 lights up on the receiver.<br>ⓘ COMPACT*plus*/AS-i safety light curtain may not be interrupted for the system integration, that is, with the teaching-in of the code table of the AS-i slave by the AS-i safety monitor. |
| 6 | **Press the SERVICE button on the AS-i safety monitor** |
| 7 | **Press the start signal to restart the AS-i system**<br>The system restart is made according to the AS-i-side configuration of a restart interlock or an automatic restart in the AS-i safety monitor (see the user manual for “asimon configuration and diagnosis software” for AS-i safetymonitor). |

It is determined with the first pressing of the SERVICE button if an AS-i slave is missing. This is noted in the error memory of the AS-i safety monitor. The AS-i safety monitor changes to configuration mode. With the second pressing of the SERVICE button, the code sequence of the new AS-i slave is saved and tested to assure correctness. If this is okay, the AS-i safety monitor changes back to the protective mode.

After the swoop-out of a defective safety-set AS-i slave, be sure to check the correct functioning of the new AS-i slave.

**Checking for safe switching-off:**

The fault-free functioning of the safe AS-i system, that is, the safe switching-off of the AS-i safety monitor with activation of an assigned safety-set sensor (e.g. COMPACT*plus*/AS-i) must be checked by a specialist and authorized person on a yearly basis.

To facilitate this, the COMPACT*plus*/AS-i Slave must be activated once a year and the switching behavior must be checked by observing the safety outputs of the AS-i safety monitor.

# 8 Parameterization

## 8.1 Factory settings

When delivered, the CPT transmitter is set and ready for operation on

- Transmission channel 1

with switch S2 in the connection cap in the L (left) position.

The CPR-s receiver is also ready for operation and its switches S1 to S6 are set on L (left) which means:

- No contactor monitoring (EDM)
- Transmission channel 1
- Without start/restart interlock
- AutoScan mode
- Direction for display, connection cap above
- No contact-based additional safety sensor connected

You have the option of setting parameters for individual functions with the internal switches as described below.

## 8.2 Transmitter parameterization

To switch the transmission channel to channel 2

➢ Turn the device power off.

➢ Loosen the 4 screws and remove the connection cap of the CPT transmitter.

➢ Turn the middle switch S2 to the right setting R.

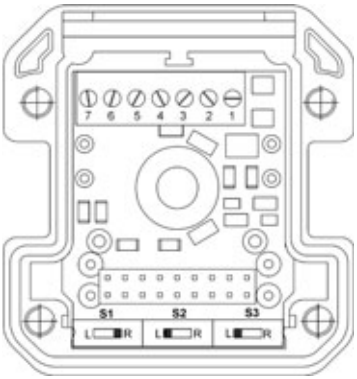



**Fig. 8.2-1:** Transmitter connection cap, switch positions

| Switch | Function | Pos. | CPT functions, can be set by switch | Factory setting |
|---|---|---|---|---|
| S1 | | L | Reserved | R |
| | | R | Switch must be in this position | |
| S2 | Transmissionch annel | L | Transmission channel 1 | L |
| | | R | Transmission channel 2 | |
| S3 | | L | Reserved | L |
| | | R | Reserved | |

**Table 8.2-1:** Transmitter functions depending on switch settings



➢ When replacing the connection cap, ensure that none of the plug pins extending out of the profile are bent.

➢ Check the transmitter display after the change has been made and it has been turned back on. After self-testing, it permanently displays the selected transmission channel.

ⓘ A change in the transmitter transmission channel also requires the transmission channel of the corresponding receiver to be changed.

## 8.3 Receiver parameterization

Five switches on the front and one switch on the back of the removable display and parameter module in the receiver are used for switching the receiver functions. To do this:

➢ Turn off the CPR receiver power,

➢ loosen the 4 screws on the connection cap and

➢ pull the connection cap straight off.

The operating elements are now exposed.

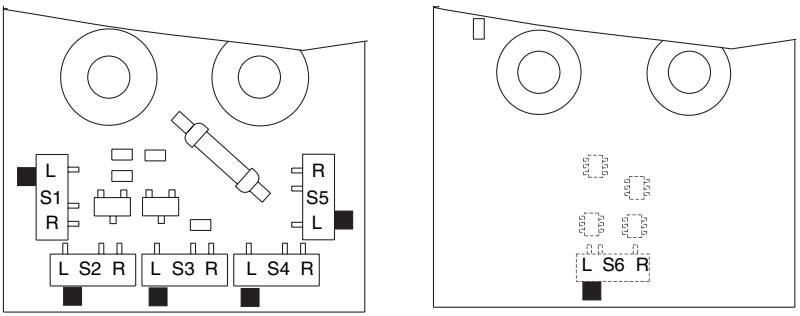



**Fig. 8.3-1:** Display and parameterization module, front and rear side (from the front)

The following table shows the functions that are possible with the CP-s receiver, which can be selected using switches S1 to S6. Plan the required settings carefully and always observe the **Notes on safety** for each of the individual functions.

The module that has already been parameterized with SafetyLab can no longer be changed with switches. If one or more switches are changed to the switch setting R, the error indication E 17 appears after turning on the receiver. If, on the other hand, the switch is set back to the factory setting L, the value of this display and paremeterization module set using SafetyLab is valid.

If the setting of a module with switches parameterized with SafetyLab is required, the module must first be reset with SafetyLab and password to the basic setting. Only then can the switches S1 to S6 become effective again with their functions shown below.



| Switch | Function | Pos. | "Standard" function package, functions can be set by switch | Factory setting |
|---|---|---|---|---|
| S1 | Contactor monitoring | L | SW: Default = No contactor monitoring EDM | L |
| | | R | With dynamic contactor monitoring, feedback signal to M2, response time max. 300 ms | |
| S2 | Transmissionc hannel | L | SW: Default = Transmission channel 1 | L |
| | | R | Transmission channel 2 | |
| S3 | S/RS interlock | L | SW: Default = No S/RS interlock, (delay TD= 100 ms) | L |
| | | R | With S/RS interlock, start button required on L5 or M1 | |
| S4 | MultiScan | L | SW: Default = AutoScan mode light curtains: H=1, multiple light beam safety devices: H=7 | L |
| | | R | DoubleScan, light curtains: H=2, multiple light beam safety devices: H=14 | |
| S5 | Display direction | L | SW: Default = Display down | L |
| | | R | Display down | |
| S6 | Optional safety circuit | L | SW: Default = No additional safety circuit activated | L |
| | | R | 2-Channel safety circuit L3/L4 expected, response time = 40 ms + allowance interface, simultaneity with closing: 0.5 s | |

**Table 8.3-1:** CPR-s receiver functions depending on switch settings

After every safety-relevant function change, check the optical safety device for proper effectiveness. Instructions can be found in Chapters 10 and 13.

The parameterization options of the receiver are described below, which are possible by changing switches S1 to S6 without the “SafetyLab” software.

The settings described in the following can, however, also be made via SafetyLab without changing the switches. For parameterization with PC, this is connected via the optical interface between connection cap and 7-segment display on the receiver. All switches S1 to S6 must be set in the factory setting to position L so that changes made with SafetyLab can be made effective. For other significant settings see the Diagnostics and Parameterization Software SafetyLab user manual.

### 8.3.1 S1 – contactor monitoring (EDM)

Place switch S1 in the R setting to activate the dynamic contactor monitoring function. As illustrated in the wiring examples in Chapter 7, the receiver expects the signal from the positive-guided normally closed contacts within 300 ms after the OSSDs on M2 are turned on or off.

If this signal is not received, the receiver will show an error message and go to the error locking state, from which it can only be returned to normal operation by switching the supply voltage off and back on again.

### 8.3.2 S2 – Transmission channel

In factory setting L, the receiver expects a transmitter set to transmission channel 1. After switch S2 has been changed to the R setting, the receiver expects signals from a transmitter that has also been changed to transmission channel 2.

### 8.3.3 S3 – Start/restart interlock

The COMPACT*plus* leaves the factory with the S3 switch in the L setting, therefore with automatic start/restart. You can select internal start/restart interlock by moving switch S3 to the R setting if no downstream machine interface takes over this function.

Internal start/restart interlock requires a start button to be connected against + 24 V either on the machine interface input M1 or optionally on pin L5 of the local interface.

Release can be achieved by pressing and releasing the start button for 100 ms <= t <= 4s. This requires the active protective field to be free and, if activated, the optional safety circuit at L3, L4 is closed.

If start buttons are connected to both M1 and L5, they both have the same effect. If both buttons are pressed simultaneously, the total time for which one or both buttons was pressed is counted.

### 8.3.4 S4 – MultiScan mode

In factory set position L, AutoScan mode is active (FS). If the switch is set to position R, the scan mode is switched to DoubleScan mode. The tables of Chapter 12 show the response times for both modes. Caution! The changeover extends the response time of your optical safety device. The safety distance must be corrected correspondingly. References can be found in Chapters 4.2.4 and 6.

### 8.3.5 S5 – Display turn-around

The 7-segment display of the receiver can be turned around, e.g. if the cable entry for sender and receiver is selected from below. With the changeover of S5 to position R, the display turns around.

### 8.3.6 S6 – Additional contact-based safety circuit

When switch S6 is moved to the right position, an additional safety switch with two contacts like a door switch, Section Emergency STOP button or another Active Opto-electronic Protective Device with two normally open contacts can be connected to this safety circuit. The “Notes on Safety for Section Emergency STOP” can be found in Chapter 4.2.6.

If switch S6 is changed to position R, COMPACT*plus* expects a connection on L3 and L4 of the local interface exclusive signal level, e.g. on L3 a connection to 0V, on L4 to +24 V. Otherwise the safety switching outputs will not release even with free protective field and, where applicable, after pressing and releasing the start button. The 7-segment display shows in this case “U1” alternating with “C1” “C2”. The tri-state inputs L3 and L4 are monitored at cross circuit; short circuit against 0 and +24 VDC and simultaneous closing of both contacts within 0.5 s. The response time for this additional safety circuit is 40 ms and an additional time, which depends on the type of safety output (Chapter 4.2.6).

# 9 Setting the device into service

Before the COMPACT*plus* is put into service for the first time on a power-driven production machine, an experienced technician must check the entire setup and the integration of the optical safety device into the controls. For more information, see Chapters 6, 7 and 10.

Before connecting the supply voltage for the first time and while the transmitters and receivers are being aligned, it must also be ensured that the outputs of the optical safety device do not have any effect on the machine. The switching elements that finally set the dangerous machine in motion must be safely switched off and secured against restarting.

The same precautionary measures apply after each change in parameter-based functions of the optical safety device, after repairs or during maintenance work.

Only after it has been determined that the optical safety device functions are correct it can be integrated into the machine's control circuit!



## 9.1 Switching on the device

Ensure that transmitter and receiver are protected against overcurrent (see Chapter 12.1.2). There are special requirements for the supply voltage: The power supply unit must have a load current reserve of at least 1A, the ability to bridge a power outage for at least 20ms and it must guarantee secure supply isolation with usage of receivers with transistor output.

### 9.1.1 Display sequence for CPT transmitter

After the device is turned on, “8.” appears for a few moments on the transmitter display followed by an “S” for about 1 second for the self test. The display then switches and permanently shows the selected transmission channel, “1” or “2”.

ⓘ A “.” next to the number indicates when the test input is open. As long as the test input is open, the transmitter diodes do not deliver any valid light pulses.

If the error display is shown on the transmitter (constant display of F or 8), then the 24 V DC connection voltage and wiring should be checked. If the display remains after it is turned on again, abort the setup process immediately and send in the malfunctioning transmitter to be checked.

### 9.1.2 Display sequence for the CPR-s receiver

After the receiver is turned on or restarted, the following will appear in the factory setting:

- 88: = Self test
- 1x xx 1 = “Standard” function package; x xx = Firmware version
- Hx: H = MultiScan factor; x = number of scans
- tx xx: t = Response time of the AOPD; x xx = Value in milliseconds
- Cx: C = Transmission channel; x = Number of the channel (FS = 1)

In case of a failure, the display will show “Ex xx” or “Fx xx”. Using the error number, Chapter 11 “Troubleshooting” will provide information on whether it is an error “E” in external wiring or an internal fault “F”. With internal faults “F”, immediately interrupt the initial operation and send the defective receiver in to be checked.

However, if errors are found and cleared in the external wiring, the receiver will be restored to normal mode and startup can be continued.

If the internal **start/restart interlock function is not activated** (FS)**,** because, for example this function is executed by a downstream safety interface, the receiver's LEDs display after startup:

The receiver switches to the ON state as soon as it receives all beams!

| **LED** | ***Without* S/RS interlock, transmitter/ receiver not aligned or protective field *not free*** | | ***No* S/RS interlock, transmitter/receiver aligned and protective field *free*** | |
|---|---|---|---|---|
| Red/ green | Red ON = | OFF state of the OSSDs | Green ON = | ON state of the OSSDs |
| Orange | OFF = | Protective field interrupted or transmitter/receiver alignment error | ON = | Weak beam indication with free active protective field |
| Yellow | OFF = | Restart interlock not locked | OFF = | Restart interlock not locked |
| Blue | OFF = | No special function active | OFF = | No special function active |

**Table 9.1-1:** Receiver display sequence without start/restart interlock

If the **internal start/restart interlock function** is activated (activation, see Chapters 4.2.2 and 8.3.3), after startup the LEDs of the receiver display:

| **LED** | ***With* S/RS interlock *before* the start button is pressed and released** | | ***With* S/RS interlock *after* the start button is pressed and released while the protective field is free** | |
|---|---|---|---|---|
| Red/ green | Red ON = | OFF state of the OSSDs | Green ON = | ON state of the OSSDs |
| Orange | OFF = | Protective field interrupted or transmitter/receiver alignment error | ON = | Weak beam indication with free active protective field |
| | ON = | Active protective field free | | |
| Yellow | ON = | S/RS interlock locked | OFF = | S/RS interlock unlocked |
| Blue | OFF = | No special function active | OFF = | No special function active |

**Table 9.1-2:** Receiver display sequence with internal start/restart interlock

## 9.2 Aligning transmitter and receiver

Transmitter and receiver must be at the same height or, if installed in a horizontal position, be at the same distance from the reference surface and slightly fastened at first. The small specified angle of beam spread of ± 2° requires increased precision in aligning the two components with each other before the devices are screwed firmly into place.

ⓘ If cascaded AOPDs are aligned with each other, it must always be in the order of host first, then guest.

### 9.2.1 Aligning with the 7-segment display of the receiver

If the MagnetKey is placed on the position in the receiver/host display field reserved for this purpose, briefly removed and then replaced, the 7-segment display switches from the permanent display to the setup mode.

| | |
|---|---|
| Individual device alignment | Switch the receiver display to setup mode with MagnetKey:<br>  <br>The first beam under the display (synchronization beam) meets the first receiver diode → the top horizontal beam in the left display lights up:<br>  <br>The last beam also hits the corresponding diode of the receiver → the lowest horizontal beam in the left display lights up:<br>  |
| Align host/guest combination | First align the host as an individual device (see above):<br>  <br>The top and bottom horizontal beams of the right 7-segment display light up if both transmitter and receiver of the guest(s) are aligned with one another. With two guests, the above right beam represents the first beam of the first guest and the bottom right beam represents the last beam of the second guest.<br>  |

**Table 9.2-1:** Aligning with the aid of the 7-segment displays

- With internal S/RS interlock: The orange LED2 of the receiver is lit constantly, → rotate transmitter and receiver to each other optimally and fix them in place.
- Without internal S/RS interlock: The LED1 of the receiver is constantly lit green, → rotate transmitter and receiver to each other optimally and fix them in place.

When the MagnetKey is removed, the 7-segment display of the receiver switches back into permanent display mode.

### 9.2.2 Optimizing the alignment by turning the transmitter and receiver

Using standard mounting brackets for fastening requires level, precisely aligned mounting surfaces so that, for example, if mounted vertically using adjustable sliding nuts, then only the precise heights of the transmitter and receiver have to be set.

If this requirement is not met, swiveling mounting brackets (accessories) can be used as described in Chapter 6.3.

**Alignment with internal start/restart interlock**

If the protective field is clear, the alignment can be optimized by observing the orange LED2 on the receiver (protective field free). Precondition here is that the pre-alignment work has been completed to such an extent that the orange LED2 is already constantly lit.

- ➢ Unscrew the locking screws on the transmitter's swivelling mounting brackets so that you can just move it. Move the transmitter until the orange LED2 switches off. Note this position. Move the transmitter back until the orange LED2 is constantly lit again and then continue until it goes off again. Now move the transmitter back to the center of the two positions found and fix the swiveling mounting brackets so that it cannot be moved.
- ➢ Now do exactly the same with the receiver and move it to the center between the two positions where LED2 goes off. Fix the receiver into place. The optimum setting is consequently achieved.
- ➢ For cascaded systems, the procedure can be performed for all transmitters and receivers one after the other, beginning with the host. A precise preliminary adjustment of all components is also required here.

**Alignment without internal start/restart interlock**

- ➢ The procedure is the same as described above. Instead of the orange LED2, observe LED1 of the receiver. The transition point is where LED1 switches from green to red. LED2 can be lit at the transition points during the setup procedure (weak beam indication).

# 10 Testing

## 10.1 Testing before setting the equipment in service the first time

Testing by an experienced technician before initial startup must ensure that the optical safety device and any other safety components that might be present have been selected in accordance with local specifications, especially the European Machine and Machine Utilization Directive, and that they provide the required protection when properly operated.

- ➢ Use the regulations listed above, where required, with the help of the checklists provided in the Appendix of these instructions, to check that the safety devices are properly installed, that they are properly wired into the controls and that they work in all machine modes. When selecting the checklist, note the type of protection (danger point, danger area or access/perimeter guarding).
- ➢ The same testing requirements apply if the machine in question has not been operated for a longer period of time and after major modifications or repairs if this could affect the safety of the machine.
- ➢ Observe the specifications regarding the instructing of operation personnel by experienced technicians before work is started. Instruction of personnel is the responsibility of the machine owner.

Leuze lumiflex provides a specialist service in Germany, which undertakes the required testing and monitoring tasks (**www.leuze.de**). The results of the test are documented for the machine owner in accordance with ISO 9000 ff.

## 10.2 Regular inspections

Regular inspections are also carried out in accordance with local regulations. They are designed to discover changes (e.g. in stopping times) or manipulations to the machine or safety device.

- ➢ You must have the effectiveness of the safety device checked by an experienced technician at the required intervals, but at least once per year.
- ➢ The applicable checklist in the Appendix may also be used during regular testing.

**Leuze lumiflex** also provides a specialist service for regular tests.

## 10.3 Daily testing with the test rod

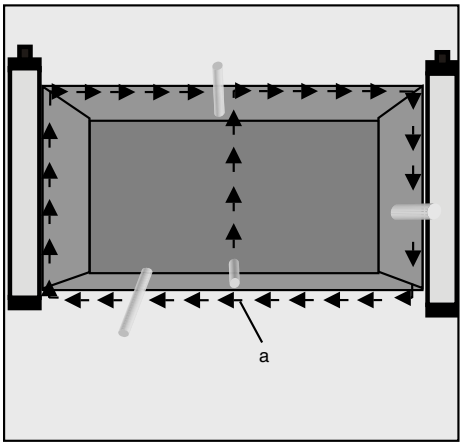
COMPACT*plus-s*are self-testing safety light curtains and multiple light beam safety devices. Nevertheless it is very important to check the protective field for its effectiveness daily to be sure that the protection also stays effective at every point after a parameter or tool change.

Work authorities in Germany require **daily testing** with the test rod in accordance with ZH1/281 for presses with hand feed in metal industries.

Never use your fingers, hand or arm for checking the system!

➢ When selecting the test rod, use the nameplate on the AOPD receiver indicating the resolution as a guideline.

➢ If internal start/restart interlock is selected and the AOPD is released, LED1 lights up green. When the test rod is inserted, LED1 switches to red and LED3 lights up yellow (restart interlock locked!). During the test procedure, the orange LED2 must not light up at any point.




a = Beginning of test

**Fig. 10.3-1:** Testing the protective field with the test rod

➢ If the AOPD is being operated without the internal start/restart interlock, it is sufficient to watch LED1 on the receiver during the testing procedure. When the test rod is inserted into the protective field, this LED1 must switch from “green” to “red” and must not switch back to “green” at any point during the test.

If the test does not yield the desired result, the cause could be a protective field height that is too low or reflections from reflective metals or tools brought into the area. In this case the installation of the safety light curtain must be checked by a specialist. If the cause cannot be clearly defined and remedied, the machine or system may not be used!

### 10.4 Cleaning the front screens

The front screens on the transmitters and receivers must be cleaned regularly depending on how dirty they are. If the orange LED2 on the receiver is on with free protective field (LED1 is green) a “weak signal reception” is indicated. The collective “malfunction/dirt” signal is provided on M4 in the factory setting. The dirt signal is generated with time filtering (10 min) from the internal weak beam signal. If this signal is activated (LOW signal on M4), then cleaning of the front screen may be required with free protective field and switched LED2. If cleaning the screens does not improve this, then the detection range and alignment must be checked. We recommend using a mild cleanser for cleaning the front screens.

The screens are resistant to thinned acids or alkalis and resistant to organic solvents within limits.



## 11 Troubleshooting

The following information is used for rapid troubleshooting in the event of a malfunction.

### 11.1 What should I do if an error occurs?

If the AOPD shows an error on the display, the machine must be stopped immediately and checked by an experienced technician. If it is found that the error cannot be clearly defined and remedied, your local Leuze office and or the Leuze lumiflex hotline can assist.

### 11.2 Quick diagnostic using the 7-segment displays

Operational malfunctions often have simple causes that you can remedy yourself. The following tables will help you do this.

### 11.2.1 Transmitter diagnostic

| Symptom | Measures to clear errors |
|---|---|
| 7-Segment display does not light up | Check +24 V supply voltage (also check for polarity)<br>Check the connection cable<br>Replace the transmitter if required |
| 8. is constantly lit | Hardware error, replace transmitter |
| F. is constantly lit and briefly interrupted by an error number | Internal error, replace transmitter |
| Decimal point in the 7-segment display is lit. | Jumper 3-4 is missing in the transmitter's connection cap or external circuit is not closed<br>Insert jumper |

**Table 11.2-1:** Transmitter diagnostic



### 11.2.2 Receiver diagnostic

The receiver distinguishes between error codes (Ex xx) and fault codes (Fx xx). Only error codes provide you with information about events or conditions that you can eliminate. If the receiver shows a fault code F, it must be replaced (see Chapter 11.4). For this reason, only error codes E are listed below.

| Code | Cause/Meaning | Measures to clear errors |
|---|---|---|
| | LEDS and 7-segment displays do not light up | Check +24 V supply voltage (also check for polarity), check connection cable and replace the receiver if necessary. |
| 8 : 8 | is constantly lit → Hardware fault | Replace receiver |
| F x(x) | Internal hardware fault | Replace receiver |
| E 1 | Cross connection between OSSD1 and OSSD 2 | Remove connection |
| E 2 | Overload on OSSD1 | Use correct load |
| E 3 | Overload on OSSD2 | Use correct load |
| E 4 | Overvoltage on OSSD1 | Use correct power supply |
| E 5 | Overvoltage on OSSD2 | Use correct power supply |
| E 6 | Circuit against GND on OSSD1 | Remove connection |
| E 7 | Circuit against 24V on OSSD1 | Remove connection |
| E 8 | Circuit against GND on OSSD2 | Remove connection |
| E 9 | Circuit against 24V on OSSD2 | Remove connection |
| E 10 | DIP switch not correctly positioned | Correct switch positions |
| E 11 | Current and configured beam count differ | Correct beam parameters with PC and SafetyLab |
| E 12 | Guest lit during operation, device too long | Connect correct guest(s) before power-on |
| E 13 | Guest removed during operation, device too short | Connect correct guest(s) before power-on |
| E 14 | Undervoltage on power supply line | Check/change power supply or load |
| E 15 | Reflection errors at PC interface | Protect interface optically |

**Table 11.2-2:** Receiver diagnostic

| Code | Cause/Meaning | Measures to clear errors |
|---|---|---|
| E 16 | Error at input/output | Switch signal line on correctly |
| E 17 | Fault in the parameterization or wrong switch setting S1 to S6 | Reset to basic setting with PC and SafetyLab or switch all switches S1 to S6 to position L |
| E 20 | Electromagnetic interference | Suppression of electromagnetic interference and/or signal lines |
| E 21 | Electromagnetic interference (DC) | Suppression of electromagnetic interference and/or signal lines |
| E 22 | Electromagnetic interference (DC) | Suppression of electromagnetic interference and/or signal lines |
| E 30 | Feedback contact of contactor monitoring not opening | Replace contactor, check wiring |
| E 31 | Feedback contact of contactor monitoring not closing | Replace contactor, check wiring |
| E 32 | Feedback contact of contactor monitoring is not closed | Replace contactor, check wiring |
| E 40 | Safety circuit on L3 / L4 has short cut to GND | Remove connection |
| E 41 | Safety circuit on L3 / L4 has short cut to 24V | Remove connection |
| E 42 | Safety circuit on L3 / L4: does not close simultaneously | Replace sensor |

**Table 11.2-2:** Receiver diagnostic

## 11.3 AutoReset

After an error or a fault has been detected and indicated, with the exception of the locking error/fault, a restart follows automatically in the

- transmitter after about 2 seconds and
- in the receiver after about 10 seconds

in the respective device. If an error is therefore no longer present, the machine/ application can be restarted, but the temporary error code is then lost.

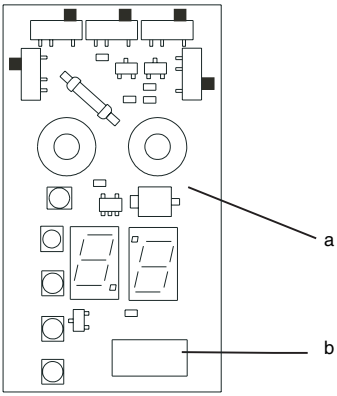
If such errors happen frequently and the cause must be found, the error code should be retained until the resetting is released by an operator. This is achieved on the receiver by setting the MagnetKey to the corresponding position on the receiver display.

The receiver will no longer reset automatically after approx. 10 seconds. It will now permanently display the last error code. Only after taking away the key and waiting another 10 seconds does the AutoReset procedure take place again.

The receiver is not automatically reset after 10 seconds with locking errors (e.g. E30, E31, E32). The receiver goes instead to the error locking status, from which it can only come out of by switching the supply voltage off and back on again.

## 11.4 Maintaining the parameterization when replacing the receiver

All setting values are stored on the display and parameterization module, where switches S1 to S6 are also located. When replacing a device, all parameter settings can be transferred to the new **same-model** receiver by exchanging this module.




a = Display and parameter module
b = Plug connection

**Fig. 11.4-1:** Display and parameter module

When replacing a receiver it must be ensured that an **identical exchange device** is used. This is the only way that the correct functionality is reached for the **same installation point** if the correctly parameterized display and parameterization module is transferred into the exchange device.

Even when exchanging the display and parameterization module, it is an unavoidable necessity to carefully recheck all safety-related functions of the COMPACT*plus-s* before placing it in service again. Non-observance can cause impairments of the protective function.

# 12 Technical data

## 12.1 General data

### 12.1.1 Beam/protective field data

| Safety Light Curtain | Detection range | | Physical resolution | Height of protective field | |
|---|---|---|---|---|---|
| | Min. | Max. | | Min. | Max. |
| CP14- | 0 m | 6 m | 14 mm | 150 mm | 1800 mm |
| CP30- | 0 m | 18 m | 30 mm | 150 mm | 1800 mm |
| CP50- | 0 m | 18 m | 50 mm | 450 mm | 3000 mm |
| CP90- | 0 m | 18 m | 90 mm | 750 mm | 3000 mm |

| Multiple light beam safety device | Detection range | | Beam distance in mm | Number of beams | Heights of beams above reference level in mm (EN 999) |
|---|---|---|---|---|---|
| | Min. | Max. | | | |
| CP500/2- | 0 m | 18 m | 500 mm | 2 | 400, 900 |
| CP501/2- | 6 m | 70 m | 500 mm | 2 | 400, 900 |
| CP400/3- | 0 m | 18 m | 400 mm | 3 | 300, 700, 1100 |
| CP401/3- | 6 m | 70 m | 400 mm | 3 | 300, 700, 1100 |
| CP300/4- | 0 m | 18 m | 300 mm | 4 | 300, 600, 900, 1200 |
| CP301/4- | 6 m | 70 m | 300 mm | 4 | 300, 600, 900, 1200 |

**Table 12.1-1:** Beam/protective field data

### 12.1.2 System data

| | |
|---|---|
| Safety category | Type 4 in accordance with EN IEC 61496 |
| Supply voltage Uv<br>Transmitter and receiver | +24V DC, ± 20 %, external power supply with secure supply line isolation and equalization with a 20 ms loss in voltage required, current reserve of at least 1 A |
| Residual ripple of supply voltage | ± 5 % within Uv limits |
| Transmitter power consumption | 75 mA |
| Receiver power consumption | 160 mA without external load and additional sensor equipment |
| Shared value for external fuse in the feed line for transmitter and receiver/transceiver | 4 A |
| Transmitter: Light-emitting diodes<br>in accordance with EN 60825-1:1994+ A1:2002+A2001:<br>Class:<br>Wavelengths:<br>Power: | <br><br>1<br>880 nm<br>< 50µW |
| Synchronization | Optical between transmitter and receiver |

**Table 12.1-2:** General system data

ENGLISH

| | |
|---|---|
| Safety class (VDE 106):<br>Exception:<br>Machine interface /R1 with separate cable for switching voltage > 42 V<br>Safety class: | III<br><br><br><br>I |
| Type of protection | IP65* |
| Ambient temperature, operation | 0 ... 50 °C |
| Ambient temperature, storage | -25 ... 70 °C |
| Relative humidity | 15 ... 95 % |
| Vibration fatigue limit | 5 g, 10 - 55 Hz according to IEC/EN 60068-2-6 |
| Resistance to shocks | 10 g, 16 ms according to IEC/EN 60068-2-29 |
| Dimensions | See dimensional drawings and tables |
| Weight | See table |

*) Without additional measures the devices are not suited for outdoor use.

**Table 12.1-2:** General system data

### 12.1.3 Receiver, local interface, status and control signals

| | | |
|---|---|---|
| Voltage output, only for command devices or safety sensor equipment | 24V DC ± 20%<br>max. 0.5 A | |
| L1: Signal input | Input: | Contact or transistor against +24V DC<br>current load: 20 mA max. |
| L2: Signal input/output | Input:<br><br>Output: | Contact or transistor against +24V DC<br>current load: 20 mA max.<br>pnp, +24VDC-switching, 60mA max. |
| L3, L4: TriState signal input for potential-free safety circuit | Input: | Contact or transistor against +24VDC or against GND<br>current load: 20 mA max. |
| L5: Signal input/output | Input:<br><br>Output: | Contact or transistor against +24V DC<br>current load: 20 mA max.<br>pnp, +24VDC-switching, 500mA max. |

**Table 12.1-3:** Receiver, local interface, status and control signals

### 12.1.4 Receiver, machine interface, status and control signals

| | | |
|---|---|---|
| M1, M2: Signal input | Input: | Contact or transistor against +24V DC<br>current load: 20 mA max. |
| M3, M4: Signal input/output | Input:<br><br>Output: | Contact or transistor against +24V DC<br>current load: 20 mA max.<br>pnp: +24VDC-switching, 60mA max. |
| M5: Signal input/output | Input:<br><br>Output: | Contact or transistor against +24V DC<br>current load: 20 mA max.<br>npn: GND switching, 1A max. |

**Table 12.1-4:** Receiver, machine interface, status and control signals

### 12.1.5 Receiver, machine interface, safety-related transistor outputs

| **OSSDs safety switchoutputs** | **2 Safety-related pnp semiconductor outputs, cross circuit monitored, resistant to short circuits** | | |
|---|---|---|---|
| | **Min.** | **typical** | **Max.** |
| Switching voltage high active (Uv – 1V)<br>Switching voltage, low<br>Switched current<br>Leakage current<br>Load capacity<br>Load inductivity | +18.2V<br>0V<br>2 mA | +23V<br>0V<br>500 mA<br>< 2 µA | +27.8V<br>+2.5V<br>650 mA<br>< 200 µA *)<br>< 3.3 µF<br>2.2 H |
| Permissible wire resistance for load | - | - | < 1 kΩ **) |
| Permissible wire gauge | 1 mm² with conductor sleeve | | 1.5 mm² |
| Permissible wire length between receiver and load (at 1 mm²) | - | - | 100 m |
| Test pulse width | 20 µs | - | 214 µs |
| Test pulse distance | 8 ms | - | 22 ms |
| OSSD restart time after beam interruption | - | 100 ms | - |
| OSSD response time | See tables in Chapter 12.2 | | |

*) In case of a failure (disconnection of GND wire) the outputs emulate a 120 kΩ resistor in line with Uv. A subsequent Safety PLC, must not recognize this as a logical “1”.
**) Be aware of other restrictions due to cable length and load current

**Table 12.1-5:** Receiver, machine interface, safety-related transistor outputs

ⓘ The output transistors carry out the spark extinction. With transistor outputs, it is therefore not necessary to use the spark extinction elements recommended by contactor/valve manufacturers etc. (RC modules, varistors or recovery diodes). These extend the delay times of inductive switching elements.

### 12.1.6 Receiver, machine interface, safety-related relay outputs

| OSSD Relay outputs | | 2 Potential-free relay outputs | | |
|---|---|---|---|---|
| | | Min. | typical | Max. |
| /R1<br>/R2<br>/R3 | MG 25 cable screw<br>when using only **one** connection cable:<br>Hirschmann plug (typical 0.5 mm²)<br>MIN-series plug (AWG 16 = 0.75 mm²)<br>⚠ The protective extra low voltage, 42V AC/DC may under no circumstances be exceeded. | | | |
| | **With switching voltage 24V DC** | **15V DC** | **24V DC** | **30V DC** |
| | Switching current inductive load* [τ=L/R=40 ms] | | | 1.5 A |
| | Assigned cable length, A = 0.75 mm²<br>Fuse: max. 2 A slow | | | 26 m |
| | Switching current inductive load* [τ=L/R=40 ms] | | | 1.5 A |
| | Assigned cable length, A = 0.5 mm²<br>Fuse: max. 2 A slow | | | 9 m |
| | Switching current ohmic load | | up to 0.4 A | 3.0 A |
| | Assigned cable length, A = 0.75 mm²<br>Fuse: max. 3.15 A slow | | 100 m | 13 m |
| | Switching current ohmic load | | up to 0.4 A | 2.0 A |
| | Assigned cable length, A = 0.5 mm²<br>Fuse: max. 2.5 A slow | | 60 m | 13 m |
| /R1 | MG 25 cable screw, 2 cables<br>When using an **additional** cable for the OSSD switching contacts:<br>4 x 0.75 mm² + PE safety class I<br>⚠ Insulating plate is compulsory in the connection cap (see Fig. 7.5-3) | | | |
| | **With switching voltage 115V AC** | | **115V AC** | **127V AC** |
| | Switching current, inductive load*<br>(cosφ = 0.8) e.g. contactors, valves, etc. | | 0.6 A | 2.0 A |
| | Assigned cable length, A = 0.75 mm² (AWG 16); fuse: max. 2.5 A slow | | 100 m | 30 m |
| | Switching current, ohmic load | | 0.5 A | 3.0 A |
| | Assigned cable length, A = 0.75 mm² (AWG 16); fuse: max. 3.15 A slow | | 100 m | 16 m |

**Table 12.1-6:** Receiver, machine interface, safety-related relay outputs

| OSSD Relay outputs | | 2 Potential-free relay outputs | | |
|---|---|---|---|---|
| | | Min. | typical | Max. |
| /R1 | MG 25 cable screw, 2 cables<br>When using an **additional** cable for the OSSD switching contacts:<br>4 x 0.75 mm² + PE safety class I<br>⚠ Insulating plate is compulsory in the connection cap (see Fig. 7.5-3) | | | |
| | **With switching voltage 230V AC** | | **230V AC** | **250V AC** |
| | Switching current, inductive load* (cosφ = 0.8)<br>e.g. contactors, valves, etc. | | 1.2 A | 2.0 A |
| | Assigned cable length, A = 0.75mm²<br>Fuse: max. 2.5 A slow | | 100 m | 60 m |
| | Switching current, ohmic load | | 1 A | 3.0 A |
| | Assigned cable length, A = 0.75mm²<br>Fuse: max. 3.15 A slow | | 100 m | 32 m |
| Transmitter test input response time | | 18 ms | - | 66 ms |
| Restart time after beam interruption | | - | 115 ms | - |
| OSSD response time | | Depends on number of beams, MultiScan factor H and type of machine interface, see tables in Chapter 12.2 | | |

⚠ It applies with safety-related relay outputs that: The cable or cables for machine control must generally be laid with protected installation in a cable duct or with armor in such a way that cross-connections of the cable wires can be safely ruled out.

*) With relay outputs, the spark extinction elements recommended by the manufacturers of contactors/valves etc. must be used (RC modules, varistors, etc.). With DC voltages, no recovery diodes should be used. These extend the delay times of inductive switching elements.

**Table 12.1-6:** Receiver, machine interface, safety-related relay outputs

### 12.1.7 Receiver machine interface, AS-i Safety at Work

| OSSDs safety related switching outputs | 4-Bit AS-i data | | |
|---|---|---|---|
| | Min. | typical | Max. |
| Permissible wire length | - | - | 100 m |
| Restart time after beam interruption | | 140 ms | |
| Slave address range | 1 | - | 31 |
| Slave address range (FS) | 0 (ex-factory) | | |
| Transmitter ID-code/IO-code | - | | |
| ID-code receiver | B | | |
| IO-code receiver | 0 | | |
| AS-i profile | Safe slave | | |
| Cycle time in accordance with AS-i specifications | 5 ms | | |
| OSSD response time | See tables in Chapter 12.2 | | |
| Additional response time of the AS-i system | 40 ms | | |

**Table 12.1-7:** Receiver machine interface, AS-i Safety at Work

## 12.2 Dimensions, weights, response times

### 12.2.1 Safety light curtains with transistor outputs, relay outputs or AS-i connection

| Dim. A [mm] | Dim. B [mm] | CPT CPR [kg] | tH1 = Response time of the AOPD in ms with MultiScan factor H=1 (FS) /T = Transistor outputs; /R = Relay outputs; /A = AS-i bus connection n = Number of beams | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CP14-xxxx | | | | CP30-xxxx | | | | CP50-xxxx | | | | CP90-xxxx | | | |
| | | | n | /T | /R | /A | n | /T | /R | /A | n | /T | /R | /A | n | /T | /R | /A |
| | | | | tH1 [ms] | tH1 [ms] | tH1 [ms] | | tH1 [ms] | tH1 [ms] | tH1 [ms] | | tH1 [ms] | tH1 [ms] | tH1 [ms] | | tH1 [ms] | tH1 [ms] | tH1 [ms] |
| 150 | 284 | 0.7 | 16 | **5** | **20** | **10** | 8 | **5** | **20** | **10** | | | | | | | | |
| 225 | 359 | 0.9 | 24 | **7** | **22** | **12** | 12 | **7** | **22** | **12** | | | | | | | | |
| 300 | 434 | 1.1 | 32 | **9** | **24** | **14** | 16 | **5** | **20** | **10** | | | | | | | | |
| 450 | 584 | 1.5 | 48 | **12** | **27** | **17** | 24 | **7** | **22** | **12** | 12 | **7** | **21** | **12** | | | | |
| 600 | 734 | 1.9 | 64 | **15** | **30** | **20** | 32 | **9** | **24** | **14** | 16 | **5** | **20** | **10** | | | | |
| 750 | 884 | 2.3 | 80 | **18** | **33** | **23** | 40 | **10** | **25** | **15** | 20 | **6** | **21** | **11** | 10 | **6** | **21** | **11** |
| 900 | 1034 | 2.7 | 96 | **22** | **37** | **27** | 48 | **12** | **27** | **17** | 24 | **7** | **22** | **12** | 12 | **7** | **21** | **12** |
| 1050 | 1184 | 3.1 | 112 | **25** | **40** | **30** | 56 | **13** | **28** | **18** | 28 | **8** | **23** | **13** | 14 | **5** | **20** | **10** |
| 1200 | 1334 | 3.5 | 128 | **28** | **43** | **33** | 64 | **15** | **30** | **20** | 32 | **9** | **24** | **14** | 16 | **5** | **20** | **10** |
| 1350 | 1484 | 3.9 | 144 | **31** | **46** | **36** | 72 | **17** | **32** | **22** | 36 | **9** | **24** | **14** | 18 | **6** | **21** | **11** |
| 1500 | 1634 | 4.3 | 160 | **35** | **50** | **40** | 80 | **18** | **33** | **23** | 40 | **10** | **25** | **15** | 20 | **6** | **21** | **11** |
| 1650 | 1784 | 4.7 | 176 | **38** | **53** | **43** | 88 | **20** | **35** | **25** | 44 | **11** | **26** | **16** | 22 | **7** | **22** | **12** |
| 1800 | 1934 | 5.1 | 192 | **41** | **56** | **46** | 96 | **22** | **37** | **27** | 48 | **12** | **27** | **17** | 24 | **7** | **22** | **12** |
| 2100 | 2234 | 5.9 | | | | | | | | | 56 | **13** | **28** | **18** | 28 | **8** | **23** | **13** |
| 2400 | 2534 | 6.7 | | | | | | | | | 64 | **15** | **30** | **20** | 32 | **9** | **24** | **14** |
| 2700 | 2834 | 7.5 | | | | | | | | | 72 | **17** | **32** | **22** | 36 | **9** | **24** | **14** |
| 3000 | 3134 | 8.3 | | | | | | | | | 80 | **18** | **33** | **23** | 40 | **10** | **25** | **15** |

**Table 12.2-1:** Safety light curtains, dimensions and response times with AutoScan (FS: H=1)

| Dim. A [mm] | Dim. B [mm] | CPT CPR [kg] | tH2 = Response time of the AOPD in ms with MultiScan factor H=2 (DoubleScan) /T = Transistor outputs; /R = Relay outputs; /A = AS-i bus connection n = Number of beams | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CP14-xxxx | | | | CP30-xxxx | | | | CP50-xxxx | | | | CP90-xxxx | | | |
| | | | n | /T | /R | /A | n | /T | /R | /A | n | /T | /R | /A | n | /T | /R | /A |
| | | | | tH2 [ms] | tH2 [ms] | tH2 [ms] | | tH2 [ms] | tH2 [ms] | tH2 [ms] | | tH2 [ms] | tH2 [ms] | tH2 [ms] | | tH2 [ms] | tH2 [ms] | tH2 [ms] |
| 150 | 284 | 0.7 | 16 | **9** | **24** | **14** | 8 | **9** | **24** | **14** | | | | | | | | |
| 225 | 359 | 0.9 | 24 | **12** | **27** | **17** | 12 | **12** | **27** | **17** | | | | | | | | |
| 300 | 434 | 1.1 | 32 | **15** | **30** | **20** | 16 | **9** | **24** | **14** | | | | | | | | |
| 450 | 584 | 1.5 | 48 | **22** | **37** | **27** | 24 | **12** | **27** | **17** | 12 | **12** | **27** | **17** | | | | |
| 600 | 734 | 1.9 | 64 | **28** | **43** | **33** | 32 | **15** | **30** | **20** | 16 | **9** | **24** | **14** | | | | |
| 750 | 884 | 2.3 | 80 | **35** | **50** | **40** | 40 | **18** | **33** | **23** | 20 | **10** | **25** | **15** | 10 | **10** | **25** | **15** |
| 900 | 1034 | 2.7 | 96 | **41** | **56** | **46** | 48 | **22** | **37** | **27** | 24 | **12** | **27** | **17** | 12 | **12** | **27** | **17** |
| 1050 | 1184 | 3.1 | 112 | **48** | **63** | **53** | 56 | **25** | **40** | **30** | 28 | **13** | **28** | **18** | 14 | **8** | **23** | **13** |
| 1200 | 1334 | 3.5 | 128 | **54** | **69** | **59** | 64 | **28** | **43** | **33** | 32 | **15** | **30** | **20** | 16 | **9** | **24** | **14** |
| 1350 | 1484 | 3.9 | 144 | **61** | **76** | **66** | 72 | **31** | **46** | **36** | 36 | **17** | **32** | **22** | 18 | **9** | **24** | **14** |
| 1500 | 1634 | 4.3 | 160 | **67** | **82** | **72** | 80 | **35** | **50** | **40** | 40 | **18** | **33** | **23** | 20 | **10** | **25** | **15** |
| 1650 | 1784 | 4.7 | 176 | **74** | **89** | **79** | 88 | **38** | **53** | **43** | 44 | **20** | **35** | **25** | 22 | **11** | **26** | **16** |
| 1800 | 1934 | 5.1 | 192 | **80** | **95** | **85** | 96 | **41** | **56** | **46** | 48 | **22** | **37** | **27** | 24 | **12** | **27** | **17** |
| 2100 | 2234 | 5.9 | | | | | | | | | 56 | **25** | **40** | **30** | 28 | **13** | **28** | **18** |
| 2400 | 2534 | 6.7 | | | | | | | | | 64 | **28** | **43** | **33** | 32 | **15** | **30** | **20** |
| 2700 | 2834 | 7.5 | | | | | | | | | 72 | **31** | **46** | **36** | 36 | **17** | **32** | **22** |
| 3000 | 3134 | 8.3 | | | | | | | | | 80 | **35** | **50** | **40** | 40 | **18** | **33** | **23** |

**Table 12.2-2:** Safety light curtains, dimensions and response times with DoubleScan (H=2)

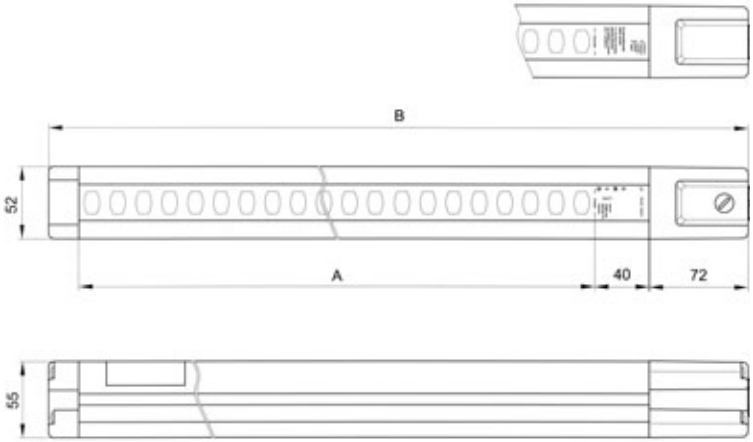



**Fig. 12.2-1:** Dimensions for series with 14 mm, 30 mm, 50 mm and 90 mm resolution

### 12.2.2 Guest series

| Dim. A [mm] | Dim. B [mm] | Mass CT-..S CR-..S [kg] | $t_S$ = Response time Guest; n = Number of beams; $t_S$ has to be multiplied with the value of the chosen MultiScan Factor H<br>Example: C14-300S with H = 1: $t_S$ = 6.4 ms<br>C14-300S with H = 4: $t_S$ = 25.6 ms | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | C14-xxxxS | | | C30-xxxxS | | | C50-xxxxS | | |
| | | | n | $t_S$ [ms] H = 1 | $t_S$ [ms] H = 2* | n | $t_S$ [ms] H = 1 | $t_S$ [ms] H = 2* | n | $t_S$ [ms] H = 1 | $t_S$ [ms] H = 2* |
| 150 | 284 | 0.7 | 16 | **3.2** | **6.4** | 8 | **1.6** | **3.2** | | | |
| 225 | 359 | 0.9 | 24 | **4.8** | **9.6** | 12 | **2.4** | **4.8** | | | |
| 300 | 434 | 1.1 | 32 | **6.4** | **12.8** | 16 | **3.2** | **6.4** | | | |
| 450 | 584 | 1.5 | 48 | **9.6** | **19.2** | 24 | **4.8** | **9.6** | 12 | **2.4** | **4.8** |
| 600 | 734 | 1.9 | 64 | **12.8** | **25.6** | 32 | **6.4** | **12.8** | 16 | **3.2** | **6.4** |
| 750 | 884 | 2.3 | 80 | **16.0** | **32.0** | 40 | **8.0** | **16.0** | 20 | **4.0** | **8.0** |
| 900 | 1034 | 2.7 | 96 | **19.2** | **38.4** | 48 | **9.6** | **19.2** | 24 | **4.8** | **9.6** |
| 1050 | 1184 | 3.1 | 112 | **22.4** | **44.8** | 56 | **11.2** | **22.4** | 28 | **5.6** | **11.2** |
| 1200 | 1334 | 3.5 | 128 | **25.6** | **51.2** | 64 | **12.8** | **25.6** | 32 | **6.4** | **12.8** |
| 1350 | 1484 | 3.9 | 144 | **28.8** | **57.6** | 72 | **14.4** | **28.4** | 36 | **7.2** | **14.4** |
| 1500 | 1634 | 4.3 | 160 | **32.0** | **64.0** | 80 | **16.0** | **32.0** | 40 | **8.0** | **16.0** |
| 1650 | 1784 | 4.7 | 176 | **35.2** | **70.4** | 88 | **17.6** | **35.2** | 44 | **8.8** | **17.2** |
| 1800 | 1934 | 5.1 | 192 | **38.4** | **76.8** | 96 | **19.2** | **38.4** | 48 | **9.8** | **19.6** |
| 2100 | 2184 | 5.9 | | | | | | | 56 | **11.2** | **22.4** |
| 2400 | 2484 | 6.7 | | | | | | | 64 | **12.8** | **25.6** |
| 2700 | 2784 | 7.5 | | | | | | | 72 | **14.4** | **28.8** |
| 3000 | 3084 | 8.3 | | | | | | | 80 | **16.0** | **32.0** |

H = 2 corresponds to d-scan (double scan)

**Tabelle 12.2-3:** Guest series, dimensions and reponse time

An increase of the MultiScan Factor H increases the response time! A renewed calculation and adaptation of the safety distance according to Chapter 6.1.1 is urgently required.

### 12.2.3

| Dim. A [mm] | Dim. B [mm] | Mass [kg] | Response time $t_S$; number of beams n; Total response time with Host: See calculation example | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | C14..S | | C30..S | | C50..S | |
| | | | n | $t_S$ [ms] | n | $t_S$ [ms] | n | $t_S$ [ms] |
| 150 | 234 | 0.7 | 16 | 3.2 | 8 | 1.6 | | |
| 225 | 309 | 0.9 | 24 | 4.8 | 12 | 2.4 | | |
| 300 | 384 | 1.1 | 32 | 6.4 | 16 | 3.2 | | |
| 450 | 534 | 1.5 | 48 | 9.6 | 24 | 4.8 | 12 | 2.4 |
| 600 | 684 | 1.9 | 64 | 12.8 | 32 | 6.4 | 16 | 3.2 |
| 750 | 834 | 2.3 | 80 | 16.0 | 40 | 8.0 | 20 | 4.0 |
| 900 | 984 | 2.7 | 96 | 19.2 | 48 | 9.6 | 24 | 4.8 |
| 1050 | 1134 | 3.1 | 112 | 22.4 | 56 | 11.2 | 28 | 5.6 |
| 1200 | 1284 | 3.5 | 128 | 25.6 | 64 | 12.8 | 32 | 6.4 |
| 1350 | 1454 | 3.9 | 144 | 28.8 | 72 | 14.4 | 36 | 7.2 |
| 1500 | 1584 | 4.3 | 160 | 32.0 | 80 | 16.0 | 40 | 8.0 |
| 1650 | 1734 | 4.7 | 176 | 35.2 | 88 | 17.6 | 44 | 8.8 |
| 1800 | 1884 | 5.1 | 192 | 38.4 | 96 | 19.2 | 48 | 9.8 |
| 2100 | 2184 | 5.9 | | | | | 56 | 11.2 |
| 2400 | 2484 | 6.7 | | | | | 64 | 12.8 |
| 2700 | 2784 | 7.5 | | | | | 72 | 14.4 |
| 3000 | 3084 | 8.3 | | | | | 80 | 16.0 |

**Table 12.2-4:** Guests series dimensions and response times

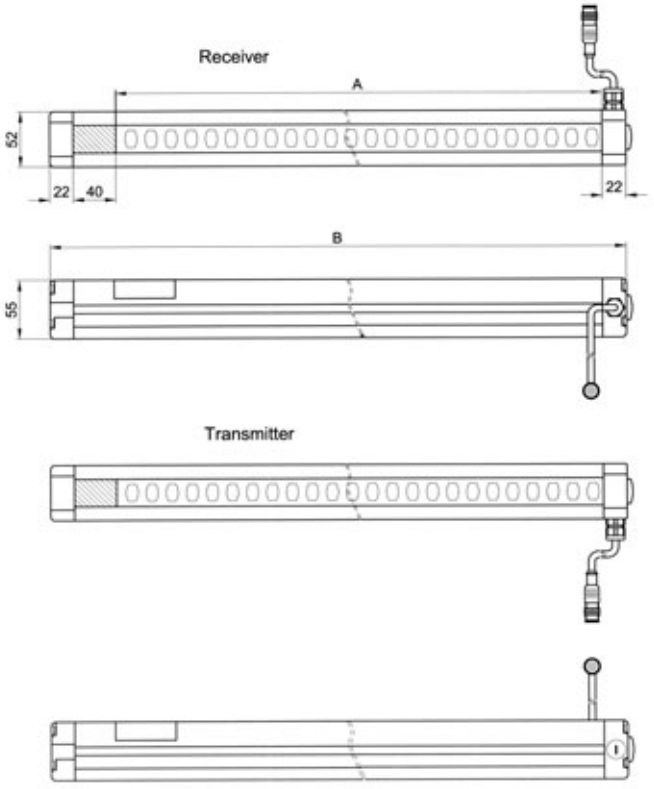



**Fig. 12.2-2:** Guest series dimensions

### 12.2.4 COMPACTplus-s Multiple Light Beam Safety Devices

| Dim. A [mm] | Dim. B [mm] | CPT/ CPR-m [kg] | tH7 = Response time of the AOPD with MultiScan factor H=7 (FS) //T = Transistor output; /R = Relay output; /A = AS-i bus connection; n = Number of beams | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CP500/2-... / CP501/2-... | | | | CP400/3-... / CP401/3-... | | | | CP300/4-... / CP301/4-... | | | |
| | | | n | /T | /R | /A | n | /T | /R | /A | n | /T | /R | /A |
| | | | | tH7 [ms] | tH7 [ms] | tH7 [ms] | | tH7 [ms] | tH7 [ms] | tH7 [ms] | | tH7 [ms] | tH7 [ms] | tH7 [ms] |
| 500 | 734 | 1.9 | 2 | **19** | **34** | **24** | | | | | | | | |
| 400 | 1034 | 2.7 | | | | | 3 | **19** | **34** | **24** | | | | |
| 300 | 1184 | 3.1 | | | | | | | | | 4 | **19** | **34** | **24** |

**Table 12.2-5:** Multiple light beam safety devices, dimensions and response times with AutoScan (FS: H=7)

| Dim. A [mm] | Dim. B [mm] | CPT/ CPR-m [kg] | tH14 = Response time of the AOPD with MultiScan factor H=14 /T = Transistor output; /R = Relay output; /A = AS-i bus connection; n = Number of beams | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CP500/2-... / CP501/2-... | | | | CP400/3-... / CP401/3-... | | | | CP300/4-... / CP301/4-... | | | |
| | | | n | /T | /R | /A | n | /T | /R | /A | n | /T | /R | /A |
| | | | | tH14 [ms] | tH14 [ms] | tH14 [ms] | | tH14 [ms] | tH14 [ms] | tH14 [ms] | | tH14 [ms] | tH14 [ms] | tH14 [ms] |
| 500 | 734 | 1.9 | 2 | **36** | **51** | **41** | | | | | | | | |
| 400 | 1034 | 2.7 | | | | | 3 | **36** | **51** | **41** | | | | |
| 300 | 1184 | 3.1 | | | | | | | | | 4 | **36** | **51** | **41** |

**Table 12.2-6:** Multiple light beam safety devices, dimensions and response times with DoubleScan (H=14)

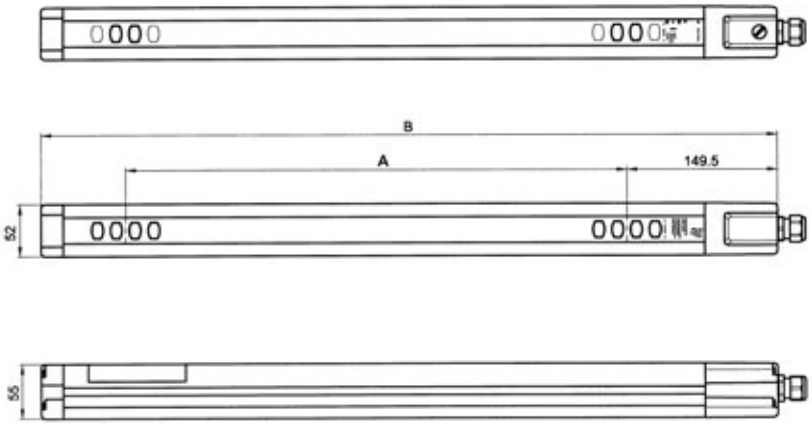



**Fig. 12.2-3:** Dimensions, COMPACT*plus-s* Multiple Light Beam Safety Devices

### 12.2.5 Dimensions of the mounting brackets

Dimensions in mm

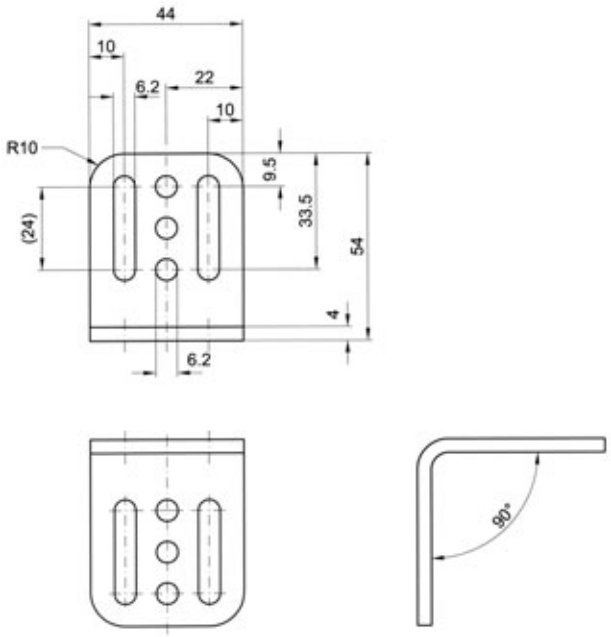
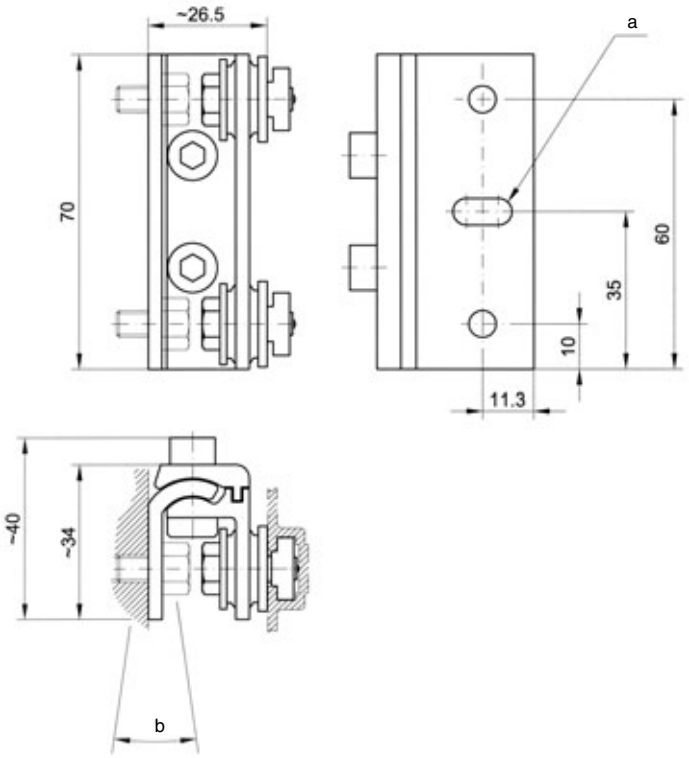



**Fig. 12.2-4:** Standard mounting bracket

### 12.2.6 Swiveling mounting bracket dimensions

Dimensions in mm




a = Slot 13 x 6
b = Swiveling angle ± 4°

**Fig. 12.2-5:** Option: Swiveling mounting bracket with shock absorber

# 13 Appendix

## 13.1 Delivery

All COMPACT*plus-s* are delivered with:

- 1 CPT Transmitter
- 1 CPR-s Receiver
- 4 Sliding nuts
- 4 Standard mounting brackets
- 1 MagnetKey
- 1 Operating instructions
- 1 Self-adhesive information plate

Additionally included in delivery for the

**CP14-s and CP30-s series are:**

- 1 Test rod 14/30 mm

## 13.2 Accessories

| Item | Description | Order number |
|---|---|---|
| BT-SSD | Swiveling mounting bracket with shock absorber | 560300 |
| SITOP power | Power supply 115 – 230V 50/60 Hz = → 24 V/5 A | 549940 |
| LOGO! power | Power supply 115 – 230V 50/60 Hz = → 24 V/1.3 A | 549908 |
| UDC-1000 | Universal device mounting column, height 1000 mm | 549810 |
| UDC-1300 | Universal device mounting column, height 1300 mm | 549813 |
| UDC-1600 | Universal device mounting column, height 1600 mm | 549816 |
| UDC-1900 | Universal device mounting column, height 1900 mm | 549819 |
| UMC-1000 | Universal mirror column, continuous mirror 1000 mm | 549710 |
| UMC-1300 | Universal mirror column, continuous mirror 1300 mm | 549713 |
| UMC-1600 | Universal mirror column, continuous mirror 1600 mm | 549716 |
| UMC-1900 | Universal mirror column, continuous mirror 1900 mm | 549719 |
| UMC-1002 | Universal mirror column, 2 individual adjustable mirrors, 1000 mm | 549702 |
| UMC-1303 | Universal mirror column, 3 individual adjustable mirrors, 1300 mm | 549703 |
| UMC-1304 | Universal mirror column, 4 individual adjustable mirrors, 1300 mm | 549704 |
| UM60-300 | Swiveling corner mirror, length 300 mm | 529603 |
| UM60-450 | Swiveling corner mirror, length 450 mm | 529604 |
| UM60-600 | Swiveling corner mirror, length 600 mm | 529606 |
| UM60-750 | Swiveling corner mirror, length 750 mm | 529607 |
| UM60-900 | Swiveling corner mirror, length 900 mm | 529609 |
| UM60-1050 | Swiveling corner mirror, length 1050 mm | 529610 |
| BT-UM60 | Installation set of 2 UM60 mounting swivel brackets incl. screws | 430105 |
| LA78 C/R-UDC | External laser alignment aid for column mounting | 560030 |
| CB-M12-3000-8W/M | Cable for local connection with angled M12x8 plug, 3 m | 150704 |
| CB-M12-10000-8W/M | Cable for local connection with angled M12x8 plug, 10 m | 150699 |
| AC-LDH-11W/F | Hirschmann cable socket, angled, incl. crimp contacts | 426045 |
| AC-LDH-11G/F | Hirschmann cable socket, straight, incl. crimp contacts | 426046 |
| CB-8N-10000-11G/W | Cable for /T2 – machine interface 10 m, straight socket | 426042 |
| CB-8N-25000-11G/W | Cable for /T2 – machine interface 25 m, straight socket | 426044 |
| CB-8N-50000-11G/W | Cable for /T2 – machine interface 50 m, straight socket | 426043 |
| AC-PDA1/A | AS-i adapter for bus connection and 24V supply voltage | 580004 |
| AM 06 | AS-i adapter, M12 bus terminal for AS-i flat cable | 50024346 |
| AKB 01 | AS-i flat cable, yellow | 50024750 |
| CB-M12-1000-G/MF | AS-i cable adapter, 5-wire, 1 m | 548361 |
| CB-M12-2000-G/MF | AS-i cable adapter, 5-wire, 2 m | 548362 |

**Table 13.2-1:** Accessories for COMPACT*plus-s*

## 13.3 Checklists

The inspection before the initial operation determines the safety related integration of the active opto-electronic protective device (AOPD) into the machine and its control. The results of the inspection must be written down and kept with the machine documents. They can then be used as a reference during the subsequent regular inspections.

### 13.3.1 Checklist for safeguarding danger points

COMPACT*plus-s* Safety Light Curtains (resolution 14 to 40 mm),
normal approach to the protective field

ⓘ This checklist represents a help tool. It supports but does not serve for the inspection before the initial operation or the regular inspections by an expert.

| | | |
|---|---|---|
| ● Is the safety distance calculated accordingly to the valid formula for **danger point protection**, considering the resolution and the effective response time of the AOPD, the response time of a possibly used safety interface and the stopping time of the machine? Is this minimum distance between the protective field and danger point considered? | yes | no |
| ● Is access to the danger point only possible through the protective field of the AOPD and are other possible accesses protected by suitable safety components? | yes | no |
| ● Is reaching-over, reaching-under or reaching-around the protective field effectively prevented, e.g. by mechanical measures (welded or screwed)? | yes | no |
| ● Is unprotected presence between the protective field and danger point safely excluded, e.g. through fixed mechanical measures or through the control of monitored mechanical components or cascading of the COMPACT*plus*? | yes | no |
| ● Are transmitter and receiver fixed against displacement after the alignment? | yes | no |
| ● Is the external condition of the safety device and the control devices in good condition with no faults? | yes | no |
| ● Are all connectors and connection cables in fault-free conditions? | yes | no |
| ● Is the start/restart button for resetting the AOPD positioned outside the danger zone with written indication and is it effective? | yes | no |
| ● Are the safety outputs (OSSDs), linked into the subsequent machine control unit in accordance with the required safety category? | yes | no |
| ● Are the subsequent circuit elements controlled by the AOPD monitored by the feedback circuit (EDM), e.g. contactors with positive-guided contacts or safety valves? | yes | no |
| ● Does the actual integration of the AOPD into the machine control unit match the circuit diagrams? | yes | no |

- Is the AOPD effective during the entire dangerous movement of the machine? yes no
- Is a possibly connected Section Emergency STOP button effective and after its resetting, is pressing and releasing of the start/restart button required to start the machine again? yes no
- Is a possibly connected Safety Door Switch effective and after its resetting, is pressing and releasing of the start/restart button required to start the machine again? yes no
- Is the dangerous movement stopped immediately if the power supply voltage of the AOPD is interrupted and is the start/restart button required to start the machine again after power returns? yes no
- Is the plate with information about the daily check of the AOPD provided so that it can be seen easily by operating personnel? yes no



### 13.3.2 Checklist for safeguarding danger areas

For COMPACT*plus-s* Safety Light Curtain (resolution 50 to 116 mm), parallel approach to the protective field

ⓘ This checklist represents a help tool. It supports but does not serve for the inspection before the initial operation or the regular inspections by an expert.

- The height of the protective field above the reference level relates to the resolution of the AOPD. Was the resolution used during the calculation of the minimum height and is this result considered? yes no
- Has the safety distance been calculated according to the valid formula for **safeguarding danger areas** and has this minimum distance between the most distant beam and the danger point been observed? yes no
- During risk assessment, has it been ensured that only protective field heights less than 300 mm above the floor are regarded as low enough not to be crawled under (EN 999)? yes no
- Is the access to the danger point only possible through the protective field of the AOPD and are other access possibilities, especially from the sides, protected by suitable hard guards or other means? yes no
- Is unprotected presence between the next beam and the danger point definitively excluded? yes no
- Are transmitter and receiver fixed against displacement after the alignment? yes no
- Is the external condition of the safety device and the control devices in good condition with no faults? yes no
- Are all connectors and connection cables in fault-free conditions? yes no

- Is the start/restart button for resetting the AOPD positioned outside the danger zone with written indication and is it effective? yes no
- Are both of the safety outputs (OSSDs), linked into the downstream machine control in accordance with the required safety category? yes no
- Are the downstream circuit elements controlled by the AOPD, e.g. contactors with positive-guided contacts or safety valves, monitored by the feedback circuit (EDM)? yes no
- Does the actual integration of the AOPD into the machine control unit match the circuit diagrams? yes no
- Is the AOPD effective during the entire dangerous movement of the machine? yes no
- Is a possibly connected Section Emergency STOP button effective and after its resetting, is pressing and releasing of the start/restart button required to start the machine again? yes no
- Is a possibly connected Safety Door Switch effective and after its resetting, is pressing and releasing of the start/restart button required to start the machine again? yes no
- Is the dangerous movement stopped immediately if the power supply voltage of the AOPD is interrupted and is the start/restart button required to start the machine again after power returns? yes no



### 13.3.3 Checklist for access or perimeter guarding

COMPACT*plus-s* Multiple Light Beam Safety Device (2, 3 or 4 beams), approaching direction normal to the protective field.

ⓘ This checklist represents a help tool. It supports but does not serve for the inspection before the initial operation or the regular inspections by an expert.

- Has the safety distance been calculated according to the valid formula for **access and perimeter guarding** and has this minimum distance between protective field and danger points been observed? yes no
- Has it been ensured that the lowest infrared beam of a 2-beam AOPD is located 400 mm above reference level; with a 3 or 4-beam AOPD, located 300 mm above reference level? yes no
- During risk assessment, was it considered that 2-beam AOPDs mounted above floor level are regarded as being possible to crawl under (EN 999)? yes no
- Is the approach to the danger area only possible through the protective field of the AOPD and are other approach possibilities protected by suitable hard guards or other means? yes no

- Are transmitter and receiver, and also corner mirror columns if applicable, fastened sufficiently against displacement after their adjustment? yes no
- Is the external condition of the safety device and the control devices in good condition with no faults? yes no
- Are all connectors and connection cables in fault-free conditions? yes no
- Is the start/restart button for resetting the AOPD positioned outside of the danger zone and not reachable from inside? Is there a good overview over the danger area from the position of the start/restart button? yes no
- Are both of the safety outputs (OSSDs), linked into the downstream machine control in accordance with the required safety category? yes no
- Are the downstream circuit elements controlled by the AOPD, e.g. contactors with positive-guided contacts or safety valves, monitored by the feedback circuit (EDM)? yes no
- Does the actual integration of the AOPD into the machine control unit match the circuit diagrams? yes no
- Is the AOPD effective with interruption of any beam and does the system lock (inevitable with activated start/restart interlock as only the access and not the presence in the danger area is registered)? yes no
- Is a possibly connected Section Emergency STOP button effective and after its resetting, is pressing and releasing of the start/restart button required to start the machine again? yes no
- Is a possibly connected Safety Door Switch effective and after its resetting, is pressing and releasing of the start/restart button required to start the machine again? yes no
- Is the dangerous movement stopped immediately if the power supply voltage of the AOPD is interrupted and is the start/ restart button required to start the machine again after power returns? yes no

## 13.4 EC Declaration of Conformity



**Leuze lumiflex**

### *EC-Declaration of Conformity*

according to Machinery Directive 98/37/EC, Annex II C

| | |
|---|---|
| We herewith declare, | Leuze lumiflex GmbH + Co. KG<br>Liebigstr. 4<br>82256 Fürstenfeldbruck |

that the following described safety components in our delivered version complies with the appropriate basic safety and health requirements of the Machinery Directive 98/37/EC based on its design and type, as brought into circulation by us. In case of alteration of the safety components, not agreed upon by us, this declaration will lose its validity.

| | |
|---|---|
| Description of the safety component: | Safety light curtain /<br>Multiple light beam safety device |
| Safety component type: | **COMPACTplus CP14-s, CP30-s, CP50-s, CP90-s**<br>**CP500/2-s, CP400/3-s, CP300/4-s**<br>**CP501/2-s, CP401/3-s, CP301/4-s** |
| Serial number: | see type plate |
| Safety category: | AOPD type 4 |
| Safety function: | Active Opto-electronic Protective Device |
| Applicable directives and standards: | Machinery Directive 98/37/EC<br>EMC Directive 89/336/ECC<br>Low-Voltage Directive 73/23/ECC<br>DIN EN 60204-1:1998<br>EN IEC 61496-1:1998<br>IEC 61496-2:1997<br>DIN EN 954-1:1997<br>EN 60825-1:1994+A1:2002+A2:2001 |
| Notified body according to annex VII: | TÜV PRODUCT SERVICE GmbH, IQSE<br>Zertifizierstelle<br>Ridlerstraße 31<br>D-80339 München/Germany |
| Charged to do: | EC - type examination<br>Examination certificate no. Z10 03 12 22795 039 |
| CE-marking: | The compliance with the directives 73/23/EWG and 89/336/EWG is certified by the CE-mark. |

Fürstenfeldbruck, 27.04.2004

ppa. Dr. Holger Lehmitz
Manager product unit
Safety at work

ppa. Werner Lehner
Manager product management

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