MLG-2 Pro

Measuring automation light grid

SICK

Sensor Intelligence.

Described product

MLG-2 Pro

Manufacturer

SICK AG
Erwin-Sick-Str. 1
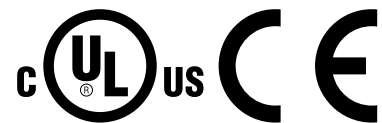79183 Waldkirch
Germany

Legal information

Original document

This document is an original document of SICK AG.

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1 About this document

1.1 Purpose of this document

These operating instructions are for giving technical personnel of the machine manufacturer or operator instructions on the mounting, configuration, electrical installation, commissioning, operation, and maintenance of the MLG-2 measuring automation light grid.

These operating instructions do not provide information on operating the machine into which a measuring automation light grid is integrated. For information about this, refer to the operating instructions of the particular machine.

1.2 Scope

These operating instructions apply to the MLG-2 Pro measuring automation light grid.

1.3 Target group

These operating instructions are intended for planning engineers, developers, and operators of plants and systems into which one or more MLG-2 measuring automation light grids are to be integrated. They are also intended for people who integrate the MLG-2 into a machine, carry out its commissioning, or who are in charge of maintenance.

1.4 Information depth

These operating instructions contain information about the MLG-2 measuring automation light grid on the following topics:

- Mounting
- Electrical installation
- Commissioning and configuration
- Care
- Fault diagnosis
- Part numbers
- Conformity and approval

When planning and using a measuring automation light grid such as the MLG-2, technical skills are required that are not covered by this document.

The official and legal regulations for operating the MLG-2 must always be complied with.

> **(i) NOTE**
> Please also refer to the SICK AG website: www.sick.de.

1.5 Symbols used

Recommendation

Recommendations are designed to assist you in the decision-making process with respect to the use of a certain function or a technical measure.

> **(i) NOTE**
> Notes inform you about special aspects of the device.

●, ☀, ○

LED symbols describe the status of a diagnostics LED. Examples:

●   The LED is illuminated continuously.

☀ The LED flashes evenly.
☼ The LED flashes briefly.
○ The LED is off.

▶   Take action …

Instructions for taking action are indicated by an arrow. Carefully read and follow the instructions for action.

⚠ **CAUTION**
Warning!

A warning indicates a specific or potential hazard. This is intended to protect you against accidents.

Read carefully and follow the warnings!

⏩ ⏩ **Sender and receiver**

In figures and connection diagrams, the symbol ⏩ indicates the sender and ⏩ indicates the receiver.

1.6   Abbreviations used

BNB	Beam Number (x) Blocked
BNM	Beam Number (x) Made
CBB	Central Beam Blocked
CBM	Central Beam Made
FBB	First Beam Blocked
FBM	First Beam Made
IDI	Inner Dimension
LBB	Last Beam Blocked
LBM	Last Beam Made
MDA	Minimum Detectable Absorption
MDO	Minimum Detectable Object
MLG-2	Measuring automation light grid 2
MOL	Minimum Detectable Object Length
MSB	Most Significant Bit
NBB	Number of Beams Blocked
NBM	Number of Beams Made
NCBB	Number of Consecutive Beams Blocked
NCBM	Number of Consecutive Beams Made
ODI	Outer Dimension
RLC	Run-length code
SDD	SOPAS Device Description
PLC	Programmable logic controller

2 Safety information

2.1 Requirements for the qualification of personnel

The MLG-2 measuring automation light grid must only be mounted, commissioned, and maintained by authorized personnel.

> **NOTE**
> Repair work on the MLG-2 may only be performed by qualified and authorized service personnel from SICK AG.

The following qualifications are necessary for the various tasks:

Task	Qualification
Mounting	• Basic practical technical training • Knowledge of the current safety regulations in the work-place
Electrical installation and device replacement	• Practical electrical training • Knowledge of current electrical safety regulations • Knowledge of the operation and control of the devices in their particular application (e. g., industrial robots, storage and conveyor systems)
Commissioning, operation, and configuration	• Knowledge of the current safety regulations and of the operation and control of the devices in their particular application • Knowledge of automation systems • Knowledge of how to use automation software

Table 1: Authorized personnel

2.2 Correct use

The MLG-2 measuring automation light grid is a measuring device which is manufactured according to the recognized industrial regulations and which meets the quality requirements stipulated in ISO 9001:2008 as well as those relating to environmental management systems as defined in ISO 14001:2009.

The measuring automation light grids are solely intended for the optical and non-contact detection of objects, animals, and persons.

A measuring automation light grid is designed for mounting and may only be operated according to its intended function. For this reason, it is not equipped with direct safety devices.

The system designer must provide measures to ensure the safety of persons and systems in accordance with the legal guidelines.

In the event of any other usage or modification to the MLG-2 measuring automation light grid (e.g., due to opening the housing during mounting and electrical installation) or in the event of changes made to the SICK software, any claims against SICK AG under the warranty will be rendered void.

Foreseeable misuse

The MLG-2 is **not** suitable for the following applications, among others:

- As a safety device to protect persons, their hands, or other body parts
- Under water

- In explosive environments
- Outdoors, without additional protection

2.3   General safety notes

⚠️ **CAUTION**

Observe the following to ensure the safe use of the MLG-2 as intended.

The measuring automation light grid must be installed and maintained by trained, qualified personnel with knowledge of electronics, precision engineering, and control programming. The relevant technical safety standards must be observed.

All persons entrusted with the installation, operation, or maintenance of the devices must follow the safety guidelines:

- The operating instructions must always be available and must be followed.
- Unqualified personnel must stay away from the system during installation and maintenance.
- The system must be installed in accordance with the applicable safety regulations and mounting instructions.
- The work safety regulations of the employers' liability insurance associations and trade associations in the respective country must be observed during installation.
- Failure to observe the relevant work safety regulations may lead to physical injury or cause damage to the system.

3   Product description

3.1   Type labels of the MLG-2 Pro

The MLG-2 Pro senders and receivers each have a type label.
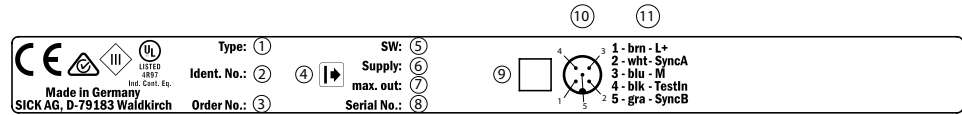
Figure 1: Type label of sender
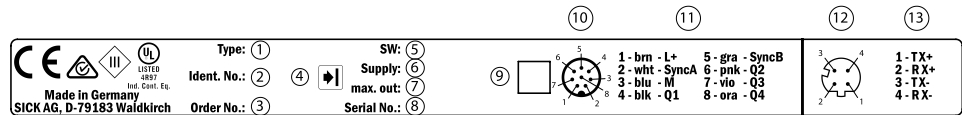
Figure 2: Type label of receiver

①   Type code

②   Part number for the individual sender or receiver

③   Part number of the entire MLG-2

④   Symbol for sender or receiver

⑤   Firmware version

⑥   Required power supply

⑦   Maximum output current

⑧   Serial number

⑨   2D matrix code, contains the order numbers of the sender/receiver, the order number of the MLG-2, and the serial number

⑩   Diagram of the M12/5-pin or M12/8-pin male connector

⑪   Pin assignment of the M12/5-pin or M12/8-pin male connector

⑫   Diagram of the M12/4-pin female connector

⑬   Pin assignment of the M12/4-pin female connector

3.2   MLG-2 Pro type code

Example

MLG-2 with 5 mm beam separation, type Pro, detection height 145 mm, 1 input, 1 switching output and 2 analog outputs, no options, 5 m sensing range and pre-configuration for NBB,LBB,object detection and teach-in.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
M	L	G	0	5	A	-	0	1	4	5	B	1	0	5	0	1

Table 2: Example of an MLG-2 Pro type code

Position	Meaning	
1 … 3	Product family	MLG
4 and 5	Beam separation	02 = 2.5 mm 05 = 5 mm 10 = 10 mm 20 = 20 mm 25 = 25 mm 30 = 30 mm 50 = 50 mm

Table 3: Meaning of the positions in the type code

Position	Meaning	
6	Type	0 = Special type A = Pro
7	Hyphen	–
8 … 11	Detection height	0000 = Special detection height see table 4, page 12
12	Interfaces, I/O	see table 5, page 13
13	Options	1 = none
14 and 15	Optical properties	see table 6, page 13
16 and 17	Preconfiguration of the I/O con- nections and the software	see "MLG-2 Pro preconfigurations", page 13

Table 3: Meaning of the positions in the type code

3.2.1 Monitoring height

	Type						
	MLG02…	**MLG05…**	**MLG10…**	**MLG20…**	**MLG25…**	**MLG30…**	**MLG50…**
Monitoring height [mm]	145	145	140	140	–	–	–
	295	295	290	280	275	270	250
	445	445	440	440	425	420	400
	595	595	590	580	575	570	550
	745	745	740	740	725	720	700
	895	895	890	880	875	870	850
	1045	1045	1040	1040	1025	1020	1000
	1195	1195	1190	1180	1175	1170	1150
	–	1345	1340	1340	1325	1320	1300
	–	1495	1490	1480	1475	1470	1450
	–	1645	1640	1640	1625	1620	1600
	–	1795	1790	1780	1775	1770	1750
	–	1945	1940	1940	1925	1920	1900
	–	2095	2090	2080	2075	2070	2050
	–	2245	2240	2240	2225	2220	2200
	–	2395	2390	2380	2375	2370	2350
	–	2545	2540	2540	2525	2520	2500
	–	–	2690	2680	2675	2670	2650
	–	–	2840	2840	2825	2820	2800
	–	–	2990	2980	2975	2970	2950
	–	–	3140	3140	3125	3120	3100

Table 4: Monitoring height [mm]

3.2.2 Combinations of MLG-2 Pro inputs and outputs

Position 12	Inputs and outputs, data interface	Connection type
B	2 × switching output (Q) and 2 × analog output (QA) or 1 × input (IN) and 1 × switching output (Q) and 2 × analog output (QA)	M12/8-pin, A-coded
I	2 × switching output (Q) and 1 × RS-485 interface or 1 × input (IN) and 1 × switching output (Q) and 1 × RS-485 interface	M12/8-pin, A-coded
R	4 × switching output (Q) or 2 × input (IN) and 2 × switching output (Q)	M12/8-pin, A-coded

Table 5: Possible combinations of MLG-2 Pro inputs and outputs

3.2.3 Optical properties

Position 14 and 15	Sensing range	Minimum detectable object length
00	Special	Special
32	2 m	2.5 mm
05	5 m	5 mm
08	8.5 m	5 mm

Table 6: Sensing range and minimum detectable object length

3.2.4 MLG-2 Pro preconfigurations

Position 16, 17	QA1	QA2	Q1/C	Q2/IN1	Teach-in
01	NBB	LBB	Object detection	Teach-in	Standard operating mode
02	NBB	LBB	Object detection	Object detection (inverted)	Standard operating mode
03	NBB	LBB	Object detection	Object detection (inverted)	Standard & cross beam operating mode
04	NBB	FBB	Object detection	Teach-in	Standard operating mode
05	NBB	FBB	Object detection	Object detection (inverted)	Standard operating mode
06	NBB	FBB	Object detection	Object detection (inverted)	Standard & cross beam operating mode

Table 7: Preconfiguration of MLG-2 Pro with I/O combination B (see table 5, page 13)

Position 16, 17	RS-485 Output	RS-485 Data transmission rate	Q1/C	Q2/IN1	Teach-in
01	System status States of the switching outputs NBB LBB FBB ODI IDI	9600 baud	Object detection	Teach-in	Standard operating mode
02	System status States of the switching outputs Beam status	9600 baud	Object detection	Teach-in	Standard operating mode
03	System status States of the switching outputs Beam status	9600 baud	Object detection	Object detection (inverted)	Standard operating mode
04	System status States of the switching outputs RLC	9600 baud	Object detection	Teach-in	Standard operating mode
05	System status States of the switching outputs RLC	9600 baud	Object detection	Object detection (inverted)	Standard operating mode

Table 8: Preconfiguration of MLG-2 Pro with I/O combination I (see table 5, page 13)

Position 16, 17	Q1/C	Q2/IN1	Q3	Q4/IN2	Teach-in
01	Object detection	Teach-in	Object detection	Object detection	Standard operating mode
02	Object detection	Teach-in	Object detection (inverted)	Object detection	Standard operating mode
03	Object detection	Teach-in	Object detection	Object detection	Standard & cross beam operating mode
04	Object detection	Object detection	Object detection	Object detection	Standard operating mode
05	Object detection	Object detection (inverted)	Object detection (inverted)	Object detection (inverted)	Standard operating mode
06	Object detection	Object detection	Object detection	Object detection (inverted)	Standard & cross beam operating mode

Table 9: Preconfiguration of MLG-2 Pro with I/O combination R (see table 5, page 13)

3.3 MLG-2 product properties

- Different beam separations from 2.5 mm to 50 mm
- Monitoring heights from 130 to 3,140 mm
- Operating range up to 2 m, 5 m or 8.5 m
- Quick response time
- Convenient configuration using the SOPAS ET software interface
- Detection of transparent objects
- Dust- and sunlight-resistant
- Integrated applications including object detection, height classification, etc.

3.4 Setup and function

The MLG-2 is an optical light grid. It comprises a sender and a receiver.

The sender consists of sender optics, several sender elements (LEDs), and actuation electronics. The receiver consists of receiver optics, several receiver elements (photodiodes) and evaluation electronics.

3.4.1 MLG-2 Pro device components

Figure 3: MLG-2 Pro

➡️|	Receiver
➡️	Sender
①	Receiver connection
②	Ethernet configuration interface on the receiver
③	Sender connection

The receiver has a connection for the power supply, for inputs and outputs, and for synchronization. It also has an Ethernet connection for configuration via TCP/IP.

The sender has a connection for the power supply, for synchronization, and for a test input.

3.4.2 Measurement principle

Provided no object is located between the sender and receiver elements, the light beams from the sender elements will hit the receiver elements.

If an object is located between the sender and receiver elements, the light beams will be blocked, depending on the size of the object.

Detection area
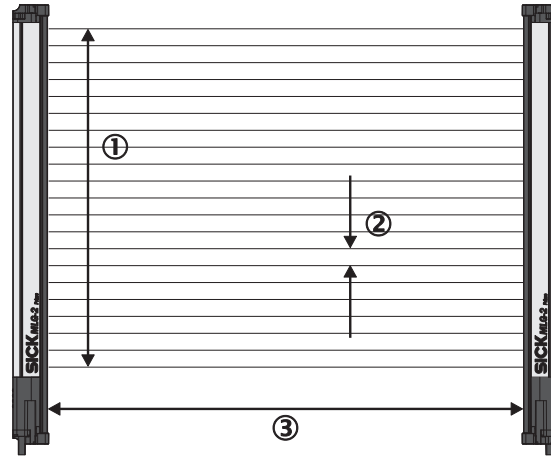
Figure 4: Detection area of the MLG-2

① Monitoring height
② Beam separation
③ Sensing range

The detection area is determined by the monitoring height and the sensing range of the light grid. The monitoring height is determined by the beam separation and the number of beams. The sensing range of the light grid is the distance between sender and receiver.

3.4.3 Synchronizing the MLG-2

The sender and receiver synchronize with each other electronically, thus **one** electrical connection between the sender and receiver is necessary.

3.4.4 Beam separations and monitoring height

Beam separations

In order to achieve different levels of measurement accuracy, the MLG-2 is available with different beam separations.
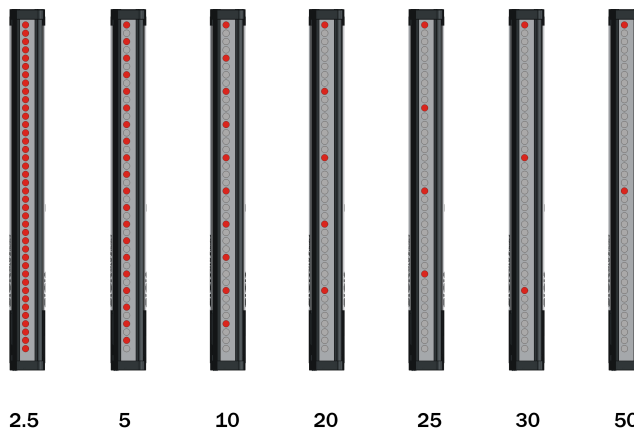
Figure 5: Schematic depiction of available beam separations (mm)

Maximum and minimum monitoring height

The number of LEDs is limited to 510. This results in different maximum monitoring heights depending on the beam separation. The minimum monitoring height is determined by the beam separation and the smallest module size for this beam separation.

Beam separation	Maximum monitoring height	Minimum monitoring height
2.5 mm	1195 mm	145 mm
5 mm	2,545 mm	145 mm
10 mm	3,140 mm	140 mm
20 mm	3,130 mm	130 mm
25 mm	3,125 mm	275 mm
30 mm	3,1320 mm	270 mm
50 mm	3,100 mm	250 mm

Table 10: Maximum monitoring heights

3.4.5   Teach-in

During the teach-in process, the switching thresholds for all beams are individually adjusted for the sensing range and the ambient conditions.

After teach-in has been completed, it must be ensured that the setup is no longer changed otherwise another teach-in will have to be carried out.

The MLG-2 Pro provides the following options for carrying out a teach-in:

- Pressing the teach-in button
- Automatic teach-in (when switching on)
- Signal at a switching input
- SOPAS ET
- IO-Link
- Webserver

Teach-in quality

The teach-in quality indicates the quality after the teach-in process. The MLG-2 calculates this value based on the quality of the light level received. The teach-in quality depends on the alignment of the MLG-2 and the cleanliness of the front screens.

The value remains constant until another teach-in process is carried out.

Process quality

The process quality indicates the quality of the light level currently being received. The MLG-2 analyzes the light level received when the light path is unblocked and compares this to the values after the last teach-in process.

If the received values are getting worse, the process quality drops.

Possible causes of a drop in process quality include:

- Contamination or fogging of the front screen of the sender and/or receiver
- Misalignment
- Continuous partial blocking of a light beam or several light beams

Retrieving teach-in quality and process quality data

The quality performance indicators can be retrieved in various ways:

- SOPAS ET
- RS485
- IO-Link
- Integrated web server
- switching outputs
- Analog outputs

3.4.6 Beam blanking

Individual beams can be blanked.
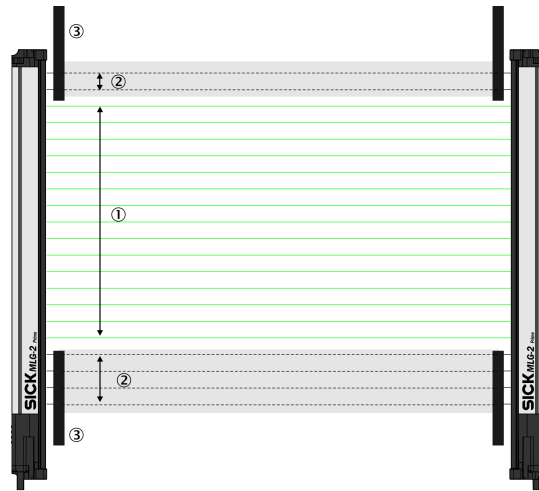
Figure 6: Detection area with beams blanked

①   Included beams
②   Blanked beams
③   Structural restrictions on the detection area

The MLG-2 Pro offers various options for blanking light beams (see "Teach-in", page 90).

- One-off blanking
  The blocked beams are blanked.
- Beam blanking for each teach-in
  The blocked beams are blanked in every teach-in process.

> **NOTE**
> If this option is selected and an object is located in the detection area during the teach-in process, this will not be identified as an error.

- Manual blanking
  Light beams can be individually selected and blanked using the interface in SOPAS ET and via IO-Link (see "Representation of the detection area", page 59). The beams are not taken into account in the measurement, even if they are made at the time of the teach-in process.

3.4.7 Sensing ranges

Operating range

Light grids are generally available with a 2 m range, 5 m range or 8.5 m sensing range. This is referred to as the operating range, which includes an operating reserve.

Limiting range

It is also possible to operate the MLG-2 up to its limiting range, which goes beyond the operating range.

Operating range	Limiting range
2 m	2.8 m
5 m	7 m
8.5 m	12 m

Table 11: Limiting range

Operation within the limiting range requires the following conditions:

- Clean ambient conditions
- Front screens are cleaned regularly
- Regular teach-in

The following functions cannot be provided when operating within the limiting range:

- High level of operating reserves
- High measurement accuracy
- Transparent operating mode
- Dust- and sunlight-resistant operating mode

> **NOTE**
> The sensing range of the MLG-2 Pro is reduced in certain operating modes (see "MLG-2 operating modes", page 26).

3.5 Scan time

In the MLG-2, not all light beams are active at the same time, instead one light beam is activated after the other starting from the bottom.
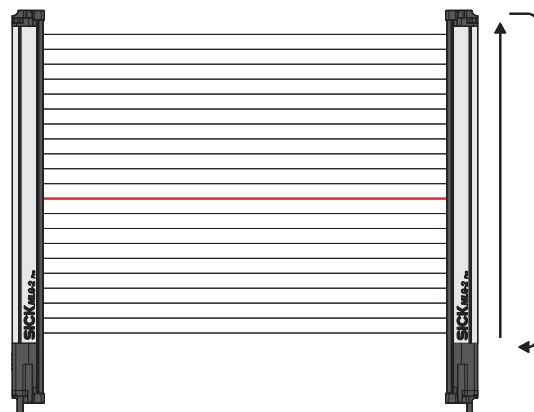
Figure 7: Standard scan method

The scan time increases according to the number of beams of an MLG-2.
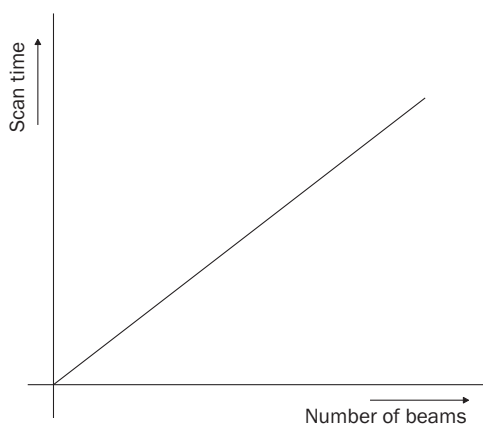
Figure 8: Scan time in relation to the number of beams

The scan time is used to determine the **response times** of the outputs, the **minimum presence time** of an object and the **repeat accuracy of a measurement result (reproducibility)**.

- The **response time** is the time it takes for an output to react following the detection of an object/gap. The maximum response time is 3 × the scan time plus the transmission time to the outputs.
- The **minimum presence time** is the time an object or a gap has to be in the detection area for it to be detected. The minimum presence time is max. 2 × the scan time.
- The repeat accuracy of a measurement result (**reproducibility**) is the amount of time by which an object detection can differ from a previous or subsequent detection. The reproducibility time is 1 × the scan time.

3.5.1 Response time, minimum presence time and reproducibility of the MLG-2

On the MLG-2, the response time, minimum presence time, and reproducibility are displayed via SOPAS ET. Response time and minimum dwell time can be read off in the diagram.

3.5.2 Scan time with cross-beam function

When the cross-beam function is enabled, the light beam from a sender LED is received by three receiver diodes in two scans. This doubles the scan time.
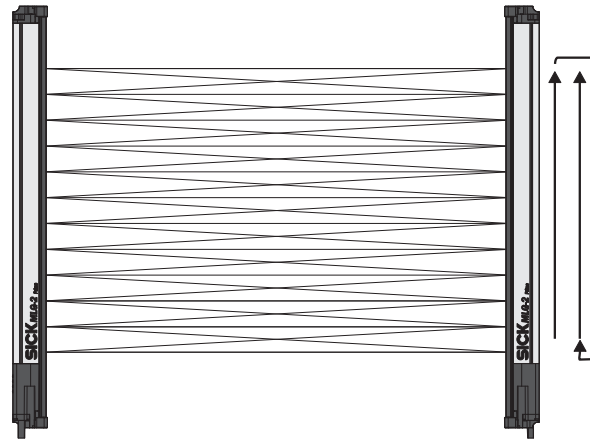
Figure 9: Cross-beam function

3.5.3 Scan time with high-speed scan on the MLG-2

With high-speed scan, several beams are active in each cycle. This reduces the scan time by a variable factor.
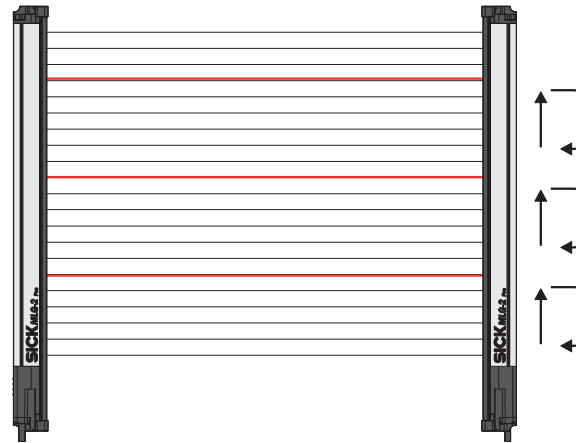
Figure 10: High-speed scan

The scan time is also dependent on the number of beams. Beyond a certain number of beams, the scan time is reduced because it is possible to use the high-speed scan.
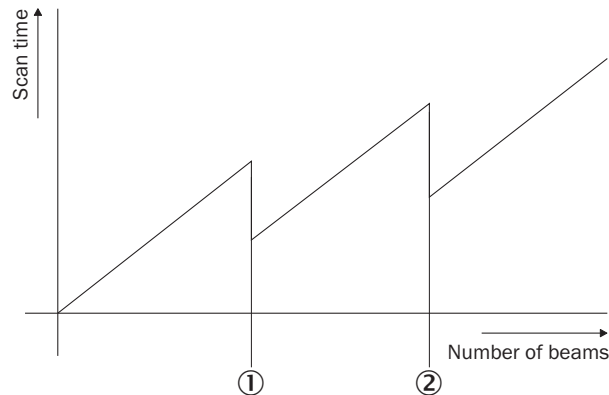
Figure 11: Scan time in relation to the number of beams when using the high-speed scan

① High-speed scan with 2 beams active simultaneously

② High-speed scan with 3 beams active simultaneously

The number of beams that can be activated at the same time depends on the size of the detection area (sensing range, beam separation, and number of beams). On the MLG-2, the response time, minimum presence time, and reproducibility are displayed via SOPAS ET. You can also find the response time and minimum presence time when using the high-speed scan in the diagrams in these operating instructions (see "Diagrams", page 122).

> **i** **NOTE**
> With a beam separation of 2.5 mm, the high-speed scan can only be adjusted in combination with the high measurement accuracy function.

3.6 Beam separation and minimum detectable object

The measurement accuracy achieved by the MLG-2 depends on the beam separation.

3.6.1 Minimum detectable object with parallel-beam function

In order for an object to be detected continuously, it must completely cover at least one beam. This is referred to as the minimum detectable object, or MDO.
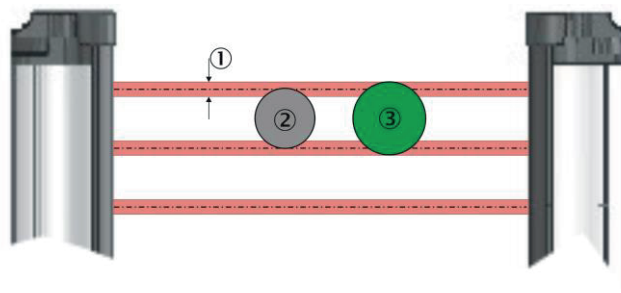
Figure 12: Minimum detectable object

① Beam diameter
② Object is not completely reliably detected
③ Object is reliably detected (meets requirements of minimum detectable object size)

> **i** **NOTE**
> For moving objects, the minimum detectable object depends on the speed of the object.

Beam separation	Minimum detectable object (stationary object)[12]
2.5 mm	3.5 mm
5 mm	9 mm
10 mm	14 mm
20 mm	24 mm
25 mm	29 mm
30 mm	34 mm

Table 12: Minimum detectable object in relation to the beam separation of the MLG-2

Beam separation	Minimum detectable object (stationary object)[12]
50 mm	54 mm

Table 12: Minimum detectable object in relation to the beam separation of the MLG-2

1   Only if the object also meets the minimum detectable object length requirements.
2   All the values are typical values and can be found in the respective setting modes.

> **ⓘ NOTE**
> The minimum detectable object size is also dependent on the other performance options, such as the configured response time and operating reserve. The precise minimum detectable object size is displayed in SOPAS ET on the MLG-2 (see "SOPAS ET interface", page 54).

3.6.2 Minimum detectable object length

When an object moves through the detection area, it must have a certain length.
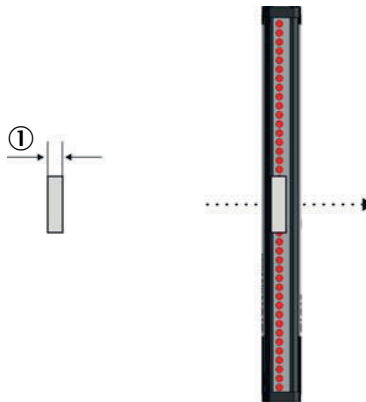
Figure 13: Minimum detectable object length

①   Minimum detectable object

> **ⓘ NOTE**
> For moving objects, the minimum detectable object length also depends on the speed of the object.

Beam separation	Minimum detectable object length (stationary object)[1]
2.5 mm	2.5 mm
5 ... 50 mm	5 mm

Table 13: Minimum detectable object length with the MLG-2

1   Only if the object also meets the minimum detectable object requirements.

> **ⓘ NOTE**
> The minimum detectable object length is also dependent on the other performance options, such as the configured response time and operating reserve. The precise minimum detectable object length is displayed in SOPAS ET on the MLG-2 (see "SOPAS ET interface", page 54).

3.6.3 Minimum detectable object with cross-beam function

The parallel-beam function is used for measuring by default. With the parallel-beam function, each light beam is received only by the receiver element situated directly opposite.

With the cross-beam function, a sender LED projects beams to several receiver diodes. The cross-beam function increases the measurement accuracy and enables the detection of smaller objects.
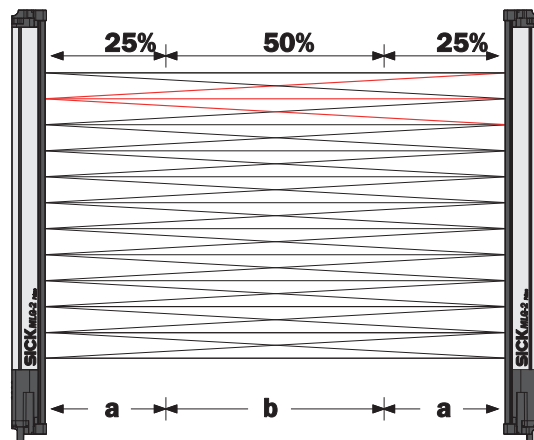
Figure 14: Cross-beam function

A minimum distance between the sender and the receiver is required for the cross-beam function. The minimum detectable object size depends on the position of the object within the detection area. Detection of the smaller minimum detectable object size is therefore only possible in the central area (b) of the detection area.

- The cross-beam function is only useful for object detection (NBB ≤ 1). For other applications (height classification, object recognition, etc.), the results of the parallel-beam function are used.
- Use of the cross-beam function increases the response time.
- With the cross-beam function, a minimum distance needs to be maintained between sender and receiver. The minimum distance depends on the aperture angle of the light grid.
- For moving objects for the cross-beam function, the minimum detectable object depends on the speed of the object.

Beam separation	Minimum distance 2 m variant	Minimum distance 5 m variant	Minimum distance 8.5 m variant	Minimum detectable object (stationary object)	
				In area B	In area A
2.5 mm	200 mm	–	–	2.5 mm	4 mm
5 mm	–	110 mm	120 mm	6.5 mm	9 mm
10 mm	–	220 mm	240 mm	9 mm	14 mm
20 mm	–	440 mm	480 mm	14 mm	24 mm
25 mm	–	550 mm	600 mm	16.5 mm	29 mm
30 mm	–	660 mm	720 mm	19 mm	34 mm
50 mm	–	1110 mm	1200 mm	29 mm	54 mm

Table 14: Minimum detectable object with cross-beam function on the MLG-2

- High-speed scan is not possible.
- The minimum detectable object size with cross-beam function is also dependent on the other performance options, such as the configured response time and operating reserve. The precise minimum detectable object size is displayed in SOPAS ET on the MLG-2 (see "SOPAS ET interface", page 54).

3.6.4 Minimum detectable object with high measurement accuracy from the MLG-2

On the MLG-2, the measurement accuracy can be increased in SOPAS ET (see "Performance options", page 93). This means that an object can be detected even if it only covers half of a beam.
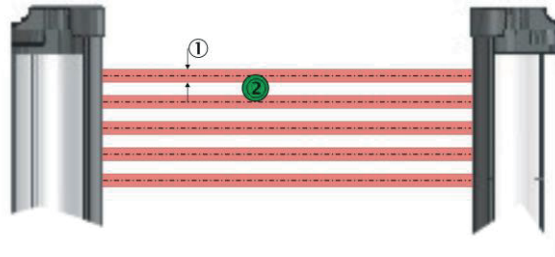
Figure 15: Minimum detectable object size with high measurement accuracy

①   Beam diameter
②   Object is reliably detected (meets requirements of minimum detectable object size)

Beam separation	Minimum detectable object (stationary object)[1]
2.5 mm	2.5 mm
5 mm	5 mm
10 mm	10 mm
20 mm	20 mm
25 mm	25 mm
30 mm	30 mm
50 mm	50 mm

Table 15: Minimum detectable object size with high measurement accuracy

[1]   Only if the object also meets the minimum detectable length requirements see table 13, page 23).

Minimum detectable object length

Beam separation	Minimum detectable object length (stationary object)[1]
2.5 mm	1 mm
5 … 50 mm	2 mm

Table 16: Minimum detectable object length with high measurement accuracy

[1]   Only if the object also meets the minimum detectable length requirements (see table 12, page 22).

- When using high measurement accuracy to detect moving objects, the minimum detectable object length also depends on the speed of the object and the other performance options, such as the configured response time and operating reserve. The precise minimum detectable object length is displayed in SOPAS ET on the MLG-2 (see "SOPAS ET interface", page 54).
- Sensing ranges larger than the operating range are not possible when using high measurement accuracy.
- High measurement accuracy can cause the operating reserve to decrease in the event of large sensing ranges and imperfect alignment.

3.7 Operating reserve

The operating reserve defines the operational safety before contamination, vibrations, misalignment, temperature fluctuations, etc. cause the MLG-2 to produce incorrect measurements.

The MLG-2 is subject to a certain level of contamination depending on its environment and application. In principle, the MLG-2 must be cleaned regularly and a teach-in should be carried out after cleaning.

3.7.1 Operating reserves on the MLG-2

On the MLG-2, the operating reserve can be adjusted according to the operating mode.

Standard operating reserve

The standard setting for the operating reserve is the best setting for most applications.

High level of operating reserves

Setting the operating reserve high makes the MLG-2 very resistant to contamination. However, it is not possible to activate high measurement accuracy in this case.

> **NOTE**
> In order to achieve a high operating reserve, the input sensitivity must be increased. This increases the risk of reflection. If there are reflective surfaces near the detection area, the light beams from the LEDs may reflect off these surfaces and reach the receiver, even though there is an object in the detection area.
> The high input sensitivity means that only opaque objects can be detected. Transparent or semi-transparent objects are not detected.

Low operating reserve

Setting the measurement accuracy high reduces the operating reserve. When the operating reserve is low, the MLG-2 must be cleaned more frequently and a teach-in process must be carried out.

3.8 MLG-2 operating modes

The MLG-2 has the operating modes **Standard**, **Transparent** and **Dust and Sunlight-Resistant**.

Within the operating modes, the performance options can be used to modify the response time, minimum detectable object size, minimum detectable absorption (in Transparent operating mode), and operating reserve.

- The configurable performance options depend on the operating mode selected.
- When the operating mode is changed, a new teach-in process must be performed.

3.8.1 Standard operating mode

Standard operating mode is the mode in which most measuring applications can be carried out.

- Only opaque objects can be detected.
- There must not be a high level of constant light irradiation.

3.8.2 Transparent operating mode

Transparent operating mode enables the detection of transparent objects, such as those made of glass, PET, etc.

Transparent objects do not completely cover the light beam. In order to detect these objects, they must have what is known as a minimum detectable absorption (MDA).

ℹ️ **NOTE**

It is not possible to use the cross-beam function, high operating reserve or high-speed scan in the Transparent operating mode.

Minimum detectable absorption

In order to detect a transparent object, it must absorb a certain percentage of the energy from the light beam. Depending on the objects being measured, an object can be detected with 30% absorption, 15% absorption, or 10% absorption.

ℹ️ **NOTE**

The minimum detectable absorption that an object needs in order to be detected increases with the sensing range (see "Minimum detectable absorption", page 124).

Examples of the signal attenuation of transparent objects[1]:

- Approx. 10% signal attenuation:
  Clean PET bottles, clear glass, thin and clear films (e.g., cellophane), household plastic film, plastic wrapping
- Approx. 15% signal attenuation:
  Clean clear glass bottles, thick films, film and wrapping folded multiple times
- Approx. 30% signal attenuation:
  Green and brown glass, colored glass bottles

The following prerequisites must be met:

- The sender and receiver must be aligned precisely with one another.
- The sender and receiver elements must be kept clean at all times.

AutoAdapt

The AutoAdapt function is active in the Transparent operating mode. AutoAdapt adjusts the switching threshold at which objects are detected in accordance with the level of contamination on the MLG-2. As a result, the MLG-2 thus becomes less sensitive as the level of contamination increases.

3.8.3 Dust- and sunlight-resistant operating mode

Dust and sunlight-resistant operating mode is intended for applications when there is a large amount of dust in the environment or a high level of solar radiation.

- Dust and sunlight-resistant operating mode reduces the maximum sensing range

---

[1] Examples are for illustrative purposes only. The signal attenuation and the minimum detectable absorption to be configured must be determined for each individual application.

- To 1.2 m for devices with a 2 m operating range
- To 3 m for devices with a 5 m operating range
- To 5 m for devices with an 8.5 m operating range
- This operating mode can only be configured on an MLG-2 with fewer than 240 beams.

3.9 Interfaces

The MLG-2 can be used to evaluate the measurements in different ways. The MLG-2 provides various interfaces for data output.

- Switching outputs (Push-Pull)
- Analog outputs
- RS-485 interface
- IO-Link interface

The MLG-2 can output the raw data via the interfaces in the form of the beam status or run-length code, so the user can evaluate the data him/herself.

The MLG-2 can also preprocess the raw data (beam function, e.g., NBB – number of beams blocked) and output the data via bus or analog interfaces.

The preprocessed data can be assigned directly to the switching outputs via a programmable function logic or via predefined applications.

3.9.1 Output of measurement data (raw data)

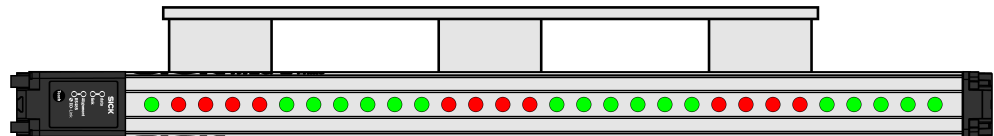The MLG-2 provides the status of all beams at its data interface using a data message.

Figure 16: Status of the beams

0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0

Table 17: Example status for an MLG-2 with 32 beams

0 Beam clear
1 Beam blocked

The data message can be output continuously or in response to particular events.

Run-length code

In order to reduce the volume of data, the run-length code can be output instead of the complete status of all beams. This code only contains the status change of the beams.

The run-length code indicates how many beams currently have the same status.

0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
1	4				6						4				6						4				7						

Table 18: Example status for the run-length code of an MLG-2 with 32 beams

RLC = 1464645

The example shows: 1 beam made, 4 beams blocked, 6 beams made, 4 beams blocked, 6 beams made, 4 beams blocked, 5 beams made.

The first value **always** indicates the number of **unblocked** beams. If the first beam is blocked, the first value will therefore be zero. The second value indicates how many beams are blocked; in the example in table 19, this value = 1.

	1	0	0	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0
0	1		2			4				4			2				5	

Table 19: Example run-length code with the first beam blocked

> **NOTE**
>
> The run-length code can contain a maximum of 16 values; i.e., 15 status changes. It is therefore only useful for measuring objects with a small number of parts, e.g., a pallet. Objects such as pallet cages are not suitable as they involve too many status changes.

3.9.2 Preliminary evaluation

Beam functions for preliminary evaluation

The MLG-2 creates a preliminary evaluation on the basis of the beam status, e.g.:

- NBB – Number of Beams Blocked
- NBM – Number of Beams Made
- LBB – Last Beam Blocked
- FBB – First Beam Blocked

: Table shows all available functions.

The results of the preliminary evaluation can be output via the data interfaces and processed further externally. Alternatively, they can first be processed in a function programming option in the MLG-2.

Function programming for the MLG-2 Pro

Function programming can be used to carry out complex applications with variables, operands, and functions in SOPAS ET.

1st option:

The beam functions are directly linked with the outputs.

Example:

> Q1 = Total number of beams made (NBM) ≥ 30
> The output Q1 switches when the total number of beams made is greater than or equal to 30.

2nd option:

The MLG-2's beam functions are used to define beam function variables first.

Example:

> BFVar 1: Total number of beams made (NBM) ≥ 30
> BFVar 2: Number of consecutive beams blocked (NCBB) = 5
> These can be linked to logical variables.

Example:

> LogVar1 = BFVar 1 OR BFVar 2
> The logical variables can be linked in turn to the outputs (Q).

Example:

> Q1 = LogVar1 = true
> The output Q1 switches when the total number of beams made is greater than or equal to 30 or when the number of consecutive beams blocked equals 5.

3.9.3 Configurable applications of the MLG-2 Pro

The MLG-2 provides predefined applications which are assigned to the outputs. The following options are available for configuring the applications:

- – Via SOPAS ET (see "Configuration with SOPAS ET", page 53)
- – Using the integrated web server (see "MLG-2 configuration with the internal web server", page 108)
- – Using IO-Link (see "IO-Link", page 110)

Application	MLG-2 Pro
Height classification	■
Object detection/object width	■
Contamination warning	■
Object recognition	■
Hole detection/hole size	■
Outer/inner dimension	■
Classification of the object position	■
Classification of the hole position	■
Zones	■
Diagnostics	■

Table 20: Configurable applications for switching outputs

Application		MLG-2 Pro
NBB	Object detection	■
NBM	Hole detection	■
LBB	Object height measurement (last beam blocked)	■
FBB	Object height measurement (first beam blocked)	■
ODI	Measurement of the outer dimension	■
IDI	Measurement of the inner dimension	■
CBB	Measurement of the object position	■
CBM	Measurement of the hole position	■
–	Diagnostics	■
NBB Zone X (X = 1, 2, 3 or 4)	Object detection system within a zone	■
NCBB Zone X (X = 1, 2, 3 or 4)	Object width within a zone	■
FBB Zone X (X = 1, 2, 3 or 4)	Object height measurement (first beam blocked) within a zone	■
LBB Zone X (X = 1, 2, 3 or 4)	Object height measurement (last beam blocked) within a zone	■
CBB Zone X (X = 1, 2, 3 or 4)	Object position within a zone	■

Table 21: Configurable applications for analog outputs

3.10   Display and operating elements

3.10.1   Sender

The sender has three LEDs on its front. The LEDs are located on the connection side.

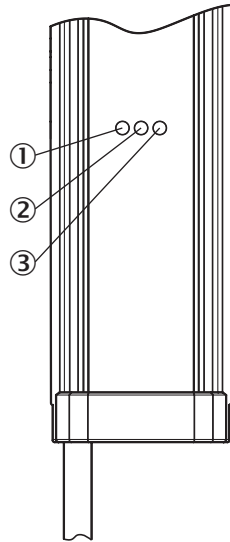The section LED indicators and error indicators on page 116 explains the meaning of the LED indicators.

Figure 17: LEDs on the sender

①   Yellow

②   Red

③   Green

3.10.2   Receiver

LEDs

The receiver has three LEDs on its front and a control panel with LEDs and membrane keys on its rear. The LEDs and the control panel are located on the connection side.

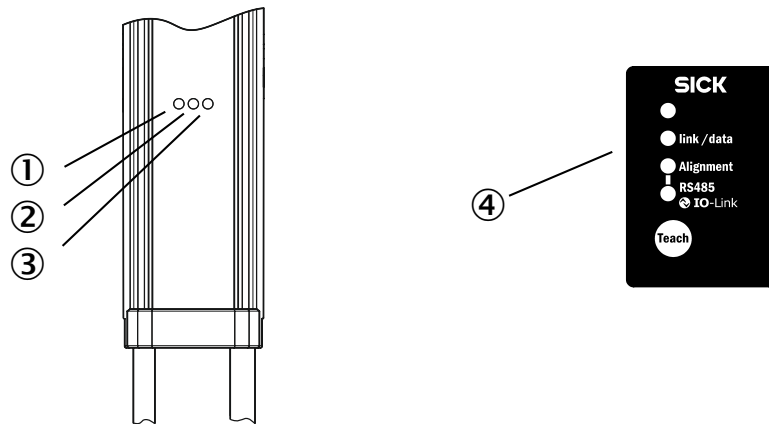The section LED indicators and error indicators on page 116 explains the meaning of the LED indicators.

Figure 18: LEDs on the front side

① Yellow
② Red
③ Green
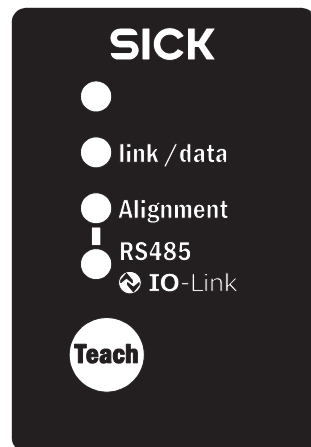④ LEDs on the control panel

Control panel

Figure 19: Control panel of the MLG-2 Pro

The teach-in process for the MLG-2 can be started by pressing the **Teach** button.

The MLG-2 control panel can be locked to prevent incorrect operation. The lock can be activated and deactivated via SOPAS ET, IO-Link, or via the pushbuttons on the control panel.

Locking the control panel

▶ Press the **Teach (Set)** pushbutton for 15 s.

✓ The control panel is locked; the configuration cannot be changed.

Disabling the lock

▶ On the MLG-2 Pro, press the **Teach** button for 15 s.

✓ The lock is disabled again.

3.11 Inputs

3.11.1 Switching inputs on the MLG-2 Pro receiver

On the MLG-2 Pro, the switching inputs can be used for the following functions (see "System settings for the EXPERT user level", page 65):

- Teach-in
- Standby
- Activating or deactivating digital or analog outputs
- Triggering RS485 data output

3.11.2 Test input on the sender

The test input can be used to switch off the sender. This simulates a complete blocking of the beams. This makes it possible to test the behavior of the switching or analog outputs that have been configured accordingly.

3.12 Application examples

3.12.1 Application examples for the MLG2

The MLG-2 is suitable for complex applications including e. g. start and end detection, detection of small or transparent objects, traffic applications, volume measurement, or contour measurement.
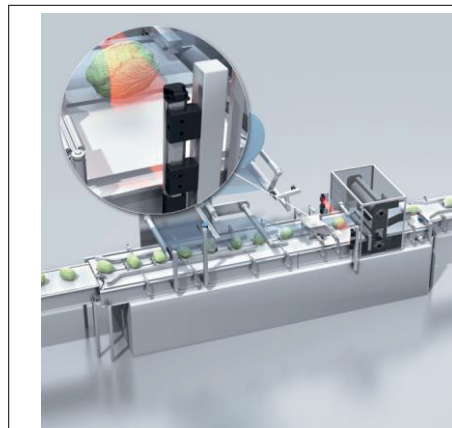
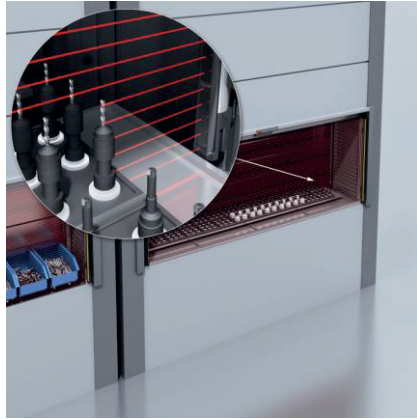|	
Figure 20: Start and end detection	*Figure 21: Detection of transparent objects*

Table 22: Application examples for the MLG-2

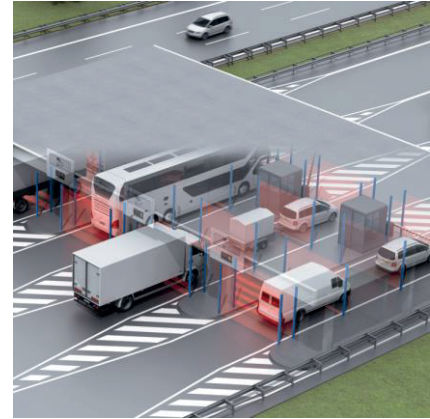Figure 22: Detection of small objects

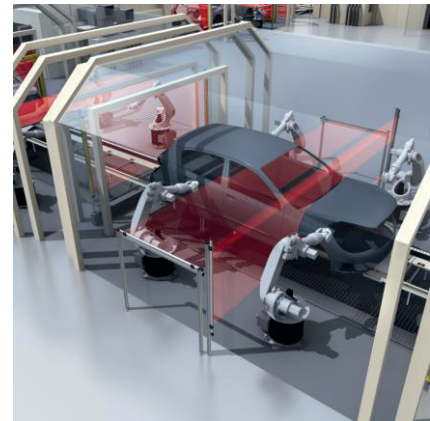Figure 23: Traffic applications

Figure 24: Volume measurement

Figure 25: Contour measurement

Table 22: Application examples for the MLG-2

4 Mounting

4.1 Scope of delivery

1 × sender

1 × receiver

4/4 x QuickFix brackets[2]

1 × Quick Start Guide

4.2 Recommended mounting arrangements

When several MLG-2s are mounted close to one another, there is a risk of mutual inter-ference. This is particularly likely if there are shiny surfaces nearby or if the objects being detected are shiny.

Therefore, when mounting two MLG-2s close to one another, their light beams should be oriented in opposite directions.

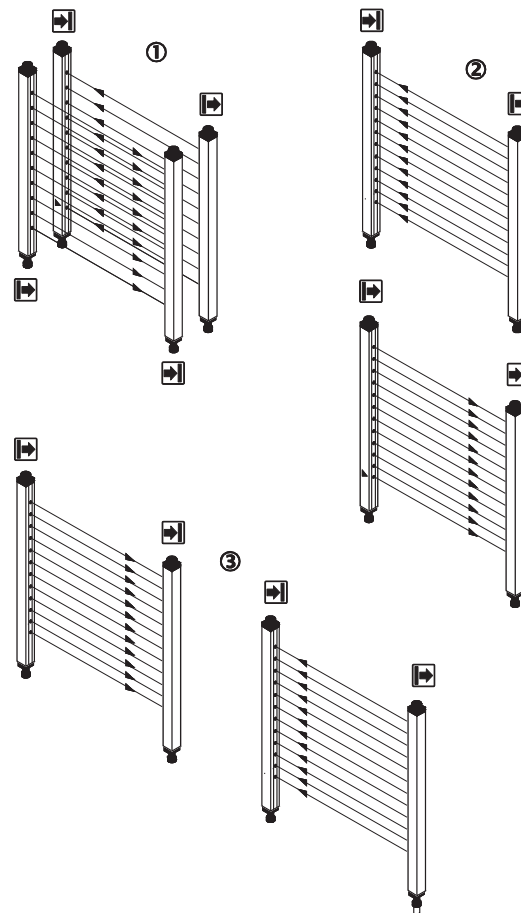### 4.2.1 Mounting with light in opposite directions

Figure 26: Placement with light in opposite directions

①   Two MLG-2s, one behind the other
②   Two MLG-2s, one above the other
③   Two MLG-2s, one next to the other

---

[2]   6 x QuickFix brackets for detection heights above 2 m.

> **NOTE**
>
> When two MLG-2s are placed opposite one another and their light beams are in opposite directions,① reflections may occur from sender 1 to receiver 2 in the case of shiny objects.

4.2.2 Mounting with light in the same direction

When several MLG-2s are mounted with their light beams oriented in the same direction, a minimum distance must be maintained between the MLG-2s. The minimum distance increases as the distance between the sender and receiver increases and is dependent on the operating range.
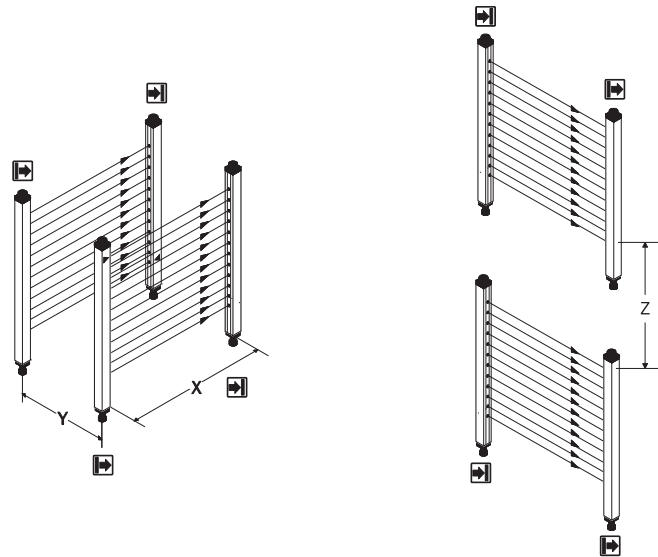
Figure 27: Distances when light is in the same direction

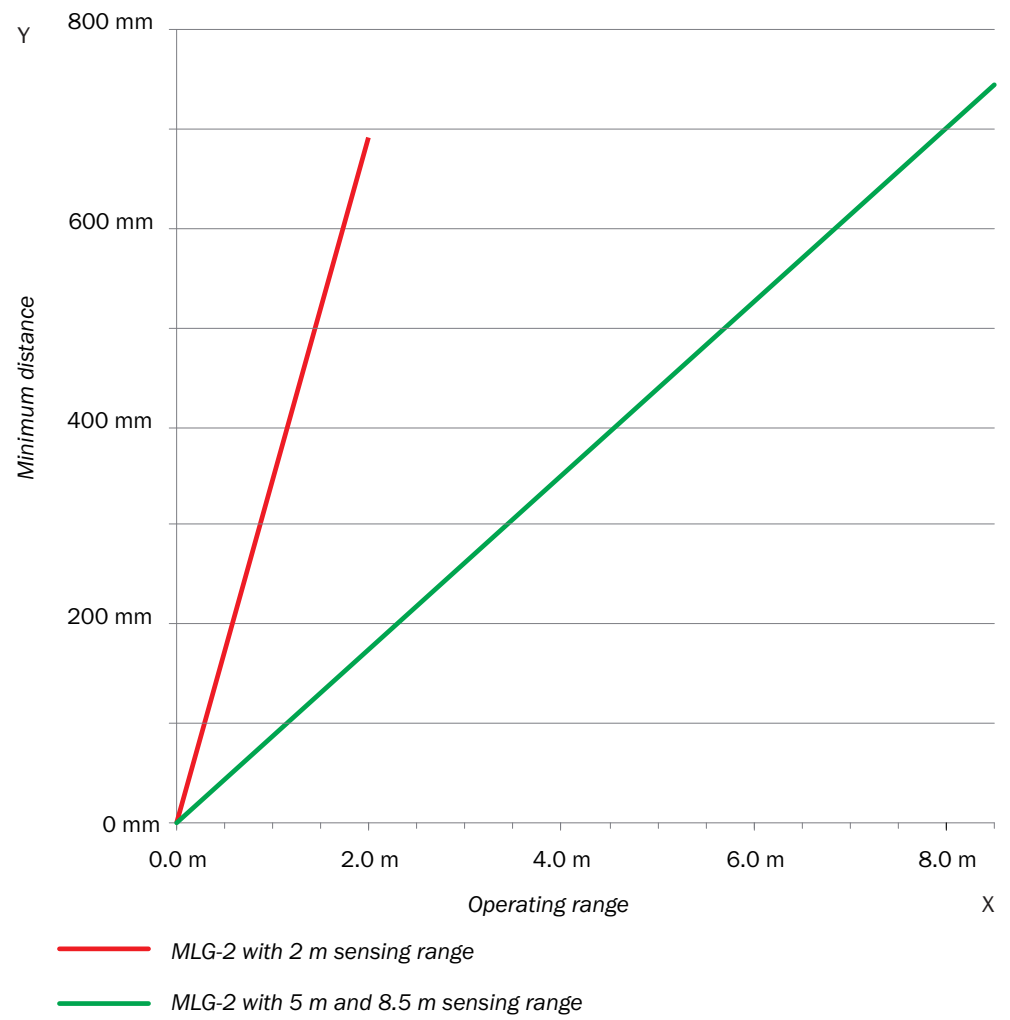|	
X	Operating range
Y	Minimum distance of the MLG-2
Z	Minimum distance of the MLG-2

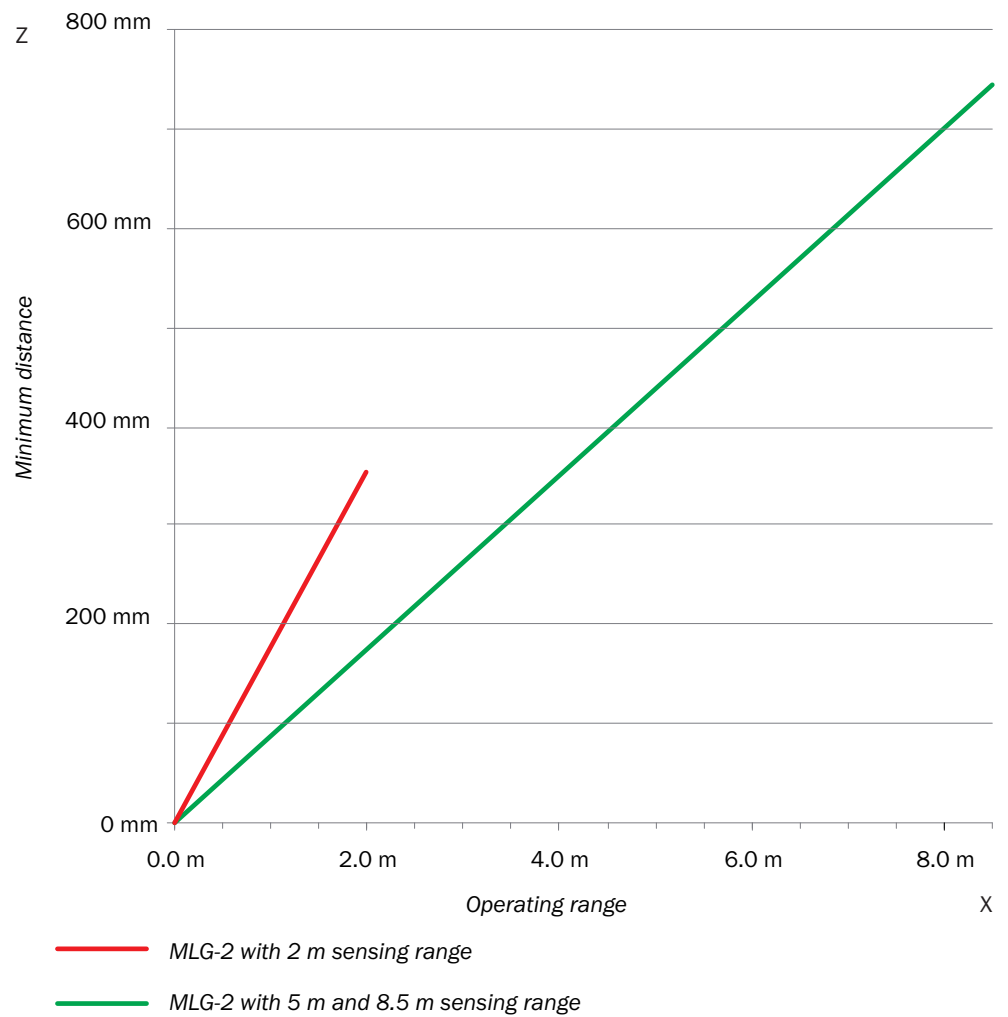*Figure 28: Graph, distances when light is in the same direction*

Figure 29: Graph, distances when light is in the same direction (XZ)

4.2.3 Placement of two light grids at right angles

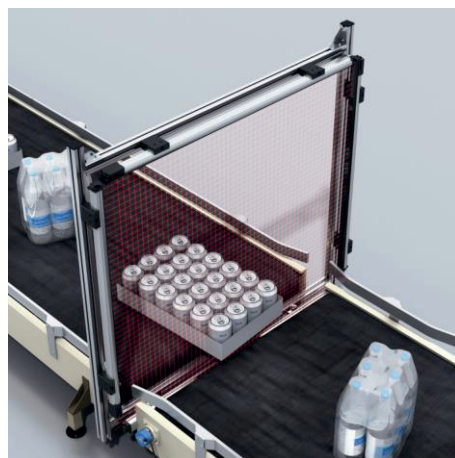Light grids are placed at right angles for volume detection or operator guidance, for example.

Figure 30: Placement of two light grids at right angles

Standby solution

Select the Standby function for both light grids (this function is set under the energy-saving options in SOPAS ET). You should only ever activate one light grid at a time via the relevant inputs.

Test inputs solution

Activate the test inputs of both senders alternately. The beams will be switched off in each case for as long as the test input is active.

Mounting solution

Mount the two MLG-2 as far apart as possible.

4.2.4 Minimum distance from reflective surfaces

Reflective surfaces between the sender and receiver may result in disruptive reflections and beams being deflected and, hence, result in a failure to detect objects.

In the case of reflective surfaces, a minimum distance must be maintained between the reflective surface and the light beams to ensure reliable operation.

This minimum distance depends on the distance between sender and receiver and on the operating range.

MLG-2 with 2 m sensing range [1]
MLG-2 with 2 m sensing range [2]
MLG-2 with 5 m sensing rangev [3]
MLG-2 with 8,5 m sensing range [3]

[1] Applies to reflective surfaces parallel to the housings.
[2] Applies to reflective surfaces perpendicular to the housings.
[3] Applies to reflective surfaces perpendicular and parallel to the housings.
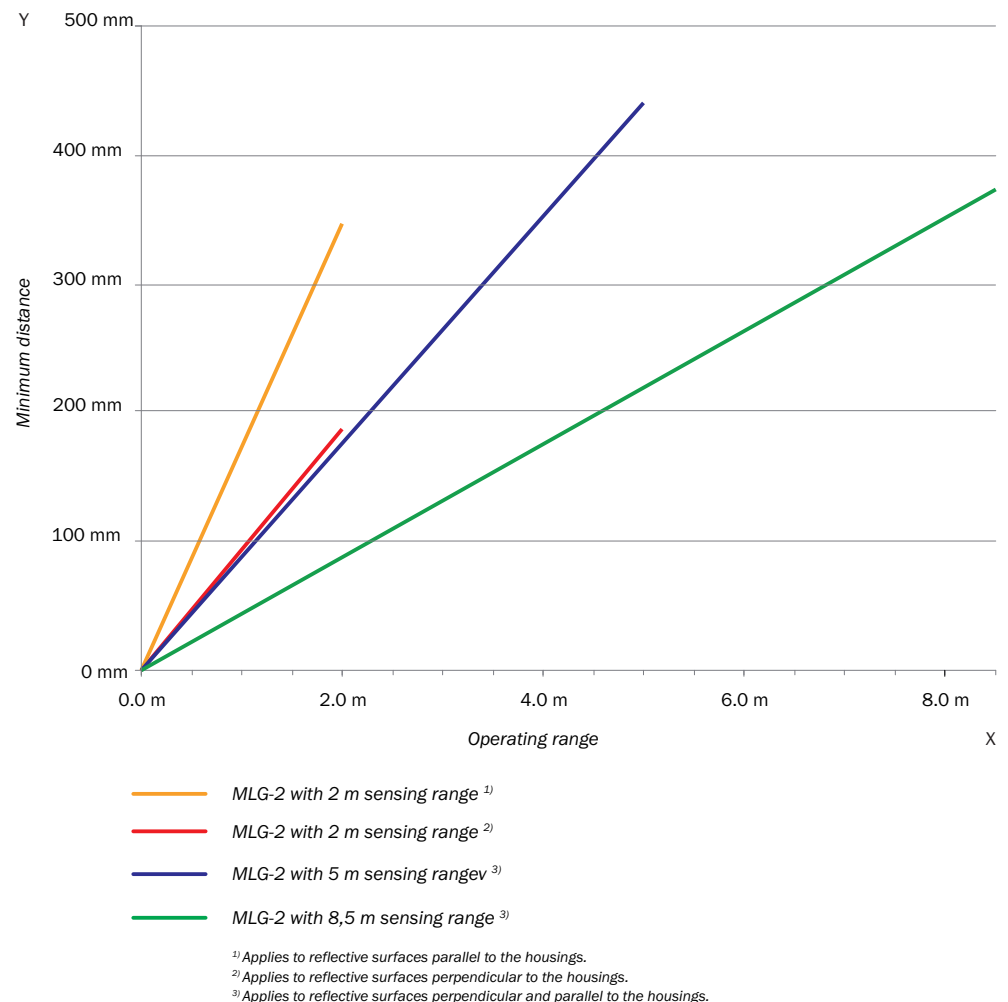
Figure 31: Graph, minimum distance from reflective surfaces

This distance also applies to reflective surfaces located next to the light grid (parallel to the sending/receiving axis).

4.3 Mounting procedure

▶ Mount the sender and receiver at the same height. For minor adjustments when aligning, the sender and receiver can be adjusted in the brackets.

▶ If possible, mount the top bracket at a height such that the offset in the housing of the MLG-2 sits on the bracket. This prevents the MLG-2 from sliding down.
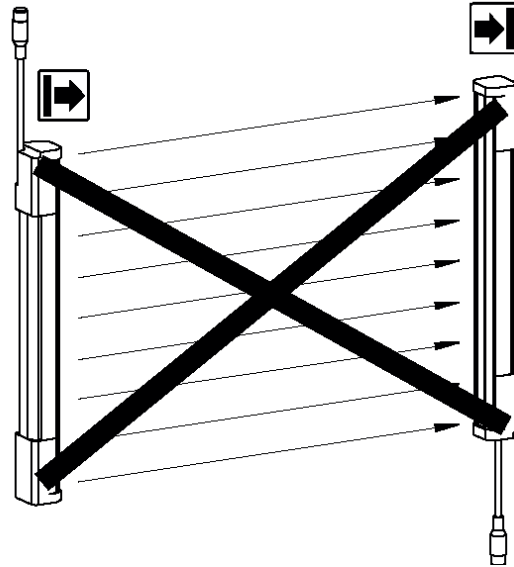

Figure 32: The sender and receiver are aligned incorrectly

The end with the cable connection must point in the same direction for both devices. Sender and receiver must **not be installed at 180° rotated relative to each other**.

Tighten the screws used to mount the bracket to a torque of 5 to 6 Nm. Tighten the screws used to secure the MLG-2 in the bracket to a torque of 2.5 to 3 Nm. Higher torques can damage the bracket while lower torques do not provide adequate fixation to prevent the MLG-2 from moving in the event of vibrations.

When mounting, make sure that sender and receiver are aligned correctly. The optical lens systems of sender and receiver must be located opposite one another. If necessary, use a water level to check the components are parallel.

4.3.1 Mounting the QuickFix bracket

QuickFix brackets can be mounted in two ways:

- On the side
- On the back

The two mounting surfaces for the brackets of the sender or receiver must not be angled more than ±2° to each other. If this is not possible, use the optional FlexFix bracket.

Mounting the QuickFix bracket on the side of a machine or profile frame

Up to a monitoring height of 2 m, the sender and receiver are mounted with two QuickFix brackets each.

For a monitoring height of more than 2 m, the sender and receiver are mounted with three QuickFix brackets each.

The QuickFix bracket consists of two parts, which are pushed into each other. An M5 screw is used to join both parts and to clamp the housing (sender or receiver).

Mounting can be carried out in two ways:

- With the M5 screw through the QuickFix bracket to the machine or profile frame. A screw nut or threaded hole is required on the machine or profile frame.
- With the M5 screw through the machine or profile frame to the QuickFix bracket. A screw nut is required for each QuickFix bracket.

When choosing the length of the M5 screw (hexagon head or cylinder head screw), consider the QuickFix bracket and the machine or profile frame.

⚠️ **CAUTION**
Risk of injury from protruding screw thread!

When mounting through the machine or profile frame to the QuickFix bracket, the M5 screw can present an injury risk if too long.

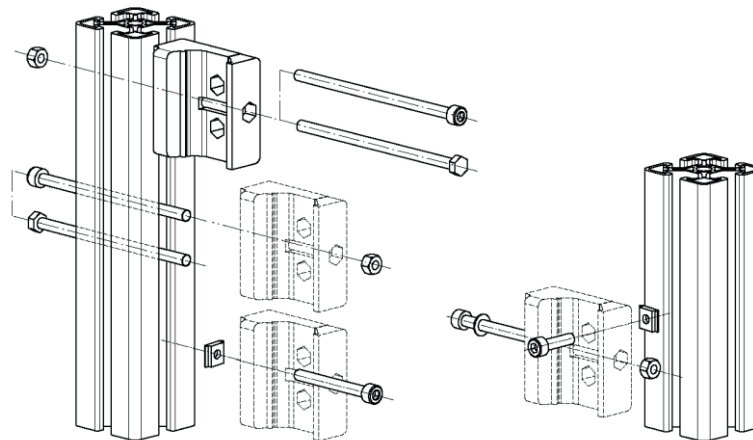▶ Select an appropriate screw length to prevent any risk of injury from an overrun.

Figure 33: Mount QuickFix bracket to a profile frame

Mount QuickFix bracket to the back of a device column

ℹ️ **NOTE**
The QuickFix bracket has cable routing. Depending on the installation, the cable routing can make mounting easier.

The sender and receiver are each mounted with two QuickFix brackets.

The QuickFix bracket consists of two parts, which are pushed into each other. An M5 screw is used to join both parts and to clamp the housing (sender or receiver).

You need two M5 screws per bracket if mounting them on the back.

▶ Choose the length of the M5 screw such that it is possible to clamp the housing (sender or receiver) in the QuickFix bracket.

4.3.2 Mounting the FlexFix bracket

In the FlexFix bracket, sender and receiver can be flexibly rotated by ±15°.

FlexFix brackets can be mounted in two ways:

- On the side
- On the back

Mounting the FlexFix bracket on a profile frame

The sender and receiver are mounted at the designated points using two FlexFix brackets in each case.

M5 screws are inserted through the FlexFix bracket and into the machine or profile frame for mounting. A screw nut or threaded hole is required on the machine or profile frame.
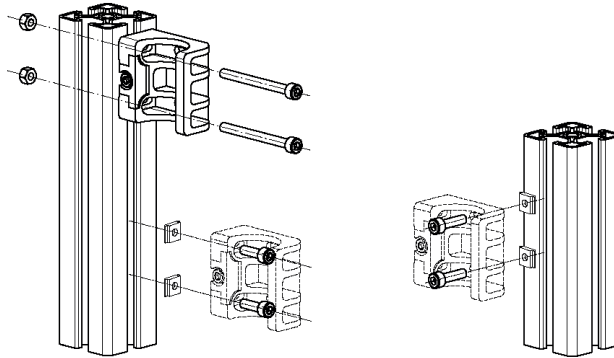

Figure 34: Mounting the FlexFix bracket on a profile frame

Screwing the sender or receiver into the FlexFix brackets

After mounting the FlexFix brackets, screw the sender or receiver into the FlexFix brackets from the front. Then align the sender and receiver.

> **NOTE**
> The MLG-2 can only be screwed in when both FlexFix brackets are in alignment. If necessary, use a water level to check the components are parallel.
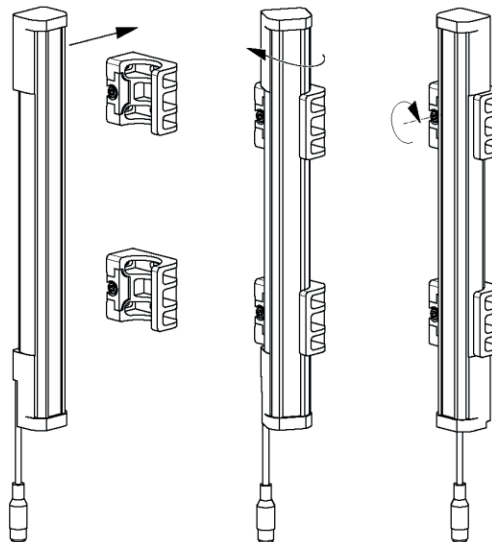

Figure 35: Inserting the MLG-2 in the FlexFix brackets

▶ Use an M5 screw to fix the position of the sender and receiver in the FlexFix bracket.

5   Electrical installation

> ⚠ **CAUTION**
> **De-energize the system!**
> The system could inadvertently start while you are connecting the devices.
>
> ▶   Make sure that the entire system is disconnected from the power supply during the electrical installation work.

> ℹ **NOTE**
> - The MLG-2 complies with the EMC regulations for the industrial sector (Radio Safety Class A). It may cause radio interference if used in a residential area.
> - Do not lay cables parallel to other cables, especially not to devices with a high level of radiated emission, such as a frequency converter.
> - When using cables over 15 m in length, or in locations with a high level of interference, we recommend using a T-distributor in order to connect the sender and receiver via a short synchronization cable wherever possible.

> ⚠ **CAUTION**
> These devices must be fused with a 1 A/30 V DC fuse.

Wire cross-section		Maximum amperage for over-current protection
AWG	mm²	
20	0.52	5
22	0.32	3
24	0.20	2
26	0.13	1
28	0.08	0.8
30	0.05	0.5

Table 23: Overcurrent protection

5.1   MLG2 Pro electrical installation

For the MLG2 Pro, the sender and receiver synchronize with each other electronically. This means that **cabling is required** between the sender and receiver.

You must connect the Sync_A connection on the sender to Sync_A on the receiver, and Sync_B on the sender to Sync_B on the receiver.

To simplify the connections, T-distributors are available so that standard cables can be used for the wiring (see "T-distributor for MLG2 Pro connection", page 46).
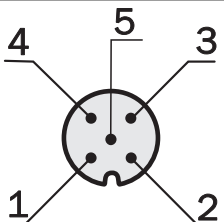
Sender connection: M12/5-pin, A-coded

Male connector	Pin	Signal	Meaning	Color
	1	L+	24 V supply voltage	Brown
	2	Sync_A	Synchronization	White
	3	M	GND supply voltage	Blue
	4	Test_In	Test input	Black
	5	Sync_B	Synchronization	Gray

Table 24: Pin assignment, MLG-2 Pro sender

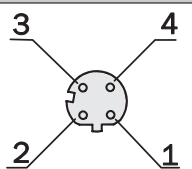**Connection for receiver configuration: M12/4-pin, D-coded**

Female connector	Pin	Signal	Meaning
	1	TX+	Ethernet
	2	RX+	Ethernet
	3	TX−	Ethernet
	4	RX−	Ethernet

Table 25: Pin assignment, MLG2 Pro receiver, Ethernet

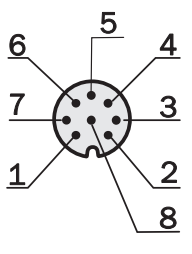**Receiver I/O connection with switching outputs (Q): M12/8-pin, Acoded**

Male connector	Pin	Signal	Meaning	Color
	1	L+	24 V supply voltage	Brown
	2	Sync_A	Synchronization	White
	3	M	GND supply voltage	Blue
	4	Q1/C	Switching output 1 with IO-Link interface	Black
	5	Sync_B	Synchronization	Gray
	6	Q2/IN1	Switching output 2 or Switching input 1[1]	Pink
	7	Q3	Switching output 3	Violet
	8	Q4/IN2	Switching output 4 or Switching input 2[1]	Orange

Table 26: Pin assignment, I/O, MLG2 Pro receiver, with 4 × Q

[1] Configurable

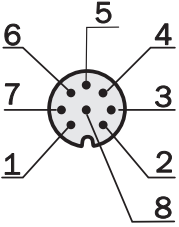**Receiver I/O connection with analog outputs (QA): M12/8-pin, Acoded**

Male connector	Pin	Signal	Meaning	Color
	1	L+	24 V supply voltage	Brown
	2	Sync_A	Synchronization	White
	3	M	GND supply voltage	Blue
	4	Q1/C	Switching output 1 with IO-Link interface	Black
	5	Sync_B	Synchronization	Gray
	6	Q2/IN1	Switching output 2 or Switching input 1[1]	Pink
	7	QA1	Analog output 1	Violet
	8	QA2	Analog output 2	Orange

Table 27: Pin assignment, I/O, MLG2 Pro receiver, with QA

[1]   Configurable

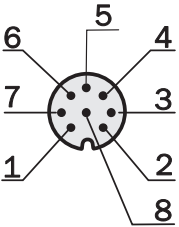### Receiver I/O connection with RS485 interface: M12/8-pin, A-coded

Male connector	Pin	Signal	Meaning	Color
	1	L+	24 V supply voltage	Brown
	2	Sync_A	Synchronization	White
	3	M	GND supply voltage	Blue
	4	Q1/C	Switching output 1 with IO-Link interface	Black
	5	Sync_B	Synchronization	Gray
	6	Q2/IN1	Switching output 2 or Switching input 1[1]	Pink
	7	RS485_A	RS-485 interface	Violet
	8	RS485_B	RS485 interface	Orange

Table 28: Pin assignment, I/O, MLG2 Pro receiver, with RS-485

[1]   Configurable

5.1.1 T-distributor for MLG2 Pro connection

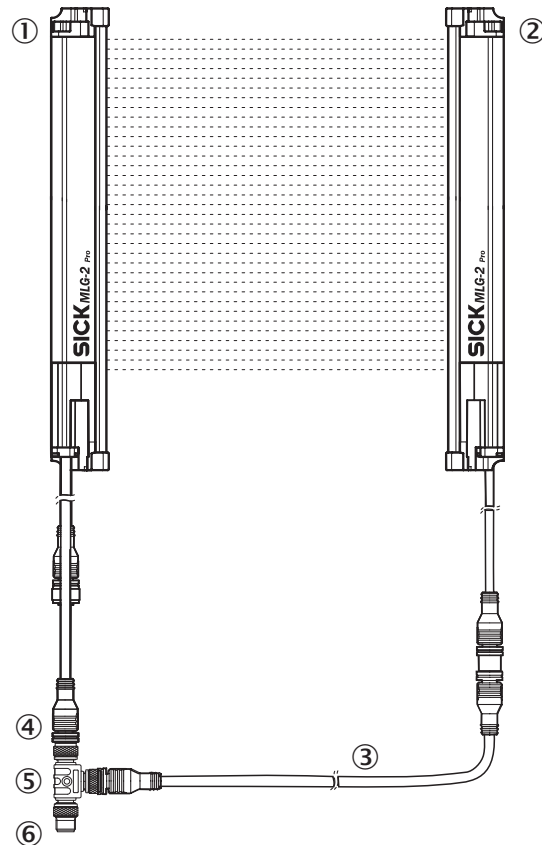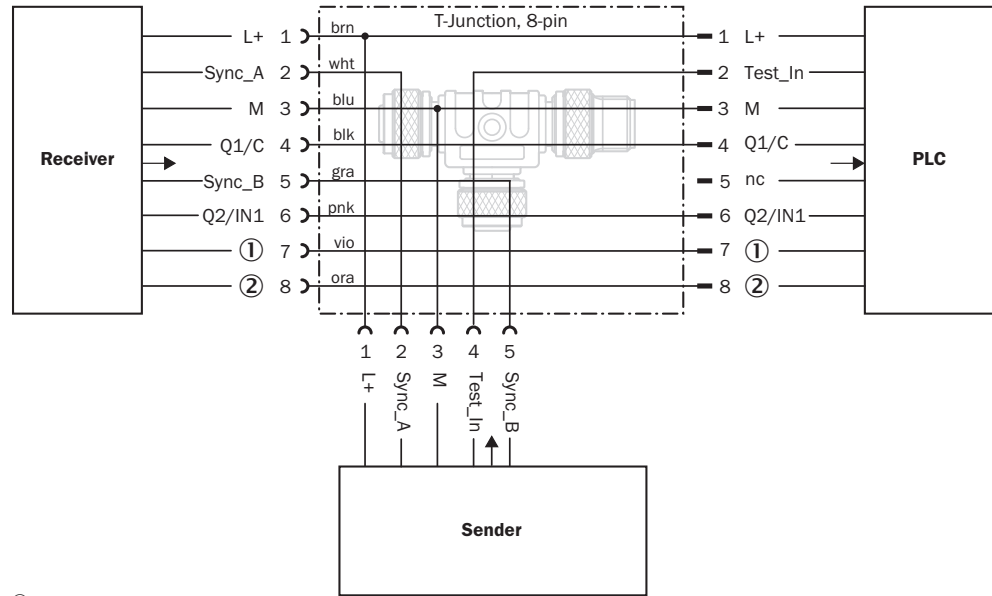*Figure 36: T-distributor connection*

①   MLG-2 receiver
②   MLG-2 sender
③   Connection cable
④   MLG-2 connection
⑤   T-distributor
⑥   Connection to PLC, IO-Linkfield module in place of a first-generation MLG

For the MLG-2 Pro, there are three T-distributors available which are used to connect the sender and receiver to one another, as well as provide connection facilities for the following options:

- Connection to a PLC, for example
- Connection to an IO-Linkfield module
- Connection in place of a first-generation MLG
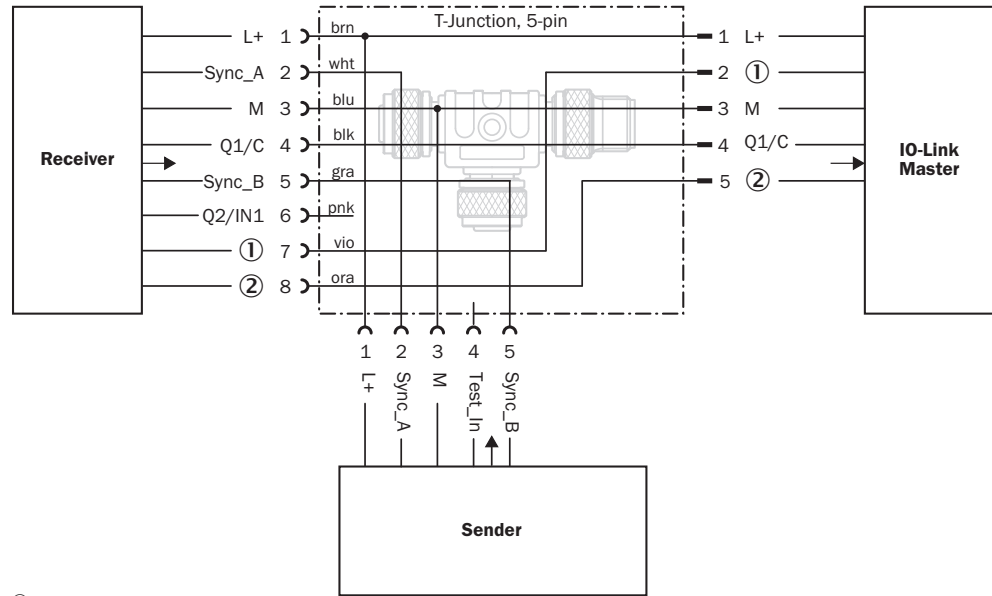
Sender, receiver, PLC connection

① Q3/QA1/RS-485_A
② Q4/IN2/QA2/RS-485_B

Figure 37: T-distributor for sender, receiver, PLC

Male connector	Pin	Signal	Meaning
	1	L+	24 V supply voltage
	2	Test_In	Test input
	3	M	GND supply voltage
	4	Q1/C	Switching output 1 with IO-Link interface
	5	Not connected	Not connected
	6	Q2 IN1	Switching output 2 or Switching input 1
	7	Q3 QA1 RS485_A	Switching output 3 or Analog output 1 or RS-485 interface
	8	Q4 IN2 QA2 RS485_B	Switching output 4 or Switching input 2 or Analog output 2 or RS-485 interface

Table 29: Pin assignment of the PLC connection

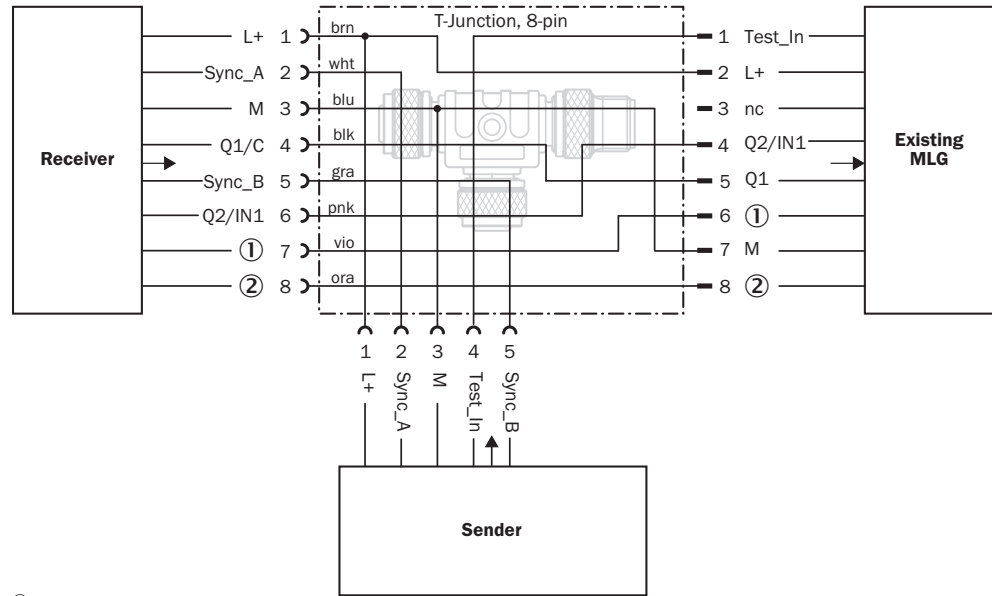**Sender, receiver, IO-Link master connection**

① Q3/QA1/RS-485_A
② Q4/IN2/QA2/RS-485_B

Figure 38: T-distributor for sender, receiver, IO-Link master

Male connector	Pin	Signal	Meaning
	1	L+	24 V supply voltage
	2	Q3 QA1 RS485_A	Switching output 3 or Analog output 1 or RS-485 interface
	3	M	GND supply voltage
	4	Q1/C	Switching output 1 with IO-Link interface
	5	Q4 IN2 QA2 RS485_B	Switching output 4 or Switching input 2 or Analog output 2 or RS-485 interface

Table 30: Pin assignment of the IO-Link master connection

Connection between sender, receiver, existing MLG connection

① Q3/QA1/RS-485_A
② Q4/IN2/QA2/RS-485_B

Figure 39: T-distributor for sender, receiver, existing MLG connection

Male connector	Pin	Signal	Meaning
	1	Test_In	Test input
	2	L+	24 V supply voltage
	3	Not connected	Not connected
	4	Q2 IN1	Switching output 2 or Switching input 1[1, 2]
	5	Q1	Switching output 1
	6	Q3 QA1 RS485_A	Switching output 3 or Analog output 1 or RS-485 interface
	7	M	GND supply voltage
	8	Q4 IN2 QA2 RS485_B	Switching output 4 or Switching input 2 or Analog output 2 or RS-485 interface

Table 31: Pin assignment of the existing MLG connection

[1] Can be configured for MLG-2 Pro
[2] To replace a first-generation MLG, you must configure Q2/IN1 as an input.

6 Commissioning

6.1 Mechanical alignment of sender and receiver

After mounting and electrical installation, the sender and receiver must be aligned with each other. No objects should be located between the sender and the receiver. The light path must be clear.

Alignment with the QuickFix bracket

You have the following adjustment options with the QuickFix bracket:
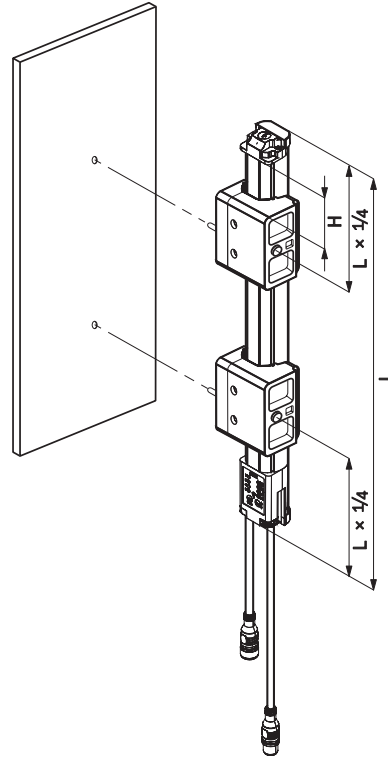
- Adjust vertically (H)

Figure 40: Alignment with the QuickFix bracket

Alignment with the FlexFix bracket

You have the following adjustment options with the FlexFix bracket:

- Adjust vertically (H)
- Rotate (± 15°)
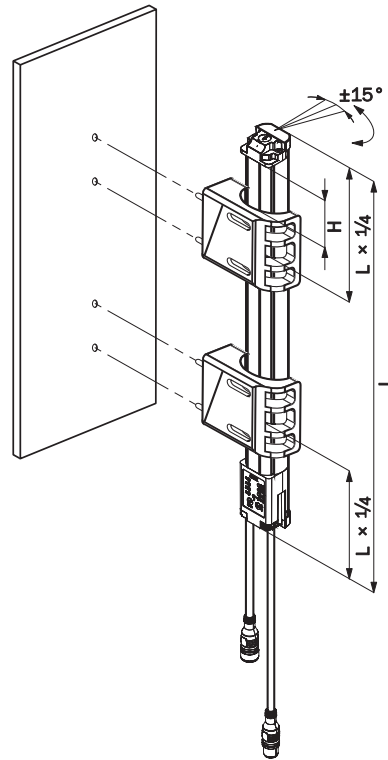
Figure 41: Alignment with the FlexFix bracket

6.2   Alignment and teach-in

To ensure the alignment aid works perfectly, the device should be rotated once from the left bracket stop to the right stop. This makes the best possible settings for the input sensitivity and ensures that the alignment aid shows the most helpful values.
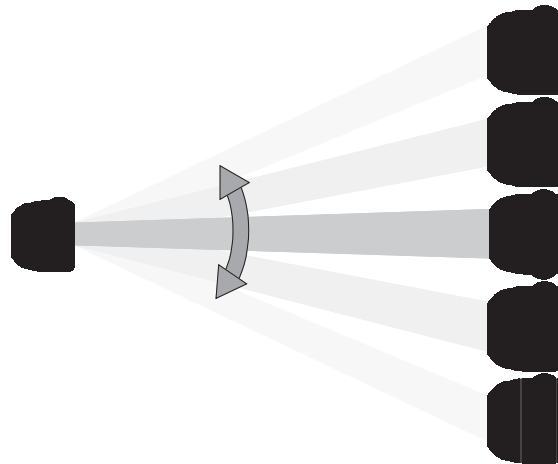
Figure 42: Rotate the receiver once

6.2.1   MLG-2 Pro

The yellow LED on the front of the receiver and the **Alignment** LED show the rough alignment.
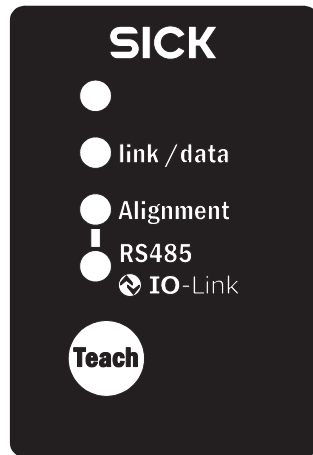
Figure 43: Control panel of the MLG-2 Pro

☀ 3 Hz yellow

The yellow LED on the front flashes rapidly.

▶ Improve the alignment of the MLG-2.
  ○
  When the yellow LED and the **Alignment** LED go out, the MLG-2 is optimally aligned.

> **i** **NOTE**
> With the MLG-2 Pro, SOPAS ET will help you to align the device and teach-in the sensitivity (see "Teach-in", page 90).

▶ Now fix the position of the sender and receiver.

Teach-in

▶ Press the **Teach** pushbutton (< 1 s).[3]
✓ **☀ 1 Hz yellow**
✓ The yellow LED on the front and the **Alignment** LED flash slowly.

If the teach-in process is successful, the yellow LED on the front and the **Alignment** LED go out. The MLG-2 is operational.

If the teach-in process is unsuccessful, the Alignment and RS-485/IO-Link LEDs flash rapidly, as does the red LED on the front of the device.

▶ Check that the MLG-2 is correctly aligned, that the front screens are clean and that there are no objects located in the light path.
▶ Then carry out the teach-in process again.

---

[3] On the MLG-2 Pro, the teach-in process can also be triggered via SOPAS ET, IO-Link, the integrated web server or the Teach input.

7 Configuration with SOPAS ET

7.1 Preparation

7.1.1 Installing the software

SOPAS ET 3.0 or higher is required for configuring the MLG-2.

The latest version of SOPAS ET can be found at **www.sick.de** > Search > SOPAS.

Please note the system requirements for SOPAS ET. These requirements are specified on the download website:

▶ Run the setup.exe from the download website.
▶ Follow the instructions in the Setup wizard.

Ethernet settings

The MLG-2 is shipped with the following IP network configuration:
▪ DHCP activated.
▪ IP address: 192.168.200.100
▪ Subnet mask: 255.255.255.0

You can change the IP network configuration in SOPAS ET.

If you would like the MLG-2 to acquire an IP address from a DHCP server, DHCP must be activated. If the MLG-2 is unable to locate a DHCP server, the MLG-2 will use the IP address 192.168.200.100.

Starting the software

Use the application **SICK** > **SOPAS Engineering Tool** > **Sopas** from the Start menu to configure the MLG-2.

7.1.2 Device selection

A SOPAS Device Description (SDD) is required in order to configure the MLG-2.

Detecting a connected device

When an MLG-2 is connected to the PC/notebook via Ethernet, the SDD can be loaded directly from the device and SOPAS ET will detect the MLG-2 type automatically.

Configuring a device offline

Alternatively, you can select the MLG-2 type offline using the device selection wizard. To do this, you must load the SDD from the Internet. This requires an Internet connection.

You can either enter the type code of the MLG-2 directly into the device selection wizard or define the following criteria:

• Monitoring height
• Maximum sensing range
• Interface (number and type of inputs and outputs)
• Size of the smallest object in the application

Once you have selected the desired MLG-2, the configuration interface/wizard starts up.

(i) NOTE
If you configure a device offline, you must then connect the PC to the MLG-2 and download the MLG-2 configuration.

7.2 SOPAS ET interface

At the top of the interface, you can change the MLG-2 type, the operating mode, and the user level.
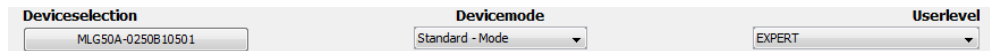

Figure 44: Device selection, operating mode and user level

Device selection

If you carry out the configuration offline (without a connected MLG-2), you can change the MLG-2 type via the button shown on the left.

If the MLG-2 is online, the type code of the MLG-2 will be displayed.

Operating modes

The MLG-2 has the following operating modes:

- Standard
  For normal measuring tasks involving opaque objects (recommended for the majority of applications)
- Transparent
  For transparent objects, e.g., made of glass, PET, etc.
- Dust- and sunlight-resistant
  For applications when there is a large amount of dust in the environment or a high level of solar radiation

> **NOTE**
> When the operating mode is changed, a new teach-in process must be performed.

The choice of operating mode affects the performance options.

User level

The configuration is divided into two user levels.

The user level **EASY** shows only the parameters that are absolutely necessary and is a quick way of completing the task. This level is automatically activated when SOPAS ET starts up.

For experienced users or those with more complex requirements, the user level **EXPERT** allows you to configure all of the parameters.
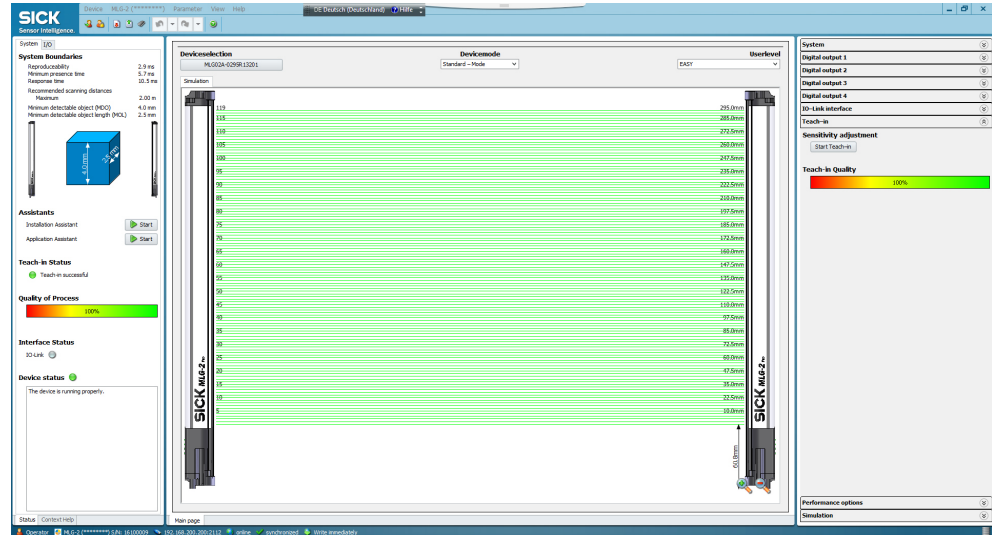
Three-part interface

Figure 45: SOPAS ET interface

The **left-hand side** of the graphical interface provides information on the system boundaries, the status and the interfaces of the connected MLG-2.

The **central** area shows a simulation of the light grid and its beams.

The **right-hand side** of the interface lists the available options in expandable menus.

7.2.1   System boundaries, status, and interfaces

System boundaries
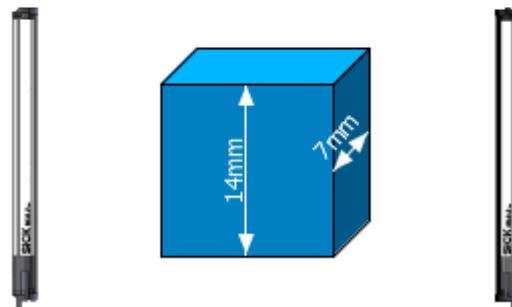
Figure 46: Display of the system boundaries

Under "System boundaries", SOPAS ET displays the reproducibility, minimum presence time, and response time ().

SOPAS ET displays the maximum recommended sensing range with which the MLG-2 can be safely operated.

The minimum detectable object (MDO) and the minimum detectable object length (MOL) are shown in millimeters as well as graphically.

The system boundaries are largely dependent on the configured performance options (see "Performance options", page 93).

Wizards

Figure 47: Wizards

You can start the Installation Wizard or Application Wizard under **Wizards**.

- The **Installation Wizard** will help you to align the MLG-2 and carry out the teach-in process.
- The **Application Wizard** will help you to configure the settings for the switching outputs (also called digital outputs) or analog outputs of the MLG-2. Only the necessary adjustments for the MLG-2 will be offered, according to the choice of application.

Recommendation

Use this wizard for the initial configuration of a device. The separate adjustments available in the main interface allow the user to make specific changes to the configuration.

Status inputs/outputs

Under **Status inputs/outputs**, SOPAS ET shows the status of the switching outputs and the analog outputs as well as the digital inputs (depending on the I/O configuration).

Figure 48: Status display for inputs and outputs

Next to the relevant indicators, you will find the function configured for the inputs and outputs.

Example:

- For Q1, LBB ≥ 13 is configured, the output is switched because the condition has been met.
- IN2 is configured as the input for teach-in.
- NBM is configured for QA1.
  The upright triangle indicates that the analog value is changing from 4 mA to 20 mA.
- ODI is configured for QA2.
  The inverted triangle indicates that the analog value is changing from 20 mA to 4 mA.

> **NOTE**
>
> As of firmware version V.1.4.0, the status of the inputs/outputs is now located in the new I/O tab. An overview of the basic functions and the run-length code values are also available in the new tab.
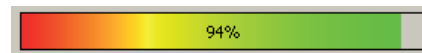

Process quality

Figure 49: Display of the process quality

SOPAS ET shows the process quality as a percentage and as a colored bar.

Interface status

SOPAS ET displays the status of communication via the respective interface.

- Green = Communication active
- Gray = Communication not active

Device status

SOPAS ET displays the device status via a colored indicator and in the form of plain text:

- Green = System running properly
- Yellow = Warning pending
- Red = Error has occurred

7.2.2 Basic functions and status of the output

Basic functions

Under **Basic functions**, you will find the following information:

- The current values for the beam functions (see "Beam functions", page 107)
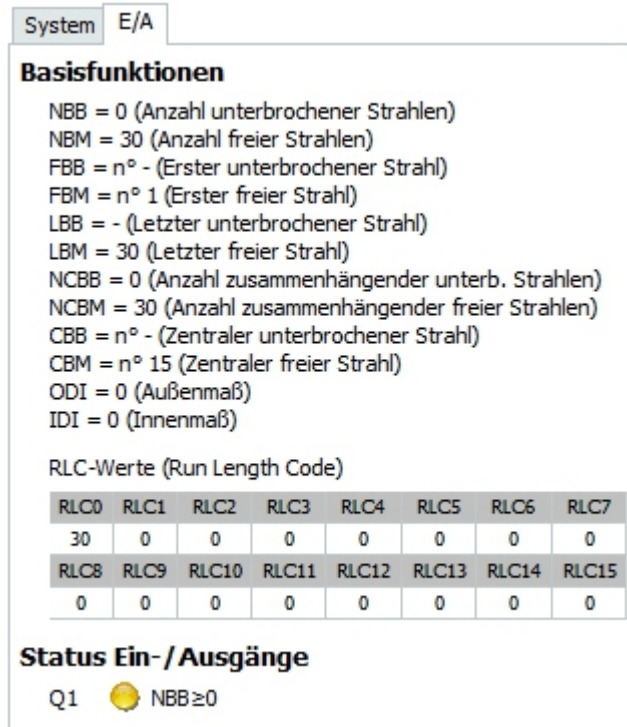- The current values for the run-length code

Figure 50: Basic functions and status of the output

Status inputs/outputs

Under **Status inputs/outputs**, SOPAS ET shows the status of the switching output.

Next to the indicator, you will find the function configured for the output.

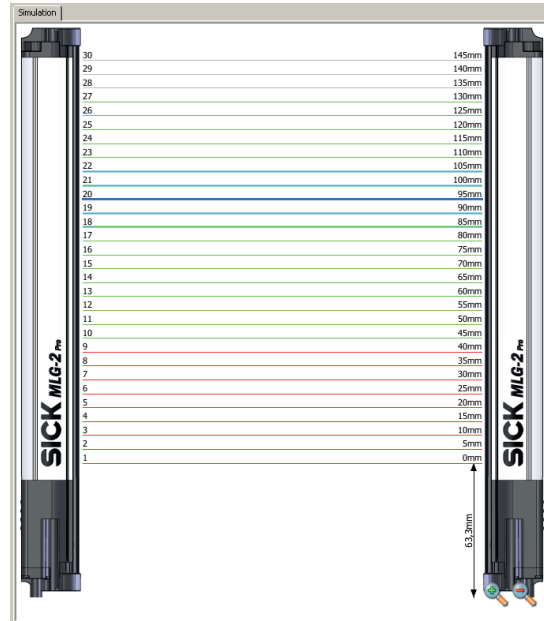### 7.2.3   Representation of the detection area

Figure 51: Detection area – Simulation

The **central** area of the SOPAS ET interface shows a simulation of the MLG-2 and its beams:

- Green = made beams
- Red = Blocked beams
- Gray = Blanked beams
- Blue = Beams selected with the mouse
- Turquoise = Configured tolerance

You can use the context menu to perform certain actions with the selected beams.

Context menu – Combining beams into zones

▶   Select multiple consecutive beams.
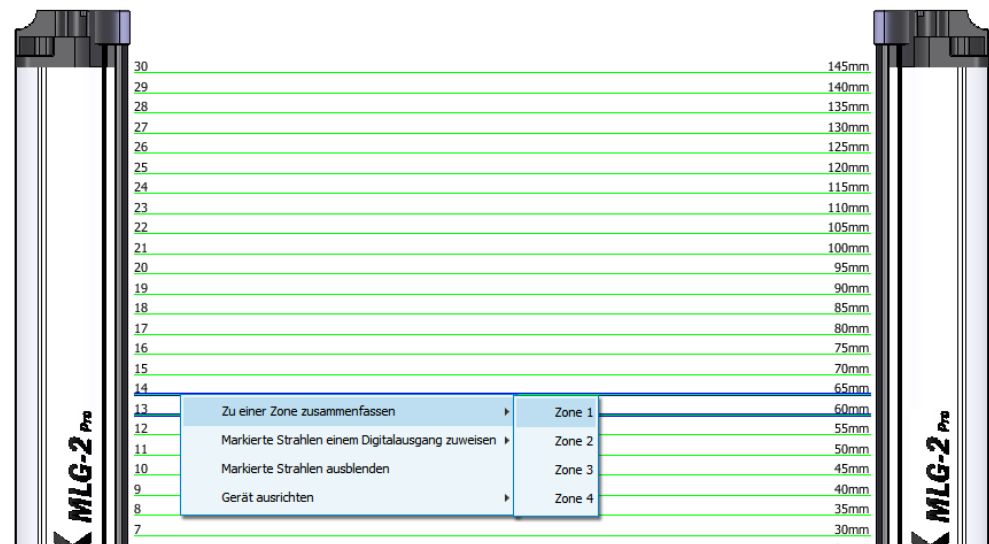▶   In the context menu, select the command **Combine to a zone > Zone X**.

Figure 52: Combining beams into zones

First, configure a zone in the beam window. In the example, beams 13 and 14 are combined into one zone. Next, assign an application and a zone to the desired output (see ""Zone measuring" function", page 85).

Context menu – Using beams for object recognition

▶   Select several beams (by pressing the Ctrl key).

▶   In the context menu, select the command **Use marked beams for switching output > as object to recognize > assign to Qx**
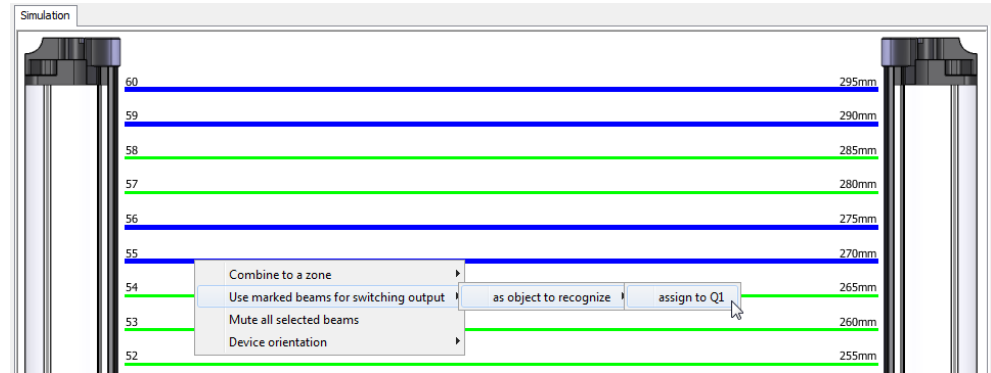

Figure 53: Using beams for object recognition

In the example, beams 10 and 11 and beams 14 and 15 are assigned to output Q1. If these beams are blocked, output Q1 switches. The object size may vary positively or negatively by the number of tolerance beams set (see "Object recognition", page 69).

Context menu – Using beams for height classification

▶   Select a beam.

▶   In the context menu, select the command **Use marked beams for switching output > as maximum height > assign to Qx**.
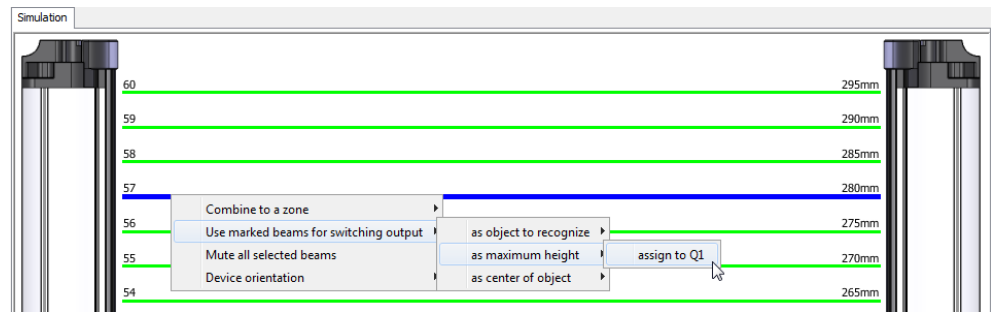

Figure 54: Using beams for height classification

In the example, beam 12 is assigned to output Q1. If the last beam blocked is greater than or equal to beam 12, output Q1 switches.

Context menu – Using beams to classify the object position

▶   Select a beam.

▶   In the context menu, select the command **Use marked beams for switching output > as center of object > assign to Qx**.
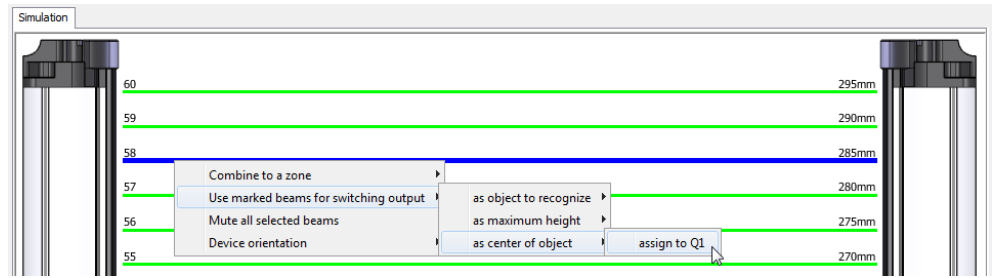
Figure 55: Using beams to classify the object position

In the example, beam 13 is assigned to output Q1. If beam 13 is detected as the center of the object (e.g., beams 12, 13, 14 or beams 11, 12, 13, 14, 15 are blocked), output Q1 switches.

Context menu – Blanking beams

▸   Select one or more beams (press the Ctrl key to select several beams).
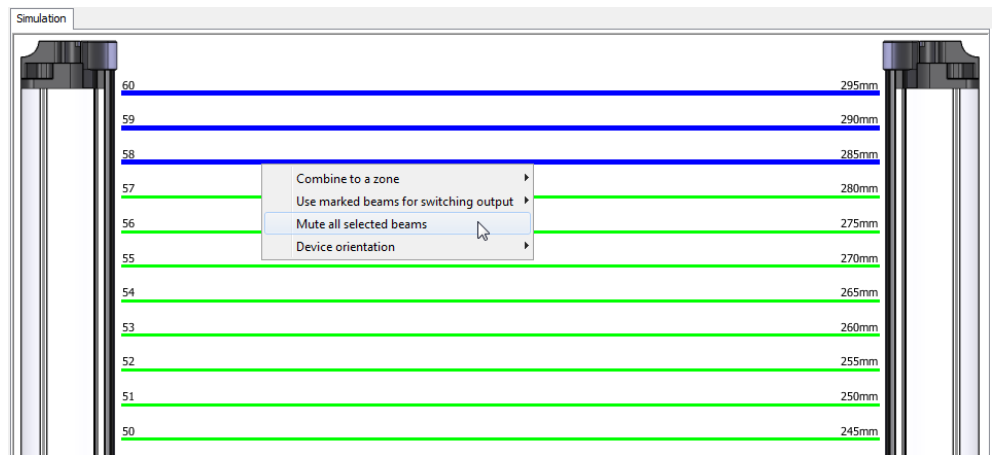▸   In the context menu, select the command **Blank all selected beams**.

Figure 56: Blanking beams

In the example, beams 13, 14, and 15 are selected and blanked. They are shown in gray and excluded from the measurement.
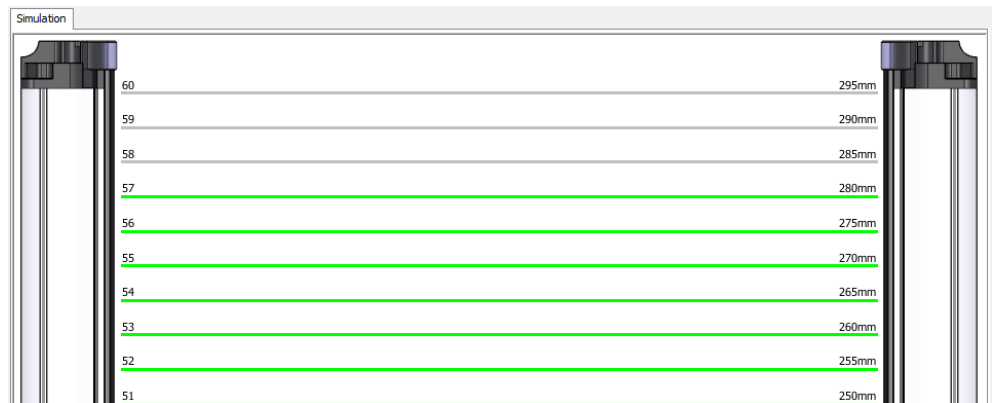

Figure 57: Blanked beams

Context menu – Rotate the MLG-2 display

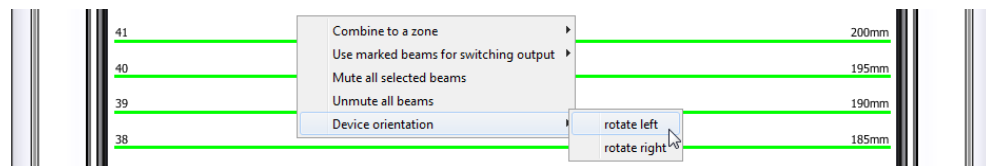The display of the MLG-2 can be adapted for particular applications.

Figure 58: Rotate the MLG-2 display

▶ In the context menu, select the command **Device orientation** > **rotate left** or > **rotate right.**
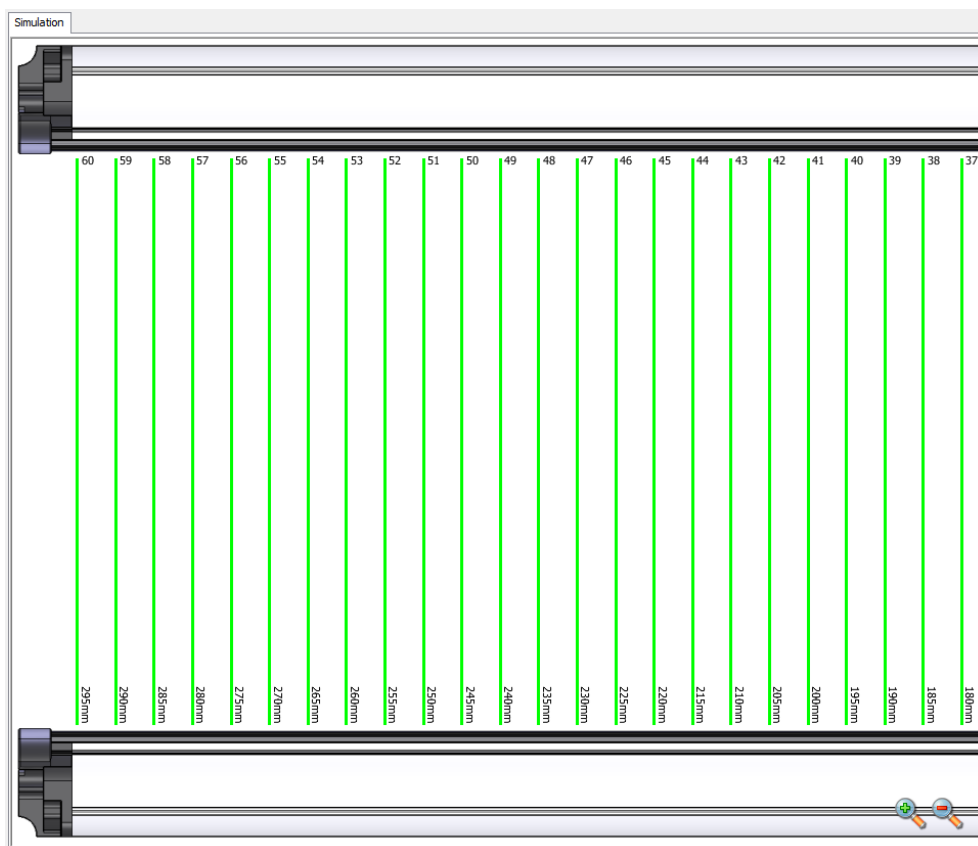

Figure 59: Display of the MLG-2 rotated

Repeat this process until you are happy with how the image appears.

7.2.4 Expandable menus

The expandable menus on the right-hand side help you to configure the MLG-2.

Figure 60: Expandable menus for configuration

▶ Click on the double arrow to open the expandable menu.
▶ To close the expandable menu, click the double arrow – which is now inverted – again.

Configuring the outputs

When the MLG-2 is online, the configuration of the outputs is written to the device and transferred immediately to the status indicator for the outputs. You will see the response of the outputs immediately in the status indicator.
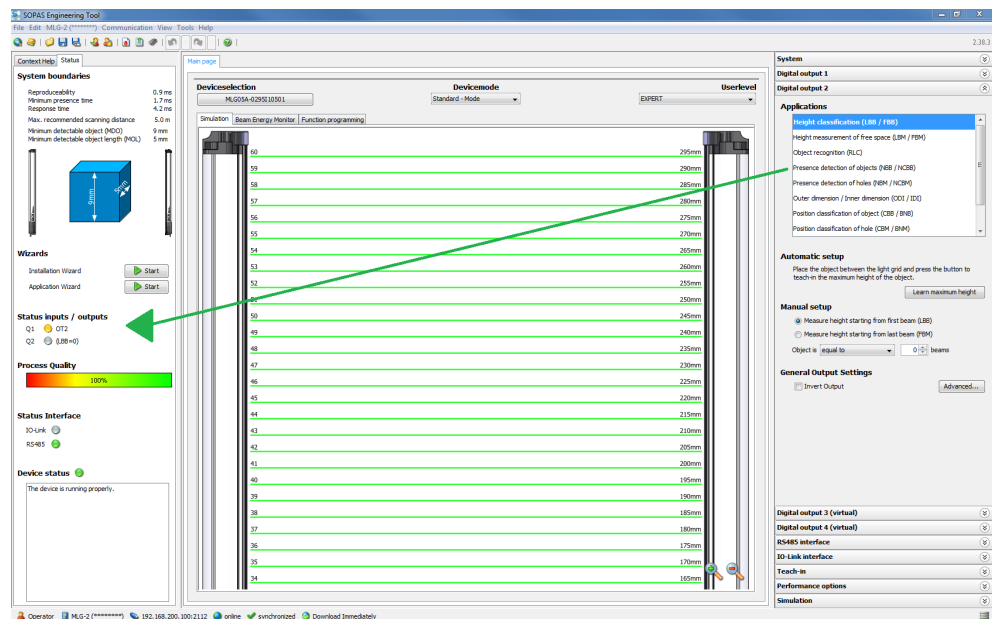

Figure 61: Effect of the output configuration on the status indicator

Configuring the performance options

When the MLG-2 is online, the performance options are written to the device and displayed immediately in the system boundaries (it may be necessary to perform a teach-in process after changing the performance options).
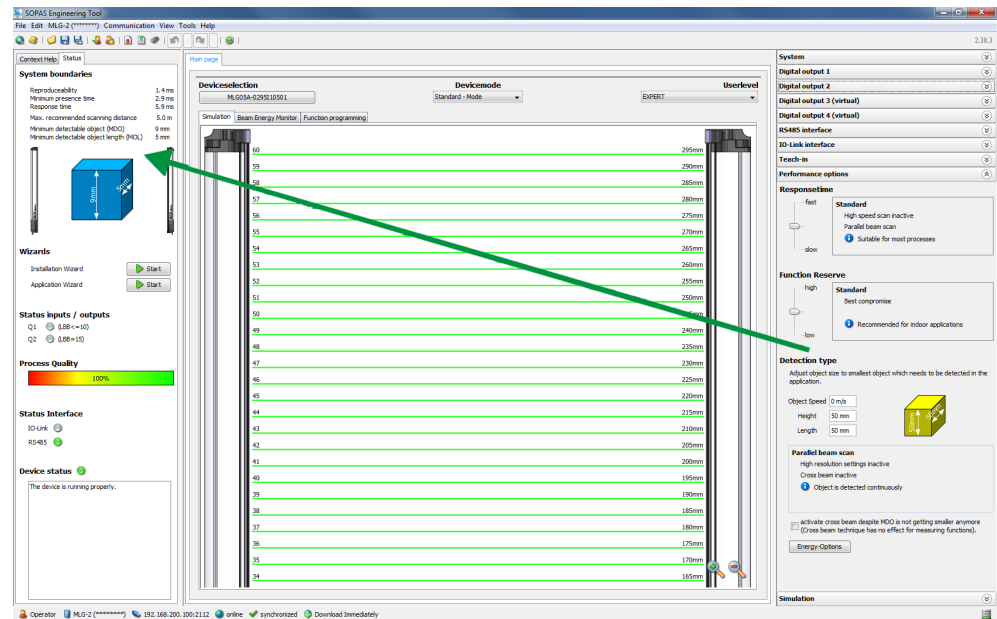
Figure 62: Effects of the performance options on the system boundaries

7.3 System settings

7.3.1 System settings for the user levels EASY and EXPERT

Identification

The **identification** area contains the following information:

- Type code
- Order number
- Manufacturer
- Serial number
- User-defined device name
  You can enter a description of the application or usage of the MLG-2 here.

Version

The **Version** area contains the following information:

- Hardware version
- Software version

IO-Link

The **IO-Link** area contains the following information:

- IO-Link revision
- Minimum cycle time in ms
- Switching operation supported (yes or no)
- Length of the process data from the MLG-2 to the PLC in bytes
- Length of the process data from the PLC to the MLG-2 in bytes

Pushbutton lock

You can use the pushbutton lock to set two options for the teach-in button on the device:

- Released: A teach-in process can be triggered using the button.
- Locked: The teach-in button is locked to prevent inadvertent actuation, for example.

7.3.2 System settings for the EXPERT user level

I/O configuration

You can configure the inputs or outputs according to the type of MLG-2.

I/O configuration

I/O No.	Pin No.	Pin configuration
1	4	OUTPUT
2	6	INPUT

Figure 63: I/O configuration

The table shows the inputs and outputs, the relevant pins on the connection and the current configuration.

The following configuration options are available:

- **Output,** the connection is configured as an output
- **Input,** the connection is configured as an input
- **Not defined,** the connection has not been activated (either as an input or an output)

> **ℹ NOTE**
>
> If you change the configuration of a connection, all of the functions that have been configured for the input (e.g., as teach-in) or the output (e.g., for object recognition) will be lost.

Beam numbering

On delivery, beam 1 is located on the connection side of the MLG-2. You can choose to configure the MLG-2 so that the beam numbering begins at the top.
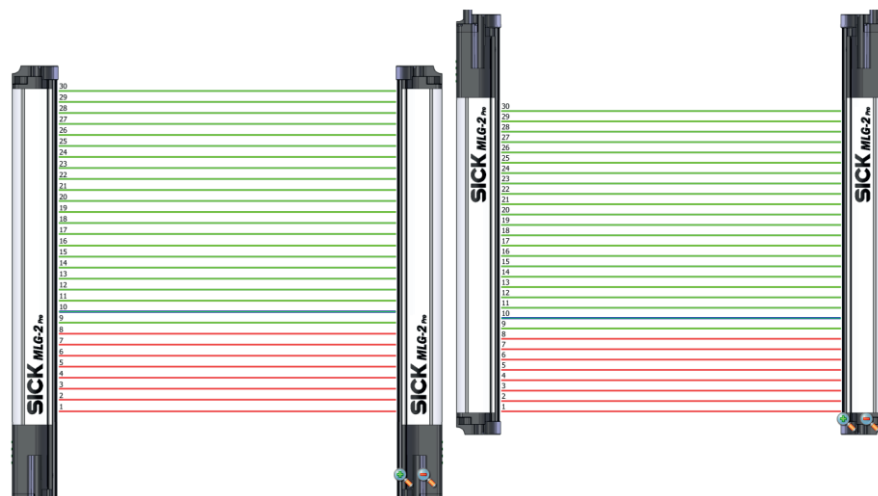

Figure 64: Beam numbering

This might be a good idea, for example, if you mount the MLG-2 with the connections facing upward, but still want to measure height classification from the bottom.

> ℹ️ **NOTE**
> Beam numbering has consequences for the beam functions FBB, FBM, LBB, LBM, CBB, CBM, RLC, and on the beam status.

> ℹ️ **NOTE**
> This affects measuring functions that have already been configured. In the example, a height classification is configured with the 10th beam (blue).

Pushbutton lock

You can use the pushbutton lock to set two options for the teach-in button on the device:

- Released: A teach-in process can be triggered using the button.
- Locked: The teach-in button is locked to prevent inadvertent actuation, for example.

Reset

You have the option to reset the MLG-2 to the factory settings.

If you reset to factory settings, you will lose all data that has already been configured.

> ℹ️ **NOTE**
> - The factory settings are restored as soon as 1 is written.
> - The MLG-2 will be reset too. Therefore, the control reports, where necessary, an error that the MLG-2 is no longer available.
> - The following applies after resetting to factory settings:
>   - No process data such as beam functions or beam status is output.
>   - The alignment aid is active.
>   - A teach-in is required. All functions become available again only after a successful teach-in process.

The **Reset** command sets the MLG-2 back to the **factory settings**.

Ethernet

In the Ethernet area, you can select the option **DHCP** or **Static** in the **Addressing mode** field.

For the "Static" addressing mode, you can change the IP address, the subnet mask and the gateway address. The MAC address is also displayed.

> ℹ️ **NOTE**
> **Only make changes if you know your network very well and you know what effect the changes will have on the settings!**

7.4 Measuring and diagnostic functions for switching outputs

A measuring or diagnostic function can be configured for each switching output on the MLG2. If the criteria configured for the function are met, this is signaled on the relevant output.

All measuring functions can be configured manually. The configurable details are shown for the selected measuring function.

For the **height classification** and **object recognition** measuring functions, objects that are actually in the detection area can be defined automatically.

The measuring functions that have been set are shown graphically in the Simulation area and can be edited here using the mouse.
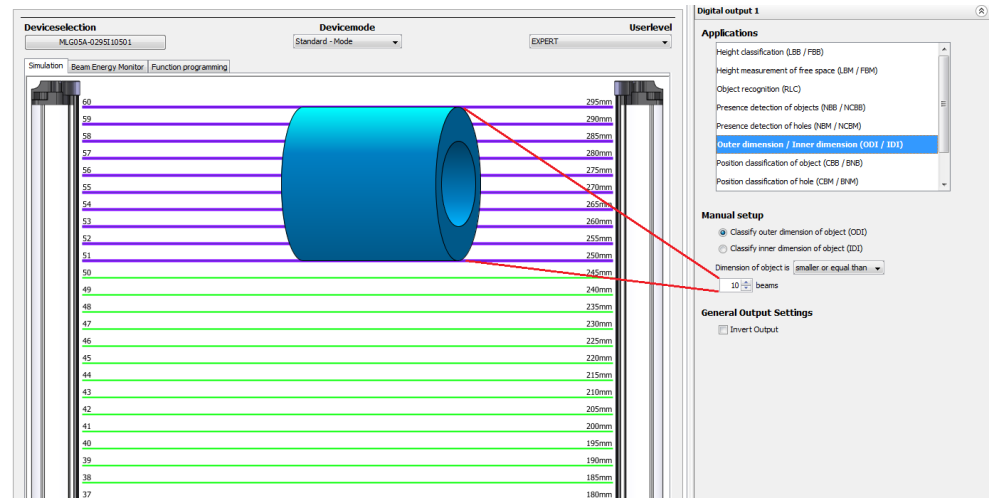

Figure 65: Example representation of the outer dimension

The results of the measuring functions are shown on the status display for the outputs (see "Basic functions and status of the output", page 58).

> **NOTE**
> The configuration of the switching outputs is linked to the function programming option (only visible in the **EXPERT** user level). Settings made when configuring the outputs are also shown in the function programming option. If very complex configurations are created for an output in the function programming option, these can no longer be changed in the configuration of the switching outputs.

7.4.1 Height classification

A switching output switches when the measured object corresponds to the configured or defined height.

Automatic configuration

SOPAS ET can teach in the maximum object height automatically.

The output becomes active when an object is larger than the defined object. The device checks, therefore, whether an object exceeds a certain height.

▶ Place or hang the object in the detection area of the MLG-2.
▶ Click **Learn maximum height.**
The measurement is taken from the top or bottom automatically, depending on the alignment of the object.
The algorithm first checks whether the first or last beam is blocked:
– If the first beam is blocked, the height is measured from the bottom[4] .
– If the last beam is blocked, the height is measured from the top[4] .
If both the first and last beams are made or blocked, the optical center of gravity is determined.
– If more beams are blocked on the side of the first beam, the height is measured from the bottom.
– If more beams are blocked on the side of the last beam, the height is measured from the top.

---

[4] Applies when light grid is mounted upright with the connection side facing down and beam numbering beginning on the connection side (factory setting).

ℹ NOTE

Blocked beams are shown in the simulation in red and made beams are shown in green. The automatically defined object height can be further adjusted afterward.

Manual configuration

▶ Select the beam from which the height is to be measured:
  – Height measured from last beam
  – Height measured from first beam
▶ Select one of the following settings for the height classification and enter the number of beams **n**:
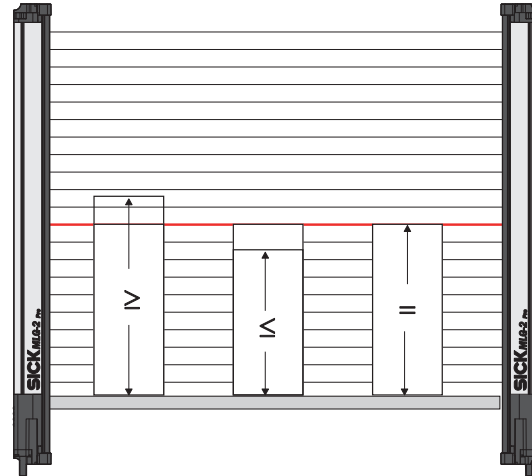

Figure 66: Settings for the height classification

- **≥ Object is greater than or equal to n beams:**
  The output becomes active when an object covers the beam defined as the top beam or reaches beyond this beam.
- **≤ Object is less than or equal to n beams:**
  The output becomes active when an object covers the beam defined as the top beam or reaches less beams.
- **= Object is equal to n beams:**
  The output becomes active when an object covers the beam defined as the top beam.

The beam that has been set is shown in blue in the **Simulation** area. It can be moved using the mouse.
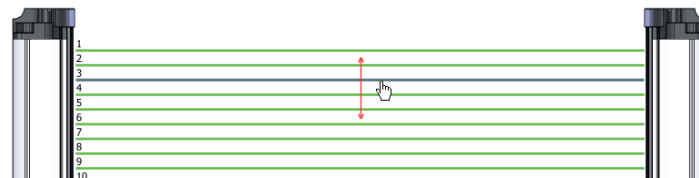

Figure 67: Setting the height with the mouse

Zone selection

For additional information, see ""Zone measuring" function", page 85 .

Output settings

General options for switching outputs see "Advanced settings for the outputs", page 84.

7.4.2   **Object recognition**

The MLG-2 memorizes the pattern of configured or defined objects. The output switches when the MLG-2 recognizes objects or gaps with the configured size.

NOTE

The maximum number of beam status changes may not exceed half the number of beams, however a minimum of 16 and maximum of 120.

Defining an object automatically

You can define the object to be detected automatically.

▶   Place the object(s) in the detection area of the MLG-2.
▶   Then click **Teach-in object.**

The size of the objects and the size of the gaps between the objects are shown in the simulation. The sizes can be further adjusted afterward.

Manual configuration

In the simulation, you can determine the size of the object(s) by selecting corresponding beams.

Figure 68: Beams highlighted in color in the simulation

The blue beams in the Simulation area represent the object; the beams shown in turquoise are the tolerance.

Settings for automatic and manual configuration

▶   Select one of the following settings for object recognition:

•   **Static**
         An object will be recognized if it is in the exact location in which the object was configured or automatically defined. This also applies to multiple objects, e.g., the feet of a pallet.
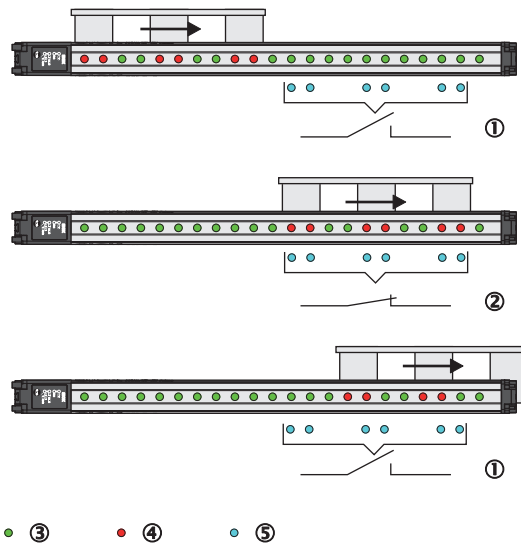
Figure 69: Object recognition, static

①   Output not switched
②   Output switched
③   Made beam
④   Blocked beam
⑤   Configured beam

- **Dynamic**
  An object will be recognized at every point in the detection area. The object is allowed to move within the detection area. This also applies to multiple objects, e.g., the feet of a pallet.
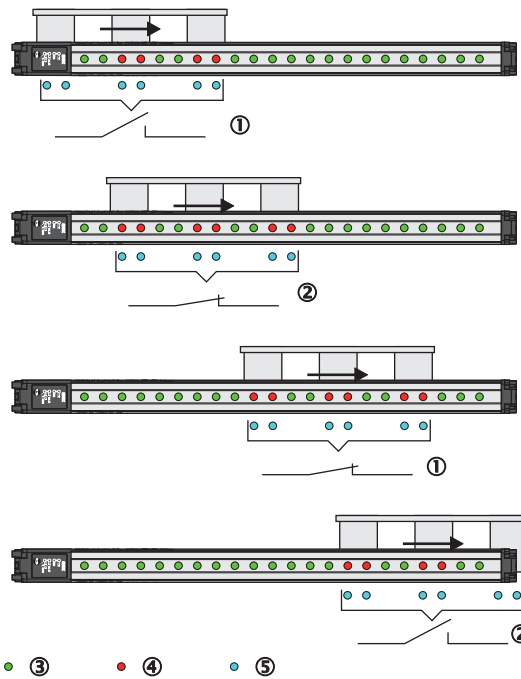

Figure 70: Object recognition, dynamic

①   Output not switched
②   Output switched
③   Made beam

④   Blocked beam

⑤   Configured beam

- **Tolerance**

  Without a tolerance, objects will only be recognized if they block exactly the configured number of beams. If you enter a tolerance, the object size can vary positively or negatively by the number of tolerance beams.
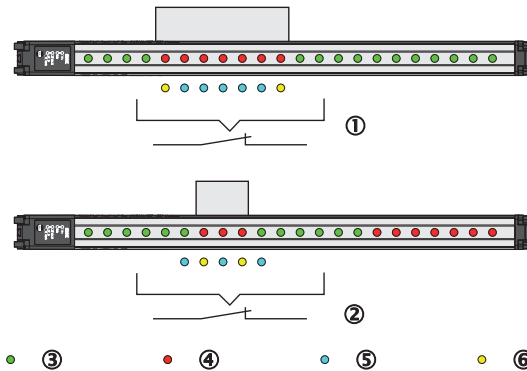
Figure 71: Object recognition with tolerance

①   Positive tolerance

②   Negative tolerance

③   Made beam

④   Blocked beam

⑤   Configured beam

⑥   Tolerated beams

When a tolerance is set, it is shown in the simulation with turquoise beams.

Output settings

General options for switching outputs see "Advanced settings for the outputs", page 84.

7.4.3   Object detection/object width

A switching output switches when an object of a particular size is present in the detection area.

A corresponding setting is configured which requires a certain number of beams or a certain number of **consecutive** beams to be blocked.

The number of beams is configured in the settings or configured graphically in the **Simulation** area using the mouse.
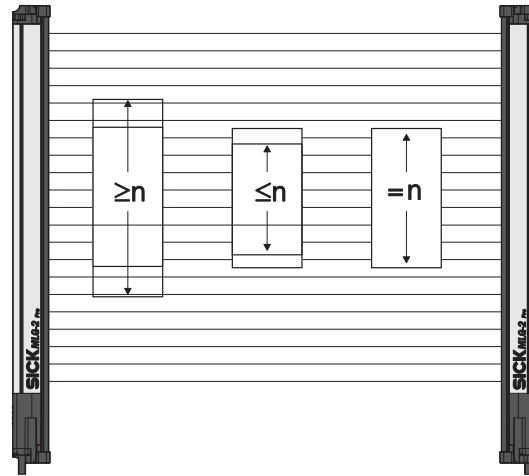
Figure 72: Object detection/object width

▶ Select one of the following n settings for the object detection/object width and enter the number of beams n:

- **≥n object is greater than or equal to n beams::**
  The output becomes active if the configured number of beams or more were covered.
- **≤n object is less than or equal to n beams:**
  The output becomes active if the configured number of beams or less were covered.
- **= n object is equal to n beams:**
  The output becomes active if precisely the configured number of beams were covered.

The object size that has been set is shown in the **Simulation** area. It can be changed using the mouse.
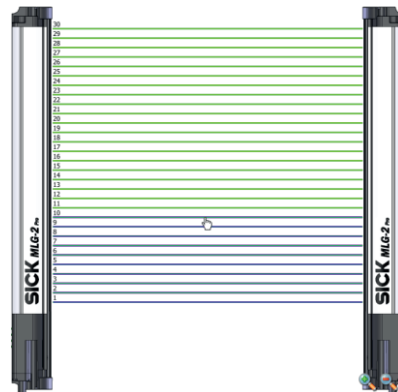

Figure 73: Setting the object size with the mouse

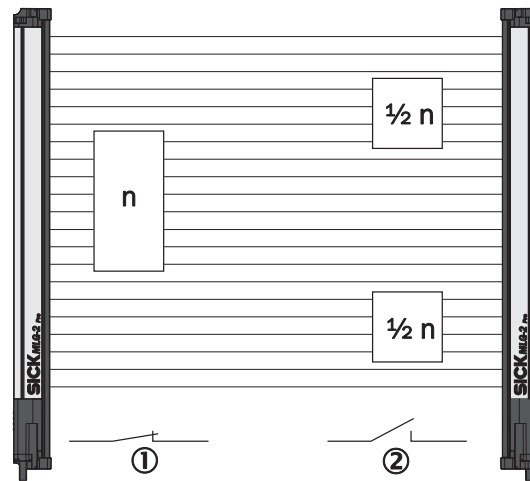**Only take into account consecutive beams:**

Figure 74: Object detection of consecutive objects

①   Criterion met
②   Criterion not met

The output becomes active when consecutive beams are covered. If this option is not activated, the number of blocked beams can also be made up of several objects or objects with gaps.

Zone selection

For additional information, see ""Zone measuring" function", page 85 .

Output settings

General options for switching outputs see "Advanced settings for the outputs", page 84.

7.4.4   Hole detection/hole size

A switching output switches when an object with a hole of a particular size is present in the detection area.

A corresponding setting is configured which requires a certain number of beams or a certain number of **consecutive** beams to be made.

The number of beams is configured in the settings.

The measuring function can be used for **hole detection**, e.g., in a metal sheet, by configuring a number of made beams ≥.**1**.

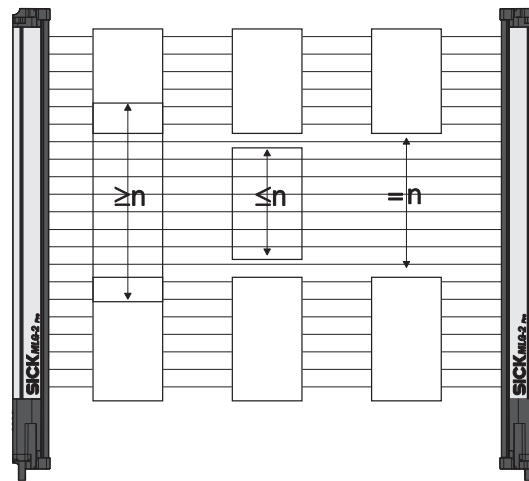▶   Select one of the following settings for the hole detection and enter the number of beams n:

Figure 75: Hole detection/hole size

- **≥n hole is greater than or equal to n beams::**
  The output becomes active if the configured number of beams or more were made.
- **≤n hole is less than or equal to n beams::**
  The output becomes active if the configured number of beams or less were made.
- **= n hole is equal to n beams:**
  The output becomes active if precisely the configured number of beams were made.

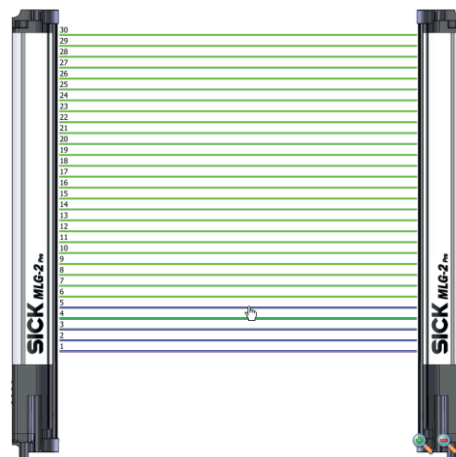The hole size that has been set is shown in the **Simulation** area. It can be changed using the mouse.

Figure 76: Setting the hole size with the mouse

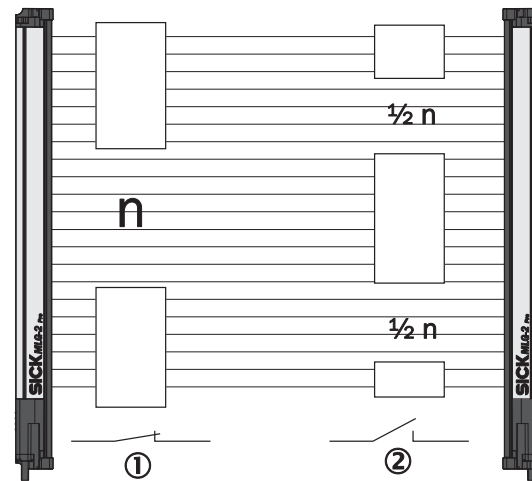**Only take into account consecutive beams:**

Figure 77: Detection of consecutive beams

①   Criterion met

②   Criterion not met

The output becomes active when the beams are made through a single hole. If this option is not activated, the number of made beams can also be made up of several gaps.

Output settings

General options for switching outputs .

7.4.5   Outside/inside dimension

A switching output switches when an object with a particular outside or inside dimension is detected.

NOTE

If there are several objects in the detection area, the largest object determines the measured value.

The following settings are possible for measuring the outside or inside dimension:

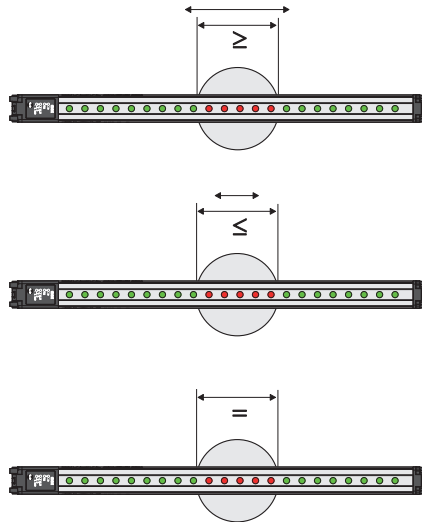▶   Configure whether you want to measure the **outside dimension** or **inside dimension**.
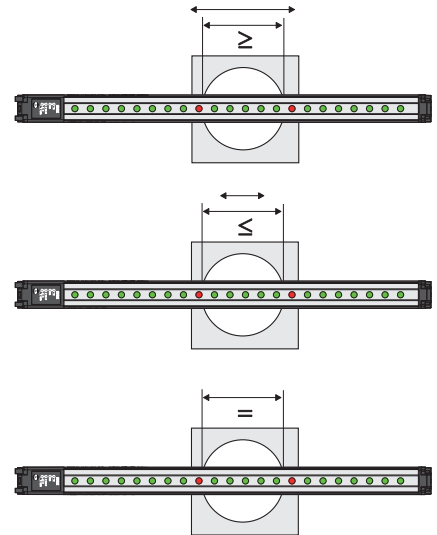
Figure 78: Measurement of the outside dimension

Figure 79: Measurement of the inside dimension

▶ Select one of the following settings:

- **≥ Object diameter is greater than or equal to n beams:**
  The output becomes active if the configured number of beams or more were blocked/made.
- **≤ Object diameter is less than or equal to n beams:**
  The output becomes active if the configured number of beams or less were blocked/made.
- **= Object dimension is equal to n beams:**
  The output becomes active if precisely the configured number of beams was blocked/made.

A particular number of beams is configured for the outside or inside dimension in the settings. The object size is shown in the **Simulation** area and can be changed here using the mouse.
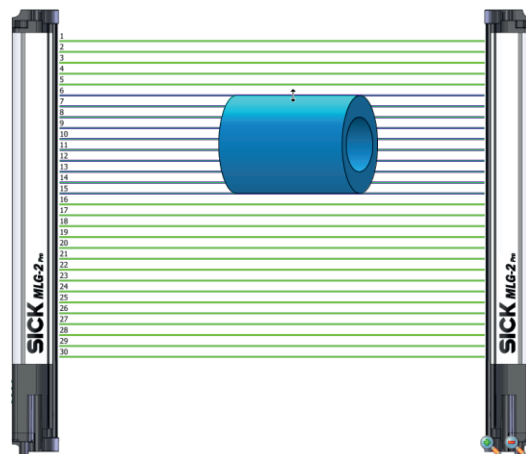

Figure 80: Setting the outside dimension with the mouse

Output settings

General options for switching outputs .

7.4.6 Classification of an object position

A switching output switches when the center of an object is located exactly on the beam configured as the position.

> **NOTE**
> If there are several objects in the detection area, the central beam of the largest object determines the object position.

A particular beam is configured for the classification of the object position in the settings.

▶ Select one of the following settings:

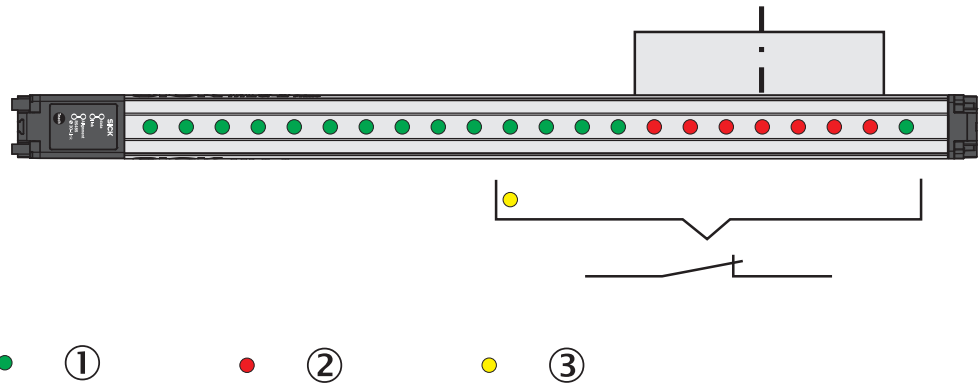• **The object center is greater than or equal to the position of beam number n.**

● ① ● ② ● ③

Figure 81: Classification of the object position – greater than or equal to object center

① Made beam
② Blocked beam
③ Configured beam

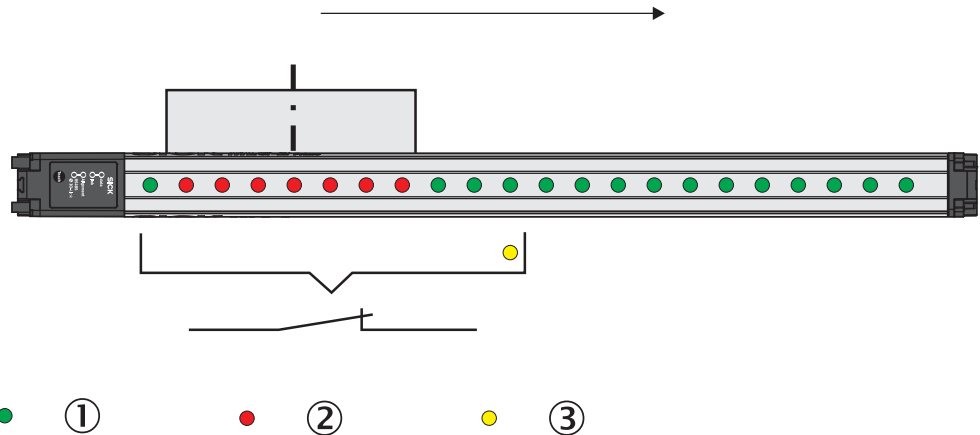• **The object center is less than or equal to the position of beam number n.**

● ① ● ② ● ③

Figure 82: Classification of the object position – less than or equal to object center

① Made beam
② Blocked beam
③ Configured beam

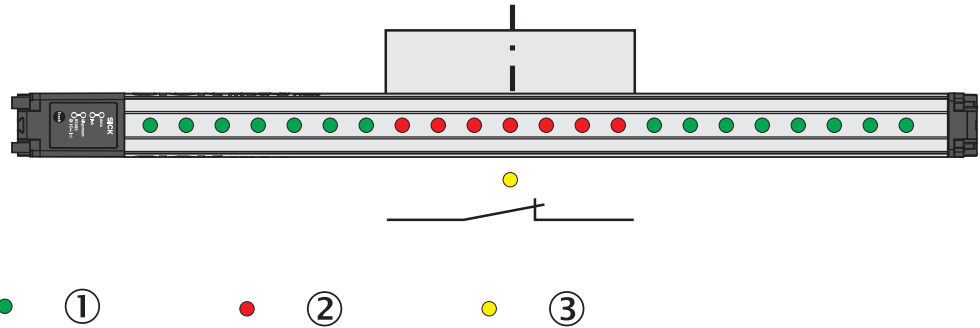• **The object center is equal to the position of beam number n.**

Figure 83: Classification of the object position – equal to object center

① Made beam
② Blocked beam
③ Configured beam

General options for switching outputs see "Advanced settings for the outputs", page 84.

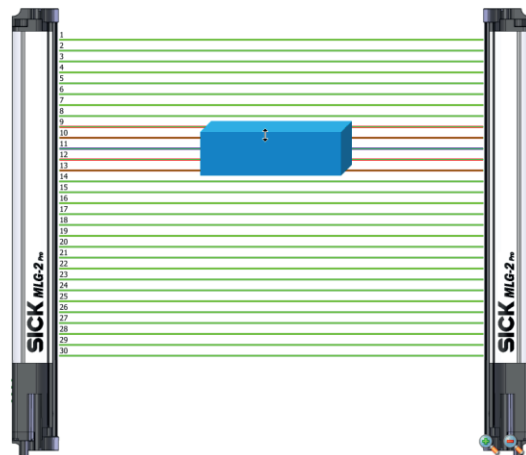The object position that has been set is shown in the **Simulation** area. It can be changed using the mouse.

Figure 84: Setting the object position with the mouse

Zone selection

For additional information, see ""Zone measuring" function", page 85 .

7.4.7 Classification of a hole position

A switching output switches when the center of a hole is located on the beam configured as the hole position.

> **NOTE**
> If there are several holes in the detection area, the central beam of the largest hole determines the hole position.

A particular beam is configured for the classification of a hole position in the settings.

▶ In addition, select one of the following settings:

• **The hole center is greater than or equal to the position of beam number n.**
  The number of the beam located in the center of the hole is greater than or equal to the number of the configured beam.

● ①   ● ②   ● ③

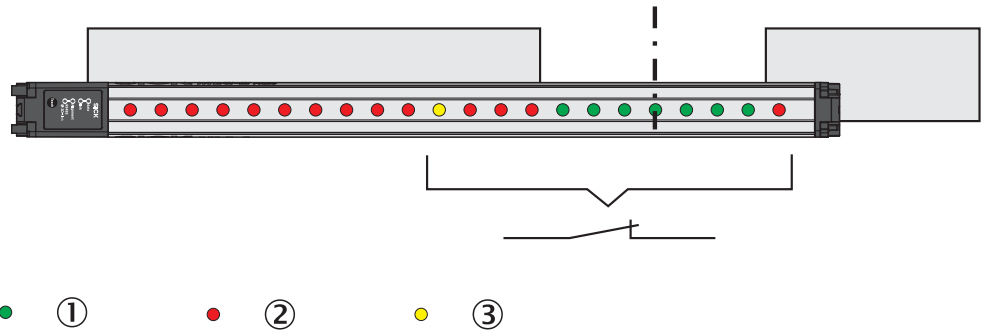*Figure 85: Classification of the hole position – greater than or equal to hole center*

①   Made beam
②   Blocked beam
③   Configured beam

- **The hole center is less than or equal to the position of beam number n.**
  The number of the beam located in the center of the hole is less than or equal to the number of the configured beam.

● ①   ● ②   ● ③

Figure 86: Classification of the hole position – less than or equal to hole center

①   Made beam
②   Blocked beam
③   Configured beam

- **The hole center is equal to the position of beam number n.**
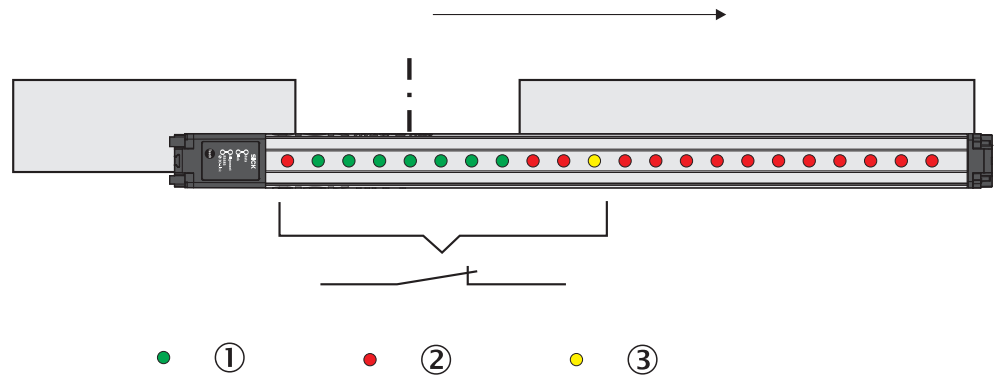 The center of the hole is located exactly on the configured beam.
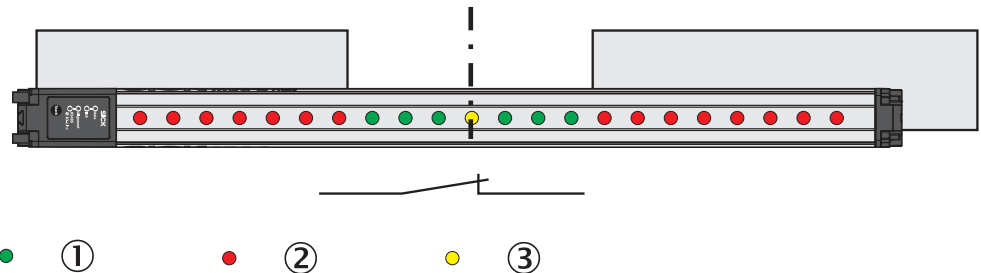

● ①   ● ②   ● ③

Figure 87: Classification of the hole position – equal to hole center

①   Made beam
②   Blocked beam
③   Configured beam

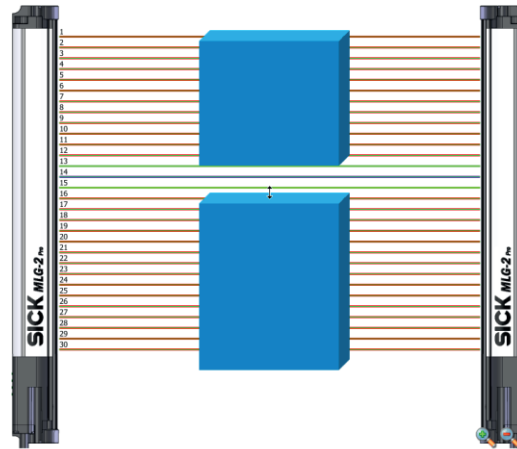The hole position that has been set is shown in the **Simulation** area. It can be changed using the mouse.

Figure 88: Setting the hole position with the mouse

Output settings

General options for switching outputs see "Advanced settings for the outputs", page 84.

7.4.8 Diagnostics

As well as measuring functions, diagnostic functions can also be assigned to the outputs. Depending on the configuration, the output will respond when certain faults occur or when the teach-in quality or process quality fall below a configured percentage.

Diagnostic settings

- **Activate Qn in the event of the following error messages:**
  - **Contamination**
    The output is activated when a contamination warning occurs.
  - **Electrical short-circuit**
    The output is activated when a short-circuit occurs in the wiring.
  - **Teach-in error**
    The output is activated when an error occurs during the teach-in process.
  - **Hardware error**
    The output is activated when an error occurs with the hardware. Possible cause: LED defective, receiver element defective, etc.
- **Activate Qn if the teach-in quality falls below ...%**
  The output is activated when the teach-in quality falls below a certain percentage (see "Teach-in", page 17).
  You can define the percentage in increments of 1%.
- **Activate Qn if the process quality falls below ...%**
  The output is activated when the process quality falls below a certain percentage (see "Teach-in", page 17).
  You can define the percentage in increments of 1%.

Output settings

General options for switching outputs see "Advanced settings for the outputs", page 84.

7.5 Measuring and diagnostic functions for analog outputs

A measuring or diagnostic function can be configured for each analog output on the MLG2.

An analog output changes its output current from 4 to 20 mA or from 20 to 4 mA analogously to the measured object.

All measuring functions are configured manually. The configurable details are shown for the selected measuring function.

7.5.1 Object height measurement

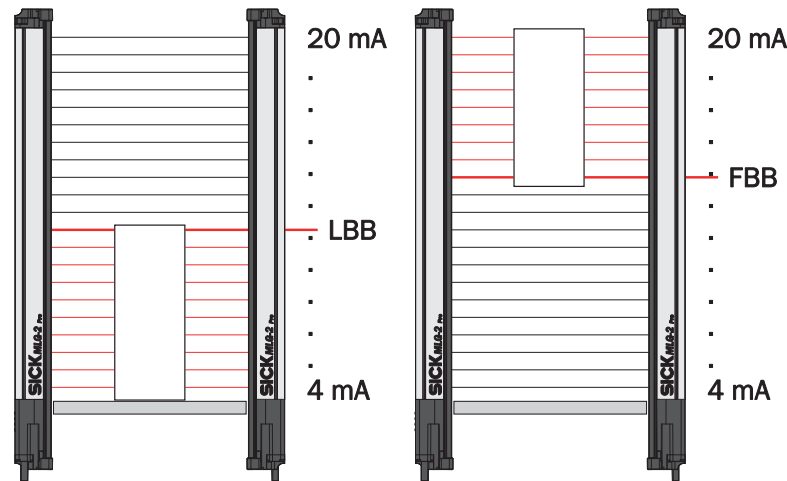An analog output changes its output current analogously to the height of an object.

Figure 89: Settings for object height measurement

▶ Configure the alignment of the object in the detection area:

- **Height measurement starting at beam 1 (LBB)**
  The output provides a current which is analogous to the height of the highest blocked beam.
- **Height measurement starting at the last beam (LBB)**
  The output provides a current which is analogous to the height of the lowest blocked beam.

Output settings

For general options for analog outputs, see section see "Advanced settings for the outputs", page 84.

7.5.2 Hole detection

An analog output changes its output current analogously to the total number of beams made.
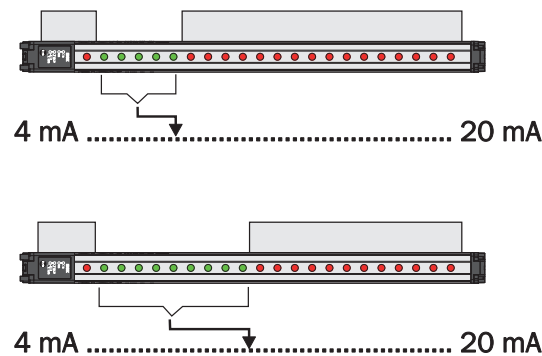

Figure 90: Hole detection

The output current increases with the number of beams made.

Output settings

For general options for analog outputs, see section see "Advanced settings for the outputs", page 84.

7.5.3 Object detection

An analog output changes its output current analogously to the total number of beams blocked.
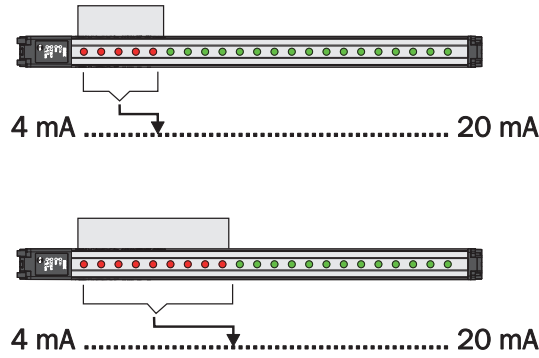

Figure 91: Object detection

The output current increases with the number of beams blocked.

Output settings

General options for analog outputs see "Advanced settings for the outputs", page 84.

7.5.4 Measuring the outer or inner dimension

An analog output changes its output current analogously to the outer or inner dimension of an object.

The output displays the outer or inner dimension of an object. On this basis, the output provides a current analogous to the number of blocked/made beams.
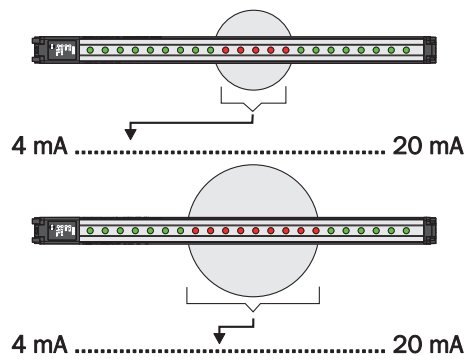
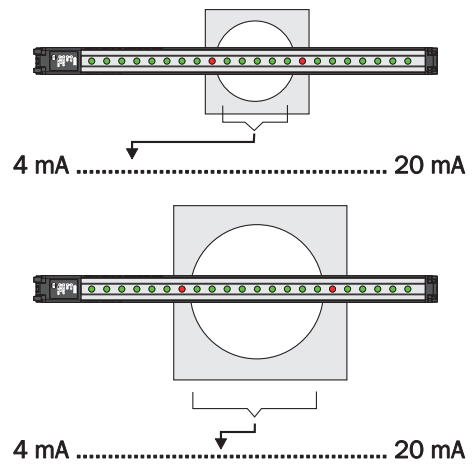

Figure 92: Measurement of the outside dimension

Figure 93: Measurement of the inside dimension

▶ Configure whether you want to measure the outside dimension or inside dimension.

Output settings

General options for analog outputs see "Advanced settings for the outputs", page 84.

7.5.5   Measurement of the object position

An analog output changes its output current analogously to the position of the object center in the detection area.
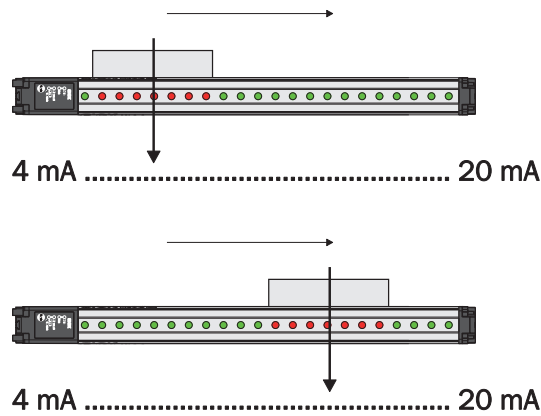
4 mA .... 20 mA

4 mA .... 20 mA

Figure 94: Measurement of the object position

Output settings

For general options for analog outputs, see section see "Advanced settings for the outputs", page 84.

7.5.6   Measurement of the hole position

An analog output changes its output current analogously to the position of the hole center in the detection area.

4 mA .... 20 mA

4 mA .... 20 mA
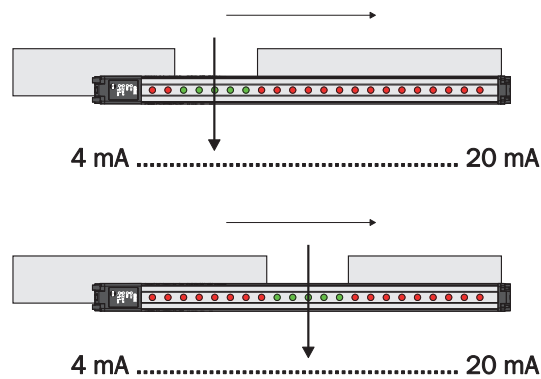
Figure 95: Measurement of the hole position

Output settings

General options for analog outputs see "Advanced settings for the outputs", page 84.

7.5.7   Diagnostic functions

- **Teach-in quality**
  An analog output changes its output current analogously to the teach-in quality (see "Teach-in", page 17).
- **Process quality**
  An analog output changes its output current analogously to the process quality (see "Teach-in", page 17).

Output settings

General options for analog outputs .

7.6 Advanced settings for the outputs

Switching outputs

For switching outputs, you can select the option **Invert output**.

At the EXPERT user level, you can also enter a **minimum pulse width** for the output signal in ms.

Very fast or small objects trigger a short output signal. Under some circumstances, these may not be detected by slow controls. Via the minimum pulse width, you can set a pulse width that your control will detect.
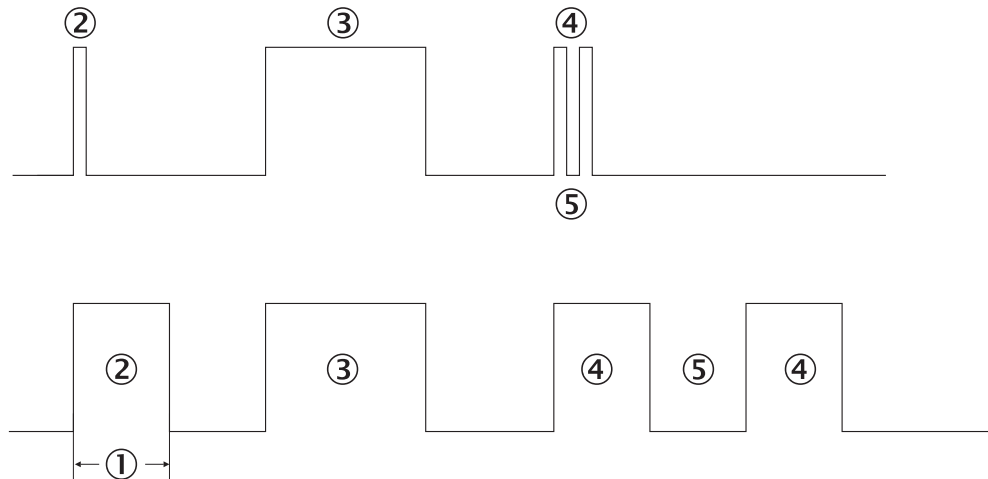

Figure 96: Examples of the effect of a configured minimum pulse width

①   Minimum pulse width
②   A pulse that is too short is extended.
③   A long output pulse remains unchanged.
④   Two short output pulses are extended.
⑤   The break also corresponds to the minimum pulse width (1).

Analog outputs

For analog outputs, select one of the following settings:

- 4 mA … 20 mA
  The output current increases with the number of the highest/lowest blocked beam. If the measured value is invalid, e.g. because no beam is blocked, there will be 4 mA of current.
- 20 mA … 4 mA
  The output current decreases with the number of the highest/lowest blocked beam. If the measured value is invalid, e.g. because no beam is blocked, there will be 20 mA of current.

Activating the output (only at the EXPERT user level)

At the **EXPERT** user level, you can also configure a setting so that an output only changes its status when a particular input is activated. This method can be used to switch the measuring function on or off.

▶   Click **Advanced…**.
▶   Activate the option **Use input to activate or deactivate output**.

▶   Select which input is to be used.

▶   You should also configure whether the input is to be **high active** or **low active**.

NOTE

This function is only available if the inputs have not been configured for other functions ().

7.7   Zones

7.7.1   "Zone measuring" function

Prerequisites

▪   "Expert" user level

Description of operation

The beams of the MLG-2 can be divided into four zones. Each zone can be assigned one beam function or application. Zones and beam functions are assigned using the outputs. The functions NBB Zone n, LBB Zone n, FBB Zone n, CBB Zone n and NCBB Zone n are available for each zone (n = 1, 2, 3 or 4).
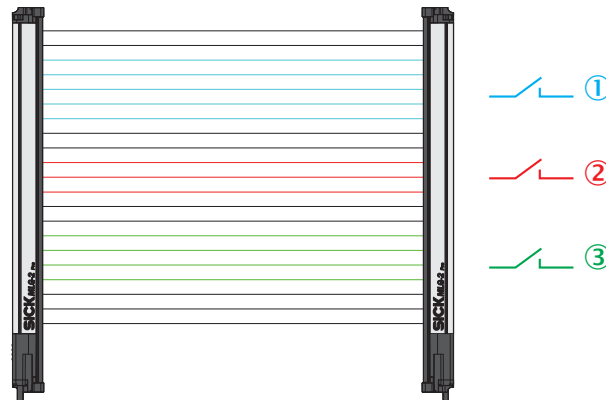

Figure 97: Measuring within zones

①   e.g. Zone 1 (NBB Zone 1, LBB Zone 1, FBB Zone 1, CBB Zone 1 or NCBB Zone 1)
②   e.g. Zone 2 (NBB Zone 2, LBB Zone 2, FBB Zone 2, CBB Zone 2 or NCBB Zone 2)
③   e.g. Zone 3 (NBB Zone 3, LBB Zone 3, FBB Zone 3, CBB Zone 3 or NCBB Zone 3)

Configuring the "Zone measuring" function using SOPAS ET

Example: You would like to assign Zone 1 and the application "Object detection/Object width (NBB/NCBB)" to digital output 1.

First, configure one or more zones. Next, assign an application and a zone to the desired output. You can configure the zones either in the beam window or via the **Zones** expandable menu.

Configuring zones in the beam window

▶   Click the **Zones** expandable menu.
▶   In the middle section of SOPAS ET (beam window), mark the beams that you would like to combine into a zone.
▶   Using **Combine to a zone** from the context menu, select the zone that the beams will be assigned to – in this case **Zone 1**.
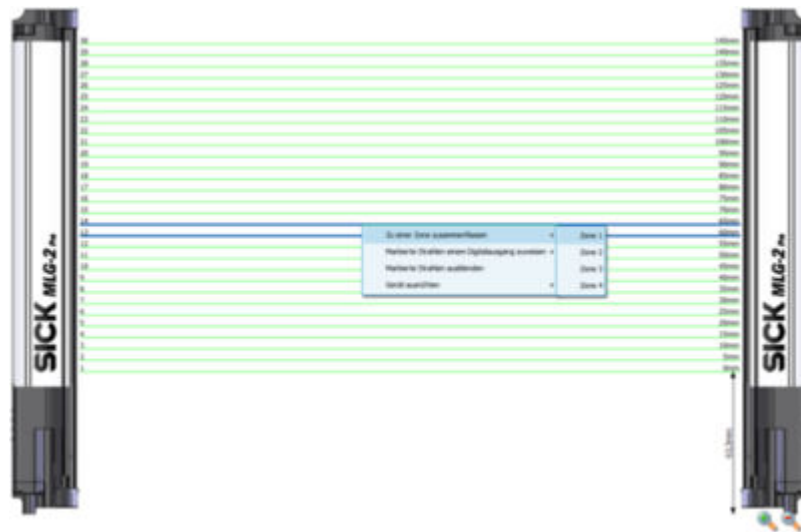
Figure 98: SOPAS ET beam window – Combining beams into zones

✓   The configured zones are indicated in the **Zones** expandable menu.

Configuring **Zones** in the expandable menu

▶   Click the **Zones** expandable menu.
▶   In the **Zone selection** area, define the "Zone no.", "First beam" and "Last beam" for the zone.

▶   Activate the zone you wish to assign to an output.

Configuring an output

▶   Click the **Digital output 1** expandable menu, for example.

Figure 99: SOPAS ET – Assigning an application and zone to an output

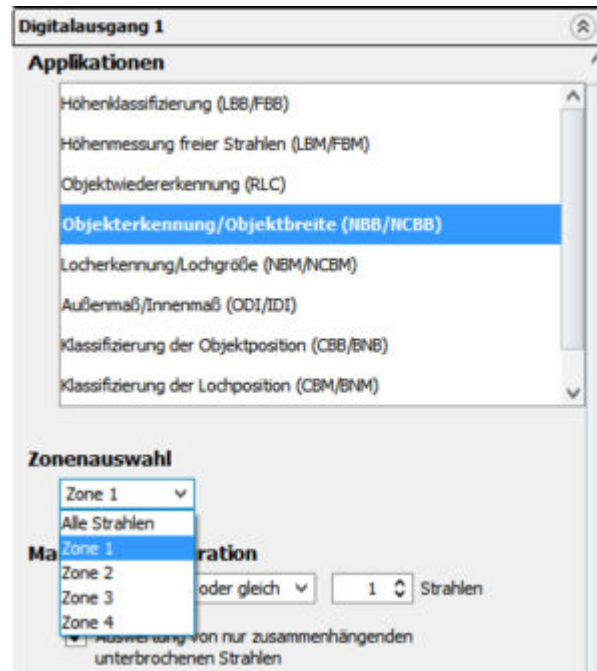▸ In the **Applications** area, select an application such as **Object detection/Object width (NBB/NCBB)**.

▸ Using the drop-down list from the **Zone selection** area, select the zone that the application will apply to – in this case **Zone 1**.

✓ The configured basic function (beam function) and the related status are displayed in the **Basic functions** area of the **I/O** tab in the left-hand window, e.g., **NBB Zone 1 = 0 (number of blocked beams in Zone 1)**.

7.8 Data output via the interfaces

The expandable **Interfaces** menu is only displayed if the device in use has a data interface (RS485 and/or IO-Link).

7.8.1 RS485 – Data transmission format

In the **EASY** user level, you can configure the **data transmission rate** of the RS485 interface (the following data transmission rates are supported):

1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 bit/s

In the **EXPERT** user level, you can also compile the data transmission format individually.
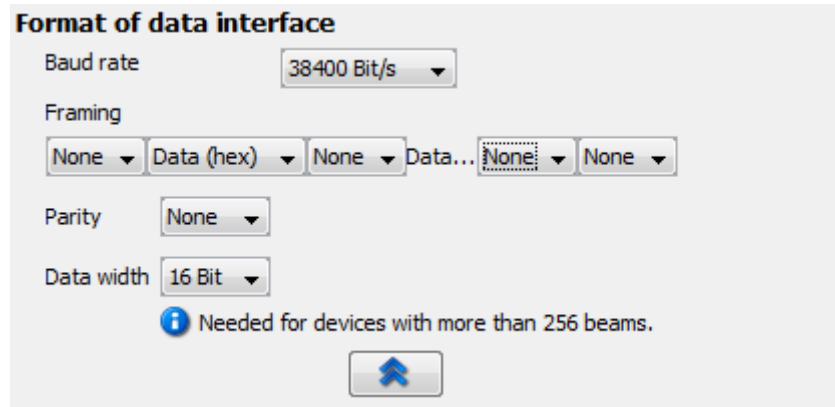
Figure 100: Data transmission format

The following options are possible:

- Start character
- Format of transmission message:
  – Hexadecimal
  – Decimal
  – Binary
- Separator
- Up to two stop characters
- Parity
- Data width

7.8.2 RS485 – Transmission mode

For the RS485 interface, you can configure when data is transmitted. The following options are available:

Settings	Description
Continuous	Sends the data continuously.
Beam status change	Sends the data only when the beam status is modified.
Deactivated	Sets the RS-485 data interface to deactivated.
Triggered	The selected input is used as an external trigger for the data output. As long as the input is active, data is transmitted.
On request	The light grid responds with a data string if the selected character is received.
Interval	Sends the data using the specified interval.
Beam status change with interval	Sends the data only when the beam status is modified or the interval has elapsed.

Table 32: Transmission mode via RS485

7.8.3 RS485 and IO-Link – Data transmission content

NOTE

The total amount of process data (payload + frame) must not exceed 180 bytes (see "RS-485", page 112). SOPAS ET monitors the situation to make sure the maximum amount of process data is not exceeded. If this happens, you will not be able to add any more functions to the message.

Configure the content of the transmission message for the RS485 interface. The following functions are available:

- Beam status
  The status of all MLG-2 beams is output serially, starting with beam number 1.
  - 0 = Beam made
  - 1 = Beam blocked
- The individual beam functions
  see "Beam functions", page 107
- Run-length code
  see "Output of measurement data (raw data)", page 28
  Only the changes between blocked and made beams are issued.
- switching outputs
- Process quality
- Teach-in quality
- Counter

Figure 101: Available functions

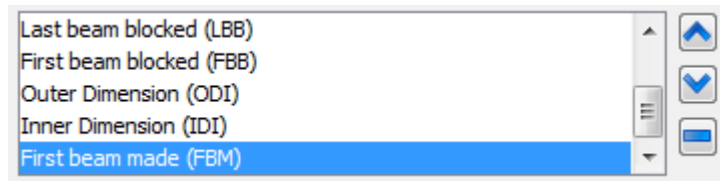▸ Select a function in the **Available functions** window and click on the + button.

Figure 102: Selected functions

✓ The function is transferred to the **Selected functions** window.
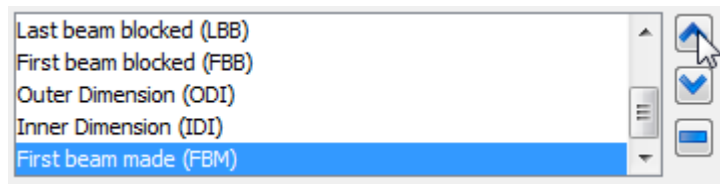

Figure 103: Sorting selected functions

▸ Select a function in the **Selected functions** window and click either the **<** or **>** button.
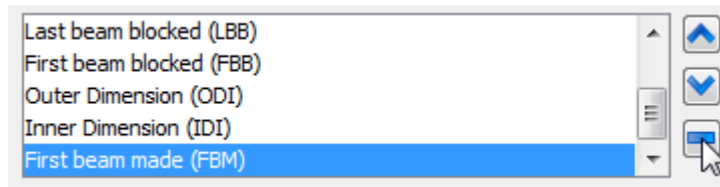✓ The function is moved up or down.

Figure 104: Removing selected functions

▸ Select a function in the **Selected functions** window and click on the – button.
✓ The function will be removed from the **Selected functions** window.

Simulation of data contents

STX	NBB	FBM	BeamStatus
02	0000	0001	00
BeamStatus	BeamStatus	BeamStatus	BeamStatus
00	00	00	00
BeamStatus	BeamStatus	BeamStatus	ODI
00	00	00	0000
ETX	CR		
03	0D		

Data bytes count: 143
Telegram content

Figure 105: Simulation of data contents

The selected process data is displayed as a simulation under **Simulation of data contents:**

- Based on the current beam status if the device is online
- Based on the simulation if the device is offline

7.9 Teach-in

During the teach-in process, the switching thresholds for all beams are individually adjusted for the sensing range and the ambient conditions.

A teach-in process must be carried out when commissioning, when changing operating mode or performance options, and at regular intervals in general.

▶ Click **Teach-in**.
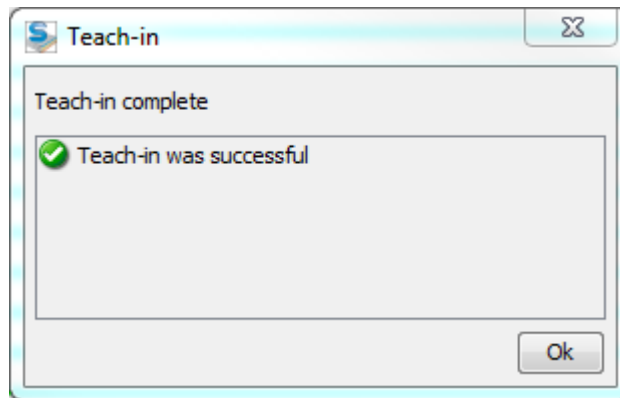✓ The teach-in process starts. If the teach-in process is successful, a corresponding message is displayed.

Figure 106: Teach-in successful

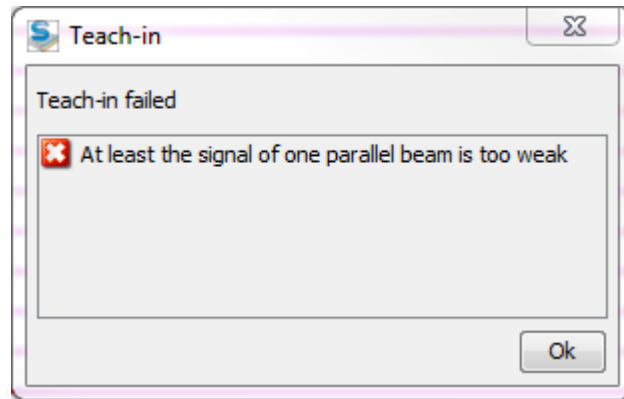Similarly, if any errors occur, a corresponding message is displayed.

Figure 107: Teach-in failed

▶   Then, check that the MLG-2 is correctly aligned, that the front screens are clean and that there are no objects located in the light path.

▶   Then carry out the teach-in process again.

Determining the teach-in input (only in the EXPERT user level)

You can configure an input as the teach-in input.

> **NOTE**
> This is only possible if a connection has been configured as an input (see "System settings for the EXPERT user level", page 65) and if the input is being used for a different purpose (see "Advanced settings for the outputs", page 84).

Teach-in when switching on

If you activate the **Automatic teach-in when switching on device** option, the teach-in process will be performed every time you switch the device on.

Teach-in quality
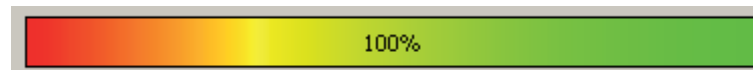
Figure 108: Teach-in quality

The teach-in quality indicates how successful the teach-in process has been. The MLG-2 calculates this value based on the quality of the light level received.

The value remains constant until another teach-in process is carried out.

Beam blanking (only in the EXPERT user level)

If you do not want to evaluate certain beams for your application, you can exclude them from the teach-in process.

How to blank blocked beams:

The beams from the MLG-2 that are **not** to be accounted for in the measurement must be blocked.

Figure 109: Example of the blanking of blocked beams

①   Made beams

②   Blocked beams

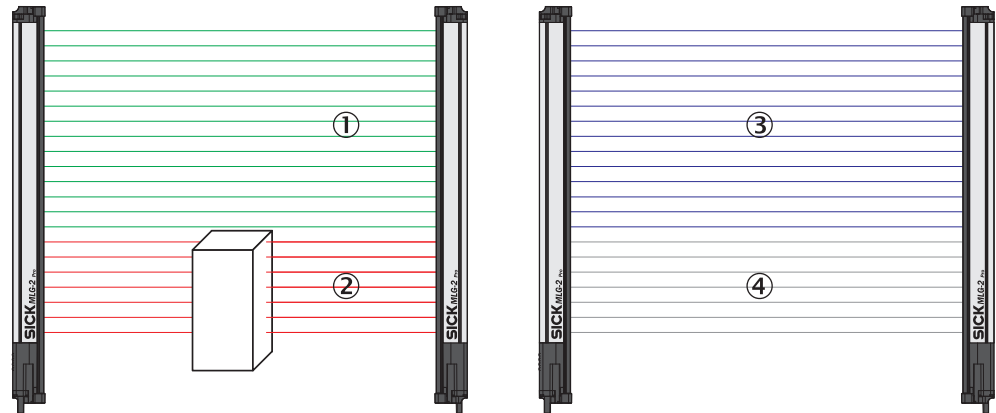③   Beams included in the measurement

④   Excluded beams

▶   Click **Blank all blocked beams**.

✓   The blocked beams will not be taken into account in the measurement.

▶   Activate the **Activate beam blanking for every teach-in**option too.

✓   The blocked beams are excluded from every teach-in process in the future.

> **ⓘ NOTE**
> You will never be notified that beams are blocked during the teach-in process.

▶   Click **Blank all made beams**.

✓   The made beams will not be taken into account in the measurement.

How to blank made beams:

Figure 110: Example of blanking made beams
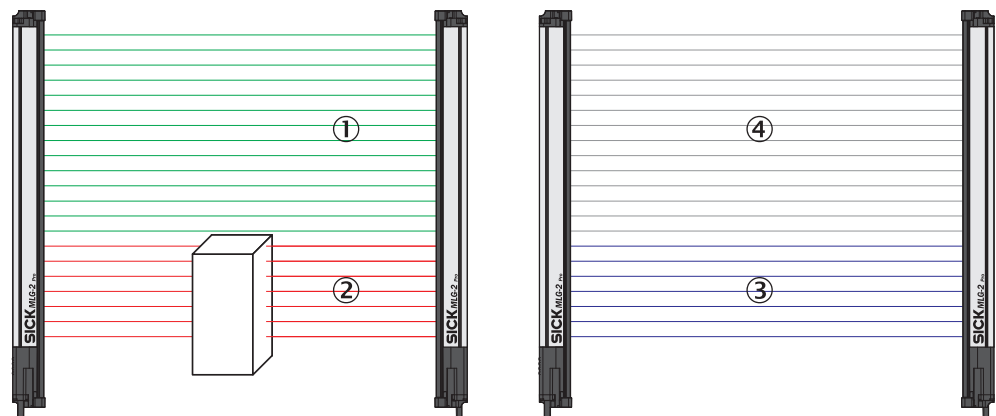
①   Made beams

②   Blocked beams

③   Beams included in the measurement

④   Excluded beams

▶   Click **Blank all made beams**.

✓   The made beams will not be taken into account in the measurement.

▶   Activate the **Activate beam blanking for every teach-in**option too.

✓   The blocked beams are excluded from every teach-in process in the future.

7.10   Performance options

The performance options can be used to modify the response time, operating reserve, detection type, and (in Transparent operating mode), minimum detectable absorption of an object.

Responsetime

fast

High speed
High speed scan active
Cross beam inactive
ⓘ Recommended for high speed processes

slow

Function Reserve

high

Standard
Best compromise

ⓘ Recommended for indoor applications

low

Detection type

Adjust object size to smallest object which needs to be detected in the application.

Object Speed | 1 m/s
Height | 50 mm
Length | 50 mm

Figure 111: Performance options for Standard operating mode and Dust- and sunlight-resistant operating mode

Responsetime

fast

Standard
High speed scan inactive
Parallel beam scan
ⓘ Suitable for most processes

slow

Minimum Detectable Absorption

30%

Approx. 15% signal attenuation
AutoAdapt active

ⓘ Regular Teach-in recommended

10%

Detection type

Adjust object size to smallest object which needs to be detected in the application.

Object Speed 1 m/s
Height 50 mm
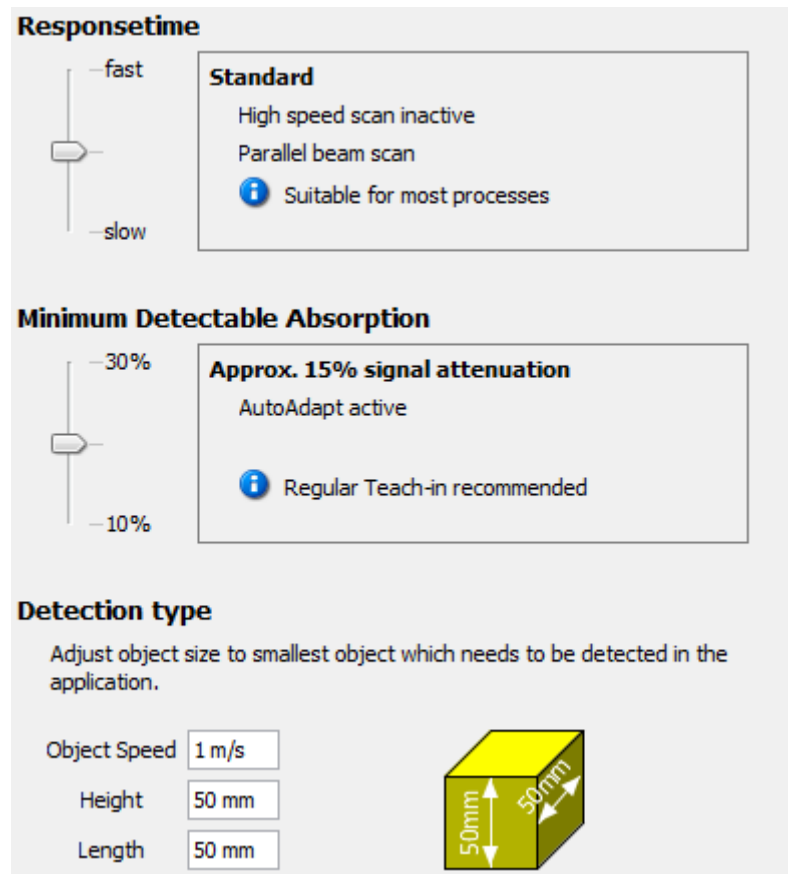Length 50 mm

50mm 50mm 50mm

Figure 112: Performance options for Transparent operating mode

You can change the response time, operating reserve, or minimum detectable absorption by moving the slider up or down.

ⓘ **NOTE**
- The configurable performance options depend on the operating mode selected.
- The performance options are dependent on each other.
- A teach-in process must be performed after most changes. A button is provided in the performance options for this purpose.

▶ Click the button to perform the teach-in process and to apply the modified performance options.
✓ The system boundaries resulting from the performance options are displayed on the left in SOPAS ET (see "System boundaries, status, and interfaces", page 55).

Response time

The response time depends on the scan method and the beam function. A short response time requires a **high-speed scan** and the **parallel-beam function**.

▶ Select one of the following options:

- **Fast** – High-speed scan and parallel-beam function are active
- **Medium** – High-speed scan not active and parallel-beam function active

> **NOTE**
> - If **High-speed scan** is deactivated in the energy options, you cannot switch to **Fast.**
> - Only **Medium** can be set in Transparent operating mode.
> - If the cross beam function is activated via **Detection type**, the system switches to **Slow.**
> - For MLG-2 with a 2 m sensing range, the high measurement accuracy function must be used for **High-speed scan.**

Operating reserve

The operating reserve affects how long the measurement can be performed correctly in the event of adverse ambient conditions or contamination.

- **High** – Highly resistant to contamination, risk of reflection with shiny objects
- **Medium** – Best compromise between reflection resistance and operating reserve
- **Low** – High measurement accuracy

> **NOTE**
> It is not possible to set an operating reserve in **Transparent** operating mode.

Minimum detectable absorption of an object (only in Transparent operating mode)

The minimum detectable absorption (MDA) of an object must be configured in **Transparent** operating mode. In order to detect a transparent object, it must absorb a certain percentage of the energy from the light beam.

The following options are available for configuring the minimum detectable absorption[5]:

- Approx. 10% signal attenuation:
  clean PET bottles, clear glass, thin and clear films (e.g., cellophane), household plastic film, plastic wrapping
- Approx. 15% signal attenuation:
  clean clear glass bottles, thick films, film and wrapping folded multiple times
- Approx. 30% signal attenuation:
  green and brown glass, colored glass bottles

> **NOTE**
> The minimum detectable absorption that an object needs in order to be detected increases with the sensing range (see "Minimum detectable absorption", page 124).

Detection type

With the help of the mapped object, you can set the minimum detectable object size and minimum detectable object length, and enter the speed of the object through the detection area.

The object speed and size determine which scanning procedure is to be used.

- ▶ Enter the speed at which the object being detected will move through the detection area in the **Object speed** field.
- ▶ Enter the height of the smallest object to be detected in the **Height** field.
- ▶ Enter the length of the smallest object to be detected in the **Length** field.

The figure to the right of the fields shows the entered values in proportion.

---

[5]   Examples are for illustrative purposes only. The signal attenuation and the minimum detectable absorption to be configured must be determined for each individual application.

Figure 113: Illustration of the measuring object

7.10.1 "Cross beam" function

Prerequisites

- "Expert" user level
- Reasonable beam separation: ≥ 10 mm
- Possible operating modes: standard or dust- and sunlight-resistant
- High-speed scan is deactivated.
- The object being detected is located in the center section of the detection area.
- Only for "Cross beam measuring": ≤ 255 beams

Notes

- see "Minimum detectable object with cross-beam function ", page 24

Description of operation

The MLG-2 offers the following beam functions: "Parallel beam", "Cross beam switching" and "Cross beam measuring." The system automatically selects the "Parallel beam" or "Cross beam switching" function depending on the specific object size that is to be detected. As an alternative, the user also has the option of manually activating the "Cross beam switching" or "Cross beam measuring" function.

In the "Cross beam switching" option, the crossed beams are also used for object detection. The crossed beams do not affect the beam status, beam functions or blanked beams.

In the "Cross beam measuring" function, a group of crossed beams is combined into a single virtual beam. Virtual beams are treated as additional real beams and do not have any affect on the beam status, beam functions or blanked beams. If the "Cross beam measuring" function is activated, the real and virtual beams are renumbered, which means that the number of beams is nearly doubled.
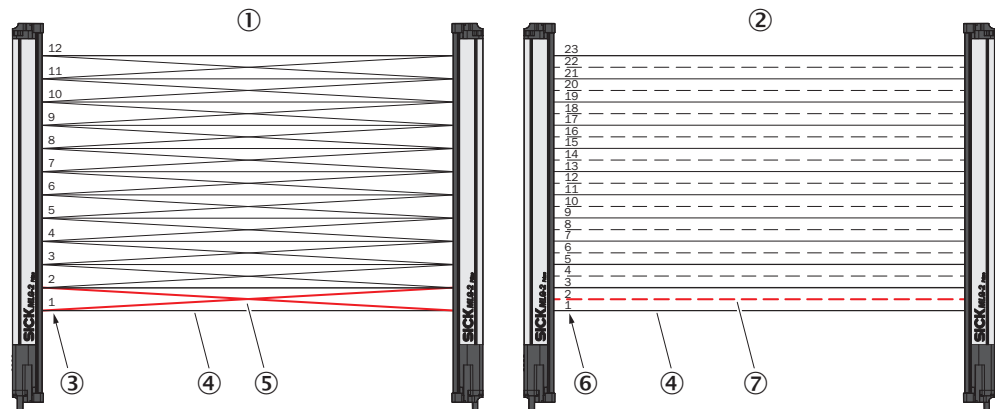

Figure 114: Left: "Cross beam switching", right: "Cross beam measuring"

①   Cross beam switching
②   Cross beam measuring
③   Beam numbering for "Cross beam switching"
④   Parallel beam
⑤   Crossing beams

⑥   Beam numbering for "Cross beam measuring"

⑦   Crossing beams, displayed as a virtual beam

Example with "Cross beam measuring"

When the "Cross beam switching" function is used, a light grid with a beam separation of 20 mm can detect a wide object with a thickness of 1 mm, but cannot output a measured value for the height, for example. With the "Cross beam measuring" function, it is also possible to output a measured value for the height.

Configuring the "Cross beam switching" function using SOPAS ET

▶ In SOPAS ET, click on the **Performance options** expandable menu in the right-hand window.

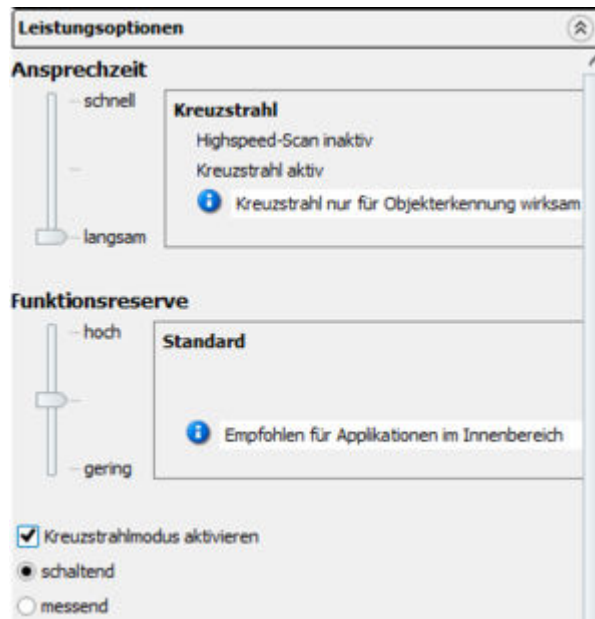▶ In the **Operating reserve** area, enable the **Activate cross beam mode** function.

Figure 115: SOAPS ET – Activating cross beam switching mode

▶ Select the **switching** function.

✓ The "Cross beam switching" function is now activated.

Configuring the "Cross beam measuring" function using SOPAS ET

⚠ **NOTICE**
If the "Cross beam measuring" function is activated, the real and virtual beams are renumbered. Existing configurations are not converted. Check the existing configuration for the "Cross beam measuring" function. Adjust the configuration accordingly.

▶ In SOPAS ET, click on the **Performance options** expandable menu in the right-hand window.

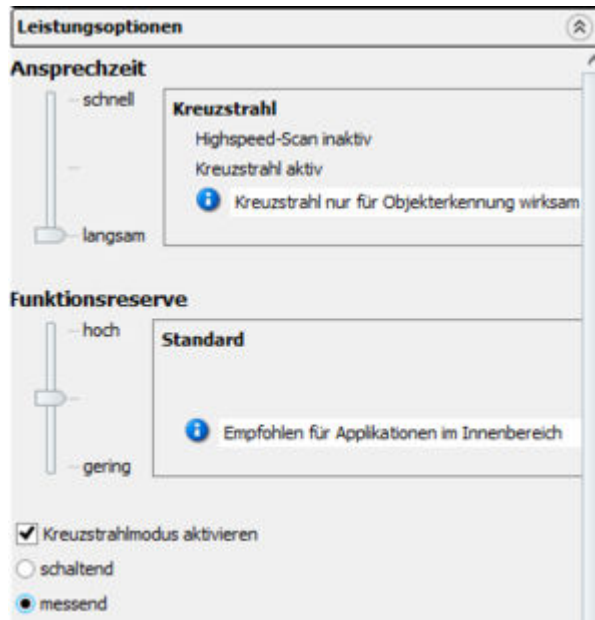▶ In the **Operating reserve** area, enable the **Activate cross beam mode** function.

Figure 116: SOAPS ET – Activating cross beam measuring mode

▶ Select the **measuring** function.

✓ The following dialog box will open: **Warning. Activating this function will increase the number of beams. All beam-dependent settings must be adjusted accordingly.**
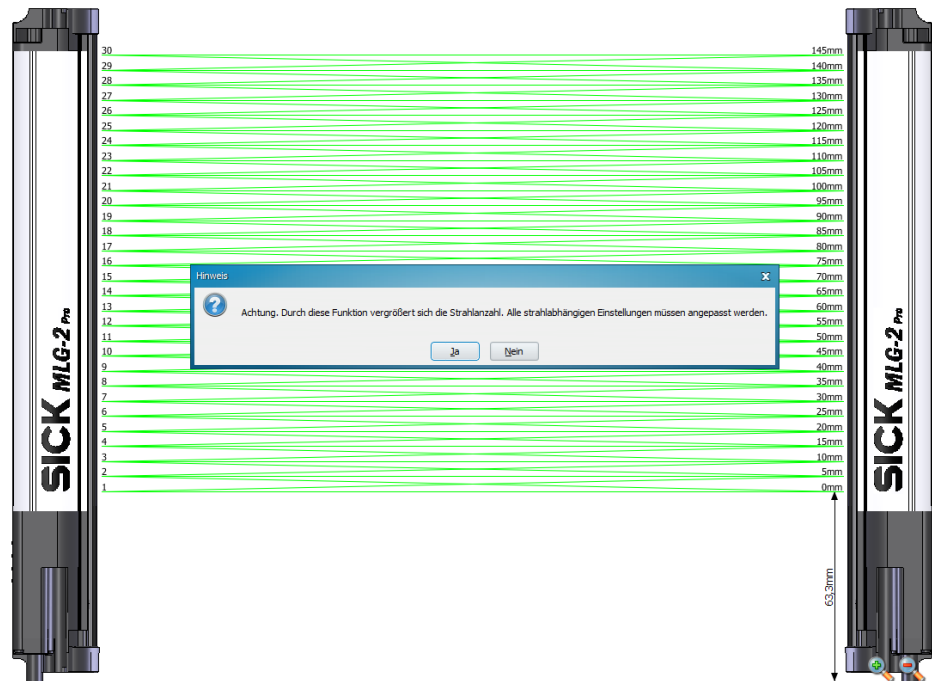

Figure 117: SOAPS ET, beam window – "Cross beam measuring" display

▶ Click **Yes** to activate the **Cross beam measuring mode**. Click **No** to cancel.

✓ The light grid display is adjusted in the middle section (beam window). The real and virtual beams are renumbered and, as a result, the number of beams is nearly doubled. The virtual beams are displayed as dashed lines.

▶ Check the existing configuration for the "Cross beam measuring" function.

▶ Adjust the configuration for the "Cross beam measuring" function accordingly.

7.10.2 **Energy options (only in the EXPERT user level)**

In order to reduce energy consumption, the MLG-2 can be set to Standby mode and the high-speed scan function can be deactivated.

Standby mode freezes the status of the outputs, i.e., they do not change their status even when objects enter or leave the detection area.
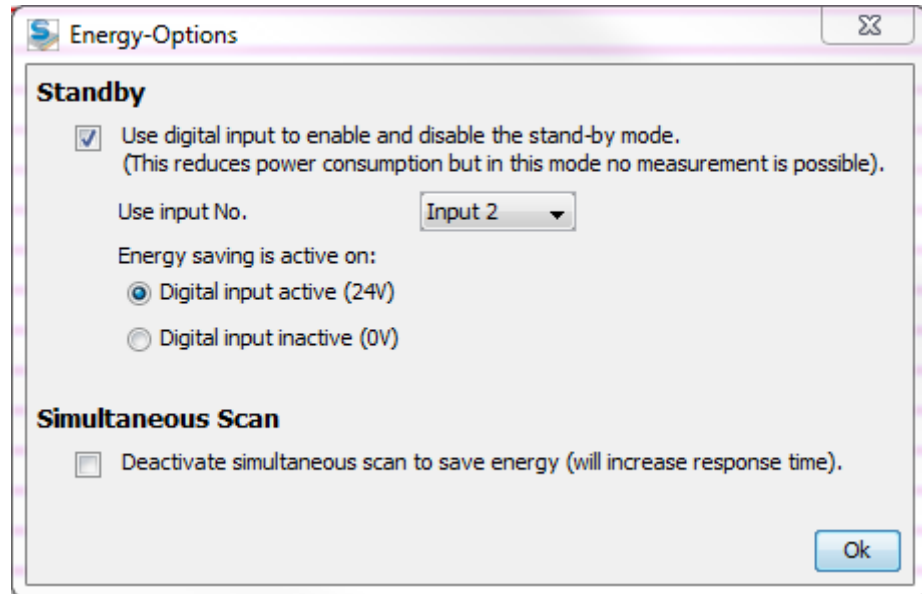

Figure 118: Energy options

▶ Select an input for activating Standby mode.
▶ You should also select one of the following options for the input:
  – Switching input, high-active
  – Switching input, low-active

Deactivating high-speed scan function

Because the high-speed scan function results in a higher current consumption, it can be deactivated. In this case, the function cannot be activated again via the response time slider.

7.11 Beam evaluation

7.11.1 **"Blocked Beams Hold (BBH)" evaluation mode**

Prerequisites

▪ "Expert" user level

Notes

• You can choose one of the following evaluation modes: Standard, Blocked Beams Hold (BBH) or Lost Beams Hold (LBH).
• You can select the "Blocked Beams Hold (BBH)" evaluation mode for one beam function or for multiple beam functions simultaneously.

Description of operation

The "Blocked Beams Hold (BBH)" evaluation mode is activated by a trigger signal on the hardware input or via IO-Link. If this evaluation mode has been activated, any beams that have been blocked are saved and displayed as blocked beams. Once the evaluation mode is deactivated by a withdrawal of the trigger signal, the blocked beams are reset to made beams.

You can select the "Blocked Beams Hold (BBH)" evaluation mode for each individual beam function or for multiple beam functions simultaneously. As a result, beam functions for which the "Blocked Beams Hold (BBH)" evaluation mode was configured are calculated based on this evaluation mode.

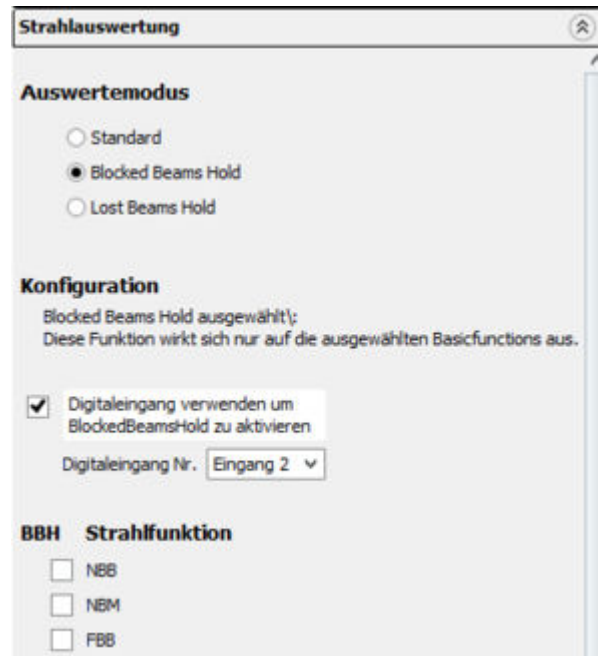**Configuring the "Blocked Beams Hold (BBH)" function using SOPAS ET**

Figure 119: SOPAS ET – "Blocked Beams Hold (BBH)" function

▶ In SOPAS ET, click on the **Beam evaluation** expandable menu in the right-hand window.

▶ In the **Evaluation mode** area, select the **Blocked Beams Hold (BBH)** evaluation mode.

✓ The message **Blocked Beams Hold selected.** is displayed in the **Configuration** area. **This function only affects the selected basic functions.**

▶ In the **BBH beam function** area, activate the beam functions for which the Blocked Beams Hold evaluation mode will be used.

▶ If the evaluation mode is to be activated and deactivated using a hardware input, check the **Use digital input to activate BlockedBeamsHold** box.

▶ Select the desired digital input from the drop-down list.
Please note that you can only assign one function to an input. If necessary, you must deactivate the **Use digital input to start teach process** option in the **Teach-in** expandable menu.

✓ In the **I/O** tab in the left-hand window, the beam functions for which the output mode was selected are marked by **(BBH)**. The message TRIGGER_BBH_MODE is displayed in the **Input/Output status** area if the "BBH" evaluation mode was activated by an input.

7.11.2   "Lost Beams Hold (LBH)" evaluation mode

Prerequisites

- "Expert" user level

Notes

- You can choose one of the following evaluation modes: Standard, Blocked Beams Hold (BBH) or Lost Beams Hold (LBH).
- The "Lost Beams Hold (LBH)" evaluation mode affects all beam functions.

Description of operation

In the "Lost Beams Hold (LBH)" evaluation mode, a blocked beam is displayed as a blocked beam until a new beam is blocked. This allows the position to be determined for objects that are smaller than the minimum detectable object.

This evaluation mode assumes that the object being detected is always positioned within the detection area. This means that the object must be located either above or below the last beam blocked when a previously blocked beam is no longer blocked and a different beam is not yet blocked. Once the object blocks a different beam, this new position is detected and the saved last beam blocked is deleted. If the object moves outside the detection area, the last beam blocked remains blocked.

Example

The "Lost Beams Hold (LBH)" output mode is used to detect the position of thin objects that are no longer detected by a parallel beam.

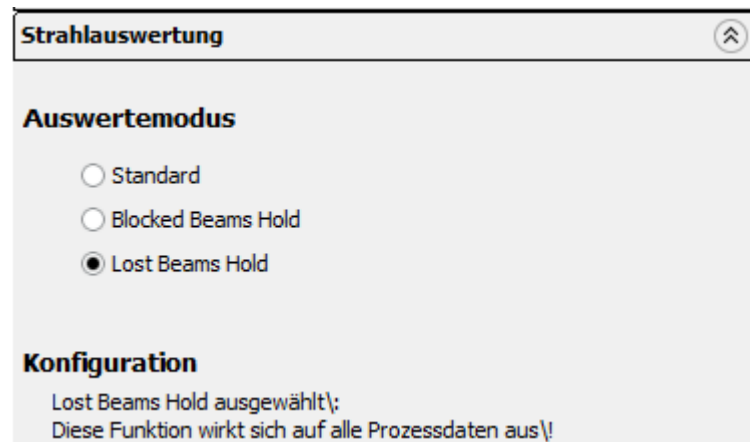### Configuring the "Lost Beams Hold (LBH)" function using SOPAS ET

Figure 120: SOPAS ET – "Lost Beams Hold (LBH)" function

- ▶ In SOPAS ET, click on the **Beam evaluation** expandable menu in the right-hand window.
- ▶ In the **Evaluation mode** area, select the **Lost Beams Hold (LBH)** evaluation mode.
- ✓ The message **Lost Beams Hold selected.** is displayed in the **Configuration** area. **This function affects all process data.**
- ✓ At the bottom of the **I/O** tab in the left-hand window, the beam evaluation mode OFF, Blocked Beams Hold or Lost Beams Hold is displayed.

7.12   Simulation

If you configure an MLG-2 offline – i.e., without a connection to the device – you can simulate the operation of the MLG-2 using simulation objects. The objects required for the simulation can be set via the expandable **Simulation** menu. This includes the number of objects, their shape, size, and speed.
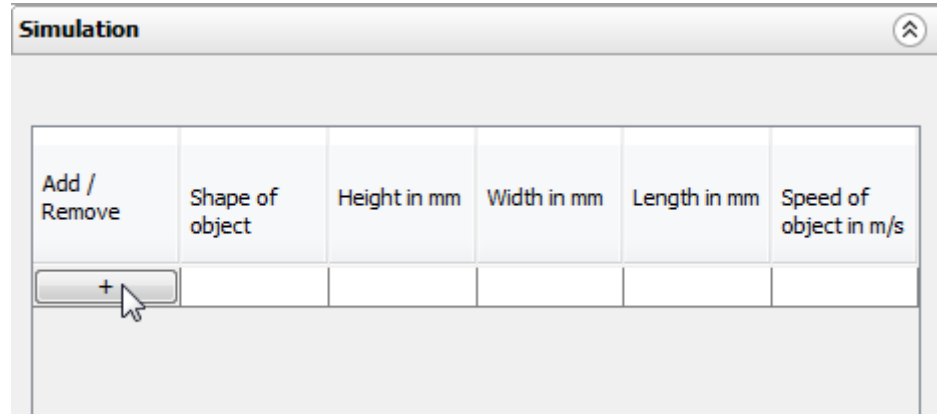
▶   Click on the plus sign to add a simulation object.

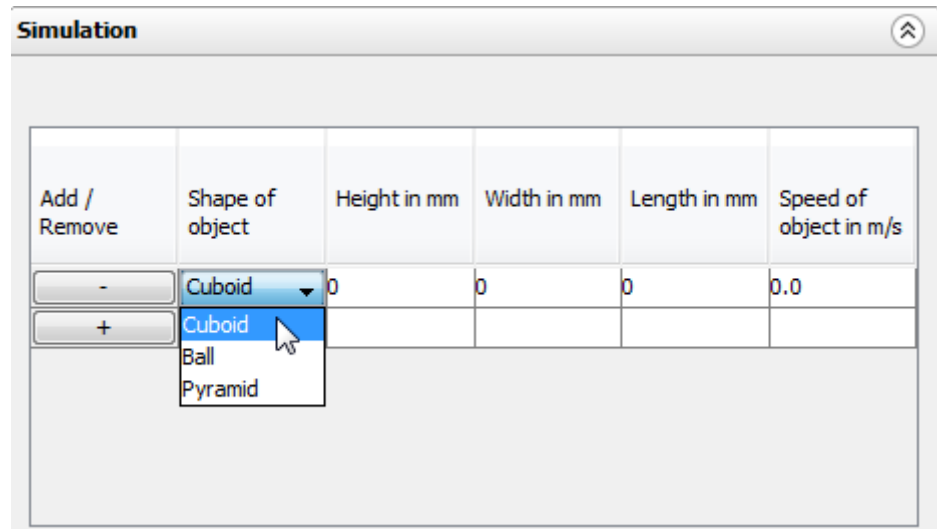*Figure 121: Add simulation object*

▶   Select the object shape.

Figure 122: Determine the shape of the simulation object

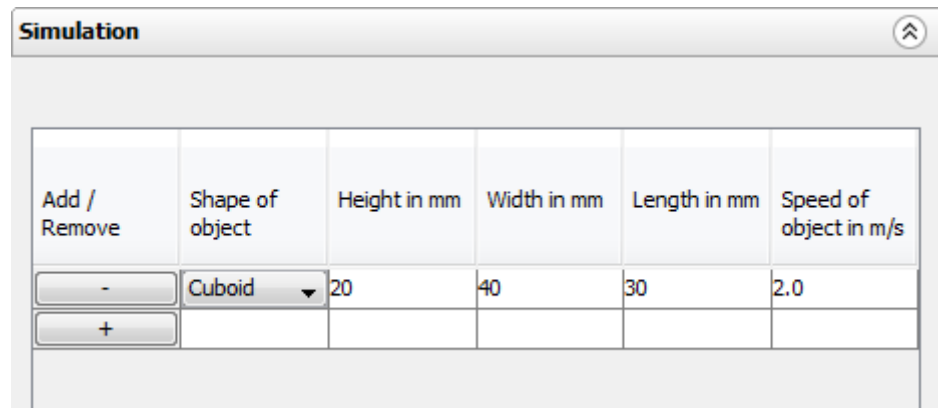▶   Enter the height, width, and length in mm. Enter the object speed in m/s.

Simulation					
Add / Remove	Shape of object	Height in mm	Width in mm	Length in mm	Speed of object in m/s
−	Cuboid ▾	20	40	30	2.0
+					

Figure 123: Determine the size of the simulation object

▶   Click **Start simulation**.

Distance between sender and receiver (only for simulation) 2.5 m

🔴 Start simulation

ℹ During the simulation all beams are recorded in the beam monitor.
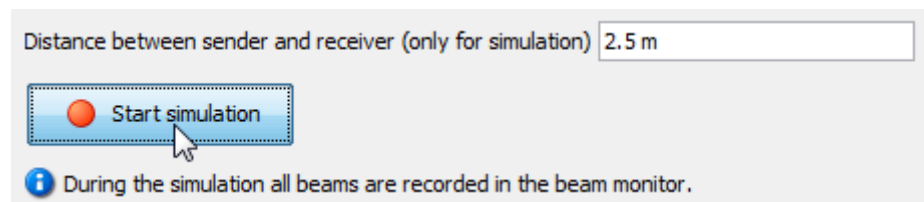
Figure 124: Start simulation

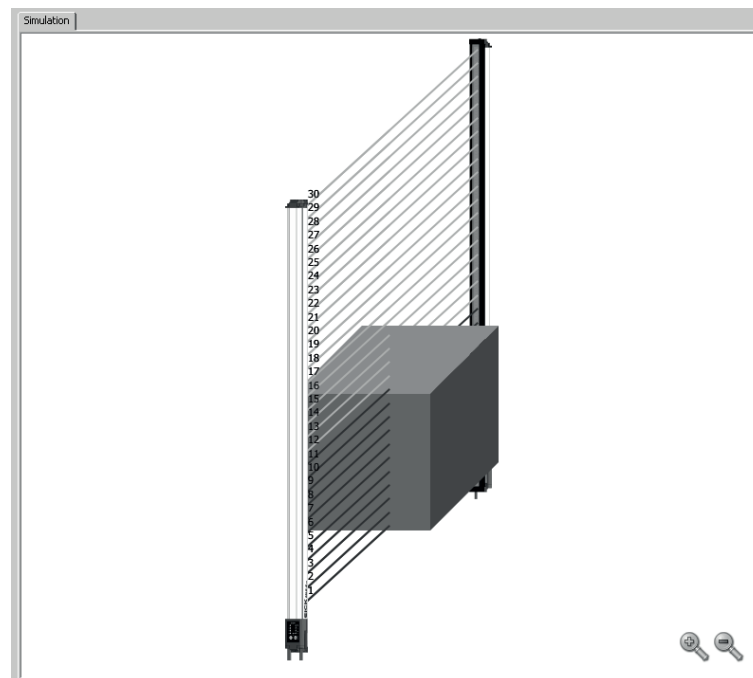✓   The configured simulation object is moved through the MLG-2 in the **Simulation** area.

Figure 125: Simulation object in Simulation area

7.13   Beam monitor (only in the EXPERT user level)

If SOPAS ET is connected to an MLG-2, the **Beam monitor** tab shows the current beam status as a function of time as well as the status of the configured outputs.
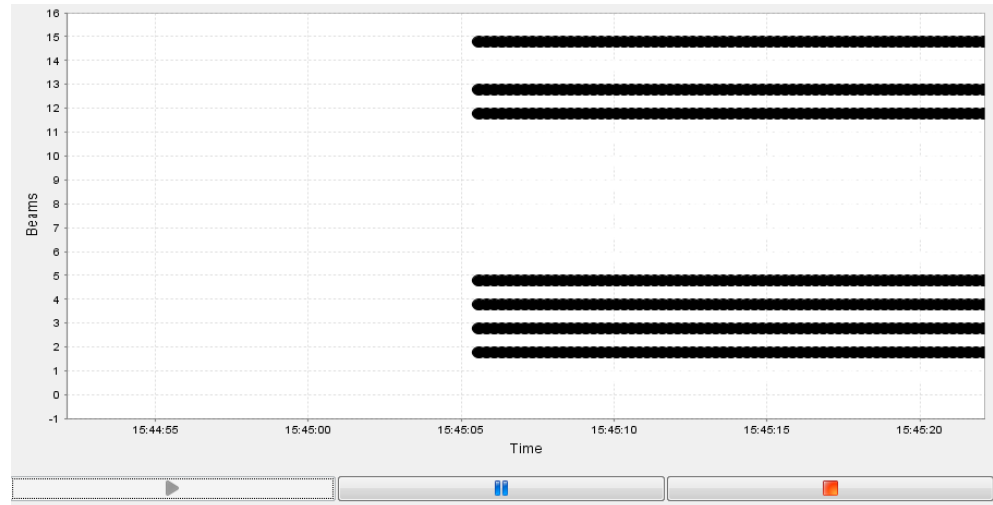
Figure 126: Beam status

This not only shows whether the beam is blocked or made, but also indicates partial coverage of the beam using grayscale, i.e., a half-blocked beam is shown in 50% gray.

If an object is moved through the detection area within the simulation while offline, the made and blocked beams are recorded just as in online operation. If the object is moved using the mouse, only the static beam status is displayed.

7.14 Function programming (in the EXPERT user level)

Function programming can be used to carry out complex applications with variables, operands, and functions in the **EXPERT** user level.

1st option:

"Beam function variables" are defined in the **Beam function variables** area using the beam functions (see "Beam functions", page 107).

Example:

BFVar 1: Total number of beams made (NBM) ≥ 30

These variables can be linked directly to the outputs in the **Switching outputs** area.

Example:

Q1 = BFVar 1 = true
Output Q1 switches when the total number of beams made is greater than or equal to 30.

2nd option:

Several beam function variables are defined in the **Beam function variables** area using the beam functions (see "Beam functions", page 107).

Example:

BFVar 1: Number of beams made (NBM) ≥ 30
BFVar 2: Number of consecutive beams blocked (NCBB) = 5

These can be linked to logical variables in the **Logical variables** area.

Example:

LogVar1 = BFVar 1 OR BFVar 2

The logical variables can be linked in turn to the outputs (Q) in the **Switching outputs** area.

Example:

Q1 = LogVar1
The output Q1 switches when the total number of beams made is greater than or equal to 30 or when the number of consecutive beams blocked equals 5.

> **NOTE**
> If outputs have already been configured using the operating elements available in the **Easy** user level, these settings will be automatically transferred to the **Function programming** view.

Beam function variables

Name	Beam Function	Operation	Value	Result
BFVar1	ODI	≤	10	🟡
BFVar2	LBB	=	15	⚪
BFVar3	NBB	=	0	🟡
BFVar4	NBB	=	0	🟡
BFVar5	NBB	=	0	🟡
BFVar6	NBB	=	0	🟡
BFVar7	NBB	=	0	🟡
BFVar8	NBB	=	0	🟡
BFVar9	NBB	=	0	🟡
BFVar10	NBB	=	0	🟡

Combination of logical variables

Name	BFVar/Input	Operation	BFVar/Input	Result
LogVar1	BFVar1	AND	BFVar1	🟡
LogVar2	BFVar1	AND	BFVar1	🟡
LogVar3	BFVar1	AND	BFVar1	🟡
LogVar4	BFVar1	AND	BFVar1	🟡
LogVar5	BFVar1	AND	BFVar1	🟡
LogVar6	BFVar1	AND	BFVar1	🟡
LogVar7	BFVar1	AND	BFVar1	🟡
LogVar8	BFVar1	AND	BFVar1	🟡
LogVar9	BFVar1	AND	BFVar1	🟡
LogVar10	BFVar1	AND	BFVar1	🟡

Digital outputs/virtual outputs

Name	Connection	Variable
Q1	=	ZONE1
Q2 (virtual)	=	BFVar2
Q3 (virtual)	=	BFVar3
Q4 (virtual)	=	BFVar4
Q5 (virtual)	=	OT1
Q6 (virtual)	=	OT1
Q7 (virtual)	=	OT1
Q8 (virtual)	=	OT1
Q9 (virtual)	=	OT1
Q10 (virtual)	=	OT1
Q11 (virtual)	=	OT1
Q12 (virtual)	=	OT1
Q13 (virtual)	=	OT1
Q14 (virtual)	=	OT1
Q15 (virtual)	=	OT1
Q16 (virtual)	=	OT1

Figure 127: Function programming

7.14.1 Beam functions

Name	Function (English)	Function (German)	Description
NBB	Number of Beams Blocked	Anzahl unterbroch-ener Strahlen	Total number of beams blocked (e.g., for object detection)
NBM	Number of Beams Made	Anzahl freier Strah-len	Total number of beams made (e.g., for hole detection)
NCBB	Number of Consecu-tive Beams Blocked	Anzahl zusammen-hängender unter-brochener Strahlen	If there are multiple objects in the detection area, the greatest number of consecutive beams blocked is dis-played.
NCBM	Number of Consecu-tive Beams Made	Anzahl zusammen-hängender freier Strahlen	If there are multiple gaps in the detection area, the greatest number of consecutive beams made is dis-played.
LBB	Last Beam Blocked	Letzter unterbroch-ener Strahl	Beam number of the last beam blocked (e.g., for object height meas-urement)
LBM	Last Beam Made	Letzter freier Strahl	Beam number of the last beam made
FBB	First Beam Blocked	Erster unterbroch-ener Strahl	Beam number of the first beam blocked (e.g., for height classification of a hanging object)
FBM	First Beam Made	Erster freier Strahl	Beam number of the first beam made
ODI	Outside Dimension	Außenmaß	Total number of beams between the first and last beams blocked (e.g., for measuring the outside dimension)
IDI	Inside Dimension	Innenmaß	Total number of beams made between the first and last beams blocked (e.g., for measuring the inside dimension)
CBB	Central Beam Blocked	Zentraler unter-brochener Strahl	Beam number of the central beam blocked (e.g., for measuring an object position)
CBM	Central Beam Made	Zentraler freier Strahl	Beam number of the central beam made (e.g., for measuring a hole position)
BNB	Beam Number Blocked	Strahlnummer x unterbrochen	True when a predefined beam is blocked
BNM	Beam Number Made	Strahlnummer x frei	True when a predefined beam is made
ALARM Q1	–	–	Configuration same as with SOPAS ET
QoR	Quality of Run	Process quality	0 … 100 percent
QoT	Quality of Teach	Teach-in quality	0 or 100 in percent 0 = teach-in was unsuccessful 100 = teach-in was successful
RLC1 … 16	Run-length code	–	Outputs the value of the relevant change
NBB Zone X (X = 1, 2, 3 or 4)	Number of Beams Blocked Zone X	Number of Beams Blocked Zone X	Total number of beams blocked (e.g., for object detection) in the indicated zone

Table 33: Beam functions for preliminary evaluation

Name	Function (English)	Function (German)	Description
NCBB Zone X (X = 1, 2, 3 or 4)	Number of Consecutive Beams Blocked Zone X	Number of Consecutive Beams Blocked Zone X	If there are multiple objects in the detection area, the greatest number of consecutive beams blocked in the indicated zone is displayed.
FBB Zone X (X = 1, 2, 3 or 4)	First Beam Blocked Zone X	First Beam Blocked Zone X	Beam number of the first beam blocked (e.g., for object height measurement) in the indicated zone
LBB Zone X (X = 1, 2, 3 or 4)	Last Beam Blocked Zone X	Last Beam Blocked Zone X	Beam number of the last beam blocked (e.g., for object height measurement) in the indicated zone
CBB Zone X (X = 1, 2, 3 or 4)	Central Beam Blocked Zone X	Central beam blocked in Zone X	Beam number of the central beam blocked (e.g., for measuring an object position) in the indicated zone

Table 33: Beam functions for preliminary evaluation

7.15 MLG-2 configuration with the internal web server

The MLG-2 has an integrated web server which can be used to configure the MLG-2 without SOPAS ET. However, not all parameters can be configured and it does not provide the same diagnostics options.

> **NOTE**
> The interface is only available in English.
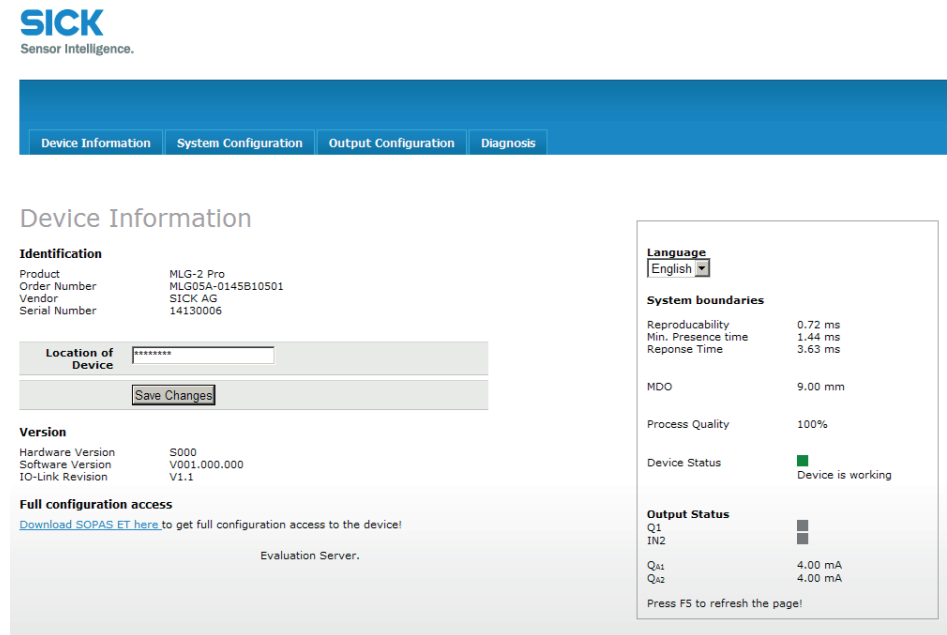
Figure 128: Interface of the integrated web server

Accessing the web server

The MLG-2 web server is accessed via the IP address of the MLG-2.

On delivery, DHCP is activated. If there is a DHCP server on the network, the MLG-2 obtains the IP address from this server. You can look up the IP address there.

The MLG-2 supports universal plug and play. This means that you can also find the IP address in the system settings of your Windows PC/notebook.

If there is no DHCP server on the network, the MLG-2 reverts to the IP address 192.168.200.100.

Working with the web server

The displayed values are not always updated automatically. The browser page may therefore need to be refreshed (e.g., by pressing F5).

8 IO-Link

The MLG-2 has an IO-Link interface.

8.1 Configuration via acyclic service data

The service data can be used to configure functions such as the alignment aid, teach-in, pushbutton lock, beam blanking, or a change of operating mode. It can also be used to read out the process or teach-in quality, for example.

> **(i) NOTE**
> The parameter lists for all readable and writable data are available as separate documents:
> * MLG-2 Pro, IO-Link V1.01 (SICK part number 8017124)
> * MLG-2 Pro, IO-Link V1.1 (SICK part number 8017185)

8.2 Data storage (IO-Link)

All light grid parameters can be saved in the control system via an IO-Link master using the data storage IO-Link function. If the device is replaced, these parameters can be written to the new device or they can be distributed to multiple MLG-2s with the same application.

> **(i) NOTE**
> The device replacement via the IO-Link function data storage is only possible with an MLG-2 with the same part number. This is only valid in conjunction with V1.1.

If the IO-Link master does not support data storage technology, the SICK memory stick (SICK part number 1064290) can provide this functionality (see **www.sick.de**).

8.3 Output of process data from the MLG-2 Pro

Transmission data

* Cycle time: 14 ms (applies to IO-Link V1.1)
* Frame type: TYPE_2_V
* Data volume (payload): 32 bytes

Data output

The MLG-2 Pro device variant has a configurable process data format. The IO-Link index 120 (dec) determines the format. The following options are possible:

* Value 0 = Data output of the beam status in the run-length code
* Value 1 = Data output of the binary beam status
* Value 2 = User-defined, configurable data output

Data output of the beam status in the run-length code

Byte 0	Byte 1	Byte 2 ... 31
Status of the switching outputs Bit 0 ... 3: Q1 ... Q4 Bit 3 ... 7: reserved	System status	Beam status in the run-length code RLC1 ... RLC15

Table 34: Data output of the beam status in the run-length code

NOTE

The run-length code can contain a maximum of 16 values; i.e. 15 status changes.

Data output of the binary beam status

Byte 0	Byte 1	Byte 2 ... 31
Status of the switching outputs Bit 0 ... 2: Q1 ... Q3 Bit 3 ... 7: reserved	System status	Beam status

Table 35: Data output of the binary beam status

NOTE

The binary output is limited to 240 beams.

User-defined data output

Bytes 0 and 1	Bytes 2 and 3	...	Bytes 30 and 31
Output function 1	Output function 2	...	Output function 16

Table 36: User-defined data output

The content of output functions 1 to 16 can be configured via IO-Link index 67dec and ranges from RLC and all beam functions to status and quality values.

9 RS-485

You can configure the output of process data via the RS-485 interface using SOPAS ET or the integrated web server. The options for configuration with the integrated web server are limited in comparison to those available in SOPAS ET.

The transmission message comprises the following parts:

- A frame
  This can be configured.
- The payload
  20 slots are available and can be individually filled with all types of data from the MLG-2. The sequence of the data to be transmitted is determined by the configuration of the corresponding slots.

Frame start	Payload	Frame end
e.g. STX	Slot 1 to 20[1]	Consists of up to 2 stop characters, e.g. CR LF (default = ETX and None)

Table 37: User-defined data output

[1] Depending on the configuration, the individual slots can be separated using separators (see "RS485 – Data transmission format", page 87).

The start and stop characters can be configured. Separators can be configured between the payload slots (see "Data output via the interfaces", page 87).

9.1 Payload

The following data can be configured as the payload:

- Diagnostic data
  System status, statuses of the switching outputs, teach-in quality, process quality, message counter

System status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Synchronization error	Teach-in error	Hardware error	Contamination warning	Teach-in active	Excess temperature warning	Process data invalid	Output short-circuit

Table 38: Content of the system status

States of the switching outputs

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	Reserved	Q4	Q3	Q2	Q1

Table 39: Content of the switching output statuses

- Measurement data
  Beam status, RLC, beam functions

> **NOTE**
> ▪ The total amount of process data (payload + frame) **must not exceed 180 bytes.** If more process data is configured, the data is only output up to the last slot which still fits (incl. start and stop characters and separators) in the data frame of 180 bytes. No subsequent process data is output.
> ▪ If the beam status does not fit in the data frame of 180 bytes, none of it will be output.

9.2 Data volume for the beam functions

The data volume for the beam functions depends on the following factors:

- Number of beams on an MLG-2 and the resulting data width for the transmission of a beam function
  - 8 bits with up to 255 beams
  - 16 bits with more than 255 beams
- Transmission type
  Binary, hexadecimal (ASCII-coded), decimal (ASCII-coded)

8-bit or 16-bit data width

In order to output data such as the number of beams blocked (beam function = NBB), different data widths are required depending on the number of beams on the light grid in use.

Examples:

MLG**50**A-**2050**I10501, a device with 50-mm resolution and 2050-mm monitoring height, 2050/50 + 1 = 42 beams

If all beams on the light grid are blocked, NBB = 42. A transmission width of 8 bits is sufficient.

MLG**05**A-**2095**I10801, a device with 5-mm resolution and 2095-mm monitoring height 2095/5 + 1 = 420 beams

If all beams on the light grid are blocked, NBB = 420. A transmission width of 16 bits is required.

Transmission type

The data can be transmitted in binary, hexadecimal, or decimal format:

Above example with NBB = 42 and 8-bit data width:

- Binary = 1 byte: 0010 1010
- HEX = 2 ASCII characters = 2 bytes: 2A
- DEC = 3 ASCII characters = 3 bytes: 042

Above example with NBB = 420 and 16-bit data width:

- Binary = 2 bytes: 0000 0001 1010 0100
- HEX = 4 ASCII characters = 4 bytes: 01 A4
- DEC = 3 ASCII characters = 3 bytes: 420

9.3 Data volume for the separators

Each separator is 1 byte long.

If separators are configured, a separator is output after each configured entry or after every package of 8 beams in the case of the beam status.

9.4 Transmitting the beam status

Beams are always output in packages of 8; the beam status is always output with a data width of 8 bits (MSB = first beam).

The data volume depends on the transmission type and the number of beams on the MLG-2.

Transmission type

- Binary = 1 bit per beam = 1 byte for eight beams
- HEX = 2 ASCII characters = 2 bytes for eight beams
- DEC = 3 ASCII characters = 3 bytes for eight beams

Example calculation for the data volume of the beam status with hexadecimal transmission of the beam status for an MLG-2 with 420 beams:

420/8 = 52.5, rounded up to 53 × 2 bytes = **106 bytes**

9.5 Calculation examples for the total data volume

MLG05A-2095I10801 with 420 beams

16-bit format = active (required because the MLG-2 has more than 255 beams)

Data format = HEX

The following settings are configured:

- Start character = STX (1 byte)
- Separator = % (1 byte in each case)
- Stop character 1 = ETX (1 byte)
- No stop character 2 = (0 bytes)
- Process data:
  - System status (4 bytes)
  - Beam status (106 bytes)
  - Beam function LBB (4 bytes)
  - Beam function FBB (4 bytes)
  - Beam function NBB (4 bytes)

Calculation of the data volume for the beam status

420 beams/8 beams per data package = 52.5, rounded up to 53 × 2 bytes = **106 bytes**

Total data volume:

```
      1  Byte start character
+     4  Byte system status
+     1  Byte separator
+   106  Byte beam status
+    52  Byte separators in beam status
+     1  Byte separator after the last beam status package
+     4  Bytes LBB
+     1  Byte separator
+     4  Bytes FBB
+     1  Byte separator
+     4  Bytes NBB
+     1  Byte stop character 1
=   180  Byte
```

The available data volume is sufficient to transmit the data from the example.

10 Servicing

The MLG-2 measuring automation light grid is maintenance-free. Depending on the ambient conditions, regular cleaning is required.

Depending on the ambient conditions of the MLG-2, the front screens must be cleaned regularly and in the event of contamination. Static charges can cause dust particles to be attracted to the front screen.

NOTE

▶ Do not use aggressive cleaning agents.
▶ Do not use abrasive cleaning agents.
▶ Do not use cleaning agents that contain alcohol, e.g., window cleaner.

We recommend anti-static cleaning agents.

We recommend the use of anti-static plastic cleaner (SICK part number 5600006) and the SICK lens cloth (SICK part number 4003353).

How to clean the front screen:

▶ Use a clean, soft brush to remove dust from the front screen.
▶ Then wipe the front screen with a clean, damp cloth.
▶ Check the position of the sender and receiver after cleaning.
▶ Perform the teach-in process on the MLG-2 again. To do this, press the **Teach** push-button.

11 Troubleshooting

This chapter describes how to identify faults on the MLG-2.

11.1 Response to faults

⚠️ **CAUTION**
Cease operation if the cause of the malfunction has not been clearly identified.
Immediately put the machine out of operation if you cannot clearly identify the fault and if you cannot safely remedy the problem.

11.2 SICK support

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

11.3 LED indicators and error indicators

This section explains what the LED error indicators mean. The status indicators are described in a separate section .

LEDs on the front of the sender

Red LED	Yellow LED	Green LED	Meaning
○	○	○	Supply voltage off or too low
○	○	●	Supply voltage on
○	☀ 1 Hz	●	Test input active
●	○	○	Hardware error

Table 40: LED indicators on the sender

LEDs on the front of the receiver

Red LED	Yellow LED	Green LED	Meaning
○	○	○	Supply voltage off or too low
○	○	●	Supply voltage on
○	●	●	Light path blocked (at least one beam blocked)
○	○	☀ 1 Hz	IO-Link communication
○	☀ 1 Hz	●	Teach-in active
○	☀ 3 Hz	●	Contamination warning or alignment aid active
☀	☀	☀	Find-me function active (only via IO-Link) If multiple MLG-2s are installed in one application, you can activate the "Find Me" function to identify a certain MLG-2.
☀ 10 Hz	●	●	Error occurred during teach-in, at least one beam blocked
●	○	○	Hardware error
●	●	○	Synchronization error: both sync beams blocked
●	○	●	Short-circuit

Table 41: LED indicators on the receiver

LEDs on the MLG-2 Pro control panel

LED	Meaning
RS485/IO-Link	
●	No communication to
○	Supply voltage off or too low
☀ 1 Hz	Communication via IO-Link/RS485
Alignment:	
●	Light path blocked (at least one beam blocked)
○	No object in the light path
☀ 3 Hz	Contamination warning
☀ 1 Hz	Teach-in active
Link[1]	
●	If there is an Ethernet connection
Data[1]	
☀	If data is being received or sent

Table 42: LEDs on the MLG-2 Pro control panel

[1]   The LED indicators correspond to the Ethernet standard.

11.4   Advanced diagnostics on the MLG-2

The supplied SOPAS ET software contains advanced diagnostics options. These options allow you to further isolate the problem if the error situation is unclear or if there are availability issues. You can find detailed information:

- In the Status field (in the bottom left of the main screen)
- In the system boundaries display (minimum detectable object for the current configuration, minimum presence time, reproducibility, response time)

12 Decommissioning

12.1 Disposal

Always dispose of serviceableness devices in compliance with local/national rules and regulations with respect to waste disposal.

> **NOTE**
> We would be pleased to be of assistance on the disposal of this device. Please contact us.

12.2 Returns

To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:

- Details of a contact person
- A description of the application
- A description of the fault that occurred

13 Technical data

13.1 Data sheet

General data

Protection class	III (EN 61140)
Enclosure rating	IP 65 and IP 67 (EN 60529)[1]
Class according to UL 60947	Class 2
Ambient operating temperature (UL/CSA: surrounding air temperature)	–30 ... +55 °C
Storage temperature	–40 ... +70 °C
Vibration resistance	Sine-wave vibration 10-150 Hz 5 g
Shock resistance	Continuous shocks 10 g, 16 ms, 1000 shocks Single shocks 15 g, 11 ms, 3 per axis
Electromagnetic compatibility	According to EN 61000-6-2 Interference immunity for industrial environments and EN 61000-6-4 Emission standard for industrial environments
MTTF	15 years
Dimensions	see "Dimensional drawings", page 126
Weight	Sender + receiver approx. 2 kg/m + 0.1 kg
Materials • Housing • Front screen	 • Aluminum, anodized • PMMA
Firmware version	see "Type labels of the MLG-2 Pro", page 11

Table 43: MLG-2 data sheet - general data

[1]   Do not use light grids outdoors unless protected (condensation will form).

Electrical specifications (for 24 VDC and 25 °C ambient temperature)

Supply voltage V_S	24 VDC ± 20%
Residual ripple (within V_S)	< 10%
Current consumption of sender • Typical • Maximum • With 3x high-speed scan	 • 40 mA + (0.05 mA × number of beams) • < 55 mA + (0.05 mA × number of beams) • < 110 mA + (0.05 mA × number of beams)
Current consumption of receiver • Typical • MLG-2 Pro maximum • In sunlight-resistant mode where a beam of 150 klx is sent to all receiver optics	 • 80 mA + (0.25 mA × number of beams) • < 120 mA + (0.2 mA × number of beams) • < 120 mA + (0.5 mA × number of beams)

Table 44: MLG-2 data sheet - electrical specifications

Required overvoltage protection when using the following wire gages	
• AWG 20/0.52 mm^2 • AWG 22/0.32 mm^2 • AWG 24/0.20 mm^2 • AWG 26/0.13 mm^2 • AWG 28/0.08 mm^2 • AWG 30/0.05 mm^2	• 5 A • 3 A • 2 A • 1 A • 0.8 A • 0.5 A

Table 44: MLG-2 data sheet - electrical specifications

Inputs

Input voltage	0 V … V_S
Logic level switching points • HIGH • LOW	• > 15 V • < 5 V The pulse duration must be greater than the response time (see figure 129, page 122)

Table 45: MLG-2 data sheet - inputs

Outputs

Switching type	Push-pull
Logic level switching points • HIGH • LOW	• V_S – 3 V • < 3 V
Maximum output current per output	100 mA
Output load per output • Capacitive • Inductive	• 100 nF • 1 H
Load resistance for analog output 4 … 20 mA	< 600 Ω
Response time	see figure 129, page 122

Table 46: MLG-2 data sheet - outputs

Ethernet interface

Data transmission rate	100 Mbit/s
Default IP address	192.168.200.100
Subnet mask	255.255.255.000
Protocol	TCP/IP
Maximum length of cable	According to IEE802.3 (typ. 100 m)

Table 47: MLG-2 data sheet - Ethernet interface

RS-485 interface

Data transmission rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 bit/s

Table 48: MLG-2 data sheet - RS-485 interface

IO-Link interface

Version	1.1

Table 49: MLG-2 data sheet - IO-Link interface

Data transmission rate	■ COM2: 38.4 kbit/s
	■ COM3: 230.4 kbit/s
Maximum length of cable	20 m
Cycle time	
• MLG-2 Pro	• 14 ms
Vendor ID	26
Device ID	
• MLG-2 Pro	• 8388712
Process data	
• MLG-2 Pro	• 32 bytes (TYPE_2_V)[1]

Table 49: MLG-2 data sheet - IO-Link interface

[1] For an IO-Link master with V1.0, reverts to interleaved mode (consisting of TYPE_1_1 (process data) and TYPE_1_2 (on-request data)).

Technical measurement data

Wavelength	850 nm
Ambient light immunity	
• Standard operating mode	• 150,000 lx (constant light, indirect)
• Sunlight-resistant operating mode[1]	• 150,000 lx (constant light, direct and indirect)
Minimum detectable object for devices with 5 mm, 10 mm, 20 mm, 25 mm, 30 mm, 50 mm beam separation	
• With normal measurement accuracy	• Beam separation + 4 mm
• With high measurement accuracy	• Beam separation
• In Transparent operating mode	• Beam separation[2]
• In Sunlight-resistant operating mode	• Beam separation + 4 mm
• Cross beam function	• 0.5 × beam separation + 4 mm
Minimum detectable object for devices with 2.5 mm beam separation	
• With normal measurement accuracy	• Beam separation + 1 mm
• In Sunlight-resistant operating mode	• Beam separation + 1.5 mm
• With high measurement accuracy	• Beam separation
• In Transparent operating mode	• Beam separation[3]
• Cross beam function	• 0.2 × beam separation + 3.5 mm
Beam separation	2.5 mm, 5 mm, 10 mm, 20 mm, 25 mm, 30 mm, 50 mm
Number of beams	6 … 510
Detection height	130 … 3140 mm
Limiting range	2.8 m/7 m/12 m depending on device type[4]
Operating range	2 m/5 m/8.560 m depending on device type[5]
Minimum sensing range	
• With parallel-beam function	• 0 mm
• With cross-beam function	• 0.2 … 1.20 m (see table 51, page 122)
Initialization time after switch-on	< 1 s

Table 50: MLG-2 data sheet - technical measurement specifications

Response time	see "Response time and minimum presence time without high-speed scan", page 122
Minimum presence time	see "Minimum detectable absorption", page 124
Cycle time	8 ... 48 µs per beam[6]

Table 50: MLG-2 data sheet - technical measurement specifications

1. Only possible for devices with < 240 beams.
2. For opaque objects. For transparent objects + 4 mm
3. For opaque objects. For transparent objects + 1 mm
4. In Sunlight-resistant operating mode depending on device type.
5. In Sunlight-resistant operating mode: 3 m/5 m depending on device type.
6. Depending on device version and operating mode.

MLG-2 with sensing range	Raster						
	2.5 mm	5 mm	10 mm	20 mm	25 mm	30 mm	50 mm
2 m	0.20 m	–	–	–	–	–	–
5 m	–	0.11 m	0.22 m	0.44 m	0.55 m	0.66 m	1.10 m
8.5 m	–	0.12 m	0.24 m	0.48 m	0.60 m	0.72 m	1.20 m

Table 51: Minimum sensing range with cross-beam function

13.2 Diagrams

13.2.1 Response time and minimum presence time without high-speed scan
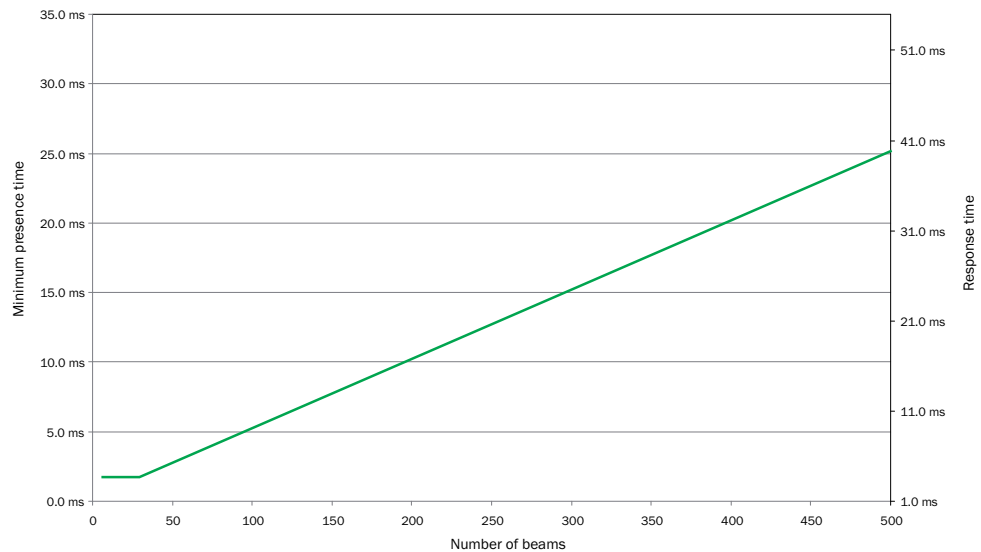
Figure 129: Graph, MLG-2 Pro response time and minimum presence time

> **NOTE**
> If the cross-beam function is configured, multiply the minimum presence time and the response time by 2.

13.2.2   Response time and minimum presence time during high-speed scan with 2,5 mm resolution
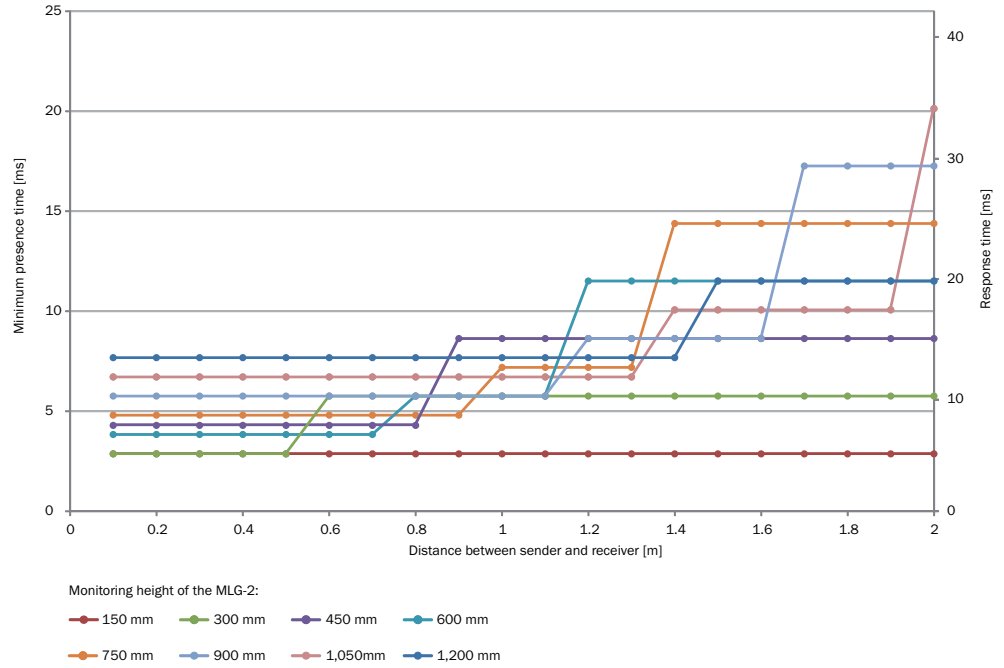
Figure 130: Response time and minimum presence time up to 2 m sensing range

13.2.3   Response time and minimum presence time during high-speed scan with up to 3.5 m sensing range
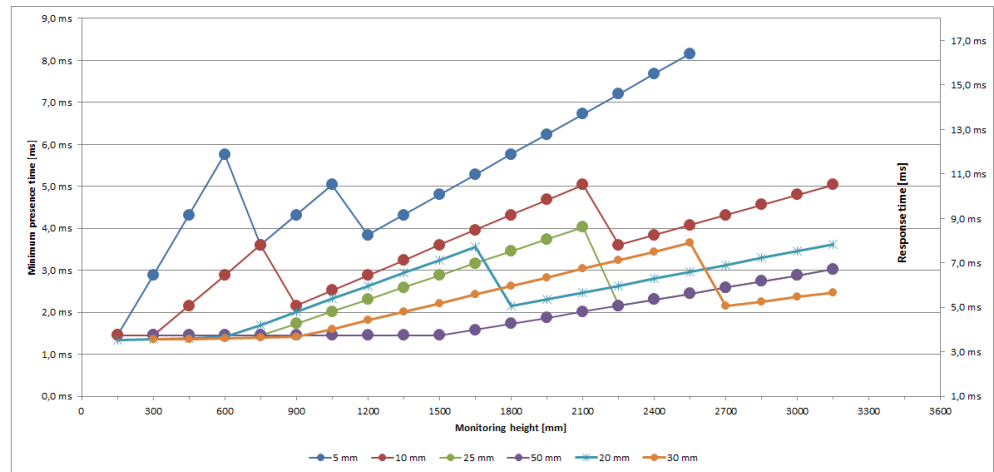
Figure 131: Response time and minimum presence time up to 3.5 m sensing range

13.2.4 Response time and minimum presence time during high-speed scan with up to 8.5 m sensing range
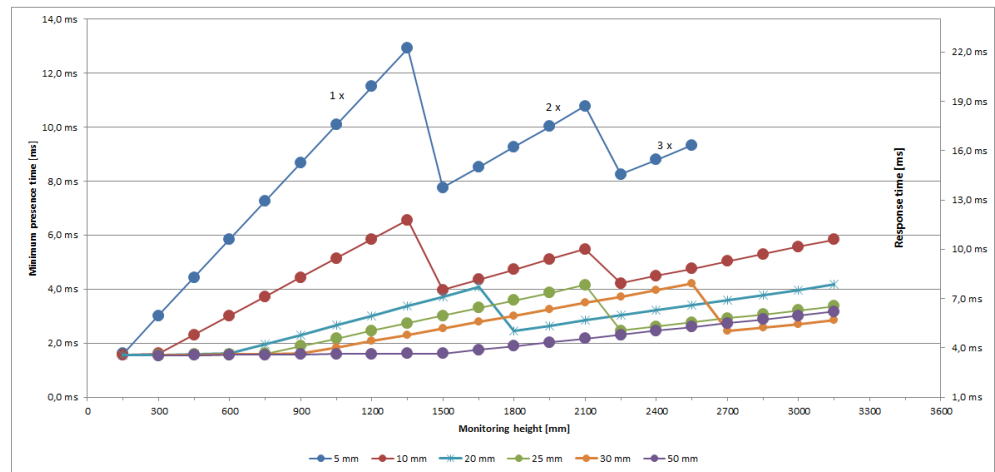
Figure 132: Response time and minimum presence time up to 8.5 m sensing range

13.2.5 Minimum detectable absorption
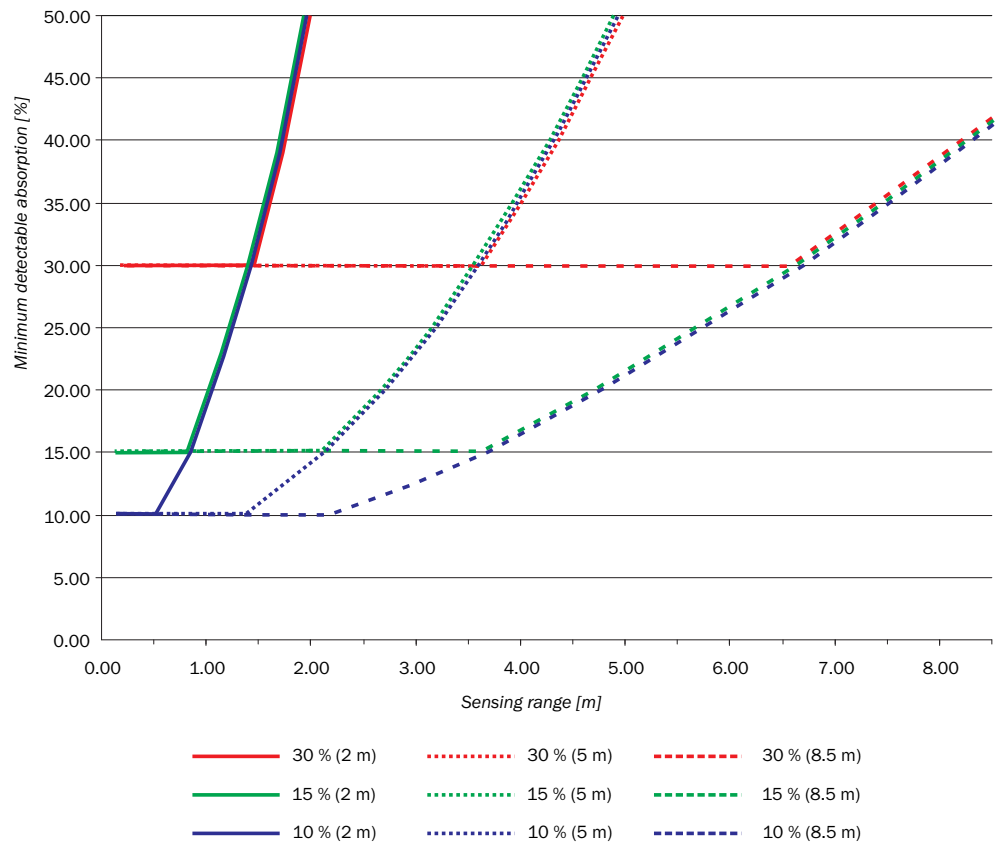
Figure 133: Minimum detectable absorption required for devices with 2 m, 5 m and 8.5 m sensing range

NOTE
The minimum detectable absorption which can be read from the diagram applies after the teach-in process with clean ambient conditions. The minimum detectable absorption increases with the level of contamination. Clean the front screens of the sender and receiver regularly, then perform a teach-in process.

13.3 Dimensional drawings

13.3.1 MLG-2 Pro dimensional drawing
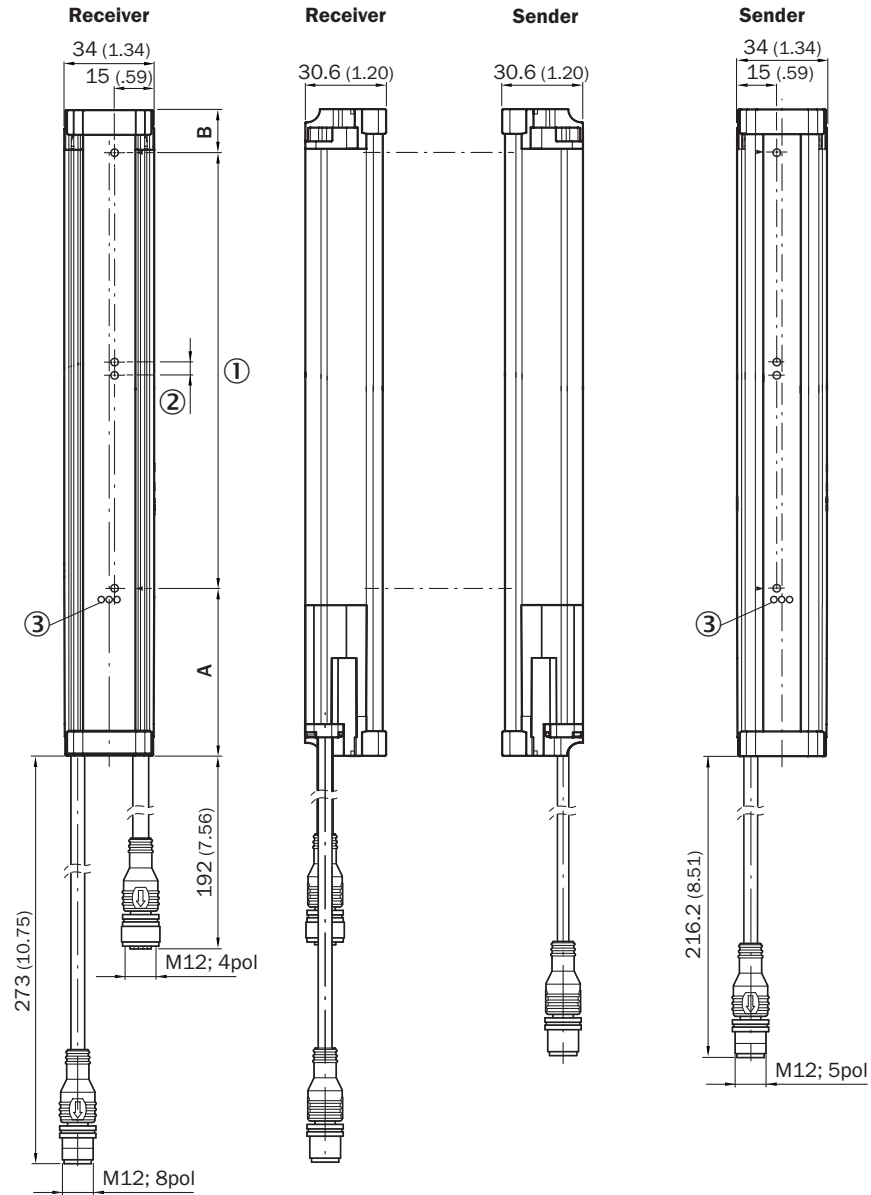
	A [1]	B [2]
Beam separation 2.5 mm	62.25 (2.45)	17.15 (0.68)
Beam separation 5 mm	63.3 (2.49)	16.1 (0.63)
Beam separation 10 mm	68.3 (2.69)	16.1 (0.63)
Beam separation 20 mm	68.3 (2.69)/78.3 (3.08) [3]	16.1 (0.63)
Beam separation 25 mm	83.3 (3.28)	16.1 (0.63)
Beam separation 30 mm	88.3 (2.69)	16.1 (0.63)
Beam separation 50 mm	108.3 (4.26)	16.1 (0.63)

[1] Distance: MLG-2 edge - first beam
[2] Distance: MLG-2 edge - last beam
[3] MLG20x-xx**40**: 68.3 mm
   MLG20x-xx**80**: 78.3 mm

Figure 134: MLG-2 Pro (mm) dimensional drawing

①   Detection height[6] = (n × SA) – 1 SA (see table 52, page 127)
②   Beam separation (SA)
③   Status indicator: green, yellow, red LEDs

13.3.2   Measurement tables

	Type/beam separation						
	MLG02.../ 2.5 mm	MLG05.../ 5 mm	MLG10.../ 10 mm	MLG20.../20 mm	MLG25.../ 25 mm	MLG30.../30	MLG50.../ 50 mm
Monitoring height [mm]/number of beams	145/59	145/30	140/15	140/8 *	–	–	–
	295/119	295/60	290/30	280/15	275/12	270/10	250/6
	445/179	445/90	440/45	440/23 *	425/18	420/15	400/9
	595/239	595/120	590/60	580/30	575/24	570/20	550/12
	745/299	745/150	740/75	740/38 *	725/30	720/25	700/15
	895/359	895/180	890/90	880/45	875/36	870/30	850/18
	1045/419	1045/210	1040/105	1040/53 *	1025/42	1020/35	1000/21
	1195/479	1195/240	1190/120	1180/60	1175/48	1170/40	1150/24
	–	1345/270	1340/135	1340/68 *	1325/54	1320/45	1300/27
	–	1495/300	1490/150	1480/75	1475/60	1470/50	1450/30
	–	1645/330	1640/165	1640/83 *	1625/66	1620/55	1600/33
	–	1795/360	1790/180	1780/90	1775/72	1770/60	1750/36
	–	1945/390	1940/195	1940/98 *	1925/78	1920/65	1900/39
	–	2095/420	2090/210	2080/105	2075/84	2070/70	2050/42
	–	2245/450	2240/225	2240/113 *	2225/90	2220/75	2200/45
	–	2395/480	2390/240	2380/120	2375/96	2370/80	2350/48
	–	2545/510	2540/255	2540/128 *	2525/102	2520/85	2500/51
	–	–	2690/270	2680/135	2675/108	2670/90	2650/54
	–	–	2840/285	2840/143 *	2825/114	2820/95	2800/57
	–	–	2990/300	2980/150	2975/120	2970/100	2950/60
	–	–	3140/315	3140/158 *	3125/126	3120/105	3100/63

Table 52: Monitoring height (mm)/number of beams

Beam separation	Distance from MLG-2 edge to first beam
2.5 mm	62.25 mm
5 mm	63.3 mm
10 mm	68.3 mm
20 mm	68.3 mm (*), otherwise 78.3 mm
25 mm	83.3 mm
30 mm	88.3 mm
50 mm	108.3 mm

Table 53: Distance from MLG-2 edge to first beam

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[6]   See type code.

14 Ordering information

The ordering information for the MLG-2 can be found in the MLG-2 product information with the SICK part number 8017054.

15 Accessories

15.1 Accessories

Type	Description	Part no.
AR60	Laser alignment aid for various sensors, laser class 2 (IEC 60825): Do not look into the beam.	1015741
Adapter AR60	Adapter AR60 for MLG-2	4070854
Lens cloth	Cloth for cleaning the front screen	4003353
Plastic cleaner	Plastic cleaner and polish, anti-static, 0.5 liters	5600006

Table 54: Accessory part numbers

Type	Description	Part no.
SBO-02F12-SM1	M12 male connector 8-pin, on 1 × M12 female connector 8-pin, on 1 × M12 female connector, 5-pin, for connecting to a PLC	6053172
SBO-02F12-SM2	M12 male connector, 5-pin, on 1 × M12 female connector, 8-pin, on 1 × M12 female connector, 5-pin, for connecting to an IO-Link master	6053283
SBO-02F12-SMx	M12 male connector 8-pin, on 1 × M12 female connector 8-pin, on 1 × M12 female connector, 5-pin, for connecting to an existing MLG connection	Available soon

Table 55: T-distributor part numbers

Type	Description	Part no.
BEF-1SHABP004	Mounting kit for replacement of swivel mount brackets 2019649 and 2019659 or side bracket 2019506 with the FlexFix bracket when using the bore holes provided	2071021
BEF-1SHABPKU4	FlexFix bracket, plastic	2066614
BEF-3SHABPKU2	QuickFix bracket, plastic	2066048

Table 56: Mounting material part numbers

Type	Description	Part no.
SiLink2 Master	IO-Link V1.1 port class A, USB2.0 connection, optional external power supply 24 V/1 A	1061790
SICK Memory Stick	IO-Link version V1.1, port class 2, PIN 2, 4, 5 galvanically connected, 18 V DC ... 32 V DC supply voltage (limit values during operation in short-circuit protected network, max. 8 A)	1064290

Table 57: Connection module part numbers

Type	Description	Part no.
T-nuts	Sliding nut	4031411
Sliding nut	Sliding nut, M5	5305719
Sliding nuts	Sliding nut set, M5, 4 pieces	2017550
UH sliding nut	Sliding nut, item profile, M6	5305615

Table 58: Sliding nut part numbers

Type	Head A connection type	Head B connection type	Connecting cable	Part no.
DOL-1205-G05MAC	Female connector, M12, 5-pin, straight, screened	Cable, flying leads	5 m, 5-wire	6036384
DOL-1205-G02M	Female connector, M12, 5-pin, straight, unscreened	Cable, flying leads	2 m, 5-wire	6008899
DOL-1205-G05M			5 m, 5-wire	6009868
DOL-1205-G10M			10 m, 5-wire	6010544
DOL-1205-G15M			15 m, 5-wire	6029215
DOL-1208-G02MF	Female connector, M12, 8-pin, straight, screened	Cable, flying leads	2 m, 8-wire	6020663
DOL-1208-G05MF			5 m, 8-wire	6020664
DOL-1208-G10MF			10 m, 8-wire	6048434

Table 59: Part numbers for connecting cable with female connector

Type	Head A connection type	Head B connection type	Part no.
DOS-1205-G	Female connector, M12, 5-pin, straight, unscreened	Screw terminals	6009719
DOS-1208-G	Female connector, M12, 8-pin, straight, unscreened	Screw terminals	6028422
DOS-1208-GA	Female connector, M12, 8-pin, straight, screened	Screw terminals	6028369
STE-1205-G	Male connector, M12, 5-pin, straight, unscreened	Screw terminals	6022083
STE-1208-GA	Male connector, M12, 8-pin, straight, screened	Screw terminals	6028370

Table 60: Female and male connector part numbers

Type	Head A connection type	Head B connection type	Connecting cable	Part no.
DSL-1205-G01MC	Male connector, M12, 5-pin, straight, unscreened	Female connector, M12, 5-pin, straight	1 m, 5-wire	6029280
DSL-1205-G02MC			2 m, 5-wire	6025931
DSL-1205-G05MC			5 m, 5-wire	6029282
DSL-1205-G10MC			10 m, 5-wire	6038954
DSL-1208-G01MAC	Female connector, M12, 8-pin, straight, screened	Male connector, M12, 8-pin, straight	1 m, 8-wire	6026625
DSL-1208-G02MAC			2 m, 8-wire	6030121
DSL-1208-G05MAC			5 m, 8-wire	6032325
DSL-1208-G10MAC			10 m, 8-wire	6034901

Table 61: Part numbers for connecting cable with male/female connector

Type	Head A connec-tion type	Head B connec-tion type	Connecting cable	Part no.
SSL-1204-G02ME	Male connector, M12, 4-pin, D-coded, screened	Male connector, M12, 4-pin, D-coded	2 m, 4-wire	6034420
SSL-1204-G05ME			5 m, 4-wire	6034422
Connection cable (male connector-male connector)	Male connector, M12, 4-pin, straight, D-coded, screened	Male connector, RJ-45, 8-pin, straight	5 m, 4-wire, AWG26	6034415
SSL-2J04-G02ME	Male connector, M12, 4-pin, straight, D-coded, screened	Male connector, RJ-45, 8-pin, straight	2 m, 4-wire, AWG26	6034414

Table 62: Ethernet connecting cable part numbers

16 Annex

16.1 Compliance with EU directive

EU declaration of conformity (extract)

The undersigned, who represents the manufacturer below, hereby declares that the product complies with the regulations of the EU directive(s) below (including all relevant changes), and that it is based on the relevant standards and/or technical specifications.

Complete EU declaration of conformity for download: www.sick.de

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