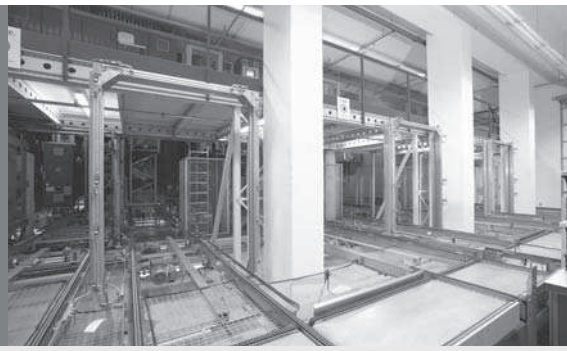
OPERATING INSTRUCTIONS



MLG CANopen

Modular Light Grid

EN

SICK
Sensor Intelligence.

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1 General information

1.1 Information on the operating instructions

These operating instructions provide important information on handling MLG CANopen modular light grids by SICK AG. A prerequisite for their safe operation is that all safety information and handling instructions stated in this manual are observed.

In addition, any local accident prevention guidelines and general safety specifications applicable for use of the light grids must be complied with.

Ensure you read through these operating instructions carefully before starting to work with the light grids. It constitutes an integral part of the product and should be stored in the direct vicinity of the light grid so it remains accessible for personnel at all times.

Should the light grid be passed on to a third party, these operating instructions should be handed over with it.

NOTE!

These operating instructions describe the “Inputs and outputs, data interface” feature for all modular MLG light grids in the C (CANopen) variant.

→ See page 14, chapter 3.2.1 “Type code”.

1.2 Explanation of symbols

Warnings

Warnings in these operating instructions are indicated by symbols. The warnings are introduced by signal words that indicate the extent of the danger.

These warnings must be observed at all times and care must be taken to avoid accidents, injuries to personnel and damage to objects.

DANGER!

... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING!

... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION!

... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

NOTICE!

... indicates a potentially damaging situation, which may lead to damage to equipment or objects if not prevented.

Tips and recommendations

NOTE!

... highlights useful tips and recommendations as well as information for efficient and fault-free operation.

1.3 Limitation of liability

Applicable standards and regulations, the latest state of technological development and many years of knowledge and experience have all been taken into account when assembling the data and information contained in these operating instructions.

The manufacturer accepts no liability for damage caused by:

- failing to observe the operating instructions
- incorrect use
- use by untrained personnel
- unauthorized alterations
- technical modifications
- use of unauthorized spare parts/wear and tear parts.

With special variants, where optional extras have been ordered or owing to the latest technical changes, the actual delivery may vary from the features and illustrations shown here.

1.4 Delivery

The following are included in the delivery:

- MLG S sender
- MLG E receiver
- Optional: Accessories (→ page 89, chapter 14)

Documentation enclosed for each light grid:

- Quickstart

1.5 Customer service

Do not hesitate to contact our customer service should you require any technical information.

For your representative, see the rear of these operating instructions.

NOTE!

Before calling, make a note of all type label data such as type code, serial number etc. to ensure faster processing.

1.6 EC Declaration of Conformity

→ The EC Declaration of Conformity can be downloaded via the Internet from “www.mysick.com”.

1.7 Environmental protection

NOTICE!
Danger to the environment due to improper disposal of the light grid!

Disposing of the light grid improperly may cause damage to the environment.

For this reason:

- Always observe the valid regulations on environmental protection.
- Following appropriate disassembly, send any disassembled components for recycling.
- Separate the materials according to their type and place them in recycling containers.

2 Safety

2.1 Correct use

MLG light grids are opto-electronic sensors consisting of a sender (MLG S) and a receiver (MLG E).

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

SICK assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to incorrect use of the product that does not conform to its intended purpose and is neither described nor mentioned in this documentation.

2.2 Improper use

MLG light grids do not constitute safety components in accordance with the EC Machinery Directive (2006/42/EC).

MLG light grids may not be used for personal security applications.

MLG light grids are not safety light grids. MLG light grids may not be used as a safety device to prevent access for persons, their hands or other bodily parts to hazardous areas for safety purposes.

MLG light grids may not be used in potentially explosive atmospheres.

Any other uses not described under correct use are prohibited.

Never install/connect accessories whose quantity and composition are not expressly specified or that are not approved by SICK AG.

WARNING!
Danger due to improper use!

All improper usage can lead to dangerous situations.

For this reason:

- Light grids should be used according to their intended use only.
- All information in the operating instructions must be strictly complied with.

All claims for damages arising as a result of improper use are precluded. Liability for all damages arising as a result of improper use lies solely with the operator.

2.3 Modifications and conversions

Modifications and conversions to the light grid and/or the installation may lead to unforeseeable dangers.

Technical modifications and enhancements to the light grid in particular require the written approval of the manufacturer.

2.4 Requirements for skilled persons and operating personnel

WARNING!
Danger of injury due to insufficient training!

Improper handling may lead to considerable damage to persons and equipment.

For this reason:

– All activities should always be performed by designated persons only.

Training requirements for the various activity areas in these operating instructions are as follows:

- **Instructed personnel**
  Such persons have been instructed during training by the operator about tasks they have been allotted and about possible dangers in case of improper behavior.
- **Skilled persons**
  Such persons are able, due to their specialist training, knowledge and experience as well as their knowledge of the pertinent regulations, to perform tasks delegated to them and detect any possible dangers on their own initiative.
- **Electricians**
  Such persons are able, due to their specialist training, knowledge and experience as well as their knowledge of pertinent regulations, to perform work on electrical systems and detect any possible dangers on their own initiative.
  In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e.g. Master Electrician). Other relevant regulations applicable in other countries must be observed.

3 Identification

3.1 Type label

Each sender and receiver is fitted with a type label.

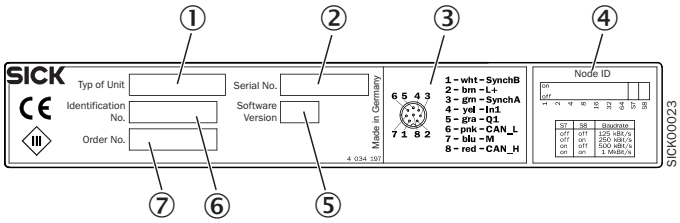


Fig. 1: Type label

1 Type code, →see page 13, chapter 3.2
2 Serial number (DAT code)
3Example connection diagram
4 Node ID and baud rate
5 Software version
6 Identification number
7 Order no.

3.2 Type code

Type of unit

NOTE!

During installation, commissioning and configuration, you will need to know the exact type of your light grid. For this, see the type of unit specified on the type label and note the last four characters. These final four characters contain information about inputs and outputs, data interface, range, parameters and beam type. →See also page 14 ff.

Example of type of unit

Type of Unit: MLGE1-1190C811

→ Short designation in the operating instructions: C811

3.2.1 Type code MLG

M	L	G	E	1	–	1	1	9	0	C	8	1	1	
1	2	3	4	5		6	7	8	9	10	11	12	13	14

Position	Description
1–3	**Product family** **MLG**
4	E Receiver S Sender
5	**Beam spacing** 0 Special variant 1 10 mm 2 20 mm 3 30 mm 5 50 mm 7 25 mm
6–9	**Detection height** [1] 0000 Special variant 0100 100 mm ... 3140 3,140 mm
10	**Inputs and outputs, data interface** F PNP outputs E NPN outputs I PNP output, 1 RS-485 T NPN output, 1 RS-485 C CANopen P PROFIBUS D IO-Link, switching H IO-Link, measuring A Analog, PNP outputs N Analog, NPN outputs
11	**Connection type** 0 Special variant 1 Cable gland 2 Terminal chamber 4 M12 plug, 12-pin 5 M12 plug, 5-pin 8 M12 plug, 8-pin
12	**Range, optical property, aperture angle** 0 Special variant 1 5 m, infrared, ± 3.6° 2 8.5 m, infrared, ± 3.6° 3 20 m, infrared, ± 3.6° (on request) 4 5 m, infrared, ± 10° 5 8.5 m, infrared, ± 10° 6 5 m, infrared, ± 1.8° (on request)
13	**Parameter settings, beam type** 0 Special variant 1 Standard 2 Parameterization interface 3 Triple crossover beam 4 Quintuple crossover beam (on request) L Triple crossover beam, output Q inverted
14	**Special device variants** S Special M Sample F Private label K Customer-specific

1) Possible detection heights depend on the beam spacing. Detection heights are graduated in increments of 150 mm as standard. A maximum of 240 beams are possible for each light grid. → For possible monitoring heights, see page 85, chapter 13.2.

4 Structure and function

4.1 Setup

MLG

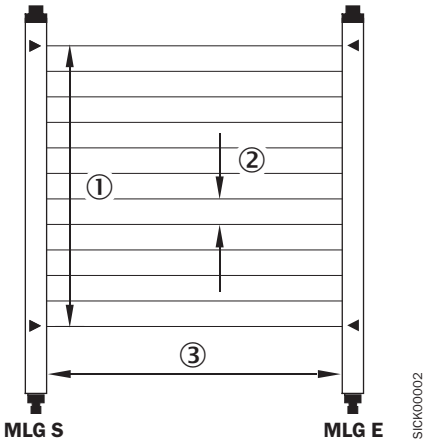


Fig. 2: MLG modular light grid setup

MLG S: Sender
MLG E: Receiver

1 Monitoring height
2 Beam spacing
3 Range: Distance between sender and receiver

4.2 Function

Modular MLG light grids are compact, optical and modular light grids consisting of a sender (MLG S) and a receiver (MLG E).

The sender consists of sender optics, several sender elements (LEDs) and actuation electronics. The receiver consists of receiver optics, several sender elements (photodiodes) and actuation electronics. A sender element and a receiver element situated opposite one another each constitute a channel. Providing 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.

Via the CANopen interface, the light grid can be configured for specific applications. → See page 43, chapter 9.

Modular light grids with CANopen are parameterized in the factory with the parallel beam function.

4.3 Detection area

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

4.4 MDO (Minimum Detectable Object)

The minimum detectable object is the minimum size an object needs to be for it to be detected by the light grid. The minimum detectable object is known as the MDO for short.

The minimum detectable object depends on the light grid's beam spacing, range type and beam function.

The less the beam spacing and the lower the range type, the smaller the object that can be detected by the light grid will be. The crossover beam function can detect smaller objects than the parallel beam function.

4.5 Beam function

With the beam function, we distinguish between parallel beam function and crossover beam function.

Factory setting

Modular light grids with CANopen are parameterized in the factory with the parallel beam function.

The beam function can be modified via the CANopen interface.
→ See page 76, chapter 9.7.6.

Parallel beam function

With the parallel beam function, each light beam is received by the receiver element located directly opposite only.

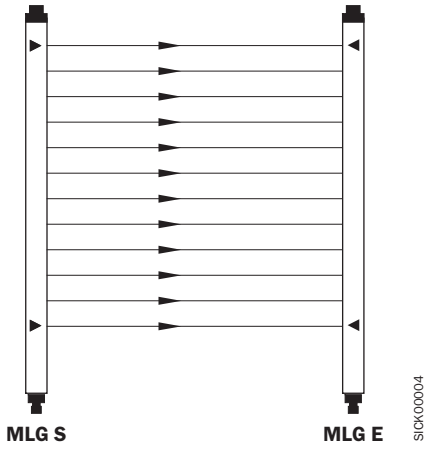


Fig. 3: Parallel beam function

Minimum detectable object (MDO) with parallel beam function – 5 m range type

The following table shows the minimum detectable object (MDO) for the 5 m range type depending on beam spacing. → See page 13, MLG type code, item 5 “Beam spacing” and item 12 “Range”.

Type	Beam spacing	MDO
1x ... xx1x 1x ... xx4x 1x ... xx6x	10 mm	15 mm
2x ... xx1x 2x ... xx4x 2x ... xx6x	20 mm	25 mm
7x ... xx4x	25 mm	30 mm
3x ... xx1x 3x ... xx4x 3x ... xx6x	30 mm	35 mm
5x ... xx1x 5x ... xx4x 5x ... xx6x	50 mm	55 mm

Table 1: MDO with parallel beam function – 5m range type

Minimum detectable object (MDO) for parallel beam function – 8.5 m range type

The following table shows the minimum detectable object (MDO) for the 8.5 m range type depending on beam spacing. → See page 13, MLG type code, item 5 “Beam spacing” and item 12 “Range”.

Type	Beam spacing	MDO
1x ... xx2x 1x ... xx5x	10 mm	20 mm
2x ... xx2x 2x ... xx5x	20 mm	30 mm
3x ... xx2x 3x ... xx5x	30 mm	40 mm
5x ... xx2x 5x ... xx5x	50 mm	60 mm

Table 2: MDO with parallel beam function – 8.5 m range type

Crossover beam function

With the crossover beam function, a light beam emitted by a sender element is received alternately by a receiver element located directly opposite and receiver elements located above and beneath it.

The crossover beam function increases the resolution and enables detection of smaller objects (MDO).

Response time is longer when compared to the parallel beam function. → See page 86, chapter 13.4.

With the crossover beam function, a minimum distance needs to be observed between sender and receiver. The minimum distance depends on the aperture angle of the light grid.

Minimum detectable object (MDO) with the crossover beam function

The minimum detectable object (MDO) is specified for the following areas:

- Area a: close to the sender and receiver
- Area b: the central area between sender and receiver.

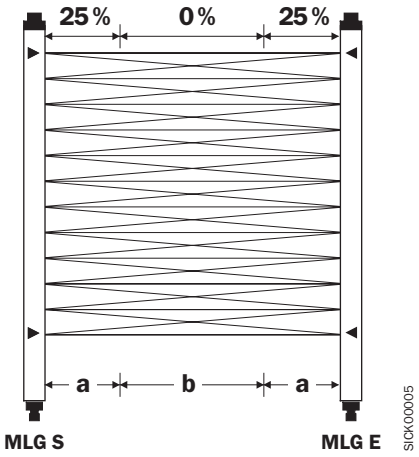


Fig. 4: Crossover beam function

Minimum detectable object (MDO) with crossover beam function – 5 m range type, aperture angle ± 3.6° and ± 10°

The following table shows the minimum detectable object (MDO) for the 5 m range type depending on beam spacing and aperture angle. → See page 13, MLG type code, item 5 “Beam spacing” and item 12 “Range”.

Type	Beam spacing	Minimum distance [1]	MDO	
			Area a	Area b
1x ... xx1x	10 mm	200 mm	15 mm	> 10 mm
1x ... xx4x		180 mm		
2x ... xx1x	20 mm	360 mm	25 mm	> 15 mm
2x ... xx4x		320 mm		
7x ... xx4x	25 mm	400 mm	30 mm	> 18 mm
3x ... xx1x	30 mm	520 mm	35 mm	> 20 mm
3x ... xx4x		470 mm		
5x ... xx1x	50 mm	840 mm	55 mm	> 30 mm
5x ... xx4x		750 mm		

1) *With the crossover beam function, a minimum distance needs to be observed between sender and receiver. The minimum distance depends on the aperture angle of the light grid.*

Table 3: MDO with crossover beam function – 5 m range type

Minimum detectable object (MDO) with the crossover beam function – 8.5 m range type, aperture angle ± 3.6° and ± 10°

The following table shows the minimum detectable object (MDO) for the 8.5 m range type depending on beam spacing and aperture angle. → See page 13, MLG type code, item 5 “Beam spacing” and item 12 “Range”.

Type	Beam spacing	Minimum distance [1]	MDO	
			Area a	Area b
1x ... xx2x	10 mm	200 mm	20 mm	> 15 mm
1x ... xx5x		180 mm		
2x ... xx2x	20 mm	360 mm	30 mm	> 20 mm
2x ... xx5x		320 mm		
3x ... xx2x	30 mm	520 mm	40 mm	> 25 mm
3x ... xx5x		470 mm		
5x ... xx2x	50 mm	840 mm	60 mm	> 35 mm
5x ... xx5x		750 mm		

1) *With the crossover beam function, a minimum distance needs to be observed between sender and receiver. The minimum distance depends on the aperture angle of the light grid.*

Table 4: MDO with crossover beam function – 8.5 m range type

4.6 Example applications

MLG light grids with CANopen are suitable for simple and complex applications such as checking for projections, access control, ejection control, start and end recognition, height measurement, hole detection, slack regulation, profile detection and operator guidance.

Fig. 5: Checking for projections

Fig. 6: Access control

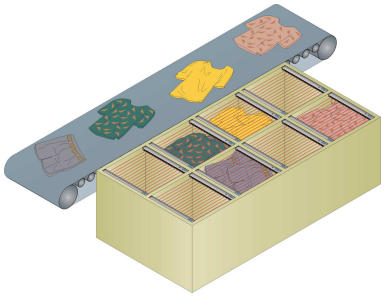


Fig. 7: Ejection control

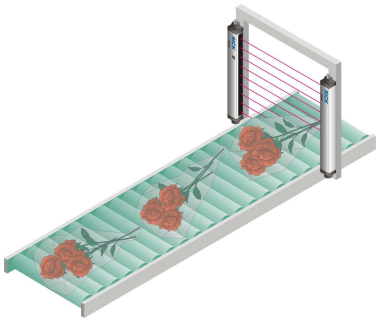


Fig. 8: Start and end recognition

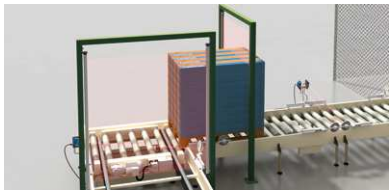


Fig. 9: Height measurement

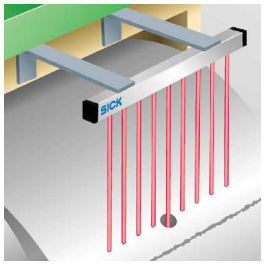


Fig. 10: Hole detection

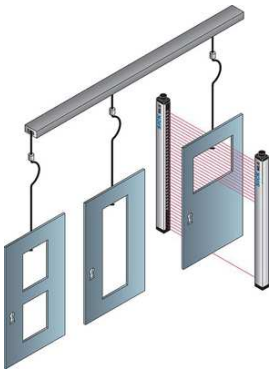


Fig. 11: Profile detection

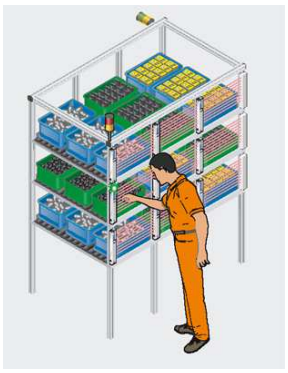


Fig. 12: Operator guidance

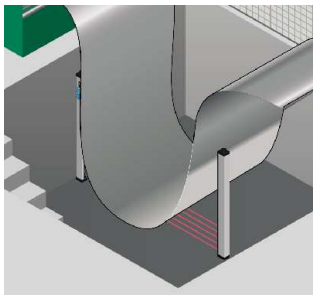


Fig. 13: Slack regulation

4.7 Status indicators

4.7.1 MLG S sender

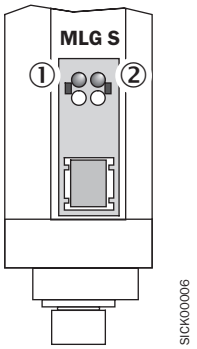


Fig. 14: Sender status indicators

1 LED red
2 LED green

Sender – LEDs

LED	Description
Green LED	Supply voltage on.
Red LED	Sender defective. → See page 81, chapter 11.

Table 5: Sender – LEDs

4.7.2 MLG E receiver

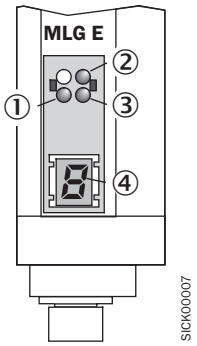


Fig. 15: Receiver status indicators

1 LED yellow
2 LED red
3 LED green
4 7-segment display

Receiver – LEDs

LED	Description
Green LED	Supply voltage on.
Yellow LED illuminates permanently	Sender and receiver are correctly aligned to one another and the light path is not blocked.
Yellow LED flashes	■ Sender and receiver are not correctly aligned to one another. ■ Contamination found. ■ Permissible range exceeded.
Yellow LED off	■ Light path blocked. ■ Sender and receiver are not correctly aligned to one another.
Red LED	Malfunction → See page 81, chapter 11.

Table 6: Receiver – LEDs

Receiver – 7-segment display

Display	Description
H	Blocked Beams Hold (BBH) is active. → See page 65, chapter 9.7.4.
L	Sensitivity teach-in is active. → See page 42, chapter 8.1.
P	Parameterization mode is active.
S	Stand-by is active.
E1, E2, E9	Malfunction → See page 81, chapter 11.

Table 7: Receiver – 7-segment display

5 Transport and storage

5.1 Transport

Improper transport

NOTICE!

Damage of light grid due to improper transport

Considerable damage may occur to the light grid during improper transport.

For this reason:

- Light grids should only be transported by trained specialist staff.
- Utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Note the dimensions of the light grid.
- Do not remove packaging until immediately prior to starting mounting.

5.2 Transport inspection

On receipt of delivery, please check for completeness and for any damage that may have occurred during transportation.

In case of damage from transportation that is visible externally, proceed as follows:

- Do not accept the delivery or else do so only conditionally.
- Note down the scope of damage on the transport documents or on the transport company's delivery note.
- Initiate a complaint process.

NOTE!

Submit a complaint about all defects as soon as they are detected. Claims for replacement due to damage are only valid prior to applicable complaint deadlines.

5.3 Storage

The following should be observed for storage of light grids:

- Do not store light grids outdoors.
- Store them in a dry area that is protected from dust.
- Do not expose the light grid to any aggressive substances.
- Protect light grids from sunlight.
- Avoid mechanical shocks.
- Storage temperature: -25 to +70 °C
- Max. relative air humidity: 95%, non-condensing
- In case of storage periods longer than 3 months, the general condition of all components and the packaging should be checked on a regular basis.

NOTE!

Other storage conditions may apply for special equipment. → See separate operating instructions for special equipment.

6 Mounting

6.1 Mounting procedure

1. When determining a storage location, always consider the mounting instructions for the sender and receiver.
   → See this page, chapter 6.2.
2. Mount the receiver in a fixed position.
   → See page 33, chapter 6.3.
3. Mount sender such that it can be rotated left and right in its bracket.
4. Establish an electrical connection.
   → See page 35, chapter 7.
5. Align the sender to the receiver. When aligned correctly, the yellow LED on the receiver will light up constantly.
6. Mount the sender in a fixed position.

6.1.1 Aligning the sender and receiver

NOTE!

The sender must always be aligned to the receiver.

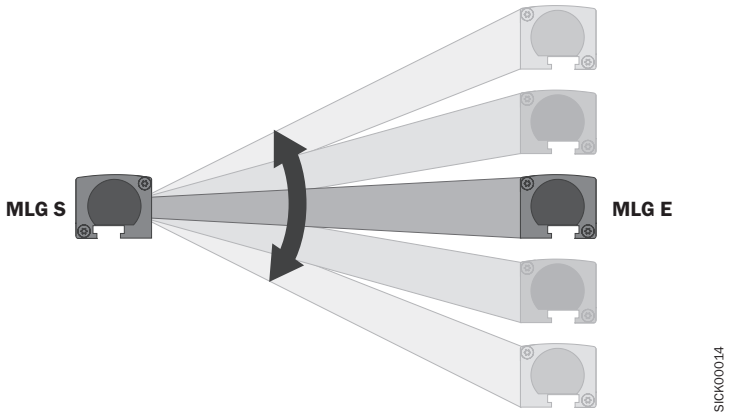


Fig. 16: Aligning the sender to the receiver, view from above

6.2 Mounting instructions

To ensure fault-free operation, the following mounting instructions should be observed:

- Technical data such as maximum range etc. must be complied with.
  → See page 84, chapter 13.
- Only use the light grid outdoors with additional equipment.
- In temperatures below the minimum permissible temperature for light grids, use a heater with an IP-67 housing.
  → See page 88, chapter 13.9.
- Protect the receiver from direct sunlight.
- To prevent condensation water, avoid exposing the light grid to rapid changes in temperature.
- Maintain a minimum distance to reflective surfaces.
  → See page 28, chapter 6.2.3.
- Maintain a sufficient distance to other light grid systems.
  → See page 29, chapter 6.2.4 and page 31, chapter 6.2.5.
- Maintain a sufficient distance to optoelectric devices such as photoelectric sensors. → See page 32, chapter 6.2.6.

6.2.1 Mounting position

The following points should be observed with regard to the mounting position:

- Use the same orientation when mounting receiver and sender. Electrical connections must point in the same direction.
- Mount the receiver and sender at the same height.

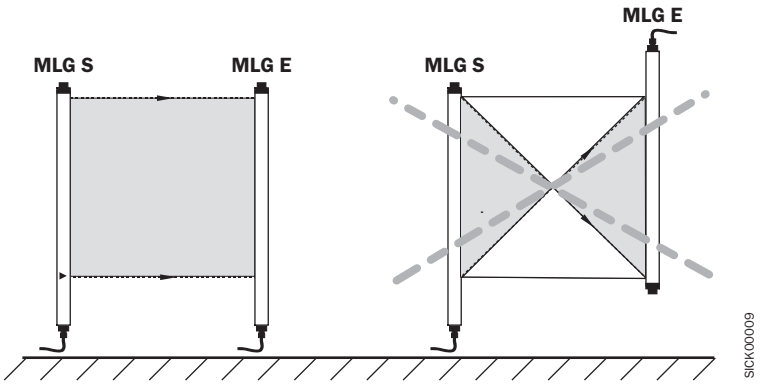


Fig. 17: Mounting position

6.2.2 Mounting offset

Mounting offset is the distance between the first light beam and the object holder or reference level. The first light beam is indicated by an arrow on both the sender and receiver.

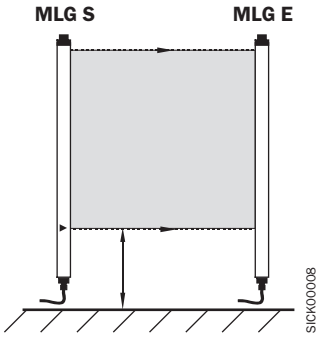


Fig. 18: Mounting offset

6.2.3 Minimum distance from reflective surfaces

Reflective surfaces between the sending and receiving beam path may lead to disruptive reflections and beams being deflected and hence failure to detect objects.

In case of reflective surfaces, a minimum distance must be observed between the reflective surface and the first light beam to ensure the light grid operates reliably.

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

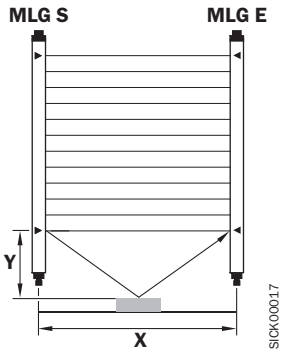


Fig. 19: Distance to reflective surfaces

X Distance between sender and receiver
Y Minimum distance of reflective surface to first light beam.

→ See page 29, Fig. 21.

6.2.4 Placement of several light grids

Should you wish to mount several light grids, you will need to observe a minimum mounting distance between the light grids. This minimum distance will be larger the greater the operating range of the light grids is.

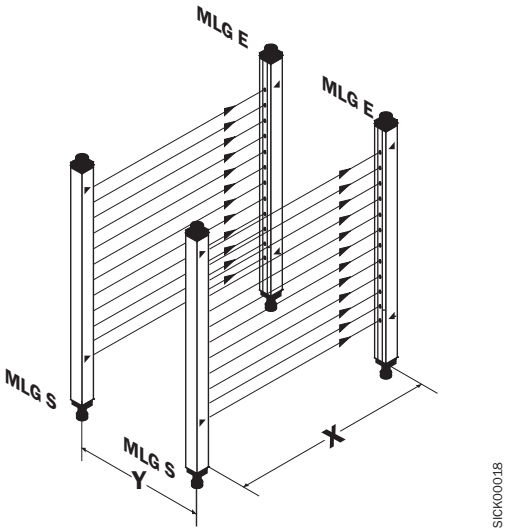


Fig. 20: Placement of two light grids with parallel beam function beamed in the same direction

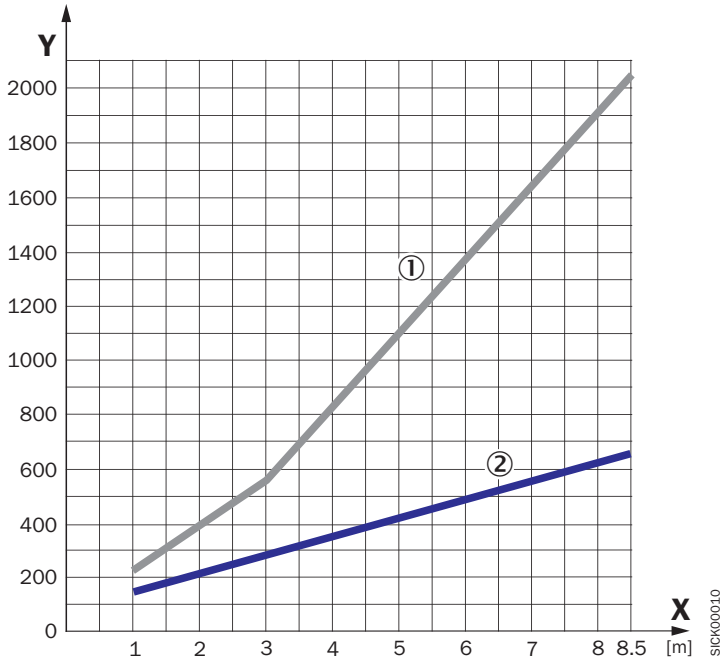


Fig. 21: Minimum distance Y depending on operating range X

X Operating range
Y Minimum distance of light grids
1 MLG with an aperture angle of ±10°
2 MLG with an aperture angle of ±3.6°

Alternative placements

Should it not be possible to keep light grids the minimum distance apart, they can alternatively be placed as follows:

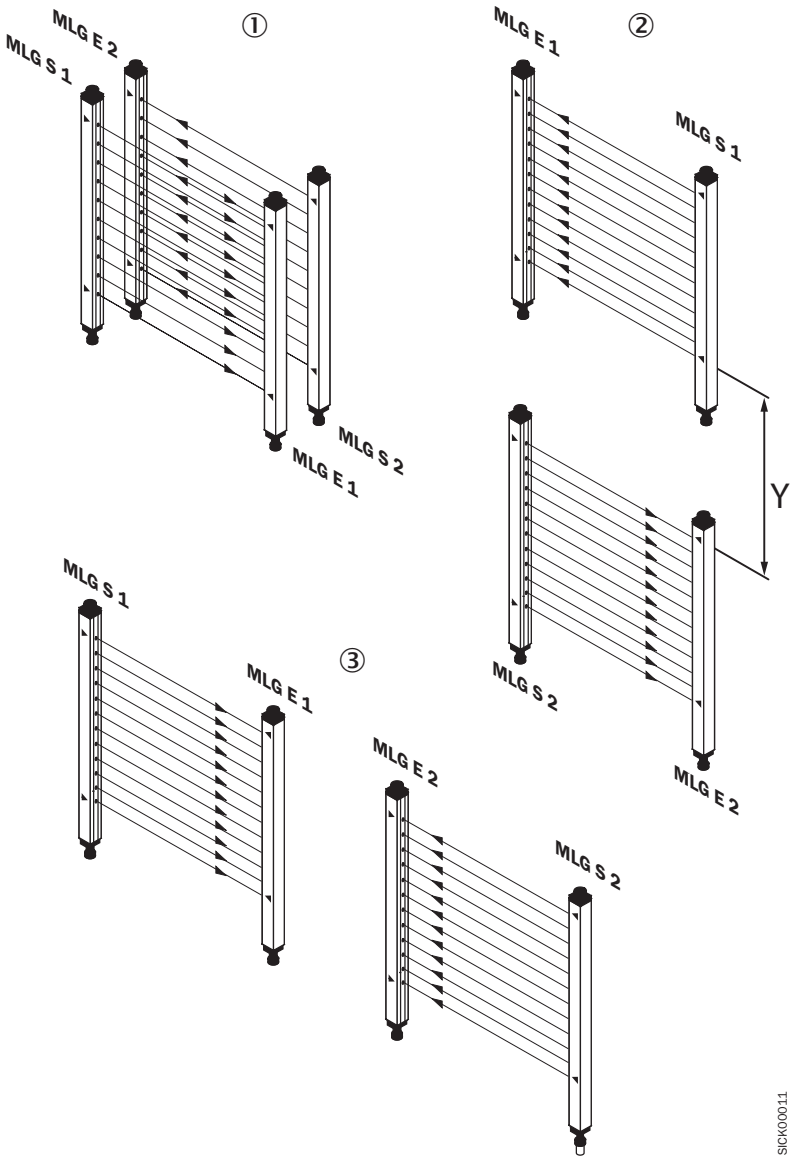


Fig. 22: Alternative placement for several light grids with parallel beam function

1 Placements with light beamed in opposite directions
2 Placement on top of one another
3 Placement in a row

NOTE!

When two light grids are situated opposite one another and beam their light in opposite directions, reflections may occur from sender S 1 to receiver E 2 for the object being scanned.

6.2.5 Placement of two light grids at right angles

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

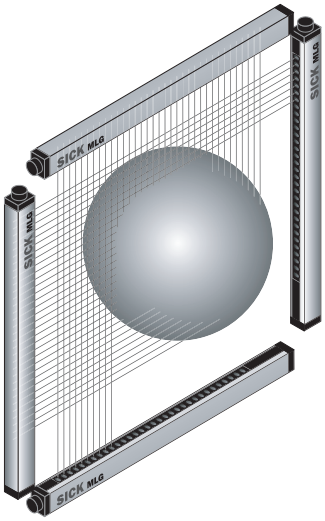


Fig. 23: Placement at a right angle

You can suppress mutual interference either by how you mount the light grids or via the control.

Mounting

Mount light grids ≥ 10 mm apart from one another.

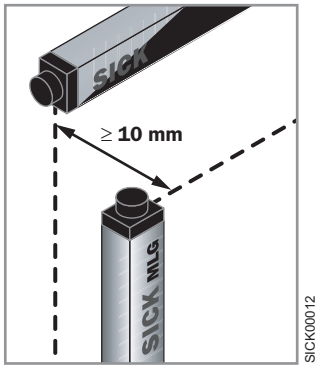


Fig. 24: Light grids at a right angle placed at a distance

Control

- For both light grids, choose the “Stand-by” input function. You should only ever activate one light grid at the same time via the relevant inputs. → See page 79, chapter 9.7.11.
- Alternatively, you can activate the test inputs of both senders alternately.

6.2.6 Placing light grids alongside photoelectric sensors

NOTE!

Since optoelectric devices with a large beam path in the direct vicinity of a light grid can cause the light grid to malfunction, we recommend using laser photoelectric sensors or photoelectric sensors with a small beam path in the light grid's direct vicinity.

Mount the light grid as follows:

- The light path of the photoelectric sensor and the light path of the light grid must run parallel to one another but in opposite directions.

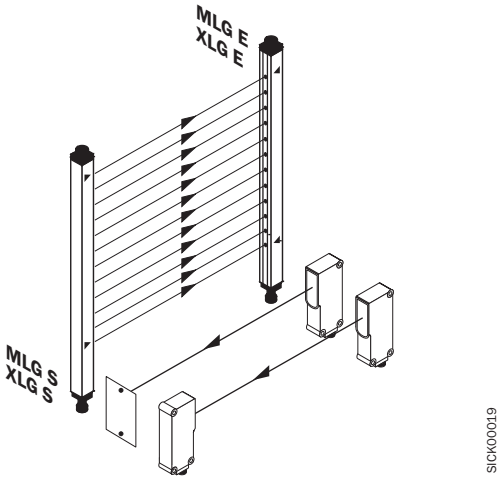


Fig. 25: Placing a light grid alongside photoelectric sensors

6.3 Mounting light grids

The following optional fastening accessories are available:

- Swivel bracket
- T-nuts with sliding nuts.

6.3.1 Mounting light grids with a swivel bracket

→ For dimensions and part number, see page 93, Fig. 37.

NOTE!!

Only light grids with monitoring heights of up to 1600 mm may be mounted with a swivel bracket.

Note the following points:

- Mounting instructions: → See page 27; chapter 6.2.
- For final assembly, both hexagon socket screws must remain accessible.

1. Mount the bracket the receiver using an M8 screw.
2. Place the receiver into the bracket and align it.
3. Tighten the bracket's two hexagon socket screws.
4. Mount the sender as per steps 1 to 3.

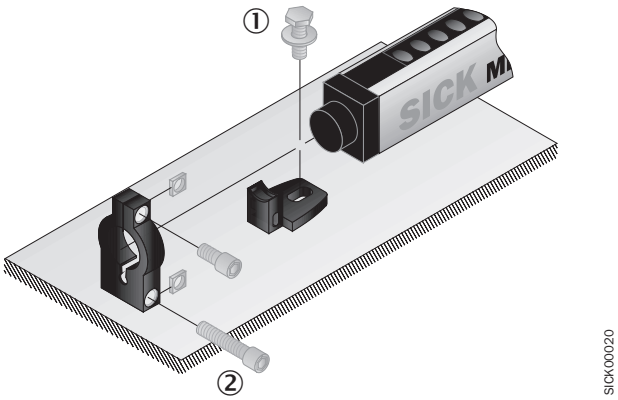


Fig. 26: Mounting light grids with the optional swivel bracket

1 M8 fastening screw
2 Hexagon socket screws (x2)

6.3.2 Mounting light grids with T-nuts and sliding nuts

→ For dimensions and part number, see page 93, Fig. 38.

Note the following points:

- Mounting instructions: → See page 27; chapter 6.2.
- For final assembly, the two clamping screws must remain accessible.

1. Mount two wall-mounting brackets onto a wall for the receiver at a suitable distance.
2. Mount two sliding nuts onto the receiver at suitable distances.
3. Slide the receiver into the two wall-mounting brackets from above using the sliding nuts.
4. Tighten the clamping screws.
5. Mount the sender as per steps 1 to 4.

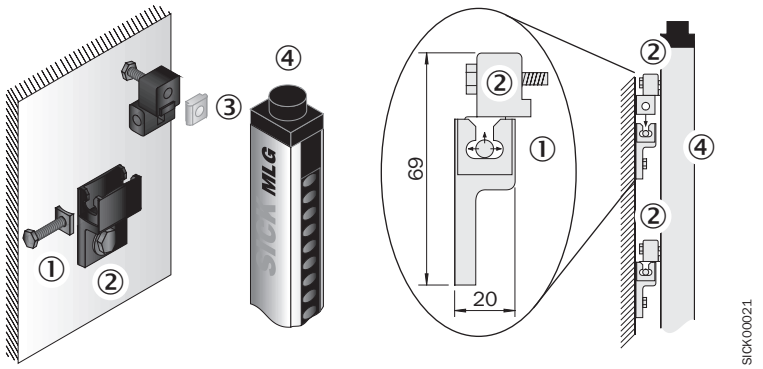


Fig. 27: Mounting light grids with optional T-nuts and sliding nuts

1 Clamping screw for fixing
2 Wall-mounting bracket
3 Sliding nut
4 Sender or receiver

7 Electrical connections

7.1 Safety

Incorrect supply voltage

NOTICE!

Equipment damage due to incorrect voltage supply!

Supplying an incorrect voltage can lead to damage to equipment.

For this reason:

– Only operate the light grid using a protected low voltage and safe, protection class III electrical insulation.

Working while energized

NOTICE!

Damage to equipment or unpredictable operation due to working while energized!

Working while energized may lead to unpredictable operation.

For this reason:

– Only carry out wiring work with the light grid de-energized.

– Only connect and disconnect cable connections in a de-energized state.

7.2 Wiring instructions for trouble-free operation

The following instructions should be observed for wiring:

- Do not lay cable parallel to other cables, especially not parallel to devices with a high level of electromagnetic interference such as a frequency converter.
- For wiring, we recommend using the CANopen adapter with ready-for-use connection cables. → See page 89, chapter 14.

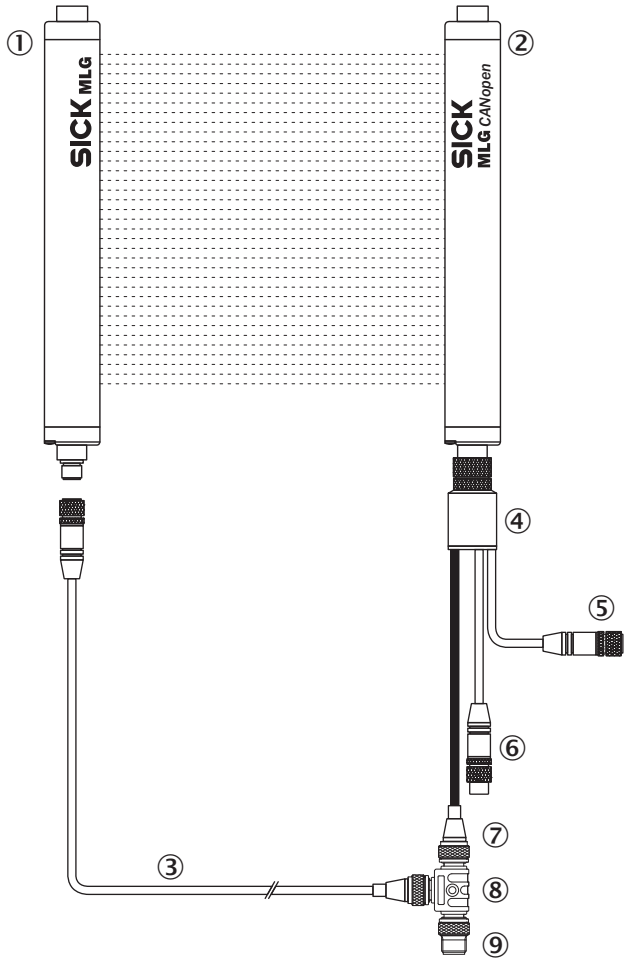


Fig. 28: Connecting sender and receiver via a CANopen adapter, connection cable and T-distributor

1 *Sender*
2 *Receiver*
3 *Connection cable (optional)*
4 *CANopen adapter (optional)*
5 *CANopen OUT*
6 *CANopen IN*
7 *Light grid receiver connection*
8 *T-distributor (optional)*
9 *Supply, switching state Q1, test input*

7.3 Connecting the light grid electrically

NOTE!

A label with a connection example and details of inputs and outputs can be found on the sender and the receiver.

1. Ensure the light grid is de-energized.
2. Wire the sender and receiver according to the connection example.

- Connect the sender's “Sync A” connection to the “Sync A” connection on the receiver.
- Connect the sender's “Sync B” connection to the “Sync B” connection on the receiver.

7.4 Connection examples

Type C8xx

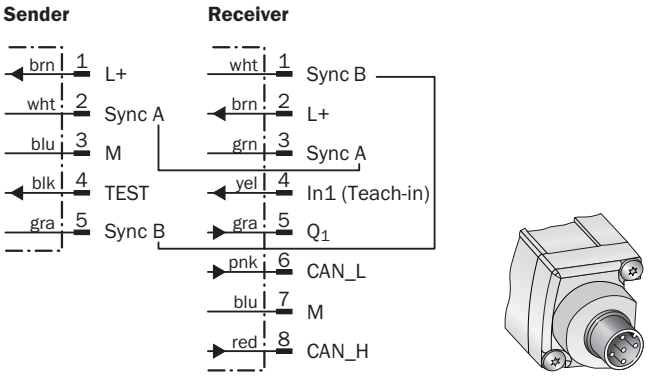


Fig. 29: Connection example, M12 plug, 8-pin

CANopen adapter/T-distributor

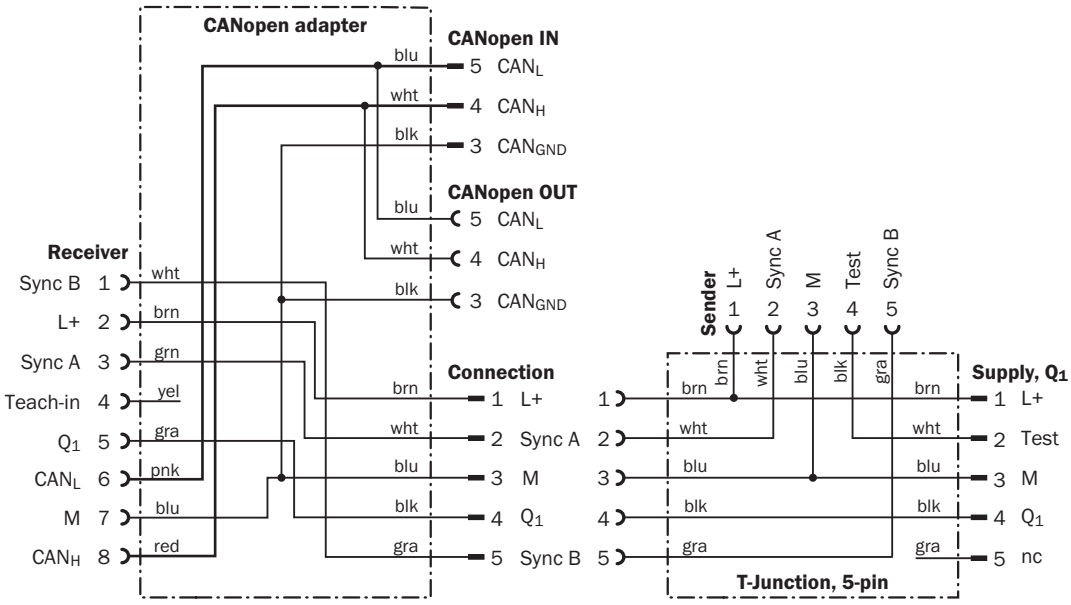


Fig. 30: Connection example, M12 plug, 8-pin

7.5 Assignment of inputs and outputs

Light grids with the CANopen interface are parameterized in the factory with the parallel beam function. The beam function can be configured via the CANopen interface. → See page 43, chapter 9.

Type	Output	Input
	Q1 [1]	**In1** [2]
		Teach-in
C8x1	PNP	–

1) The output switches on when at least one beam is blocked.

2) Input In1 is physically present on the receiver. When a CANopen adapter is used, the input will no longer be available.

Table 8: Light grid with CANopen

7.6 Bus cable

Always use twisted pair and shielded cables.

Bus cable characteristic values

The bus cable must have the following characteristic values as per the ISO 11898-2 standard:

- Impedance: 120 Ω
- Specific delay: 5 ns/m
- Resistance coating: < 110 Ω/km
- Wire cross-section: 0.25 ... 0.8 mm2
  (depends on baud rate and length of cable)

For further details, see ISO 11898-2 and the CANopen specification CiA303-1.

NOTE!

For suitable cables and ready-to-use pugs, see page 89 ff, chapter 14.1.

7.7 Connecting the bus cable to the CANopen M12 plug

Connect the bus cable to the CANopen M12 plug as follows:

Pin no.	Signal	Function
6	CAN_L	CAN Low data cable
8	CAN_H	CAN High data cable
7	Ground	Ground connection
Thread/housing	Shield	Ground connection

Table 9: Pin assignment for CANopen M12 plug

NOTICE!

Equipment damage due to incorrect connection!

Incorrect connection can lead to unpredictable operation.

For this reason:

– Never swap over the two CAN Low und CAN High data cables in a segment.
– At both ends of the cable, place large areas of the shield onto protective ground.

Connecting the shield with protective ground

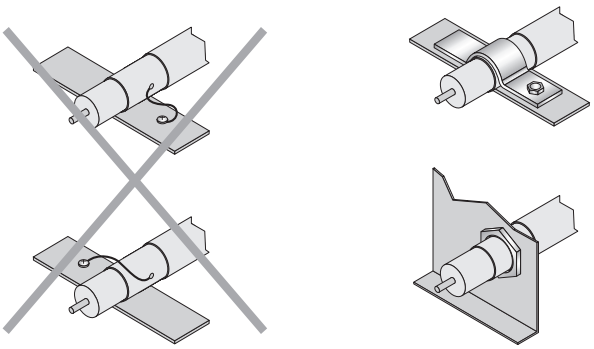


Fig. 31: Connecting a large area of the shield with the protective conductor

All nodes in a CANopen network must be connected one after the other in a linear bus (line topology). The cable is thus looped through from one station to the next.

A an alternative, signal lines are also permissible in a CANopen network. Since all signals lines cause unwanted reflections onto the bus however, they should be avoided.

NOTE!

Signal lines may not be fitted with a terminating resistor.

The lengths for signal lines shown in the following table may not be exceeded.

Baud rate	125 kbit/s	250 kbit/s	500 kbit/s	1 Mbit/s
Length of signal line	8 m	5 m	3 m	0.3 m

Table 10: Maximum length of signal lines

Data shown in the table is intended as guideline values. These values may vary according to transceiver modules and bus cables used.

7.8 Hardware settings

7.8.1 Terminating bus resistors

If the light grid is used at the end of a bus segment, a terminating resistor must be connected externally.

In a CANopen network, both ends of the bus system must always be terminated.

NOTE

→ For a bus terminating resistor and a CANopen adapter, see page 89, chapter 14.
The bus terminating resistor can be connected directly to the CANopen adapter.

7.8.2 Setting the device address

→ See page 44, chapter 9.2.

7.8.3 Setting the baud rate

→ See page 46, chapter 9.3.

8 Commissioning

8.1 Teaching in the sensitivity

During commissioning and at regular intervals, as necessary, the optimum sensitivity must be taught in for each of the light grid's receiving channels. This procedure is called teach-in.

8.1.1 Teaching in the sensitivity via the control byte

With this method, you start teaching in the sensitivity via the control byte. → See page 79, chapter 9.7.11.

1. No objects should be between the sender and the receiver. The light path must be clear.
2. Switch on the supply voltage for the light grid. The green LEDs on the receiver and the sender should illuminate.
3. Activate teach-in mode via the control byte (bit 6). The 7-segment display shows “L” for “learning”.
4. Deactivate teach-in mode via the control byte (bit 6).
5. The teach-in process is quit automatically. The “L” in the display ceases to be lit.
6. The yellow LED on the receiver illuminates. The light grid is operational.

NOTE!

If the yellow LED on the receiver flashes or remains unlit, sender and receiver are not correctly aligned to one another.

9 CANopen interface

You can perform the following using the CANopen interface for example:

- Configure the CANopen interface.
- Call up up to 4 items of process data (TPDO, 32 byte).
- Variably map process data.
- Select up to 15 basic functions.
- Select the parallel beam or crossover beam function. The crossover beam function only affects switching output Q.
- Hide beams.
- Set parameters for the output weak signal.
- Define input functions such as stand-by etc.

9.1 Basics

CAN stands for “Controller Area Network”. The CAN interface has been standardized in the international standard ISO 11898. In the standard, only layer 1 (physical layer) and layer 2 (data backup layer) of the ISO/OSI reference model are standardized. Higher layers are defined in what are known as profiles.

MLG light grids use the open protocol standard CANopen, which is maintained by CAN in Automation (CiA) and has been standardized in the European standard EN 50325-4. CANopen defines the user layer (layer 7) of the ISO/OSI reference model.

CANopen is an asynchronous, serial field bus. All subscribers are connected in a line as a rule (line topology). Signals lines and star-shaped placement are permissible but this is not always possible.

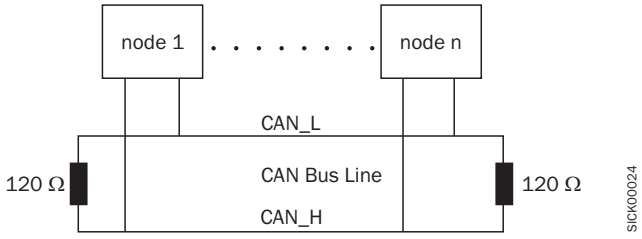


Fig. 32: Line topology

Up to 127 subscribers can be connected together in one segment.

At the start and end of each segment, the bus needs to be terminated. A passive 120 ohm bus terminating resistor is sufficient for this. The simplest type of bus termination are M12 terminal screw connections.

The bus can be expanded with bridges and repeaters.

CANopen technical data

Description	Value
Standard	ISO 11891 (CAN) EN 50325-4 (CANopen)
Support	CiA (CAN in Automation)
Physical layer	Layer 7 (user layer)
Max. length	5000 m at 10 kbit/s
Maximum number of subscribers	127
Transmission rate	up to 1 Mbit/s

Table 11: CANopen technical data

9.2 Setting the device address

A unique node ID must be allocated to each subscriber for communication.

CANopen incorporates a unique master, which takes on network management tasks. The MLG light grid is integrated into the CANopen network as a slave.

Valid node IDs are between 0 and 127.

Node ID 0 is reserved for the master.

MLG light grid software is set to the node ID 6 in the factory. No ID is set for the hardware (DIP switches 1 to 6).

The node ID is stored permanently in the EEPROM.

You can allocate the node ID to an MLG light grid as follows:

- Hardware ID allocation via DIP switches 1 to 6 in the receiver
- Software ID allocation via CANopen bus using the LSS function.

9.2.1 Allocating hardware IDs via DIP switches

Working while energized

NOTICE!

Damage to equipment or unpredictable operation due to working while energized!

For this reason:

– Only remove the cover for the DIP switches in a de-energized state.

– Only set DIP switches with the light grid de-energized.

You can set node IDs between 1 and 63 via DIP switches 1 to 6 in the receiver.

If DIP switches 1 to 6 are set to OFF position, no ID is set and ID allocation is possible via the LSS function. As soon as an ID is set via DIP switches, the ID set via the LSS function is ignored.

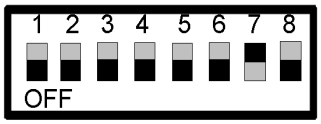


Fig. 33: Setting node IDs via DIP switches 1 to 6 in the receiver

DIP switches	1	2	3	4	5	6
Number of significant conditions in ON position	1	2	4	8	16	32
Number of significant conditions in OFF position	0	0	0	0	0	0

Table 12: Setting the node ID via DIP switches

9.2.2 Setting software IDs via CANopen

You set the node ID via CANopen in the dialog using the Layer Setting Service (LSS). The Layer Setting Service (LSS) is implemented according to the CiA Draft Standard Proposal 305, Version 2.2. The MLG CANopen light grid supports LSS slave services only.

You can set the node ID between 1 and 127. The light grid software is set to node ID 6 in the factory.

NOTE!

To transfer node ID set via CANopen, it is essential to reset communication or else reset the device.

9.3 Setting the baud rate

Working while energized

NOTICE!

Damage to equipment or unpredictable operation due to working while energized!

For this reason:

– Only remove the cover for the DIP switches in a de-energized state.
– Only set DIP switches with the light grid de-energized.

You set the baud rate (transmission speed) for CANopen communication on the MLG light grid via DIP switches 7 and 8.

Parameters for software cannot be set here.

Baud rate	DIP switch 7	DIP switch 8
125 kbit/s	OFF	OFF
250 kbit/s	OFF	ON
500 kbit/s	ON	OFF
1 Mbit/s	ON	ON

Table 13: Setting the baud rate via a DIP switch

9.3.1 Baud rate and length of cable

The max. length of the cable within a segment depends on the baud rate (transmission speed).

The table below shows the range per segment without use of repeaters for all baud rates supported by MLG CANopen.

Baud rate [bit/s]	125 k	250 k	500 k	1 M
Range [m] / segment	500	250	100	30

Table 14: Max. range depending on baud rate

NOTE!

This values are intended as guideline values. The values may vary according to the transceiver modules and bus cables used.

9.4 Parameter settings and configuration

You can configure and set parameters on the MLG CANopen light grid for your application using the EDS file (Electronic Data sheet).

All light grid functions are available as objects, which you can call up and modify using Service Data Objects (SDOs).

You define which objects you want to receive as Process Data Objects (PDOs) using dynamic mapping.

9.4.1 Electronic Data sheet (EDS)

An electronic data sheet is required for the use and configuration of a CANopen device. The EDS file contains the complete object directory of the MLG CANopen light grid with index, subindex, name, data type, access rights etc.

NOTE

You can download the EDS file for the MLG light grid from www.mysick.com.

9.4.2 Overview of available objects

All variables and parameters for the MLG light grid are summarized in the object directory under CANopen. These are assigned to what are known as objects so that the parameters can be addressed.

The following object types are distinguished:

- Service Data Objects (SDO)
- Process Data Objects (PDO)
- Network Management Objects (NMT)
- Other objects (e.g. synchronization or error).

The objects become addressable by being assigned to indices and subindices.

A distinction is made between the following access types (attributes):

- rw (read/write): Parameter can be read and written.
- ro (read only): Parameter can only be read.
- const.: Value is constant and can only be read.

Index	Name	Access type
Communication segment		
0x1000	Device type	const.
0x1001	Error register	ro
0x1005	COB-ID SYNC	rw
0x1008	Manufacturer device name	const.
0x1009	Manufacturer hardware version	const.
0x100A	Manufacturer software version	const.
0x1010	Store parameter field	ro
0x1011	Restore default parameters	rw
0x1014	COB-ID EMCY	ro
0x1017	Producer heartbeat time	rw
0x1018	Identity object	ro
0x1400	Receive PDO Communication Parameter 1	rw
0x1600	Receive PDO Mapping Parameter 1	rw
0x1800–0x1803	Transmit PDO Communication parameter 1–4	rw
0x1A00–0x1A03	Transmit PDO Mapping parameter 1–4	rw
Manufacturer segment		
0x2000	Beam status	ro
0x2001	Beam mask	rw
0x2005	Display orientation	rw
0x2006	Basic functions	ro
0x2008	System status	ro
0x2009	Multiple scan	rw
0x200A	Contamination alarm setting	rw
0x200B	Sensitivity setting	rw
0x200C	Number of beams	ro
0x200F	Manufacturing date	ro
0x2100	Control byte	rw

Table 15: MLG light grid object directory

NOTE!

The MLG CANopen light grid uses 4 TPDOs (Transmit Process Data Objects) and 1 RPDO (Receive Process Data Object). Objects for a higher number of PDOs have not been implemented and are not supported.

9.4.3 Explanation of object information

Objects are described in detail as follows in the chapters below:

Information	Description
Name/Index	Object code/parameter code
Subindex	Selects the individual object elements.
Data type	Data type used
Attribute	Access type: ■ rw (read/write): Parameter can be read and written. ■ ro (read only): Parameter can only be read. ■ const.: Value is constant and can only be read.
Default	Factory setting
Min	Minimum value
Max	Maximum value
PDO mapping	■ "Yes": the object can be transmitted as part of a PDO. Whether the object can be transmitted as a TPDO or RPDO is shown in brackets. ■ "–": No PDO mapping
Description	Explanations and additional data

Table 16: Explanation of object information

9.5 Communication segment

The communication segment contains a wide range of information about device data, statuses and the identity of the device.

9.5.1 Index 0x1000: Device Type

Data type	UNSIGNED32
Attribute	ro
Default	0x00000000
PDO mapping	–
Description	The word with the lower value (16 bits) of the device type specifies the device profile. The value 0x0000 specifies that a standardized profile is not used. The word with the higher value contains other profile-specific information.

Table 17: Index 0x1000: Device type

9.5.2 Index 0x1001: Error register

<table>
<tr><td>Data type</td><td>UNSIGNED8</td></tr>
<tr><td>Attribute</td><td>ro</td></tr>
<tr><td>Default</td><td>0x00</td></tr>
<tr><td>PDO mapping</td><td>–</td></tr>
<tr><td>Description</td><td>The error register in CANopen shows the error state for the device coded in bits. If a bit is set, this indicates that the corresponding error is present.
<table>
<tr><th>Bit</th><th>Significance</th><th>Used with MLG?</th></tr>
<tr><td>0</td><td>General error</td><td>yes</td></tr>
<tr><td>1</td><td>Current error</td><td>no</td></tr>
<tr><td>2</td><td>Voltage error</td><td>no</td></tr>
<tr><td>3</td><td>Temperature error</td><td>no</td></tr>
<tr><td>4</td><td>Communication error (buffer overflow)</td><td>yes</td></tr>
<tr><td>5</td><td>Device profile-related error</td><td>no</td></tr>
<tr><td>6</td><td>Reserved (always 0)</td><td>no</td></tr>
<tr><td>7</td><td>Manufacturer-specific error</td><td>yes</td></tr>
</table>
Table 18: Object 0x1001: Error register
The “Manufacturer-specific error” error bit is set when one of the following errors is set:
■ SyncError
■ noLight error
■ HW error
The “Communication error” error bit is set if an error message for the CANopen software is pending.
The “General error” error bit is set if at least one other error bit is set.</td></tr>
</table>

Table 19: Index 0x1001: Error register

9.5.3 Index 0x1005: COB-ID SYNC

Data type	UNSIGNED32
Attribute	rw
Default	0x00000080
PDO mapping	–
Description	The object specifies the COB-ID for SYNC messages and indicates whether the device is sending SYNC messages.

Bit	Significance
31	No significance
30	■ 0: The device is not sending SYNC messages. ■ 1: The device is sending SYNC messages.
29	■ 0: 11-bit identifier (CAN 2.0A) ■ 1: 29-bit identifier (CAN 2.0B)
28–0	Identifier (29 or 11 bit)

Table 20: SYNC message – meanings of bits

Default value = 0x0000 0080:
The device is not sending SYNC messages.
The device is using the 11-bit identifier 0x80 for SYNC messages.

Table 21: Index 0x1005: COB-ID SYNC

9.5.4 Index 0x1008: Manufacturer device name

Data type	Visible string
Attribute	const.
Default	Device name
PDO mapping	–
Description	The object contains the device name as an ASCII string.

Table 22: Index 0x1008: Manufacturer device name

9.5.5 Index 0x1009: Manufacturer hardware version

Data type	Visible string
Attribute	const.
Default	Hardware version
PDO mapping	–
Description	The object contains the version code for the hardware (ASCII string).

Table 23: Index 0x1009: Manufacturer hardware version

9.5.6 Index 0x100A: Manufacturer software version

Data type	Visible string
Attribute	const.
Default	Software version
PDO mapping	–
Description	The object contains the version code for the software (ASCII string).

Table 24: Index 0x100A: Manufacturer software version

9.5.7 Index 0x1010: Store parameter field

The MLG CANopen light grid supports saving after each parameter change.

There is no need to save parameters manually and this is not supported. For this reason, this object can only be read and not written. When the object is read, it will inform the user about the save function being supported.

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	ro
	Default	3
	PDO mapping	–
	Description	Contains the largest array subindex
Subindex 1: Save all parameters		
	Data type	UNSIGNED32
	Attribute	ro
	Default	2
	PDO mapping	–
	Description	The device supports automatic saving of parameters. The device does not support saving of parameters by means of a command sequence.
Subindex 2: Save communication parameters		
	Data type	UNSIGNED32
	Attribute	ro
	Default	2
	PDO mapping	–
	Description	See subindex 1.

Subindex 3: Save application default parameters		
	Data type	UNSIGNED32
	Attribute	ro
	Default	2
	PDO mapping	–
	Description	See subindex 1.

Table 25: Index 0x1010: Store parameter field

9.5.8 Index 0x1011: Restore default parameters

Specific parameters are allocated their factory setting with this parameter.

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	ro
	Default	3
	PDO mapping	–
	Description	Contains the largest array subindex
Subindex 1: Restore all default parameters		
	Data type	UNSIGNED32
	Attribute	rw
	Default	0
	PDO mapping	–
	Description	Factory settings are assigned to all parameters for which these are available. This happens when the following value is written: 0x64616F6C. The character sequence “load” returns this numerical value “0x64616F6C” (“l”: 0x6C, “o”: 0x6F, “a”: 0x61, “d”: 0x64).
Subindex 2: Restore communication default parameters		
	Data type	UNSIGNED32
	Attribute	rw
	Default	0
	PDO mapping	–
	Description	All communication parameters for which factory settings are available are assigned their factory settings. This happens when the following value is written: 0x64616F6C. The character sequence “load” returns this numerical value “0x64616F6C” (“l”: 0x6C, “o”: 0x6F, “a”: 0x61, “d”: 0x64).

Subindex 3: Restore application default parameters		
	Data type	UNSIGNED32
	Attribute	rw
	Default	0
	PDO mapping	–
	Description	All application parameters for which factory settings are available are assigned their factory settings. This only happens when the following value is written: 0x64616F6C. This is the numerical value which returns the character sequence “load“ ('l': 0x6C, 'o': 0x6F, 'a': 0x61, 'd': 0x64).

Table 26: Index 0x1011: Restore default parameters

9.5.9 Index 0x1014: COB-ID EMCY

Data type	UNSIGNED32
Attribute	rw
Default	134
PDO mapping	–
Description	The object specifies the COB-ID for EMCY messages. EMCY messages sent by the MLG CANopen light grid have the following meanings:

EMCY Error Code	Significance
0x1001	SyncError
0x1002	noLight error
0x1003	HW Error
0x8210	PDO contains too little data
0x8220	PDO contains too much data

Table 27: EMCY Error Codes

Table 28: Index 0x1014: COB-ID EMCY

9.5.10 Index 0x1017: Heartbeat producer time

Data type	UNSIGNED16
Attribute	rw
Default	0
Min	0
Max	65535
PDO mapping	–
Description	This parameter specifies the time interval in ms for sending the heartbeat message. If the value of the parameter is not equal to 0, the MLG CANopen light grid will function as a heartbeat producer. The parameter value 0 means that no heartbeat messages are sent.

Table 29: Index 0x1017: Heartbeat producer time

9.5.11 Index 0x1018: Identity object

This parameter contains general information on identification via the MLG CANopen light grid.

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	ro
	Default	4
	PDO mapping	–
	Description	Contains the largest array subindex
Subindex 1: Vendor ID		
	Data type	UNSIGNED32
	Attribute	ro
	Default	0x02000056
	PDO mapping	–
	Description	Unique Vendor ID for SICK AG Division Advanced Industrial Sensors
Subindex 2: Product code		
	Data type	UNSIGNED32
	Attribute	ro
	Default	03
	PDO mapping	–
	Description	Unique product ID

Subindex 3: Revision number		
	Data type	UNSIGNED32
	Attribute	ro
	Default	0x00010000
	PDO mapping	–
	Description	The revision number is made up of the major revision number (bits 31-16) and the minor revision number (bits 15-0). The major revision number is increased if the device's CANopen behavior is expanded e.g. by new objects.
Subindex 4: Serial number		
	Data type	UNSIGNED32
	Attribute	ro
	Default	–
	PDO mapping	–
	Description	Serial number of the MLG

Table 30: Index 0x1018: Identity object

9.6 Communication objects

The following objects contain detailed information about communication parameters of the CANopen process data.

Each Process Data Object (PDO) has one communication object and one mapping parameter object.

Communication objects specify which objects are sent as process data, which COB IDs are used and which transmission type is selected for this.

The communication objects comprise four TPDOs (Transmit Process Data Objects) and one RPDO (Receive Process Data Object). The four TPDOs can be found from index 180x onwards. The one RPDO can be found at index 1400.

While parameters are being changed, no process data is available.

Description of the various transfer types

The parameter “Transmission Type” (subindex 2 of each PDO) contains information on when a TPDO (Transmit Process Data Object) is sent or how RPDOs (Receive Process Data Object) received are handled.

PDO index area	Transmission type				
	Cyclical	Acyclical	Synchronous	Asynchronous	RTR
0	–	X	X	–	–
1–240	X	–	X	–	–
241–251	Reserved				
252	–	–	X	–	X
253	–	–	–	X	X
254, 255	–	–	–	X	–

Table 31: Transmission types in CANopen

Acyclical and synchronous data transmission – transmission type 0

With acyclical and synchronous data transmission, only one Process Data Object (PDO) is sent if the light grid receives a SYNC frame and the data has changed. This means the light grid only sends one TPDO (Transmit Process Data Object) after receiving a SYNC frame and if the beam status has changed. For an RPDO (Receive Process Data Object), this transmission type means that the data received is evaluated only after the next SYNC.

Cyclical and synchronous data transmission – transmission type 1 to 240

With synchronous and cyclical data transmission, a TPDO (Transmit Process Data Object) is not sent until after a certain number of SYNC frames have been received. This number may be between 1 and 240. An RPDO (Receive Process Data Object) processes the data received only after the next SYNC.

RTR data transmission – transmission type 252 and 253

“RTR” stands for “Remote Transmission Request”. With RTR data transmission, data is only transferred after an RTR frame has been received.

With synchronous RTR data transmission (transmission type 252), the process data is redetermined for each SYNC. Process data is only transferred after an RTR frame has been received.

With asynchronous RTR data transmission (transmission type 253), the current data is constantly determined and transferred after a request is received.

NOTE!

Transmission types 252 and 253 are only permissible for TPDOs (Transmit Process Data Object).

Some bus module manufacturers do not support RTR data transmission. For this reason, we do not recommend using transmission types 252 and 253.

Asynchronous data transmission – transmission type 254 and 255

With asynchronous data transmission, transmission of TPDOs (Transmit Process Data Object) is event-driven. This means transmission takes place each time the status of the beams changes. An RPDO (Receive Process Data Object) is evaluated immediately after receipt.

This transmission type can be linked with the event timer.

Dynamic PDO mapping

Mapping objects are used to define which parameters and data are to be used. In the mapping object, links are created to objects from the object directory. Objects linked in the mapping object are sent in Process Data Objects (PDOs). A separate mapping object exists for each Process Data Object.

Subindex 0 for a mapping object specifies the number of linked objects. If a new object is linked, the device tests the validity of the link. If the linked object is not available or cannot be linked, an error message will be triggered.

9.6.1 Index 0x1400: Receive PDO Communication Parameter 1

This parameter configures the communication parameters for the Receive Process Data Object (RPDO).

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	ro
	Default	2
	PDO mapping	–
	Description	Contains the largest array subindex
Subindex 1: COB-ID		
	Data type	UNSIGNED32
	Attribute	rw
	Default	Node ID + 0x200
	PDO mapping	–
	Description	Specifies whether the relevant RPDO is used and defines its COB-ID.

Bit	Significance
31	■ 0: PDO is valid ■ 1: PDO is not being used
30	■ 0: reacts to RTR ■ 1: does not react to RTR
29	■ 0: 11-bit identifier (CAN 2.0A) ■ 1: 29-bit identifier (CAN 2.0B)
28–0	COB-ID

Table 32: COB-ID RPDO

Subindex 2: Transmission type		
	Data type	UNSIGNED8
	Attribute	rw
	Default	254
	Min	0
	Max	255
	PDO mapping	–
	Description	Specifies how PDO data received is processed by MLG CANopen.

Table 33: Index 0x1600: Receive PDO mapping parameter 1

9.6.2 Index 0x1600: Receive PDO Mapping Parameter 1

This parameter configures mapping for the Receive PDO (RPDO).

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	rw
	Default	1
	Min	0
	Max	1
	PDO mapping	–
	Description	Actual number of objects mapped to the RPDO.
Subindex 1–8: Mapping entry 1–8		
	Data type	UNSIGNED32
	Attribute	rw
	Default	0x2100 sub00
	PDO mapping	–
	Description	Specifies the index, subindex and width of the relevant RPDO sub-area.

Bits 31–16	Bits 15–8	Bits 7–0
Index	Subindex	Length in bits

Table 34: RPDO mapping entry

Table 35: Index 0x1600: Receive PDO mapping parameter 1

9.6.3 Index 0x1800–0x1803: Transmit PDO communication parameters 1–4

The following parameters are described here:

- Object 0x1800: Communication parameter for TPDO1
- Object 0x1801: Communication parameter for TPDO2
- Object 0x1802: Communication parameter for TPDO3
- Object 0x1803: Communication parameter for TPDO4

The structure of objects 0x1800–0x1803 is identical.

Each of these parameters configures a Transmit Process Data Object (TPDO).

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	ro
	Default	5
	PDO mapping	–
	Description	Contains the largest array subindex
Subindex 1: COB-ID		
	Data type	UNSIGNED32
	Attribute	rw
	Default	Object 0x1800: Node ID + 0x180 Object 0x1801: Node ID + 0x280 Object 0x1802: Node ID + 0x380 Object 0x1803: Node ID + 0x480
	PDO mapping	–
	Description	Specifies whether the relevant TPDO is being used and defines its COB-ID.

Bit	Significance
31	■ 0: PDO is valid ■ 1: PDO is not being used
30	■ 0 : reacts to RTR ■ 1: does not react to RTR
29	■ 0: 11-bit identifier (CAN 2.0A) ■ 1: 29-bit identifier (CAN 2.0B)
28–0	COB-ID

Table 36: COB-ID TPDO

Subindex 2: Transmission type		
	Data type	UNSIGNED8
	Attribute	rw
	Default	Object 0x1800: 254 Object 0x1801: 254 Object 0x1802: 254 Object 0x1803: 254
	Min	0
	Max	255
	PDO mapping	–
	Description	Specifies how the light grid transmits Process Data Objects (PDOs). → See page 57, Table 31.
Subindex 3: Inhibit Time		
	Data type	UNSIGNED16
	Attribute	rw
	Default	Object 0x1800: 0 Object 0x1801: 0 Object 0x1802: 0 Object 0x1803: 0
	Min	0
	Max	65535
	PDO mapping	–
	Description	Inhibit time in 0.1 ms increments. The next PDO with the same COB-ID may only be sent after this time has expired. The parameter value 1000 corresponds to an inhibit time of 100 ms.
Subindex 5: Event timer		
	Data type	UNSIGNED16
	Attribute	rw
	Default	Object 0x1800: 0 Object 0x1801: 0 Object 0x1802: 0 Object 0x1803: 0
	Min	0
	Max	65535
	PDO mapping	–
	Description	Defines a time interval in 1 ms increments which, on expiry, acts as a triggering event for transmitting the PDO. This event also affects other events that trigger sending. The parameter value 0 deactivates this mechanism.

Table 37: Index 0x1800 - 0x1803: Transmit PDO Communication Parameters 1–4

Subindex 3 – Inhibit Time

The inhibit time (transmit delay time) specifies the minimum waiting time in ms between the transmission of two identical TPDOs.

NOTE

Some bus module manufacturers do not support use of inhibit time. We recommend using synchronous communication if you want to control the bus load.

Subindex 5 – Event Timer

Subindex 5 of the TPDOs contains an event timer. This timer runs in the background and triggers an event on expiry. This means if no event occurs in the purely asynchronous transmission type (beam status change), a TPDO will be sent when the set event time (in 1ms increments) expires.

No event timer can be set for the MLG light grid's RPDO.

9.6.4 Index 0x1A00-0x1A03: Transmit PDO Mapping Parameters 1 - 4

The following parameters are described here:

- Object 0x1A00: Mapping Parameter for TPDO1
- Object 0x1A01: Mapping Parameter for TPDO2
- Object 0x1A02: Mapping Parameter for TPDO3
- Object 0x1A03: Mapping Parameter for TPDO4

The structure of objects 0x1A00–0x1A03 is identical.

Each of these parameters configures mapping for a Transmit Process Data Object (TPDO).

Subindex 0: Number of entries		
	Data type	UNSIGNED8
	Attribute	rw
	Default	Object 0x1A00: 7 Object 0x1A01: 0 Object 0x1A02: 0 Object 0x1A03: 0
	PDO mapping	–
	Description	Actual number of objects mapped.
Subindex 1–8: Mapping entry 1–8		
	Data type	UNSIGNED32
	Attribute	rw
	Default	Object 0x1A00: 0x2006 sub 01 0x2006 sub 02 0x2006 sub 03 0x2006 sub 04 0x2006 sub 05 0x2006 sub 06 0x2008 sub 00 Object 0x1A01: 00000000 Object 0x1A02: 00000000 Object 0x1A03: 00000000
	PDO mapping	–
	Description	Specifies the index, subindex and width of the relevant TPDO subarea.

Bits 31-16	Bits 15-8	Bits 7-0
Index	Subindex	Length in bits

Table 38: TPDO mapping entry

Table 39: Index 0x1A00-0x1A03: Transmit PDO Mapping

9.7 Manufacturer segment

All Process Data Objects from index 0x2000 onwards contain application-specific data required or determined by the light grid.

9.7.1 Index 0x2000: Beam status (light beams status)

This object contains the status of all beams on the light grid as a whole. Using the Beam Status parameter, you can read which beams are made and which beams are blocked. The object 0x2000 is divided up into 30 subindices. A subindex always comprises 8 beams so that at least 1 byte (8 beams) needs to be transmitted.
→ For the number of beams, see page 85, chapter 13.2.

Subindex 0: Number of entries		
	Data type	UINT8
	Attribute	ro
	Default	30
	PDO mapping	–
	Description	Contains the largest subindex
Subindex 1: Beam statuses B1–B8		
	Data type	UINT8
	Attribute	ro
	Default	0
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Binary beam status for beam 1 to beam 8
Subindex 2: Beam statuses B9–B16		
	Data type	UINT8
	Attribute	ro
	Default	0
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Binary beam status for beam 9 to beam 16

Subindex 3 - 30: Beam statuses Bxx–Bxx		
	Data type	UINT8
	Attribute	ro
	Default	0
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Binary beam statuses for beam xx to beam xx (always 8 beams).

Table 40: Index 0x2000: Beam statuses

Division of subindices for beam status

Subindex	Contents	Subindex	Contents
0	Number of entries	16	Beam statuses B121–B128
1	Beam statuses B1–B8	17	Beam statuses B129–B136
2	Beam statuses B9–B16	18	Beam statuses B137–B144
3	Beam statuses B17–B24	19	Beam statuses B145–B152
4	Beam statuses B25–B32	20	Beam statuses B153–B160
5	Beam statuses B33–B40	21	Beam statuses B161–B168
6	Beam statuses B41–B48	22	Beam statuses B169–B176
7	Beam statuses B49–B56	23	Beam statuses B177–B184
8	Beam statuses B57–B64	24	Beam statuses B185–B192
9	Beam statuses B65–B72	25	Beam statuses B193–B200
10	Beam statuses B73–B80	26	Beam statuses B201–B208
11	Beam statuses B81–B88	27	Beam statuses B209–B216
12	Beam statuses B89–B96	28	Beam statuses B217–B224
13	Beam statuses B97–B104	29	Beam statuses B225–B232
14	Beam statuses B105–B112	30	Beam statuses B233–B240
15	Beam statuses B113–B120		

Table 41: Division of subindices in index 0x2000 – beam statuses

9.7.2 Index 0x2001: Mask beam

You use this object to mask as many beams as you wish. This will enable you to adapt the monitoring area to your application.

Beam numbers are always counted starting from the connection side.

- Input range: 000 ... 255
  - 255: All beams active
  - 000: All beams deactivated
- Factory setting: 255

Beams are masked using binary representation.

The response time with this object may be up to 650 ms.

Example: Beams 3 to 14 are to be masked.

Mask beams B1 ... B8								
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Beam 1	Beam 2	Beam 3	Beam 4	Beam 5	Beam 6	Beam 7	Beam 8	
1	1	0	0	0	0	0	0	
128	64	–	–	–	–	–	–	= 192 DEZ

Mask beams B9 ... B16								
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Beam 9	Beam 10	Beam 11	Beam 12	Beam 13	Beam 14	Beam 15	Beam 16	
0	0	0	0	0	0	1	1	
–	–	–	–	–	–	2	1	= 003 DEZ

Table 42: Example of beam masking for beams 3 to 14

In this example, you will need to enter the following values for the subindices 1 and 2:

- Subindex 1 for light beams 1 ... 8: 192
- Subindex 2 for light beams 9 ... 16: 003

Subindex 0: Number of entries		
	Data type	UINT8
	Attribute	ro
	Default	30
	PDO mapping	–
	Description	Contains the largest subindex

Subindex 1: Mask beams B1–B8		
	Data type	UINT8
	Attribute	rw
	Default	255
	Min	0
	Max	255
	PDO mapping	–
	Description	Mask beams for beam 1 to beam 8
Subindex 2: Mask beams B9–B16		
	Data type	UINT8
	Attribute	rw
	Default	Depending on the number of beams
	Min	0
	Max	255
	PDO mapping	–
	Description	Mask beams for beam 9 to beam 16
Subindex 3: Mask beams Bxx–Bxx		
	Data type	UINT8
	Attribute	rw
	Default	Depending on the number of beams
	Min	0
	Max	255
	PDO mapping	–
	Description	Beam mask for beam xxx to beam xxx (always 8 beams).

Table 43: Index 0x2001: Beam mask

Division of the remaining subindices for beams 17 to 240 is identical to the beam status.

9.7.3 Index 0x2005: Display orientation

Data type	UINT8
Attribute	rw
Default	0
Min	0
Max	1
PDO mapping	–
Description	This object determines the orientation for the 7-segment display on the plug side of the receiver. The display can be turned upside down if the light grid is mounted with the plug side up. ■ 0x01 = plug side up (display turned over) ■ 0x00 = plug side down (display normal)

Table 44: Index 0x2005: Display orientation

9.7.4 Index 0x2006: Basic functions

Basic functions calculate simple results from the current beam status.

Each subindex contains a basic function that can also be linked in TPDOs (Transmit Process Data Objects).

The digital switching output cannot be configured and switches after the condition NBB >= 1.

Subindex 0: Number of entries		
	Data type	UINT8
	Attribute	ro
	Default	15
	PDO mapping	–
	Description	Contains the largest subindex
Subindex 1: NBB (Number of Beams Blocked)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Number of Beams Blocked

Subindex 2: NBM (Number of Beams Made)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Number of Beams Made
Subindex 3: FBB (First Beam Blocked)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	First Beam Blocked
Subindex 4: FBM (First Beam Made)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	First Beam Made
Subindex 5: LBB (Last Beam Blocked)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Last Beam Blocked

Subindex 6: LBM (Last Beam Made)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Last Beam Made
Subindex 7: NCBB (Number of Consecutive Beams Blocked)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Number of Consecutive Beams Blocked
Subindex 8: NCBM (Number of Consecutive Beams Made)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Number of Consecutive Beams Made
Subindex 9: CBB (Central Beam Blocked)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Central Beam Blocked

Subindex 10: CBM (Central Beam Made)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Central Beam Made
Subindex 11: NBBr (Number of Beams Blocked real)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Number of Beams Blocked real
Subindex 12: LBBr (Last Beam Blocked real)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Last Beam Blocked real
Subindex 13: ODI (Outside Dimension)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Outside dimension

Subindex 14: IDI (Inside Dimension)		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	Inside Dimension
Subindex 15: Switching Status		
	Data type	UINT8
	Attribute	ro
	Default	Current measured value
	Min	0
	Max	255
	PDO mapping	yes (TPDO)
	Description	This parameter outputs the physical, digital switching state. The light grid switches as soon as at least one beam is broken (NBB >= 1). ■ 1 = at least one beam blocked ■ 0 = all beams made

Table 45: Index 0x2006: Basic functions

Description of basic functions

Name	Function	Description	Special features
NBB	Number of Beams Blocked	Total beams blocked	–
NBBr	Number of Beams Blocked real	Total beams currently blocked	Only recommended when using input function BBH
NBM	Number of Beams Made	Total beams made	–
FBB	First Beam Blocked	Beam number of first blocked beam [1]	[2]
FBM	First Beam Made	Beam number of first beam made [1]	[3]
LBM	Last Beam Made	Beam number of last beam made [1]	[3]
LBB	Last Beam Blocked	Beam number of last beam blocked [1]	[2]
LBBr	Last Beam Blocked real	Beam number of last currently blocked beam [1]	Only recommended when using input function BBH
NCBB [4]	Number of Consecutive Beams Blocked	In case of several areas, the number of beams for the largest area is output.	NCBB [4]
NCBM [4]	Number of Consecutive Beams Made	In case of several areas, the number of beams for the largest area is output.	NCBM [4]
CBB [4]	Central Beam Blocked	Beam number of central blocked beam in a group [1]	CBB [4]
CBM [4]	Central Beam Made	Beam number of central beam in a group of interconnected made beams [1]	CBM [4]
ODI	Outside Dimension	Outputs the external dimensions of an object.	ODI
IDI	Inside Dimension	Outputs the interior dimensions of an object.	
Output Status	Switching Status	The switching state follows the condition NBB ≥ 1	

1) *The beam number is always counted starting from the connection side 1 is therefore the beam located nearest to the connection.*
2) *If no beams are blocked, the following is output with HEX: FF, with DEZ: 255 and with BIN: 1111 1111.*
3) *If no beams are made, the following is output with HEX: FF, with DEZ: 255 and with BIN: 1111 1111.*
4) *With several groups, the largest group is always considered ($NCBB_{MAX}$, $NCBM_{MAX}$, CBB_{MAX}, CBM_{MAX}). In case of an even number of beams, the beam with the higher value is evaluated.*

Table 46: Description of basic functions

9.7.5 Index 0x2008: System Status

<table>
<tr><td>Data type</td><td>UINT8</td></tr>
<tr><td>Attribute</td><td>ro</td></tr>
<tr><td>Default</td><td>0</td></tr>
<tr><td>Min</td><td>0</td></tr>
<tr><td>Max</td><td>255</td></tr>
<tr><td>PDO mapping</td><td>yes (TPDO)</td></tr>
<tr><td>Description</td><td>This object contains information about various system statuses for the CANopen MLG:
<table>
<tr><th>Bit</th><th>Significance</th></tr>
<tr><td>7</td><td>E1 – SYNC-Error
■ 0 = normal function
■ 1 = synchronization error with sender</td></tr>
<tr><td>6</td><td>E2 – receive signal too low on teach-in
■ 0 = normal function
■ 1 = receive signal too low</td></tr>
<tr><td>5</td><td>E9 – general hardware error
■ 0 = normal function
■ 1 = hardware error has occurred</td></tr>
<tr><td>4</td><td>CONT – Contamination monitoring state
■ 0 = no contamination
■ 1 = contamination has occurred</td></tr>
<tr><td>3</td><td>TA – Teach-in status
■ 0 = Teach-in inactive
■ 1 = Teach-in active</td></tr>
<tr><td>2</td><td>PMA – Parameterization mode
■ 0 = normal function
■ 1 = device in parameterization mode</td></tr>
<tr><td>1</td><td>PDINV – Validity of process data
■ 0 = Data is valid
■ 1 = Data is invalid</td></tr>
<tr><td>0</td><td>N/A – not available</td></tr>
</table>
Table 47: System statuses – meanings of bits</td></tr>
</table>

Table 48: Index 0x2008: System status

9.7.6 Index 0x2009: Multiple scan (beam function)

Data type	UINT8
Attribute	rw
Default	0
Min	0
Max	8
PDO mapping	–
Description	You use the multiple scan parameter to select the beam function. → See page 16, chapter 4.5. Possible values: ■ 0x00 = parallel beam ■ 0x08 = Triple crossover beam Values other than those permitted for this object will be rejected by the light grid by it sending an ERROR message via CANopen. The response time with this object may be up to 650 ms.

Table 49: Index 0x2009: Multiple scan

NOTE

Selection of the beam function has no influence on the basic function and beam status (BS).

9.7.7 Index 0x200A: Contamination alarm setting

Data type	UINT8
Attribute	rw
Default	3
Min	0
Max	255
PDO mapping	–
Description	The alarm “Contamination control signaling output” is triggered if the receiver receives too little light for a specified number of light beams. The alarm is triggered in the following cases: Sender and receiver are contaminated or sender and receiver are not correctly aligned to one another. The alarm is output as follows: ■ the yellow LED on the MLG E receiver flashes ■ bit 4 is set in the byte status (see Index 0x2008: System Status). For number of beams n, you can set between 1 and the maximum number of beams for the light grid being used. If the number of beams 0 is specified, the alarm is output permanently. If a number of beams is specified that is larger than the number of beams of the light grid, the alarm is never output.

Table 50: Index 0x200A: Contamination alarm setting

9.7.8 Index 0x200B: Sensitivity setting

Data type	UINT8
Attribute	rw
Default	255
Min	0
Max	255
PDO mapping	–
Description	Teaching in the sensitivity is essential for reliable operation of the MLG light grid. With this procedure, all beams are set individually to the range currently used between sender and receiver. This process must be repeated if the range is changed. → See page 42; chapter 8.1. The following options exist for teaching in the sensitivity: **Automatic teach-in** The “Automatic” option is suitable for most applications and provides a safe operational state. **Manual teach-in** With this the setting can be adjusted to the application: ■ High operating reserve ■ The switching threshold is set as robust so that the light grid will work safely in case of moderate contamination on the light grid. This option is only suitable for opaque objects (which cannot be penetrated by IR). ■ High sensitivity Even partially transparent objects can be detected The following points must be noted with this setting: ■ The distance between receiver and sender must be at least 600 mm. ■ The system is more sensitive to contamination, misalignment, temperature fluctuations or vibrations. ■ We recommend repeating the teach-in process at regular intervals. Possible values: 0xFF = Automatic 0x80 = Manual – high operating reserve 0x01 = Manual – high sensitivity Values other than those defined for this object will be rejected by the MLG light grid by it sending an ERROR message via CANopen.

Table 51: Index 0x200B: Sensitivity setting

NOTE

*Setting the sensitivity does **not** replace the teach-in procedure.*

9.7.9 Index 0x200C: Number of Beams

Data type	UINT8
Attribute	ro
PDO mapping	–
Description	Number of beams on MLG CANopen light grid

Table 52: Index 0x200C: Number of beams

9.7.10 Index 0x200F: Manufacturing date

Data type	UNSIGNED16
Attribute	ro
PDO mapping	–
Description	Decimal numerical value indicating the date of manufacture. Example: ■ 1101 = year: 2011, month: January ■ 1111 = year: 2011, month: November

Table 53: Index 0x200F: Manufacturing date

9.7.11 Index 0x2100: Control byte

Data type	UINT8
Attribute	rw
Default	0
Min	0
Max	255
PDO mapping	yes (RPDO)
Description	

Bit	Significance
7	TEST – Activation of sender test input ■ 0 = normal function of light grid ■ 1 = TEST active, i.e. sender is being switched off. For checking whether the receiver shows all beams as blocked when the sender is switched off (functional test).
6	LEARN – teaching in the sensitivity ■ 0= Deactivate teach-in of sensitivity ■ 1 = Teach-in of sensitivity activated
5	BBH – Blocked Beams Hold ■ 0 = Blocked Beams Hold deactivated ■ 1 = Blocked Beams Hold activated For more details, see after this table.
4	N/A – not available
3	N/A – not available
2	SB – Stand-by (sender is switched off. Beam status, basic functions and the switching state are retained but are invalid). ■ 0 = Stand-by deactivated ■ 1 = Stand-by activated
1	N/A – not available
0	N/A – not available

Table 54: Control byte – description of bits

Table 55: Index 0x2100: Control byte

Using the BBH (Blocked Beams Hold) input function

The BBH (Blocked Beams Hold) input function is suitable for height measurement. With this function, all beams blocked during measuring e.g. by a passing object are saved. The measuring result can be fetched by the light grid after measuring.

NOTE!

As long as the "BBH" function is set, an H will be visible on the receiver's display.

10 Cleaning and maintenance

10.1 Cleaning

NOTICE!

Equipment damage due to improper cleaning!

Improper cleaning can lead to damage to equipment.

For this reason:

– Never use cleaning agents containing aggressive substances.
– Never use pointed objects for cleaning.

Clean the front screens at regular intervals with a lint-free cloth and plastic cleaning agent.

The cleaning interval essentially depends on the ambient conditions.

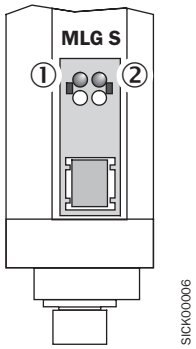
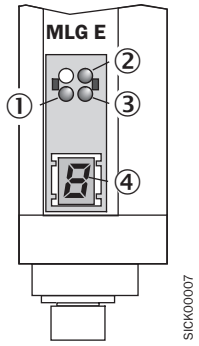
10.2 Maintenance

No maintenance work is required for MLG light grids.

11 Rectification of faults

Possible malfunctions and rectification measures are described in the table below.

In case of malfunctions that cannot be rectified using the information below, please contact the manufacturer. For your representative, see the rear of these operating instructions.

MLG	Display	Possible causes	Rectification of faults
Sender  *1 LED red* *2 LED green*	Red LED illuminates.	Sender defective.	Return sender and receiver to your SICK representative.
Receiver  *1 LED yellow* *2 LED red* *3 LED green* *4 7-segment display*	Yellow LED flashes.	Front screens dirty.	■ Clean front screens. → See page 80, chapter 10.1. ■ Teach in sensitivity. → See page 42, chapter 8.1.
		Permissible range exceeded.	Mount sender and receiver within permissible range.
		Sender and receiver are no longer correctly aligned to each other.	■ Align sender to receiver. → See page 26, chapter 6.1.1. ■ Teach in sensitivity. → See page 42, chapter 8.1.
	Red LED illuminates. “E1” appears on the display.	Synchronization error between sender and receiver.	Check wiring.
	Red LED illuminates. “E2” appears on the display.	During sensitivity teach-in, the input signal is too weak on the receiver.	■ Align sender to receiver. → See page 26, chapter 6.1.1. ■ Teach in sensitivity. → See page 42, chapter 8.1.
	Red LED illuminates. “E9” appears on the display.	Hardware fault	Return sender and receiver to your SICK representative.

MLG	Display	Possible causes	Rectification of faults
Receiver (continued)	Green LED illuminates. “P” appears on the display.	The light grid is not operational. Parameterization mode active.	The display goes out as soon as parameterization mode is quit.
		The light grid is not operational. Parameterization mode has ended. There is a malfunction.	■ Check wiring. ■ Check termination.
	Green LED illuminates. “L” appears on the display.	Teach-in mode active	Depending on the procedure, teach-in mode will be exited automatically or else must be actively quit. → See page 42, chapter 8.1.
	Green LED illuminates. “H” appears on the display.	BBH (Blocked Beams Hold) input function active.	Deactivate BBH input function. (Control byte, Index 0x2100). → See page 79, chapter 9.7.11.
	Green LED illuminates. “S” appears on the display.	"Stand-by” input function is active.	Deactivate “stand-by” input function. (Control byte, Index 0x2100). → See page 79, chapter 9.7.11.

Table 56: Rectification of faults

11.1 Returning the light grid

To enable efficient processing and for the cause to be determined quickly, please include the following when returning the light grid:

- details of a contact person
- a description of the application
- a description of the error that has occurred.

11.2 Disposal

The following points should be observed when disposing of the light grid:

- Do no dispose of the light grid as household waste.
- Dispose of the light grid according to the pertinent regulations in your country.

12 Repairs

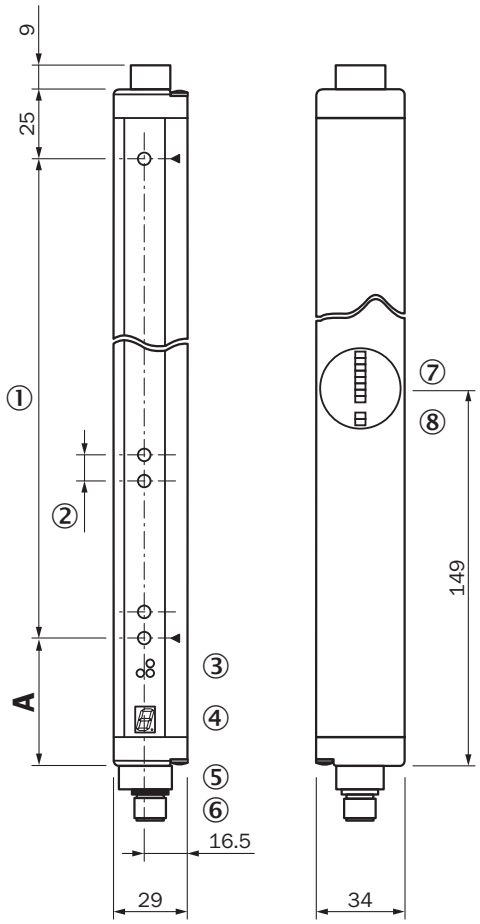
Repairs may only be carried out by the manufacturer. Any manipulation or modification of device will invalidate the manufacturer warranty.

13 Technical specifications

NOTE!

You can also download, store and print the relevant online data sheet with technical data, dimensions and connection diagrams via the web at "www.mysick.com".

13.1 Dimensions



Dimensions in mm

	A Distance: MLG edge – first beam
Beam spacing 10 mm	49
Beam spacing 20 mm	49 / 59
Beam spacing 25 mm	52
Beam spacing 30 mm	69
Beam spacing 50 mm	89

All dimensions in mm

Fig. 34: MLG CANopen light grid dimensions

1 *Monitoring height*
2 *Beam spacing*
3 *LED status indicator:*
4 *7-segment display*
5 *Ground*
6 *M12 plug*
7 *Node ID*
8 *Baud rate setting*

Distance from housing – first beam

Type	Beam spacing	Connection, M12 plug
1-x ...	10 mm	49
2-x ...	20 mm	■ 49 [1)] ■ 59 [2)]
7-x ...	25 mm	64
3-x ...	30 mm	69
5-x ...	50 mm	89
1) with even number of beams, 2) with odd number of beams		

Table 57: Distance from housing – first beam

13.2 Monitoring height and number of beams

Monitoring height [mm] / number of beams				
x1-x ... **Beam spacing 10 mm**	**x2-x ...** **Beam spacing 20 mm**	**x-7x ...** **Beam spacing 25 mm**	**x-3x ...** **Beam spacing 30 mm**	**x-5x ...** **Beam spacing 50 mm**
140 / 15	140 / 8	125 / 6	120 / 5	100 / 3
290 / 30	280 / 15	275 / 12	270 / 10	250 / 6
440 / 45	440 / 23	425 / 18	420 / 15	400 / 9
590 / 60	580 / 30	575 / 24	570 / 20	550 / 12
740 / 75	740 / 38	725 / 30	720 / 25	700 / 15
890 / 90	880 / 45	875 / 36	870 / 30	850 / 18
1040 / 105	1040 / 53	1025 / 42	1020 / 35	1000 / 21
1190 / 120	1180 / 60	1175 / 48	1170 / 40	1150 / 24
1340 / 135	1340 / 68	1325 / 54	1320 / 45	1300 / 27
1490 / 150	1480 / 75	1475 / 60	1470 / 50	1450 / 30
1640 / 165	1640 / 83	1625 / 66	1620 / 55	1600 / 33
1790 / 180	1780 / 90	1775 / 72	1770 / 60	1750 / 36
1940 / 195	1940 / 98	1925 / 78	1920 / 65	1900 / 39
2090 / 210	2080 / 105	2075 / 84	2070 / 70	2050 / 42
2240 / 225	2240 / 113	2225 / 90	2220 / 75	2200 / 45
2390 / 240	2380 / 120	2375 / 96	2370 / 80	2350 / 48
	2540 / 128	2525 / 102	2520 / 85	2500 / 51
	2680 / 135	2675 / 108	2670 / 90	2650 / 54
	2840 / 143	2825 / 114	2820 / 95	2800 / 57
	2980 / 150	2975 / 120	2970 / 100	2950 / 60
	3140 / 158	3125 / 126	3120 / 105	3100 / 63

Table 58: Monitoring height and number of beams

13.3 Type

Minimum detectable object (MDO)	■ Parallel beam function: 15 ... 60 mm ■ Crossover beam function: Area a: 15 ... 60 mm / Area b: 10 ... 35 mm → See page 16 ff, chapter 4.5.
Beam spacing	10 mm / 20 mm / 25 mm / 30 mm / 50 mm
Number of beams	3 ... 240 → See page 85, chapter 13.2.
Monitoring height	100 ... 3,140 mm in 150 mm stages → See page 85, chapter 13.2.
Wavelengths	880 nm
Synchronization between sender and receiver	Via cable, connections “Sync A” and “Sync B“

Table 59: Type

13.4 Performance data

Limiting scanning distance (maximum range)	7 m or 12 m depending on light grid type No reserves for environmental influence and ageing of diodes
Operating range	5 m and 8.5 m depending on light grid type
Maximum range	■ Parallel beam function: 0 m ■ Crossover beam function: 200 ... 840 mm
Initialization period after switching on supply voltage	< 1 s
Response time	■ Parallel beam function: 0.2 ms per beam + 8.8 ms ■ Triple crossover beam function: 3 x (0.2 µs per beam + 8.8 ms) The response time depends on the beam function and the selected basic function.

Table 60: Performance data

13.5 Supply

Supply voltage U_V	18 ... 30 V DC
Protective circuit	■ Reverse polarity protected connections ■ Interference pulse suppression
Sender current consumption at 24 V DC without load	< 140 mA + 2 mA/beam
Receiver current consumption at 24 V DC without load	< 100 mA + 3 mA/beam
Residual ripple	< 5 V_{SS}

Table 61: Supply

13.6 Inputs

Inputs	→ See page 38, chapter 7.5.
Response time input	■ Input functions on receiver: < 20 ms ■ Test input at sender: < 80 ms

Table 62: Inputs

13.7 Outputs

Outputs	1 output → See page 38, chapter 7.5.
Protective circuits	■ Short-circuit protected outputs ■ Interference pulse suppression
Maximum output current	100 mA
Output load	■ Capacitive: 100 nF ■ Inductive: 1 H
Load resistance	for light grids with analog output ■ Output signal 4 ... 20 mA: < 600 ohms ■ Output signal 0 ... 10 V: > 1 kilohms

Table 63: Outputs

13.8 CANopen interface

CANopen interface	→ See page 43, chapter 9.
Baud rate	125 kbit/s ... 1 Mbit/s (factory setting: 500 kbit/s)

Table 64: CANopen interface

13.9 Ambient condition

Protection class	Protection class III
Electromagnetic compatibility	EN 60947-5-2
Ambient temperature range	–25 ... +55 °C
Ambient condition	Do not use light grid outdoors unless protected (condensation water will form)
Enclosure rating	IP 65
Storage temperature range	–25 ... +70 °C
MLG: Insensitivity to ambient light	■ Direct: 12500 lx ■ Indirect: 50000 lx [1)]
Vibration resistance	10 ... 100 Hz: 10 g as per IEC 68-2-6
Shock resistance	25 g/11 ms as per IEC 68-2-27

1) Constant light stability

Table 65: Ambient condition

13.10 Design

Dimensions	→ See page 84; chapter 13.1.
Weight	■ approx. 1480 g for a sender or receiver with a monitoring height of 1200 mm ■ per extension of monitoring height by 150 mm: +160 g
Materials	■ Housing: Aluminum, anodized ■ Front screen: PMMA
Display	7-segment display, LEDs
Enclosure rating	IP 65

Table 66: Design

14 Accessories

14.1 Connection systems

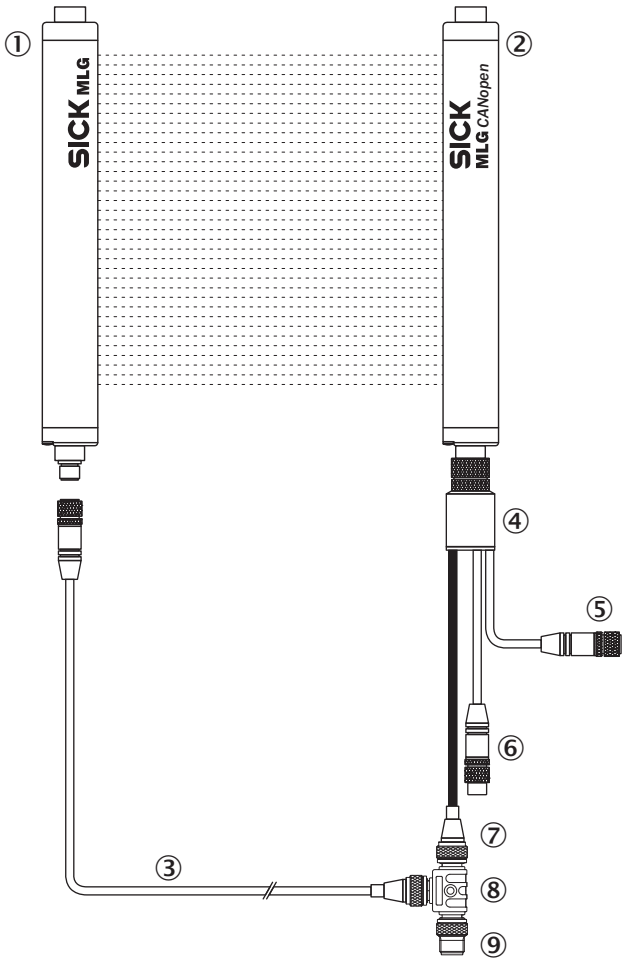
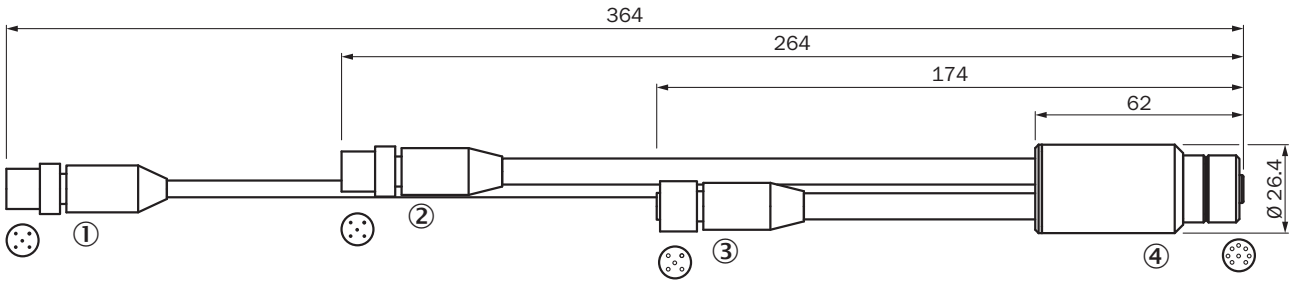


Fig. 35: Connecting sender and receiver via a CANopen adapter, connection cable and T-distributor

1 *Sender*
2 *Receiver*
3 *Connection cable (optional)*
4 *CANopen adapter (optional)*
5 *CANopen OUT*
6 *CANopen IN*
7 *Light grid receiver connection*
8 *T-distributor (optional)*
9 *Supply, switching state Q1, test input*



All dimensions in mm

Fig. 36: CANopen adapter, straight

1 T-distributor connection cable
2 CAN IN
3 CAN OUT
4 Receiver connection

Description	Type	Part no.
ADAPT-CAN-GE-MLG Prog, 8-pin. 0.3 m	ADAPT-CAN-GE-MLG	1052957

T-distributor

Description	Type	Part no.
T-distributor, 1 x M12 plug, 5-pin and 2x M12 sockets, 5-pin	SBO-02G12-SM	6029305

Cable plug

Description	Type	Part no.
Cable plug, straight, M12, 5-pin, without cable	STE-1205-G	6022083
Cable plug (knurl), straight, shielded, M12, 5-pin, without cable	STE-1205-GA	6027533

Cable sockets

Description	Type	Part no.
Cable socket, straight, PVC, A-coded, 2 m	DOL-1205-G02M	6008899
Cable socket, straight, PVC, orange, A-coded, 5 m	DOL-1205-G05M	6009868
Cable socket, straight, PVC, orange, A-coded, 10 m	DOL-1205-G10M	6010544
Cable socket, straight, PVC, orange, A-coded, 15 m	DOL-1205-G15M	6029215
Cable socket, angled, PVC, orange, A-coded, 2 m	DOL-1205W02M	6008900
Cable socket, angled, PVC, orange, A-coded, 5 m	DOL-1205W05M	6009869
Cable socket, angled, PVC, orange, A-coded, 10 m	DOL-1205W10M	6010542

Description	Type	Part no.
Cable socket, straight, without cable, A-coded	DOS-1205-G	6009719
Cable socket, straight, PUR halogen-free, black, A-coded, 2 m	DOL-1205-G02MC	6025906
Cable socket, straight, PUR halogen-free, black, A-coded, 5 m	DOL-1205-G05MC	6025907
Cable socket, straight, PUR halogen-free, black, A-coded, 10 m	DOL-1205-G10MC	6025908
Cable socket, straight, PVC, orange, A-coded, 2 m	DOL-1205-G02MN	6028140
Cable socket, straight, PVC, orange, A-coded, 5 m	DOL-1205-G05MN	6028141
Cable socket, straight, PVC, orange, A-coded, 10 m	DOL-1205-G10MN	6028142

CANopen

Description	Type	Part no.
Cable, sold by meter, AL PT, shielded, PUR halogen-free, black	LTG-2804-MW	6028328
Cable plug, M12, 5-pin, bus in	STE-1205-GA	6028333
Cable plug, straight, with terminal resistor, M12, 5-pin	STE-1205-GKEND	6037193
Cable socket, straight with shield, A-coded, without cable	DOS-1205-GA	6027534
Cable socket, straight with shield, PUR halogen-free, black, A-coded (drop cable), 5 m	DOL-1205-G05M-Can	6021166
Cable socket, straight with shield, PUR halogen-free, black, A-coded (drop cable), 6 m	DOL-1205-G06MK	6028326
1:1 connection cable, M12/M12, with shield, PUR halogen-free, purple, A-coded (CAN/DeviceNet), drop cable, 1 m	DSL-1205-G01MK	6021164
1:1 connection cable, M12/M12, with shield, PUR halogen-free, purple, A-coded (CAN/DeviceNet), drop cable, 6 m	DOL-1205-G06MK	6028327

Connection cables

Description	Type	Part no.
1:1 connection cable, M12/M12, PUR halogen-free, black, A-coded, 1 m	DSL-1205-G01MC	6029280
1:1 connection cable, M12/M12, PUR halogen-free, black, A-coded, 2 m	DSL-1205-G02MC	6025931
1:1 connection cable, M12/M12, PUR halogen-free, black, A-coded, 5 m	DSL-1205-G05MC	6029282
1:1 connection cable, M12/M12, PUR halogen-free, black, A-coded, 10 m	DSL-1205-G10MC	6038954
1:1 connection cable, M12/M12, PUR halogen-free, black, A-coded	DSL-1205-G1M5C	6029281
1:1 connection cable, M12/M12, with shield, PUR halogen-free, purple, A-coded (CAN/DeviceNet), drop cable, 1 m	DSL-1205-G01MK	6021164
1:1 connection cable, M12/M12, with shield, PUR halogen-free, purple, A-coded (CAN/DeviceNet), drop cable, 6 m	DOL-1205-G06MK	6028327

14.2 Mounting systems

Swivel mount

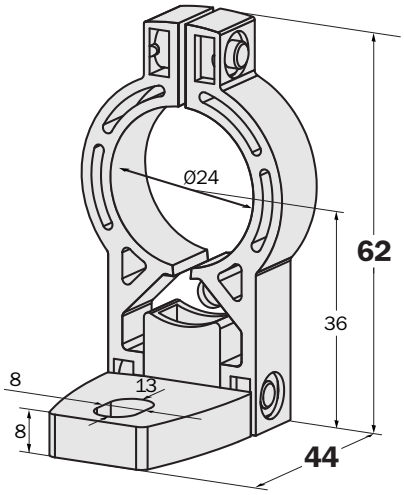
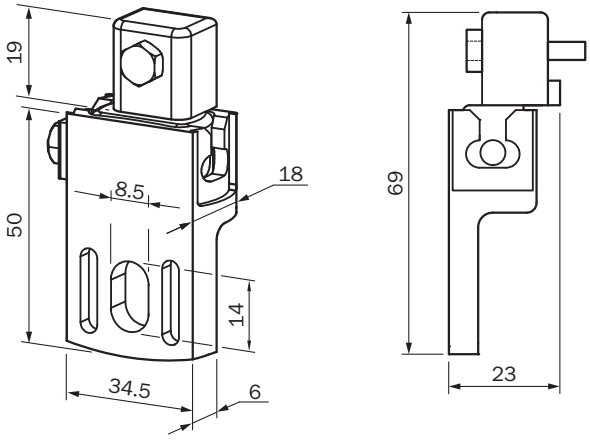


Fig. 37: Swivel mount

Description	Type	Part no.
Swivel mount (x4), monitoring height up to 1600 mm	BEF-2SMKEAKU4	2019649

T-nuts with sliding nuts



All dimensions in mm

Fig. 38: T-nuts with sliding nuts

Description	Type	Part no.
Bracket with sliding nuts (x4 M5)	BEF-NUT-MLG	2023696

Other mounting systems

Description	Type	Part no.
Swivel mounting bracket, undamped	BEF-1SHABAAL4	2017751
Bracket without sliding nuts, rotatable, side bracket	BEF-1SHABAZN4	2019506
Mounting bracket, rotatable, vibration-damped and impact-resistant	BEF-1SHADAAL2	2018742
Rotatable mounting bracket, vibration-damped	BEF-1SHADAAL4	2017752
Swivel mount, 24 mm, omega bracket, fastening kit for device columns	BEF-2SMKEAAL2	2045884
Swivel bracket, 24 mm	BEF-2SMKEAAL4	2044848
Stainless steel rotatable bracket	BEF-2SMKEAES4	2030288
Mounting bracket, fixed (large)	BEF-3WNGBAST4	7021352
Mounting bracket, fixed (small)	BEF-3WNKBAST4	2044068
Universal bracket (plate without thread) for attachment of bars (BEF-MSxx)	BEF-KHS-G01	2022464
Clip/tapered (without fastening plate) for attachment of bars (BEF-MSxx)	BEF-KHS-KH1	2022726
Mounting bar, straight, 300 mm	BEF-MS12G-B	4056055
Mounting bar, straight, 200 mm	BEF-MS12G-NA	4058914
Mounting bar, straight, 300 mm	BEF-MS12G-NB	4058915
Mounting bar, L-shaped, 150 mm x 150 mm	BEF-MS12L-A	4056052
Mounting bar, L-shaped, 250 mm x 250 mm	BEF-MS12L-B	4056053
Mounting bar, L-shaped, 150 mm x 150 mm	BEF-MS12L-NA	4058912
Mounting bar, L-shaped, 250 mm x 250 mm	BEF-MS12L-NB	4058913
Mounting bar, L-shaped, 50 mm x 70 mm	BEF-MS12L-S01	4055623
Mounting bar, L-shaped, 100 mm x 170 mm	BEF-MS12L-S02	4055624
Mounting bar, L-shaped, 100 mm x 250 mm	BEF-MS12L-S03	4055625
Mounting bar, L-shaped, 150 mm x 350 mm	BEF-MS12L-S04	4055626
Mounting rod, U-shaped, 130 mm x 52 mm x 130 mm	BEF-MS12U	4065437
Mounting bar, Z-shaped, 150 mm x 70 mm x 150 mm	BEF-MS12Z-A	4056056
Mounting bar, Z-shaped, 150 mm x 70 mm x 250 mm	BEF-MS12Z-B	4056057
Mounting bar, Z-shaped, 100 mm x 150 mm x 200 mm	BEF-MS12Z-C	4064563

Description	Type	Part no.
Mounting bar, Z-shaped, 150 mm x 70 mm x 150 mm	BEF-MS12Z-NA	4058916
Mounting bar, Z-shaped, 150 mm x 70 mm x 250 mm	BEF-MS12Z-NB	4058917
Bar clip for 12 mm cylindrical bar(s)	BEF-RMC-D12	5321878
Nuts set with T-nuts, sliding nuts	–	2017550

14.3 Other accessories

Description	Type	Part no.
Anti-static plastic cleaner	–	5600006
Lens cloth	–	4003353
AR60 alignment aid	–	1015741
Adapter for AR60	–	4032462

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