OPERATING INSTRUCTIONS

RS25

Register sensors

EN

SICK
Sensor Intelligence.

Table of contents

Table of contents

Table of contents

1 General information

1.1 Information regarding the operating instructions

These operating instructions provide important information on how to handle the RS25-WF334000 and RS25-WL334000 register sensors from SICK AG. Adherence to all the specified safety instructions and guidelines is a prerequisite for working safely.

You must also comply with any local work safety regulations and general safety specifications applicable to the use of the register sensor.

Ensure that you read through these operating instructions carefully before starting any work. They constitute an integral part of the product and should be stored in the direct vicinity of the register sensor so they remain accessible to personnel at all times.

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

Danger of explosion at non-observance of the safety notes and incorrect handling – RS25-WL334000

ATEX

DANGER!

Danger of explosion at non-observance of the safety notes and incorrect handling RS25-WL334000!

Danger of explosion at non-observance of the enclosed safety notes and incorrect handling of the RS25-WL334000.

For this reason:

- Read and observe the following safety notes for applications in the potentially explosive area:
  - ATEX related Operating instructions for RS25-WL334000
  - ATEX General Information/Safety instructions
  - ATEX related Technical data.

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, personal injury, and material damage.

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.

ATTENTION

... indicates a potentially harmful situation, which may lead to material damage if not prevented.

Tips and recommendations

NOTE

... highlights useful tips and recommendations as well as information for efficient and trouble-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 conversions
- Technical modifications
- Use of unauthorized spare parts/consumable 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 Scope of delivery

The scope of delivery includes the following:

Register sensor RS25, calibrated in the factory, comprising of

- Evaluation unit
- Optical sensor head firmly installed to evaluation unit with fiber-optical cables and sealed
- Optional: Accessories (→ Page 53, Chapter 15).

Enclosed documentation for the non-ATEX-version RS25-WF334000 per register sensor:

- Quickstart

Enclosed documentation for the ATEX version RS25-WL334000 per register sensor:

- Quickstart
- ATEX General Information/Safety instructions
- ATEX related Technical data
- ATEX related Operating Instructions

You can download the following files online at "www.mysick.com/en/RS25":

- Operating Instructions RS25
- XDD file
- XDD explanation.

1.5 Customer service

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

Please refer to the back page of these operating instructions for your agent's contact details.

NOTE

Before calling, make a note of the type designation and serial number to enable faster processing. You can find the type designation and serial number on the type label.
→ SeePage 14, Chapter 3.1.

1.6 EC declaration of conformity

→ You can download the EC declaration of conformity online from "www.mysick.com/en/RS25".

1.7 Environmental protection

→ See Page 48, Chapter 12.3 "Disposal".

1.8 Warranty

Repairs may only be carried out by the manufacturer. Any manipulation or modification of the sensor will invalidate the manufacturer warranty. For example:

- Opening the sensor housing
- Removing the fiber-optic cable
- Destruction of the cable seal on the fiber-optic cable

2 Safety

2.1 Correct use

The RS25 register sensor is an opto-electronic sensor intended for non-contact recognition of print marks in the printing industry. → For examples, see Page 18, Chapter 4.3.

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

ATEX

The RS25-WL334000 register sensor is suitable for use in environments with potentially explosive gases; for example, in cases where dissolved inks are used.

The RS25-WL334000 register sensor is approved for the following applications:

- Evaluation unit: ATEX Ex II (2)G [Ex op is Gb] IIB
- Optical sensor head: ATEX Ex II 2G Ex op is IIB T4 Gb
- SICK AG assumes no responsibility or liability for damages resulting from the installation of the RS25-WL334000 in unintended areas.

2.2 Incorrect use

The RS25 register sensor does not constitute a safety component according to the EC Machinery Directive (2006/42/EC).

The RS25-WF334000 register sensors must not be used in explosion areas.

Any other use that is not described as correct use is prohibited.

Never install or connect accessories if their quantity and composition are not clearly specified, or if they have not been approved by SICK AG.

WARNING

Danger due to incorrect use.

Any incorrect use can result in dangerous situations.

For this reason:

- Register sensors should be used according to correct use specifications only.
- All information in these operating instructions must be strictly complied with.

2.3 Modifications and conversions

Modifications and conversions to the register sensor and/or the installation may result in unforeseeable dangers.

Technical modifications and expansions made to the register sensor require the prior written approval of the manufacturer.

2.4 Requirements for skilled persons and operating personnel

WARNING

Risk of injury due to insufficient training.

Improper handling may result in considerable personal injury and material damage.

For this reason:

- All activities should only ever be performed by designated persons.

These operating instructions list the training requirements for the various fields of activity, as follows:

- **Instructed personnel**
  During a briefing by the operator, such persons have been instructed about tasks assigned to them and about potential dangers in the event of improper action.
- **Skilled personnel**
  Due to their specialist training, skills, and experience, as well as their knowledge of the relevant regulations, such persons are able to perform tasks delegated to them and detect any potential dangers on their own initiative.
- **Electricians**
  Due to their specialist training, skills, and experience, as well as their knowledge of the relevant standards and provisions, such persons are able to perform work on electrical systems and detect any potential 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.

2.5 Operational safety and particular hazards

Please observe the safety notes and the warnings listed here and in other chapters of these operating instructions to reduce the possibility of risks to health and avoid dangerous situations.

2.6 Hazard warnings and operational safety

Light sender

The optical sensor head of the RS25 register sensor uses RGB light. The sensor meets the criteria of risk group 0 according to IEC 62471:2006.

No special measures are required.

3 Identification

3.1 Type label

3.1.1 Evaluation unit

The following type label is located on the back of the evaluation unit.

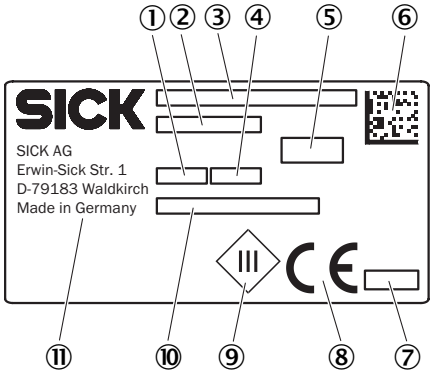


Fig. 1: Type label evaluation unit

1 *Dat-Code (JJ/WW) (YY/WW)*
2 *Material number*
3 *Type designation*
4 *Serial number*
5 *Performance characteristics e.g. supply voltage*
6 *2D matrix code*
7 *QS identification*
8 *CE mark*
9 *Protection class III*
10 *MAC address*
11 *Manufacturer address*

3.1.2 Optical sensor head

The following type label is located on the optical sensor head:

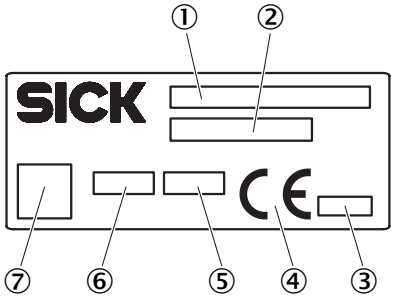


Fig. 2: Type label optical sensor head

1 *Type designation*
2 *Material number*
3 *QS identification*
4 *CE mark*
5 *Serial number*
6 *Dat-Code (JJ/WW) (YY/WW)*
7 *Serial number as 2D matrix code*

3.2 Type designation

The RS25 register sensor is available in the following versions:

Type designation	Description
RS25-WF334000	Non-ATEX version, Ethernet Powerlink data interface
RS25-WL334000	ATEX-certified version, Ethernet Powerlink data interface • Evaluation unit: ATEX Ex II (2)G [Ex op is Gb] IIB • Optical sensor head: ATEX Ex II 2G Ex op is IIB T4 Gb

Table 1: Type designation

4 Structure and function

4.1 Structure

Evaluation unit

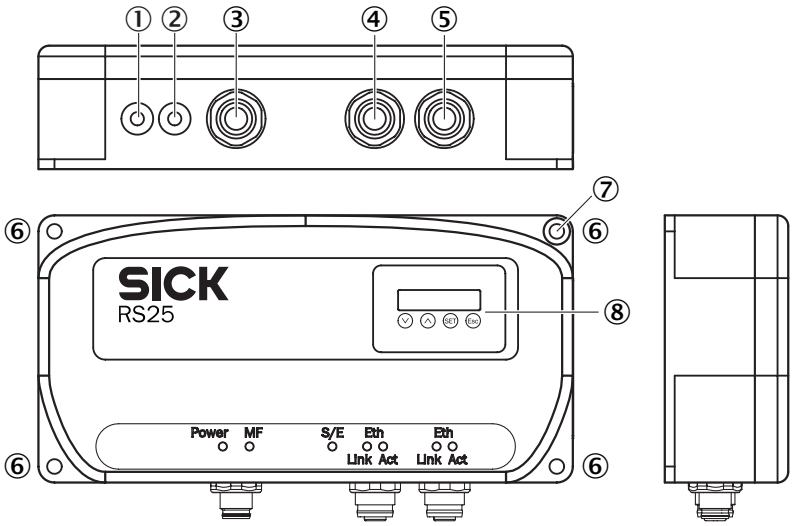


Fig. 3: Structure of the "RS25 register sensor – evaluation unit"

1 *Connection optical sensor head receiver*
2 *Connection optical sensor head transmitter*
3 *Connection supply voltage*
4 *Connection Ethernet Powerlink*
5 *Connection Ethernet Powerlink*
6 *Fixing hole*
7 *Surface anodized free*
8 *Display and operating unit*

Optical sensor head

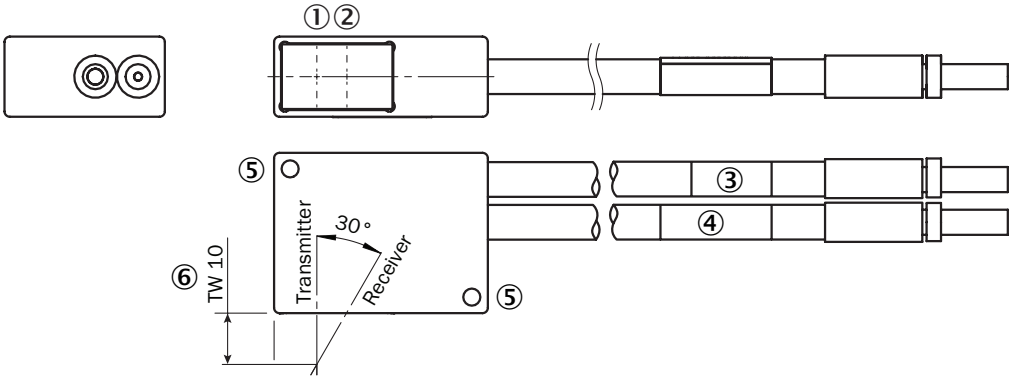


Fig. 4: Structure of the "RS25 register sensor – optical sensor head"

1 *Optical axis transmitter*
2 *Optical axis receiver*
3 *Fiber-optic cable transmitter*
4 *Fiber-optic cable receiver*
5 *Fixing hole*
6 *Sensing range (TW) in mm*

4.2 Function

The RS25 register sensor is an opto-electronic sensor intended for non-contact recognition of print marks in the printing industry.

The RS25 register sensor consists of an evaluation unit and an optical sensor head. The optical sensor head is firmly connected to the evaluation unit via one fiber-optic cable each for the transmitter and receiver.

The printing industry uses print marks, such as triangles, for lateral and longitudinal register monitoring. The edges are detected by the register sensor RS25.

The register sensor RS25 is connected to Ethernet Powerlink. Ethernet Powerlink supplies a high-resolution NetTime for synchronization via the network. All detected edges are transmitted from the RS25 register sensor to the PLC with the NetTime as a reference.

In this way, high-quality information is provided to the PLC. The PLC can calculate the lateral and longitudinal offset using the exact timing of the rising and falling edges. For longitudinal monitoring, the distances of the front edges are calculated. For lateral monitoring, the thickness of the mark is compared with the thickness of the previous marks.

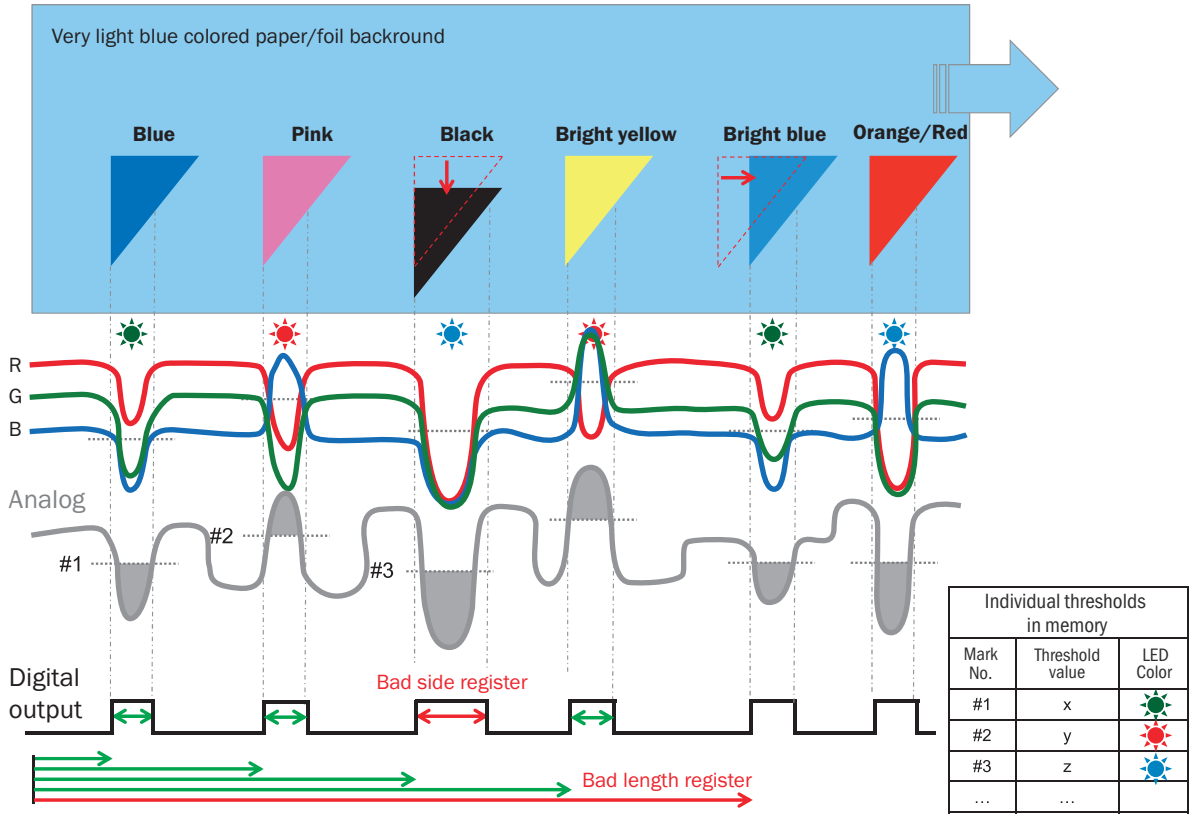


Fig. 5: Function of the RS25

4.3 Application

The RS25 register sensor is suitable for the following applications within the printing industry:

- Longitudinal and lateral register control
- Multicolored register control in low-contrast conditions, with and without the key code
- Cut-off control

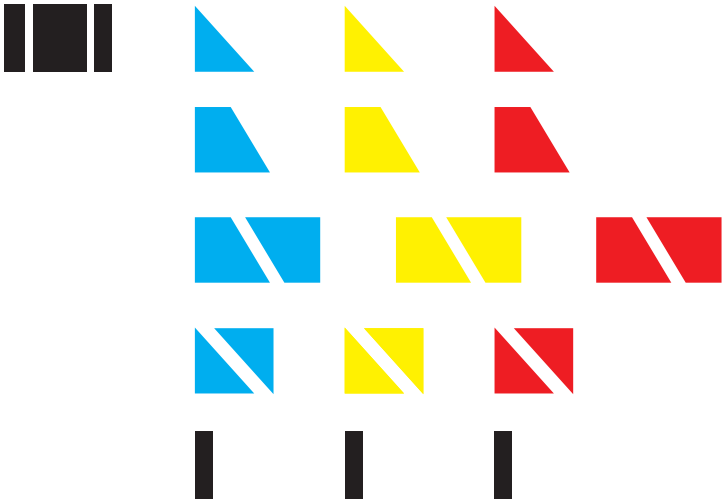


Fig. 6: Applications – examples of print marks

4.4 Display and operating elements

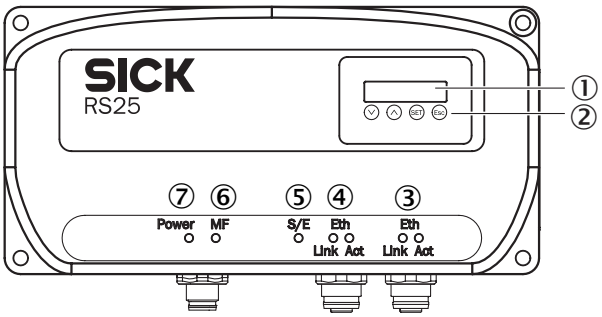


Fig. 7: Display and operating elements

1 *Display*
2 *Pushbuttons*
3 *LED function indicator (green) "Eth, Link and Act"*
4 *LED function indicator (green) "Eth, Link and Act"*
5 *LED function indicator (green/red) "S/E"*
6 *LED function indicator (yellow) "MF"*
7 *LED function indicator (green) "Power"*

Function indicators (LEDs)

Function indicator	Description
Power	Supply voltage available. • Green LED: Normal operation/Supply voltage on • LED off: No operation
MF	Without function
S/E	Ethernet Powerlink connection display • Green LED: Ethernet Powerlink connection correctly connected • Red LED: Faulty Ethernet Powerlink connection
Eth/Link (x 2)	Ethernet connection display • Green LED: Ethernet connection available • LED off: No Ethernet connection available
Eth/Act (x 2)	Data transfer display • Green LED: Data transfer • LED off: No data transfer

Table 2: Function indicators (LEDs)

Symbols for modes

The register sensor distinguishes between the modes "Operation", "Commissioning" and "Parameterization and Diagnosis".

Symbol	Description
RUN	The RUN symbol is displayed in operating mode.
SET	The SET symbol is displayed in commissioning mode. Commissioning comprises the following steps: • Check reflection quality/contrast quality. • Teach-in background • Teach-in key code • Teach-in print marks
MEN	The MEN symbol is displayed in configuration and diagnostic modes.

Table 3: Symbols for modes

Pushbuttons

Pushbutton	Description
	• Select menu, parameter, or option. • Reduce value.
	• Select menu, parameter, or option. • Increase value.
	• Switch to the "Menu" level. • Switch to the next-lowest menu level. • Save parameter change. • Confirm selection.
	• Short press: Exit parameters without saving. Switch to the next-highest menu level. • Long press: Exit parameters without saving. Switch to the bar graph display.

Table 4: Pushbuttons

5 Transport and storage

5.1 Transport

Improper transport

ATTENTION

Damage to the register sensor due to improper transport

Considerable material damage may occur in the event of improper transport.

For this reason:

- Register sensors should only be transported by trained specialist staff.
- The utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

5.2 Transport inspection

Improper transport

Upon delivery, please check the delivery for completeness and for any damage that may have occurred during transportation.

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

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

NOTE

Complaints regarding defects should be filed as soon as these are detected. Claims for replacement due to damage are only valid before the applicable complaint deadlines.

5.3 Storage

Please consider the following conditions when storing register sensors:

- Do not store outdoors.
- Store in a dry area that is protected from dust.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: between –20 and +70 °C
- Relative air humidity: max. 95%, non-condensing
- In case of storage periods of longer than 3 months, the general condition of all components and packaging should be checked on a regular basis.

Minimum bend radius

ATTENTION

Destruction of the fiber-optic cable

The fiber-optic cable can be destroyed by a small bend radius.

For this reason:

- Do not allow the fiber-optic cable to go below the minimum bend radius of 80 mm.

6 Mounting

6.1 Mounting procedure

Minimum bend radius

ATTENTION

Destruction of the fiber-optic cable

The fiber-optic cable can be destroyed by a small bend radius.

For this reason:

- Do not allow the fiber-optic cable to go below the minimum bend radius of 80 mm.

The optical sensor head is securely connected to the evaluation unit upon delivery.

1. Select the mounting site for the evaluation unit and the optical sensor head of the RS25 register sensor based on the information in the next chapter, "Requirements at the mounting site".
2. Mount the evaluation unit and optical sensor head using the fixing holes.
   → For dimensions, see Page 49, Chapter 14.1.

6.2 Requirements at the mounting site

The mounting site must meet the following requirements:

- For technical data, → see Page 49, Chapter 14.
- Sensing range: 10 mm
  The sensing range is the distance from the front edge (housing edge) of the optical sensor head to the object with the print marks.
- In the case of high-gloss backgrounds, maintain a tilt angle of 5 to 15° for the optical sensor head. → See the Page 23, Fig. 9 and Page 24, Fig. 10.

Assembly optical sensor head for diffuse marks and diffuse background

Transmitter and receiver are placed at an angle of 30° to each other in the optical sensor head. If the optical sensor head is installed in parallel to the background, only the diffuse reflections will reach the receiver and are detected by it. The directly reflecting reflections will not reach the receiver. → See Page 23, Fig. 8.

The placement according to figure Fig. 8. is suitable for diffuse marks and a diffuse background.

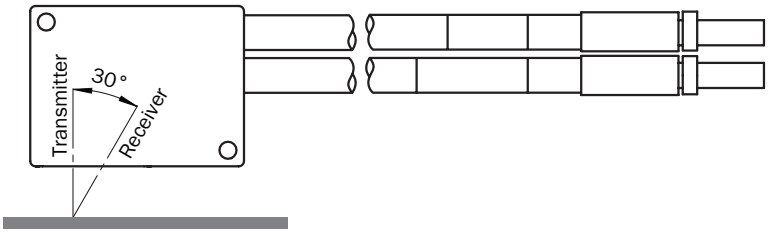


Fig. 8: Assembly optical sensor head for diffuse marks and diffuse background

Assembly optical sensor head for glossy marks and glossy background

Almost all the transmitter light is reflected in the reflective direction by a glossy background. Most of the light is reflected directly into the transmitter in a placement according to figure Fig. 8. Only a very small part of the light that is scattered to the side would reach the receiver and be detected by it.

For glossy marks or a glossy background the optical sensor head should be inclined as compared to the surface. The optical sensor head may be tilted in its longitudinal or lateral axis. There are advantages and disadvantages to either placement.

Tilt in the longitudinal axis

The optical sensor head is tilted around its longitudinal axis by 15°.

- Advantage: A relatively large share of the reflected light, also that reflected by the background, reaches the receiver (may be saturated).
- Disadvantage: The distance between the transmitter and the background differs from the distance between the receiver and the background. Due to the low depth of field, the optical sensor head is difficult to install at the correct distance.

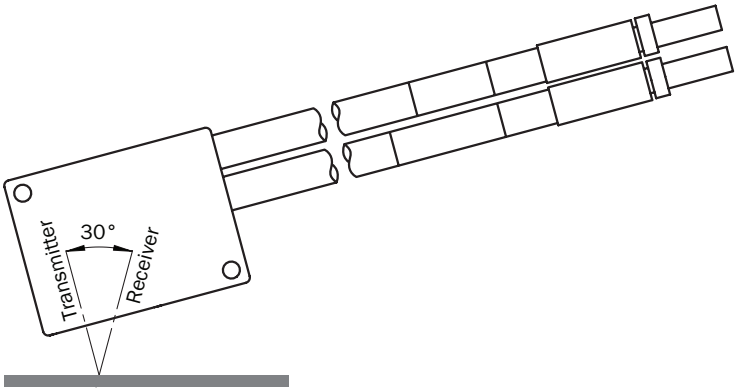


Fig. 9: Optical sensor head tilted longitudinally, assembly version at glossy marks and a glossy background

Tilt in the lateral axis

The optical sensor head is tilted around its lateral axis by 5 to 10° (Fig. 10 (II)). The reflected light does not reach the receiver. Almost all the light is reflected into the reflective direction at a glossy mark. The reflective reflections are hardly detected by the receiver. Only the diffuse part of the matte background is detected by the receiver. Only a small part of the light from the diffuse background reaches the receiver as compared to the placement in figure Fig. 9.

- Advantage: The distances between transmitter and background, as well as between receiver and background, are identical. The optical sensor head can be aligned easily.
- Disadvantage: Only little light is reflected into the receiver.

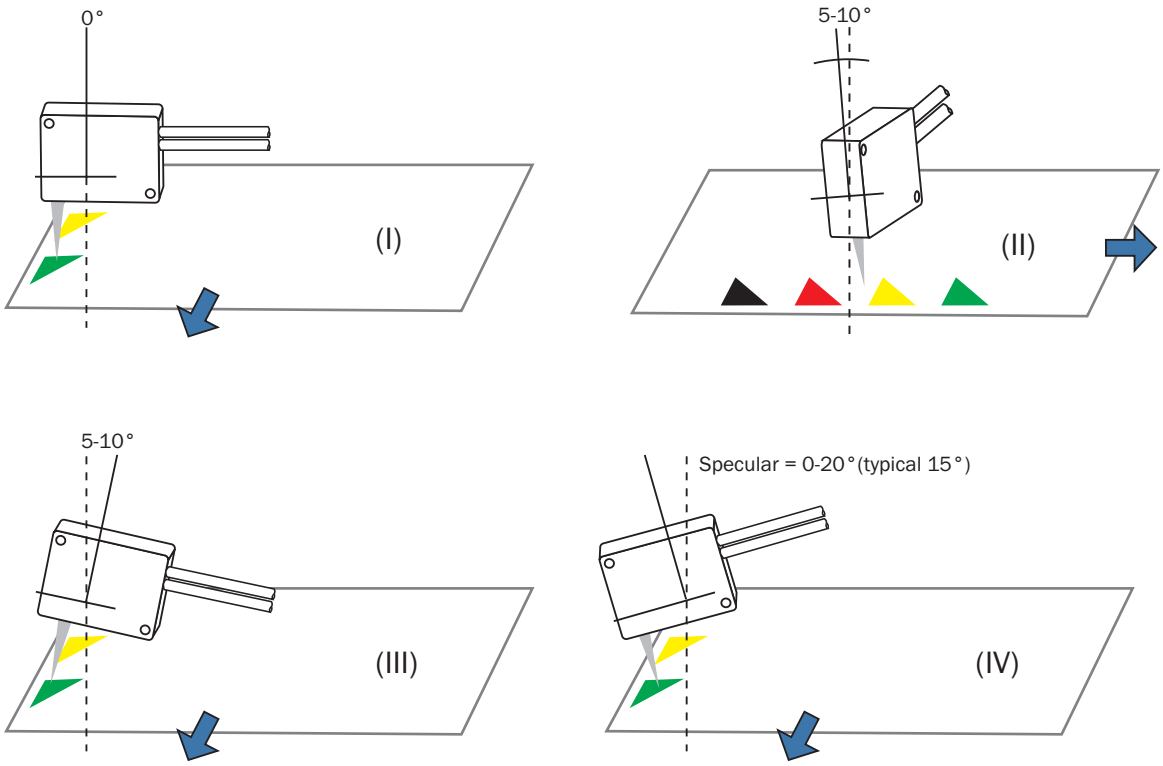


Fig. 10: Optical sensor head tilted in the lateral axis, assembly version at glossy marks

7 Electrical connection

7.1 Safety

Incorrect supply voltage

ATTENTION

Equipment damage due to incorrect supply voltage.

An incorrect supply voltage may result in damage to the equipment.

For this reason:

- Only operate the register sensor with safety extra-low voltage.

Working with voltage

ATTENTION

Equipment damage or unpredictable operation due to working with voltage.

Working with voltage may result in unpredictable operation.

For this reason:

- Only carry out wiring work when the power is off.
- Only connect and disconnect cable connections when the power is off.

7.2 Wiring notes

ATTENTION

Faults due to incorrect wiring.

Incorrect wiring may result in operational faults.

For this reason:

- Only use shielded cables with twisted-pair wires.
- Follow the wiring notes precisely.

NOTE

→ *For pre-assembled cables, see Page 53, Chapter 15.1.*

All electrical connections of the register sensor are configured as M12 round connectors.

The IP65 protection class is only achieved with screwed plug connectors or cover caps.

Please observe the following wiring instructions:

- A correct and complete cable shielding concept is required for trouble-free operation.
- The cable shield must be connected at both ends in the control cabinet and at the evaluation unit. The cable shield of the pre-assembled cable is connected to the knurled nut and thus also to the sensor housing.
- The cable shield in the control cabinet must be connected to the operating ground over a large surface area.
- Appropriate measures must be taken to prevent equipotential bonding currents flowing through the cable shield.
- Do not lay cables parallel to other cables, especially not to devices with a high level of radiated emission, such as a frequency converter.

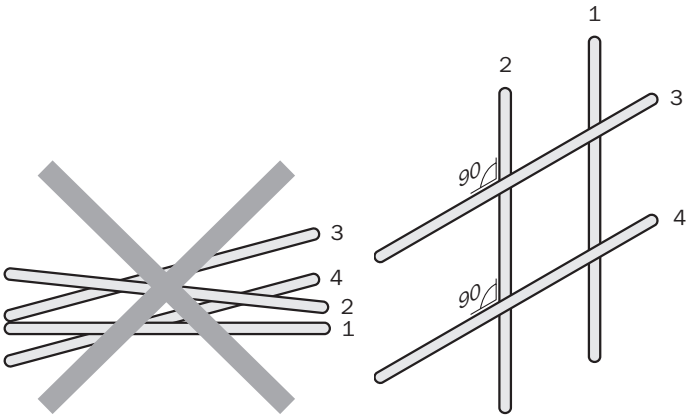


Fig. 11: Cross cables at right angles

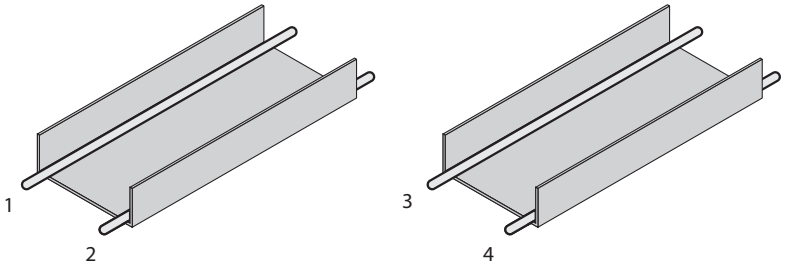


Fig. 12: Ideal laying –
Place cables in different cable channels

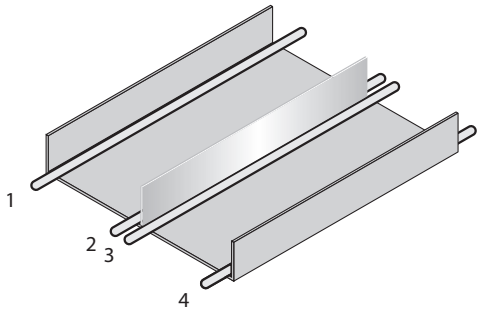


Fig. 13: Alternative laying – Separate cables with metallic separators

1 Cables very sensitive to interference (analog measuring cables)

2 Cables sensitive to interference (sensor cables, communication signals, bus signals)

3 Cables which are a source of interference (control cables for inductive loads, motor brakes)

4 Cables which are powerful sources of interference (output cables from frequency inverters, welding system power supplies, power cables)

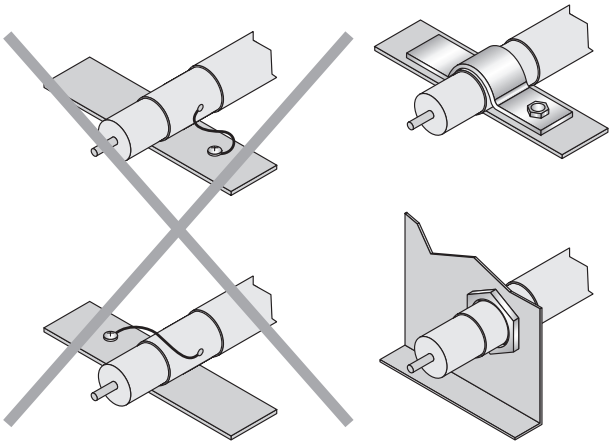


Fig. 14: Attach the shield using a short connection with a large surface area – ground both ends

7.3 Connecting the register sensor electrically

NOTE

→ For pre-assembled cables, see Page 53, Chapter 15.1.

1. Ensure that there is no voltage.
2. Connect the supply voltage to the M12 cable socket.
3. Connect the Ethernet cable to the plug.

7.4 Connection diagrams

7.4.1 Supply voltage connection diagram

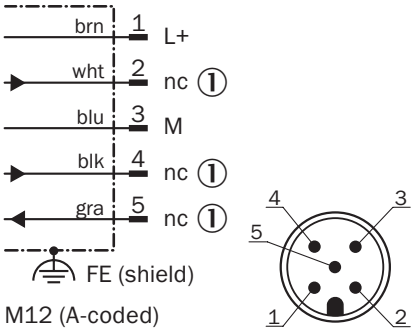


Fig. 15: Supply voltage connection diagram, M12 plug, 5-pin, A-coded

1 nc: not connected

Contact	Marking	Wire color	Description
1	L+	Brown	Supply voltage: +24 V DC ± 20 % (max. current: 250 mA)
2	nc	White	Not assigned
3	M	Blue	Supply voltage: 0 V
4	nc		Not assigned
5	nc		Not assigned

Table 5: Description of plug supply voltage

7.4.2 Ethernet connection diagram

The register sensor has a 100Base-T Ethernet connection.

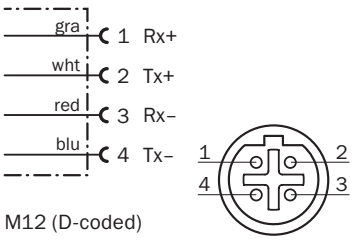


Fig. 16: Ethernet connection diagram, M12 socket, 4-pin, D-coded

Contact	Marking	Wire color	Description
1	Rx+	White	Receive data signal, not inverted
2	Tx+	Gray	Send data signal, not inverted
3	Rx–	Red	Receive data signal, inverted
4	Tx–	Blue	Send data signal, inverted

Table 6: Ethernet socket description

8 Commissioning

Pushbutton damage

ATTENTION

Pushbutton damage due to improper handling

Improper handling of the pushbuttons can damage them. This will make operation difficult or impossible.

For this reason:

- Only handle the pushbuttons with your fingers or a suitable pointing device.
- Do not handle the pushbuttons with sharp or hard objects.

8.1 Steps to be performed

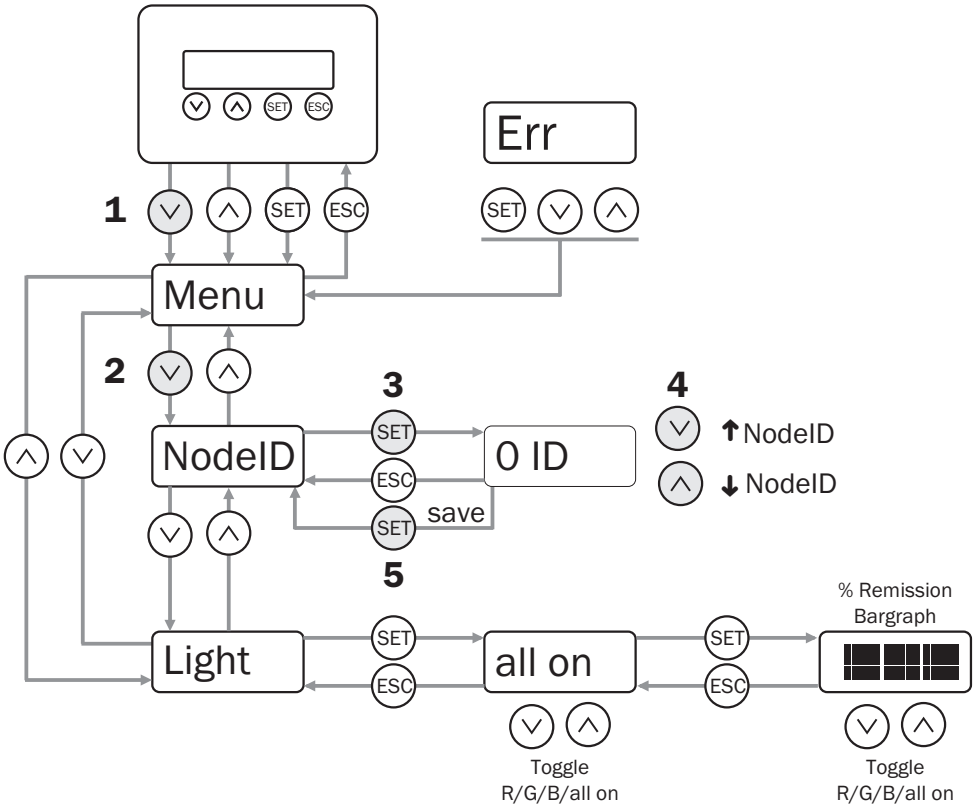
Perform the following steps during commissioning:

- Set Node ID. → See Page 31, Chapter 8.2.
- Switch the red, green, yellow LED or all LEDs on and off. → See Page 31, Fig. 17.
- Check reflection quality/contrast quality. → See Page 30, Chapter 8.
- Integrate XDD file of the register sensor RS25 into the configuration program. → See Page 34, Chapter 8.5.
- Configure register sensor RS25. → See page Page 34, Chapter 8.6.

→ For the overall menu structure see Page 31, Fig. 17.

8.2 Setting Node ID

You can set the Node ID for the register sensor using the "Node ID" parameter.



6. Perform a restart. This is done by switching the supply voltage off and then on again after 5 seconds.

The register sensor is ready to communicate with the control (PLC).

Fig. 17: Setting Node ID, menu structure

1. Press the ⌄ pushbutton. The "Menu" menu is displayed.
2. Press the ⌄ pushbutton. The parameter "Node ID" is displayed.
3. Press the SET pushbutton. The value "0 ID" is displayed.
4. Press the ⌃ pushbutton to set a higher "Node ID". Press the ⌄ pushbutton to set a lower "Node ID".
5. Complete one of the following steps:
   - Press the SET pushbutton to save all inputs. The "Node ID" menu is displayed.
   - Press the ESC pushbutton to cancel the process.
6. Perform a restart. This is done by switching the supply voltage off and then on again after 5 seconds.

The register sensor is ready to communicate with the control (PLC).

8.3 Operation via the evaluation unit

8.3.1 Selecting parameters

You can select a menu, parameter, or option using the SET, ▽ and △ pushbuttons. → For the overall menu structure see Page 31, Fig. 17.

8.3.2 Selecting options

1. Select the desired parameter using the SET, ▽ and △ pushbuttons.
2. Select the desired option using the ▽ or △ pushbuttons.
3. Complete one of the following steps:
   - Press the SET pushbutton to save the change.
   - Press the ESC pushbutton to cancel the process. The parameter name is displayed again.
4. Complete one of the following steps to return to the status indicator:
   - Press the ESC pushbutton repeatedly until the status indicator is displayed again.
   - Wait for approx. one minute. The display will automatically switch back to the status indicator if no buttons are pressed. Any settings you have made will also be saved.

8.3.3 Changing the value

1. Select the desired parameter using the SET, ▽ and △ pushbuttons.
2. Press the SET pushbutton. The current value of the parameter is displayed. The first digit on the left flashes.
3. Press the △ pushbutton to increase the digit. Press the ▽ pushbutton to lower the digit.
4. Press the SET pushbutton to save the digit entered. The next digit flashes.
   Press the ESC pushbutton to cancel the process.
5. Repeat steps 3 and 4 until the last digit is saved. The parameter name is displayed.
6. Press the ESC pushbutton repeatedly until the status indicator is displayed again. Alternatively, you can wait for approx. one minute. The display will automatically switch back to the status indicator if no buttons are pressed.

8.4 Checking reflection quality/contrast quality

Reflection quality (Contrast quality)

Check the reflection quality or contrast quality via the display of the evaluation unit. The bar graph represents the quality of the reflection of the individual LEDs in the sensor. To determine the quality of the reflection, select the appropriate LED and illuminate a surface.

You can select between the following LEDs:

- R: Red LED
- G: Green LED
- B: Blue LED, or
- W: White light (R + G + B: all LEDs).

→ For the overall menu structure see Page 31, Fig. 17.

Example

The white light is used.

The bar graph values correspond to 0 to 16,000. The two narrow, rectangular, red marks at the top and bottom display a reference position at which a calibrated white surface reflects 90 %. This corresponds to a value of 5,000 ans is the reference value.

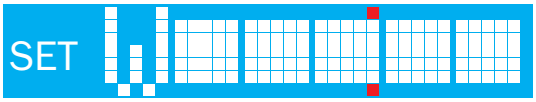


Fig. 18: The white light illuminates a high-gloss surface

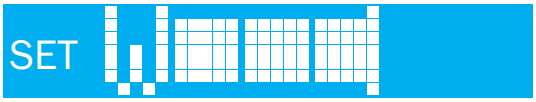


Fig. 19: The white light illuminates a piece of white paper

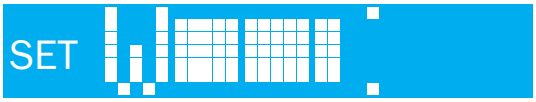


Fig. 20: The white light illuminates a piece of yellow paper

8.5 Integrating XDD file of the register sensor RS25 into the configuration program (XDD file)

To connect Powerlink devices to the network and use configuration programs to configure them, an electronic data sheet, or XDD file, is required. The XDD (XML Device Description) file is a standardized XML format and corresponds to the specifications of the EPSG (Ethernet Powerlink Standardization Group). → For more information on Ethernet Powerlink, see "www.ethernet-powerlink.org".

NOTE

You can download the XDD file online from "www.mysick.com/en/RS25".

Load the XDD file into the configuration program. For this, proceed according to the instructions of the configuration program.

8.6 Configuration of the register sensor RS25

8.6.1 Configuration procedure without key code

→ For the description of the operating modes see Page 35, Chapter 9.

A "T_0-Trigger" must be sent for configuration without key code.

1. Switch on the supply voltage.
2. Switch to "Oscilloscope mode".
3. Perform the teach-in for the background. Set the "Mode" parameter. Deactivate the key code. Send a „T_0-Trigger“.
4. Perform the teach-in for the print marks. Set the "Mode" parameter. Send a „T_0-Trigger“.
5. Switch to "RUN mode".

8.6.2 Configuration procedure using key code

→ For the description of the operating modes see Page 35, Chapter 9.

For configuration by key code, no "T_0-Trigger" has to be sent.

1. Switch on the supply voltage. The system starts automatically.
2. Switch to "Oscilloscope mode".
3. Perform the teach-in for the background. Set the "Mode" parameter. Set a "T_0-Trigger"
4. Activate the key code and perform a teach-in for key codes.
5. Perform the teach-in for the print marks. Set the "Mode" parameter.
6. Switch to "RUN mode".

The values are updated according to the "T_0-Trigger" setting.

9 Description of the operating modes and parameters

9.1 Overview of the operating modes

The register sensor is controlled by different modes. The "Operation mode" field is an object in the cyclical data transfer via Ethernet Powerlink. The following modes are available:

Mode	Description
Idle mode	Stand-by mode The sensor is waiting to be switched to another mode. All LEDs are off in this mode.
Oscilloscope mode	In this mode, the sensor sends the raw data of the light remission values for the three colors red, green, and blue in a cycle.
Teach-in background mode	In this mode, the sensor reads the light remission values of the background for all three colors. The background values serve as the basis for the following modes: "Teach-in printing marks", "Search/Teach-in key code", and "RUN".
Search/Teach-in key code mode	In this mode, the sensor looks for key codes and detects the first edge of the key code. For this mode, you must first complete the teach-in process for the background.
Teach-in printing marks	In this mode, the sensor detects the light remission values for the three colors and selects the best color for each mark. The best color is the one which has the highest difference in terms of the light remission values between the print mark and the background. The values calculated here are required for the RUN mode.
RUN mode and/or with key codes	In this mode, the sensor looks for the edges of the print marks using the values that have been previously taught in and the configured colors. It then sends the exact time stamp of all detected print marks to the PLC via cyclical data exchange.

Table 7: Operating modes

9.2 Idle mode

The following table describes the "Idle mode":

Description	
Function	Stand-by mode The sensor is waiting to be switched to another mode. All LEDs are off in this mode.
Activation	Some modes, such as "Teach-in and search key code", switch to Idle mode as soon as they are ended or if a fault has occurred.
Prerequisite	No parameters are required.
Feedback	No feedback is provided.
Speed	The maximum speed is not restricted for this mode.

Table 8: Idle mode

9.3 Oscilloscope mode

The following table describes the "Oscilloscope mode":

Description	
Function	In this mode, the sensor sends the raw data of the light remission values for all three colors of red, green, and blue, or for just one color, in a cycle. → See the figure below.
Activation	This mode must be activated via Ethernet Powerlink in the "Operation mode" field. This mode must be deactivated again via the "Operation mode" field. The parameter "T_0-Trigger“ is not used for this mode.
Prerequisite	The following parameters must be set before starting: • Timing resolution: 4 µs to 250 µs • Sending color: "red", "green", "blue", or "red + green + blue"
Feedback	The following data is sent from the sensor to the PLC. • Mode changes or faults • Raw data of the light remission values for the selected colors. Timing values are relative to the Ethernet Powerlink NetTime.
Speed	The maximum speed is not restricted for this mode.

Table 9: Oscilloscope mode

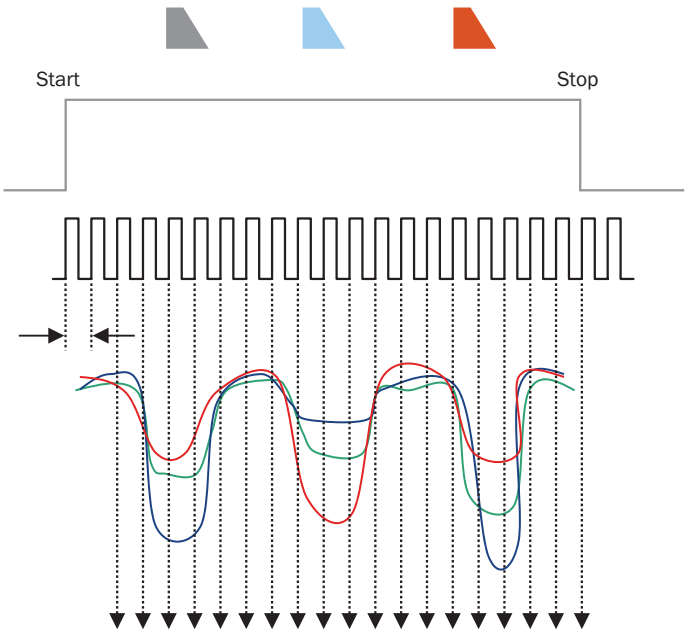


Fig. 21: Explanation of Oscilloscope mode

9.4 Teach-in background mode

The following table describes the "Teach-in background mode":

Description	
Function	In this mode, the sensor reads the light remission values of the background for all three colors. → See the figure below. The background values serve as the basis for the following modes: "Teach-in printing marks", "Search/Teach-in key code" and "RUN".
Activation	This mode must be activated via Ethernet Powerlink in the "Operation mode" field. Once the teach-in process is complete, or a fault has occurred, the mode will be deactivated automatically. You can use the parameter "T_0-Trigger" to set the time for the reading window to be started.
Prerequisite	The following parameter must be set before starting: • Δc: Reading window width. No print marks must be located within the reading window. The following value is delivered by the PLC: • T_0-Trigger
Feedback	The following data is sent from the sensor to the PLC. • The main value of the light remission values within the reading window • The minimum and maximum contrast values of the background for troubleshooting purposes.
Speed	The maximum speed is not restricted for this mode.

Table 10: Teach-in background mode

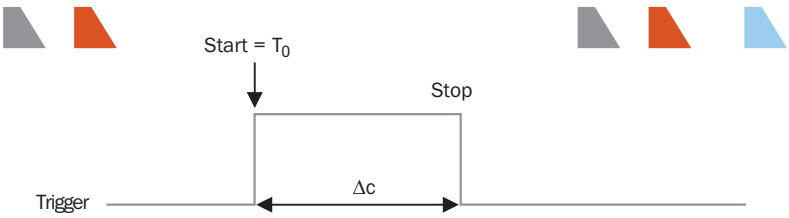


Fig. 22: Explanation of Teach-in background mode

Δc Reading window with for the background
No print marks must be located within the reading window.

9.5 Search/Teach-in key code mode

The following table describes the "Search/Teach-in key code mode":

Description	
Function	In this mode the sensor looks for key codes and detects the first edge of the key code. You need to first perform a teach-in for the background for this mode.
Activation	This mode must be activated via Ethernet Powerlink in the "Operation mode" field. The parameter "T_0-Trigger“ includes the time stamp reference for the sensor NetTime that is used. Measuring is started with "T_0-Trigger". Once the teach-in process is complete, or a fault has occurred, the mode will be deactivated automatically.
Prerequisite	The following values and parameters must be set before starting: • The key code geometry in µs • T_0-Trigger time stamp • Key code = yes Key code use is activated.
Feedback	The sensor sends the following data to the PLC via the cyclical data traffic: • The precise time stamp (t1) of the first key code edge regarding the trigger time T_0 • Trigger time T_0 first configured via the PLC The sensor sends the following data to the PLC via the acyclical data traffic: • Best detected sending color for the key code • Light remission value for the selected sending color for the key code
Speed	Up to 10 m/s

Table 11: Search/Teach-in key code mode

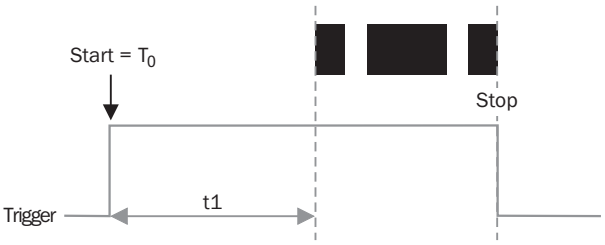


Fig. 23: Explanation of Search/Teach-in key code mode

9.6 Teach-in printing mark mode

The following table describes the "Teach-in printing mark mode":

Description	
Function	In this mode, the sensor detects the light remission values for the three colors and selects the best color for each mark. The best color is the one which has the highest difference in terms of the light remission values between the print mark and the background. Before you launch RUN mode, a successful teach-in process is required for the print marks. If "Teach-in printing mark" mode is used without key codes, the PLC must send the values for "T_0-Trigger". The measuring must be started before the first print mark. After the last configured reading window for print marks, the teach-in process stops automatically. → See the figure below.
Activation	The mode must be activated via Ethernet Powerlink in the "Operation mode" field. To begin measuring, the PLC must calculate the "T_0-Start" time for the first reading window. After the last configured reading window for print marks, the teach-in process stops automatically.
Prerequisite	• The marks must be within the configured reading window. The following parameters must be set before starting: • T_0-Trigger: Start of the reading window • Δbx: Width of the reading window for print marks • Key code = no Key code use is deactivated.
Feedback	The following data is sent from the sensor to the PLC. • Mode changes or faults • Raw data of the light remission values for the selected colors. Timing values are relative to the Ethernet Powerlink NetTime.
Speed	10 m/s

Table 12: Teach-in printing mark mode

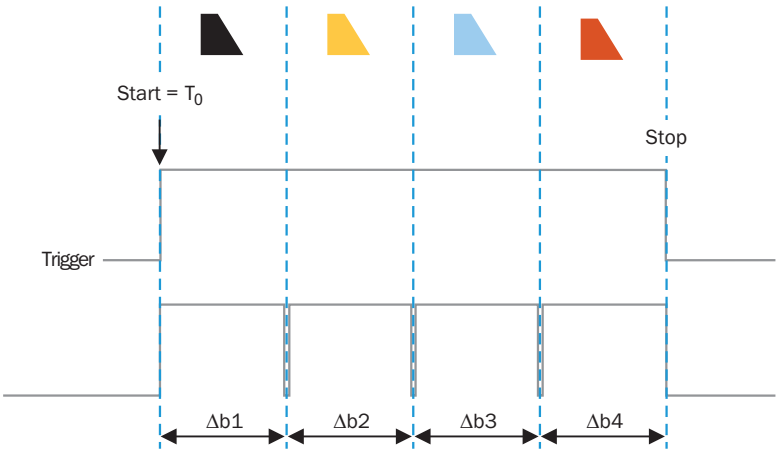


Fig. 24: Explanation of Teach-in printing mark mode

Δbx Reading window width for print marks configured via Ethernet Powerlink

9.7 RUN mode without key code

The following table describes the "RUN mode without key code":

Description	
Function	In this mode, the sensor measures the exact timing of all edges of the print marks and sends the exact time stamps of all detected print marks to the PLC. In this mode, the sensor uses the values and configured colors that were taught in during the teach-in process. Without key codes, the sensor starts measuring automatically as soon as the NetTime corresponds to the "T_0-Start" configuration. The sensor uses the previously defined reading window for print marks and sends the exact timing of the rising and falling edges of the print marks. → See the figure below.
Activation	The mode must be activated this mode via Ethernet Powerlink in the "Operation mode" field. "T_0-Trigger“ includes the time stamp reference for the sensor NetTime that is used. Measuring is started with "T_0-Trigger". This mode must be deactivated again via the "Operation mode" field.
Prerequisite	The following values must be set before starting: • Limit values of sending colors and light remission values of the taught in print marks • The light remission value for the background The following parameters must be set before starting: • Δbx: Width of the reading window for print marks • Key code = no Key code use is deactivated.
Feedback	The following data is sent from the sensor to the PLC. • Mode changes or faults • The exact timing of the rising and falling edges of the print marks as a reference for the "T_0-Trigger" value • The configured "T_0-Trigger" value • Light remission values for each print mark in every reading window
Speed	Speeds of up to 10 m/s are possible in this mode.

Table 13: RUN mode without key code

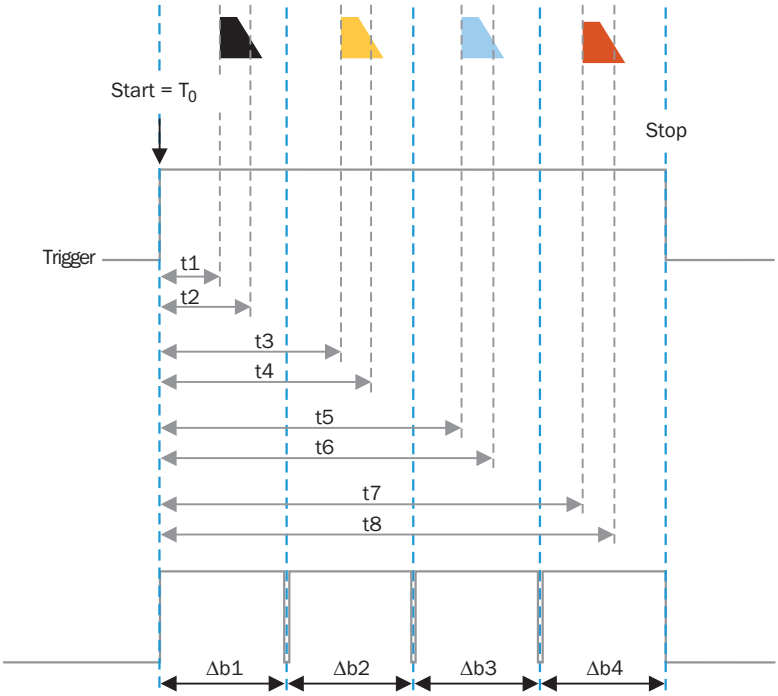


Fig. 25: Explanation of RUN mode without key code

Δbx Readings window width for print marks in µs

9.8 RUN mode with key code

The following table describes the "RUN mode with key code":

Description	
Function	In this mode, the sensor measures the exact timing of all edges of the print marks and sends the exact time stamps of all detected print marks to the PLC. In this mode, the sensor uses the values and configured colors that were taught in during the teach-in process. If a key code is used, "T_0-Trigger" parameter is not required. The sensor detects the key code and automatically sets "T_0-Trigger" parameter at the beginning of the detected key code as a time stamp of the Ethernet Powerlink NetTime. All timings are based on this "T_0-Trigger" time stamp. → See the figure below.
Activation	You can activate this mode via Ethernet Powerlink in the "Operation mode" field. "T_0-Trigger" from the PLC is ignored in this mode. This mode must be deactivated again via the "Operation mode" field.
Prerequisite	The following values must be set before starting: • Limit values of sending colors and light remission values of the taught in print marks • Light remission value for the background • Key code The following parameters must be set before starting: • Δax: The time between the first key code edge and the start of the first reading window for print marks • Δbx: Reading window width for print marks • Key code = yes Key code use is activated.
Feedback	The following data is sent from the sensor to the PLC. • Mode changes or faults • The exact timing of the rising and falling edges of the print marks as a reference for the "T_0-Trigger" value • The detected "T_0-Trigger" value • Light remission values for each print mark in every reading window
Speed	Speeds of up to 10 m/s are possible in this mode.

Table 14: RUN mode with key code

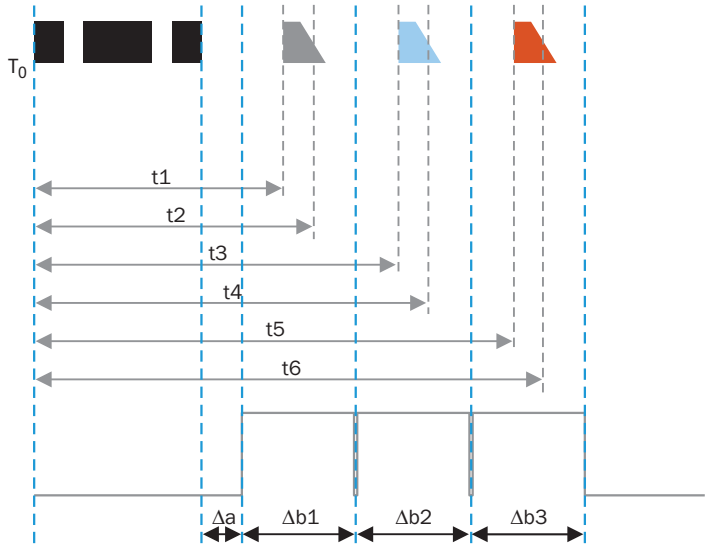


Fig. 26: Explanation of RUN mode with key code

T_0 Trigger T_0 evaluated by the sensor

Δax Time between key code and the first reading window

Δbx Reading window width for print marks, configured via Ethernet Powerlink

10 Operation using Ethernet Powerlink

10.1 Ethernet Powerlink interface

The figure below shows a typical example of an Ethernet Powerlink network.

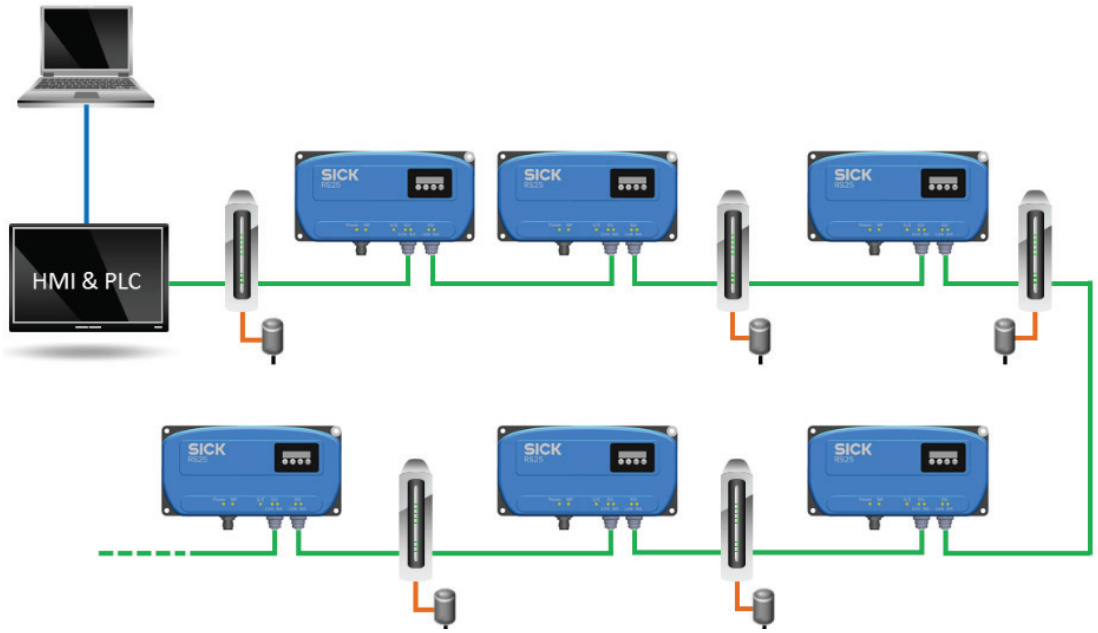


Fig. 27: Example of an Ethernet Powerlink network

10.2 Cyclical and acyclical data exchange

Cyclical data exchange is controlled via a PLC and is subject to strict time constraints. A fixed time window is assigned to every participant (node) for the responses to requests from the PLC. To keep cycle times low, the PLC determines whether it sends a request to the sensor on every cycle or only on every second or third cycle. The asynchronous phase begins once the cyclical phase is complete. In this phase, the participants (nodes) can send asynchronous data.

During cyclical data exchange, critical information, requests, and commands are transferred, such as:

- Time-critical data from the PLC to the register sensor
- Time-critical data from the register sensor to the PLC, such as "key codes" and "print marks"

During acyclical data exchange, non-critical information, requests, and commands are transferred:

- Configuration data from PLC > register sensor and register sensor > PLC
- Diagnostic data from PLC > register sensor and register sensor > PLC

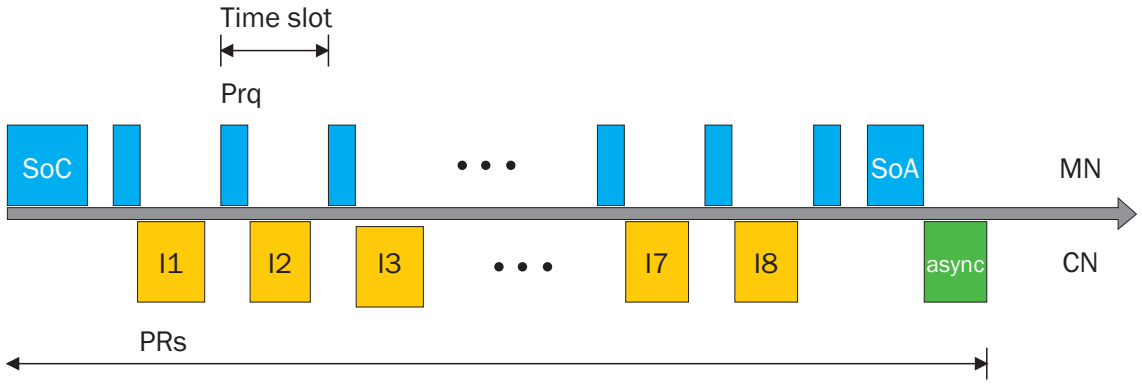


Fig. 28: Cyclical and acyclical data exchange, EPL communication (Ethernet Powerlink)

async Acyclical data

CN Controlled nodes (network participants)

Ix I1 to I8, network participants

MN Managing node (participant that controls the data transfer)

PRq Poll request

PRs Poll response

SoC Start of cycle (start of the cyclical data cycle)

SoA Start of asynchronous (start of the acyclical data cycle)

TS Time slot (time window for responses)

10.3 NetTime

The Ethernet Powerlink NetTime is a remote clock that is supplied by the PLC. The NetTime is responsible for the synchronization of the entire EPL network. The NetTime guarantees that, in order to control the printing machine, all the time stamps to and from the sensor are consistent with the other sensors or the data from the encoder for synchronization purposes.

10.4 Speed

Ethernet cables are used for the Ethernet Powerlink network. 10 Mbit or 1 Gbit networks are possible. Under ideal conditions, it is possible to configure a cycle time of 400 µs and jitter (accuracy fluctuation) of less than or equal to 1 µs. The standard cycle time is 1.2 ms.

10.5 Mapping (Object dictionary)

The data from the Ethernet Powerlink interface is mapped to objects. Each object has several sub-indexes. The first sub-index manages the numbers of the available sub-indexes. The other sub-indexes contain the data with the read, write, and read/write access for the PLC of the Ethernet Powerlink network. The data sizes (in bytes) of the sub-indexes are different.

11 Cleaning and maintenance

11.1 Cleaning

ATTENTION

Equipment damage due to improper cleaning.

Improper cleaning can result in equipment damage.

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.

11.2 Maintenance

The register sensor requires the following maintenance work at regular intervals:

Interval	Maintenance work	To be performed by
Cleaning interval depends on ambient conditions and climate	Clean the housing, particularly the front window.	Specialist
Every 6 months	Check the screw connections and plug connections.	Specialist

Table 15: Maintenance schedule

12 Troubleshooting

Potential malfunctions and rectification measures are described in the table below and in the next chapter.

In case of malfunctions that cannot be rectified using the information below, please contact the manufacturer. Please refer to the back page of these operating instructions for your agent's contact details.

Faults may occur during the teach-in process or as a result of other events, such as a short-circuit. In the case of a fault, the teach-in process will be interrupted. If valid teach-in data is already available, this will be used.

Faults are displayed with "F" and a number.

12.1 Error codes

Any faults in the actions and modes are generally encoded in the corresponding return values. If encoding is not possible (because the action has not yet been completed, for example) the following error codes are available and are transferred:

Error code on the display	Possible causes
F001	Error code in the case of a command that is not defined or is only defined as read-only.
F004	Error code the command index 3120hex and sub-index 07hex with the parameter 01hex (set the configured form) apply, and one of the 5 key code lengths (index 3120hex, sub-index 01hex to 05hex) is not greater than the permissible tolerance (index 3120hex, sub-index 06hex).

12.1.1 Faults caused by mounting or teaching-in

Check the individual items according to the following table.

Cause/Item to be checked	Inspection	Troubleshooting
Material is highly glossy.	Check distance and angle of the optical sensor head.	Tilt optical sensor head more or less. If necessary, do not use the specified distance and angle. → See Page 22, Chapter 6.2.
The optical sensor head is not installed at the correct distance. The optical sensor head does not detect the printed area correctly. For example, the mark is not detected or the contrast is too low.	Check focus and contour of light spot.	Correct distance or angle of optical sensor head. → See Page 22, Chapter 6.2.
The system's EMC radiated emission is too high.	The system's EMC radiated emission is too high; e.g., frequency converter.	• Check wiring. • Always use screened and twisted cables for the sensor.

Table 16: Faults caused by mounting or teaching-in

12.2 Returns

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

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

12.3 Disposal

Please observe the following when disposing of the removal sensor:

- Do not dispose of the device along with household waste.
- Dispose of the device according to the applicable regulations in your country.

13 Repairs

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

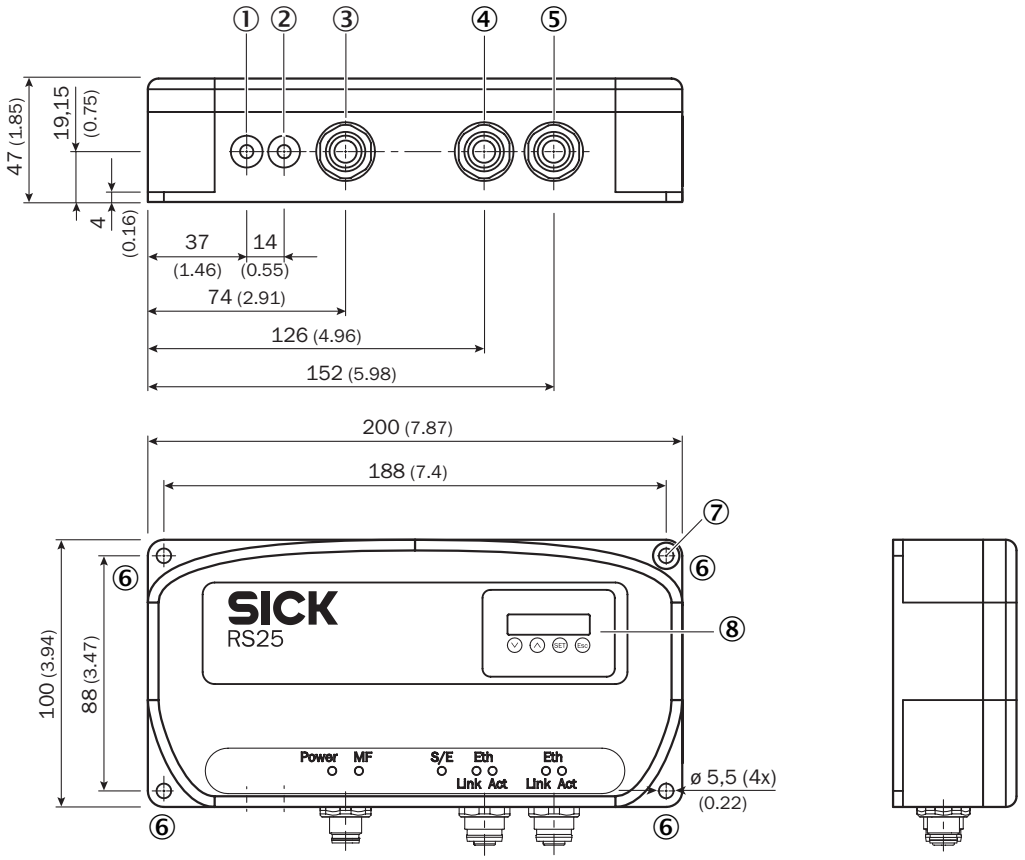
14 Technical data

NOTE

You can download, save, and print the relevant online data sheet, including technical data, dimensions, and connection diagrams from "www.mysick.com/en/RS25".

14.1 Dimensions

14.1.1 Evaluation unit

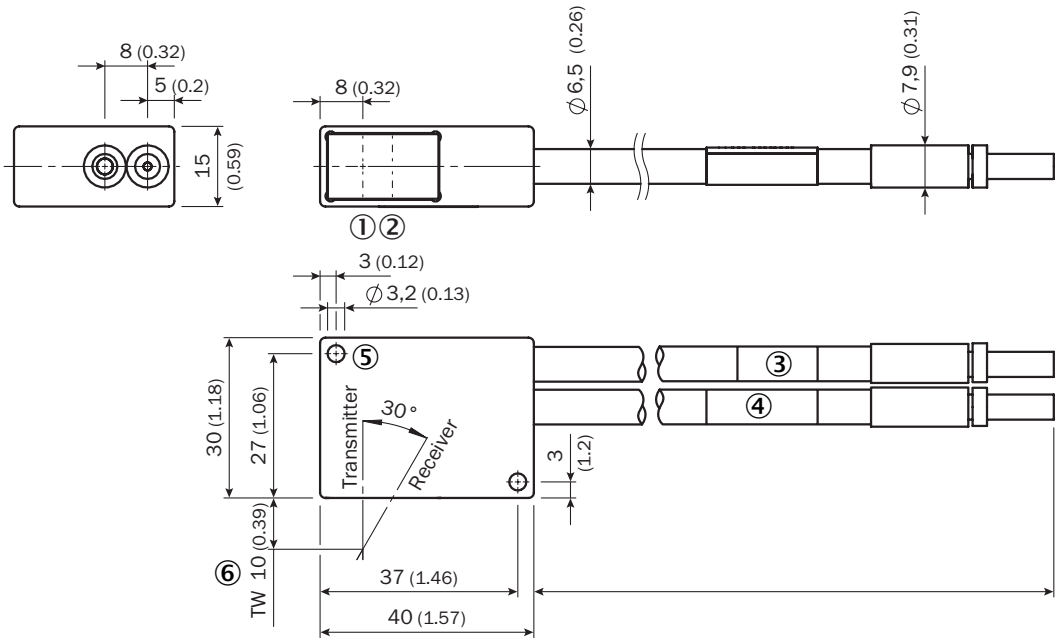


All dimensions in mm (inch)

Fig. 29: Dimensions of the evaluation unit for the RS25 register sensor

1 *Connection optical sensor head receiver*
2 *Connection optical sensor head transmitter*
3 *Connection supply voltage*
4 *Connection Ethernet Powerlink*
5 *Connection Ethernet Powerlink*
6 *Fixing hole*
7 *Surface anodized free*
8 *Display and operating unit*
9 *LED function indicator (green) "Eth, Link and Act"*
10 *LED function indicator (green) "Eth, Link and Act"*
11 *LED function indicator (green/red) "S/E"*
12 *LED function indicator (yellow) "MF"*
13 *LED function indicator (green) "Power"*

14.1.2 Optical sensor head



All dimensions in mm (inch)

Fig. 30: Dimensions of the optical sensor head for the RS25 register sensor

1 *Optical axis transmitter*
2 *Optical axis receiver*
3 *Fiber-optic cable transmitter*
4 *Fiber-optic cable receiver*
5 *Fixing hole*
6 *Sensing range (TW) in mm*

14.2 Optics/Performance

Light source [1]	• LED, red, green, blue • White light (R + G + B: all LEDs)
Wavelength	400 nm to 700 nm
Light spot size	Optical sensor head: 1.1 mm x 2.0 mm
Sensing range	10 mm
Sensing range tolerance	± 1 mm
Max. number of marks per register	20
Start code	Configurable
Precision	≤ 40 µm

1) Average service life 100,000 h at T_U = +25 °C.

Table 17: Optics/Performance

14.3 Power supply

Supply voltage V_S [1]	24 V DC ± 20 %
Power consumption (without load)	< 250 mA
Residual ripple	< 5 V_{ss} within the acceptable supply voltage V_S (must not undercut or exceed U_V tolerances)

1) Limit values: Max. 8 A for operation in a short-circuit protected network.

Table 18: Power supply

14.4 Ambient conditions

ATEX (Ex approval)	RS25-WL334000 only • Evaluation unit: ATEX Ex II (2)G [Ex op is Gb] IIB • Optical sensor head: ATEX Ex II 2G Ex op is IIB T4 Gb
Protection class [1]	III
Electromagnetic compatibility	EN 61000-6-4
Ambient temperature range	• Operation: –10 °C to +55 °C • Storage: –20 °C to +70 °C
Ambient light safety	30,000 lx
Enclosure rating	IP 65
Noise	EN60068-2-64
Shock resistance	EN 60086-2-27

1) Reference voltage 50 V DC

Table 19: Ambient conditions

14.5 Structural design

Dimensions	→ See Page 49, Chapter 14.1.
Weight	• Evaluation unit: 1,000 g • Optical sensor head: 450 g inc. fiber-optic cable
Materials	• Evaluation unit: Aluminum • Sensor head: Aluminum alloy, sandblasted • Front screen: Glass
Connections [1]	• 1 x M12 plug, 5-pin: Supply voltage connection • 2 x M12 sockets, 4-pin: Ethernet connection
Optical sensor head connection cable	• 1 x fiber-optic cable sender, 1 x fiber-optic cable receiver • Length: 3,200 mm • Diameter: 8 mm • Minimum bend radius: 80 mm (dynamic), 40 mm (static) • Outer shell: Acid-resistant
Display	6 points with a 5 x 7 point matrix

1) Use twisted and screened cables.

Table 20: Structural design

15 Accessories

15.1 Connectors

15.1.1 Supply voltage

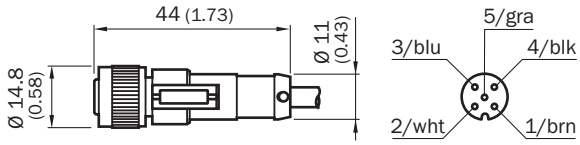


Fig. 31: Cable socket, M12, 5-pin, straight, with cable, shielded

Description	Type	Part number
Cable socket, M12, 5-pin, straight, 5 m, PVC	DOL-1205-G05MAC	6036384
Cable socket, M12, 5-pin, straight, 10 m, PVC	DOL-1205-G10MAC	6036385
Cable socket, M12, 5-pin, straight, 20 m, PVC	DOL-1205-G20MAC	6036386

15.1.2 Ethernet cables, RS25 and RJ45

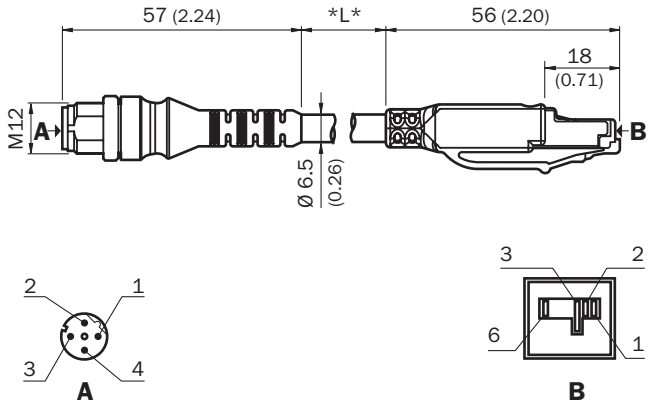


Fig. 32: Ethernet cable M12, 4-pin, shielded

Description	Type	Part number
Ethernet cable, M12, 4-pin, shielded (D-coded) on RJ45 plug, 8-pin, 2 m	SSL-2J04-G02ME	6034414
Ethernet cable, M12, 4-pin, shielded (D-coded) to RJ45 plug, 8-pin, 5 m	SSL-2J04-G05ME	6035389
Ethernet cable, M12, 4-pin, shielded (D-coded) on RJ45 plug, 8-pin, 10 m	SSL-2J04-G10ME	6030928
Ethernet cable, M12, 4-pin, shielded (D-coded) on RJ45 plug, 8-pin, 20 m	SSL-2J04-G20ME	6036158
Ethernet cable, M12, 4-pin, shielded (D-coded) on RJ45 plug, 8-pin, 25 m	SSL-2J04-G25ME	6033555

15.1.3 Ethernet cables, RS25 to RS25

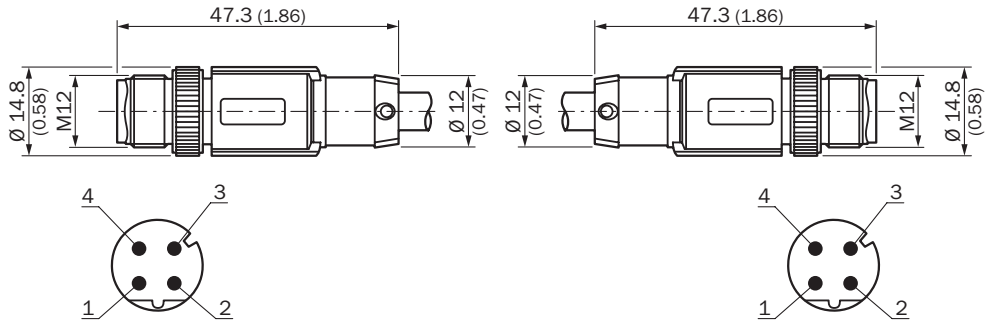


Fig. 33: Ethernet cable M14, 4-pin, shielded

Description	Type	Part number
Ethernet cable, M12, 4-pin, straight, on M12 plug, 4-pin, straight, 2 m	SSL-1204-G02ME90	6045222
Ethernet cable, M12, 4-pin, straight, on M12 plug, 4-pin, straight, 5 m	SSL-1204-G05ME90	6045277
Ethernet cable, M12, 4-pin, straight, on M12 plug, 4-pin, straight, 10 m	SSL-1204-G10ME90	6045279

Index

Index

8015887/2013-03-26 · (2013-03) · A4 4c int39

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