SICK.COM

OPERATING INSTRUCTIONS

Dx35

Distance sensor

SICK Sensor Intelligence

Described product

Dx35

Manufacturer

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

Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Information on the operating instructions

Read these operating instructions carefully before starting any work in order to familiarize yourself with the product and its functions.

The operating instructions are an integral part of the product and should remain accessible to the personnel at all times. When handing this product over to a third party, include these operating instructions.

These operating instructions do not provide information on the handling and safe operation of the machine or system in which the product is integrated. Information on this can be found in the operating instructions for the machine or system.

1.2 Further information

You can find the product page with further information via the SICK Product ID:
pid.sick.com/{P/N}/{S/N}
(see "Product identification via the SICK product ID", page 13).

The following information is available depending on the product:

- This document in all available language versions
- Data sheets
- Other publications
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Software
- Accessories

1.3 Symbols and document conventions

Warnings and other notes

DANGER
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

WARNING
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

CAUTION
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

NOTICE
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

NOTE
Highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

Instructions to action

→ The arrow denotes instructions to action.

1. The sequence of instructions is numbered.
2. Follow the order in which the numbered instructions are given.

✔ The tick denotes the results of an action.

2 Safety information

2.1 General safety notes

Please observe the safety notes and the warnings listed here and in other sections of this product documentation to reduce the possibility of risks to health and avoid dangerous situations.

CAUTION
Failure to observe the relevant work safety regulations may lead to physical injury or cause damage to the system.

WARNING
Electrical voltage!

Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- The power supply must be disconnected when attaching and detaching electrical connections.
- The product must only be connected to a voltage supply as set out in the requirements in the operating instructions.
- National and regional regulations must be complied with.
- Safety requirements relating to work on electrical systems must be complied with.

WARNING
Risk of injury and damage caused by potential equalization currents!

Improper grounding can lead to dangerous equipotential bonding currents, which may in turn lead to dangerous voltages on metallic surfaces, such as the housing. Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- Follow the notes in the operating instructions.
- Install the grounding for the product and the system in accordance with national and regional regulations.

Laser notes

CAUTION
Optical radiation: Class 1 Laser Product

The accessible radiation does not pose a danger to the eyes or skin when viewed directly for up to 100 seconds.

Caution - if any operating or calibrating equipment other than those specified here are used or other methods are employed, this can lead to dangerous exposure to radiation.

→ Use only the tools and auxiliary equipment specified in this documentation.
→ Only carry out the procedures specified in this documentation.
→ Never look directly at the laser beam using optical instruments. Optical instruments include magnifying glasses, microscopes, telescopes and binoculars.
→ Do not open the housing unless carrying out the mounting and maintenance operations provided in this documentation. Opening the housing will not switch off the laser. Opening the housing may increase the level of risk.

CAUTION

Optical radiation: Class 2 Laser Product

The human eye is not at risk when briefly exposed to the radiation for up to 0.25 seconds. Exposure to the laser beam for longer periods of time may cause damage to the retina. The laser radiation is harmless to human skin.

Caution - if any operating or calibrating equipment other than those specified here are used or other methods are employed, this can lead to dangerous exposure to radiation.

- → Use only the tools and auxiliary equipment specified in this documentation.
- → Only carry out the procedures specified in this documentation.
- → Never look directly at the laser beam using optical instruments. Optical instruments include magnifying glasses, microscopes, telescopes and binoculars.
- → Do not look into the laser beam intentionally.
- → Never point the laser beam at people's eyes.
- → If it is not possible to avoid looking directly into the laser beam, e.g., during commissioning and maintenance work, suitable eye protection must be worn, see technical data.
- → Avoid laser beam reflections caused by reflective surfaces. Be particularly careful during mounting and alignment work.
- → Do not open the housing unless carrying out the mounting and maintenance operations provided in this documentation. Opening the housing will not switch off the laser. Opening the housing may increase the level of risk.

It is not possible to entirely rule out temporary disorienting optical effects, particularly in conditions of dim lighting. Disorienting optical effects may come in the form of dazzle, flash blindness, afterimages, photosensitive epilepsy, or impairment of color vision, for example.

Repairs and modifications

NOTICE

Improper work on the product

A modified product may not provide the expected functionality.

- → Apart from the procedures described in this document, do not repair, open, manipulate or otherwise modify the product.

2.2 Intended use

The Dx35 distance sensor is an opto-electronic measuring device and is used for optical, non-contact distance measurement of objects.

The distance sensor is used for the detection of distances between the distance sensor and a measuring object. The measuring object can be a natural object (DS35 / DT35 product variant) or a suitable (retro-reflective) reflector (DL35 / DR35 product variant). The required optical properties of the measuring object are specified in the technical data section of this document.

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 not described in this documentation.

2.3 Improper use

Impermissible use

- As a physical guard. The product works as an indirect protective measure and cannot provide protection from parts thrown from the application nor from emitted radiation.
- As a safety component as defined in the relevant applicable safety standards for machines, e.g. Machinery Directive.
- Detection of persons and animals
- Detection of transparent items

Impermissible ambient conditions

- Outdoor areas
- Direct UV radiation (sunlight)
- Precipitation
- Inadequate protection against moisture and contamination
- Publicly accessible areas
- Explosion-hazardous area
- Corrosive environment

2.4 Cybersecurity

Overview

To protect against cybersecurity threats, the operator must have a comprehensive cybersecurity concept, which must be continuously monitored and maintained. A suitable concept consists of organizational, technical, procedural, electronic, and physical levels of defense and considers suitable measures for different types of risks. The measures implemented in this product can only support protection against cybersecurity threats if the product is used as part of such a concept.

You will find further information at www.sick.com/psirt, e.g.:

- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (security advisories)

2.5 Limitation of liability

Relevant standards and regulations, the latest technological developments, and our many years of knowledge and experience have all been taken into account when compiling the information and notes contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Non-compliance with product documentation (e.g. operating instructions)
- Improper use
- Use of untrained staff.
- Unauthorized conversions or repair
- Technical modifications
- Use of unauthorized spare parts, wear and tear parts, and accessories

2.6 Modifications and conversions

NOTICE
Modifications and conversions to the device may result in unforeseeable dangers.

Interrupting or modifying the device or SICK software will invalidate any warranty claims against SICK AG. This applies in particular to opening the housing, even as part of mounting and electrical installation.

2.7 Qualification of personnel

Any work on the product may only be carried out by personnel qualified and authorized to do so.

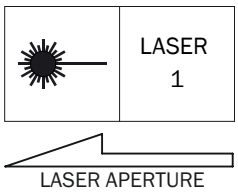
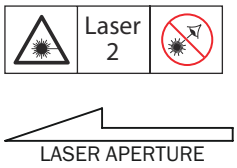
Qualified personnel are able to perform tasks assigned to them and can independently recognize and avoid any potential hazards. This requires, for example:

- technical training
- experience
- knowledge of the applicable regulations and standards

2.8 Notes on the product

Warnings on the product

Table 1: Warnings on the product

Symbol	Meaning
	Danger from laser radiation Optical radiation: Class 1 Laser Product EN 60825-1:2014+A11:2021 IEC 60825-1:2014 Complies with 21 CFR 1040.10 and 1040.11, except for compliance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56 dated May 8, 2019. Further laser protection regulations that need to be observed may apply (e.g. national laws). Laser output aperture, see figure 19, page 51
	Danger from laser radiation Optical radiation: Class 2 Laser Product EN 60825-1:2014+A11:2021 IEC 60825-1:2014 Complies with 21 CFR 1040.10 and 1040.11, except for compliance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56 dated May 8, 2019. Further laser protection regulations that need to be observed may apply (e.g. national laws). Laser output aperture, see figure 19, page 51

2.9 UL conformity

For additional information visit:

→ **www.sick.com/Dx35**

CAUTION
Using control elements or settings or executing procedures other than those specified in this document may result in dangerous exposure to radiation.

3 Product description

3.1 Product identification via the SICK product ID

SICK product ID

The SICK product ID uniquely identifies the product. It also serves as the address of the web page with information on the product.

The SICK product ID comprises the host name pid.sick.com, the part number (P/N), and the serial number (S/N), each separated by a forward slash.

For many products, the SICK product ID is displayed as text and QR code on the type label and/or on the packaging.

Figure 1: SICK product ID

3.2 Scope of delivery

Table 2: Scope of delivery

No. of units	Component	Note
1	Device in the version ordered	Depending on version
1	Printed safety notes, multilingual	Brief information and general safety notes

The actual scope of delivery may differ for special designs, additional orders or due to the latest technical changes.

3.3 Product identification

Type code

The type code provides information about the properties of the device type:

Table 3: Structure of type designation

D	T	3	5	-	B	1	5	5	5	1	X
1	2	3	4		5	6	7	8	9	10	11

Table 4: Type code

Position	Description
1 ... 4	**Sub product family** DS35: Distance sensor, switching on natural objects DT35: Distance sensor, measurement on natural objects DL35: Distance sensor, measurement on reflective tape DR35: Distance sensor, switching on reflective tape
5	**Switching output** B: B-type or push-pull output
6	**Speed, sensing range** 1: Adjustable
7	**Connection type** 5: M12 plug, 5-pin
8	**Light sender, laser class** 2: Red light, laser class 2 5: Red light, laser class 1 8: Infrared light, laser class 1

Position	Description
9	**Interface** 2: Digital outputs (Q1 and Q2) and IO-Link 5: Analog current or voltage output (Qa), digital output (Q1) and IO-Link
10	**Measurement** 1: Optimized for natural objects 2: Optimized for reflective tape
11	**Other** X: Additional characters possible

3.4 Display and control elements

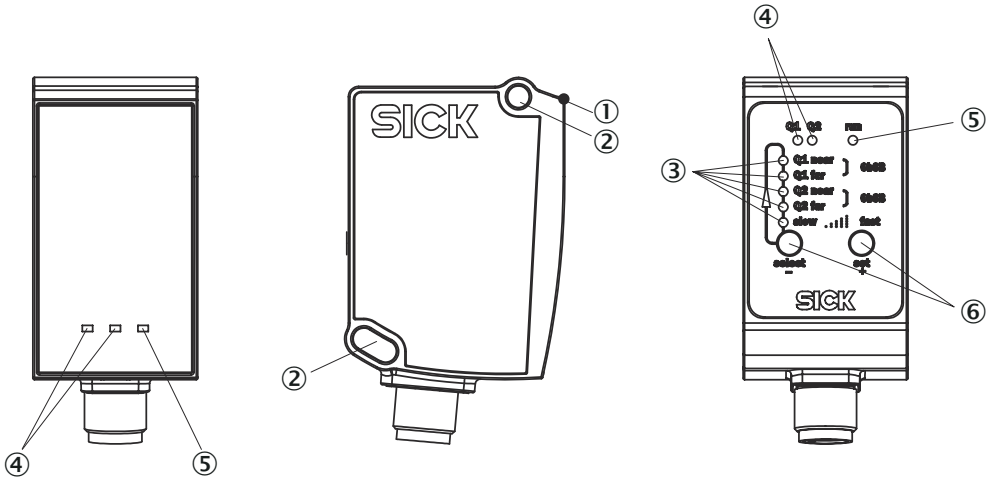


Figure 2: Device layout

① Reference surface (corresponds to distance 0 mm)
② M4 fixing hole
③ Teach-in LEDs
④ Status Q1 / Q2 LEDs
⑤ LED for operating status
⑥ Operating buttons

Description of LED displays

LED	Status (color)	Description
Q1	● (Orange)	Digital output active
	○ (Orange)	Digital output not active
Q2	● (Orange)	Digital output active (Q2) or measured value within analog output scaling (Qa)
	○ (Orange)	Digital output not active (Q2) or measured value outside analog output scaling (Qa)
Q1 and Q2 in run mode	☀	LEDs flash alternately for longer than 10 seconds: There is an error. Check supply voltage, temperature range, EMC disturbances, etc.
Q1 and Q2 in teach mode	☀	LEDs flash simultaneously: teach is being performed. LEDs flash alternately for 5 seconds: teach failed.
Q1 and Q2 in alignment mode	☀	Display of the alignment quality (IR variants only): Slow flashing (approx. 1 Hz) = poor alignment quality, fast flashing (approx. 15 Hz) = good alignment quality

LED	Status (color)	Description
Run	● (Front: Orange) ● (Rear: Green)	Supply voltage is on
	○ (Orange)	No supply voltage
Q1 near, Q1 far, Q2 near, Q2 far, in teach mode		Perform one-point or window teach. One of the LEDs lights up: Teach can be performed. One of the LEDs flashes: Fine teach can be performed.
Q1 near + Q1 far (ObSB) in teach mode		Teach in ObSB or background for switching output Q1: Both LEDs light up: Teach can be performed. Both LEDs flash: Fine teach can be performed.
Q2 near + Q2 far (ObSB) in teach mode		Teach in ObSB or background for switching output Q2: Both LEDs light up: Teach can be performed. Both LEDs flash: Fine teach can be performed.
slow ... fast in teach mode		Set speed. "Slow ... fast" LED flashes cyclically: 1 x: Super-slow 2 x: Slow 3 x: Medium 4 x: Fast 5 x: Super-fast LED “slow ... fast” lights up continuously: Expert or expert setting, adjustable only via IO-Link
Q1 near, Q1 far, Q2 near, Q2 far, slow ... fast in alignment mode		Display of the alignment quality (IR variants only): The greater the number of LEDs that light up, the better the alignment quality.
Q1 near, Q1 far, Q2 near, Q2 far, slow ... fast in expert mode		“Q1 near” LED lights up and “slow ... fast” LED flashes cyclically: Select function for multifunctional input “MF”. 1 x: Teach 2 x: Laser off 3 x: Inactive “Q1 far” LED lights up and “slow ... fast” LED flashes cyclically: Select level for multifunctional input “MF”. 1 x: low active 2 x: high active DT35 and DL35 variants only “Q2 near” LED lights up and “slow ... fast” LED flashes cyclically: Select Q2 output function. 1 x: 4...20 mA 2 x: 0...10 V 3 x: Switching

● = Lights up; ☼ = Flashes; ○ = Does not light up.

Operating buttons

Pushbutton	Description
select (–)	In run mode Press **select** pushbutton longer than 5 seconds: Enter or leave teach mode. In teach mode Press **select** : Select function. In fine teach mode Move previously taught-in switching point by –10 mm.
set (+)	In run mode (IR variants only) Press **set** pushbutton longer than 5 seconds: Enter or leave alignment mode. In teach mode Press **set** pushbutton: Perform teach, select function. In fine teach mode Move previously taught-in switching point by +10 mm.

Pushbutton	Description
select + **set**	In run mode Press **select** and **set** simultaneously for longer than 10 seconds: Enter or leave expert mode. In teach mode, after previously performing teach, press **select** and **set** push-buttons simultaneously for less than 1 second: Enter or leave fine teach.

3.5 Functions

If Q1 and Q2 are used as switching outputs, the following operation modes are available: Distance to Object (DtO), Window (Wnd), and Object between Sensor and Background (ObSB). The measured distance value can be transferred cyclically over IO-Link.

For the DT35 and DL35 models, the Q2 output can be configured as a current output (4 ... 20 mA), voltage output (0 ... 10 V), or switching output.

4 Transport and storage

4.1 Transport

NOTICE
Damage due to improper transport!

- The product must be packaged with protection against shock and damp.
- Recommendation: Use the original packaging.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

4.2 Transport inspection

Immediately upon receipt in incoming goods, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

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

NOTE
Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.3 Storage

- Do not store outdoors.
- Store in a place protected from moisture and dust.
- Recommendation: Use the original packaging.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 51.
- Relative humidity see "Technical data", page 51.
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

5.1 Mounting instructions

- Observe the technical data.
- Protect the sensor from direct sunlight.
- To prevent condensation, avoid exposing the device to rapid changes in temperature.
- The mounting site has to be designed for the weight of the device.

5.2 Mounting the device

1. Mount the distance sensor using the fixing holes provided, "Dimensions", page 51.
   Note the permissible tightening torques of the screws:
   - When using the mounting accessories or equivalent construction: max. 1.2 Nm.
   - When using screws with a polyamide spot coating (according to ISO 8992): max. 2.0 Nm.
   - For any other type of connection between the device and screws: max. 1.0 Nm.
   - The connection between a screw and the housing of the device must be made using a washer (ISO 7092, for size M4) or an equivalent washer.
2. Make the electrical connection. Attach and tighten the tension-free cable, "Connecting the device electrically", page 22.
3. Switch on the supply voltage.

✔ The green operating LED lights up.

4. Align the light spot so that the desired object is measured.

5.3 Select and mount the reflector (only for DL35 and DR35)

NOTE
You can find suitable reflectors and suitable reflective tape at **www.sick.com/Dx35**.

→ To avoid direct surface reflections, mount the reflector with a tilt of approx. +1° ... +3° in one of the 2 axes (horizontal or vertical).

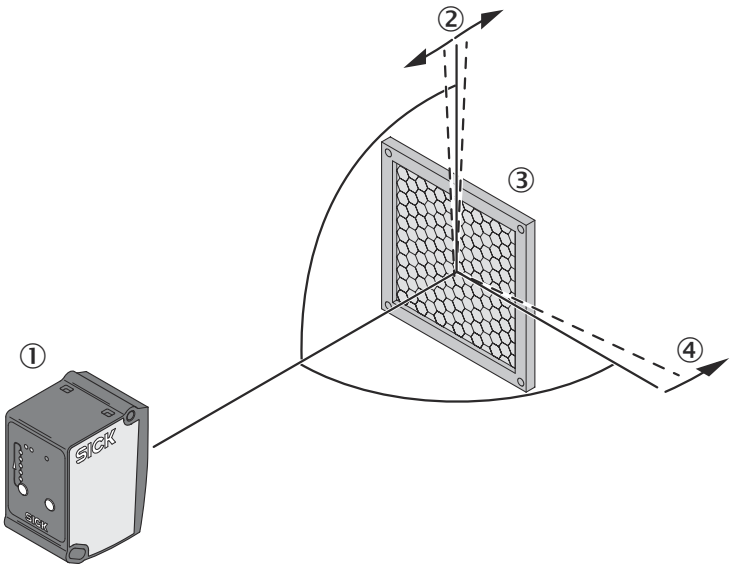


Figure 3: Reflector tilt

① Distance sensor

② Tilt of the vertical axis of the reflector approx. +1°...+3°

③ Reflector

④ Tilt of the horizontal axis of the reflector approx. +1°...+3°

Avoid shiny surfaces in the measurement area since these cause beam deflections and therefore faulty measurements due to false echoes.

5.4 Alignment aid (Dx35-xxx8xx)

The infrared models DS35-B15821, DT35-B15851, DL35-B15852, and DR35-B15822 have an alignment aid.

You can determine the exact position of the light spot with the aid of reflective tape. The typical light beam diameter of the device must be taken into account here.

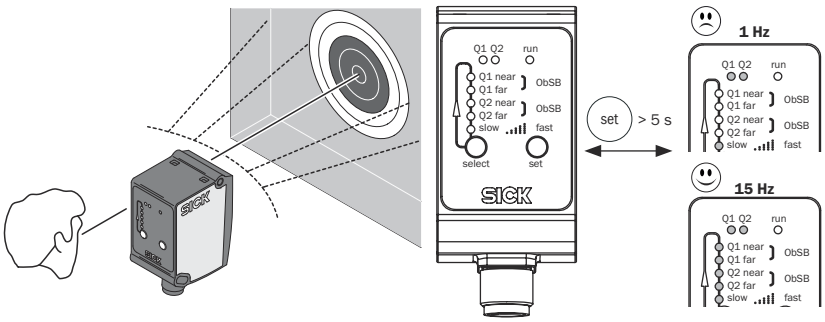


Figure 4: Alignment aid for infrared light variants (Dx35-xxx8xx)

1. Attach small reflective tape to the object to be detected.

NOTE
For a simpler alignment, you can also first use a reflective strip in the horizontal direction and then in the vertical direction.

2. Activate alignment mode of the device. To do this, in run mode, press the **set** pushbutton for longer than 5 seconds.

3. Perform coarse alignment. To do this, align the distance sensor roughly in the direction of the reflective tape.
4. Perform fine adjustment. Align the distance sensor such that the highest possible alignment quality is indicated.

✔ The alignment quality is indicated as follows:

- Using the vertically arranged LEDs Q1 near to slow ... fast: The greater the number of that LEDs light up, the higher the alignment quality.
- Using the LEDs Q1 and Q2: The faster both LEDs flash, the higher the alignment quality. Slow flashing at approx. 1 Hz corresponds to poor alignment quality (no reflective tape). Rapid flashing at approx. 15 Hz corresponds to high alignment quality (highest reflective level).

5. Activate alignment mode of the device. To do this, press the **set** pushbutton longer than 5 seconds or wait 5 minutes without pressing any pushbuttons.
6. Remove small reflective tape from the object to be detected.
7. For DL35 and DR35 device variants, attach large reflective tape for performing the measurement.

6 Electrical installation

6.1 Prerequisites for safe operation of the device

WARNING
Risk of injury and damage caused by electrical current!

As a result of equipotential bonding currents between the device and other grounded devices in the system, faulty grounding of the device can give rise to the following dangers and faults:

- Dangerous voltages are applied to the metal housings.
- Devices will behave incorrectly or be destroyed.
- Cable shielding will be damaged by overheating and cause cable fires.

Remedial measures

- Only skilled electricians should be permitted to carry out work on the electrical system.
- If the cable insulation is damaged, disconnect the voltage supply immediately and have the damage repaired.
- Ensure that the ground potential is the same at all grounding points.
- Where local conditions do not meet the requirements for a safe earthing method, take appropriate measures. For example, ensure low-impedance and current-carrying equipotential bonding.

The device is connected to the peripheral devices (any local trigger sensor(s), system controller) via shielded cables. The cable shield – for the data cable, for example – rests against the metal housing of the device.

If the peripheral devices have metal housings and the cable shields are also in contact with their housings, it is assumed that all devices involved in the installation have the **same ground potential**.

This is achieved by complying with the following conditions:

- Mounting the devices on conductive metal surfaces.
- Correctly grounding the devices and metal surfaces in the system
- If necessary: Low-impedance and current-carrying equipotential bonding between areas with different ground potentials

If these conditions are not fulfilled, equipotential bonding currents can flow along the cable shielding between the devices due to differing ground potentials and cause the hazards specified. This is, for example, possible in cases where there are devices within a widely distributed system covering several buildings.

Remedial measures

The most common solution to prevent equipotential bonding currents on cable shields is to ensure low-impedance and current-carrying equipotential bonding. If this equipotential bonding is not possible, the following solution approaches serve as a suggestion.

NOTICE
We expressly advise against opening up the cable shields. This would mean that the EMC limit values can no longer be complied with and that the safe operation of the device data interfaces can no longer be guaranteed.

Measures for widely distributed system installations

On widely distributed system installations with correspondingly large potential differences, the setting up of local islands and connecting them using commercially available **electro-optical signal isolators** is recommended. This measure achieves a high degree of resistance to electromagnetic interference.

The use of electro-optical signal isolators between the islands isolates the ground loop. Within the islands, a stable equipotential bonding prevents equalizing currents on the cable shields.

Measures for small system installations

For smaller installations with only slight potential differences, insulated mounting of the device and peripheral devices may be an adequate solution.

Even in the event of large differences in the ground potential, ground loops are effectively prevented. As a result, equalizing currents can no longer flow via the cable shields and metal housing.

6.2 Wiring instructions

NOTE

Pre-assembled cables can be found on the product page.

It can be accessed via the **SICK Product ID**: **pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if specified).

NOTICE

Faults during operation and defects in the device or the system

Incorrect wiring may result in operational faults and defects.

- Follow the wiring notes precisely.

The enclosure rating stated in the technical data is achieved only with screwed plug connectors or blind plugs.

Route cables and wires in accordance with EMC requirements to prevent interference from devices such as switching power supplies, motors, clocked drives, and contactors.

6.3 Connecting the device electrically

1. Ensure the voltage supply is not connected.
2. Connect the sensor according to the connection diagram.
3. Connect the supply voltage.

DT35 and DL35 connection diagram

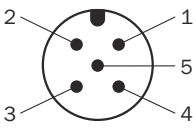


Figure 5: M12 plug, 5-pin, A-coded

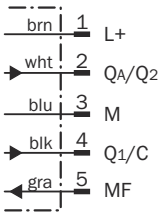


Figure 6: Connection diagram

Table 5: Legend for connection diagram

Contact	Labels	Wire color	Description
1	L+	Brown	Supply voltage
2	Qa/Q2	White	Analog output/digital output 2
3	M	Blue	Supply voltage 0 V
4	Q1 / C	Black	Digital output 1 / IO-Link
5	MF	Gray	Multifunctional input (MF)

DS35 and DR35 connection diagram

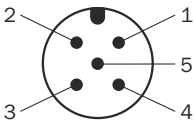


Figure 7: M12 plug, 5-pin, A-coded

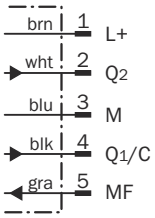


Figure 8: Connection diagram

Table 6: Legend for connection diagram

Contact	Labels	Wire color	Description
1	L+	Brown	Supply voltage
2	Q2	White	Digital output 2
3	M	Blue	Supply voltage 0 V
4	Q1 / C	Black	Digital output 1 / IO-Link
5	MF	Gray	Multifunctional input (MF)

7 Operation

7.1 General notes

If the device is unable to measure, adjust the measuring speed or optimize the alignment.

For a successful teach operation, the device must be able to measure. The distance to the teach-in object must not change during the teach-in operation. The object must be in the measuring range, and the distance values taught in for the distance near to the sensor and the distance far from the sensor must not be exactly the same during a switching window or the analog scaling.

To prevent EMC interference, observe the wiring instructions. If an environment is disrupted by EMC interference, data output via IO-Link is the preferred solution. If the application requires an output of the measured values in such an environment via the analog output, an analog current output should also be preferred to using the voltage output, because this is significantly less susceptible to EMC interference.

NOTE

The switching mode and the settings can be changed by executing a teach function by means of a multifunctional input (see "Expert mode", page 30) or IO-Link (see "Operation via IO-Link", page 33).

NOTE

The LEDs, the process data bits of the outputs in IO-Link and the output visualization in SOPAS display the logical status of the outputs. This does not necessarily correspond to the electrical level of the switching outputs. The electrical level of an output depends on the setting of the corresponding logic, the output circuit (NPN or PNP) and the logical status of the output. The examples in this document refer to a PNP circuit.

7.2 Operation via pushbutton

NOTICE

Pushbutton damage due to improper handling!

Improper handling of the pushbuttons can damage them. This will make operation difficult or impossible. Damage may negatively affect the enclosure rating.

- Operate the pushbuttons only with your fingers or a suitable aid.
- Do not operate the pushbuttons using sharp or hard objects.

7.2.1 Performing teach-in

Teach mode automatically ends if no pushbuttons have been pushed for 5 minutes.

For the DT35 and DL35 distance sensors, for the Q2 output, you can select a current, voltage, or switching output. The desired output must be selected before the teach-in process.

The hysteresis is preset to 25 mm and can be adjusted only via IO-Link.

7.2.1.1 Performing one-point teach (DtO)

Distance to object (DtO) – one-point teach

Set a switching point. If the measured distance value falls below (normally open contact: switching point logic **High-active**) or exceeds (normally closed contact: switching point logic **Low-active**), a signal is output (change of output level).

You can perform a one-point teach for the Q1 and/or Q2 switching output. Factory setting for Q1: DtO 10000 mm.

For normally open contact behavior, teach in the switching point for Q1 near or for Q2 near. For normally closed contact behavior, teach in the switching point for Q1 far or for Q2 far.

Ensure that you perform a Window teach-in if you teach in the switching points for Q1 near and Q1 far or for Q2 near and Q2 far in a teach-in procedure, see "Performing window teach (Wnd)", page 26.

Distances smaller than 50 mm cannot be taught in. The device displays this as an error and automatically sets the switching point to 50 mm.

Q1 near or Q2 near (normally open contact)

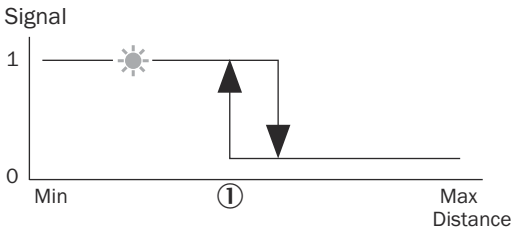


Figure 9: Q1 near or Q2 near (normally open contact) one-point teach

① switching point

Example: One-point teach is to be performed for the Q1 switching output.

1. Position object at teach point 1.
2. Press the **select** pushbutton for longer than 5 seconds.

✔ The LED **Q1 near** lights up.

3. Press the **set** pushbutton.

✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach-in was not successful, the LEDs **Q1** and **Q2** flash alternately.

4. If necessary, perform fine teach.
5. To leave teach-in mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

Q1 far or Q2 far (normally closed contact)

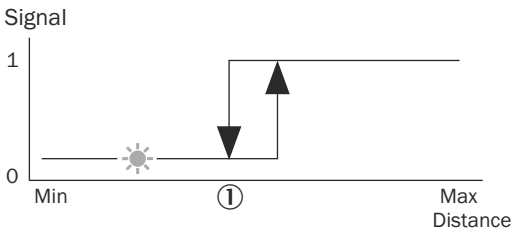


Figure 10: One-point teach, Q1 far or Q2 far (normally closed contact)

① switching point

Example: One-point teach is to be performed for the Q1 switching output.

1. Position object at teach point 1.
2. Press the **select** pushbutton for longer than 5 seconds.

✔ The LED **Q1 near** lights up.

3. Press the **select** pushbutton.

✔ The LED **Q1 far** lights up.
4. Press the **set** pushbutton.
✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.
5. If necessary, perform fine teach.
6. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

7.2.1.2 Performing window teach (Wnd)

Window (Wnd)

Set an upper and a lower switching threshold (two switching points). If the measured distance is inside (normally open contact: High-active switching point logic) or outside (normally closed contact: Low-active switching point logic) the switching window, a signal is output (change of output level).

Distances smaller than 50 mm cannot be taught in. The sensor displays this as an error and automatically sets the switching point to 50 mm.

near < far (normally open contact)

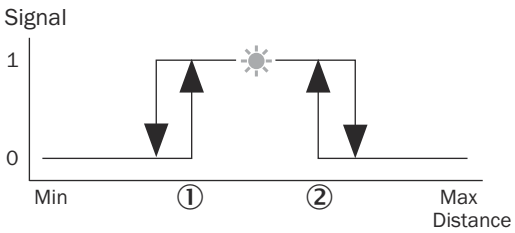


Figure 11: Setting switching points for switching window (normally open contact)

① Switching point 1

② Switching point 2

Example: Window teach is to be performed for the Q1 switching output.

1. Position object at teach point 1.
2. Press the **select** pushbutton for longer than 5 seconds.
✔ The LED **Q1 near** lights up.
3. Press the **set** pushbutton.
✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.
4. If necessary, perform fine teach.
5. Position object at teach point 2.
6. Press the **select** pushbutton.
✔ The LED **Q1 far** lights up.
7. Press the **set** pushbutton.
✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.
8. If necessary, perform fine teach.
9. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

far < near (normally closed contact)

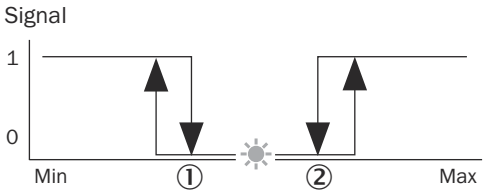


Figure 12: Setting switching points for switching window (inverted behavior)

① Switching point far

② Switching point near

Example: Window teach is to be performed for the Q1 switching output.

1. Position object at teach point 2.
2. Press the **select** pushbutton for longer than 5 seconds.

✔ The LED **Q1 near** lights up.

3. Press the **set** pushbutton.

✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.

4. If necessary, perform fine teach.
5. Position object at teach point 1.
6. Press the **select** pushbutton.

✔ The LED **Q1 far** lights up.

7. Press the **set** pushbutton.

✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.

8. If necessary, perform fine teach.
9. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

7.2.1.3 Teaching in the background (ObSB)

Object between Sensor and Background (ObSB)

Set a background as a reference. If the reference background is not detected (normally open contact: High-active switching point logic) or if the reference background is detected (normally closed contact: Low-active switching point logic), a signal is output. In the ObSB output mode, all objects deviating from the background are detected. Objects that are reflective or black are also detected.

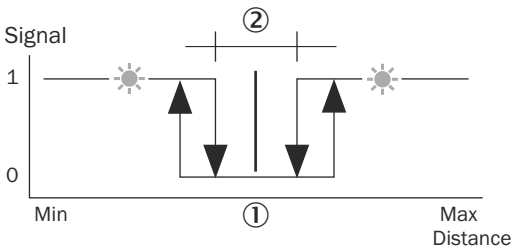


Figure 13: Teaching in object between sensor and background (ObSB) (normally open contact)

① Switching point 1

② Tolerance around switching point: ± 25 mm

Example: ObSB mode is to be set for the Q1 switching output.

1. Align distance sensor on background (teach point 1).
2. Press the **select** pushbutton for longer than 5 seconds.

✔ The LED **Q1 near** lights up.

3. Keep pressing the **select** pushbutton until the LED **Q1 near** and **Q1 far (ObSB)** lights up.
4. Press the **set** pushbutton.

✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.

5. If necessary, perform fine teach.
6. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

7.2.2 Scaling analog output

The analog output function for Q2 is available only in the DT35 and DL35 distance sensors.

If the "near" teach point is taught in at a distance greater than the "far" teach point, the output behavior is inverted.

You can scale the analog output of the sensor within the specified measuring range of the sensor. The measurement must be possible on the object to be taught in at the time of the teach.

Factory setting:

- DT35: 4 mA / 0 V ≙ 50 mm, 20 mA / 10 V ≙ 10,000 mm
- DL35: 4 mA / 0 V ≙ 200 mm, 20 mA / 10 V ≙ 50,000 mm
- The analog output has a resolution of 12 bits.

Set the output behavior for the output Q2 (4 ... 20 mA / 0 ... 10 V / switching output 2) in expert mode.

Minimum distance between the switching points of the distance near the sensor and the distance far from the sensor: 50 mm.

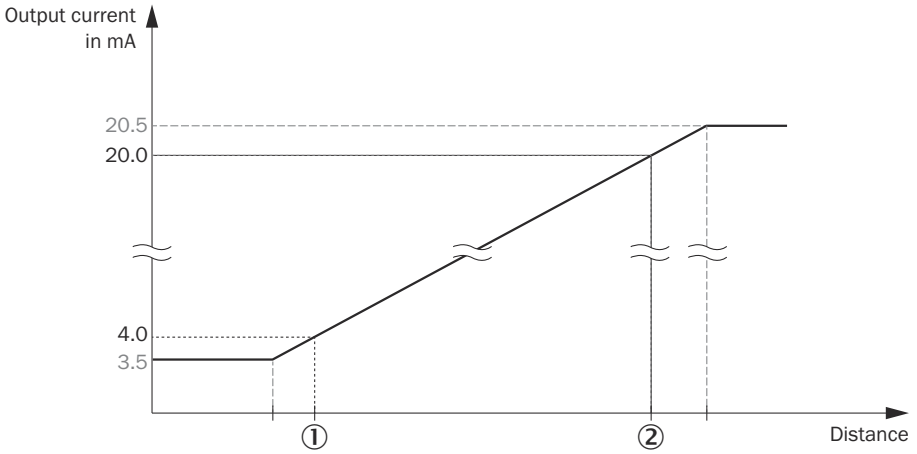


Figure 14: Current output signal, 20 mA distance value is greater than the 4 mA distance value

① Distance value for 4 mA

② Distance value for 20 mA

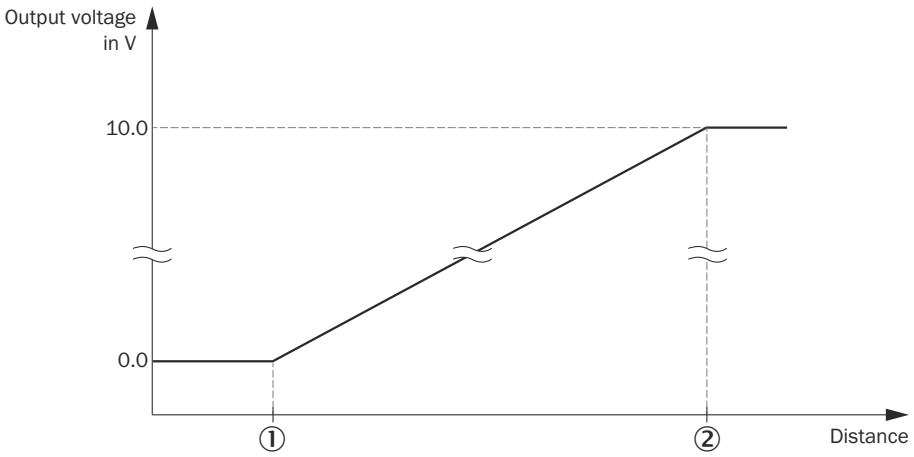


Figure 15: Voltage output signal, distance value 10 V greater than distance value 0 V

① Distance value for 0 V

② Distance value for 10 V

Example: 4 mA is to correspond to a distance near the sensor and 20 mA is to correspond to a distance far from the sensor.

Prerequisite: 4 ... 20 mA has been selected for Q2.

1. Position object at teach point 1.
2. Press the **select** pushbutton for longer than 5 seconds.

✔ The LED **Q1 near** lights up.

3. Keep pressing the **select** pushbutton until the LED **Q2 near** lights up.
4. Press the **set** pushbutton.

✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.

5. If necessary, perform fine teach.
6. Position object at teach point 2.
7. Press the **select** pushbutton.

✔ The LED **Q2 far** lights up.

8. Press the **set** pushbutton.

✔ If the teach was successful, the setting is applied immediately. The LEDs **Q1** and **Q2** flash twice simultaneously. If the teach was not successful, the LEDs **Q1** and **Q2** flash alternately.

9. If necessary, perform fine teach.
10. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

7.2.3 Performing fine teach

Fine teach automatically ends if no pushbuttons have been pushed for 30 seconds.

You can perform a fine teach directly after successfully performing a teach. You can use the fine teach to move the taught-in switching point or analog point.

✔ Teach has been executed.

1. Press the **select** and **set** pushbuttons simultaneously for less than 1 second.

✔ The LED of the teach point to be moved flashes.

2. Perform one of the following steps:

- Every time you press the **set (+)** pushbutton, you move the previously taught-in point by +10 mm.
- Every time you press the **select (–)** pushbutton, you move the previously taught-in point by –10 mm.

3. In order to leave fine teach mode, either press the **select** and **set** pushbuttons longer than 1 second or wait 30 seconds without pushing the pushbuttons.

7.2.4 Configuring the speed

The configured speed affects the measuring range, reproducibility, switching frequency, and response time to be achieved.

1. Press the **select** pushbutton for longer than 5 seconds.

✔ The LED **Q1 near** lights up.

2. Keep pressing the **select** pushbutton until the LED **slow ... fast** lights up.
3. Keep pressing the **set** pushbutton until the desired speed has been set.
   - LED **slow ... fast** flashes cyclically 1 x: super-slow
   - LED **slow ... fast** flashes cyclically 2 x: slow
   - LED **slow ... fast** flashes cyclically 3 x: medium
   - LED **slow ... fast** flashes cyclically 4 x: fast
   - LED **slow ... fast** flashes cyclically 5 x: super-fast
   - LED **slow ... fast** llights up continuously: expert setting, adjustable only via IO-Link
4. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

7.2.5 Expert mode

Use expert mode to set the following functions:

- Function for multifunction input MF: External teach (factory setting), laser off, multi-functional input MF deactivated
- Level for multifunction input MF: High active (factory setting), Low active
- Output behavior for output 2: (DT35 / DL35 only): 4... 20 mA (factory setting), 0 ... 10 V, switching output Q2

Table 7: Overview of expert mode

Description	Active LED	LED slow ... fast
Function for multifunction input	**Q1 near**	• LED **slow ... fast** flashes 1 x: external teach • LED **slow ... fast** flashes 2 x: laser off • LED **slow ... fast** flashes 3 x: multifunctional input MF deactivated
Level for multifunction input	**Q1 far**	• LED **slow ... fast** flashes 1 x: low active • LED **slow ... fast** flashes 2 x: high active
Output behavior for output Q2 (DT35 / DL35 only)	**Q2 near**	• LED **slow ... fast** flashes 1 x: 4 ... 20 mA • LED **slow ... fast** flashes 2 x: 0 ... 10 V • LED **slow ... fast** flashes 3 x: switching output

Example: The output Q2 is to be set to 0 ... 10 V.

1. From operating mode only: Press **select** and **set** pushbuttons simultaneously for longer than 10 seconds. The LED **Q1 near** lights up and the LED **slow ... fast** flashes cyclically according to the previous setting.
2. Keep pressing the pushbutton until the LED **Q2 near** lights up.
3. Keep pressing the **set** pushbutton until the desired option has been set.
   - LED **slow ... fast** flashes 1 x: 4 ... 20 mA
   - LED **slow ... fast** flashes 2 x: 0 ... 10 V
   - LED **slow ... fast** flashes 3 x: switching output.

4. In order to leave expert mode, press the **select** and **set** pushbuttons for longer than 10 seconds or wait 5 minutes without pushing the pushbuttons.

7.2.6 Resetting the settings to the factory setting

1. Switch off the supply voltage.
2. Press the **select** pushbutton.
3. Hold down the **select** pushbutton and switch on the supply voltage.
4. When all teach LEDs flash, release the **select** pushbutton.

✔ All settings have been reset to the factory setting.

7.2.7 External teach functions

You can activate or deactivate the return information about the result of a teach procedure via IO-Link or via the multifunctional input MF. The return information is provided via Q1.

You can perform an external teach by applying a signal to the multifunctional input. To do this, the “External Teach” option must be selected (factory setting). If the MF input is not used, the Inactive setting should be selected, or the input connected to GND or 24 V accordingly. EMC influences could trigger the teach function unintentionally.

The timing tolerance for the two “Move last teach point” functions is ± 20 ms. The timing tolerance is ± 30 ms for the other teach functions.

Teach function	Time [ms]
Move last teach point + 10 mm	60
Move last teach point – 10 mm	120
Switching off laser	200
Switching on laser	300
Teach in Q1 distance to object	400
Teach in inverted behavior Q1 distance to object	500
Teach in Q1 near for window	600
Teach in Q1 far for window	700
Teach in Q1 object between sensor and background	800
Teach in Q1 window centering [1, 2]	900
Teach in Q2 distance to object	1000
Teach in inverted behavior Q2 distance to object	1100
Teach in Q2 near for window	1200
Teach in Q2 far for window	1300
Teach in Q2 object between sensor and background	1400
Teach in Q2 window centering [1, 2]	1500
Teach in analog output 4 mA [3]	1600
Teach in analog output 20 mA [3]	1700
Teach in analog output 0 V [3]	1800
Teach in analog output 10 V [3]	1900
Teach in analog output centering [1, 2, 3]	2000
Deactivate teach confirmation [4]	2100
Activate teach confirmation [4]	2200
Laser off	> 3,000

1 Centering limits; the near and far points that have been moved via centering must always lie within the value range limits. Moved points must always be evaluated by the user.

2 For a description, see section Centering function or center shift

3 These parameters are valid only for DT and DL models. For DS and DR models, these teach functions would cause an error indication (Q1 and Q2 LEDs flashing alternately).

4 For a description, see section Teach confirmation

7.2.8 Behavior if no measurement is possible

If a distance measurement cannot be run, an error is output. Possible causes of the error:

- The measuring object is outside of the measuring range.
- The light signal received by the sensor is not strong enough.
- The laser is switched off.

The sensor behaves as follows when the factory settings are active:

Table 8: Behavior if no measurement is possible

	Minimum distance undershot	Maximum distance exceeded	Signal too weak
Analog output current increasing, default	3.5 mA	20.5 mA	20.5 mA
Analog output current decreasing	20.5 mA	3.5 mA	3.5 mA
Analog output voltage increasing	0 V	10 V	10 V
Analog output voltage decreasing	10 V	0 V	0 V
Distance value in IO-Link	Distance value	Distance value	0 mm
Distance value in SOPAS	Distance value	Distance value	0 mm

You can configure the sensor behavior for the event that no measurement is possible.

The following options are available:

Output minimum/maximum value (“Clamp”)

A replacement value is output in place of the distance value (see value for “Signal too weak” in the previous table).

This behavior corresponds to the factory settings.

Hold last measured value (“Hold”)

The last valid distance value is frozen and output again (held). This process repeats until it is once again possible to run a measurement.

7.3 Operation via SOPAS ET

Version 2021.1 and higher of the SOPAS Engineering Tool (SOPAS ET) software can be used to parameterize the device and for service and diagnostic purposes. Measured values can be visualized and all device functions can be set and checked in SOPAS ET. The device immediately applies parameters that have been modified using SOPAS ET and permanently saves them. A separate function does not have to be called up for this purpose.

Requirements

- A computer with the SOPAS ET software installed on it, and a free USB 2.0 compatible port

  The most up-to-date version of the SOPAS ET software can be downloaded from **www.sick.com/SOPAS_ET**. The respective system requirements for installing SOPAS ET are also specified there.
- SICK SiLink2 Master (available as accessory)
- Connection cable with M12 male and female connectors, 5-pin (available as accessory)

- Device description file (SDD file)

  The current version of the SDD file is available for download on the online product page or can be installed directly via the SICK driver repository using SOPAS ET.

Establishing a connection

1. Connect the device to the SiLink2 master via the male connector or an additional connection cable.
2. Connect the SiLink2 master to the computer using the supplied USB cable.
3. Switch on and start the computer.
4. To ensure an adequate voltage supply to the device, also connect the enclosed wall plug to the SiLink2 Master.

✔ After successful initialization, the PWR status LED flashes green. The device is ready for operation and the connection to the SiLink2 master is available.

Install the SDD file via the device catalog in SOPAS ET. Following installation, the device can be selected from the device catalog and added to a project. A connection to the device is established via the communication interface. The connection must be activated for data transmission (online).

7.4 Operation via IO-Link

The device can exchange process data and parameters via IO-Link. To do this, connect the device to a suitable IO-Link Master.

The IO-Link interface of the device has the following properties:

Table 9: Properties of the IO-Link interface

IO-Link specification	Devices up to date code 2033xxxx (see type label under S/N): V1.0 Devices from date code 2034xxxx (see type label under S/N): V1.0 and V1.1 (automated changeover of the device using the uploaded IODD)
Minimum cycle time	2.3 ms
Transmission rate	COM2 (38.4 kBaud)
Process data width	16-bit outgoing (from the device to the master)
Process data type	UINT (unsigned integer)
Parameter configuration server function (data storage)	Yes (only devices from date code 2034xxxx and with IO-Link V1.1)

7.4.1 Process data

In the factory settings, the process data telegram displays the distance value measured by the device in millimeters (16-bit width unsigned).

By configuring the parameters of the device you can change the process data format as well as resolution and offset for the distance value.

Table 10: Process data formats

No.	Description	Note
0	Distance (14 bits), status of the switching output Q1 and Q2 [1), 2)]	
1	Distance (14 bits), OWS signal level warning, alarm [3), 1), 2)]	-
2	Signal level (14 bits), OWS signal level warning, alarm [3)]	-
3	Distance (16 bits) [2)]	Factory setting
4	Distance (14 bits), signal quality (2 bits)[1), 2)]	-
5	Timer (only for Extended version) [2), 4)]	-

No.	Description	Note
6	Timer, status of switching output Q1 and Q2 (only for Extended version) [1), 2), 4)]	-

1) For a configured resolution of, for example, 1 mm, and an available process data width of 14 bits, a maximum of 16,383 mm can be represented for the distance measured value. Higher values are output as 16,383 mm. If a very high resolution is required at a greater distance, you can set an offset for the process data using index 107, “process data standardization”.

2) Resolution selectable: 0.1 mm / 1 mm / 10 mm (via index 105)

3) see "Signal level and signal quality", page 39

4) see "Device backward compatibility (DBC)", page 43

4)) Signal quality from 0 to 3. 0 = No signal or very weak signal; 1 = Sufficient; 2 = Good; 3 = Excellent

7.4.2 Device data

Device data (parameters, identification data, and diagnostic information) can be transmitted to and from the device. A product-specific device description file (IODD file) is required in the IO-Link master for this purpose.

A download package containing the IODD file and supplementary documentation is available at **www.sick.com/Dx35**.

7.4.3 Service data

7.4.3.1 IO-Link-specific

Table 11: IO-Link-specific service data

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
12 (0x0C)	Device access lock	Record	R/W	16 bytes	–	Only devices from date code **2034**xxxx and with IO-Link V1.1 Bit 0: Parameter (write) access lock Bit 1: Data memory lock Bit 2: Local parameterization lock Bit 3: Local user interface lock
16 (0x10)	Manufacturer name	String	R	64 bytes	SICK AG	See IO-Link specification
17 (0x11)	Manufacturer text	String	R	64 bytes	SICK sensors	–
18 (0x12)	Product name	String	R	64 bytes	DT35-B15251	–
19 (0x13)	Product ID	String	R	64 bytes	1057652	–
21 (0x15)	Serial number	String	R	16 bytes	12130005	–
24 (0x18)	Application-specific name	String	R/W	IO-Link V1.0: 64 bytes IO-Link V1.1: 32 bytes	Dx35 product family	–

Table 12: IO-Link-specifc service data - other settings

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
84 (0x54)	User brand 1	UINT32	R/W	32 bits		–
85 (0x55)	User brand 2	UINT16	R/W	16 bits		–
40 (0x28)	Process data	UINT16	R	16 bits		see "Process data", page 33

7.4.3.2 SICK-specific – outputs

In the following tables, the factory settings are indicated in bold in the “Value range” and “Example” columns.

Table 13: SICK-specific service data – outputs

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
69 (0x45)	Q1 switching function	UINT8	R/W	• **0: DtO (Distance to Object)** • 1: ObSB (Object between Sensor and Background) • 2: Window • 3: OWS (signal level warning) • 4: Alarm (fault output)	0	
70 (0x46)	Q1 switching point near	UINT16	R/W	50 ... 50,000 mm	**–**	In 1 mm steps
72 (0x48)	Q1 switching point far	UINT16	R/W	50 ... 50,000 mm	**DT35 / DS35: 10000** **DL35 / DR35: 50000**	In 1 mm steps
71 (0x47)	Q1 hysteresis near	UINT16	R/W	0 ... 49,550 mm	**25**	In 1 mm steps
73 (0x49)	Q1 hysteresis far	UINT16	R/W	0 ... 49,550 mm	**25**	In 1 mm steps
94 (0x5E)	Q1 near-far-center displacement	UINT16	R/W	50 ... 50,000 mm	–	In 1 mm steps
92 (0x5C)	Q2 output function	UINT8	R/W	• **0: 4 ... 20 mA** [1] • 1: 0 ... 10 V • **2: Switching** [2]	**DT35 / DL35: 0** **DS35 / DR35: –**	
74 (0x4A)	Q2 switching function	UINT8	R/W	• **0: DtO (Distance to Object)** [2] • 1: ObSB (Object between Sensor and Background) • 2: Window • 3: OWS (signal level warning) • 4: Alarm (fault output)	**DS35 / DR35: 0** **DT35 / DL35:–**	see "Signal level and signal quality", page 39 and Output as alarm output
75 (0x4B)	Q2 switching point near	UINT16	R/W	50 ... 50,000 mm	**–**	In 1 mm steps
77 (0x4D)	Q2 switching point far	UINT16	R/W	50 ... 50,000 mm	**DT35 / DL35: –** **DS35: 10000** **DR35: 50000**	In 1 mm steps
76 (0x4C)	Q2 hysteresis near	UINT16	R/W	0 ... 49,550 mm	**25**	In 1 mm steps
78 (0x4E)	Q2 hysteresis far	UINT16	R/W	0 ... 49,550 mm	**25**	In 1 mm steps
95 (0x5F)	Q2 near-far-center displacement	UINT16	R/W	50 ... 50,000 mm	–	In 1 mm steps
79 (0x4F)	Q2 analog near	UINT16	R/W	50 ... 50,000 mm	**DT35: 50** **DL35: 200** **DS35/DR35: –**	In 1 mm steps
80 (0x50)	Q2 analog far	UINT16	R/W	50 ... 50,000 mm	**DT35: 10000** **DL35: 50000** **DS35 / DR35: –**	In 1 mm steps
96 (0x60)	Q2 analog near-far-center displacement	UINT16	R/W	50 ... 50,000 mm	**DT35: 5025** **DL35: 25100** **DS35 / DR35: –**	In 1 mm steps
93 (0x5D)	Q1 / Q2 signal level warning (OWS) threshold	UINT16	R/W	0 ... 65,535	–	see "Signal level and signal quality", page 39

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
65 (0x41)	Q1/Q2 inversion	Record	R/W	• **0: Q1 and Q2 not inverted** • 1: Only Q1 inverted • 2 Only Q2 inverted • 3: Q1 and Q2 inverted		Bit 0: Q1 Bit 1: Q2 Bit 2 ... 7: reserved
106 (0x6A)	Distance offset	UINT16	R/W	**0** ... 50,000		In 1 mm steps
97 (0x61)	Time function for switching output/outputs	UINT8	R/W	• **0: Disabled (deactivated)** • 1: ON delay • 2: OFF delay • 3: ON/OFF delay • 4: One-shot		
98 (0x62)	Time for time function	UINT8	R/W	0 ... 255 ms		In 1 ms steps

1) Factory setting for DT35 / DL35

2) Factory setting for DS35 / DR35

7.4.3.3 SICK-specific – sensor performance

Table 14: SICK-specific service data – sensor performance

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
103 (0x67)	Response time	UINT8	R/W	• 0: Expert • 1: Super-slow • **2: Slow** [1] • 3: Medium • **4: Fast** [2] • 5: Super-fast	2	Devices up to date code **2033**xxxx: Index 64, 67 and 66 are only available if “0: Expert” has been selected. Device from date code **2034**xxxx: As soon as index 64, 67 or 66 has been rewritten, “0: Expert” is automatically set.
64 (0x40)	Sampling period and output time	UINT8	R/W	• 0 • 1 • 2 • **3** • 4 • 5 • 6 • 7 • 8		DT35 and DS35 red laser, class 1 devices: Sampling period and output time 2^{n*} 2 ms, All other devices: Sampling period and output time 2^{n*} 1 ms Devices up to date code **2033**xxxx: Writable only if “0: Expert” was selected for index “103”. Device from date code **2034**xxxx: Writing automatically generates the selection for index “103” “0: Expert” for index “103”.

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
67 (0x43)	Averaging	UINT8	R/W	• 1: OFF • **2: Filter depth 2** • 4: Filter depth 4 • 8: Filter depth 8 • 16: Filter depth 16		Sliding averaging over x measured values. Affects only process data and analog output, not switching behavior. Devices up to date code **2033**xxxx: Writable only if “0: Expert” was selected for index “103”. Devices from **2034**xxxx: Writing automatically generates the selection “0: Expert” for index “103”.
66 (0x42)	Bit filter for switching output/outputs	UINT8	R/W	• 0: OFF • **2: Filter depth 2** • 4: Filter depth 4 • 8: Filter depth 8 • 16: Filter depth 16	Filter depth 4: Four consecutive measured values must exceed or fall below the configured switching point in order for the switching output to react.	Defines how often in succession the switching condition (e.g. exceeding switching point Q1 far) must be fulfilled before the status of the switching output changes. The bit filter affects only the switching output behavior, not the process data or the analog output. Devices up to date code **2033**xxxx: Writable only if “0: Expert” was selected for index “103”. Devices from **2034**xxxx: Writing automatically generates the selection “0: Expert” for index “103”.

1) Factory setting for DT35 / DS35

2) Factory setting for DR35 / DL35

7.4.3.4 SICK-specific – teach

Table 15: SICK-specific service data – teach

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
130 (0x82)	TEACH	UINT16	W	• 0: Q1 DtO (Q1 distance to object) • 1: Q2 DtO (Q2 distance to object) • 2: Q1 near • 3: Q1 far • 4: Q1 center • 5: Q2 near • 6: Q2 far • 7: Q2 center • 8: Q1 ObSB (Q1 object between sensor and background) • 9: Q2 ObSB (Q2 object between sensor and background) • 10: Q2 4 mA • 11: Q2 20 mA • 12: Q2 0 V • 13: Q2 10 V • 14: Q2 Analog center • 15: Fine teach +10 mm • 16: Fine teach -10 mm		A teach overwrites a function that has already been set with a newly selected function. For values that are not taught in again and for an unsuccessful teach, the old value is retained.

7.4.3.5 SICK-specific – process data

Table 16: SICK-specific service data – process data

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
83 (0x53)	Process data structure	UINT8	R/W	• 0: Distance+Q1+Q2 • 1: Distance+OWS+alarm • 2: Level+OWS+alarm • **3: Distance** • 4: Distance+signal quality • 5: Timer (only for Extended version) • 6: Timer+Q1+Q2 (only Extended version)	3	see "Process data", page 33
105 (0x69)	Process data solution	UINT8	R/W	• 0: 0.1 mm • **1: 1 mm** • 2: 10 mm		Resolution distance measured value for the process data (IO-Link only)
107 (0x6B)	Process data monitoring	UINT16	R/W	• **0** ... 50,000 mm		Move process data zero point in 1 mm steps.

7.4.3.6 SICK-specific – other settings

Table 17: SICK-specific service data – other settings

Index decimal (hex)	Description	Format	Access	Value range	Example	Note
81 (0x51)	Multifunctional input MF function	UINT8	R/W	• **0: Teach (teach-in)** • 1: Laser on/off • 2: MF OFF (MF deactivated)	1	
99 (0x63)	Multifunctional input MF level (bit 0) Multifunctional input MF teach confirmation on Q1 (bit 1)	Record	R/W	Bit 0: • 0: Low active • **1: High active** Bit 1: • **0: Inactive** • 1: Active		see "Teach confirmation function", page 43
104 (0x68)	Alarm function (bit 0)	UINT8	R/W	• **0: Clamp (zero-value output)** • 1: Hold		Select behavior for the sensor if no measurement is possible. • Clamp: The sensor outputs "0". • Hold: The last valid measured value is retained. **NOTE** | Do not set "hold" option for ObSB mode. see "Output as alarm output", page 41
82 (0x52)	Pushbutton lock	UINT8	R/W	• **0: OFF** • 1: ON	0	
68 (0x44)	Laser on/off	UINT8	R/W	• 0: OFF • **1: ON**	1	–

7.4.3.7 System command

Table 18: Service data system command

Index decimal (hex)	Description	Format	Access	Value	Note
2 (0x02)	System command: Reset to factory settings	UINT8	W	130	Reset parameter to the factory setting.

7.4.4 Error codes

For error codes, see IO-Link specification.

7.5 Additional functions

7.5.1 Signal level and signal quality

Signal level (“Level”)

The signal level corresponds to the amount of reflected light received by the receiver optics of the device. This is a dimensionless value. It essentially depends on the distance from the measuring object and on the surface of the measuring object (color,

roughness/reflectivity, angle to the optical axis). To enable the device to measure the distance correctly, the signal level must not drop below a certain value. This value depends on the selected speed.

You can configure the Q1 or Q2 output for the signal level warning (VMA). The level can be adjusted within the range 0 ... 65535. If the signal exceeds or falls below the configured level, the output is connected. Hysteresis cannot be configured. The output behavior can be inverted.

Likewise, the status of the signal level warning can be provided via the status bits (bit 0 or bit 1) as part of the process data (process data format 0) via the IO-Link interface.

Depending on the application, the setting must always be defined by the system integrator. When using the signal level warning (VMA), we recommend first performing a measurement of a reference object with known and constant optical properties.

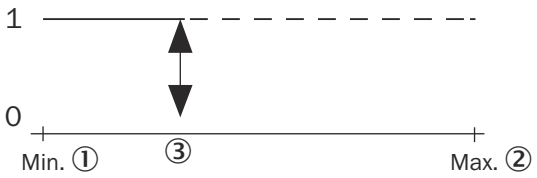


Figure 16: Output behavior for signal level warning (VMA) depends on the reception level

① Minimum reception level

② Maximum reception level

③ Switching point: Signal level threshold

Signal quality

The signal quality indicates the stability of the measurement. A meaningful value is output only if the distance between the device and the measuring object is constant. This value can be provided as part of the process data (process data format 4) via the IO-Link interface.

7.5.2 Switch delay

A time function can be activated for switching outputs Q1 and Q2. The configured time function applies to both switching outputs. The following functions are available:

Table 19: Switching behavior - functions

Function	Description
Deactivated	Right after the measured distance has exceeded the specified switching point, the state of the switching output changes (factory setting).
Switch-on delay	The changeover of the switching output from an inactive to an active state is time-delayed. The delay time is adjustable. The changeover from an active to an inactive state is not delayed.
Switch-off delay	The changeover of the switching output from an active to an inactive state is time-delayed. The delay time is adjustable. The changeover from an inactive to an active state is not delayed.
ON and OFF delay	The changeover from an inactive to an active state and vice versa is time-delayed. The delay time is adjustable.

Function	Description
One-time timer	Once the switching condition has been met, the switching output changes from an inactive to an active state. The switching output remains in an active state for a specified period regardless of how long the switching condition is met. It does not switch back to an inactive state until this time has elapsed. Any additional changes made to the switching condition during this period are still not taken into account.

NOTE
An additional delay between the time at which the switching point is exceeded and the changeover of the switching output may result from the speed settings (integration time, depth of the bit filter).

7.5.3 Find me!

The “Find me!” function makes it fast and easy to find a device that is installed in a machine or system.

When the “Find me!” function is activated, the two yellow LEDs on the device flash (Q1 and Q2) and the sender laser flashes with a frequency of 5 Hz. When the function is being used, it is not possible to perform a correct distance measurement. If the device is switched off and back on when the “Find me!” function is activated, the “Find me!” function will then no longer be active.

7.5.4 Output as alarm output

This function can be configured only via IO-Link.

You can configure the Q1 or Q2 output for the weak signal alarm or for the switching signal "No measurement possible". The output behavior can be inverted.

This function is especially useful if "Alarm function = Hold" has been set for the sensor behavior. This allows you to determine whether the sensor actually makes a measurement or a contained value is output, even if output of measured values is continuous.

Set the alarm function via the index 104, see "SICK-specific – other settings", page 39.

7.5.5 Centering function or center displacement

Use the centering teach to move the switching range center or the analog range center (12 mA/5 V) to the newly taught-in position. A centering teach is possible for Q1 windows, Q2 windows, and analog.

You can perform the centering function in the following ways:

- Teach via multifunctional input MF
- Teach via IO-Link
- Value input via IO Link.

For setting via IO-Link see "SICK-specific – outputs", page 35, index 94, 95 and 96.

The previously taught-in relative distance between near and far is retained. The values for near and far must not be moved beyond the sensor limits via a centering teach. If the teach was not successful, the LEDs Q1 and Q2 flash alternately.

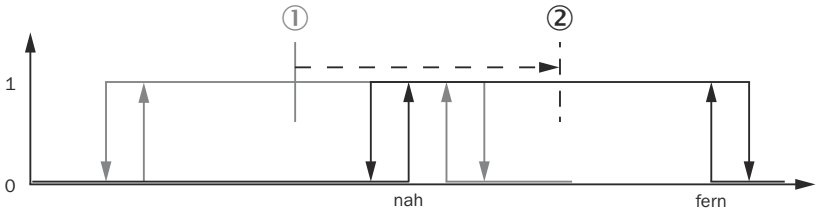


Figure 17: Centering function for the example "window not inverted."

① Old center point before centering teach

② New center point after centering teach

7.5.6 Teach confirmation function

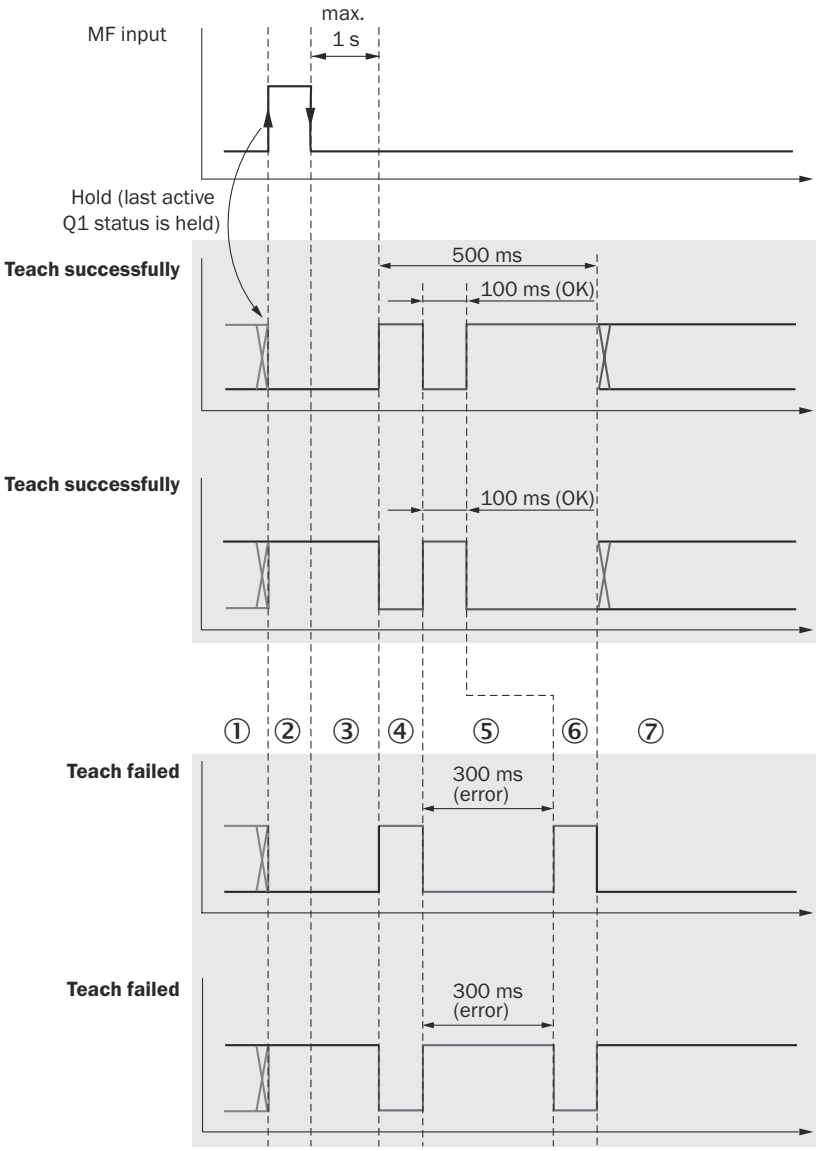


Figure 18: Teach confirmation function

① Switching output before teach

② Teach request retains the last active Q1 status in order, for example, to avoid toggling if hysteresis is too low

③ Teach processing time, max. 1 s

④ First signal edge at Q1 after starting the teach: Initiate confirmation by inverting for 100 ms.

⑤ Result: OK (100 ms), error (300 ms)

⑥ Quit confirmation after 500 ms

⑦ Return to current switching output. The switching output can be modified via a new teach point.

7.5.7 Device backward compatibility (DBC)

DT35 and DL35 type devices can be converted to the Dx35 Extended device type by changing the device ID. The Extended version provides the additional “Timer” process data function. The reverse is also possible.

This is not possible with DS35 and DR35 device types because of the missing analog output.

Table 20: Device types, device ID, function

Device type	Device ID	Description
DS35 / DR35	6488070 (630006h)	IO-Link interface
DT35 / DL35	6488065 (630001h)	IO-Link interface and analog output
Dx35 Extended	6488071 (630007h)	IO-Link interface + additional process data and analog output

Changing the device ID changes the IO-Link interface. The connection is terminated after the change. A new device search must be started in SOPAS ET.

IO-Link master: By adding the appropriate IODD (e.g. SICK-DX35-Extended-xxx-IODD1.1; DeviceID 6488071), the device ID is automatically changed during connection. A device reset sets the device ID back to the default setting.

7.5.8 Timer function

The timer function is only available with the “Dx35 Extended” device type. See section Device Backward Compatibility (DBC).

The timer function can be used to determine how long output Q1 is in the active state. This can be used, for example, to measure the time for which an object is in the sensor's detection range. The timer function can be used with all switching functions of output Q1.

Timekeeping is started each time output Q1 changes from the non-active to the active state. Timekeeping is stopped when output Q1 changes over from the active to the non-active state.

After the timekeeping has been ended, the measured time can be read out via the process data using IO-Link.

The measured time is output in milliseconds. The accuracy of the timer is affected by the sensor's speed settings (response time, depth of the bit filter). The longest measurable time span is 65,535 milliseconds (65.5 seconds).

7.5.9 Switch the laser on/off

It is possible to switch off the sender laser temporarily or permanently. No measurement is possible when the laser is switched off.

Temporarily switch the laser off

The laser can be switched off temporarily via the multifunctional input MF using the “Laser off” or “External teach” function. The laser switches off as soon as the switching condition has been met and remains switched off until it is no longer met.

Permanently switch the laser off

The laser can be permanently switched off via IO-Link, SOPAS ET and the multifunctional input MF (in the "External teach" function). It remains switched off until it is switched back on by another event. If the power supply of the sensor is interrupted in the meantime, the laser remains switched off afterwards.

7.5.10 Speed setting (“Speed”)

Description

The device supports different speed settings. Five predefined speed settings are available: “Super fast”, “Fast” (factory setting for DR35 / DL35), “Medium”, “Slow” (factory setting for DT35 / DS35) and “Super Slow”.

The sampling period, averaging and bit filter can also be individually configured via the “Expert” mode.

Table 21: Speed settings of the device

Speed setting (predefined)	Super-fast	Fast	Medium	Slow	-	Super Slow	-	-	-
Speed setting in Expert mode, sampling period	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Integration time[1] / output time (laser class 2) [ms]	1	2	4	8	16	32	64	128	256
Integration time[1] / output time (laser class 1) [ms]	2	4	8	16	32	64	128	256	512
Response time analog output (laser class 2) [ms][2)3)]	2.5	6.5	12.5	24.5	48.5	96.5	192.5	384.5	768.5
Response time analog output (laser class 1) [ms][2)3)]	4.5	12.5	24.5	48.5	96.5	192.5	384.5	768.5	1536.5
Switching frequency[2] switching output (laser class 2) [Hz]	333	100	50	25	12.5	6	3	1.5	0.7
Switching frequency[2] switching output (laser class 1) [Hz]	166	50	25	12.5	6	3	1.5	0.7	0.4

1) Continuous change of the distance from the object in the measuring range

2) Lateral entry of the object into the measuring range

3) Bit filter and averaging are off for "Super Fast".
For “Fast” and above, averaging and a bit filter of 2 are configured as default; the values correspond to these settings.

The selected speed setting affects the performance of the device. The appendix shows the “reproducibility” and “distance” performance data as a function of the remission values 6%, 18% and 90% for the five predefined speed settings, see "Repeatability", page 54.

Integration time, averaging and bit filter

- **Sampling Period**
  The sampling period, also called output time, defines the time provided for the statistical analysis via the HDDM process.
  An updated measured value is output after each of these measurement cycles is completed. The integration times available for selection are listed in the preceding table.
  The output time for the devices is calculated as follows, where n is the configured integration level:
  DT35 and DS35 with red laser (laser class 1): Sampling period or output time = 2^n * 2 ms
  All other devices: Sampling period or output time = 2^n * 1 ms
- **Averaging Analog**
  If required, a moving average can be configured for the analog output. This requires defining a specific number of measurement cycles in order to determine the average. This average measured value is output via an analog interface. This can be used, for example, to smooth jumps in a distance value in level monitoring, which results in a more stable process.
  The value range is adjustable from: 1; 2 (factory setting); 4; 8; 16.
  The integration and output time remains unchanged. However, the respective output values are averaged. As a result, equalization of the output value may be delayed in the event of a change in distance.
- **BitFilter (Switch)**
  The bit filter for switching outputs determines how often an identical output state has to recur consecutively before the signal at the switching output changes accordingly. If the defined number is not reached, the switching output remains unchanged. This may increase the reliability in the application if the distance value fluctuates around the selected switching point.
  You can chose the following condition of identical, successive output states: 0; 2 (factory setting); 4; 8; 16.
  The integration and output time remains unchanged.

8 Maintenance

8.1 Cleaning

NOTICE
Equipment damage due to improper cleaning.

Improper cleaning may result in equipment damage.

- Only use recommended cleaning agents and tools.
- Never use sharp objects for cleaning.

→ Clean the front screen at regular intervals and in the event of contamination with a lint-free lens cloth and plastic cleaning agent. The cleaning interval essentially depends on the ambient conditions.

8.2 Maintenance schedule

NOTE
No maintenance is required to ensure compliance with the laser class.

Depending on the assignment location, the following preventive maintenance tasks may be required for the device at regular intervals:

9 Return

→ Only send in devices after consulting with SICK Service.
→ The device must be sent in the original packaging or an equivalent padded packaging.

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

- Details of the contact person
- Description of the application
- Description of the error that occurred

10 Repair

Repairs on the device may only be performed by qualified and authorized personnel from SICK AG. Interference with or modifications to the device on the part of the customer will invalidate any warranty claims against SICK AG.

11 Disposal

If a device can no longer be used, dispose of it in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations. Do not dispose of the product along with household waste.

NOTICE

Danger to the environment due to improper disposal of the device.

Disposing of devices improperly may cause damage to the environment.

Therefore, observe the following information:

- Always observe the national regulations on environmental protection.
- Separate the recyclable materials by type and place them in recycling containers.

12 Technical data

12.1 Dimensions

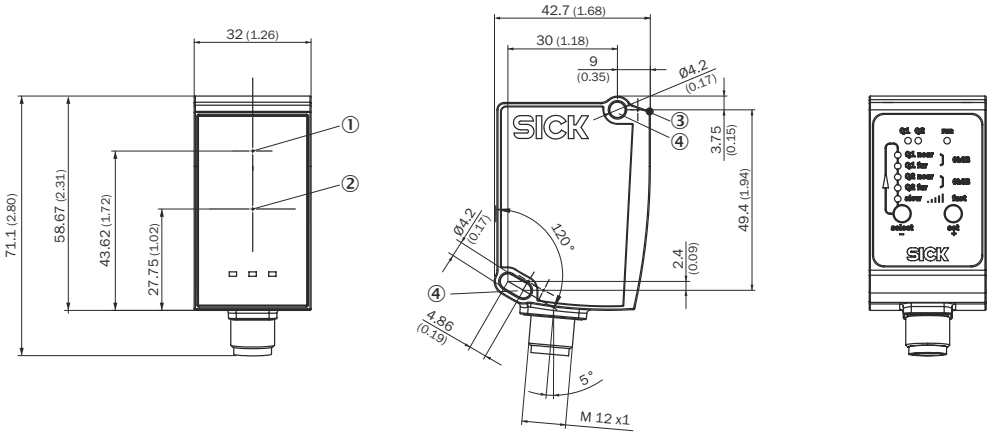


Figure 19: Dx35 dimensions, dimensions in mm (inch), decimal separator: point

① Optical axis, sender

② Optical axis, receiver

③ Reference surface (corresponds to distance 0 mm)

④ M4 fixing hole

12.2 Laser/optics

Light sender	Dx35-Bxx2xx, Dx35-Bxx5xx: laser diode, red light Dx35-Bxx8xx: laser diode, infrared light
Laser class	Dx35-Bxx2xx: 2, according to EN 60825-1 Dx35-Bxx5xx, Dx35-Bxx8xx: 1, according to EN 60825-1
Maximum output	Dx35-Bxx2xx, DT35-Bxx5xx, DS35-Bxx5xx: ≤ 250 mW Dx35-Bxx8xx: ≤ 130 mW DL35-Bxx5xx, DR35-Bxx5xx: ≤ 120 mW
Pulse duration	Dx35-Bxx2xx, Dx35-Bxx5xx: 4 ns Dx35-Bxx8xx: 3.5 ns
Wavelength	Dx35-Bxx2xx, Dx35-Bx5xx: 658 nm Dx35-Bxx8xx: 827 nm
Pulse rate	Dx35-Bxx2xx, Dx35-Bxx8xx, DL35-Bxx5xx, DR35-Bxx5xx: 1/250 DT35-Bxx5xx, DS35-Bxx5xx: 1/500
Typical light spot size	15 mm x 15 mm (at 2 m)
Average laser service life (at 25 °C)	100,000 h

12.3 Performance

Measuring range	**DT35-Bxxxxx, DS35-Bxxxxx** [1] • 90 % remission: 50 mm ... 12,000 mm • 18 % remission: 50 mm ... 5,300 mm • 6 % remission: 50 mm... 3,100 mm **DL35-Bxxxxx, DR35-Bxxxxx:** • 200 mm ... 35,000 mm (diamond grade)
Resolution[2]	0.1 mm
Repeatability	0.5 mm ... 5 mm "Repeatability", page 54

Accuracy [3),4)]	DT35-Bxxxxx, DS35-Bxxxxx: typically ± 10 mm DL35-Bxxxxx, DR35-Bxxxxx: typically ± 15 mm
Output time [5), 6)]	see "Speed setting (“Speed”)", page 45
Response time [5), 7)]	see "Speed setting (“Speed”)", page 45
Switching frequency [5), 7)]	see "Speed setting (“Speed”)", page 45
Power-up time	≤ 500 ms
Warm-up time	≤ 20 min [8)]

1) With the “Super Slow” speed setting
2) Equivalent to 1 σ
3) • DT35-Bxxxxx, DS35-Bxxxxx: At 6 % ... 90 % remission
   • DL35-Bxxxxx, DR35-Bxxxxx: On “diamond grade” reflective tape
4) Temperature drift: typically 0.5 mm/K
5) Depends on the configured speed: “Super Slow” ... “Super Fast”
6) Continuous change of the distance from the object in the measuring range
7) Lateral entry of the object into the measuring range
8) During the device warm-up phase, the measured values are subject to an increased variance (temperature drift).

12.4 Supply

Supply voltage V_S [1)]	• 12 V DC ... 30 V DC • 18 V DC ... 30 V DC (when using IO-Link) • DT35-Bxxxxx, DL35-Bxxxxx: 13 V DC ... 30 V DC (when using the analog voltage output)
Power consumption [2)]	≤ 1.7 W
Residual ripple [3)]	< 5 V_{SS}

1) Limit values, reverse-polarity protected operation in short-circuit protected network: max. 5 A
2) At 20 °C and without load
3) May not fall short of or exceed U_v tolerances

12.5 Interfaces

Data interface	IO-Link
Inputs	1x multifunctional input MF [1)]
Output signal [2),3)]	DT35-Bxxxxx, DL35-Bxxxxx: Quantity: 1 ... 2 Type: Push-pull: PNP/NPN Switching output Q2 configurable: Current output / Voltage output / Digital output Maximum output current IA: ≤ 100 mA DS35-Bxxxxx, DR35-Bxxxxx: Quantity: 2 Type: Push-pull: PNP/NPN Maximum output current IA: ≤ 100 mA
Hysteresis	DT35-Bxxxxx, DS35-Bxxxxxx: 0 mm ... 11,950 mm DL35-Bxxxxx, DR35-Bxxxxxx: 0 mm ... 34,950 mm
Analog output (only DT35-Bxxxxx, DL35-Bxxxxx)	1 x 4 mA ... 20 mA (≤ 450 Ω) / 1 x 0 V ... 10 V (≥ 50 kΩ) / –

Analog output resolution (DT35-Bxxxxx, DL35-Bxxxxx only)	12 bits

1) Response time: ≤ 60 ms
2) Output Q, short-circuit protected
3) Voltage drop < 3 V
4)) Output Q2 adaptable: 4 mA ... 20 mA / 0 V ... 10 V / switching output
5)) Configurable via IO-Link

12.6 Ambient data

Protection class	III
Ambient temperature[1]	–30 °C ... +55 °C
Storage temperature	–40 °C ... +75 °C
Max rel. air humidity (non-condensing)	≤ 95 %
Vibration resistance	EN 60068 2-6 / EN 60068-2-64
Shock resistance	EN 60068-2-27
Enclosure rating	IP 65, IP 67
Typical ambient light immunity	40 klx

1 U_V ≤ 24 V

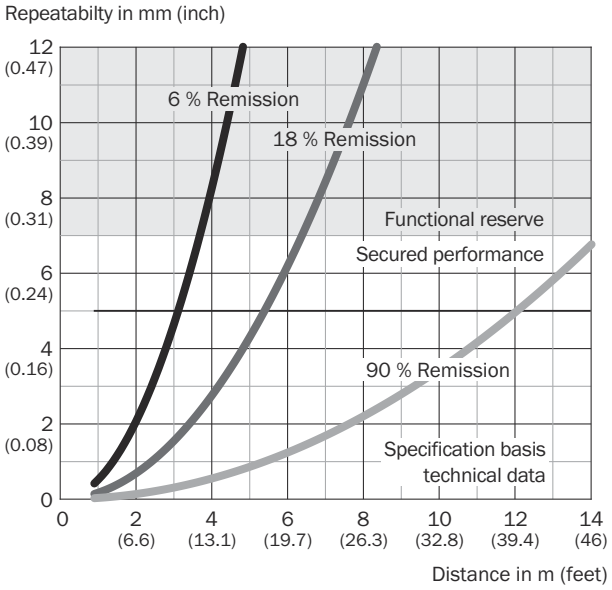
12.7 Structural design

Dimensions	32 mm x 58.67 mm x 42.7 mm
Weight	65 g
Housing material	Housing: plastic (ABS and PC) Front screen: acrylic glass (PMMA)
Connection type	Plug M12, 5-pin
Display	LEDs

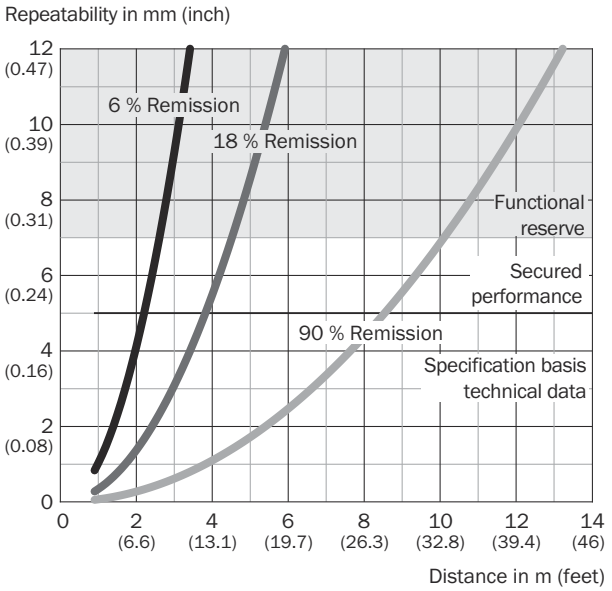
12.8 Repeatability

Device variants DT35 and DS35

Super Slow

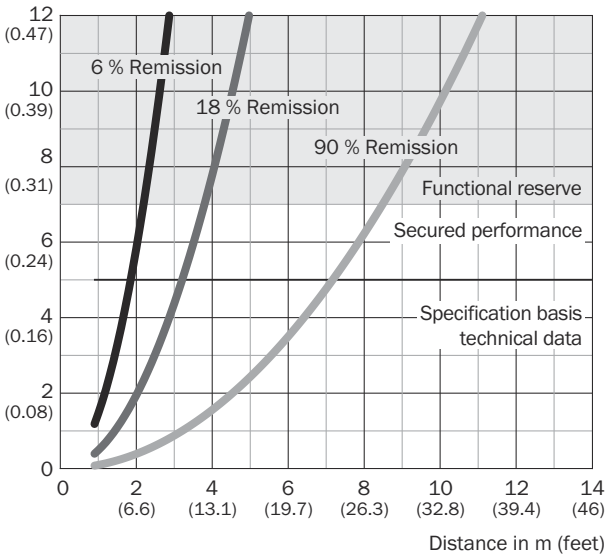


Slow



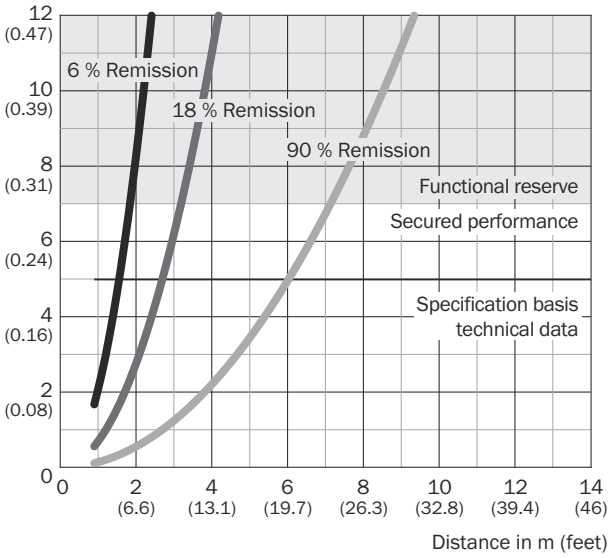
Medium

Repeatability in mm (inch)

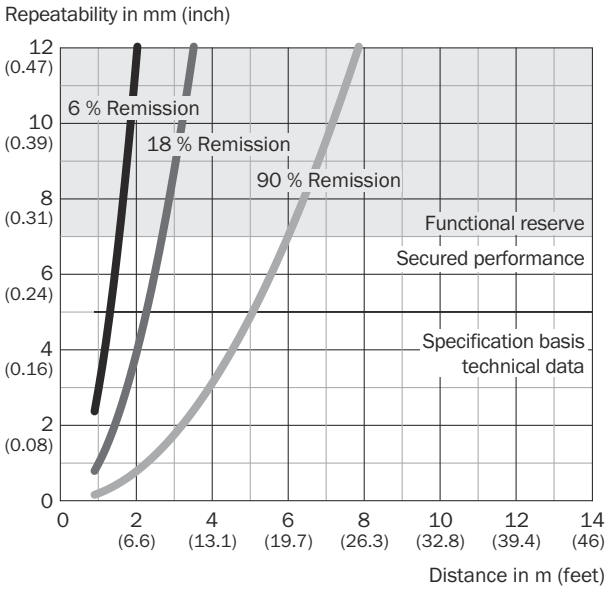


Fast

Repeatability in mm (inch)

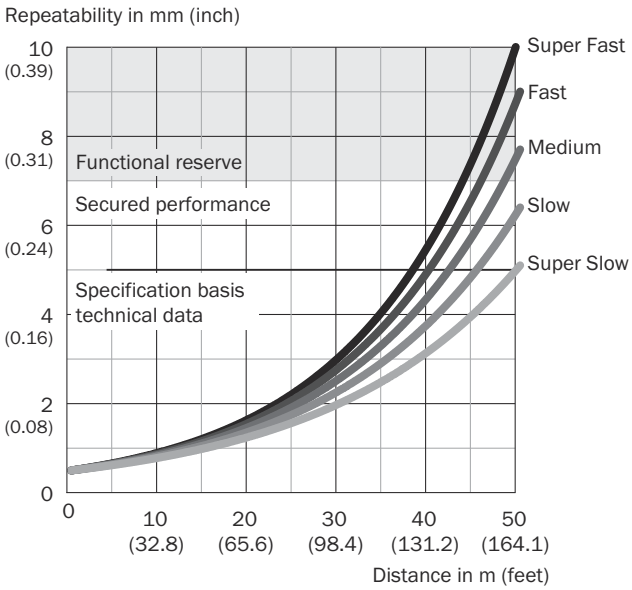


Super Fast



Device variants DL35 and DR35

Super Slow ... Super Fast



13 Accessories

NOTE

On the product page you will find accessories and, if applicable, related installation information for your product.

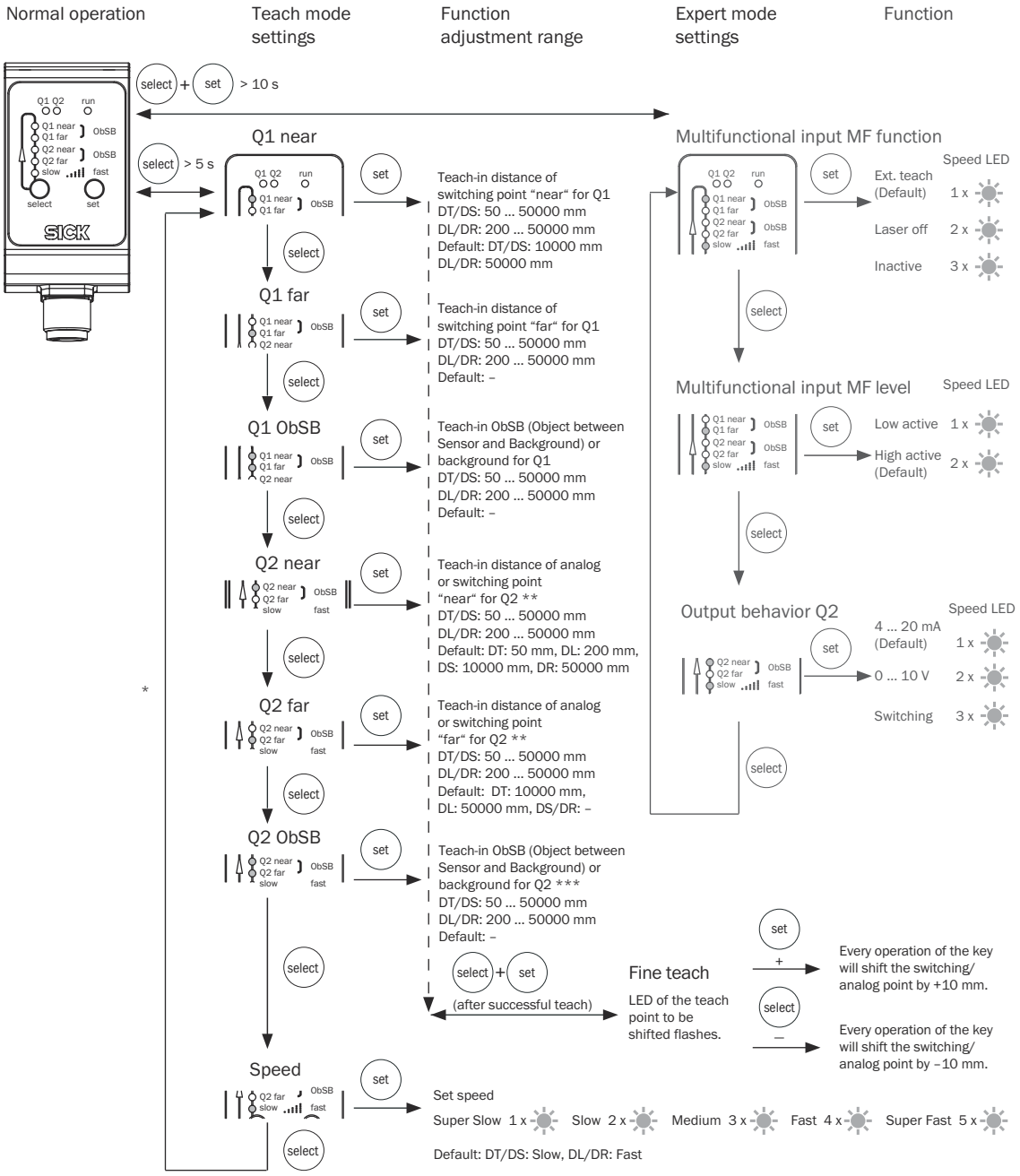
The product page can be accessed via the **SICK Product ID**: **pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

14 Annex

14.1 Menu structure



* In case of a new teach process all required switching/analog points of the specific output have to be taught in.

** For DT35/DL35: Q2 function can be selected (4 ... 20 mA/0 ... 10 V/switching). For DS35/DR35: Q2 function switching only

*** For DT35/DL35: ObSB for Q2 available with active switching function only

14.2 Conformities and certificates

You can obtain declarations of conformity, certificates, and the current operating instructions for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

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SICK AT A GLANCE

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8014868.IT2F/2025-11-25/en

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