OPERATING INSTRUCTIONS

Dx35

DISTANCE SENSORS

SICK
Sensor Intelligence.

Described product

Dx35

Manufacturer

SICK AG

Erwin-Sick-Str. 1

79183 Waldkirch
Germany

Copyright

Original document

This document is an original document published by SICK AG.

Table of contents

Important safety notes

NFPA79 applications only.

Adapters including field wiring cables are available.

→ See “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.

1 General information

1.1 Information about these operating instructions

These operating instructions provide important information on how to use devices from SICK AG.

Prerequisites for safe work are:

- Compliance with all safety notes and handling instructions supplied
- Compliance with local work safety regulations and general safety regulations for device applications

The operating instructions are intended to be used by qualified personnel and electrical specialists.

NOTE!

Read these operating instructions carefully to familiarize yourself with the device and its functions before commencing any work.

The operating instructions are an integral part of the product. Store the instructions in the immediate vicinity of the device so they remain accessible to staff at all times. Should the device be passed on to a third party, these operating instructions should be handed over with it.

These operating instructions do not provide information on operating the machine or system in which the device is integrated. For information about this, refer to the operating instructions of the specific machine.

1.2 Explanation of symbols

Warnings

Warnings in these operating instructions are labeled with 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.

IMPORTANT!

... indicates a possible hazardous situation which may lead to physical damage if it is not avoided.

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
- Improper use
- Use by untrained personnel
- Unauthorized conversions
- Technical modifications
- use of unauthorized spare parts/consumable parts.

The actual scope of delivery may differ from the features and illustrations shown here where special variants are involved, if optional extras have been ordered, or as a result of the latest technical changes.

1.4 Scope of delivery

Included in scope of delivery:

- DS35, DT35, DL35 or DR35 distance sensor
  (→ See “Type code”, Chapter 3.2 on page 16)
- Optional: Accessories (→ See Chapter 14 on page 64)

Supplied documentation:

- Safety notes

1.5 Customer service

If you require any technical information, our customer service department will be happy to help.

See the back page for relevant contact details.

NOTE!

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

1.6 EU declaration of conformity

→ You can download the EU declaration of conformity from “www.sick.com/Dx35”.

1.7 Environmental protection

→ See “Disposal”, Chapter 12 on page 55

2 Safety

2.1 Intended use

The DS35 and DT35 distance sensors are opto-electronic sensors for performing non-contact distance measurement of objects.

The DL35 and DR35 distance sensors are opto-electronic sensors for performing non-contact distance measurement on reflective tape.

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.

2.2 Improper use

DS35, DT35, DL35, and DR35 distance sensors do not constitute safety components in accordance with the EC Machinery Directive (2006/42/EC).

The distance sensors must not be used in areas having a danger of explosions.

Any other use that is not described as intended 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 improper use!

Any improper use can result in dangerous situations.

For this reason:

- Distance sensors should be used only according to intended use specifications.
- All information in these operating instructions must be strictly observed.

2.3 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 work must only ever be carried out by the stipulated persons.

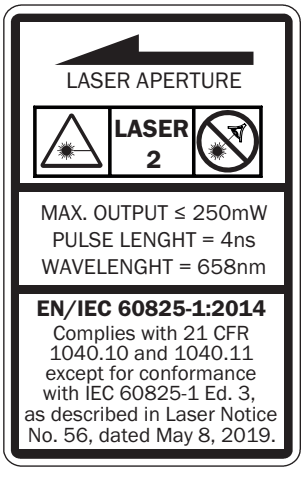
The operating instructions state the following qualification requirements for the various areas of work:

- **Qualified personnel**
  are able to carry out the work assigned to them and independently recognize potential risks due to their specialist training, knowledge, and experience, as well as knowledge of the relevant regulations.
- **Electrical specialists**
  are able to carry out work on electrical systems and independently recognize potential risks due to their specialist training, knowledge, and experience, as well as knowledge of the relevant standards and regulations.
  The electrician must comply with the provisions of the locally applicable work safety regulation.

2.4 Warning symbol on the device

Laser class 2

Distance sensors with a class 2 laser according to EN/IEC60825-1:2014 (identical laser class for issue EN/IEC 60825-1:2007) carry the following warning label.

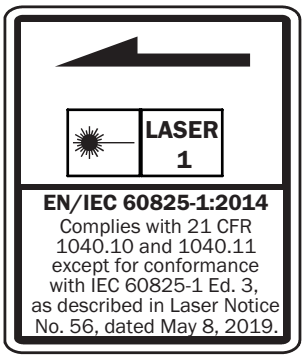


- Laser output aperture label, → See Fig. 5 on page 17
- CAUTION LASER RADIATION
  Do not look into the beam.
  Laser class 2 product
- Specification of maximum output power, pulse length, wavelength
- EN/IEC 60825-1:2014:
  Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56, dated May 8, 2019.

Fig. 1: Warning symbol on sensor with class 2 laser

Laser class 1

Distance sensors with a class 1 laser according to EN/IEC60825-1:2014 (identical laser class for issue EN/IEC 60825-1:2007) carry the following warning label.



- Laser output aperture label, → see Fig. 5 on page 17
- CAUTION LASER RADIATION Laser class 1 product
- EN/IEC 60825-1:2014: Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56, dated May 8, 2019.

Fig. 2: Warning symbol on sensor with class 1 laser Laser class 1 product

Laser warning label position

The laser warning label is located on the right side of the housing.

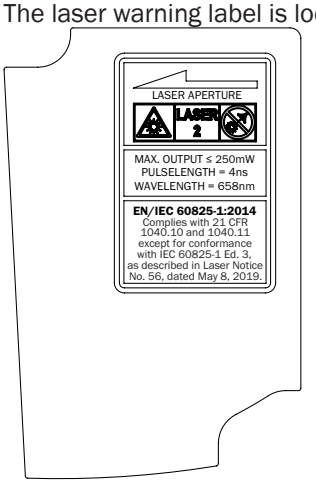


Fig. 3: Laser warning label position

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

Laser radiation

For your own safety, please read and observe the following note:

WARNING!

Risk of injury from laser radiation!

Looking directly into the laser beam may result in eye injury.

- Do not look into the laser beam.

3 Identification

3.1 Type label

The distance sensor includes the following type label:

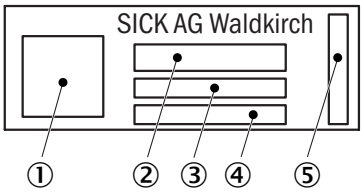


Fig. 4: "Dx35 distance sensor" type label

① *2D code*

② *For type description, see type code*

③ *Article number (order number)*

④ *Year and month of manufacture*

⑤ *Serial number*

3.2 Type code

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

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	**Output signal switching device** 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
9	**Interface** 2 Switching outputs Q1 and Q2 and IO-Link 5 Analog current or voltage output (Q2), switching output (Q1) and IO-Link
10	**Measurement** 1 Optimized for natural objects 2 Optimized for reflective tape
11	**Other info** X Additional characters possible

Table 1: "Dx35 distance sensor" type code

4 Design and function

4.1 Structure

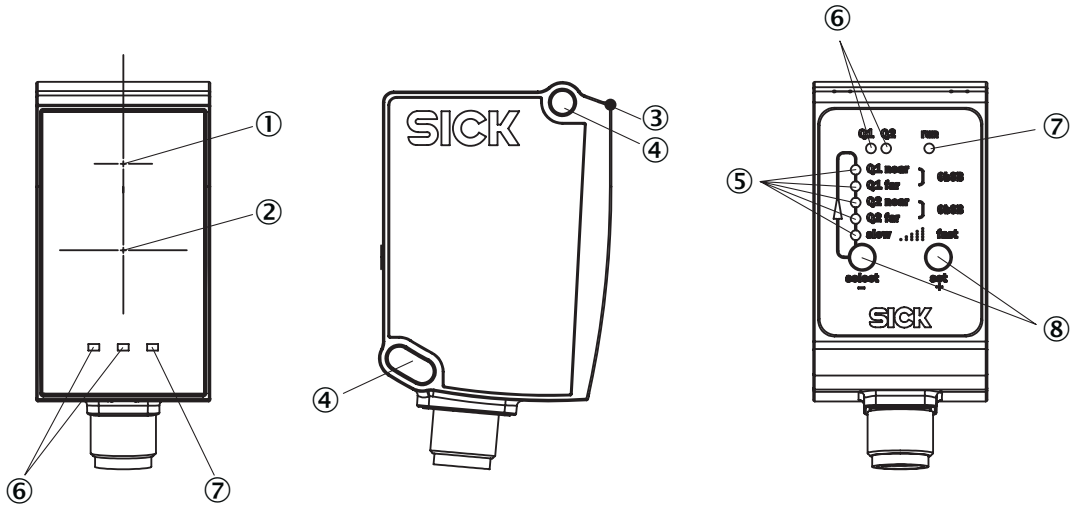


Fig. 5: "Dx35 distance sensor" structure and function

① *Optical axis, sender*
Laser output aperture corresponds to the front screen at the height of the position shown.

② *Optical axis, receiver*

③ *Reference surface (corresponds to 0 mm)*

④ *M4 fixing hole*

⑤ *Teach-in LEDs*

⑥ *Q1/Q2 status LEDs*

⑦ *Status indicator LED*

⑧ *Operating pushbuttons*

Q1 and Q2 status LEDs (continued on next page)

LED	Description
Q1	Q1 switching output indicator • Orange LED: switching output active • LED off: switching output inactive
Q2	Q2 switching output/Qa analog output indicator • LED orange: Switching output active/measured value within analog output scaling • LED off: Switching output inactive/measured value outside analog output scaling
Q1 and Q2 in run mode	• "Q1" and "Q2" LEDs flash alternately for longer than 10 seconds: fault exists. Check general conditions such as supply voltage, temperature range, EMC disturbances, etc.
Q1 and Q2 in teach mode	• "Q1" and "Q2" LEDs flash simultaneously: teach is being performed. • "Q1" and "Q2" LEDs flash alternately for 5 seconds: teach failed.

Q1 and Q2 status LEDs (continued)

LED	Description
Q1 and Q2 in alignment mode	Alignment quality indicator (IR models only) • Slow flashing (approx. 1 Hz): poor alignment quality • Rapid flashing (approx. 15 Hz): good alignment quality

Table 2: Q1 and Q2 status LEDs

Status indicator LED

LED	Description
Run	Operating indicator • Rear LED green/front LED orange: Supply voltage present • LED off: Supply voltage off

Table 3: Status indicator LED

Teach-in LEDs
(continued on next page)

LED	Description
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 "Slow ... fast" LED lights up continuously: • Expert or expert setting, adjustable only via IO-Link → See Chapter 9.3.3 on page 43
Q1 near, Q1 far, Q2 near, Q2 far, slow ... fast in alignment mode	Alignment quality indicator (IR models only) • The greater the number of LEDs that light up, the better the teach-in quality.

Teach-in LEDs (continued)

LED	Description
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 models 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

Table 4: Teach-in LEDs

Operating pushbuttons

Operating button	Description
select (–)	• In run mode Press **select** pushbutton longer than 5 seconds: Enter or leave teach mode. • In teach mode Press **select** pushbutton: Select function. • In fine teach mode Move previously taught-in switching point by –10 mm.
set (+)	• In run mode (IR models 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.
select + set	• In run mode Press **select** and **set** pushbuttons simultaneously for longer than 10 seconds: Enter or leave expert mode. • In teach mode After previously performing teach, press **select** and **set** pushbuttons simultaneously for less than 1 second: Enter or leave fine teach.

Table 5: Operating pushbuttons

4.2 Function

The DS35 and DT35 distance sensors are opto-electronic sensors for performing non-contact distance measurement of objects.

The DL35 and DR35 distance sensors are opto-electronic sensors for performing non-contact distance measurement on reflective tape.

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.

5 Transport and storage

5.1 Transport

Improper transport

IMPORTANT!

Improperly transporting the distance sensor may damage it.

Substantial material damage may result in the event of improper transport.

For this reason:

- The device should be transported only 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 starting installation work.

5.2 Transport inspection

Upon receipt, please 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 scope 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.

5.3 Storage

Store the Dx35 distance sensor under the following conditions:

- 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 range: between -40 and +75 °C
- Relative air humidity: max. 95%, non-condensing

For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

NOTE!

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

6 Mounting

Mount distance sensor using suitable screws (M4). The screws are not included in the scope of delivery.

- → See “Dimensions”, Chapter 13.1 on page 57
- → See “Technical data” (e.g. measuring range), Chapter 13 on page 56
- → See “Mounting accessories”, Chapter 14 on page 64

6.1 Aligning the DL and DR variants

For the DL and DR variants, ensure that the reflective tape is arranged such that no direct surface reflections reach the distance sensor.

Align the reflective tape to the distance sensor in an angled position of approx. 1° ... 3°. → See the figure below

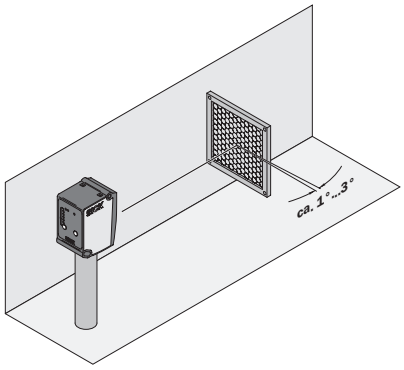


Fig. 6: Correct alignment of the reflective tape to the distance sensor

6.2 Alignment aid for infrared models

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. Observe the typical light spot diameter of the distance sensor. → See Chapter 13.2 on page 58

1. Position object.
2. Attach a small piece of reflective tape to the center of the object for performing alignment.
   → See the figure below
   For simpler alignment, you can also first use a reflective strip in the horizontal direction and then in the vertical direction.
3. Change the distance sensor to alignment mode. To do this, in run mode, press the **set** pushbutton for longer than 5 seconds.
4. Perform coarse alignment. To do this, align the distance sensor roughly in the direction of the reflective tape.

5. 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).
6. In order to leave alignment mode, either press the **set** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.
7. Remove the small reflective tape for alignment from the object.
8. For DL35 and DR35 variants, attach a large reflective tape for performing the measurement.

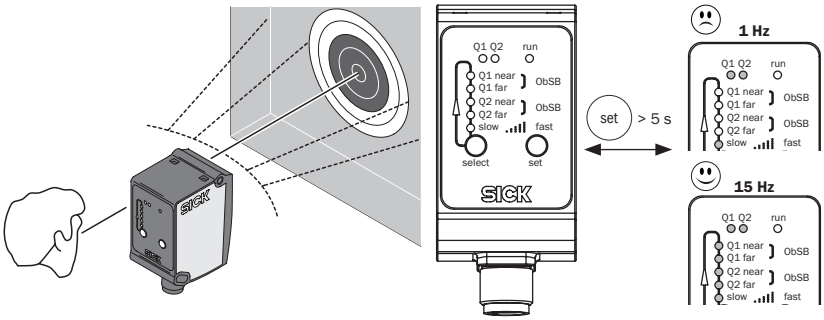


Fig. 7: Aligning infrared light models, entering alignment mode

7 Electrical connection

7.1 Safety

Incorrect supply voltage

IMPORTANT!

Equipment damage due to incorrect supply voltage!

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

For this reason:

- Operate the distance sensor using only safety extra-low voltage.
- The power supply must ensure safe electrical isolation (SELV/PELV) and limit the current to a maximum of 8 A.

Working with live parts

IMPORTANT!

Equipment damage or unpredictable operation due to working with live parts!

Working with live parts 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 instructions

IMPORTANT!

Faults due to incorrect wiring!

Incorrect wiring may result in operational faults.

For this reason:

- Follow the wiring instructions closely.

NOTE!

We recommend using pre-assembled cables for the wiring. → For pre-assembled cables, see Chapter 14 on page 64

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

The IP 65 or IP 67 protection class is only achieved using screwed plug connectors.

By using EMC-compatible cable entries and wiring, you can avoid interference from devices such as switching power supplies, motors, clocked drives, and contactors.

7.3 Connecting the distance sensor electrically

1. Ensure the voltage supply is not connected.
2. Connect the distance sensor according to the connection diagram. → See Chapter 7.4 on page 26
3. Connect the supply voltage.

7.4 Connection diagrams

7.4.1 DT35 and DL35

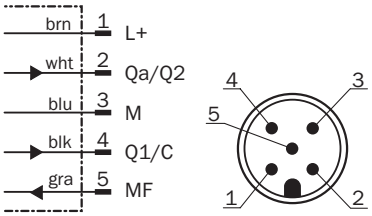


Fig. 8: DT35 and DL35 connection diagram, M12 plug, 5-pin

Contact	Signs	Wire color	Description
1	L+	brown	Supply voltage: → See Chapter 13.4 on page 59
2	Qa/Q2	White	Analog output Qa/ switching output Q2
3	M	Blue	Supply voltage: 0 V
4	Q1/C	Black	Switching output Q1/ IO-Link
5	MF	Gray	Multifunctional input MF

Table 6: Description of M12 plug, DT35 and DL35

7.4.2 DS35 and DR35

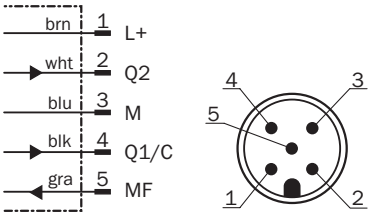


Fig. 9: DS35 and DR35 connection diagram, M12 plug, 5-pin

Contact	Signs	Wire color	Description
1	L+	brown	Supply voltage: → See Chapter 13.4 on page 59
2	Q2	White	Output signal switching device Q2
3	M	Blue	Supply voltage: 0 V
4	Q1/C	Black	Switching output Q1 / IO-Link
5	MF	Gray	Multifunctional input MF

Table 7: Description of M12 plug, DS35 and DR35

8 Commissioning

Pushbutton damage

IMPORTANT!

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.

For this reason:

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

→ For an overview of the various setup options, see Chapter 15 on page 65

8.1 Performing teach-in

NOTE!

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

NOTE!

For the DT35 and DL35 distance sensors, for the Q2 output, you can select a current, voltage, or switching output. The correct output must be selected before performing the teach procedure. → See Chapter 8.5 on page 36

NOTE!

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

8.1.1 Performing one-point teach (DtO)

Distance to object (DtO) – one-point teach

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

For non-inverted behavior, teach in the switching point for Q1 near or for Q2 near. For inverted behavior, teach in the switching point for Q1 far or for Q2 far.

Ensure that you perform a window teach if you teach in the switching points for Q1 near and Q1 far or for Q2 near and Q2 far in a teach procedure. → See Chapter 8.1.2 on page 30

In the range below 50 mm, the switching behavior is dependent on the signal quality.

Q1 near or Q2 near (non-inverted behavior)

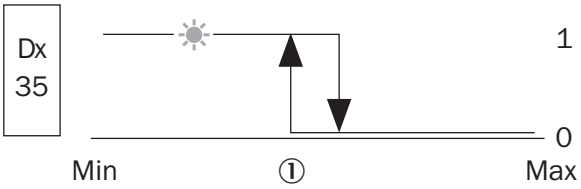


Fig. 10: One-point teach Q1 near or Q2 near (non-inverted behavior)

① *Teach point: switching point, position ①*

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 was not successful, the LEDs **Q1** and **Q2** flash alternately.
4. If necessary, perform fine teach. → See Chapter 8.3 on page 34
5. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

Q1 far or Q2 far (inverted behavior)

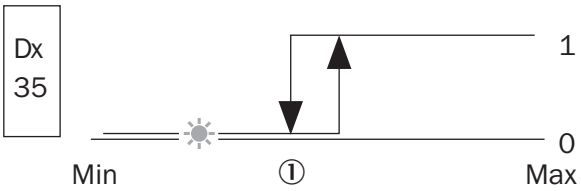


Fig. 11: One-point teach Q1 far or Q2 far (inverted behavior)

① *Teach point: switching point, position ①*

Q1 far or Q2 far (continued)

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. → See Chapter 8.3 on page 34
6. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

8.1.2 Performing window teach (Wnd)

Switching window (Wnd)

The switching output is set when the object is located within the configured window.

In the range below 50 mm, the switching behavior is dependent on the signal quality.

near < far (non-inverted behavior)

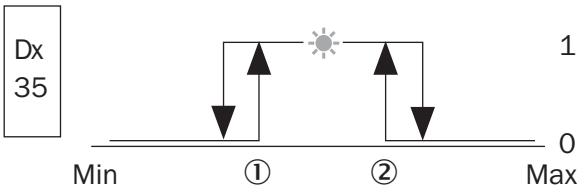


Fig. 12: Setting switching points for switching window (non-inverted behavior)

① *Teach point near, position ①*

② *Teach point far, position 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. → See Chapter 8.3 on page 34

near < far (continued)

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. → See Chapter 8.3 on page 34
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 (inverted behavior)

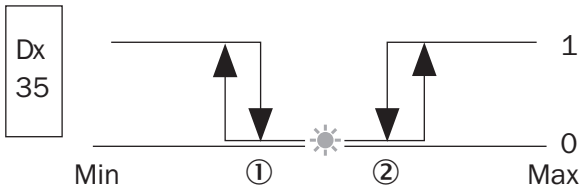


Fig. 13: Setting switching points for switching window (inverted behavior)

① *Teach point far, position 1*
② *Teach point near, position 2*

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. → See Chapter 8.3 on page 34
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. → See Chapter 8.3 on page 34
9. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

8.1.3 Teaching in the background (ObSB)

Object between Sensor and Background (ObSB)

The output is set when objects are detected that differ from the background. The tolerance range around the taught-in background is ± 25 mm plus a hysteresis of 25 mm. The hysteresis can be configured only via IO-Link.

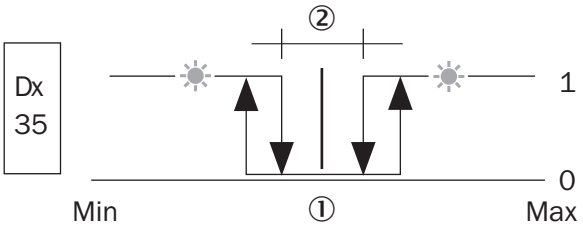


Fig. 14: Teaching in object between sensor and background (ObSB)

① *Teach point, position ①*

② *Tolerance around teach 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 LEDs **Q1 near** and **Q1 far (ObSB)** light 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. → See Chapter 8.3 on page 34
6. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

8.2 Scaling the analog output

NOTE!

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

NOTE!

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 ≙ 10000 mm
- DL35: 4 mA / 0 V ≙ 200 mm, 20 mA / 10 V ≙ 50000 mm
- The resolution of the analog output is 12 bits.

Set the output behavior for the output Q2 (4 ... 20 mA / 0 ... 10 V / switching output 2) in expert mode. → See Chapter 8.5 on page 36

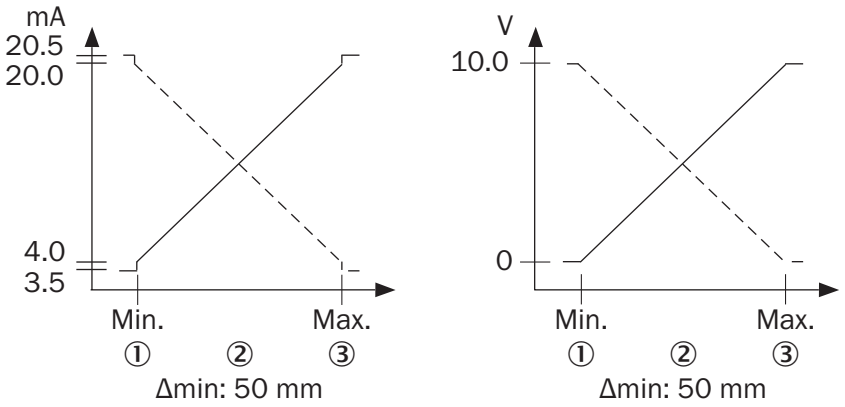


Fig. 15: Scaling the analog output

① *Teach point for distance near the sensor*

② *Minimum span between the teach points of the distance near the sensor and the distance far from the sensor: 50 mm*

③ *Teach point for distance far from the sensor*

Scaling the analog output
Example

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. → See Chapter 8.5 on page 36

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. → See Chapter 8.3 on page 34
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. → See Chapter 8.3 on page 34
10. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

8.3 Performing fine teach

NOTE!

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

Performing fine teach

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.

1. Perform teach. → See Chapter 8.1 on page 28 and Chapter 8.2 on page 33
2. Press the **select** and **set** pushbuttons simultaneously for less than 1 second. The LED of the teach point to be moved flashes.

Performing fine teach (continued)

3. 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 **set (–)** pushbutton, you move the previously taught-in point by –10 mm.
4. 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.

8.4 Configuring the speed

NOTE!

The configured speed affects the measuring range, repeatability, switching frequency, and response time to be achieved.
→ For "Repeatability" diagrams, see Chapter 13.10 on page 61
→ For output rates, response time and switching frequency, see Chapter 13.3 on page 58

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** flashes.
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** lights up continuously: Expert setting, adjustable only via IO-Link
     → See Chapter 9.3.3 on page 43
4. In order to leave teach mode, either press the **select** pushbutton longer than 5 seconds or wait 5 minutes without pushing the pushbuttons.

8.5 Expert mode

Use expert mode to set the following functions:

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

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 [1]	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

1) For DT35/DL35 distance sensors only

Table 8: Overview of expert mode

Output: 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.

8.6 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.

8.7 External teach functions

NOTE!

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. → *See Chapter 10.6 on page 53*

You can perform an external teach by applying a signal to the multifunctional input MF. The “external teach” option for the multifunction input MF must be selected via expert mode. → See Chapter 8.5 on page 36

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.

Overview of external teach functions (continued on next page)

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

Overview of external teach functions (continued)

Teach function	Time [ms]
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
Blank laser	> 3000

Table 9: Overview of external teach functions

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 Chapter 10.5 on page 52

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 Chapter 10.6 on page 53

9 IO-Link interface

The distance sensors are IO-Link-capable in accordance with following specification:

- Devices up to date code **2033**xxxx (see type label under S/N): IO-Link V1.0
- Devices from date code **2034**xxxx (see type label under S/N): IO-Link V1.0 and V1.1 (automated changeover of the device using the uploaded IODD)

You can download the specific sensor IO-Link device description and the IODD (IO Device Description) online at “www.sick.com/Dx35”.

9.1 Physical layer

Description	Value
SIO mode (standard I/O mode)	Yes
Minimum cycle time (output rate)	2.3 ms
Speed	COM2 (38.4 kBaud)
Process data width	16 bits (frame type 2.2)
Parameter configuration server function (data storage)	Yes (only devices from date code **2034**xxxx and with IO-Link V1.1)

Table 10: Physical layer

9.2 Process data

The process data for the Dx35 distance sensors has a data width of 16 bits. The content can be adjusted using the "process data structure" index 83. Factory setting for index 83: Option "3" 16-bit distance measured value

Description	Value
Access	Read
Data	2 bytes
Data type	UINT (unsigned integer)

Table 11: Process data

0: Distance measured value, status of switching outputs Q1 and Q2

MSB[1]															LSB[2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Distance measured value (14-bit) [4), 5)]														Q1	Q2

1: Distance measured value, OWS signal level warning, alarm [3]

MSB[1]															LSB [2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Distance measured value (14-bit) [4], [5]														OWS [3]	Alarm

2: Level, OWS signal level warning, alarm [3]

MSB[1]															LSB[2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Signal level (14-bit) [3]														OWS [3]	Alarm

3: Distance (factory setting)

MSB[1]															LSB [2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Distance measured value (16 bit) [5]															

4: Distance value, signal quality

MSB[1]															LSB [2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Distance measured value (14-bit) [4], [5]														Signal quality (2-bit) [6]	

5: Timer (only for Extended version [7])

MSB[1]															LSB [2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Time measured value (16 bit) [5]															

6: Timer, status of switching output Q1 and Q2 (only for Extended version [7])

MSB[1]															LSB [2]
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Time measured value (14 bit) [4], [5]														Q1	Q2

1) Most significant bit

2) Least significant bit

3) → See Chapter 10.1 on page 49

4) 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".

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

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

7) → See Chapter 10.7 on page 54

Table 12: Process data structure

9.3 Service data

9.3.1 IO-Link-specific

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
12 (0x0C)	Device Access Locks	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 storage 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 byte IO-Link V1.1: 32 byte	Dx35 product family	–

Table 13: IO-Link-specific service data

Other settings

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
84 (0x54)	User brand 1	UINT32	R/W	32 bit		–
85 (0x55)	User brand 2	UINT16	R/W	16 bit		–
40 (0x28)	Process data	UINT16	R	16 bit		Content depends on "process data" setting

Table 14: IO-Link-specific service data – other settings

9.3.2 SICK-specific – outputs

NOTE!

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

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
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 ... 50000 mm	**–**	In 1 mm steps
72 (0x48)	Q1 switching point far	UINT16	R/W	50 ... 50000 mm	**DT35/DS35: 10000** **DL35/DR35: 50000**	In 1 mm steps
71 (0x47)	Q1 hysteresis near	UINT16	R/W	0 ... 49550 mm	**25**	In 1 mm steps
73 (0x49)	Q1 hysteresis far	UINT16	R/W	0 ... 49550 mm	**25**	In 1 mm steps
94 (0x5E)	Q1 near-far-center displacement	UINT16	R/W	50 ... 50000 mm	–	In 1 mm steps
92 (0x5C)	Q2 output function	UINT8	R/W	• 0: 4 ... 20 mA • 1: 0 ... 10 V • 2: Switching	**DT35/DL35: 0** **DS35/DR35:** –	
74 (0x4A)	Q2 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)	**DS35/DR35: 0** **DT35/DL35:–**	→ See Chapter 8 on page 68, Chapter 10.1 on page 49 and Chapter 10.4 on page 51
75 (0x4B)	Q2 switching point near	UINT16	R/W	50 ... 50000 mm	**–**	In 1 mm steps
77 (0x4D)	Q2 switching point far	UINT16	R/W	50 ... 50000 mm	**DT35/DL35: –** **DS35: 10000** **DR35: 50000**	In 1 mm steps
76 (0x4C)	Q2 hysteresis near	UINT16	R/W	0 ... 49550 mm	**25**	In 1 mm steps
78 (0x4E)	Q2 hysteresis far	UINT16	R/W	0 ... 49550 mm	**25**	In 1 mm steps
95 (0x5F)	Q2 near-far-center displacement	UINT16	R/W	50 ... 50000 mm	–	In 1 mm steps
79 (0x4F)	Q2 analog near	UINT16	R/W	50 ... 50000 mm	**DT35: 50** **DL35: 200** **DS35/DR35: –**	In 1 mm steps

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
80 (0x50)	Q2 analog far	UINT16	R/W	50 ... 50000 mm	**DT35: 10000** **DL35: 50000** **DS35/DR35: –**	In 1 mm steps
96 (0x60)	Q2 analog near-far-center displacement	UINT16	R/W	50 ... 50000 mm	**DT35: 5025** **DL35: 25100** **DS35/DR35: –**	In 1 mm steps
93 (0x5D)	Q1/Q2 signal level warning (OWS) threshold	UINT16	R/W	0 ... 65535	–	→ See Chapter 10.1 on page 49
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** ... 50000		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

Table 15: SICK-specific service data – outputs

9.3.3 SICK-specific – sensor performance

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
103 (0x67)	Response time	UINT8	R/W	• 0: Expert • 1: Super-slow • **2: Slow** • 3: Medium • 4: Fast • 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. Devices from date code **2034**xxxx: As soon as index 64, 67 or 66 has been rewritten, “0: Expert” is automatically set.

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
64 (0x40)	Integration time measurement or output rate	UINT8	R/W	• 0 • 1 • 2 • **3** • 4 • 5 • 6 • 7 • 8		DT35 and DS35 red laser, class 1 devices: Integration time measurement or output rate 2^n * 2 ms, All other devices: Integration measurement or output rate 2^n * 1 ms Devices up to date code **2033**xxxx: Writable only if “0: Expert” was selected for index “103”. Devices from date code **2034**xxxx: Writing automatically generates the selection “0: Expert" for index “103”.
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 the “0: Expert” was selected for index “103”. Devices from date code **2034**xxxx: Writing automatically generates the selection “0: Expert” for index “103”.

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
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 the “0: Expert” was selected for index “103”. Devices from date code **2034**xxxx: Writing automatically generates the selection “0: Expert” for index “103”.

1) SICK-specific service data – sensor performance

9.3.4 SICK-specific – teach

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
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.

1) SICK-specific service data – teach

9.3.5 SICK-specific – process data

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
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	→ Page 39, Chapter 9.2.
105 (0x69)	Process data resolution	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 standardization	UINT16	R/W	• **0** ... 50,000 mm		Move process data zero point in 1 mm steps.

Table 16: SICK-specific service data – process data

9.3.6 SICK-specific – other settings

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
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 Chapter 10.6 on page 53

Index decimal (hex)	Description	Format	Access	Value range	Example	Remarks
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 Chapter 10.4 on page 51
82 (0x52)	Key lock	UINT8	R/W	• **0: OFF** • 1: ON	0	
68 (0x44)	Laser on/off	UINT8	R/W	• 0: OFF • **1: ON**	1	–

Table 17: SICK-specific service data – other settings

9.3.7 System command

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

Table 18: System command

9.4 Error codes

→ For error codes, see IO-Link specification

10 Other functions

10.1 Output as signal level warning (OWS)

NOTE!

This function can be configured only via IO-Link.

You can configure the Q1 or Q2 output for the signal level warning (OWS). The level can be adjusted within the range of 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.

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

→ See Chapter 9.3.2 on page 41, index 74, 93 and 65

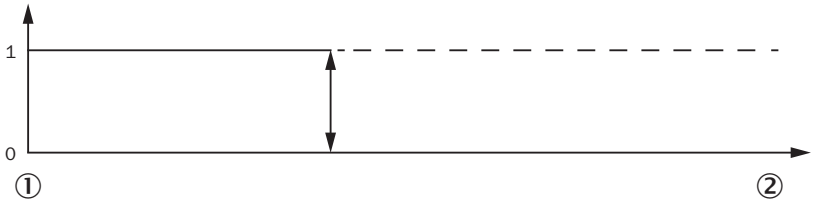


Fig. 16: Output behavior for signal level warning (OWS) depends on the reception level

① *Minimum reception level*

② *Maximum reception level*

10.2 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:

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.
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.

Table 19: Switching behavior - functions

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).

SOPAS ET: “Output settings” page > “Switching delay”

10.3 Find me!

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

When the “Find me!” function is activated, the two yellow LEDs on the sensor 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 sensor is switched off and back on when the "Find me!" function is activated, the "Find me!" function will no longer be active then.

SOPAS ET: “Identification” page

10.4 Output as alarm output

NOTE!

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 Chapter 9.3.6 on page 47

10.5 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 (→ Page 37, Chapter 8.7)
- Teach via IO-Link
- Value input via IO Link.

→ For setting via IO-Link, see Chapter 9.3.2 on page 41, 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.

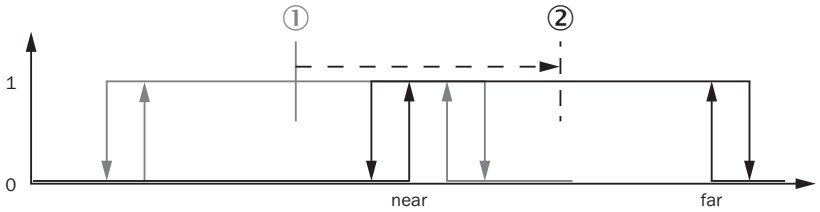


Fig. 17: Centering function for the example "window not inverted."

① *Old center point before centering teach*

② *New center point after centering teach*

10.6 Teach confirmation function

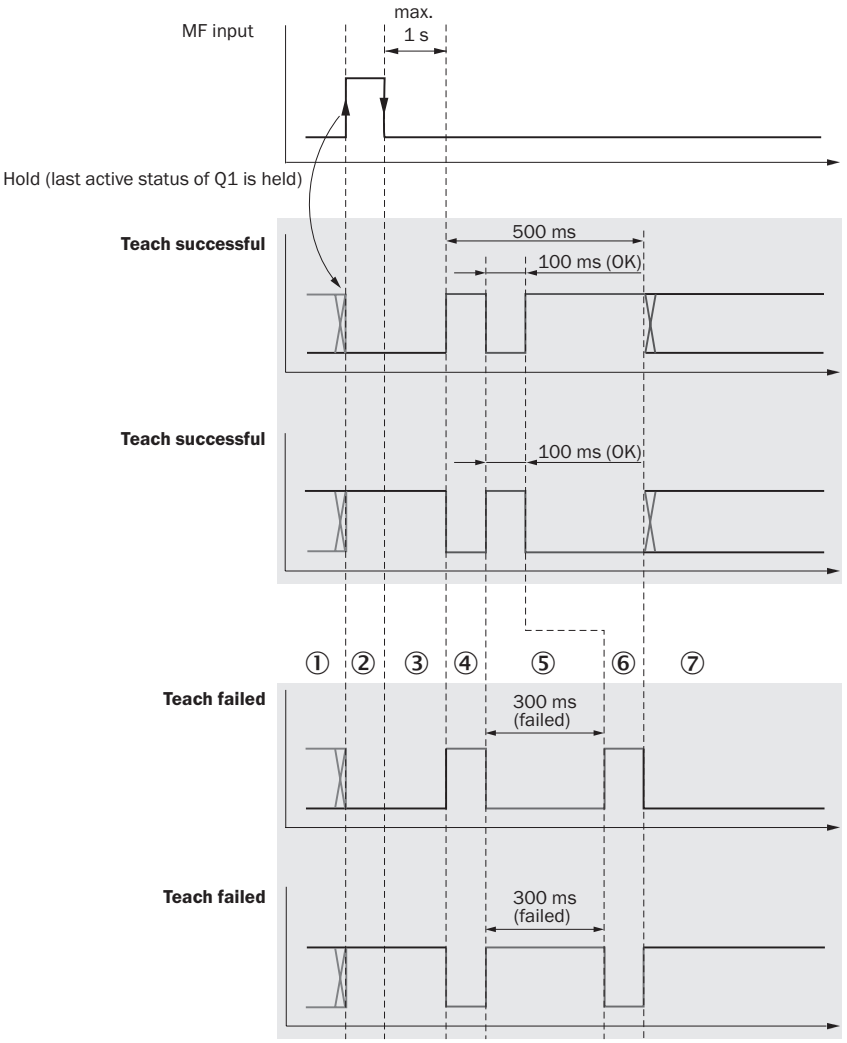


Fig. 18: Teach confirmation function

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 execution 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.*

10.7 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.

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

Table 20: Device types, device ID, function

SOPAS ET: “Identification” page > device IDs

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.

10.8 Timer function

The timer function is only available with the “Dx35 Extended” device type.
→ See Chapter 10.7 on page 54.

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).

SOPAS ET:

- "Advanced settings" page (configuring the process data)
- "Main settings & visualization" page (display of the measured time)

11 Cleaning and maintenance

11.1 Cleaning

IMPORTANT!

Device damage due to improper cleaning!

Improper cleaning may result in device damage.

For this reason:

- Never use cleaning agents containing aggressive substances.
- Never use sharp 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 distance 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 housing.	Specialist
Every 6 months depending on the application conditions with regard to shock and vibration	Check the screw connections and plug connectors.	Specialist

Table 21: Maintenance schedule

12 Disposal

Please observe the following when disposing of the device:

- Do not dispose of the device in domestic refuse.
- Dispose of the device according to the relevant country-specific regulations.

13 Technical data

NOTE!

You can download, save, and print the relevant online data sheet for your distance sensor, including technical data, dimensions, and connection diagrams, from “www.sick.com/Dx35”.

13.1 Dimensions

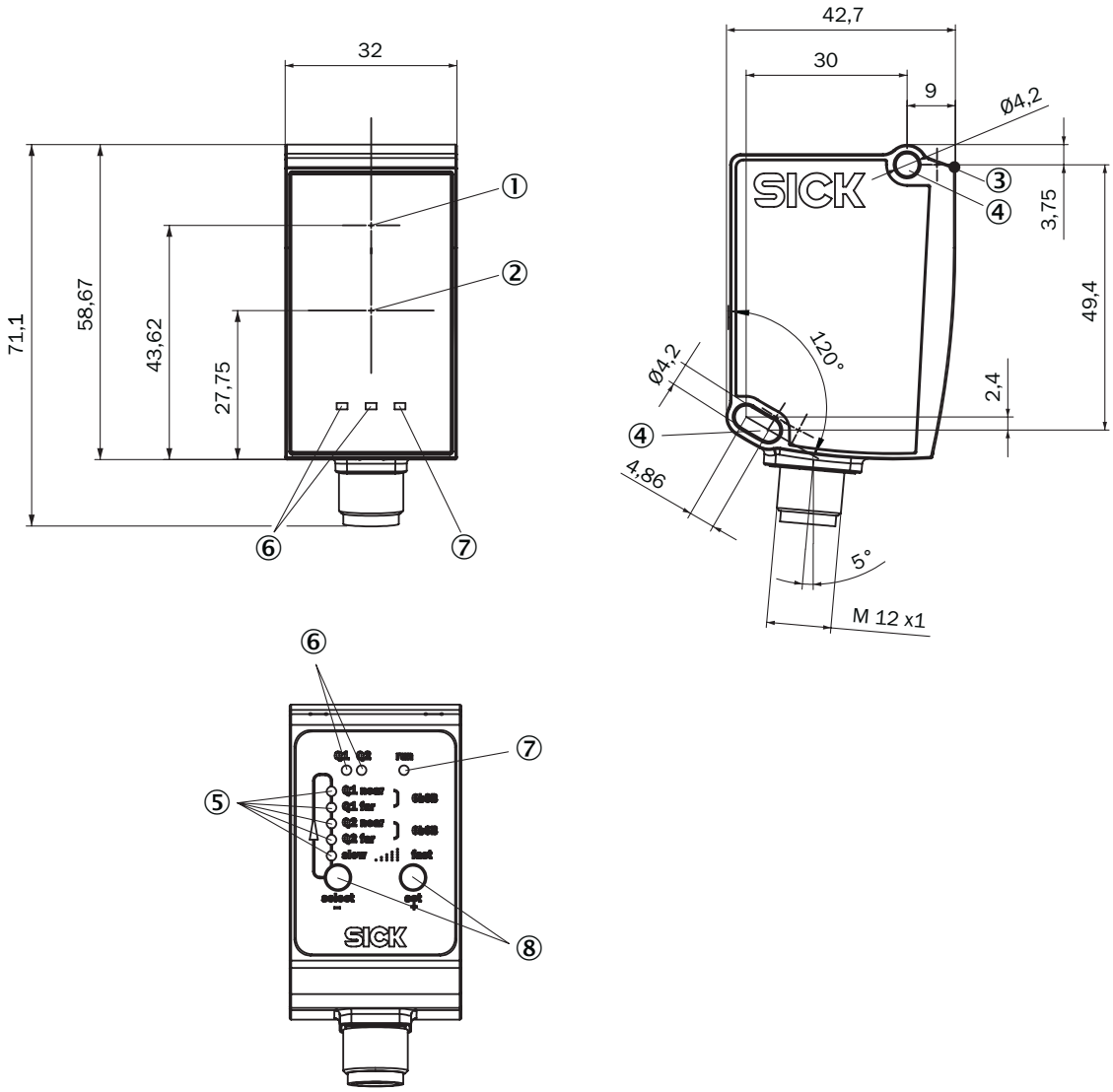


Fig. 19: "Dx35 distance sensor" dimensions

① *Optical axis, sender*
② *Optical axis, receiver*
③ *Reference surface (corresponds to 0 mm)*
④ *M4 fixing hole*
⑤ *Teach-in LEDs*
⑥ *Status Q1/Q2 LEDs*
⑦ *Operating indicator*
⑧ *Operating pushbuttons*

13.2 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
Shaft Length	• 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 for 2 m distance
Laser operating life (MTTF at +25 °C)	100,000 h

Table 22: Laser/optics

13.3 Performance data

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) → For “Repeatability” diagrams, see Chapter 13.10 on page 61
Resolution	0.1 mm
Repeatability [2]	0.5 mm ... 5 mm → For “Repeatability” diagrams, see Chapter 13.10 on page 61
Accuracy [3]	• DT35-Bxxxxx, DS35-Bxxxxx: typically ± 10 mm • DL35-Bxxxxx, DR35-Bxxxxx: typically ± 15 mm
Output rate [4], [5]	→ See Table 24, page 59
Response time [4], [6]	→ See Table 24, page 59
Switching frequency [4], [6]	→ See Table 24, page 59
Initialization time	≤ 500 ms
Warm-up time	≤ 20 min

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) Depends on the configured speed "super-slow" ... "super-fast"

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

6) Lateral entry of the object into the measuring range

Table 23: Performance data

Output rate, response time, and switching frequency as a function of the speed setting

	All Dx35 except for DT35-B15551 and DS35-B15521				
	Super-fast	**Fast**	**Medium**	**Slow**	**Super-slow**
Output rate	1 ms	2 ms	4 ms	8 ms	32 ms
Response time	2.5 ms	6.5 ms	12.5 ms	24.5 ms	96.5 ms
Switching frequency	333 Hz	100 Hz	50 Hz	25 Hz	6 Hz

	DT35-B15551 and DS35-B15521				
	Super-fast	**Fast**	**Medium**	**Slow**	**Super-slow**
Output rate	2 ms	4 ms	8 ms	16 ms	64 ms
Response time	4.5 ms	12.5 ms	24.5 ms	48.5 ms	192.5 ms
Switching frequency	166 Hz	50 Hz	25 Hz	12 Hz	3 Hz

Table 24: Overview of output rate, response time, and switching frequency

13.4 Supply

Supply voltage U_V [1]	• 12 V DC ... 30 V DC • 18 V DC ... 30 V DC (when using IO-Link) • DT35-Bxxxxx, DL-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. 8 A

2) At 20 °C and without load

3) May not fall short of or exceed U_V tolerances

Table 25: Supply

13.5 Inputs

Multifunction input MF [1]	1 x → See Chapter 8.5 on page 36

1) Response time: ≤ 60 ms

Table 26: Inputs

13.6 Outputs

Switching output [1), 2)]	• DT35-Bxxxxx, DL35-Bxxxxx: 1 x / 1 x / 2 x push-pull: PNP/NPN (100 mA), IO-Link [3)] • DR35-Bxxxxx, DS35-Bxxxxx: 2 x push-pull: PNP/NPN (100 mA), IO-Link
Hysteresis [4)]	• 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 [3)]	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 bit

1) Output Q, short-circuit protected

2) Voltage drop < 3 V

3) Output Q2 adaptable: 4 mA ... 20 mA / 0 V ... 10 V / switching output

4) Configurable via IO-Link

Table 27: Outputs – sensors with switching outputs

13.7 Interfaces

Data interface	IO-Link

Table 28: Interfaces

13.8 Ambient data

Protection class	III
Ambient temperature range [1)]	–30 °C ... +55 °C
Storage temperature range	–40 °C ... +75 °C
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

Table 29: Ambient conditions

13.9 Structural design

Dimensions	→ See Chapter 13.1 on page 57
Weight	65 g
Housing material	• Housing: plastic (ABS and PC) • Front screen: acrylic glass (PMMA)
Connection type	Male connector, M12, 5-pin
Display	LEDs → See Chapter 13.1 on page 57

Table 30: Structural design

13.10 "Repeatability" diagrams

13.10.1 DT35 and DS35 models

Characteristic curve for "super-slow" speed

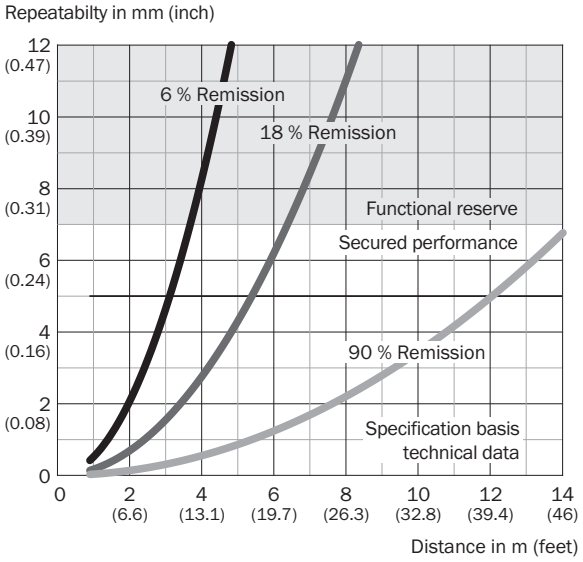


Fig. 20: Characteristic curve for "super-slow" speed

Characteristic curve for "slow" speed

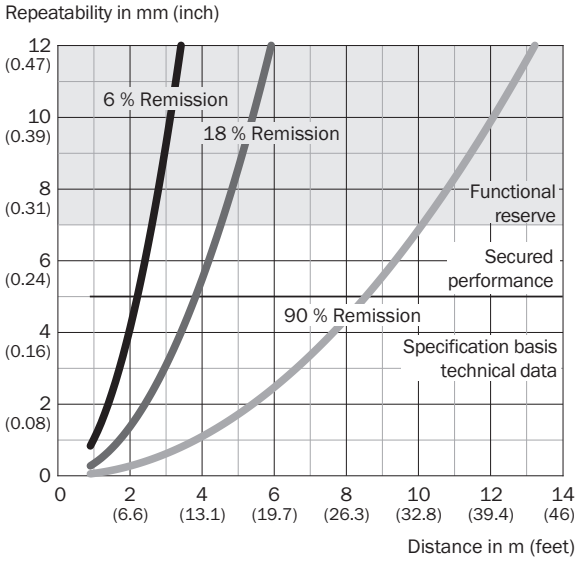


Fig. 21: Characteristic curve for "slow" speed

Characteristic curve for "medium" speed

Medium

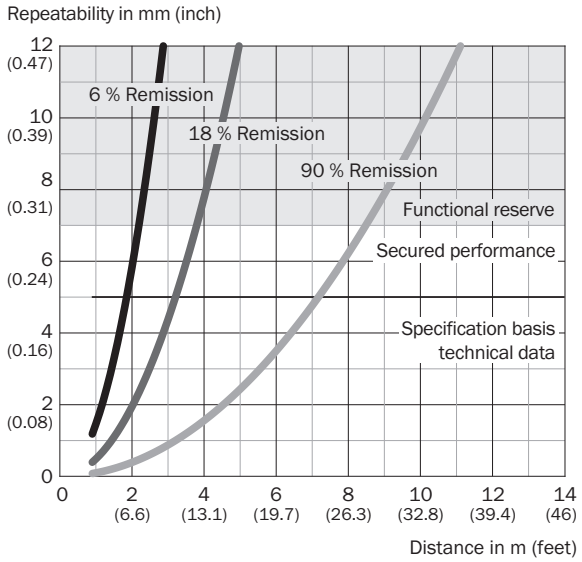


Fig. 22: Characteristic curve for "medium" speed

Characteristic curve for "fast" speed

Fast

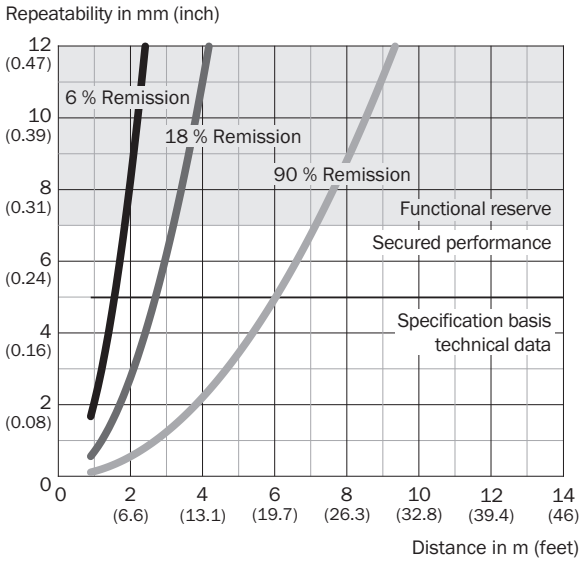


Fig. 23: Characteristic curve for "fast" speed

Characteristic curve for "super-fast" speed

Super Fast

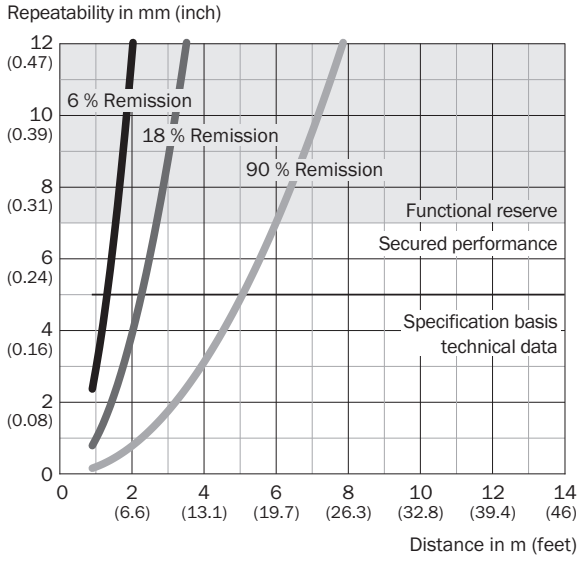


Fig. 24: Characteristic curve for "super-fast" speed

13.10.2 DL35 and DR35 models

Characteristic curve for "super-slow" ... "super-fast" speeds

Super Slow ... Super Fast

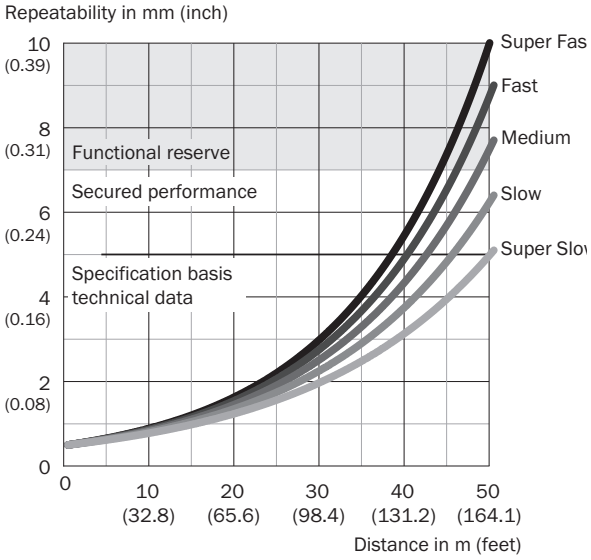


Fig. 25: Characteristic curve for "super-slow" ... "super-fast" speeds

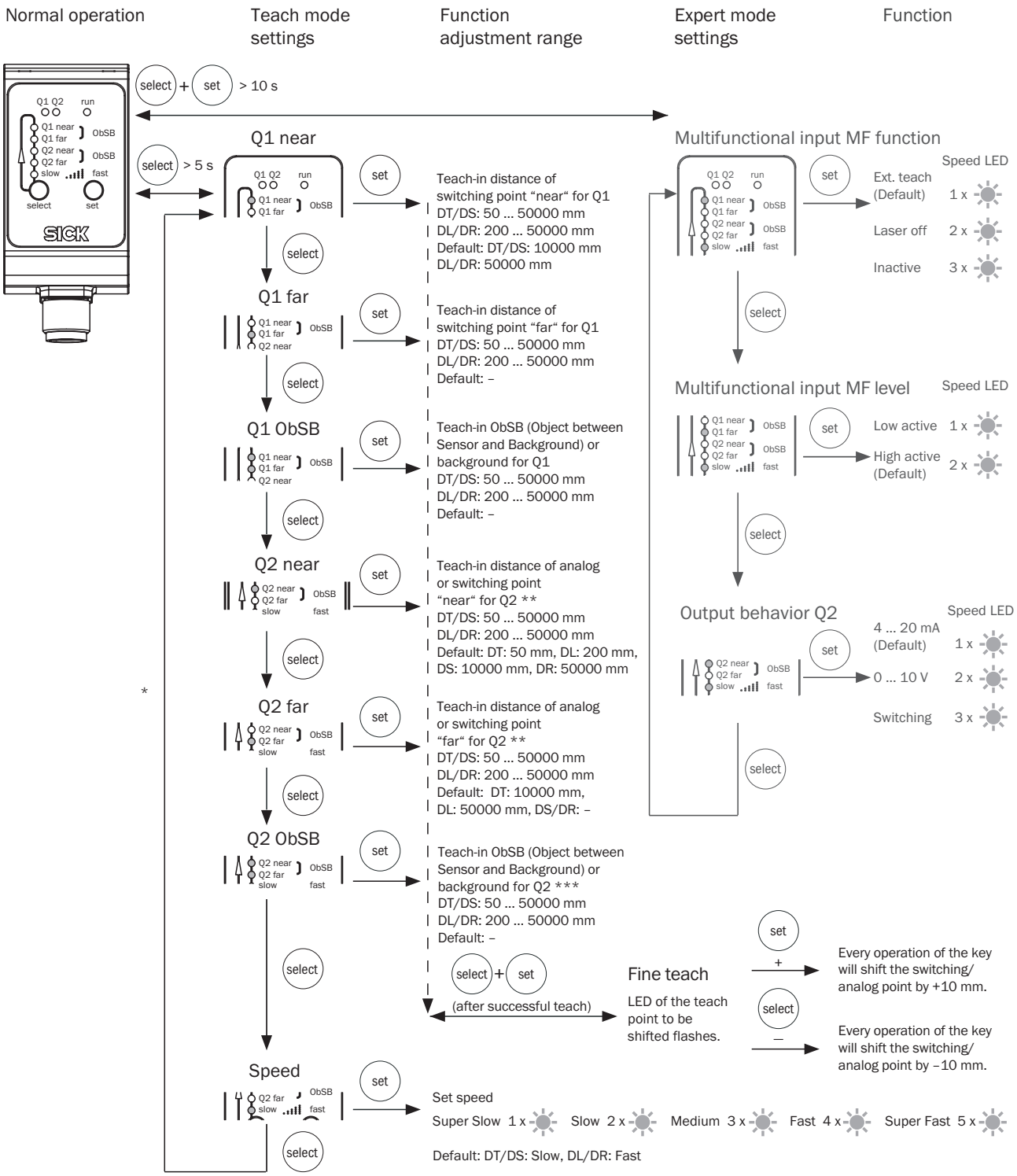
14 Accessories

NOTE!

Accessories and where applicable mounting information can be found online at:

“www.sick.com/Dx35”

15 Configuration overview



* 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

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