OPERATING INSTRUCTIONS

OLS20

Line guidance sensor

SICK
Sensor Intelligence.

Described product

OLS20

Manufacturer

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Legal information

Original document

This document is an original document of SICK AG.

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1 About this document

1.1 Further information

You can find the product page with further information under the pid.sick.com/{P/N}/{S/N}.

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

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

The following information is available depending on the product:

- Data sheets
- These publication in all available languages
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Other publications
- Software
- Accessories

1.2 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 Intended use

The OLS20 line guidance sensor is an opto-electronic sensor intended for detecting luminescent guide tracks as well as reading out 1D codes when they are driven over by automated guided vehicles.

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.

NOTICE
Radio interference may occur when the sensor is used in residential areas.

► Only use the device in industrial environments (EN 61000-6-4).

2.2 Improper use

- The sensor does not constitute a safety-relevant device according to the EC Machinery Directive (2006/42/EC).
- The sensor must not be used in explosion-hazardous areas.
- Any other use that is not described as intended use is prohibited.
- Any use of accessories not specifically approved by SICK AG is at your own risk.
- The sensor is not suitable for outdoor applications.

NOTICE
Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, take note of the following information:

► The sensor should be used only in line with intended use specifications.
► All information in these operating instructions must be strictly complied with.

2.3 Notes on UL approval

The device must be supplied by a Class 2 source of supply.

UL Environmental Rating:

- Enclosure type 1
- Ambient temperature: max. 55 °C

2.4 Limitation of liability

Applicable standards and regulations, the latest state of technological development, and our 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, consumables, and accessories

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

2.5 Requirements for skilled persons and operating personnel

WARNING
Risk of injury due to insufficient training.

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

- 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:

- **Instructed personnel** have been briefed by the operating entity about the tasks assigned to them and about potential dangers arising from improper action.
- **Skilled personnel** have the specialist training, skills, and experience, as well as knowledge of the relevant regulations, to be able to perform tasks assigned to them and to detect and avoid any potential dangers independently.
- **Electricians** have the specialist training, skills, and experience, as well as knowledge of the relevant standards and provisions to be able to carry out work on electrical systems and to detect and avoid any potential dangers independently. In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e.g., Master Electrician). Other relevant regulations applicable in other countries must be observed.

The following qualifications are required for various activities:

Activities	Qualification
Mounting, maintenance	▪ Basic practical technical training ▪ Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	▪ Practical electrical training ▪ Knowledge of current electrical safety regulations ▪ Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	▪ Basic knowledge of the design and setup of the described connections and interfaces ▪ Basic knowledge of data transmission ▪ Knowledge of the operation and control of the devices in their particular application
Operation of the devices in their particular application	▪ Knowledge of the operation and control of the devices in their particular application ▪ Knowledge of the software and hardware environment in the application

2.6 Hazard warnings and operational safety

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.

CAUTION EYE SAFETY
The OLS20 is equipped with LED illumination. The sensor meets the criteria of risk group 2 according to IEC 62471:2006. The device emits potentially dangerous optical radiation. Do not look into the lamp for extended periods of time during operation. This could damage your eyes.

2.7 Repairs

Repair work on the sensor may only be performed by qualified and authorized personnel from SICK AG. Interruptions or modifications to the sensor on the part of the customer will invalidate any warranty claims against SICK AG.

3 Product description

3.1 Product identification

3.1.1 Type label

Figure 1: Type label

① Type designation
② ID no.
③ Serial number
④ Maschine readable code

3.1.2 Structure and status indicators

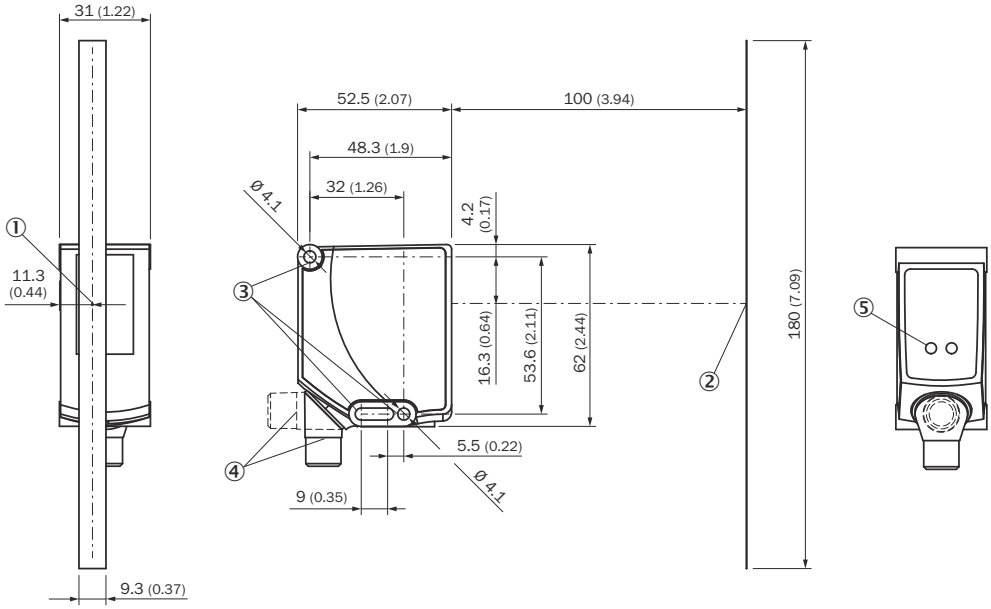


Figure 2: Device view

① Optical axis
② Field of view
③ Fixing hole
④ M12 device connection, rotatable by 270°
⑤ Display unit

Function indicators (LEDs)

Table 1: Function indicators (LEDs)

Function indicator	Description
Q	Switching output display • Yellow LED: Output active • LED off: Output inactive • LED flashing (10 Hz): Overcurrent/short-circuit protection has triggered
PWR	Operating status display • Green LED: Normal operation/Supply voltage on • LED off: No operation

3.2 Product features

The OLS20 line guidance sensor is an opto-electronic sensor which detects the line center point of up to three luminescent tracks. To do so, the sensor stimulates the guide track(s) with blue light / UV radiation and detects the remitted light using a receiver array.

This track is typically conventional adhesive tape or a colorful luminescence track. It is not necessary to teach in the sensor.

For additional information on the adhesive tape and bar code labels recommended by SICK, see the product accessories at www.sick.com/ols20.

In addition, the sensor reads 1D codes in “interleaved 2/5” format attached perpendicular to the track.

4 Transport and storage

4.1 Transport

Improper transport

CAUTION DAMAGE TO THE PATTERN SENSOR DUE TO IMPROPER TRANSPORT!
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.

4.2 Transport inspection

Immediately upon receipt at the receiving work station, 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.

4.3 Storage

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- Do not store outdoors.
- Store in a dry area that is protected from dust.
- To allow any residual dampness to evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Ambient conditions", page 39.
- Relative humidity: see "Ambient conditions", page 39.
- 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 Preparation for mounting

1 Select the mounting site for the OLS20 in accordance with the following chapter "Installation requirements", page 12.
2 Mount the OLS20 using the fixing holes.
"Structure and status indicators", page 10
"Accessories", page 40

5.1.1 Installation requirements

NOTICE
Radio interference may occur when the sensor is used in residential areas.
Only use the device in industrial environments (EN 61000-6-4).

- Typical space requirements for sensor, see "Structural design", page 39.
- Comply with technical parameters such as the permitted ambient conditions for the operation of the sensor (e.g., temperature range, EM interference), see "Ambient conditions", page 39.
- Protect the sensor from direct sunlight.
- Only affix the sensor using accessories supplied for this purpose -> there are no screw connections on the sensor.
- The light spot must cover the possible area of the three tracks.
- Sensing distance: 100 mm
  The sensing distance is the distance from the front sensor edge (housing edge) to the track or the ground.

5.1.2 Scope of delivery

The following are included with delivery:

- OLS20 Optical Line Guidance Sensor
- 1 quick-start guide

Accessories:

Accessories (e.g., cables, fastening adapters) are only supplied if ordered separately.

5.2 Mounting the sensor

Arrangement over guide track

The OLS20 must be aligned orthogonally to the guide track with its light spot. The sensing range is 100 mm.

The sensor should be attached vertically over the guide track.

Table 2: Mounting

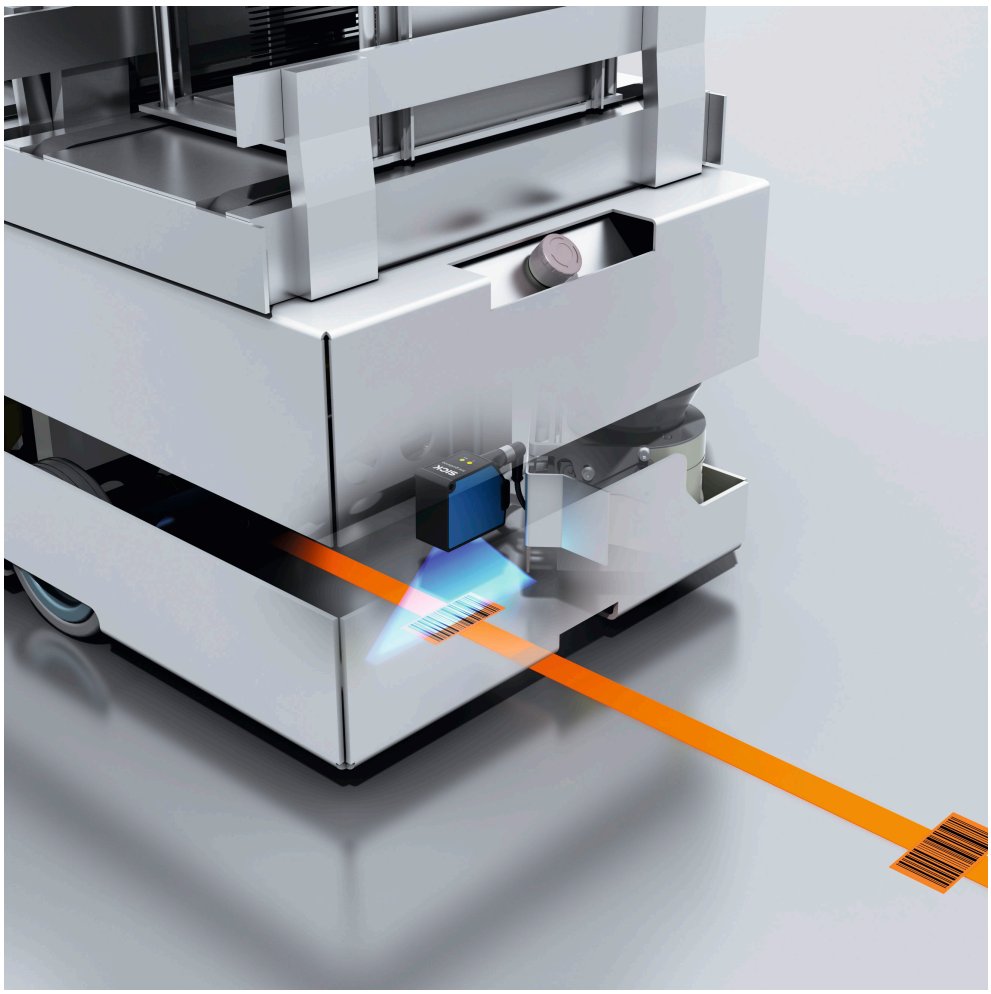


Figure 3: Arrangement over guide track

The code can be arranged directly on the track or next to the track. If it is arranged next to the track (field of view +/-50 mm), it is detected as an additional track.

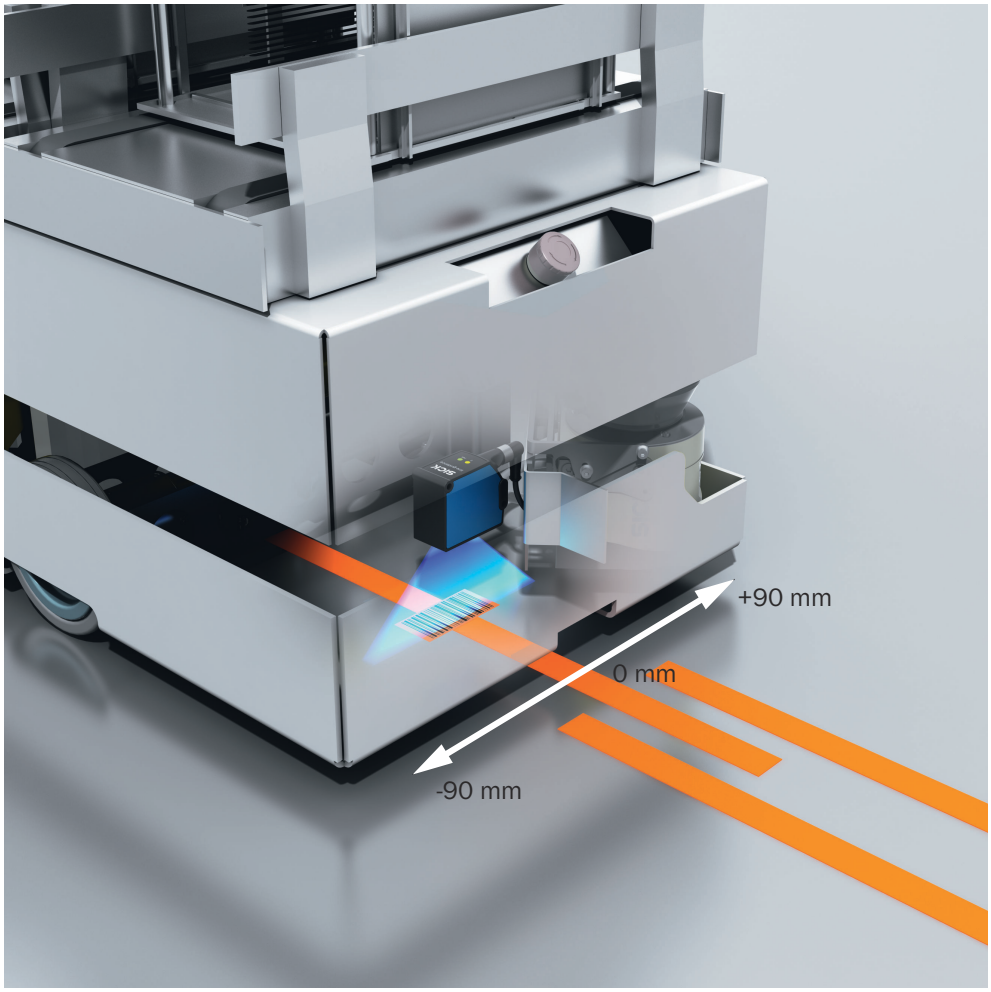


Figure 4: Arrangement with branches and junctions

Arrangement with branches and junctions

If there are branches or junctions, we recommend arranging the tracks as illustrated. The minimum distance between the tracks is 7 mm.

In addition, we recommend a minimum overlap length of the tracks of at least 10 cm. At speeds greater than 2 m / s, this range should be increased.

Figure 4 also shows the sign convention of the LCP with the factory settings. (-90 mm ... +90 mm on the cable side).

6 Electrical installation

6.1 Safety

6.1.1 Notes on electrical installation

CAUTION
Danger due to incorrect supply voltage!
An incorrect supply voltage may result in injuries from electric shocks and/or damage to the device.

- Only operate the sensor with safety/protective extra-low voltage (SELV/PELV).

NOTICE
Sensor damage or unpredictable operation due to working with live parts.
Working with live parts may result in unpredictable operation.

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

- **The electrical installation must only be performed by electrically qualified personnel.**
- **Standard safety requirements must be observed when working on electrical systems!**
- Only switch on the supply voltage for the device when the connection tasks have been completed and the wiring has been thoroughly checked.
- When using extension cables with open ends, ensure that bare wire ends do not come into contact with each other (risk of short-circuit when supply voltage is switched on!). Wires must be appropriately insulated from each other.
- Wire cross-sections in the supply cable from the user's power system must be designed in accordance with the applicable standards. When this is being done in Germany, observe the following standards: DIN VDE 0100 (Part 430) and DIN VDE 0298 (Part 4) and/or DIN VDE 0891 (Part 1).
- Electrical circuits connected to the device must be configured as SELV circuits (SELV = safety extra-low voltage/PELV = protective extra-low voltage).
- Protect the device with a separate fuse at the start of the supply circuit.

A shielded cable is not required in order to adhere to the electromagnetic compatibility guidelines specified by DIN EN 60947-5-2. It is recommended, however, especially when working with longer connecting cables.

The IP enclosure rating for the sensor is only achieved if the connected cable is completely screwed in.

CAUTION
This is a class A product. In a household environment, this device can cause radio interference. The user should take appropriate measures as required.

6.1.2 Wiring notes

NOTE
Preassembled cables can be found online at:

► www.sick.com/ols20

Please observe the following wiring notes:

- During installation, pay attention to the different cable groups. The cables are grouped into the following four groups according to their sensitivity to interference or radiated emissions:
  - Group 1: Cables very sensitive to interference, such as analog measuring cables
  - Group 2: Cables sensitive to interference, such as sensor cables, communication signals, bus signals
  - Group 3: Cables which are a source of interference, such as control cables for inductive loads, motor brakes
  - Group 4: Cables which are powerful sources of interference, such as output cables from frequency inverters, welding system power supplies, power cables
  - ► Cables in groups 1, 2 and 3, 4 must be crossed at right angles, see figure 5.
  - ► Cables in groups 1, 2 and 3, 4 must be routed in different cable channels or metallic separators must be used, see figure 6 and see figure 7. This applies particularly where cables of devices with a high level of radiated emission, such as frequency converters, are laid parallel to sensor cables.

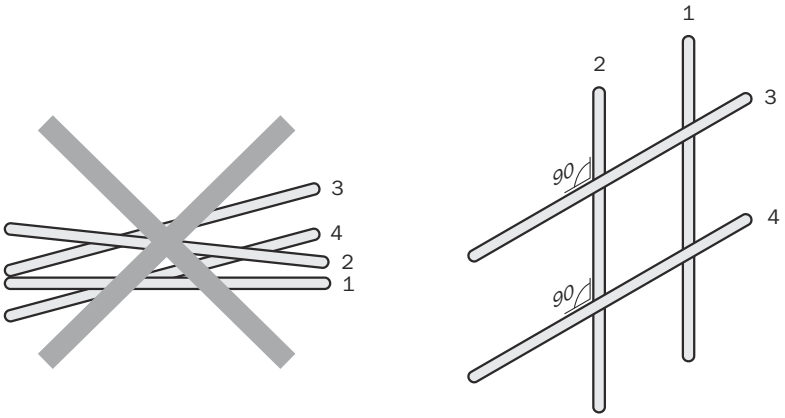


Figure 5: Cross cables at right angles

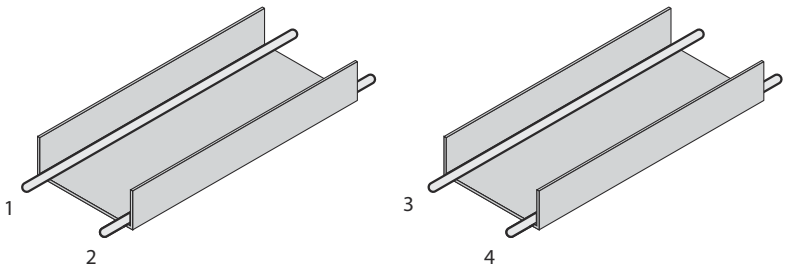


Figure 6: Ideal laying – Place cables in different cable channels

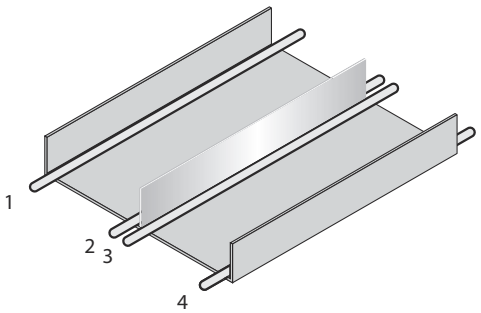
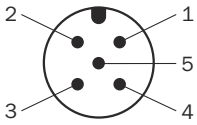


Figure 7: Alternative laying – Separate cables with metallic separators

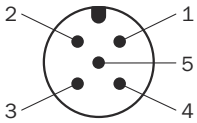
6.2 Pin assignment of the connections

M12 connection



Pin	Pin assignment
1 - BN	VIN
2 - WH	CAN HIGH
3 - BU	GND
4 - BK	C / Q
5 - GY	CAN LOW

M12 connection, RS485



Pin	Pin assignment
1 - BN	VIN
2 - WH	RS485 A
3 - BU	GND
4 - BK	C / Q
5 - GY	RS485 B

6.3 Connecting the supply voltage

The sensor must be connected to a voltage supply with the following properties:

- Supply voltage DC 18 V ... 30 V (stabilized safety extra-low voltage (SELV/PELV) as per current standard EN 60950-1)
- Electricity source with at least 3 W power

Protecting the supply cables

To ensure protection against short-circuits/overload in the customer's supply cables, the wire cross-sections used must be appropriately selected and protected.

The following standards must be observed in Germany:

- DIN VDE 0100 (part 430)
- DIN VDE 0298 (part 4) and/or DIN VDE 0891 (part 1)

Electrical connection of OLS20

- Ensure the voltage supply is not connected.
- Turn the swivel connector into the desired position.
- Connect the sensor according to the connection diagram.

6.4 CAN connection

We recommend connecting the ground cable to the CANopen communication interface as a reference.

If there is no separate CAN GND in the system, this pin is to be connected to the FE.

7 Commissioning

7.1 Overview of commissioning steps

- Connect the voltage supply.
- Commission the sensor using the factory settings.
- Configure the sensor.

7.2 Commissioning the sensor for the first time

NOTICE PUSHBUTTON DAMAGE DUE TO IMPROPER HANDLING!
Improper handling of the pushbuttons can damage them. This will make operation difficult or impossible.

For this reason:

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

Establish voltage supply: When the sensor voltage supply is correct, the green “PWR” LED lights up.

If at least one track is detected, switching output Q1 is “active” and the yellow “Q” LED lights up.

7.3 First step to commissioning with CANopen

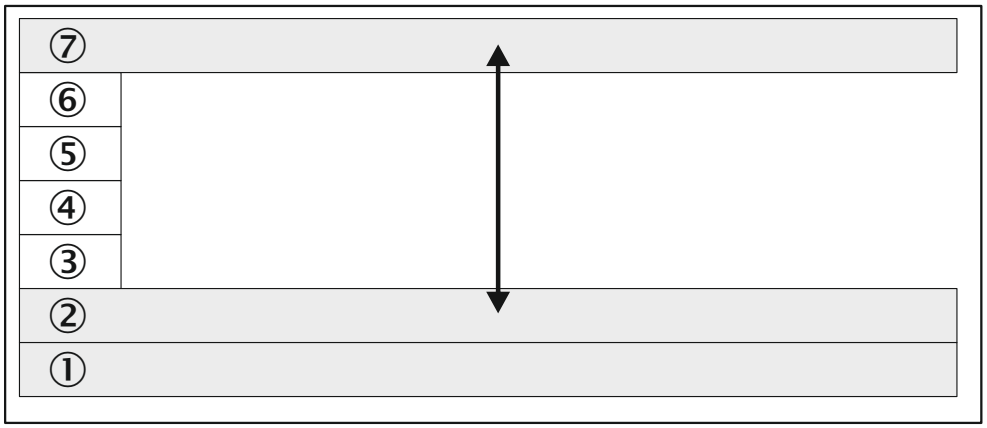
7.3.1 CANopen overview

Communication profile

The CANopen communication profile (documented in CiA DS-301) regulates how the devices in a CANopen network exchange data.

CANopen in the OSI model

The CANopen protocol is a standardized Layer 7 protocol for the CAN bus. This layer is based on the CAN Application Layer (CAL).



⑦ CAN application layer
② Data link layer
① Physical layer

NOTE
Layers 3 to 6 are not used in CANopen.

Architecture

CANopen is an asynchronous, serial fieldbus. The OLS20 is inserted into the bus via a stub cable. It needs to be terminated at the beginning and at the end of the fieldbus. A passive 120 Ω bus terminating resistor is sufficient for this purpose.

Communication channels and status

CANopen features various communication channels (SDO, PDO, Emergency Messages). These channels are formed with the help of the communication object identifier (COB ID). The COB IDs are based on the node IDs of the individual devices on the CANopen bus. The OLS20 has node ID 10 by in the factory setting. It can be addressed via the network management services (NMT) and its CANopen state machine can be switched to the necessary status (Pre-Operational, Operational, or Stopped) by the master.

Network management

Network management (NMT) initializes the nodes in a CANopen network. It also adds the nodes to the network, and stops and monitors them. The following statuses can be identified:

Table 3: Status of the CANopen state machine

Status	Description
Initializing	Initialization commences. Both the device application and device communication are initialized. After this, the node automatically switches to Pre-Operational status.
Pre-Operational	The OLS20 is ready for parameterization; acyclic communication can take place via SDO. However, the OLS20 is not yet able to commence PDO communication and is not sending out any emergency messages.
Operational	In this state, the OLS20 is fully ready for operation and can transmit messages autonomously (PDOs, emergency messages).
Stopped	In this state, the OLS20 is not actively communicating (although communication is still being actively monitored via node guarding).

The OLS20 automatically enters the operational state at startup in the factory setting.

7.3.2 Setting the ID and baud rate

There can be a maximum of 128 devices on a CANopen network: One client and up to 127 servers. Every device has a unique node ID (node address). The COB IDs (Communication Object Identifiers) of the communication channels are derived from this ID.
The following conditions must be met for communication with the CAN master:

- A correct node ID must be set on the OLS20.
  Correct is:
  - A node ID which is free in the CANopen network
  - A node ID which the master expects
- The same baud rate must be set in the OLS20 as in the master.

The following parameters are factory set on the OLS20:

- Node ID: 10
- Baud rate: 125 kbit/s

The following communication parameters can be allocated to the OLS20:

- Node ID: 1 to 127 (0 is generally assigned to the master)
- Baud rate: 10 kbit/s, 20 kbit/s, 50 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 1,000 kbit/s

Layer setting services (LSS) are supported in order to set the node ID and the baud rate of the OLS20.

The LSS slave is accessed via its LSS address (identity object), which is stored in object 1018h.

The LSS address comprises:

- Manufacturer ID
- Product code
- Revision number
- Serial number

The master uses the LSS services to request the individual services which are then executed by the OLS20. The LSS telegrams facilitate communication between LSS master and LSS slave. An LSS telegram is always 8 bytes long. Byte 0 contains the command specifier (CS), followed by 7 bytes for the data. All bytes that are not in use must be set to zero.

The following COB IDs are used:

- 07E4h = LSS slave to LSS master
- 07E5h = LSS master to LSS slave

NOTE

During LSS configuration as in the example below, only one CANopen slave device may be connected to the CAN bus, i.e. only the OLS20 to be configured.

Below are 2 examples of setting the node ID and baud rate.
In the examples, a OLS20 is configured to node ID 19 and a bit rate of 500 kbit.
The transmission direction refers to the CAN device that performs the configuration (master).

Setting the node ID

Step	Description	Direction	CAN-ID	Length	Data (hexadecimal)
1	Send “go to pre-operational” NMT command to all slaves, result: Slaves stop sending PDOs.	transmit	000h	2	80 00
2	Send “switch all slaves to LSS configuration state” LSS command, result: Slave is in “configuration” state	transmit	7E5h	8	04 01 00 00 00 00 00 00
3	Send LSS command: “Configure Node ID” to set the node ID to 19.	transmit	7E5h	8	11 **13** 00 00 00 00 00 00 (13h is the new node ID, i.e. node ID 19 (decimal))
4	LSS slave confirms setting of the new node ID.	receive	7E4h	8	11 00 00 00 00 00 00 00
5	Send “store configuration” LSS command	transmit	7E5h	8	17 00 00 00 00 00 00 00
6	LSS slave confirms saving of configuration	receive	7E4h	8	17 00 00 00 00 00 00 00
You can now either switch the device off and on again to activate new settings, or restart communication with the following NMT commands.					
7	Send “reset communication” NMT command to all slaves.	transmit	000h	2	82 00
8	Send “go to operational” NMT command to all slaves. Result: OLS20 now communicates with new Node-ID	transmit	000h	2	01 00

Configuring baud rate

Step	Description	Direction	CAN-ID	Length	Data (hexadecimal)
1	Send “go to pre-operational” NMT command to all slaves, result: Slaves stop sending PDOs.	transmit	000h	2	80 00
2	Send “switch all slaves to LSS configuration state” LSS command, result: Slave is in “configuration” state	transmit	7E5h	8	04 01 00 00 00 00 00 00
3	Send “Configure bit timing” LSS command to set the baud rate to 500 kBit.	transmit	7E5h	8	13 00 02 00 00 00 00 00 0 = 1,000 kBit/s 1 = not supported 2 = 500 kBit/s 3 = 250 kBit/s 4 = 125 kBit/s 5 = not supported 6 = 50 kBit/s 7 = not supported 8 = not supported 9 = not supported
4	LSS slave confirms the new baud rate.	receive	7E4h	8	13 00 00 00 00 00 00 00
5	Send “store configuration” LSS command	transmit	7E5h	8	17 00 00 00 00 00 00 00
6	LSS slave confirms saving of configuration	receive	7E4h	8	17 00 00 00 00 00 00 00
You can now either turn the device off and on again to activate new settings, or restart communication using the NMT commands in steps 7 to 8 of the previous example node ID configuration.					

NOTE
The node ID and baud rate can also be set using the SOPAS ET configuration software. This is available for download here: www.sick.com/SOPAS

NOTE
To perform the configuration via SOPAS ET, we recommend using an SI-Link Box for communicating with your PC.
https://www.sick.com/de/de/iola2us-01101-28silink2-master29/p/p348858

7.3.3 Process data objects (PDOs)

The OLS20 supports two transmit PDOs and no receive PDO.

Objects 0x1800 and 0x1801 contain the communication parameters.

7.3.4 PDO communication

The transmission type is factory-set to acyclic communication for TPDO1 and TPDO2. A transmission period of 20 ms is factory-set for TPDO1 and TPDO2 so that TPDO1 and TPDO2 are transmitted on a cyclical basis.

Changing the factory-set transmission type

The following options are available for the cyclical or acyclical output of transmit PDOs by the OLS20:

- Change the event timer in object 0x1800 or 0x1801 (see table 6)
- Change the transmission type in object 0x1800 or 0x1801 (see table 6)

7.4 First step to commissioning with Modbus RTU

The following describes the first steps for commissioning with Modbus RTU. In the description, we refer to the "Modbus application protocol specification V1.1" Modbus standard as well as "Modbus over serial line specification and implementation guide V1.02" available at www.modbus.org.

7.4.1 Setting the ID and baud rate

The following conditions must be met for communication with the Modbus client:

- A correct server address must be set on the OLS20.
  Correct is:
  - A server address that is free in the Modbus network
  - A server address that the master expects
- The same baud rate must be set in the OLS20 as in the client.

The following parameters are factory set on the OLS20:

- Server address: 10 (it is possible to set 1 ... 247)
- Baud rate: 9600 bps

The following communication parameters can be allocated to the OLS20:

- Server address: 1 to 247 (0 is generally assigned to the client)
- Baud rate:
  0: 1200 bps
  1: 2400 bps
  2: 4800 bps
  3: 9600 bps
  4: 19200 bps
  5: 38400 bps
  6: 57600 bps
  7: 115200 bps

NOTE
The server address and baud rate can also be set using the SOPAS ET configuration software.
This is available for download here: www.sick.com/SOPAS.

7.4.2 Basic information about Modbus and reading out code information

Modbus is based on RS-485 with a Modbus RTU protocol structure. Data exchange is always based on requests from the client and responses from the server devices. The respective request/response string looks like this:

Request

Table 4: Client/server data exchange - request

Byte	0	1	2	3	4	5	6	7
ModBus contents	Sensor address	“Function code” e.g. 0x04 Read “Input registers”	Readout: Start register (16 bit unsigned)		Readout: Number of registers N (16 bit unsigned) N = Number of registers		Checksum (16 bit unsigned)	

Response

Table 5: Client/server data exchange - response

Byte	0	1	2	2xN+3	2xN+4	2xN+5
ModBus contents	Sensor address	Response: “Function code” 0x04	Number of bytes, 2xN	Register contents	Checksum (16 bit unsigned)	

The relevant code information is provided in “Section result data”. Read it periodically (addresses starting at register 192) using "Modbus function code #4":

8 Operation

8.1 Operation via CANopen

CANopen object directory

This chapter contains information on integration of the sensor using CANopen.

All sensor functions can be accessed via the CANopen interface. All settings can be configured in this interface. The EDS file can also be found at www.sick.com/ols20.

8.1.1 Object directory

This section only describes the objects that do not have a fixed definition in the CANopen standard. Default values are listed only for parameters that can be modified by the user.

Table 6: Object directory

Index	Sub-idx	R/W	Object name	Default value	Type	Description
0x1000	-	RO	Device type		UINT32	No device profile supported
0x1001	-	RO	Error register		UINT8	
0x1005	-	RW	COB ID SYNC	0x80	UINT32	
0x1008	-	RO	Manufacturer device name		STRING	Optical Line Guidance Sensor
0x1009	-	RO	Manufacturer hardware rev		STRING	Hardware version, sensor
0x100A	-	RO	Manufacturer software rev		STRING	Firmware version, sensor
0x100C	-	R/W	Guard time		UINT16	
0x100D	-	R/W	Life time		UINT8	
0x1014	-	RW	COB-ID EMCY	0x80	UINT32	
0x1015	-	RW	Inhibit Time Emergency	0x00	UINT16	
0x1016		RO	Heartbeat Consumer Entries	0x02	UINT32	
	1	RW	Consumer Heartbeat Time 1	0x0	UINT32	
	2	RW	Consumer Heartbeat Time 2	0x0	UINT32	
0x1017	-	R/W	Heart beat time		UINT16	
0x1018		RO	Identity object		UINT8	
	1	RO	Vendor Id		UINT32	0x01000056 (SICK AG)

Index	Sub-idx	R/W	Object name	Default value	Type	Description
	2	RO	Product code		UINT32	
	3	RO	Revision number		UINT32	
	4	RO	Serial number		UINT32	
0x1800			Transmit PDO Communication Parameter 1			see section 8.1.2
	1	R/W	COB ID	0x18A	UINT32	see section 8.1.2
	2	R/W	Transmission type	0xFF	UINT8	see section 8.1.2
	3	RW	Inhibit Time	0x0	UINT16	
	5	R/W	Event timer	0x014	UINT16	
0x1801			Transmit PDO Communication Parameter 2			see section 8.1.3
	1	R/W	COB ID	0x18A	UINT32	see section 8.1.2
	2	R/W	Transmission type	0xFF	UINT8	see section 8.1.3
	3	RW	Inhibit Time	0x0	UINT16	
	5	R/W	Event timer	0x014	UINT16	see section 8.1.2
0x1A00		RO	Transmit PDO Mapping Parameter 1	0x00	UINT32	
	1	RW	Mapping Entry 1	0x00	UINT32	
	2	RW	Mapping Entry 2	0x00	UINT32	
	3	RW	Mapping Entry 3	0x00	UINT32	
	4	RW	Mapping Entry 4	0x00	UINT32	
	5	RW	Mapping Entry 5	0x00	UINT32	
	6	RW	Mapping Entry 6	0x00	UINT32	
	7	RW	Mapping Entry 7	0x00	UINT32	
0x1A01		RO	Transmit PDO Mapping Parameter 2	0x00	UINT32	
	1	RW	Mapping Entry 1	0x00	UINT32	
	2	RW	Mapping Entry 2	0x00	UINT32	

Index	Sub-idx	R/W	Object name	Default value	Type	Description
	3	RW	Mapping Entry 3	0x00	UINT32	
	4	RW	Mapping Entry 4	0x00	UINT32	
	5	RW	Mapping Entry 5	0x00	UINT32	
	6	RW	Mapping Entry 6	0x00	UINT32	
	7	RW	Mapping Entry 7	0x00	UINT32	
0x2001			Mounting parameters			
	5	R/W	Flipped upside down		BOOL	0 => Positive positions on cable outlet side 1 => Negative positions on cable outlet side
0x2002			Tape parameters			
	1	R/W	Typ. width [m]		FLOAT	Typical track width. The specification of the typical track width makes it possible to output the correct line center point even at the edge of the reading window.
	2	R/W	Min. width [m]	5 mm	FLOAT	Minimum track width. Smaller tracks are ignored.
	3	R/W	Max. width [m]	75 mm	FLOAT	Maximum track width. Wider tracks are ignored.
0x2003			Advanced settings			
	1	R/W	Off delay track detection	100 ms	UINT16	If the track is not detected (contamination), the last detected line center point is output for a defined number of milliseconds.
	2	RW	Off Delay Code Detection	100 ms	UINT16	If the code is not detected (contamination), the last detected code value is output for a defined number of milliseconds.
	3	RW	Position smoothing filter coefficient	0.0 ms		The position values are smoothed over a defined number of milliseconds.

Index	Sub-idx	R/W	Object name	Default value	Type	Description
	4	R/W	Barcode number of digits	3	UINT8	1 = 1 Digit + Checksum 2 = 2 Digit 3 = 3 Digit + Checksum 4 = 4 Digit 5 = 5 Digit + Checksum 6 = 6 Digit 7 = 7 Digit + Checksum 8 = 8 Digit 254 = Autodetection with checksum 255 = Autodetection without checksum
	5	R/W	Barcode on delay	10	UINT16	in ms
	6	R/W	Line guidance field of view	180	UINT16	in mm
0x2018		RO	Device status		UINT16	0 = Device is OK 1= Maintenance required 2 = Out of Specification 3 = Functional Check 4 = Failure
0x2019		RO	Order number		UINT32	7-digit item no. in HEX
0x2021			Result data (mapbar)			
	1	RO	LCP1		INT16	see section 8.1.2
	2	RO	LCP2		INT16	see section 8.1.2
	3	RO	LCP3		INT16	see section 8.1.2
	4	RO	Status		UINT8	see section 8.1.2
	5	RO	Width LCP1		INT16	see section 8.1.2
	6	RO	Width LCP2		INT16	see section 8.1.2
	7	RO	Width LCP3		INT16	see section 8.1.2
	8	RO	Code		UINT8	see section 8.1.2
	9	RO	Extended code		UINT32	code > 255
	10	RO	BarCode Centerpoint		INT16	Centerpoint of the detected bar code
	11	RO	Quality of Line		UINT8	Line quality in % Reference is a standardized minimum optical contrast.

Index	Sub-idx	R/W	Object name	Default value	Type	Description
0x2023			Line level			Line intensity value. Reference is normalized line intensity. > 50 digits are required for stable detection of the track and codes.
	1	RO	Intensity line 1		UINT8	
	2	RO	Intensity line 2		UINT8	
	3	RO	Intensity line 3		UINT8	

8.1.2 PDOs

The OLS20 has two TPDOs (TPDO01 and TPDO02) and no RPDO. TPDO1 can be accessed under the index 0x0180 + node ID, TPDO02 under 0x280 + node ID. In its default state (node ID 0x0A), the index for TPDO1 is 0x018A.

The TPDO1 is structured as follows:

Table 7: CANopen PDO01

	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
TPDO1	LSB LCP1	MSB LCP1	LSB LCP2	MSB LCP2	LSB LCP3	MSB LCP3	Status	Bar code

Table 8: Byte 7 status

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Status	#LCP bit 0	#LCP Bit 1	#LCP Bit 2	x	Device status	x	Code flipped	Code valid

Table 9: TPDO2

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
TPDO2	LSB Width line 1	MSP Width line 1	LSB Width line 2	MSP Width line 2	LSB Width line 3	MSP Width line 3	x	x

#LCP	UINT3	The numbers are assigned the following meanings: 0 => No track found 2 => One track found 3 => Two tracks found: Diverter on minus side (factory setting) 6 => Two tracks found: Diverter on plus side (factory setting) 7 => Three tracks found
Device status	Bool	0 => Sensor ok 1 => Sensor not OK, see 0x2018
Code flipped	Bool	0 => Code was read from the minus to the plus side of the sensor 1 => Code was read from the plus to the minus side of the sensor
Code valid	Bool	0 => No code read 1 => Valid code has been read

Table 10: Byte 8 bar code

	Bit 0-7
Bar code	Code 0 ... 255

8.1.3 Transmission types

The transmission type of the respective TPDO can be set in index 0x1800 or 0x1801. This index comprises the following subindexes:

Table 11: Subindexes

Subin-dex	Name	Permissible values	Description
1	COB-ID	-	The COB ID is automatically adjusted to the note ID and should not be amended by the user.
2	Transmission type	0xFE, 0xFF	The transmission type is set here. The OLS20 supports only event based transmission, which is configured via the event timer
3	not used	-	Not used
4	Compatibility entry	-	Not used
5	Event timer	0 ... 65535	The event timer sets the time between two transmissions from the TPDO in [ms]. A value of 0 deactivates the transmission of the process data. The smallest logical value recommended here is 10 ms.

8.2 Operation via Modbus RTU

“Input registers” register group (read-only)

The “input registers” can be read using function code 0x04.

Device identification section

The device identification details (all of data type ASCII string) can be found from 0x00 onwards in the address range of the input register.

Table 12: Device Identification

Address	Name	#Registers	Description
0	Vendor name	4	SICK AG
4	Product code	4	
8	Firmware version	6	
14	Vendor URL	6	www.sick.com
20	Product name	16	Optical Line Guidance Sensor
36	Model name	9	OLS20XXXX
45	Serial number	4	
49	Application name	16	
65	SickModbusProfileVersion	6	

Result section

The result data start at address 0xC0 and can be accessed via function code 0x04:

Table 13: Results

Address	Contents	#Regis-ters	Value
192	Status	1	UINT8
193	BCP - BarCode CenterPoint	1	UINT16
194	Bar code	2	UINT8
196	LCP1	1	UINT16
197	LCP2	1	UINT16
198	LCP3	1	UINT16
199	Width1	1	UINT16
200	Width2	1	UINT16
201	Width3	1	UINT16
202	Quality of Line	1	UINT8
216	Line intensity LCP1 (since Firmware 2.2.1)	1	UINT8
217	Line intensity LCP2 (since Firmware 2.2.1)	1	UINT8
218	Line intensity LCP3 (since Firmware 2.2.1)	1	UINT8

Detail Register Status

Table 14: Detail Register Status

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Status	#LCP bit 0	#LCP Bit 1	#LCP Bit 2	x	Device status	x	Code flipped	Code valid

Table 15: Detail Register Status

#LCP	UINT3	The numbers are assigned the following meanings: 0 => No track found 2 => One track found 3 => Two tracks found: Diverter on minus side (factory setting) 6 => Two tracks found: Diverter on plus side 7 => Three tracks found
Device status	Bool	0 => Sensor ok 1 => Sensor not OK
Code flipped	Bool	0 => Code was read from the minus to the plus side of the sensor 1 => Code was read from the plus to the minus side of the sensor
Code valid	Bool	0 => No code read 1 => Valid code has been read

Status section

The status data start at address 240 and can be accessed via function code 0x04.

Table 16: Status

Address	Contents	#Registers
240	Device status	0 = Device is OK 1= Maintenance required 2 = Out of Specification 3 = Functional Check 4 = Failure

"Holding registers" register group (read-write)

The following registers are used to configure the sensor via Modbus and can be read using function code 0x03, written to individually using function code 0x06, or written to continuously using function code 0x10.

Commands section

Table 17: Commands

Address	Contents	#Registers
96	Application name of up to 32 characters	16 any arbitrary text of max. 32 characters can be entered here

Configuration section

Table 18: Configuration

Address	Contents	#Registers	Description
144	Reading direction	1	0: Head to connector 1: Connector to head
145	Typical tape width	1	FLOAT - unit [mm]
146	Minimum tape width	1	FLOAT - unit [mm]
147	Maximum tape width	1	FLOAT - unit [mm]
148	Q off delay	1	UINT16 - unit [ms] default 100 ms
149	Barcode off delay	1	UINT16 - unit [ms] default 100 ms
150	Q inverter	1	0: not inverted 1: inverted
151	Position smoothing filter coefficient	2	FLOAT (≥ 0.0) Default 2.0
153	Barcode number of digits	1	Depending on the variant 1 = 1 Digit + Checksum 2 = 2 Digit 3 = 3 Digit + Checksum 4 = 4 Digit 5 = 5 Digit + Checksum 6 = 6 Digit 7 = 7 Digit + Checksum 8 = 8 Digit 254 = Autodetection with checksum 255 = Autodetection without checksum

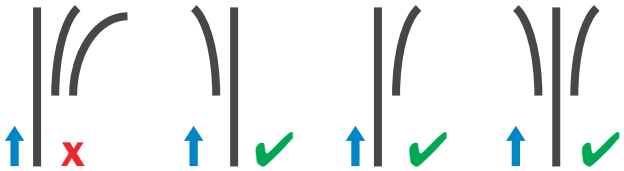
Address	Contents	#Registers	Description
154	Barcode on-delay	1	in ms default = 100 ms
155	Line guidance field of view	1	in mm default = 180 ms
156	Modbus RTU slave address	1	Changes at next system reboot.
157	Modbus RTU baud rate	1	Changes at next system reboot.
158	Modbus RTU parity setting	1	Changes at next system reboot.

8.3 Track guidance

8.3.1 Output of line center points

The OLS20 is capable of detecting up to three line center points (LCPs). The position of each line center point is output to a resolution of 1 mm. The geometric center of the sensor's longitudinal axis is the zero point, see "optical center", page 10.

By default, the positive measuring range is towards the cable outlet, and the negative measuring range is on the opposite side.



If only one line center point is found, this is output as LCP2. If a further line center point is found, it is output as LCP1 or LCP3, depending on its direction. If three LCPs are found, then each LCP is output.

If there are multiple tracks in the field of view, the track closest to zero is the main track (LCP2).

To make it easier for the control system to evaluate this data, the combination of tracks detected is output in an additional data item #LCP. The LCPs are binary-weighted:

Table 19: Line center points

LCP1 detected	LCP2 detected	LCP3 detected	#LCP	Note
no	no	no	0	Special case: No track detected
no	Yes	no	2	Only one track detected
Yes	Yes	no	3	Single diverter on the minus side detected (factory setting)
no	Yes	Yes	6	Single diverter on the plus side detected (factory setting)
Yes	Yes	Yes	7	Double diverter detected

The principle of LCP1 < LCP2 < LCP3 always applies to the LCPs.

8.3.2 Inversion of the relative position

This function enables the user to invert the convention that the positive range is at the cable outlet. This makes it easier to install the sensor when rotated by 180°.

The position can be inverted via CANopen, or via Modbus or IO-Link.

The inversion of the position signal (sensor flipped) does not affect the LED behavior.

8.3.3 Bar code detection

The OLS20 has the option of detecting 1D bar codes in the interleaved 2/5 format. Up to 4-digit bar codes are detected and read out in this case.

The OLS20 outputs the number value of the bar code via CANopen, or via Modbus or IO-Link.

In addition to track tape, SICK also offers a set of numbered bar codes as accessories see "Accessories", page 40. The assignment of the bar code value to a certain drive command or piece of position information must be done on the control side.

9 Maintenance

9.1 Cleaning

CAUTION 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 screen at regular intervals with a lint-free cloth and plastic cleaning agent. Cleaning agents containing solvents are not allowed.

The cleaning interval essentially depends on the ambient conditions.

9.2 Maintenance

The sensor requires the following maintenance work at regular intervals:

Table 20: Maintenance schedule

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

9.3 Repairs

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

10 Decommissioning

10.1 Decommissioning

Removing the sensor

1. Switch off the supply voltage to the sensor.
2. Detach all connecting cables from the sensor.
3. If the sensor is being replaced, mark its position and alignment on the bracket or surroundings.
4. Remove the sensor from the slot.

Disposing of the sensor

Any sensor which can no longer be used must be disposed of in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations. The sensor is electronic waste and must under no circumstances be disposed of with general waste.

11 Troubleshooting

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

In the case of faults that cannot be rectified using the information below, please contact the manufacturer. See the back page for your agency.

11.1 Possible error indicators

Table: Possible error indicators

Error pattern	Possible causes	Troubleshooting
Q-LED flashes yellow	Short-circuit / Overcurrent / Sensor is not connected properly	Disconnect sensor from the power network / Check pin assignment / Reconnect sensor / Check the current at the switching output

12 Technical data

NOTE
The relevant online data sheet for the OLS20, including technical data, dimensions, and connection diagrams, can be downloaded, saved, and printed at www.sick.com/ols20.

12.1 Optics / Features

Table 21: Optics / Features

	1095594, 1100421, 1113054	1108045
Light sender[1]	Blue LED	LED, UV Radiation
Wavelength	450 nm	385 nm
Light spot size	180 mm x 11 mm Track field of view +/-90 mm Code field of view +/-50 mm	
Sensing distance	100 mm	
Sensing distance tolerance	± 10 mm	
Sensing rate	5 ms	10 ms
Bar code types	2/5 interleaved	
Module width (min.)	≥ 1.5 mm	
Track radius (min.)	≥ 0.5 m	
Initialization time	< 10 s	

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

12.2 Supply

Table 22: Supply

Supply voltage V_S[1]	18 V DC ... 30 V DC
Power consumption (without load)	< 3 W
Residual ripple	< 5 V_{ss} within permitted supply voltage U_V (must not exceed or be less than the U_V tolerances.)

1 Limit values

12.3 Interfaces

Table 23: Interfaces

CANopen[1] IO-Link (V1.1, COM3)	Configuration and process interfaces
Modbus (RS485)[1] IO-Link (V1.1 COM3)	Configuration and process interfaces

1 depending on type

12.4 Output

Table 24: Output

Switching output Q	PUSH/PULL • Active ≥ U_V – 2 V • Inactive ≤ 2 V

Circuit protection	Output Q1 overcurrent and short-circuit protection (see Table 1)
Maximum output current	< 100 mA (total I_{OUT}= Q1)

12.5 Ambient conditions

Table 25: Ambient conditions

Protection class	III, for operation with safety/protective extra-low voltage (SELV/ PELV)
Electromagnetic compatibility	EN 61000-6-2, EN 55011, Class A
Ambient temperature range	–10 °C ... +55 °C
Storage temperature range	–20 °C ... +75 °C
Ambient light immunity	60,000 lx
Enclosure rating	IP64
Noise	EN60068-2-64
Shock resistance/Impact load	EN 60086-2-27

12.6 Structural design

Table 26: Structural design

Dimensions (W x H x D)	31 mm x 62 mm x 52.5 mm
Weight	250 g
Materials	Housing: metal, discharge plate: glass
Connections	• Male connector, M12[1], 5-pin[2]

1 Male connector I_N = 2 A

2 Use of a shielded cable is recommended for longer cables.

13 Accessories

NOTE
Accessories can be found on the online product page at:
www.sick.com/ols20

14 Licenses

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15 Annex

15.1 Conformities and certificates

You can obtain declarations of conformity, certificates and the current documentation 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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