OPERATING INSTRUCTIONS

GLS100

Image-based code reader for lane guidance and grid localization

SICK
Sensor Intelligence.

Described product

GLS100

Manufacturer

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Original document

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1 About this document

1.1 Information on the operating instructions

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

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

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

1.2 Scope

These operating instructions explain how to incorporate a sensor into a customer system. Step-by-step instructions are provided for all necessary activities.

The instructions are valid for all available device variants of the sensor.

► http://www.sick.com/gls100

Commissioning is described using one particular device variant as an example.

Simplified device designation in the document

In the following, the sensor is referred to in simplified form as “GLS100”.

1.3 Further information

You can find the product page with further information via the SICK Product ID:
pid.sick.com/{P/N}/{S/N}
(see "Product identification via the SICK product ID", page 9).

The following information is available depending on the product:

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

1.4 Explanation of symbols

Warnings and important information in this document 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.

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

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

2 Safety information

2.1 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.

NOTE
The device is equipped with LEDs. The device meets the criteria of risk group 0 according to IEC 62471:2006. No special measures are required (e.g., eye protection).

2.2 Intended use

The GLS100 is used for the automatic navigation and localization of automated guided vehicle systems (AGVs) in warehouses, logistics and distribution.

The device is a flexible solution for many applications. It detects and decodes both colored tapes or lanes and various types of 2D codes.

The GLS100 is usually mounted on the underside of the AGV and navigates it using the tracks or lanes applied to the floor in the form of colored tapes or 2D code tapes. 2D codes can also be applied to the floor in the form of a grid for navigation. Using the data provided by the device, the AGV system is localized and repositioned by a higher-level controller (e.g. PLC). The device is primarily designed for use in industrial and logistics areas. It meets the applicable requirements for industrial robustness, interfaces, and data processing. 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.

The product must only be used within the limits of the prescribed and specified technical specifications and operating conditions at all times.

Incorrect use, improper modification or manipulation of the product will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK for damage and secondary damage caused by this is excluded.

2.3 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.
- The sensor must not be operated with a long cable > 30 m according to EN 61000-6-2.

NOTICE
Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, observe 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.

2.4 Qualification of personnel

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

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

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

2.5 Notes on UL approval

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

UL Environmental Rating: Enclosure type 1

Maximum ambient temperature 50 °C

3 Product description

3.1 Product identification via the SICK product ID

SICK product ID

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

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

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

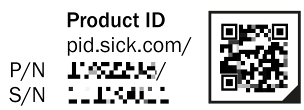


Figure 1: SICK product ID

3.1.1 Control and display elements

Device view

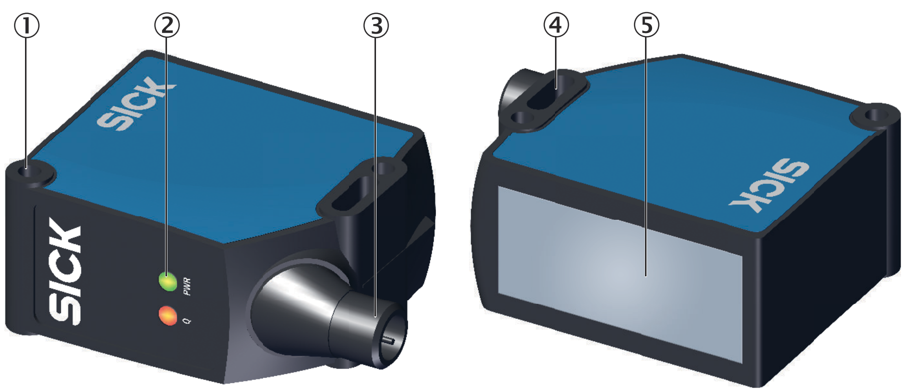


Figure 2: GLS100

① Fixing hole
② Function indicators (LEDs)
③ Connection
④ Fixing hole
⑤ Light emission

Function indicators (LEDs)

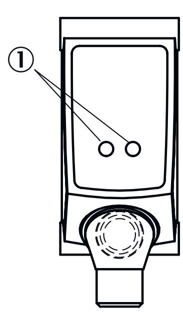


Figure 3: Function indicators (LEDs)

① Status indicators

Table 1: Function indicators (LEDs)

Function indicator	Description
Q	Status indicator • LED yellow: Code detected and read • LED off: No code detected
PWR	Operational status display • Green LED: Normal operation/Supply voltage on • LED off: No operation

3.2 Product characteristics

Function and use

The GLS100 navigates and localizes automated guided vehicle systems (AGVs) by detecting colored lanes and 2D codes of various types.

The device therefore enables the following applications:

- Lane guidance using colored tapes and lanes with the highest possible contrast to the surface
- Lane guidance using 2D code tapes
- Navigation and localization using 2D codes
- Grid localization using DataMatrix multicodes
- Combination of the above applications

Surface

The device has a field of view of 160 x120 mm and can therefore detect a large section of the surface.

DataMatrix codes can provide position data for exact fine positioning of the AGV. Alternatively, the GLS100 can be used exclusively with 2D codes.

These can be:

- applied to tapes (similar to the color lane)
- glued to the floor (in the form of a grid)
  With the grid arrangement, the AGV moves in a grid of any size without requiring separate lane tapes for the individual tracks

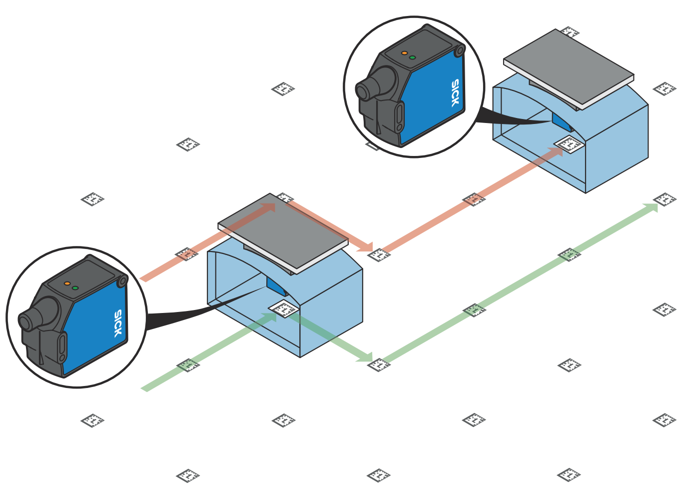


Figure 4: Grid localization GLS100

In the "Lane Guidance" operating mode, the GLS100 detects both 2D codes and color lanes. This allows the AGV to be guided from one Data Matrix grid via a color lane into another Data Matrix grid. It is also possible to switch between colored tape and code tape in the lane.

3.2.1 Color lane

NOTE
DataMatrix codes can also be used when color lanes are used.
The DataMatrix codes can be used to transmit position-specific information to the control system and thus improve the localization of the AGV.
DataMatrix code tapes always have priority over color lanes; if at least one code tape and one color lane are detected at the same time, the color lanes are ignored.
DataMatrix multicodes can be read alongside color lanes. Colored tapes and DataMatrix code tapes must not be used together at junctions, as the junction will not be recognized as such.

The GLS100 can recognize different color lanes, which are either applied to the surface as a tape or painted on as a track. The AGV can follow these lanes to be guided to its destination. The advantage of the color lane is that the path is precisely defined and the AGV follows it accordingly.

The GLS100 detects color lanes based on their contrast to the background color. Therefore, when selecting the color, it is essential that the contrast is as strong as possible. Adhesive tapes in the colors orange, green and yellow are available for the device on the Sick homepage. Alternative colors can also be used as long as they show a high contrast to the background color.

The GLS100 lighting is based on green and orange LEDs. In order to increase the reading quality and enable the clearest possible lane detection, the LED color can be changed, as the background color can be perceived differently by the sensor depending on the LED color. The orange LEDs are switched on by default.

The following read data is sent via the interface:

- Status of the sensor
- Lane center points of up to 3 color lanes
- Sensor alignment (angle orientation) of up to 3 color lanes in relation to the color lane
- Calculated distance of the sensor from the level of the lane
- Content of DM-Id-Codes
- Reading quality

The color lane must be between 10 mm and 40 mm wide. If the actual lane width deviates from the set width, this affects the Z position output by the sensor. If this is outside the configurable Z-min and Z-max values, the sensor will not output a lane. A width of 19 mm is set by default. The GLS100's field of view can detect up to three color lanes simultaneously. The distance between two lanes or between the lane and 2D code must be at least 5 mm. The GLS100 can be aligned in the X or Y direction on the color lane. The color lanes can also be applied to the surface in radii. In this case, the curve radius ≥must be 50 cm. When using colored tapes, make sure that the tape is applied to the surface smoothly and without bulges. We recommend the use of SICK sheet tape (see "Accessories", page 56) .

Heavily contaminated or badly damaged color lanes impair the reading accuracy of the GLS100. Regular inspection of the lanes and subsequent cleaning is recommended. The current read quality of the detected lanes can be read from the sensor's process data.

Sensor alignment

The GLS100 can output the angle to the color lane, the reference point is the center of the colored tape.
The angle is given as a relative value, as the color lane does not contain any directional information. By default, the angle is output as a signed value and therefore represents the orientation angle from -pi to + pi (see "Transformation of output values", page 50)

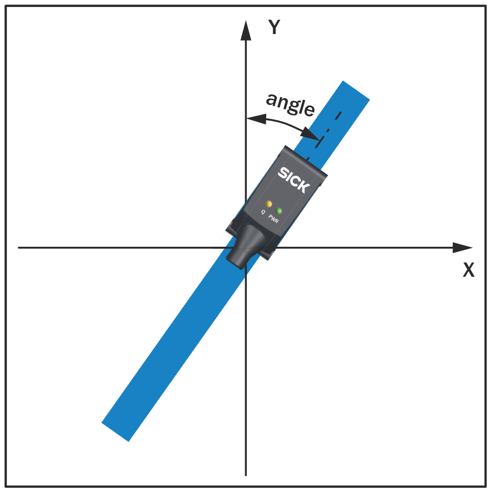


Figure 5: Sensor alignment to the color lane

Sensor distance

The GLS100 outputs the distance from the center of the sensor to the center of the color lane as a distance value as soon as a color lane is detected in the GLS100's field of view.

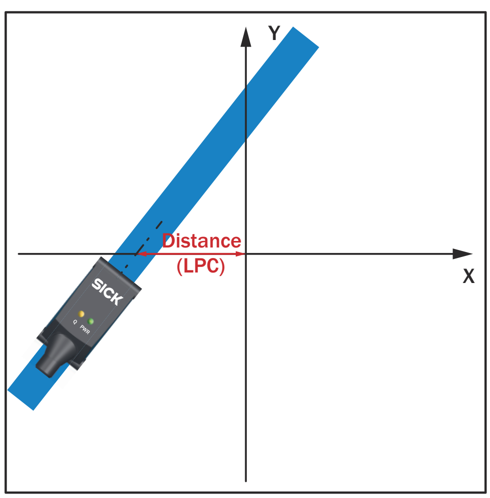


Figure 6: Sensor distance to the color lane

Junctions and merging points

As soon as the GLS100 detects more than one color lane, it interprets this as a junction or merging point.

Table 2: Junctions and merging points

Minimum distance between the lanes	5 mm
Overlapping of the lanes	50 mm minimum length to enable clear identification of the different color lanes. .

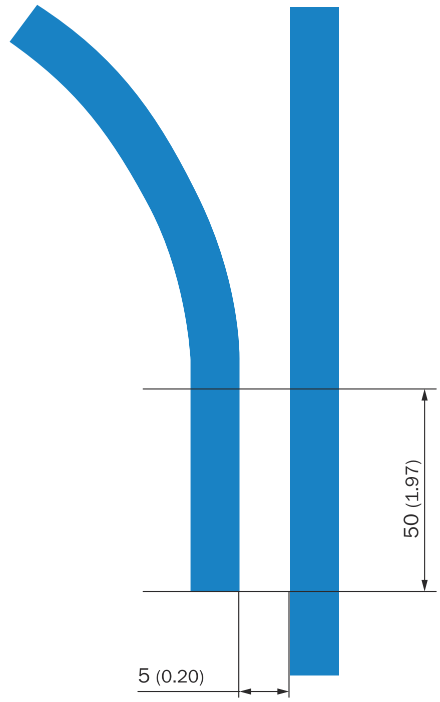


Figure 7: Junctions with colored tapes

The control system can inform the GLS100 of the appropriate direction decision (left, right, straight ahead).

If the control system does not communicate a direction decision, the GLS100 issues an error message.

NOTE

When using color lanes, 2D codes can also be used. The codes can be used to transmit position-specific information to the control system and thus improve the localization of the AGV.

DataMatrix code tapes always have priority over color lanes; if at least one code tape and one color lane are detected at the same time, the color lanes are ignored. DataMatrix multicodes can be read alongside color lanes.

Colored tapes and DataMatrix code tapes must not be used together at junctions and merging points, as the junction or merging point will not be recognized as such.

When applying the colored tapes to the surface, make sure that there is no offset at the transitions between two tapes and that the tapes do not overlap but are applied flush.

3.2.2 2D codes

The GLS100 can capture the following types of 2D codes:

- QR code
- DataMatrix single code
- DataMatrix multicode
- DataMatrix code tape

The individual 2D codes are numbered and contain position information. The GLS100 captures and decodes the 2D codes and sends the following read data via the interface.

- Status of the sensor
- X, Y and Z position of the sensor in relation to the code label
- Sensor alignment (angle orientation) in relation to the code label

- Number of the code label (code data)
- Time offset to the last image capture
- Passing speed in X and Y direction

Using this data, the AGV is localized and repositioned by the control unit.

QR code

The Quick Response (QR) code is a two-dimensional code that can be read from any direction. The QR code consists of a square matrix of black and white squares, called modules, which represent the coded data in binary form. The marking in three of the four corners of the square indicates the orientation.

In the event that the QR code is damaged, the data field of the QR code contains duplicates. Thanks to these redundancies, parts of the code structure can be damaged without affecting the readability of the code as a whole.

Figure 8: Sample QR code

NOTE
When using QR codes, the maximum overrun speed is 2 m/s.

In order to be read by the GLS100, the QR codes must fulfill the following formats:

Table 3: Formats QR code

Formats QR code	25x25 px 29x29 px 33x33 px
Maximum edge length	38 mm

Sensor alignment

The GLS100 can output the angle to the QR code. The reference point is the center of the QR code. For correct position and angle output, it is necessary that only one QR code is visible in the reading field of the GLS100. Failure to do so may result in incorrect data output.

Table 4: Sensor alignment for QR codes

	Coordinate origin is the center of the label

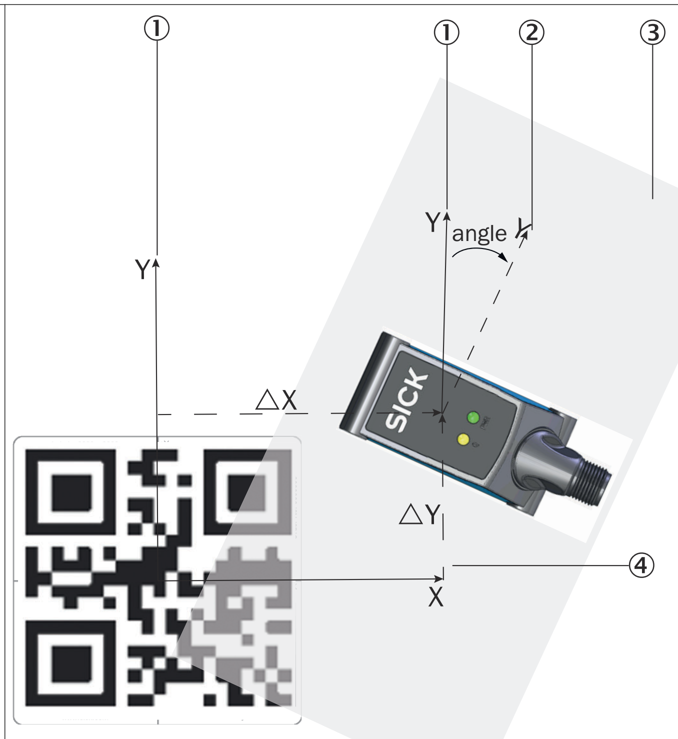
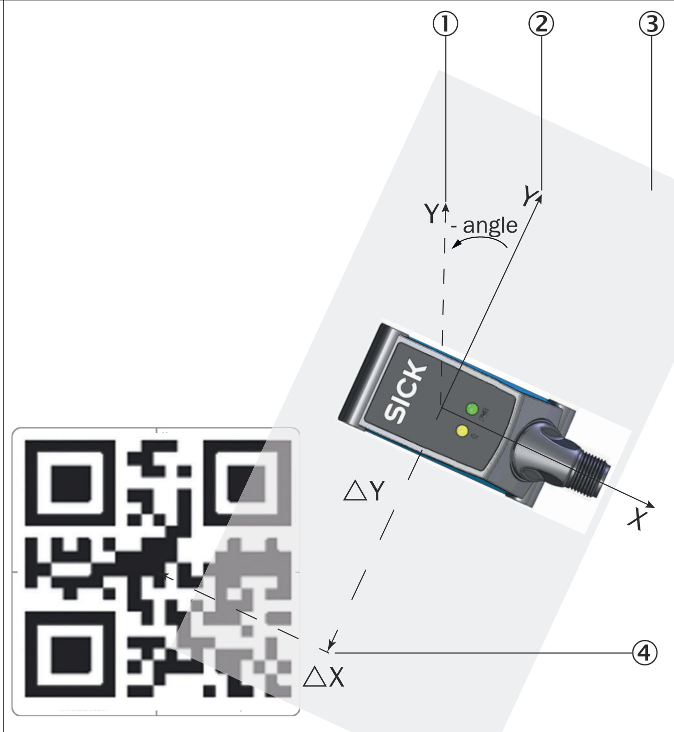
Code coordinate system	 ① Y-direction Code - coordinate system ② Y-direction Sensor - coordinate system ③ Field of view 160 mm x 120 mm ④ Coordinates in the sensor coordination system (x/y)

Table 5: Sensor coordinate system

	Coordinate origin is the optical center of the sensor
Sensor coordinate system	 ① Y-direction Code - coordinate system ② Y-direction Sensor - coordinate system ③ Field of view 160 mm x 120 mm ④ Coordinates in the sensor coordination system (x/y)

DataMatrix single code

DataMatrix codes are among the best-known types of 2D codes.

The DataMatrix code consists of four main components:

- Two continuous and interrupted edges as boundary lines (finder pattern) for the alignment and equalization of the code.
- The alignment pattern, characterized by alternating white and black cells, is used to determine the code type, the cell size and the symbol size of the code.
- Inside, there is a data field consisting of black and white modules containing the binary data in coded form. Depending on the size of the matrix, this also defines the number of possible pieces of information.
- The purpose of the surrounding quiet zone is to separate it from other visual elements in the environment.

Figure 9: DataMatrix single code

In order to be reliably read by the GLS100, the individual cells (modules) of the 2D code must have a minimum size of 1 mm (code module size).

The type of code to be read out can be selected under the “operating mode” setting. DataMatrix multicodes are selected by default. When using customer codes, the module size may have to be configured (ModBus: Register 151/152. CANopen Index 0x02002 Sub 02). Factory setting for the module size is 1.0 mm. If the module size is configured incorrectly, the sensor cannot determine the z-position correctly.

The GLS100 supports the formats 10x10 mm to 24x24 mm. We recommend using the 14x14 mm size, as this is where the GLS100 achieves the most reliable results.

DataMatrix multicode

NOTE
We recommend using the SICK multicode label as it is optimally tailored to the application. Using the multicode label from SICK enables the highest travel speeds to be reached. Alternatively, DataMatrix single codes can also be used. The smaller the code size is, the higher the risk that the code will not be read in a stable manner due to contamination or damage.

The DataMatrix multicode is a collection of DataMatrix single codes with the same content. The advantage is that this type of code is even more robust against contamination and destruction, as the GLS100 only needs to recognize an intact code for reliable data capture. The individual codes are numbered consecutively in order to be able to output a correct positioning determination.

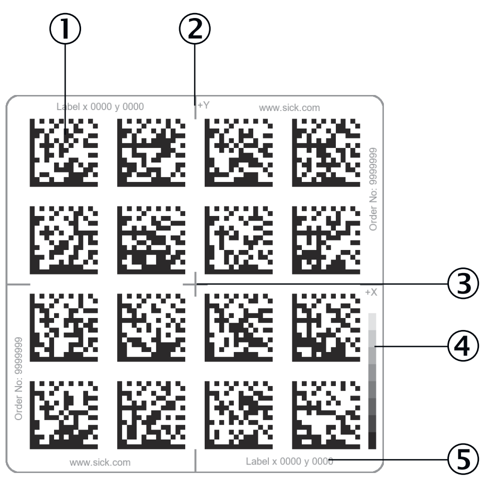


Figure 10: DataMatrix multicode

① Data Matrix Code
② Auxiliary line for alignment
③ Center of the multicode label
④ Grayscale Scale (testing of print quality of the customer print)
⑤ Code data: Number of the MultiCode label

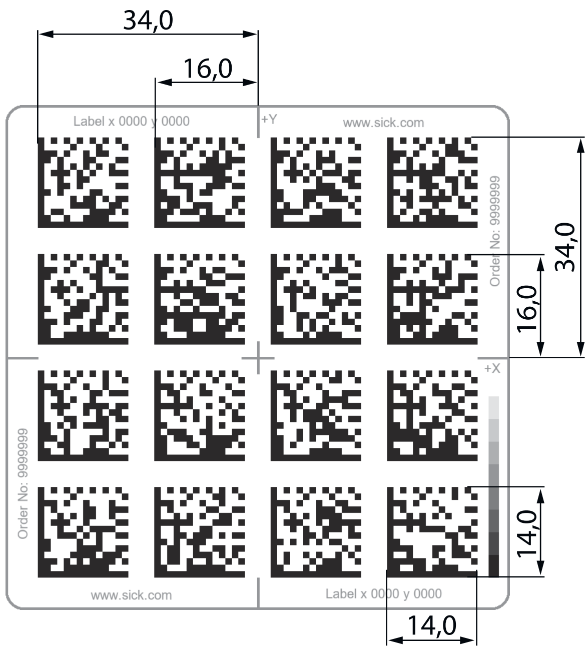


Figure 11: Dimensions of SICK DataMatrix multicode in mm

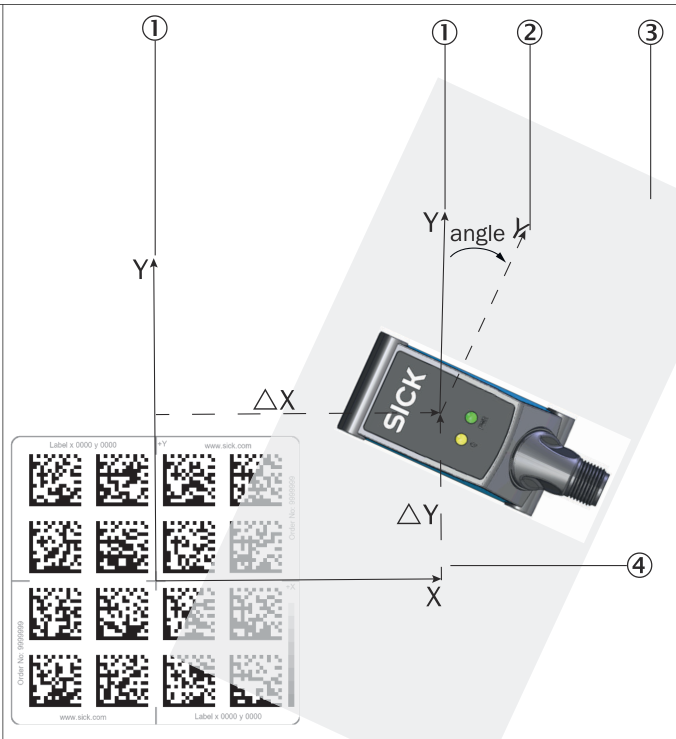
Code alignment

In the grid navigation application, the position of the vehicle or the GLS100 is determined in relation to the code. This convention (code coordinate system) is the factory setting for the GLS100,

For correct position and angle output, a maximum of one DataMatrix multicode label must be visible in the reading field of the GLS100. Otherwise, incorrect data will be output.

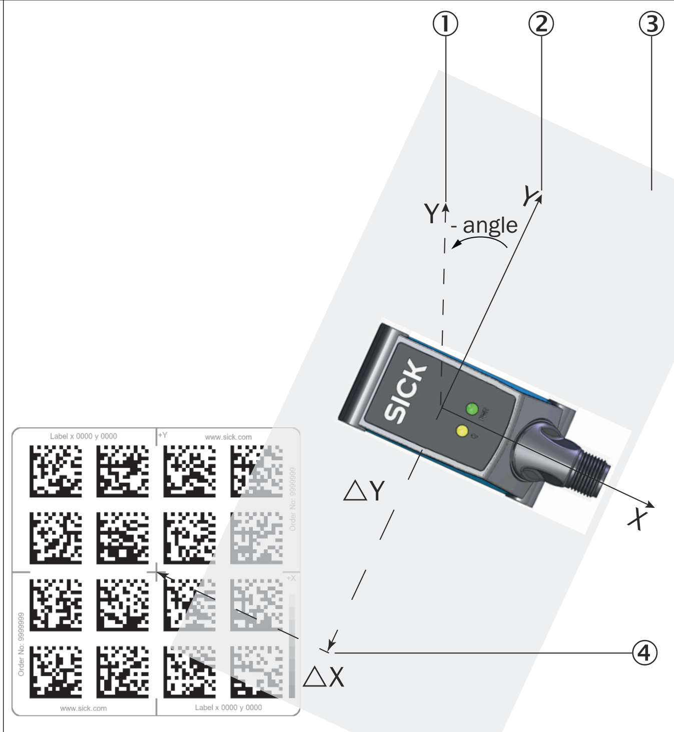
Table 6: Code coordinate system

	Data Matrix MultiCode (coordinate origin is the center of the label).

Code coordinate system	 ① Y-direction Code - coordinate system (sensor mobile and code fixed to the floor) ② Y-direction Sensor - coordinate system (sensor stationary and code moves) ③ Field of view 160 mm x 120 mm ④ Coordinates in the sensor coordination system (x/y)

In addition, it is possible – for applications with stationary mounting of the sensor (and moving code) – to obtain the position and angular alignment of the code label in relation to the sensor center point. This convention is hereinafter called the sensor coordinate system, see table 7, page 20

Table 7: Sensor coordinate system

	Coordinate origin is the optical center of the sensor
Sensor coordinate system	 ① Y-direction Code - coordinate system ② Y-direction Sensor - coordinate system ③ Field of view 160 mm x 120 mm ④ Coordinates in the sensor coordination system (x/y)

2D code tape

A 2D code tape can also be read with the GLS100. SICK provides code tapes as accessories). Alternatively, the "SICK GLS Label Generator" can be used, which is available for download on the SICK homepage (**SICK Label Generator**). Reading the 2D code tape enables the linear positioning of a vehicle, shuttle, etc. along a 2D code tape. In this case, depending on how the sensor is mounted, the X or Y output value corresponds to the linear position.

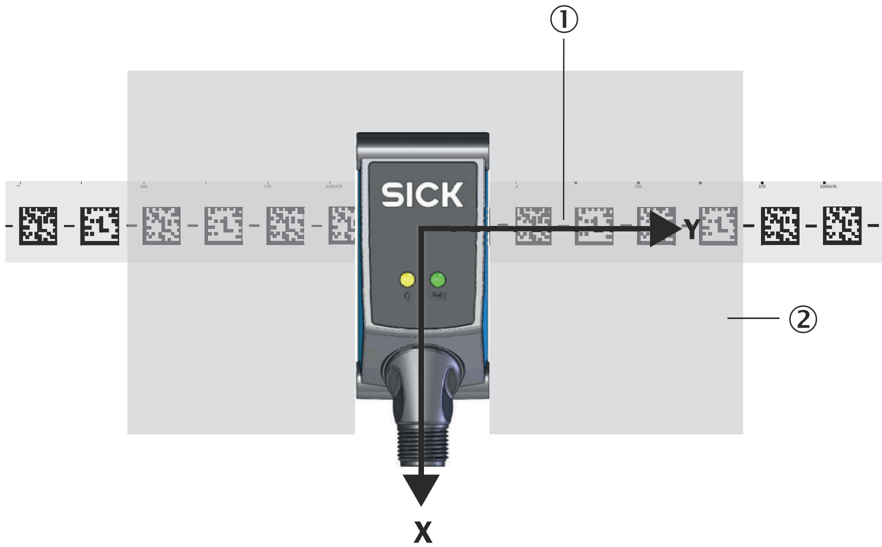


Figure 12: Sensor alignment on the 2D code tape

① Linear position here in Y direction

② Field of view 160 mm x 120 mm

The same requirements apply to the size of the DataMatrix codes shown on the code tape as for DataMatrix single codes.

The format must be at least 10x10 mm and a maximum of 24x24 mm. We recommend the use of 14x14 mm. A sufficient distance must be maintained between the individual codes in order to distinguish the individual codes

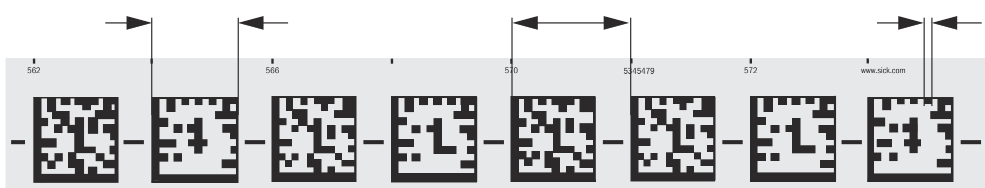


Figure 13: Dimensions SICK DataMatrix code tape in mm

The GLS100's field of view can detect up to three code tapes simultaneously. The GLS100 can be aligned in the X or Y direction on the code tape. We recommend alignment in the Y-position to ensure the highest possible overrun speeds. The code tapes can also be applied to the surface in radii. In this case, the curve radius must be ≥ 50 cm. Heavily contaminated or badly damaged code tapes impair the reading accuracy of the GLS100. Regular inspection of the lanes and subsequent cleaning is recommended.

Sensor alignment

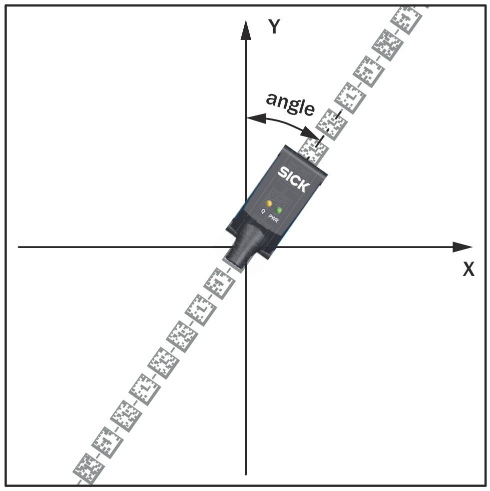


Figure 14: Sensor alignment to the code lane

Junctions and merging points

As soon as the GLS100 detects more than one color lane, it interprets this as a junction or merging point.

Table 8: Junctions and merging points

Minimum distance between the lanes	5 mm
Overlapping of the lanes	50 mm minimum length to enable clear identification of the different color lanes.

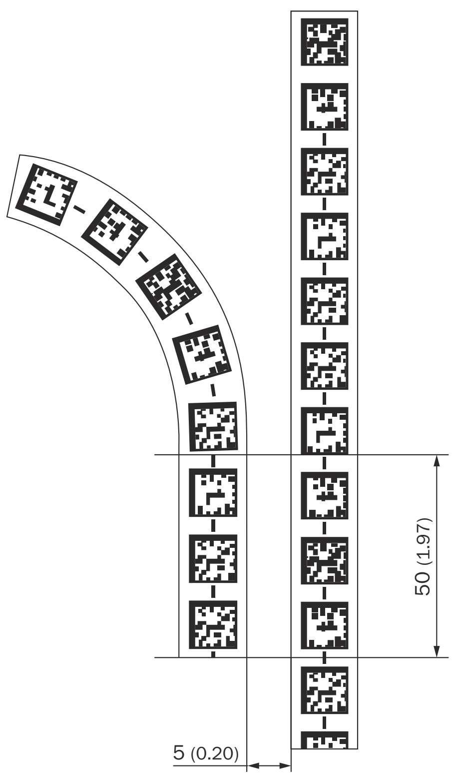


Figure 15: Junctions and merging points

The control system can inform the GLS100 of the appropriate directional decision (left, right, straight ahead).

NOTE
When using color lanes, 2D codes can also be used. The codes can be used to transmit position-specific information to the control system and thus improve the localization of the AGV.

DataMatrix code tapes always have priority over color lanes; if at least one code tape and one color lane are detected at the same time, the color lanes are ignored. DataMatrix multicodes can be read alongside color lanes.

Colored tapes and DataMatrix code tapes must not be used together at junctions and merging points, as the junction or merging point will not be recognized as such.

When applying the colored tapes to the surface, make sure that there is no offset at the transitions between two tapes and that the tapes do not overlap but are applied flush.

Datamatrix automatic mode

If "SICK automatic mode" is selected as the operating mode, the GLS100 automatically recognizes whether a Datamatrix code tape or 2D multicode is being read. Manual switching is no longer necessary. The detected code is displayed in the status byte under bit 4-7 (see Table 9, page 39).

NOTICE
In addition, SICK provides the "LabelGenerator" under Downloads Software www.sick.com/1141627 and www.sick.com/1141629. The SICK multicodes and code tapes can be generated and printed as pdf or png files. After printing on the customer side, it is advisable to check the dimensions of the codes, see Figure 6, page 17. We offer protective film against abrasion and contamination at www.sick.com/5338386

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 data".
- Relative humidity: see "Ambient data".
- 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 GLS100 in accordance with the following chapter "Mounting requirements", page 25.

2 Mount the GLS100 using the fixing holes.
"Structure and status indicators"
"Accessories", page 56

5.1.1 Mounting requirements

- Typical space requirement for sensor, see "Optik_Merkmale_GLS100".
- Comply with technical parameters such as the permitted ambient conditions for the operation of the sensor (e.g., temperature range, EM interference), see "Ambient data".
- Protect the sensor from direct sunlight.
- Only affix the sensor using accessories supplied for this purpose -> there are no screw connections on the sensor.
- Sensing distance: 100 mm (±30 mm)
  The sensing distance is the distance from the front sensor edge (housing edge) to the ground.

5.1.2 Scope of delivery

The following are included with delivery of the sensor:

- GLS100 grid localization and lane guidance sensor

Accessories:

Accessories (e.g., cables, fastening adapters) are only included with delivery if ordered separately.

5.2 Mounting the sensor

Arrangement over guide track

With the factory setting, the GLS100 must be positioned orthogonally to the color lane and the 2D code to be detected.

To achieve the maximum overrun speed, the sensor should be positioned at right angles to the direction of travel.

Table 9: Mounting

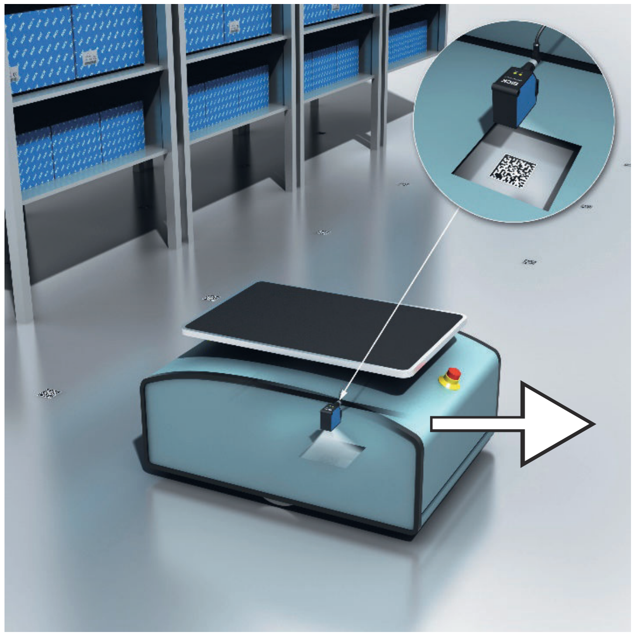


Figure 16: Arrangement via code grid and traverse direction

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.

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

6.1.2 Wiring instructions

NOTE
Pre-assembled cables can be found online at:

► www.sick.com/GLS100

Please observe the following wiring instructions:

- 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 17.

► Cables in groups 1, 2 and 3, 4 must be routed in different cable channels or metallic separators must be used, see figure 18 and see figure 19. This applies particularly where cables of devices with a high level of radiated emission, such as frequency converters, are laid parallel to sensor cables.

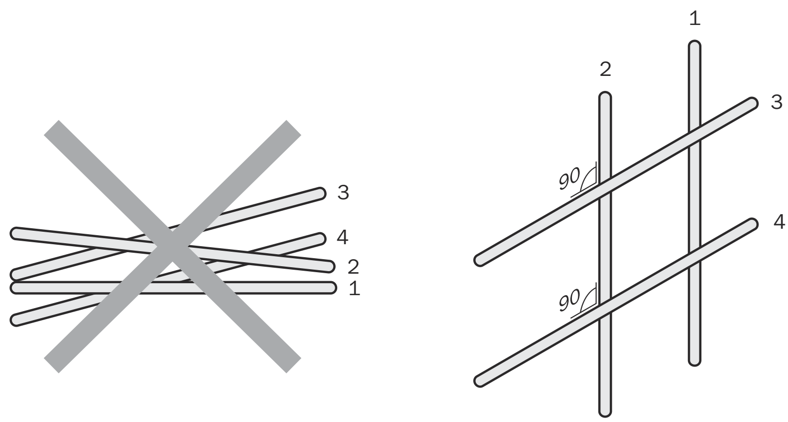


Figure 17: Cross cables at right angles

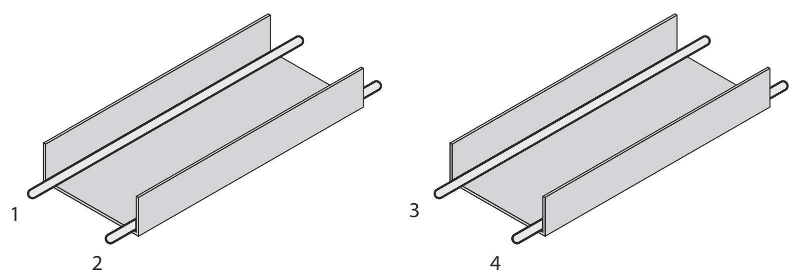


Figure 18: Ideal laying – Place cables in different cable channels

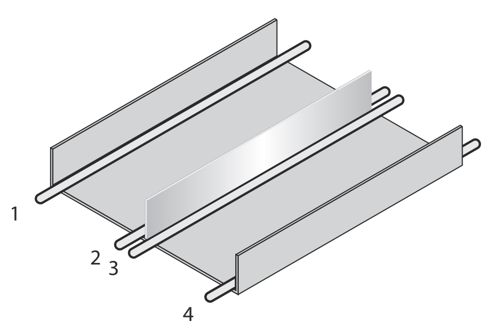
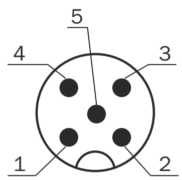


Figure 19: Alternative laying – Separate cables with metallic separators

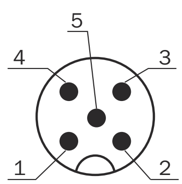
6.2 Pin assignment of the connections

M12 connection, CANopen: 1141629



PIN	Pin assignment
1 - BN	VIN
2 - WH	CAN HIGH
3 - BU	GND
4 - BK	reserved - do not connect
5 - GY	CAN LOW

M12 connection, RS485: 1141627



PIN	Pin assignment
1 - BN	VIN
2 - WH	RS485 A
3 - BU	GND
4 - BK	reserved - do not connect
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 10.8 V ... 30 V (stabilized safety extra-low voltage (SELV/PELV) as per current standard EN 60950-1)
- Power 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 GLS100

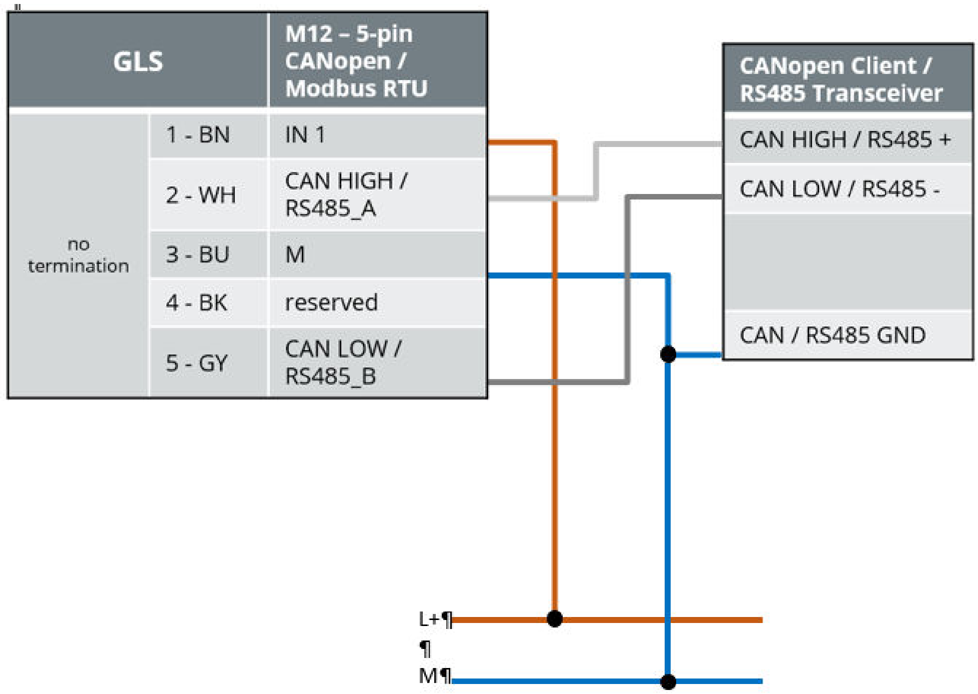


Figure 20: Electrical connection of GLS100

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

CAN connection

It is recommended to connect the ground cable to the CAN-GND. If there is no separate CAN-GND in the system, this pin must be connected to the FE.

Modbus connection

The GLS100 does not have a terminator in the device itself. The advantage is that several sensors can be combined in a bus structure and that a point-to-point connection is not the only one possible. In any case, the bus connection must be terminated with appropriate terminators.

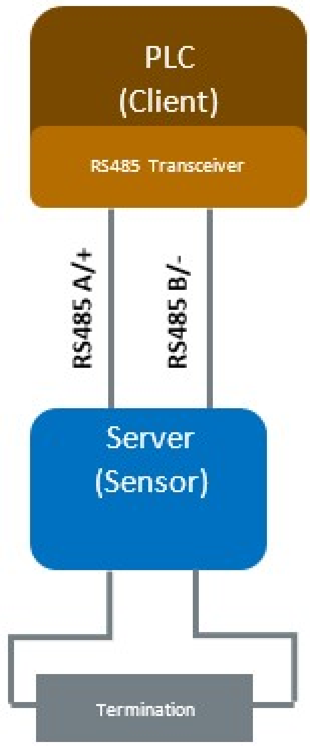


Figure 21: Point-to-point connection

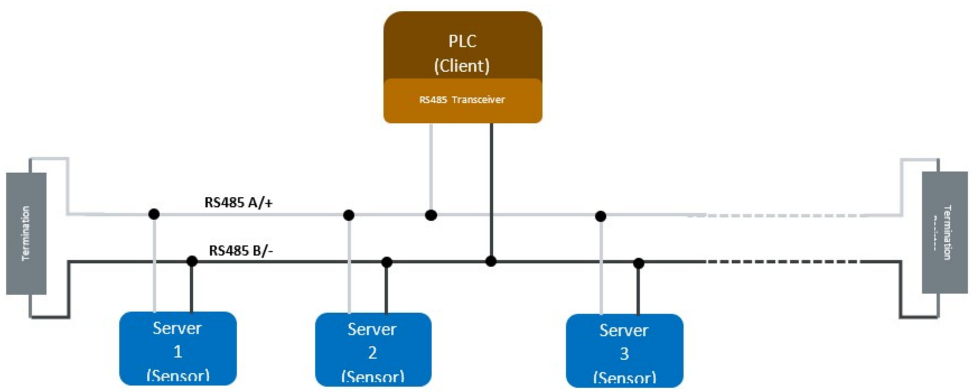


Figure 22: Bus structure

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

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

7.3 First step to commissioning with CANopen

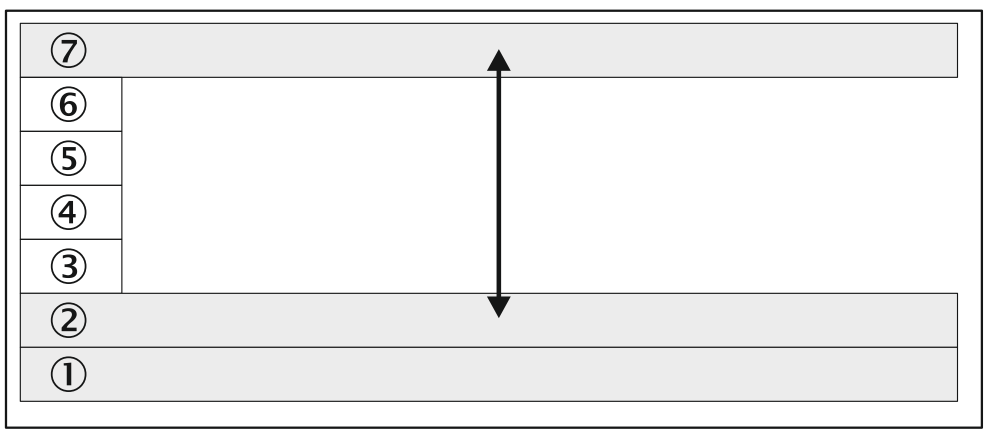
7.3.1 CANopen overview

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 GLS100 is inserted into the bus via a stub cable in a star configuration. 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 GLS100 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 required status (Pre-Operational, Operational or Stopped) by the NMT client.

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 10: 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 GLS100 is ready for parameterization; acyclic communication can take place via SDO. However, the GLS100 is not yet able to commence PDO communication and is not sending out any emergency messages.
Operational	In this state, the GLS100 is fully ready for operation and can transmit messages autonomously (PDOs, emergency messages).
Stopped	In this state, the GLS100 is not actively communicating (although communication is still being actively monitored via node guarding).

The GLS100 automatically enters the operational state at startup in the factory setting.

7.3.2 Note ID and baud rate

There can be a maximum of 128 devices in a CANopen network, one NMT client and up to 127 NMT 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 requirements must be met for communication with the NMT client:

- A correct node ID must be set on the GLS100.
  Correct is:
  - A node ID which is free in the CANopen network
  - A node ID that the NMT client expects
- The same baud rate must be set on the GLS100 as on the server.

The following parameters are factory set on the GLS100:

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

The following communication parameters can be allocated to the GLS100:

- Node ID: 1 to 127 ((0 is reserved for broadcast objects))
- Baud rate: 10 kbit/s, 20 kbit/s, 50 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 1,000 kbit/s

7.3.3 General information about CAN communication

Layer setting services (LSS) are supported in order to set the node ID and the baud rate of the GLS100.

The LSS server is accessed via its LSS address (Identity Object), which is stored in object 1018h.

The LSS address comprises:

- Vendor ID (SICK Vendor ID = Hex: 0x1000056, Dec: 16777302)
- Product code (GLS100 = Hex: 0x1006, Dec: 4102)
- Revision number (Hex: 0x10000, Dec: 65536)
- Serial number, see type label

The server requests the individual services via the LSS services, which are then executed by the GLS100. Communication between the LSS server and LSS client is carried out via the LSS telegrams. 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 client to LSS server
- 07E5h = LSS server to LSS client

NOTE
During the LSS configuration, only one server device may be connected to the CAN bus, i.e. only the GLS100 to be configured.

Below are 2 examples of setting the node ID and baud rate.
In the examples, a GLS100 is configured to node ID 19 and a bit rate of 500 kbit.
The transmission direction refers to the CAN device that carries out the configuration (client).

Setting the node ID

Step	Description	Direction	CAN-ID	Length	Data (hexadecimal)
1	Send NMT command "go to pre-operational" to all servers Result: Stop server sending pdos.	transmit	000h	2	80 00
2	Send the LSS command "switch all servers to LSS configuration state" Result: Server 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 Server confirms the 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 Server confirms that the configuration has been saved	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 NMT command 'reset communication' to all servers.	transmit	000h	2	82 00
8	Send NMT command 'go to operational' to all servers. Result: GLS100 now communicates with new Node-ID	transmit	000h	2	01 00

Configuring baud rate

Step	Description	Direction	CAN-ID	Length	Data (hexadecimal)
1	Send NMT command "go to pre-operational" to all servers Result: Server stops sending pdos.	transmit	000h	2	80 00

Step	Description	Direction	CAN-ID	Len gth	Data (hexadecimal)
2	Send the LSS command "switch all servers to LSS configuration state" Result: Server 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 Server 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 Server confirms that the configuration has been saved	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.					

Alternatively, the node ID and baud rate can be set via the SOPAS ET communication software using the Si-Link box. This is available for download here: www.sick.com/SOPAS

7.3.4 Process data objects (PDOs)

Up to four different Transmit PDOs (TPDOs) can be subscribed on the CAN interface.

The contents of the TPDOs can be freely assigned via dynamic mapping under the 0x1A00 to 0x1A06 indexes.

The communication parameters can be set under 0x1800 to 0x1806.

TPDOs 1 to 7 are mapped as described in the default mapping.

7.3.5 PDO communication

In the factory setting, the transmission type for TPDO 01, TPDO02 and TPDO03 is set to asynchronous communication. A transmission period of 50 ms is set in the factory for TPDO 01, TPDO02 and TPDO03, with which TPDO 01, TPDO02 and TPDO03 are transmitted cyclically.

Changing the transmission type factory setting

The transmission type of the Transmit PDOs can be set according to CANopen standard DS-301 in configuration registers 0x1800, 0x1801, 0x1802 of TPDOs 1 to 3.
With asynchronous transmission types 254 and 255, transmission takes place at the internal sensor update rate, i.e. 33 ms (for Data Matrix MultiCode) or 40 ms (for QR code). The factory configuration setting of the transmission type is 255.

PDO configuration for lane guidance

Depending on the application, TPDOs 4 to 7 can be set in registers 0x1803 to 0x1806 for lane guidance. These are not configured at the factory and must be configured accordingly.

If more than 4 TPDOs are required for an application, these can be sent on the messages of a node ID that is still free. In the configuration, the CobId must be adjusted according to the selected additional Node-Id. The PDOs are sent to the corresponding CAN address. No other device may be configured on this address in the CAN network

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

NOTE
The SOPAS software can be used to configure the interface, http://www.sick.com/SOPAS

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

- The GLS100 must be set to a correct server address.
  Correct is:
  - A server address that is free in the Modbus network
  - A server address that the client expects
- The same baud rate must be set in the GLS100 as in the client.

The following parameters are factory-set on the GLS100

- Server address: 10
- Baud rate: 19,200 bps
- Parity: even

NOTE
The GLS100 does not have an internal termination resistor, which serves as a bus terminator. This must be taken into account when operating the device in a Modbus network:

- For a point-to-point connection, an additional external bus terminator must therefore be used.
- If a variant with bus terminator is required, you can get in touch with your SICK contact person.

The following communication parameters can be allocated to the sensor

- Server address: 1 to 247 (0 is reserved for broadcast, e.g. address 0 can be used to send a configuration to all servers on the bus).
- Baud rate:
  3: 9,600 bps
  4: 19,200 bps
  5: 38,400 bps
  6: 57,600 bps
  7: 115,200 bps
- Parity bit:
  0 = No parity
  1 = Even parity
  2 = Odd parity

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.

NOTE
Examples and details of requests and responses can be found in the appendix: "Modbus RTU", page 58.

8 Operation

8.1 Operation via SOPAS

The SDD drivers for the SOPAS ET configuration software can be found at www.sick.com/1141627 and www.sick.com/1141629 (as well as at www.sick.com). SOPAS ET can be used to configure and analyze the sensor.

8.1.1 Overview

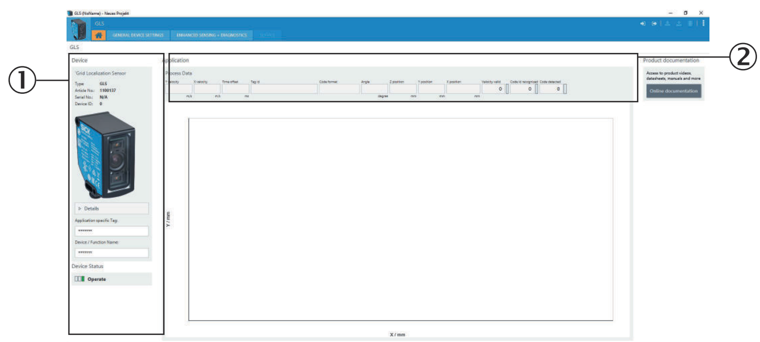


Figure 23: SOPAS overview

1 This is where you will find information about the device, for example the type or part number, and device details such as the firmware version.

2 The most important result data are displayed here, just as they are transferred in the CAN PDOs or the Modbus “result” data.
These are:
- Speed in the x and y direction
- Time offset since code reading
- TagID: numerical 2 byte value that uniquely identifies the label. For a SICK MultiCode X/Y value of the label
- Angle: orientation of the sensor relative to the code or vice-versa
- X, Y and Z position
- Status indicators for:
“velocity valid”: the GLS has output valid speed information.
TagID recognized: a code was detected and read in the field of view.
Code detected: a code was detected in the field of view.

8.1.2 General Device Settings

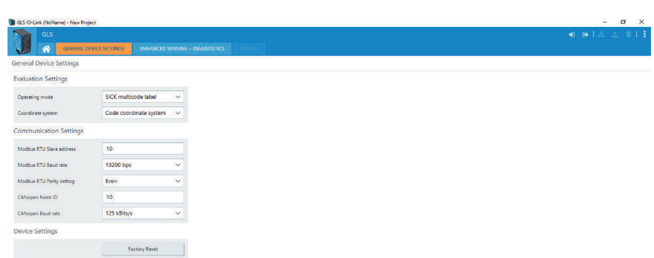


Figure 24: General Device Settings

In this menu, you can choose between the different code types (Datamatrix multicode, QR single code or code tape) of the lane guidance using colored tapes or code tape as well as the two coordinate systems (sensor coordinate system and code coordinate system) in the **evaluation settings** . The LED color can also be selected under **Device Settings** . This is particularly important for color lane guidance, as it has an influence on the**quality of lanes**depending on the background color.

8.1.3 Enhanced Sensing and Diagnostics

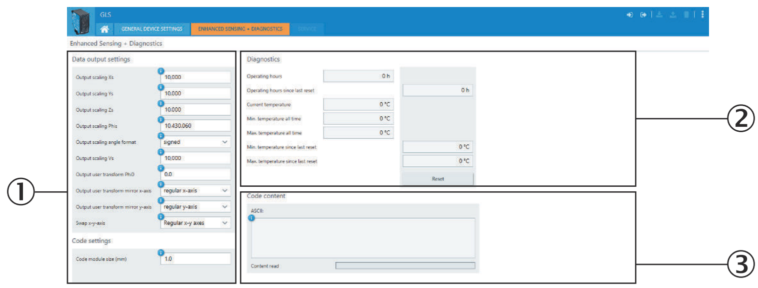


Figure 25: Enhanced Sensing and Diagnostics

1 The format and increment of the output value can be configured in this section. For a detailed explanation on the scaling of values, see "Transformation of output values", page 50. The module size of the codes used can also be configured, and are factory set to 1 mm.
This setting is correct for the SICK MultiCodes, but may need to be adjusted when using your own codes.
2 This menu can be used to read diagnostic data, for example operating hours and temperature.
3 The entire contents of the code (230 bytes) can be read in this area.

8.2 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/GLS100

8.2.1 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.

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
0x1000	-	RO	Device type	0x00000000	UINT32		No device profile supported
0x1001	-	RO	Error register	0x00	UINT8		
0x1005	-	R/W	COB ID SYNC	0x00000080	UINT32		
0x1008	-	RO	Manufacturer device name		STRING		GLSXXXX

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
0x1009	-	RO	Manufacturer hardware rev		STRING		Hardware version, sensor
0x100A	-	RO	Manufacturer software rev		STRING		Firmware version, sensor
0x100C	-	R/W	Guard time	0x0000	UINT16		
0x100D	-	R/W	Life time	0x00	UINT8		
0x1014	-	R/W	COB-ID EMCY	0x00000080	UINT32		
0x1015	-	R/W	Inhibit Time Emergency	0x0000	UINT16		
0x1016			Heartbeat Consumer Entries				
	1	R/W	Consumer Heartbeat Time 1	0x00000000	UINT32		
	2	R/W	Consumer Heartbeat Time 2	0x00000000	UINT32		
0x1017	-	R/W	Heart Beat Time	0x0000	UINT16		
0x1018		RO	Identity object		UINT8		
	1	RO	Vendor Id	0x01000056	UINT32		0x01000056 (SICK AG)
	2	RO	Product code	0x00001006	UINT32		
	3	RO	Revision number	0x00010000	UINT32		Firmware version
	4	RO	Serial number		UINT32		Device serial number
0x1800			Transmit PDO Communication Parameter 1				
	1	R/W	COB-ID	0x0000018A	UINT32		PDO 1 is valid
	2	R/W	Transmission type	0xFF	UINT8		Asynchronous
	3	R/W	Inhibit Time	0x0000	UINT16		
	5	R/W	Event timer	0x0032	UINT16		**50 ms (default)**
0x1801			Transmit PDO Communication Parameter 2				
	1	R/W	COB-ID	0x0000028A	UINT32		PDO 2 ist gültig
	2	R/W	Transmission type	0xFF	UINT8		Asynchronous
	3	R/W	Inhibit Time	0x0000	UINT16		
	5	R/W	Event timer	0x0032	UINT16		**50 ms (default)**
0x1802			Transmit PDO Communication Parameter 3				

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
	1	R/W	COB-ID	0x0000038A	UINT32		PDO 3 is valid
	2	R/W	Transmission type	0xFF	UINT8		Asynchronous
	3	R/W	Inhibit Time	0x0000	UINT16		
	5	R/W	Event timer	0x0032	UINT16		**50 ms (default)**
0x1803			Transmit PDO Communication Parameter 4				
	1	R/W	COB-ID	0x8000048A	UINT32		PDO 4 is invalid, i.e. not activated at the factory.
	2	R/W	Transmission type	0xFF	UINT8		Asynchronous
	3	R/W	Inhibit Time	0x0000	UINT16		
	5	R/W	Event timer	0x0032	UINT16		**50 ms (default)**
0x1A00							
	0	R/W	Number of mapped objects	0x02	UINT8		
	1	R/W	Mapping Entry 1	0x20210220	UINT32		map 0x2021 SI 0x02 x-position
	2	R/W	Mapping Entry 2	0x20210320	UINT32		map 0x2021 SI 0x03 y-position
	3	R/W	Mapping Entry 3	0x00000000	UINT32		
	4	R/W	Mapping Entry 4	0x00000000	UINT32		
	5	R/W	Mapping Entry 5	0x00000000	UINT32		
	6	R/W	Mapping Entry 6	0x00000000	UINT32		
	7	R/W	Mapping Entry 7	0x00000000	UINT32		
	8	R/W	Mapping Entry 8	0x00000000	UINT32		
0x1A01							
	0	R/W	Number of mapped objects	0x04	UINT8		
	1	R/W	Mapping Entry 1	0x20210110	UINT32		map 0x2021 SI 0x01 Status
	2	R/W	Mapping Entry 2	0x20210410	UINT32		map 0x2021 SI 0x04 z-position
	3	R/W	Mapping Entry 3	0x20210510	UINT32		map 0x2021 SI 0x05 angle
	4	R/W	Mapping Entry 4	0x20210710	UINT32		map 0x2021 SI 0x07 time offset
	5	R/W	Mapping Entry 5	0x00000000	UINT32		
	6	R/W	Mapping Entry 6	0x00000000	UINT32		

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
	7	R/W	Mapping Entry 7	0x00000000	UINT32		
	8	R/W	Mapping Entry 8	0x00000000	UINT32		
0x1A02							
	0	R/W	Number of mapped objects	0x03	UINT8		
	1	R/W	Mapping Entry 1	0x20210620	UINT32		map 0x2021 SI 0x06 tag id
	2	R/W	Mapping Entry 2	0x20210810	UINT32		map 0x2021 SI 0x08 x-velocity
	3	R/W	Mapping Entry 3	0x20210910	UINT32		map 0x2021 SI 0x09 y-velocity
	4	R/W	Mapping Entry 4	0x00000000	UINT32		
	5	R/W	Mapping Entry 5	0x00000000	UINT32		
	6	R/W	Mapping Entry 6	0x00000000	UINT32		
	7	R/W	Mapping Entry 7	0x00000000	UINT32		
	8	R/W	Mapping Entry 8	0x00000000	UINT32		
0x1A03							
	0	R/W	Number of mapped objects	0x00	UINT8		
	1	R/W	Mapping Entry 1	0x00000000	UINT32		
	2	R/W	Mapping Entry 2	0x00000000	UINT32		
	3	R/W	Mapping Entry 3	0x00000000	UINT32		
	4	R/W	Mapping Entry 4	0x00000000	UINT32		
	5	R/W	Mapping Entry 5	0x00000000	UINT32		
	6	R/W	Mapping Entry 6	0x00000000	UINT32		
	7	R/W	Mapping Entry 7	0x00000000	UINT32		
	8	R/W	Mapping Entry 8	0x00000000	UINT32		
0x1F80	-	const	NMT Startup	0x08	UINT32		
0x2001	-	R/W	Operating mode	2	UINT8	x	0: QR single code 1: DataMatrix single code 2: **DataMatrix label (default)** 3: DataMatrix code tape 4: DataMatrix automode 5: Lane Guidance

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
0x2002			Positioning settings		Record		Settings for the coordinate system and code used
	1	R/W	Coordinate system	1	UINT8		**1: Tag centered (default)** 2: Sensor centered
	2	R/W	Code module size	1.0	FLOAT		**1.0 mm (default)** (definition SICK MultiCode Tag)
	3	R/W	Distance to inner code	0.009	FLOAT		**0.009 m (default)** (for 1 mm pixel size in SICK MultiCode tag)
	4	R/W	Distance to outer code	0.027	FLOAT		**0.027m (default)** (for 1 mm pixel size in SICK MultiCode tag)
	5	R/W	Code tape position unit	0.01	REAL32		
	6	R/W	Colored tape width	0,019	REAL32		
	7	R/W	Colored tape distance	0,005	REAL32		
0x2003			Output scaling		Record		Scaling of output values
	1	R/W	xs	10000	FLOAT		**10,000 (default)** (result in 0.1 mm steps)
	2	R/W	ys	10000	FLOAT		**10,000 (default)** (result in 0.1 mm steps)
	3	R/W	zs	10000	FLOAT		**10,000 (default)** (result in 0.1 mm steps)
	4	R/W	phis	32,767 / pi	FLOAT		**32,767 / pi (default)**
	5	R/W	angle format	0	UINT8		**0: Signed (i.e. -pi...+pi) (default)** 1: Unsigned (i.e. 0...+2pi)
	6	R/W	vs	10000	FLOAT		**10,000 (default)** (result in 0.1 mm steps)
0x2004			Output user transform		Record		Result transformation (e.g. for non-vehicle-centered sensor mounting)
	1	R/W	phi_0	0	FLOAT		Offset value for code orientation (angle). Clockwise direction of rotation = positive values. **0 ° (default)**
	2	R/W	mirror x-axis	0	UINT8		Mirroring of x-axis **0: x-axis not mirrored (default)** 1: x-axis mirrored
	3	R/W	mirror y-axis	0	UINT8		**0: y-axis not mirrored (default)** 1: y-axis mirrored
	4	R/W	swap x-y axes	0	UINT8		Swap of x-and y-axis **0: Axes not swapped (default)** 1: Axes swapped
0x2006	-	R/W	**Emission color**	0	UINT8		See IO-Link Index 208 Emission-Color
0x2007	-	R/W	**Sensor mounting direction**	0	UINT8		See IOLink172SensorMountingDirection
0x2021			**Process Data for Code Recognition**				Result data analog to PDOs 1-3

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
	1	RO	Status		UINT16	x	"PDOs", page 45
	2	RO	x-position		INT32	x	Output unit x-position according to scaling. Value is a multiple of 1 m/x_s
	3	RO	y-position		INT32	x	Output unit x-position according to scaling. Value is a multiple of 1 m/x_y
	4	RO	z-position		INT32	x	Output unit x-position according to scaling. Value is a multiple of 1 m/x_z
	5	RO	Angle		INT16	x	Code orientation. Positive values in clockwise direction. For output value, see scaling: Multiple of 1 / phi_s.
	6	RO	Tag Id		UINT32	x	Numeric read value of the code tag; for 64-bit tag IDs, these are the lower 32 bits.
	7	RO	Time offset		UINT16	x	Time since image was taken. Unit 0.1 ms
	8	RO	x-velocity		INT16	x	Overspeed in x-direction - according to scaling. Value is a multiple of 1 m/v_s
	9	RO	y-velocity		INT16	x	Overspeed in y-direction - according to scaling. Value is a multiple of 1 m/v_s
	10	RO	Tag ID (high)		UINT32	x	Only for 64-bit tag IDs: Upper 32 bits of the numeric read code tag value.
0x2022	-		Code data		DOMAIN		2 bytes: Number of valid data bytes 230 bytes: Code content For the SICK MultiCode label, e.g.: c3 x 0000 y 0005. c3 is an internal alphanumeric indication of the code content used to identify the code.
0x2023			**Process Data for Lane Guidance**				Result data or IO-Link process data input (IO-Link index 40)
	1	RO	Status byte		UINT8		
	2	RO	Quality of Lanes		UINT8		
	3	RO	LCP1		INT16		
	4	RO	LCP2		INT16		
	5	RO	LCP3		INT16		
	6	RO	Lane Angle 1		INT16		
	7	RO	Lane Angle 2		INT16		
	8	RO	Lane Angle 3		INT16		
	9	RO	Code Lane Position 1		INT32		
	10	RO	Code Lane Position 1		INT32		
	11	RO	Code Lane Position 1		INT32		
	12	RO	Z Position		INT16		

Index	Subindex	R/W	Object name	Default value	Type	PDO mapbar	Description
	13	RO	Code X Position		INT16		
	14	RO	Code Y Position		INT16		
0x2024			**Line Intensity**				See IOLink267LineLevel
	1	RO	IOLink267Line-Level[0]		UINT8		
	2	RO	IOLink267Line-Level[1]		UINT8		
	3	RO	IOLink267Line-Level[2]		UINT8		

8.2.2 PDOs

The GLS100 has three TPDO with fixed mapping under 0x180x + node ID and no RPDO. In its default state (node ID 0x0A), the index for TPDO1 is 0x018A.

The TPDO1 is structured as follows:

Table 11: PDO1

Byte	7	6	5	4	3	2	1	0
Value	Y-Position				X-Position			

Table 12: PDO2

Byte	7	6	5	4	3	2	1	0
Value	Time offset		Angle		Z-Position		Status	

Table 13: PDO3

Byte	7	6	5	4	3	2	1	0
Value	Y-Velocity		X-Velocity		Tag-ID			

Table 14: PDO4

Byte	7	6	5	4	3	2	1	0
Value	LCP 3		LCP 2		LCP 1		Quality of Lanes	Status

Table 15: PDO5

Byte	7	6	5	4	3	2	1	0
Value	z-position		Lane Angle 3		Lane Angle 2		Lane Angle 1	

Table 16: PDO6

Byte	7	6	5	4	3	2	1	0
Value	Code Lane Position 2				Code Lane Position 1 (For color lanes: Content of DM-Id-Codes)			

Table 17: PDO7

Byte	7	6	5	4	3	2	1	0
Value					Code Lane Position 3			

Table 18: Status Bits - In code recognition mode (PDO2, 2 bytes)

Bit	15	14-8	7-4	3	2	1	0
Value	Device status: 0 = ok 1 = ERROR	Reserved	Code format	Velocity valid	Tag ID recognized	Code read	Code created
	0 = Device is OK 1 = Error						

Table 19: Status bits - In lane guidance mode (PDO1, 1 byte)

Bit	7 - 6	5	4	3	2	1	0
Value	Reserved	Code lane state	Device status	Code present	LCP3 Status	LCP2 Status	LCP1 Status
	1 = code lane detected, 0 = no code lane detected 0 = Device is OK, 1 = Error 1 = code present, 0 = code not present 1 = Lane detected, 0 = no lane detected 1 = Lane detected, 0 = no lane detected 1 = Lane detected, 0 = no lane detected **NOTE** If a code lane is detected, the LCP states represent code lane states						

NOTE

Parameter changes to the PDO mapping objects are only made in Pre-operational status.

1 First, set bit 31 to 1 in corresponding object 180xh in subindex 01h.
2 Set subindex 00h to 0 in object 1A0xh.
3 Configure the objects to be mapped in subindexes 01h to n of object 1A0xh.
4 Set subindex 00h of object 1A0xh to the number of mapped objects.
5 Then set bit 31 back to 0 in corresponding object 180xh in subindex 01h.

8.2.3 Transmission types

The transmission type of the respective TPDO can be set in index 0x1800 to 0x1803 (additionally up to 0x1806 for lane guidance). This index comprises the following subindexes:

Table 20: Subindexes

Subindex	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	0 - 255	The transmission type is set here.
3	Inhibition Time	0 - 65535	The inhibition time (send delay time) specifies in ms the minimum waiting time between the sending of two identical Transmit PDOs. It always has higher priority than the event timer, the CoS events and triggering with SYNC messages. If, for example, the event timer is set to 100 ms and the inhibition time to 1 s, the respective PDO is only sent every second.
4	Compatibility entry	-	Not used

Subindex	Name	Permissible values	Description
5	Event timer	0 ... 65535	The event timer sets the time between two transmissions from the TPDO in [ms]. The value 0 results in data being sent at the internal sensor update rate (33 ms for Data Matrix MultiCode, 40 ms for QR Code). The recommended minimum value here is 50 ms.

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

8.3 Operation via Modbus RTU

The following is an overview of the various “sections” and individual register addresses and their values.

Configuration data can be read and, if necessary, written in the “section configuration” and the code read results in the “section results”.

8.3.1 Register Groupe "Input registers" (read-only)

The "Input registers" can be read out via function code 0x04.

8.3.1.1 Section Device Identification

The Device Identification data (all of data type ASCII string) can be found in the address range of the input register from 0x00.

Table 21: Section Device Identification

Address	Name	#Registers	Ref. IO-Link Index	Description
0	Vendor name	4	16	Mandatory
4	Product code	4	219	Mandatory
8	Firmware version	6	23	Mandatory
14	Vendor URL	6	17	Regular
20	Product name	16	20	Regular
36	Model name	9	18	Regular
45	Serial number	4	21	
49	Application name	16	24	
65	SickModbusProfileVersion	6	-	

8.3.1.2 Section Index

The section index registers contain the addresses (data type UINT16) of the other sections. The registers are therefore all 2 bytes in size and the content is constant. The values are stored in the following table:

Table 22: Section Index

Address	Name	Value
128	Number of sections within table	0x4
129	Length of section 1 - Status	0x1
130	Start address of section 1	0x1000
131	Register type of section 1	0x0
132	Length of section 2 - Results	140
133	Start address of section 2	192

Address	Name	Value
134	Register type of section 2	0x0
135	Length of section 3 - Commands	18
136	Start address of section 3	96
137	Register type of section 3	0x1
138	Length of section 4 - Configuration	48
139	Start address of section 4	144
140	Register type of section 4	0x1

8.3.1.3 Section Result

The result data is from address 192 onwards and the data in the 192-196 range is compatible with the registers in FW version R1.0.1A.

Table 23: Section Result

Address	Content	#Registers	Ref. IO-Link Index	Note
192	ModBus process data → Status In code recognition mode: Bit 15: Device status Bits 14-8: Reserved Bits 7-4: Code format Bit 3: Velocity valid Bit 2: Tag ID recognized Bit 1: Code read Bit 0: Code detected In lane guidance mode: Bit 15-6: Reserved Bit 5: Code lane state Bit 4: Device status Bit 3: Code present Bit 2: LCP3 Status Bit 1: LCP2 Status Bit 0: LCP1 Status	1	tbd	16-bit unsigned 0 = Device is OK, 1 = Error 1 = code lane detected, 0 = no code lane detected 0 = Device is OK, 1 = Error 1 = code present, 0 = code not present 1 = Lane detected, 0 = no lane detected 1 = Lane detected, 0 = no lane detected 1 = Lane detected, 0 = no lane detected Note: If a code lane is detected, the LCP states represent code lane states
193	ModBus process data → XPosition	2	tbd	32-bit signed
195	ModBus process data → YPosition	2	tbd	32-bit signed
197	ModBus process data → ZPosition	1	tbd	16-bit signed
198	ModBus process data → Angle	1	tbd	16-bit signed
199	ModBus process data → TimeOffset	1	tbd	16-bit unsigned
200	ModBus process data → TagIdLow	2	tbd	32-bit unsigned
202	ModBus process data → TagIdHigh	2	tbd	32-bit unsigned
204	ModBus process data → XVelocity	1	tbd	16-bit signed
205	ModBus process data → YVelocity	1	tbd	16-bit signed

Address	Content	#Registers	Ref. IO-Link Index	Note
206	ModBus process data → QualityOfLanes	1	tbd	16-bit unsigned
207	ModBus process data → LCP1	1	tbd	16-bit signed
208	ModBus process data → LCP2	1	tbd	16-bit signed
209	ModBus process data → LCP3	1	tbd	16-bit signed
211	ModBus process data → CodeLanePos1	2	tbd	32-bit signed
213	ModBus process data → CodeLanePos2	2	tbd	32-bit signed
215	ModBus process data → CodeLanePos3	2	tbd	32-bit signed
216	ModBus process data → LaneAngle1	1	tbd	16-bit signed
217	ModBus process data → LaneAngle2	1	tbd	16-bit signed
218	ModBus process data → LaneAngle3	1	tbd	16-bit signed
219	Code data	116	165	
362	ProcessData	16	IOLink40ProcessDataInput	32 bytes long
394	Line Level	2	267	array (3x 8-bit unsigned)

8.3.1.4 Section Status

Address	Content	#Registers	Ref. IO-Link Index
4096	Device Status	1	36

An implementation according to E133867 is not used, as the device status should allow the same interpretation on the different sensor interfaces.

8.3.2 Register Gruppe "Holding registers" (read-write)

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

8.3.2.1 Section Commands

Address	Content	#Registers	Ref. IO-Link Index
96	Set Application name	16	24
112	Set Pin4 configuration	1	122
113	Reset Factory Settings	1	-

8.3.2.2 Section Configuration

Address	Content	#Registers	Ref. IO-Link Index
144	Modbus RTU slave address	1	239
145	Modbus RTU baud rate	1	240
146	Modbus RTU parity setting	1	241
147	PxV compatibility settings	1	14435
148	Pin 4 configuration	1	122

Address	Content	#Registers	Ref. IO-Link Index
149	Operating mode	1	110
150	Positioning settings - coord system	1	166 SI 1
151	Positioning settings - module size	2	166 SI 2
153	Positioning settings - dist inner code	2	166 SI 3
155	Positioning settings - dist outer code	2	166 SI 4
157	Positioning settings - code tape position unit	2	166 SI 5
159	Positioning settings - Color Tape Width	2	166 SI 6
161	Positioning settings - Color Tape Distance	2	166 SI 7
163	Sensor mounting direction	1	172
164	Emission color	1	208
165	Output scaling - xs	2	167 SI 1
167	Output scaling - ys	2	167 SI 2
169	Output scaling - zs	2	167 SI 3
171	Output scaling - phis	2	167 SI 4
173	Output scaling - angle format	1	167 SI 5
174	Output scaling - vs	2	167 SI 6
180	Output user transform - phi0	2	168 SI 1
182	Output user transform - mirror x	1	168 SI 2
183	Output user transform - mirror y	1	168 SI 3
184	Output user transform - swap xy	1	168 SI 4

8.3.3 Reading out SICK MultiCodes

Read the 12 input registers with the result data (register addresses 320 to 331) periodically (not more often than every 30 ms). Use Modbus function code 0x04.

If status bits 0, 1, 2 are set, all registers are valid.

The “time offset” value (register address 329) can be used to determine the exact relative position of the code to the vehicle. The value indicates the time from the code reading to transmission of the Modbus telegram.
If the value is 30 ms, the value was read out 30 ms ago.
In conjunction with the vehicle speed, the position of the vehicle can be precisely determined in this way.

8.4 Transformation of output values

8.4.1 Scaling of output values

The GLS100 internally calculates the position and alignment of a code with floating point accuracy. However, the result data is output as integer values.

The standard scaling of the position data (x, y, z) is 0.1 mm per increment in 32-bit two's complement. The standard scaling of the orientation angle is (pi / 32,737) per increment in 16-bit two's complement. By default, the angle is output as a signed value and therefore maps the orientation angle from -pi to + pi.

For special applications, e.g. for compatibility requirements, a scaling of the integer position and orientation data must be done. In addition, the angle output format can be adjusted by configuration.

The position scaling can be changed individually for each coordinate axis via the x_s, y_s, z_s configuration parameters.
The resulting scaling is given by x_s^{-1} m, y_s^{-1} m, z_s^{-1} m.

By default, x_s, y_s, z_s are set to 10,000 to achieve a scaling of 0.1 mm.
To achieve a scaling of 1 mm per increment, x_s, y_s, z_s must be set to the value 1,000.

Likewise, the orientation scaling can be changed via the phi_s configuration parameter. The default value (pi / 32,737) specifies the highest accuracy of the angle as a 16-bit integer value. To output the angle directly in integer degrees, set phi_s to the value 180 / pi, = 57.3.

The “angle format” configuration parameter can be used to switch between a signed (-pi... + pi, -180°... + 180°) and an unsigned (0... 2pi, 0°... 360°) angle output format.

8.4.2 Transformation of the coordinate axes

To compensate for special assembly conditions, the GLS100 can be configured to apply the following transformations to initial position and orientation data:

- mirror x-axis: Inverts the sign of the x-coordinate value
- mirror y-axis: Inverts the sign of the y-coordinate value
- swap axes: Swaps x-and y-coordinate values

The above options do not affect the value of the orientation angle. To set the angle, the configuration parameter phi_0 can be set as an offset value.

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 24: 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 Technical data

Features

Table 25: Features

	1141629	1141627
Optical focus	100 mm fixed focus	
Light sender[1]	4 x LED, visible (2x amber, 590 nm, ± 80 nm; 2x cyan, 500 nm, ± 40 nm)	
LED class	Free group (IEC 62471:2006-07, EN 62471:2008-09)	
Sensing distance	100 mm	
Sensing distance tolerance	When using 2D codes: ±30 mm [2] When using color lanes: ±10 mm [2]	
Overspeed	≤ 3.5 m/s[2]	
Repeatability (position x,y)	When using 2D codes: ±0.1 mm[3] When using color lanes: ±1 mm [3]	
Repeatability (angle)	When using 2D codes: ±0.1 ° [3][4] When using color lanes: ? [3][4]	
Absolute accu-racy across the entire field of view	2 % Difference between 2D codes and color lanes	
Field of view	160 x 120 mm	
Curve radius with lane guidance	≥0,5 m	
Lane width with color lane	10 mm - 40 mm	
Distance between lanes	≥5 mm	

1) Average service life 100,000 h at TU = +25 °C.
2) When using the SICK multicode label.
3) In optical center and after sensor warm-up phase
4) In nominal sensing range 100 mm when using the SICK multicode label.

Mechanics/electronics

Table 26: Mechanics/electronics

	1141629	1141627
Connection type	1 x M12, 5-pin male connector[1]	
Supply voltage	10.8 V ... 30 V	
Power consump-tion	< 3 W	
Enclosure rating	IP65 (EN 60529, EN 60529 / A2)	
Protection class	III	

1) Use of a shielded cable is recommended for longer connecting cables.

Performance

Table 27: Performance

	1141629	1141627
Readable code structures	2D	
2D code types	Data Matrix ECC200, QR code	

	1141629	1141627
Code qualification	On the basis of ISO/IEC 16022, ISO/IEC 15415, ISO/IEC 15416, ISO/IEC 18004	

Interfaces

Table 28: Interfaces

	1141629	1141627
Serial	-	Yes , RS-485
Serial (data transmission rate)	-	1.2/2.4/4.8/9.6/19.2/38.4/57.6/115.2 kbit/s
Serial (remark)	-	Modbus RTU
CANopen	ja	-
CANopen (data transmission rate)	50/125/250/500/1,000 kbit/s	-
Optical displays	2 LEDs (1 x power supply, 1 x code read)	

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

Ambient data

Table 29: Ambient data

	1141629	1141627
Electromagnetic compatibility EMC	EN 61000-6-3:2007+A1:2011 / IEC 61000-6-3:2006+AMD1:2010 EN 61000-6-2:2005-08	
Vibration resistance	EN 60068-2-6:2008-02 EN 60068-2-27:2010-02	
Ambient operating temperature	0 °C ... +50 °C	
Storage temperature	– 25 °C ... + 75 °C	
Permissible relative humidity	90 %, non-condensing	

12 Accessories

NOTE
Accessories can be found on the online product page at:
www.sick.com/GLS100

13 Licenses

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14 Annex

14.1 Modbus RTU

NOTE
Modbus is a client/server protocol (formerly master/slave).

14.1.1 Radio interference

NOTE
Using the device in residential areas may cause radio interference. It is the responsibility of the operating entity to take appropriate measures (e.g. shielding).

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 the “Modbus over serial line specification and implementation guide V1.02", available at www.modbus.org.

14.1.2 Setting the ID and baud rate

NOTE
The SOPAS software can be used to configure the interface, http://www.sick.com/SOPAS

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

- The GLS100 must be set to a correct server address.
  Correct is:
  - A server address that is free in the Modbus network
  - A server address that the client expects
- The same baud rate must be set in the GLS100 as in the client.

The following parameters are factory-set on the GLS100

- Server address: 10
- Baud rate: 19,200 bps
- Parity: even

NOTE
The GLS100 does not have an internal termination resistor, which serves as a bus terminator. This must be taken into account when operating the device in a Modbus network:

- For a point-to-point connection, an additional external bus terminator must therefore be used.
- If a variant with bus terminator is required, you can get in touch with your SICK contact person.

The following communication parameters can be allocated to the sensor

- Server address: 1 to 247 (0 is reserved for broadcast, e.g. address 0 can be used to send a configuration to all servers on the bus).
- Baud rate:
  3: 9,600 bps
  4: 19,200 bps
  5: 38,400 bps
  6: 57,600 bps
  7: 115,200 bps
- Parity bit:
  0 = No parity
  1 = Even parity
  2 = Odd parity

14.1.3 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 master and responses from the slave devices. The respective request/response string looks like this:

Reading out the code information

Table 30: Reading out the code information

Field	Designation	Description
Field 1	Sensor address	Sensor address 1 - 247
Field 2	Function Code	Determining whether parameters are read or written individually or in blocks
Field 3	Data	Data content of the read parameters or content of the write parameters
Field 4	CRC checksum	CRC check whether telegram OK

Request

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

Response

Byte	0	1	2	3	4	2xN+5	2xN+6	2xN+7
ModBus contents	Slave Address	Response: "Function code" 0x04	Number of bytes, 2xN	Start register		Register contents	Checksum (16 bit unsigned)	

The relevant code information is provided in "Section result data". Read it periodically (not more often than every 50 ms) (addresses 320 to 331) using "Modbus function code #4":

Example

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

Byte	0	1	2	3	4	5	6	7
Value (hex)	0x0A	0x04	0x0140		0x000C		0xF15C	
Description	The address of the Modbus server GLS (factory setting) is 0x0A.	The Modbus “function code” for reading out the “input register” is 0x04.	Start at register 320.		Read out 12 subsequent registers. Here 320 to 331.		Checksum (16 bit unsigned)	
Data type	unsigned 8-bit	unsigned 8-bit	unsigned 16-bit		unsigned 16-bit		unsigned 16-bit	

After the sensor response, interpret the status in register 320.
If bits 0.1 and 2 are set in the status, all registers have been received and are valid. Address 329 “Time offset” can be used to determine the position of the vehicle more precisely. The value indicates the time duration since the code was recorded in ms.

320 - 331 = Read code navigation data

Table 31: Example 1: 320 - 331 = Read code navigation data

	Field 1	Field 2	Field 3		Field 4
Parameter value	Server address	Function code	Start address	Number of registers Register = 16 Bit	CRC
Request from server	Delivery address 10	Read process data 4	Result section 320	Number of registers 12	Telegram check
Server → Client	0x0A	0x04	0x0140	0x000C	0xF15C
	UINT 8	UINT 8	UINT 16	UINT 16	UINT 16
Response from GLS	Address repeated	Code repeated	Number of bytes = 24	Data	CRC
Client → Server	0x0A	0x04	0x18	0x0000FFFFFBF5F FFFFF27036730A6 0003000101D6E4 B1046D	0x42FF
Result in Dec			Status (INT16)	0	see status bit pattern divided by 10 times 180/32767 X and Y value divided by 10 divided by 10,000
			X-position (INT32)	-103.5 mm	
			Y-position (INT32)	-21.7 mm	
			Z-position (INT16)	87.1 mm	
			Angle (INT16)	68.41 degrees	
			Code ID (INT32)	0003 0001	
			Time delay after code recording (INT16) 47.0 ms	47.0 ms	
			X-speed (INT16)	5.85 m/s	
			Y-speed (INT16)	0.11 m/s	

14.2 EU declaration of conformity

The EU declaration of conformity can be downloaded from the Internet at:

www.sick.com/GLS100

9400640/2024-06-14/en

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