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VISIC100SF

1 Important Information

Responsibility of user

Intended use
1.1 **About this document**

- This Manual describes:
  - Device components
  - Installation
  - Operation
  - Maintenance work required
- It contains important safety information for safe operation.

1.2 **Responsibility of user**

- Read the Operating Instructions before putting the VISIC100SF into operation.
- Observe all safety information.
- If anything is not clear: Please contact SICK Customer Service.

**Designated users**

All operators of the VISIC100SF should be specifically trained on this device, knowledgeable of relevant regulations and able to assess potential hazards related to its operation.

**Correct use**

- This Manual presumes that the VISIC100SF has been delivered as specified during project planning (e.g., for use in a tunnel) and with the relevant delivery state of the VISIC100SF (→delivered System Documentation).
- If you are not sure whether the VISIC100SF complies with the planned configuration or the delivered System Documentation:
  - Please contact SICK Customer Service.
- The VISIC100SF should only be used as described in these Operating Instructions. →p. 9, 1.3.1. The manufacturer assumes no responsibility for any other use.
- Maintenance work should be performed as prescribed in this Manual.
- Do not attempt any work on or repairs to the VISIC100SF unless described in this Manual.
- Do not modify the VISIC100SF in any way unless specifically instructed and permitted to do so by the manufacturer. Failure to observe these precautions could result in:
  - Voiding the manufacturer’s warranty.
  - Causing the VISIC100SF to become dangerous.

**Special local conditions**

- Follow all local laws, regulations, and company policies applicable at the installation location.

**Retention of document**

These Operating Instructions:

- Must be available for reference.
- Must be conveyed to new owners.
1.3 **Intended use**

1.3.1 **Purpose of the device**

The VISIC100SF measures the visibility in tunnels and at the tunnel portals. When appropriate gas sensors have been fitted, the concentrations of CO and NO in the tunnel can be determined at the same time visibility is measured.

1.3.2 **Product identification**

<table>
<thead>
<tr>
<th>Product name:</th>
<th>VISIC100SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer:</td>
<td>SICK AG</td>
</tr>
<tr>
<td></td>
<td>Erwin-Sick-Str. 1 · D-79183 Waldkirch · Germany</td>
</tr>
</tbody>
</table>

The type plate is located on the side on the rear enclosure panel.

1.3.3 **Installation location**

- In a tunnel to control ventilators
- On tunnel portals
- In basement garages
- Generally in applications similar to tunnels for measuring visibility and gas concentrations
2 Product Description

Features
Device versions
Interfaces
2.1 Features of the VISIC100SF

- Simultaneous or individual measurement of
  a) Standard:
    - Visibility (K-value)
  b) Optional
    - CO concentrations
    - NO concentrations
    - NO and CO concentrations
- Measuring visibility with fog dissipation (optional).
- Compact design with low space requirements
- Already calibrated ex factory, no readjustment required onsite (Plug & Measure).
- Scope of delivery with or without terminal box.
- Keypad and single-line display in the sender/receiver unit to
  - Display values when the device is open.
  - Control diagnosis and maintenance.
  - Assign device addresses when using bus wiring.
- Status LED signals error-free operation (green), maintenance request (yellow) and malfunction (red).
- Standard: 2 analog outputs and 2 digital outputs, 1 Modbus-RTU
- Optional: PROFIBUS DP-V0

Option:
- Terminal box: For 90 - 260 V in case 24 V DC is not available
- Fog dissipation: Version with heating
2.2 Device versions

2.2.1 Standard components: VISIC100SF visibility measurement (K-value)

Fig. 2 VISIC100SF sensor

1. Enclosure cover
2. Inlet opening for air to be measured
3. Rear enclosure panel with assembly bracket
4. Status LED
5. Screw plugs for operation without gas sensors
6. Electrical screw connection for cable (10 ... 14 mm)
7. Electrical screw connection for cable (6 ... 12 mm)
8. Connection for grounding cable
2.2.2 Optional equipment

2.2.2.1 Gas sensor for measuring CO or NO

The type plate is stuck on the gas sensor.

Fig. 3 Gas sensor type plate

On this label:
- Designation
- Item number
- Serial number
- Date of manufacture
- Measured component

Fig. 4 Gas sensors CO, NO

1 Enclosure
2 Screw fitting with gas inlet openings
3 Connection cable
4 Cable connector
5 Type plate

The CO and NO sensors can only be distinguished by their type plate. The measured component is printed clearly visible from all sides.
2.2.2.2 **Terminal box**

2 variants:
- **TB-A1**: Terminal box for cable connection. It contains:
  - 10 terminals to connect cables provided by the customer.
- **TB-A2**: Terminal box to connect the VISIC100SF to 85 - 264 V AC. It contains:
  - Power supply filter, terminals and a power supply unit.

Specifications concerning stub lines → p. 26, 6 must always be adhered to when the VISIC100SF and the associated terminal box are part of a bus system.

Fig. 5

Terminal box with 24 V power supply for the sensor

1 Enclosure cover
2 Rear enclosure panel with assembly bracket
3 Electrical screw fittings for cables:
  - 3 x 6 ... 11 mm
  - 2 x 10 ... 14 mm
4 Connection for grounding cable

Ready-made connection cables are available for both variants. (Further details on connection cables, see → p. 22, Table 2)
2.2.2.3 Fog dissipation (cover with integrated heating element)
SICK provides a variant with a heating element in the cover for fog dissipation.

Fig. 6 VISIC100SF cover with heating element for fog dissipation

1 Enclosure cover
2 Heating element
3 Voltage supply for heating element
4 Inlet opening for air to be measured
5 Flow direction of air to be measured

+ The heating element is integrated in the VISIC100SF cover and cannot be retrofitted onsite.
+ The side openings for the air to be measured are closed off on the VISIC100SF version with fog dissipation.

2.2.4 Bus interface: PROFIBUS DP-V0, Modbus-RTU
The VISIC100SF is delivered with the following bus interface depending on the configuration:
- Modbus-RTU (standard)
- PROFIBUS DP-V0 (optional)

2.2.3 Measuring principle
- Visibility: Scattered light measurement
- CO, NO: Electrochemically
2.2.4 Interior view - VISIC100SF

Fig. 7 Interior view - enclosure, complete

The enclosure cover can be held on the rear enclosure panel for maintenance purposes.

Fig. 8 Interior view - enclosure cover without heating

1. Inlet opening for air to be measured

1 Enclosure cover
2 Rear enclosure panel with assembly bracket
3 Measuring unit
Interior view - enclosure cover with heating
See → p. 16, Fig. 6

Interior view - measuring unit

Measuring unit - circuit board with display and keypad

1 Hinge fixture
2 Display with keypad
3 Slots for gas sensors
4 Slot for Status LED
5 Wiring block for bus connections (RS-485)
6 Wiring block for 24 V and signals
7 Reset button
Fig. 10  Measuring unit

1  Hinge fixture
2  Sender side
3  Receiver side
4  Optical shielding
5  Dust protection tubes
6  Opening for connector contact for enclosure cover
7  Light trap

Fig. 11  Interior view - rear enclosure panel

1  Hinge rail for measuring unit
2  Threads for gas sensors
3  Cable glands
4  Bracket for enclosure cover
2.3 Interfaces

- **Standard:**
  - 2 analog interfaces for measured value output
  - 2 digital interfaces for maintenance requests or malfunction messages
  - RS-485: Either Modbus-RTU or TAD (Tunnel Adapter Device)

- **Optional:**
  - PROFIBUS DP-V0

2.3.1 Analog interfaces characteristics

The 4 ... 20 mA interface provides a safety-related signal. If an error exists on the VISIC100SF or when the measured value underflows the lower measuring range limit, the relevant analog output switches to 1 mA. If the upper measuring range limit is exceeded, the relevant analog output switches to 23 mA.

> The analog interface can drive a load of up to 500 Ohm. The refresh rate is ≤ 1.6 seconds.

The following formula shows the relation between the output signal and the measured gas concentration:

\[
\text{Gas concentration } C \text{ (gas)} = \frac{\text{Output current - 4mA}}{16} \times \text{full-scale value}
\]

2.3.2 Digital interfaces properties

The malfunction relay provides a safety-relevant signal. If a device error is detected or a measured value is outside the measuring range, an error is signaled via the malfunction relay. If no device error exists, the malfunction relay is in a closed state. The relay opens when an error occurs.

2.3.3 Modbus-RTU Interface characteristics

See Section Start-up → p. 37, 3.7.1
3 Installation

Protective measures for assembly and installation
Material required
Preparing the installation location
Assembly
Wiring
Bus connections
### 3.1 Protective measures for assembly and installation

**NOTICE: Preventive measures for operating safety**

The VISIC100SF is normally used together with control technology.

- Should a malfunction occur on the VISIC100SF, ensure this cannot lead to conditions dangerous for traffic or can hinder traffic.

**NOTICE: The system operator is responsible for the operating safety of the device when integrated in a system**

- Observe the connection values in Section → p. 78, 9.3 when integrating the device in a system.

**WARNING: Preventive measures during assembly and installation**

- Observe the generally applicable regulations for protective clothes in tunnels.
- Observe the regulations for personal safety (e.g., lane closure, warning devices).

**NOTICE:** Assembly of the VISIC100SF may be carried out by competent persons only who, based on their device-specific training and knowledge of the device as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

**NOTICE:** SICK original assembly material is recommended for safe assembly of the VISIC100SF.

The terminal box does not have its own main power switch. In accordance with EN 61010, the following must be ensured before installation:

- A main power switch is available in the tunnel.
- Service personnel can easily access the main power switch.
- The main power switch is marked as disconnecting device.

### 3.2 Material required for assembly and installation

#### Table 1  
**Assembly material**

<table>
<thead>
<tr>
<th>Material required</th>
<th>Part number</th>
<th>Required for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixing set</td>
<td>2071034</td>
<td>VISIC100SF or terminal box</td>
</tr>
<tr>
<td>Drilling plan</td>
<td></td>
<td>→ p. 76, Fig. 50</td>
</tr>
<tr>
<td>Drilling template</td>
<td></td>
<td>→ p. 76, Fig. 51</td>
</tr>
</tbody>
</table>

#### Table 2  
**Installation material**

<table>
<thead>
<tr>
<th>Material required</th>
<th>Part number</th>
<th>Required for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line, 2 m (10 x 0.75 mm²)</td>
<td>2069830</td>
<td>Connection for VISIC100SF and terminal box</td>
</tr>
<tr>
<td>Line, 5 m (10 x 0.75 mm²)</td>
<td>2069384</td>
<td></td>
</tr>
<tr>
<td>Line, 10 m (10 x 0.75 mm²)</td>
<td>2069385</td>
<td></td>
</tr>
<tr>
<td>Line, 20 m (10 x 0.75 mm²)</td>
<td>2069386</td>
<td></td>
</tr>
<tr>
<td>Onsite lines</td>
<td></td>
<td>Robust material, suitable for outdoor applications, halogen-free, screened; wires 10 x 0.75 mm²; Connection VISIC100SF to terminal box or tunnel control room</td>
</tr>
</tbody>
</table>
### 3.3 Preparing the installation location

- Secure the place of work
- Provide sufficient light, power and, when necessary, a lifting platform at the place of work.

Keep fixing material available as well as suitable drills, lines, socket wrench set, marking material, measurement tools.

- Determine the angle of inclination: See → p. 24, Fig. 12 and → p. 24, Fig. 13

### 3.4 Assembly

#### 3.4.1 Scope of delivery

- Check the scope of delivery against the order and delivery documents.
3.4.2 Installing the VISIC100SF

1. Determine the sensor installation location according to the project planning.

Fig. 12 Maximum allowable angle of inclination and installation location height

Fig. 13 Maximum allowable angle of inclination of fitted VISIC100SF

Use a wall plate when the installation walls are extremely uneven. Consider this special solution during project planning.

2. Drill holes for the VISIC100SF wall bracket as shown in the VISIC100SF drilling plan → p. 76, Fig. 50.

3. Hammer in the M8 steel tie bar (from fixing set).
Fig. 14   Assembly - rear enclosure panel

1  Assembly bracket
2  Hinge fixture for the measuring unit

4  Fit the rear enclosure panel.
5  Hinge the measuring unit in.
6  Wiring, see → p. 29, 3.5.
7  Start-up, see → p. 36, 3.6.
8  Screw the measuring unit on.
9  Fit the enclosure cover.
3.4.4 Fitting the terminal box (optional)

Two terminal box versions

Fig. 15 Terminal box A1 for connection

Terminal box to reconnect cables provided by the customer. (e.g., rigid to flexible cable, or cross-section adaptation)

Fig. 16 Terminal box A2 for 90 - 260 V -> 24 V conversion

Terminal box with power supply unit and power supply filter

Material required for terminal box assembly and installation
Material and drilling plan are identical to the VISIC100SF sensor. See → p. 22, Table 1 and → p. 76, Fig. 51

Installing the terminal box
1 Determine the terminal box installation location according to the project planning.
2 Drill holes for the terminal box as shown in the drilling plan → p. 76, Fig. 51.
3 Hammer in the M8 steel tie bar (from fixing set).
4 Fit the terminal box.
5 Wiring, see → p. 35, 3.5.6.
6 Screw the cover on.
3.4.5 Fitting and start-up of the gas sensors (optional)

**WARNING: Hazard through low voltage**
- Disconnect the 24 V plug connection in VISIC100SF before start-up or exchanging the gas sensors.

<table>
<thead>
<tr>
<th>Material required</th>
<th>Characteristics</th>
<th>Required for</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO and/or NO sensors</td>
<td>Compact measuring sensor with connection cable, calibrated and temperature corrected</td>
<td>For CO or NO measurement (optional)</td>
</tr>
<tr>
<td>Allen key, SW 8</td>
<td></td>
<td>Removing seal screw connection</td>
</tr>
<tr>
<td>Allen key, SW 4</td>
<td></td>
<td>Screwing gas sensors on or off</td>
</tr>
</tbody>
</table>

**NOTICE: Observe sensor service life!**
The date of manufacture is marked on the labels of the CO and NO sensors. Specified service life[1]:
- Maximum storage duration: 6 months as from date of manufacture (in unopened original packaging).
- Maximum service life as from initial start-up: 1 year
- Order spare sensors close to start-up
- Observe storage conditions for sensors, see Technical Data, → p. 78, 9.3

[1] These specifications are based on compliance with the factory calibration. A check and/or exchange is necessary after longer storage and service life.

1. Check the tightness of the packaging of the gas sensors after delivery. Send the gas sensor back to the manufacturer directly when the packaging is not tight.
2. Check the date of manufacture and/or maximum storage duration.
3. Use the SW 8 Allen key to remove the black screw plug on the underside of the enclosure.

![Gas sensor screw plugs](image)

1. Screw plugs
4. Position the gas sensor in any free thread and screw in by hand.
5. Tighten the gas sensor from the outside using a SW4 Allen key.
6. Plug the data cable into one of the two connection terminal strips on the circuit board (→ p. 28, Fig. 18 marking, 3).
7 Close the device:
   ▶ Tip the measuring unit up and fasten it with the 4 screws.
   ▶ Position the enclosure cover on the front side of the device.
   ▶ Screw the two screws on the enclosure cover tight with the SW4 Allen key.

The gas sensor requires a heating up phase of maximum 30 minutes. The Status LED remains red until the heating up phase has finished.

### Cross-sensitivity Table for gas sensors

#### Table 4
Gas sensor cross-sensitivity Table

<table>
<thead>
<tr>
<th>Interfering gas</th>
<th>Target gas (CO (180 ppm))</th>
<th>Target gas (NO (60 ppm))</th>
<th>Target gas (CO₂ (5000 ppm))</th>
<th>Target gas (NO₂ (18 ppm))</th>
<th>Target gas (Hexane (100 ppm))</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>100%</td>
<td>&lt; -9%</td>
<td>&lt; 0.2%</td>
<td>&lt; -6%</td>
<td>0%</td>
</tr>
<tr>
<td>NO</td>
<td>0%</td>
<td>100%</td>
<td>&lt; 0.1%</td>
<td>&lt; 5%</td>
<td>0%</td>
</tr>
</tbody>
</table>
3.5 VISIC100SF wiring

3.5.1 Electrical installation safety information

**WARNING:** Hazard by voltage.
- Only allow an authorized electrician to work on the electric system.
- Observe the relevant safety regulations during all installation work.
- Take suitable protective measures against local risks and those arising from the plant.

**NOTICE:** Onsite electrical installation is the responsibility of the operator.
Provide separate external main power switches which disconnect all connectors, and fuses in the proximity of the VISIC100SF (max. power input of the VISIC100SF → Technical data).

**NOTICE:** Device damage through electrostatic discharges
The VISIC100SF may be connected only by an expert.
- Observe the applicable ESD Guidelines.

**NOTICE:** Avoid damage to the electronics
Before signal connections are established (also with plug connections):
- Separate the VISIC100SF and terminal box from the main power supply.

+i The terminal box does not have its own main power switch. In accordance with EN 61010, the following must be ensured before installation
- A main power switch is available in the tunnel.
- Service personnel can easily access the main power switch.
- The main power switch is marked as disconnecting device.
3.5.2 Connecting the LED

Fig. 19 Slot for the Status LED cable

Fig. 20 LED switch position on the circuit board

Switch position:
- Off (LED switched off)
- On (LED switched on)
Fig. 21  Grounding connection on VISIC100SF

1  Connection to fasten the grounding cable
3.5.3 **Wiring of analog outputs, relay outputs and voltage supply**

**Fig. 22** Wiring plan for analog signals, relay outputs and voltage supply for VISIC100SF

- **1** 10 wire cable (numbered)
- **2** Max. cable length: 20 m, → p. 22, 3.2

<table>
<thead>
<tr>
<th>Voltage supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 +24 VDC</td>
</tr>
<tr>
<td>10 Ground (GND)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Maintenance request Common</td>
</tr>
<tr>
<td>9 Maintenance request Normally Open</td>
</tr>
<tr>
<td>3 Malfunction Common</td>
</tr>
<tr>
<td>8 Malfunction Normally Closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog outputs (4 ... 20 mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Visibility +</td>
</tr>
<tr>
<td>7 Visibility -</td>
</tr>
<tr>
<td>5 Gas concentration +</td>
</tr>
<tr>
<td>6 Gas concentration -</td>
</tr>
</tbody>
</table>
3.5.4  **Bus interface wiring**

![Wiring plan for RS-485 interface](image)

- **1** RS-485 A
- **2** RS-485 B
- **3** RS-485 GND
- **4** Not connected
- **5** PROFIBUS-DP B
- **6** PROFIBUS-DP A

**The RS-485 interface can be used for Modbus or TAD (optional).**

3.5.5  **Shielding**

The shield must be grounded at both ends to ensure effective shielding against high-frequency interference. Especially on installations located away from each other, potential differences can occur and therefore lead to potential equalization currents along a cable shield. Such equalization currents on a cable shield must be avoided at all costs because these can lead to interference signals. Fig. 24 shows how the shield is contacted with the brushes of the cable gland.

![Shielding in VISIC100SF](image)

- **1** Line shield
- **2** Cable gland with wires

To prevent potential differences between individual system components, all devices on the bus must have the same potential. To achieve this, all devices must be connected to each other with a potential equalization conductor (Fig. 25).
CAUTION: Never use the line shield as potential equalization

The line shield only serves to shield against high-frequency interference and may not be used as potential equalization.

Fig. 25

Potential equalization line

1  Signal cable
2  Potential equalization cable
3  Connection for grounding cable
4  T-connector or terminal box
3.5.6 Terminal box wiring

Terminal connection diagram shows both variants:
Version 1, TB-A1: With connection terminals
Version 2, TB-A2: With power supply unit, power supply filter and connection terminals

Fig. 26 Wiring plan of the terminal box

+i Terminals 1-10 for analog variants
+i Terminals 11-20 for bus systems or TAD (Tunnel Adapter Device)
3.6 Start-up

Overview of start-up tasks
- Check wiring of VISIC100SF components.
- Check and switch on voltage supply.
- Check Status LED.
- Check measured value plausibility.
- Hardware test.

Tools required for start-up, see → p. 23, Table 3

3.6.1 Start-up, step by step

1. Separate voltage supply (e.g., disconnect 24 V plug connection).
2. Check for correct installation before start-up.
3. Using the Allen key, open the enclosure cover, take the cover off and insert it in the fixture provided.
4. Check wiring. See VISIC100SF, → p. 32, 3.5.3 and terminal box, → p. 35, 3.5.6.
5. Connect Status LED cable to circuit board slot.
6. Connect Gas sensor modules to circuit board slots, see Section 3.5.6.
7. Contact plug for voltage supply.
8. Switch the voltage supply on.
9. Plausibility check on measured values and device status. If the measured values shown on the display are implausible
   - Check enclosure for coarse contamination and clean as necessary.
10. Perform hardware test:
    - Set the device to Maintenance mode (“Maint”) using the keypad. Refer to Section “Menu” → p. 50, 5.3.3 for further information.
    - Set the current levels of analog outputs and digital outputs (maintenance request/ malfunction). Refer to Section “Menu” → p. 56, 5.6.2 and → p. 57, 5.6.4 for further information.
11. Deactivate Maintenance mode. Refer to Section “Menu” → p. 50, 5.3.2 for further information.
12. Close the device:
    - Tip measuring unit up.
    - Screw the four screws with the SW4 Allen key.
    - Position the enclosure cover on the front side of the device.
    - Screw the two screws on the enclosure cover with the SW4 Allen key.
13. Visual check: Status LED should be green. The following reasons can cause the Status LED not to be green:
    - LED switch on circuit board switched off. (Factory setting: LED switch is set to “On”) switch Figure, see → p. 30, Fig. 20.
    - Enclosure cover not fitted (Status LED red).
    - Gas sensors in heating up phase (Status LED red for max. 30 minutes).
    - Check the plug on the circuit board when the Status LED is not on.
    - Active maintenance and malfunction states. To retrieve the maintenance request and malfunction messages, see → p. 56, 5.6.2. Malfunction and maintenance request Code Tables → p. 70, Table 10 and → p. 71, Table 11.
3.7 **Bus connections**

The VISIC100SF can be run as a single device with or without a terminal box. Two analog outputs are available in this case. SICK recommends using the TAD (Tunnel Adapter Device) when three analog outputs are required. There is also the option to output VIS, CO and NO values digitally via Modbus-RTU (standard) or PROFIBUS DP-V0 (optional). The advantage of bus connections is the low wiring effort.

3.7.1 **Modbus-RTU (integrated in the VISIC100SF standard version)**

The Modbus-RTU interface allows the user to read out the VISIC100SF measured values and status information using the two function codes “Read Holding Register (0x03)” and “Read Coil (0x01)”.

The protocol (Modbus-RTU/ TAD) can be set on the RS-485 interface using the device display. See Section “Menu”, p. 53, 5.4.1

**Modbus-RTU interface configuration options**

The Modbus-RTU interface can only be configured using the device display. The following parameters can be changed here:
- Modbus-RTU ID (0 to 247), see Section “Menu” p. 53, 5.5
- Flow control, see Section “Menu” p. 54, 5.5.3
- Baud rate, see Section “Menu” p. 55, 5.5.4

The VISIC100SF must be restarted to save parameter changes. Press “Reset” to restart. (see p. 18, Fig. 9)

**Modbus-RTU data format**

<table>
<thead>
<tr>
<th>Flow control</th>
<th>Even parity, 1 stop bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odd parity, 1 stop bit</td>
</tr>
<tr>
<td></td>
<td>No parity, 1 stop bit</td>
</tr>
<tr>
<td></td>
<td>No parity, 2 stop bits</td>
</tr>
</tbody>
</table>

**Modbus-RTU baud rates**

- 4.8 k
- 9.6 k
- 19.2 k
- 38.4 k
- 57.6 k

**Read Holding Register (0x03)**

The Modbus-RTU interface register structure comprises all measured values and associated measured value status. Coding measured value status behaves synchronous to measured value status of the PROFIBUS interface, see p. 39, Table 7.
Table 5  Reading Holding Register Modbus-RTU

<table>
<thead>
<tr>
<th>Register</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>K-value, 4 byte floating point, ABCD</td>
</tr>
<tr>
<td>102</td>
<td>K-value status, 2 byte unsigned integer</td>
</tr>
<tr>
<td>103</td>
<td>CO value, 4 byte floating point, ABCD</td>
</tr>
<tr>
<td>105</td>
<td>CO value status, 2 byte unsigned integer</td>
</tr>
<tr>
<td>106</td>
<td>NO value, 4 byte floating point, ABCD</td>
</tr>
<tr>
<td>108</td>
<td>NO value status, 2 byte unsigned integer</td>
</tr>
<tr>
<td>109</td>
<td>Contamination, 2 byte unsigned integer</td>
</tr>
<tr>
<td>110</td>
<td>Maintenance request, 2 byte unsigned integer</td>
</tr>
<tr>
<td>111</td>
<td>Device fault, 2 byte unsigned integer</td>
</tr>
</tbody>
</table>

Register 109 contains information on the actual degree of contamination of the optics for visibility measurement.

Coding of registers 110 & 111 (maintenance request/device fault), see Table → p. 70, Table 10 and → p. 71, Table 11

Example:
Read 4 byte float from slave (ID 101) with start address 100:
TX-> <65 03 00 64 00 02 8D F0>
RX-> <65 03 04 3F 48 2B 67 0C ED>
Current K-value = 0x3F482B67 ≈ 0.78

3.7.1.4 Modbus-RTU Read Coil (0x01)
Function code “Read Coil (0x01)” serves to read out all malfunction and maintenance request messages from VISIC100SF.

Table 6  Read Coil Modbus-RTU

<table>
<thead>
<tr>
<th>Coil number</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Maintenance request Vis</td>
</tr>
<tr>
<td>201</td>
<td>Maintenance request CO</td>
</tr>
<tr>
<td>202</td>
<td>Maintenance request NO</td>
</tr>
<tr>
<td>216</td>
<td>Error Vis</td>
</tr>
<tr>
<td>217</td>
<td>Error CO sensor</td>
</tr>
<tr>
<td>218</td>
<td>Error NO sensor</td>
</tr>
<tr>
<td>219</td>
<td>Error EEPROM</td>
</tr>
<tr>
<td>220</td>
<td>Error heating</td>
</tr>
<tr>
<td>221</td>
<td>Error analog interface</td>
</tr>
<tr>
<td>222</td>
<td>Error FPGA</td>
</tr>
<tr>
<td>223</td>
<td>Error CPU</td>
</tr>
<tr>
<td>224</td>
<td>Error program flow</td>
</tr>
<tr>
<td>225</td>
<td>Error enclosure cover</td>
</tr>
<tr>
<td>230</td>
<td>Maintenance active</td>
</tr>
</tbody>
</table>

Example:
Read coil number 200 from slave (ID 101):
TX-> <65 01 00 C8 00 01 74 10>
RX-> <65 01 01 00 4E BB>
Maintenance request Vis = false
3.7.2 **PROFIBUS DP-V0 (optional)**

The PROFIBUS module belongs to the VISIC100SF when configured at the same time during ordering. The VISIC100SF is integrated in the bus via a restart after wiring.

3.7.2.1 **PROFIBUS addressing**

The PROFIBUS-DP address of the device can be managed via the keypad. For further information, see Section “Menu”, → p. 53, 5.5.1.

The device must be restarted after the address is changed. Press “Reset” to restart. (see → p. 18, Fig. 9)

3.7.2.2 **PROFIBUS DP-V0 baud rates**

The PROFIBUS module has an autobaud function that automatically detects the following baud rates:

- 9.6 k
- 19.2 k
- 45.45 k
- 93.75 k
- 187.5 k
- 500 k
- 1.5 M

3.7.2.3 **Access via GSD file**

The GSD file provided allows access to the following modules on the PROFIBUS master:

- KValue (Real), Status (UInt8)
- CoValue (Real), Status (UInt8)
- NoValue (Real), Status (UInt8)
- Contamination (UInt16)
- MainReq (UInt16)
- DeviceFault (UInt16)
- Counter (UInt16)
- CRC16-CCITT (UInt16)

The GSD file is delivered on a CD when the PROFIBUS module is ordered. It is also available as download on SICK’s homepage.

Every VISIC100SF measured value has a measured value status. This measured value status provides additional information on the status of the measured value. The following Table shows the measured value status coding and significance.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Status gas cell</th>
<th>Status byte PROFIBUS/Modbus</th>
<th>Status byte designation</th>
<th>Maintenance request</th>
<th>Device fault</th>
<th>4...20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No error active</td>
<td>0x80</td>
<td>Good - OK</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Value</td>
</tr>
<tr>
<td>2</td>
<td>Sensor test running</td>
<td>0xBC</td>
<td>Good - internal function check</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Value</td>
</tr>
<tr>
<td>3</td>
<td>Operating hours 1st level</td>
<td>0xA4</td>
<td>Good - maintenance required</td>
<td>Active</td>
<td>Inactive</td>
<td>Value</td>
</tr>
<tr>
<td>4</td>
<td>Operating hours 2nd level</td>
<td>0x68</td>
<td>Uncertain - maintenance demanded</td>
<td>Active</td>
<td>Active</td>
<td>1 mA</td>
</tr>
<tr>
<td>5</td>
<td>Measuring range overflow</td>
<td>0x7A</td>
<td>Uncertain - high limit</td>
<td>Inactive</td>
<td>Active</td>
<td>23 mA</td>
</tr>
<tr>
<td>5</td>
<td>Measuring range underflow</td>
<td>0x79</td>
<td>Uncertain - low limit</td>
<td>Inactive</td>
<td>Active</td>
<td>1 mA</td>
</tr>
</tbody>
</table>
3.7.3 **RS-485 - Topology and bus termination**

When using the RS-485 interface, all field devices are typically connected to one bus structure (line) (→ p. 40, Fig. 27). Each segment can have up to 32 nodes (master and slaves). The start and end of each segment must be terminated with a bus termination. A switch on the circuit board serves to set the bus termination on a VISIC100SF → p. 40, Fig. 28.

### Fig. 27

Bus topology

![Bus topology diagram]

### Fig. 28

Bus termination on the circuit board

![Bus termination diagram]

#### 3.7.4 Stub line length for terminal box on all RS-485 bus systems

Stub lines lead to reflections on the bus line and are therefore basically not allowed when bit rates higher than 1.5 Mbit/s are used.

According to the PROFIBUS specification, a maximum total of all stub lines of 6.60 m is allowed per DP segment. Longer stub lines are allowed for lower data rates.
If there are more than 32 nodes or the network span is being extended, power amplifiers (repeaters) allow linking the networks.

### Cable properties for using the RS-485 interface

SICK recommends using shielded cable type A with following properties:

<table>
<thead>
<tr>
<th>Bit rate</th>
<th>Total capacitance allowed</th>
<th>Sum of stub line lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1.5 Mbit/s</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1.5 Mbit/s</td>
<td>0.2 nF</td>
<td>6.6 m</td>
</tr>
<tr>
<td>500 kbit/s</td>
<td>0.6 nF</td>
<td>20 m</td>
</tr>
<tr>
<td>187.5 kbit/s</td>
<td>1.0 nF</td>
<td>33 m</td>
</tr>
<tr>
<td>93.75 kbit/s</td>
<td>3.0 nF</td>
<td>100 m</td>
</tr>
<tr>
<td>19.2 kbit/s</td>
<td>15 nF</td>
<td>500 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surge impedance $R_w$</th>
<th>135...165 Ohm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance per unit length $C'$</td>
<td>&lt; 30 pF/m</td>
</tr>
<tr>
<td>Loop resistance $R'$</td>
<td>110 Ohm/km</td>
</tr>
<tr>
<td>Wire diameter $d$</td>
<td>0.64 mm</td>
</tr>
<tr>
<td>Wire cross-section $q$</td>
<td>&gt; 0.34 mm²</td>
</tr>
</tbody>
</table>
4 Operation

Operating elements
Operating states
Status messages
4.1 Operating and display elements

4.1.1 Display with keypad

Fig. 29 VISIC100SF display and keypad

1 Current operating mode
2 Measured component displayed
3 Measured value of component displayed
4 Arrow button to scroll down in the menu
5 Arrow button to scroll up in the menu
6 Set button to activate functions
7 Escape button to exit a menu item

The display lighting goes on when a button is pressed. The lighting goes off 10 minutes after the last button was pressed.

Menu items
• Measured value display → p. 46, 4.3.1
  - Visibility
  - CO
  - NO
  - Contamination
• Status information
• Software version
• Operating time display
• Device address assignment
• Inputs/outputs test

More information on menu navigation can be found in Section “Menu” → p. 47, 5
4.1.2 Reset button

The Reset button restarts the VISIC100SF.

Fig. 30 Reset button position on the circuit board

Fig. 31 "Maint" LED position on the circuit board
4.2 **Operating states**

4.2.1 **Checking the operating state (visual control)**

**Status LED**

The Status LED on the underside of the enclosure shows the operating state (→ p. 13, Fig. 2)

<table>
<thead>
<tr>
<th>Operating state</th>
<th>Relay state</th>
<th>Status LED color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initialization</td>
<td>Maintenance request relay open; Malfunction relay open</td>
<td>Red</td>
</tr>
<tr>
<td>Operation</td>
<td>Maintenance request relay open; Malfunction relay closed</td>
<td>Green</td>
</tr>
<tr>
<td>Maintenance request</td>
<td>Maintenance request relay closed; Malfunction relay closed</td>
<td>Yellow</td>
</tr>
<tr>
<td>Malfunction</td>
<td>Maintenance request open/closed depending on maintenance request state; Malfunction relay open</td>
<td>Red</td>
</tr>
</tbody>
</table>

The device delivers a valid measured value in operating states operation and maintenance request.

4.2.2 **Checking malfunction displays**

Read out the error code (→ p. 50, 5.3.3).

4.3 **Checking the analog outputs**

Check the analog output for the K-value (→ p. 56, 5.6.2).
Check the analog output for the CO and/or NO value (→ p. 56, 5.6.1).

---

The VISIC100SF has 2 analog outputs. An optional TAD (Tunnel Adapter Device) or a PROFIBUS/Modbus connection is required to process a 3rd measured value.

4.3.1 **Displaying measured values**

Measured values can be displayed on the single-line, illuminated display. See → p. 44, Fig. 29. Further information on menu navigation to display measured values can be found in Section “Menu” → p. 48, 5.2.

4.4 **Operating functions**

A comprehensive description of all operating functions can be found in Section 5 “Menu”.

4.5 **Status messages**

See → p. 46, 4.2.1.

4.5.1 **Malfunction messages**

See → p. 70, Table 10.

4.5.2 **Maintenance request messages**

See → p. 71, Table 11.
5 Menu

Menu structure
Measuring operation mode “RUN”
“SET” mode
Connecting bus systems
Setting bus parameters
Output signal test
I/O mapping
5.1 **Menu structure**

The menu is split into 2 modes:

1. "RUN" = operation mode
2. "SET" = setting mode

5.1.1 **Short description: Entering settings on the keypad**

- Use the arrow buttons to scroll through the menu.
- Button “Set” serves to switch to the menu structure.
- Button “Esc” aborts a process or switches up one menu level.
- Use the *arrow buttons* to enter numeric values:
  - Use the arrow buttons to increase or decrease the digit by 1. Use “Set” to switch between the digits shown on the display.

Example of an input field with a blinking digit to be edited:

![Input Field Example](image)

5.2 **Measuring operation mode “RUN”**

Inquire the current measured values in active measuring operation.

**Fig. 32** "RUN" mode overview

- **k** = visibility
  - Value ≥ 10: “k xx.x”
  - Value < 10: “k x.xx”

- **NO XXX** = NO concentration
  - Value ≥ 10: “NO XXX”
  - Value < 10: “NO X.X”

- **CO XXX** = CO concentration
  - Value ≥ 10: “CO XXX”
  - Value < 10: “CO X.X”

- **con XX%** = contamination/soiling
  - Value ≥ 10: “con XX%”
  - Value < 10: “con X%”
5.3 **“SET” mode**

“SET” mode serves changing VISIC100SF settings.

The VISIC100SF may be operated by competent persons only who, based on their device-specific training and knowledge of the device as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Navigation in “SET” mode

- Switch from “RUN” to “SET” mode: Press “Set” for 2 seconds when in “RUN” mode for any component being displayed.
- “SET” mode is now active with menu item “Maint”.
- Use the arrow keys to scroll through the menu until the desired menu item is reached.
- Press “Set” to access the submenu items.
- Use the arrow keys to scroll through the submenu items.
- Press “Set” to activate or change a submenu item.
- Use “Esc” to exit the submenu or main menu items.

The device switches automatically to “RUN” mode when no user action is registered for 10 minutes. The background lighting goes off.

### 5.3.1 Structure and sequence of “SET” mode submenu items

1. **“Maint”** Activate maintenance
2. **“Status”** Current device status
3. **“Uptime”** Operating times display
4. **“SWVers”** Software version
5. **“Bus”** Bus settings
6. **“Test”**
   - Check analog and digital outputs
   - Confirm check of gas cells
7. **“IO-Map”** IO mapping: Assignment of a gas sensor to the second analog output
5.3.2 Activating maintenance in menu item “Maint”

Maint must be set “active” to carry out an I/O test.

Fig. 33
Activating the setting range via menu item “Maint”

Mode “active” is reset to “inactive” after 30 minutes.

The malfunction relay is activated when mode “active” is set. The Status LED is red, the analog outputs output 1 mA and the field bus interface signals an error.

The Maint LED on the circuit board is green. Further information on the Maint LED position on the circuit board can be found under → p. 45, Fig. 31.

5.3.3 Calling up maintenance request and malfunction messages with menu item “Status”

When a maintenance request or malfunction message is present, the associated maintenance request or malfunction message is output as an error code in this menu item. Scroll through with the arrow keys to display all existing error or maintenance request messages.

Abbreviations in the menu:
MRq = Maintenance Request
Fail = malfunction
MrqXXX and F_XXX = code for maintenance request or malfunction. The Error Code Table can be found in Section “Maintenance” → p. 70, Table 10.
NxtMRq = Next Maintenance Request (time remaining to next maintenance request).
5.3.4 Maintenance request for gas sensors in submenu item “NxtMRq”

The gas sensors have an operating hours counter which displays the time remaining to the next maintenance request for the gas sensors. A maintenance request is activated after an operating time longer than 365 days. Submenu item “NxtMRq” serves to read off the number of days remaining until the next maintenance request.

Abbreviations in the menu:
NxtMRq = Next Maintenance Request (time remaining to next maintenance request).
xxxxxd = number of days

Fig. 35 Display of the remaining time (in days) to the next maintenance request

Use the arrow buttons in submenu item “NxtMRq” to select between “CO” and “NO”.

+ Use the arrow buttons in submenu item “NxtMRq” to select between “CO” and “NO”.
5.3.5 Calling-up the operating duration in submenu item “Uptime”

Menu item “Uptime” provides the following information:
- NO and CO: Number of days (d) for the gas sensors currently in use.
- Up: Number of operating hours (h) since the last switch-on.
- Run: Operating duration since initial start-up in days (d).

Fig. 36 Calling up the operating duration

5.3.6 Calling up the software version in submenu item “SwVers”

The software version is shown as a 7-digit number and a 4-character change index.

Fig. 37 Calling up the software version

The software version is output as ticker text.

5.4 Connecting the bus systems

The VISIC100SF has an RS-485 output as standard. This can be used for a Modbus connection to a higher level system or to connect to the Tunnel Adapter Device (TAD). The keypad serves to configure the RS-485 interface assignment. A PROFIBUS interface is available as optional module.
5.4.1 Setting the RS-485 interface to Modbus with submenu item “Bus”

Fig. 38 Selecting the RS-485 interface protocol

5.5 Setting bus parameters

Menu item “Bus” serves to manage the parameters for the Modbus, PROFIBUS and TAD interfaces. A change to the bus system is first effective after a restart.

5.5.1 Setting the PROFIBUS address in “PB ID”

The configured address is assigned to the VISIC100SF after a restart when the device is connected as “slave” in a PROFIBUS-DP system. Submenu item “PB ID” serves to manage the PROFIBUS address. The valid address range is between 0 ... 125.

Arrow buttons: Increment and decrement the digits.
“Set” button: Activate next digit.

Fig. 39 Entering the PROFIBUS address

Press “Reset” to restart. (see → p. 18, Fig. 9)

Submenu item “PB ID” is only available when the VISIC100SF has a PROFIBUS-DP module installed.

When the bus address has been entered completely, pressing “Set” switches the menu back directly to the “Bus” main menu.
5.5.2 Setting the Modbus address in “MB ID”

The device address can be entered in menu item “Bus”, submenu item “MB ID” when the device is connected as “slave” in a Modbus system. The address range is between 0 ... 247.

Arrow buttons: Increment and decrement the digits.
“Set” button: Activate next digit. All digits must be confirmed. Call up the menu again to recheck the entry.

Fig. 40 Entering the device address

When the bus address has been entered completely, pressing “Set” switches the menu back directly to the “Bus” main menu. The setting is saved when the VISIC100SF is restarted.
Press “Reset” to restart. (see → p. 18, Fig. 9)

5.5.3 Setting the Modbus data transfer format with menu item “MB Par”

Submenu item “MB Par” serves to set the Modbus protocol parity:

- 1 start bit, 8 data bits, 1 stop bit, even parity (Even)
- 1 start bit, 8 data bits, 1 stop bit, odd parity (Odd)
- 1 start bit, 8 data bits, 1 stop bit, no parity (No 1 SB)
- 1 start bit, 8 data bits, 2 stop bits, no parity (No 2 SB)

Fig. 41 Setting the Modbus protocol parity
5.5.4 Setting the Modbus baud rate with menu item “MB BdR”

Submenu item “MB BdR” serves to set the Modbus interface baud rate:

- 4.8 k
- 9.6 k
- 19.2 k
- 38.4 k
- 57.6 k

**Fig. 42** Setting the Modbus interface baud rate

All “Bus” settings are first saved after a VISIC100SF restart.
5.6 Testing digital/analog outputs and gas sensors with “Test”

Menu item “Test” serves to test the digital/analog outputs and to confirm a gas sensors check.

5.6.1 Signal test “IO-Test”

The following signals can be set and/or tested:
- Analog output for K-value
- Analog output NO and CO
- Relay for maintenance request ("MRq")
- Relay for device malfunction ("Fail")

- The VISIC100SF has two analog outputs. One analog output is standard to output the K-value. The second output is set to “CO” at the factory. Menu item “IOMap” serves to set the second analog output to “NO” → p. 58, 5.7
- Simultaneous output of all three measured values is only possible via the PROFIBUS or Modbus interface, or the TAD.

5.6.2 Testing the analog output for the K-value with submenu item “k”

Setting and checking the milliampere setting of the analog output for the “k”-value

Submenu item “Filter” is required in connection with the test tool and is described in the Service Manual.

The mA value set on the analog output can be reset using “Maint” -> “inactive”. The VISIC100SF switches back automatically to measuring mode after 30 minutes → p. 50, Fig. 33.
5.6.3 Testing the analog output for the gas sensor with submenu item “CO/NO”

Submenu items “IOTest”, “CO/NO” are only available in the menu when the respective gas sensors are installed. Maintenance mode must be activated.

Fig. 44  Setting the output current for the gas sensor

5.6.4 Testing the “Maintenance request” relay with submenu item “MRq”

Maintenance mode must be activated.

Fig. 45  Setting and testing the maintenance request relay

The set relay can be reset using “Maint” -> “inactive”. The VISIC100SF switches back automatically to measuring mode after 30 minutes → p. 50, Fig. 33.
5.6.5 Testing the malfunction relay with submenu item “Fail”

Maintenance mode must be activated.

Fig. 46 Setting and testing the device malfunction relay

5.6.6 Managing maintenance requests for gas sensors with “Gas”

This submenu item is displayed according to the gas sensors (CO and/or NO) installed. This submenu item is password-protected and accessible for SICK Service technicians.

5.7 Assigning the second analog output with menu item “IOMap”

The VISIC100SF has two analog outputs. One analog output is standard to output the K-value. The second output is set to “CO” at the factory. Menu item “IOMap” serves to set the second analog output to “NO”.

Simultaneous output of all three measured value is only possible via the PROFIBUS or Modbus interface, or the TAD.

Fig. 47 Assigning the second analog output

NOTICE: Checking the analog output

Erroneous assignment of the second analog output can lead to unsafe operation of the VISIC100SF.

- Check changes made with menu item “IOMap” after restarting the device.
- Press “Reset” to restart (see → p. 18, Fig. 9).
6 Shutdown

Safety information
Preparation
Protective measures when storing devices
Transport
Disposal
6.1 **Technical knowledge necessary for shutdown**

Shutdown may only be performed by trained technicians or a SICK Service technician. Comply with the applicable tunnel regulations.

6.2 **Safety information on shutting down**

**WARNING: Risk of burns on the VISIC100SF with fog dissipation**

- Inner side: The heating element can heat up to 90°C
- Outer side: Can heat up to 80°C in the vicinity of the inlet openings.
  - Avoid touching the heating element without protective gloves.

**WARNING: Preventive measures for operating safety**

The VISIC100SF is normally used together with control technology.
- Ensure shutting down the VISIC100SF cannot lead to any danger or hindrance to traffic.

6.3 **Preparations for shutdown**

- Inform connected locations
- Disable/deactivate safety devices
- Clarify measuring point access (tunnel closure, lifting platform ...)

6.4 **Switch-off procedure**

The VISIC100SF can be switched off by interrupting voltage supply. There is no switch-off procedure to be observed.

6.5 **Protective measures for shutdown device**

- Store and transport the VISIC100SF in the original packaging.
- Remove the gas sensors and store closed airtight in the shipping packaging. Observe the maximum allowable storage duration before using again.
- Pay attention to storage conditions. Further information under → p. 78, 9.3

6.5.1 **Measures for short-term shutdown**

- Pay attention to the storage conditions for the measuring unit and gas sensors.
- Store gas sensors airtight.
6.6 Transport

**NOTICE: Damage to the VISIC100SF and the terminal box**
The VISIC100SF and the terminal box can be damaged when dropped or through heavy impacts during transport.
► Use the delivery cartons for transport.

**NOTICE: Damage to the measuring unit through ESD damage**
When the measuring unit is transported separately (e.g., returning for repair or spare parts delivery), ESD damage caused by incorrect packaging can lead to severe damage to the electronics.
► Always transport the measuring unit in the ESD protected packaging provided.

6.7 Disposal

► The device can easily be disassembled into its components for disposal at appropriate raw material recycling facilities.

The following subassemblies contain substances that may have to be disposed of separately:
● *Electronics*: Condensers.
● *Display*: Liquid of LC-Display.
● *Electrochemical sensors*

**WARNING: Risk of injury through chemical burns by sulfuric acid**
The gas sensors contain small amounts of liquid sulfuric acid. Skin and eye burns can occur through direct contact.
► Never open the enclosures of the gas sensors during disposal.
7 Maintenance

Necessary technical knowledge
Maintenance work
Maintenance plan
Requesting SICK Customer Service
Recommended spare parts
7.1 **Necessary technical knowledge for maintenance work**

Maintenance going beyond the tasks described here must be performed by authorized technicians only and is described in the Service Manual.

![WARNING: Hazard by voltage.](image)

- Live parts are accessible when the device is open!
- Switch the supply voltage off before opening the device.
- Only use suitable, insulated tools.

7.2 **Maintenance**

7.2.1 **VISIC100SF maintenance**

Regular maintenance: 1 x year.

7.2.1.1 **Clean device inside and outside.**

![NOTICE: Avoid contamination of the measuring unit when opening](image)

- Clean outer surfaces of device before opening.

![NOTICE: Preventive measures against ESD damage of the VISIC100SF](image)

- Maintenance of the VISIC100SF may only be carried out by a skilled technician.
- Observe the applicable ESD Guidelines.

Clean the outside of the VISIC100SF with a damp cloth before opening.
Ensure the air inlet openings are not blocked (e.g., cobwebs, sticky contamination).
Then carefully clean the inside of the device with a clean cloth.

7.2.1.2 **Clean optics**

**Fig. 48**

Cleaning optical interfaces

Tools required
- 1 x hexagonal wrench with ball head (M5 SW4)
- 1 x cotton swab

1. Receiver unit
2. Sender unit
3. Aperture
4. Light trap
5. Protective tube
6. Cylinder screw M5

1. Loosen cylinder screw (6) at the end of the protective tube.
2. Open the protective tube.
3. Clean the optical interfaces and optical beam path in the protective tube with a cotton swab.
4. Close the protective tube and fasten the cylinder screw again.
5. Repeat the procedure on the opposite side.
7.2.1.3 Gas sensor maintenance

**WARNING: Health risk through sulfuric acid**
The gas sensor contains sulfuric acid.
► When taking the gas sensors out, avoid any damage by a pointed or sharp object. Package the gas sensors carefully and securely when damaged and dispose of as hazardous waste.

Exchanging the gas sensors
1 Disconnect the data cable from the circuit board.
2 Use an SW4 Allen key to loosen the gas sensor screw fitting on the underside of the VISIC100SF enclosure.
3 Unscrew the loose sensor by hand.
4 Gas sensor disposal, → p. 61, 6.7.
5 Start-up of new sensor, → p. 27, 3.4.5.

7.3 Safety instructions for maintenance work

**NOTICE: Risk of erroneous device function when using wrong spare parts.**
► Use original SICK spare parts only.

7.4 Maintenance plan

7.4.1 Maintenance by trained users/Customer Service of manufacturer

<table>
<thead>
<tr>
<th>Maintenance interval[1]</th>
<th>Maintenance work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>▸ Clean device inside and outside</td>
</tr>
<tr>
<td></td>
<td>▸ Clean optics</td>
</tr>
<tr>
<td></td>
<td>▸ Exchange gas sensor</td>
</tr>
<tr>
<td></td>
<td>▸ Test analog outputs</td>
</tr>
<tr>
<td></td>
<td>▸ Test digital outputs</td>
</tr>
</tbody>
</table>

[1] Y = yearly

► Also observe the local statutory and works regulations which apply for the individual application.
7.5 When requesting Customer Service from SICK

Request SICK’s Customer Service in writing to the responsible office 4 weeks before the planned maintenance date at the latest. Before this date, the customer must ensure:

- Safe access to, and safeguarding the assembly and workplaces in the tunnel. The tunnel/traffic lane should be closed when necessary.
- Provision of a lifting platform or a ladder and adequate lighting at the installation locations.
- Availability of a skilled technician with knowledge of local conditions.

Inform Service about malfunctions or potential repairs as early as possible. The Service engineer can then have the spare parts and consumables available that may be necessary for the maintenance date and thus avoid unnecessary and expensive multiple journeys.
## 7.6 Spare parts

### WARNING: Malfunction hazard

▸ Use original SICK spare parts only.

### 7.6.1 Consumable parts/operating materials

<table>
<thead>
<tr>
<th>Consumable material</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO sensor</td>
<td>2071008</td>
</tr>
<tr>
<td>NO sensor</td>
<td>2071007</td>
</tr>
</tbody>
</table>

### 7.6.2 Spare parts for VISIC100SF

<table>
<thead>
<tr>
<th>Spare part</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring unit</td>
<td>2071119</td>
</tr>
<tr>
<td>Enclosure cover, standard</td>
<td>2071120</td>
</tr>
<tr>
<td>Enclosure cover with heating</td>
<td>2071121</td>
</tr>
<tr>
<td>Connection terminal strips</td>
<td>2069310</td>
</tr>
<tr>
<td>Cable gland, M20 x 1.5 D6-12</td>
<td>2071122</td>
</tr>
<tr>
<td>Cable gland, M20 x 1.5 D10-14</td>
<td>2071123</td>
</tr>
<tr>
<td>Screw plug</td>
<td>2071124</td>
</tr>
<tr>
<td>O-ring, tube</td>
<td>2071125</td>
</tr>
<tr>
<td>Status LED</td>
<td>2073008</td>
</tr>
<tr>
<td>PCB PROFIBUS</td>
<td>2073009</td>
</tr>
</tbody>
</table>

The standard enclosure cover and enclosure cover with heating cannot be swapped onsite.

### 7.6.3 Spare parts for terminal box

<table>
<thead>
<tr>
<th>Spare part</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>2073011</td>
</tr>
<tr>
<td>Mains filter</td>
<td>2073012</td>
</tr>
<tr>
<td>Terminal set 1 (for TB-A1)</td>
<td>2073018</td>
</tr>
<tr>
<td>Terminal set 2 (for TB-A2)</td>
<td>2073019</td>
</tr>
</tbody>
</table>
8 Clearing Malfunctions

- Description of device errors
- Description of maintenance request
## Clearing Malfunctions

### 8.1 Description of device errors

The VISIC100SF switches immediately to Malfunction when a serious device error occurs. In operating state Malfunction, the malfunction relay opens and both analog interfaces signal 1 mA. The digital buses (PROFIBUS and Modbus) have a measured value status which switches to “Bad” when an error occurs. The following Table shows the error codes displayed for possible device errors.

**Table 10**

<table>
<thead>
<tr>
<th>Code</th>
<th>Bit</th>
<th>Description</th>
<th>Cause</th>
<th>Notes for service</th>
</tr>
</thead>
</table>
| F_000 | 0   | VIS error                 | ▶ Degree of contamination on optics too high, no measuring           | ▶ Clean and restart device.  
| F_001 | 1   | CO sensor                 | ▶ CO sensor defective.  
▶ Sensor heating up time.                                                    | ▶ Wait for heating up time to complete.  
▶ Restart.  
▶ Exchange gas sensor.                                                         |
| F_002 | 2   | NO sensor                 | ▶ NO sensor defective.  
▶ Sensor heating up time.                                                    | ▶ Wait for heating up time to complete.  
▶ Restart.  
▶ Exchange gas sensor.                                                         |
| F_003 | 3   | EEPROM                    | ▶ EEPROM data inconsistent.                                         | ▶ Restart.  
If the error is still present after a restart, call SICK Customer Service or return the device, and specify the error code. |
| F_004 | 4   | Heating                   | ▶ Heating power input outside rated range.                           | ▶ Restart.  
If the error is still present, call SICK Customer Service.  
▶ Exchange cover.                                                              |
| F_005 | 5   | Erroneous function of analog interfaces | ▶ Electronics defective                                                | ▶ Restart.  
If the error is still present after a restart, call SICK Customer Service or return the device, and specify the error code. |
| F_006 | 6   | FPGA                      | ▶ Electronics defective  
▶ ADC underflow/overflow                                                    | ▶ Restart.  
If the error is still present after a restart, call SICK Customer Service or return the device, and specify the error code. |
| F_007 | 7   | CPU                       | ▶ RAM test error  
▶ Flash test error  
▶ Register test error.                                                         | ▶ Call SICK Customer Service or return the device, and specify the error code. |
| F_008 | 8   | Program flow              | ▶ Program flow erroneous.                                            | ▶ Restart.  
If the error is still present after a restart, call SICK Customer Service or return the device, and specify the error code. |
| F_009 | 9   | Enclosure error           | ▶ Enclosure cover not fitted.                                       | ▶ Fit enclosure cover.                                                           |
| F_014 | 14  | Maintenance               | ▶ Maintenance active on device.                                      | ▶ Deactivate maintenance on device, see → p. 50, 5.3.2                           |
8.2 Description of maintenance requests

Table 11 Description of maintenance requests

<table>
<thead>
<tr>
<th>Code</th>
<th>Bit</th>
<th>Description</th>
<th>Coding Maintenance requests</th>
<th>Notes for service</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRq_000</td>
<td>0</td>
<td>VIS measurement</td>
<td>▶ Degree of contamination 1 reached on optics.</td>
<td>▶ Clean enclosure and optics. Restart.</td>
</tr>
<tr>
<td>MRq_001</td>
<td>1</td>
<td>CO measurement</td>
<td>▶ Maintenance required for CO cell</td>
<td>▶ Exchange gas sensor.</td>
</tr>
<tr>
<td>MRq_002</td>
<td>2</td>
<td>NO measurement</td>
<td>▶ Maintenance required for NO cell</td>
<td>▶ Exchange gas sensor.</td>
</tr>
</tbody>
</table>

8.2.1 Further error causes

Data interruption through VISIC100SF self-test

Self-tests are performed every four hours for RAM/Flash and CPU registers. Short interruptions (between 8 μs and 140 ms) in communication to the Modbus-RTU/TAD interface are therefore possible and can lead to transfer errors/timeouts on the Master.
9 Specifications

Compliances
Gas sensor dimensions
Technical data
9.1 Compliances

- VISIC100SF
  The technical design of the device corresponds to the following EC Directive:
  - Directive 2004/108/EC (EMC Guideline)
  Applied EN standards:
  - EN 61326, Electrical equipment for measurement, control and laboratory use - EMC requirements
- Terminal box
  The technical design of the device corresponds to the following EC Directive:
  - Directive 2006/95/EC (Low Voltage Directive)
  Applied EN standards:
  - EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use

9.1.1 Electrical protection

- Insulation: Protection class 1 according to EN 61140.
- Insulation coordination: Overvoltage category II in accordance with EN 61010-1.
- Contamination: The control unit operates safely in an environment up to contamination level 2 according to EN 61010-1 (usual, non-conductive contamination and temporary conductivity by occasional moisture condensation).

9.1.2 Standards observed

- RABT German “Regulations governing equipping and operating road tunnels”
- ASTRA German “Ventilation of road tunnels”
- RVS German “Standards and regulations for road traffic”
- EN 50545
- EN 50271

9.1.3 Declaration of Conformity

- CE
9.2 Dimensions

Fig. 49 VISIC100SF dimensions (all units of measurement in mm)
Fig. 50 VISIC100SF drilling plan (all units of measurement in mm)

Fig. 51 Terminal box for VISIC100SF dimensions (all units of measurement in mm)
Fig. 52  Drilling plan for terminal box for VISIC100SF (all units of measurement in mm)
# Technical Data

## VISIC100SF

<table>
<thead>
<tr>
<th>Measured variable</th>
<th>Visibility (heat transmission coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gas concentration CO/NO (optional)</td>
</tr>
<tr>
<td>Measuring principle</td>
<td>Scattered light forwards (K-value)</td>
</tr>
<tr>
<td></td>
<td>Gas sensor (CO/NO)</td>
</tr>
<tr>
<td>Measuring ranges</td>
<td>Visibility (K-value): 0 ... 15 /km</td>
</tr>
<tr>
<td></td>
<td>CO: 0 ... 300 ppm</td>
</tr>
<tr>
<td></td>
<td>NO: 0 ... 100 ppm</td>
</tr>
<tr>
<td>Setting time (t_{90})</td>
<td>(\leq 60) s</td>
</tr>
<tr>
<td>Repeat accuracy</td>
<td>CO: (\leq 3) % of full-scale value</td>
</tr>
<tr>
<td></td>
<td>NO: (\leq 3) % of full-scale value</td>
</tr>
<tr>
<td>Resolution</td>
<td>Visibility (K-value): 0.001 /km</td>
</tr>
<tr>
<td></td>
<td>CO: 0.5 ppm</td>
</tr>
<tr>
<td></td>
<td>NO: 0.5 ppm</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Basic variant: -20 ... +55 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Measuring device without gas sensor:</td>
</tr>
<tr>
<td></td>
<td>-30 ... +85 °C</td>
</tr>
<tr>
<td></td>
<td>CO/NO sensors: +5 ... +20 °C</td>
</tr>
<tr>
<td>Ambient pressure</td>
<td>860 ... 1,080 hPa</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>10 % ... 100 % RH, non-condensing</td>
</tr>
<tr>
<td>Electrical safety</td>
<td>CE</td>
</tr>
<tr>
<td>Control functions</td>
<td>Continuous contamination control</td>
</tr>
<tr>
<td>System components</td>
<td>Basic variants</td>
</tr>
<tr>
<td></td>
<td>Measuring unit with wall enclosure and cover</td>
</tr>
<tr>
<td>Optional:</td>
<td>Terminal box</td>
</tr>
<tr>
<td></td>
<td>Gas sensors (CO, NO measurement)</td>
</tr>
<tr>
<td></td>
<td>Fog dissipation</td>
</tr>
<tr>
<td>Scope of delivery</td>
<td>Exact device specifications and performance data of the product can deviate and depend on the respective application and customer specification.</td>
</tr>
</tbody>
</table>

## VISIC100SF sensor

<table>
<thead>
<tr>
<th>Protection class</th>
<th>IP 6K9K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog outputs</td>
<td>2 outputs: 4 ... 20 mA, electrically isolated</td>
</tr>
<tr>
<td>Digital outputs</td>
<td>2 outputs: 48 V DC, 0.5 A, 24 W</td>
</tr>
<tr>
<td>Interfaces</td>
<td>2 x RS-485</td>
</tr>
<tr>
<td>Bus protocol</td>
<td>Integrated: Modbus-RTU</td>
</tr>
<tr>
<td></td>
<td>Optional: PROFIBUS DP-V0</td>
</tr>
<tr>
<td>Display</td>
<td>LC display</td>
</tr>
<tr>
<td></td>
<td>Status LED</td>
</tr>
<tr>
<td></td>
<td>Green: Operation</td>
</tr>
<tr>
<td></td>
<td>Red: Malfunction</td>
</tr>
<tr>
<td></td>
<td>Yellow: Maintenance request</td>
</tr>
<tr>
<td>Input and operating</td>
<td>Function buttons, single-line LC-Display</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>266 mm x 159 mm x 117 mm (details, see dimensional drawing, (\rightarrow) p. 75, Fig. 49)</td>
</tr>
<tr>
<td>Weight</td>
<td>(\leq 2.8) kg</td>
</tr>
<tr>
<td>Material, media contact</td>
<td>Stainless steel 1.4571</td>
</tr>
</tbody>
</table>
### VISIC100SF sensor

<table>
<thead>
<tr>
<th>Installation position[1]/installation angle/swivel angle:</th>
<th>Wall assembly, vertical up to 45° wall inclination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric connection</td>
<td>Voltage: 18 ... 28 V DC, main power supply with optional terminal box</td>
</tr>
<tr>
<td></td>
<td>Power consumption: Max. 1 A</td>
</tr>
<tr>
<td></td>
<td>Power input:</td>
</tr>
<tr>
<td></td>
<td>● Without heating: ≤ 5 W</td>
</tr>
<tr>
<td></td>
<td>● With heating: ≤ 20 W</td>
</tr>
</tbody>
</table>

[1] Allowable enclosure tilt during operation

### Terminal box

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>266 mm x 238 mm x 146 mm (details, see dimension drawing, → p. 76, Fig. 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>&lt;2.8 kg</td>
</tr>
<tr>
<td>Material, media contact</td>
<td>Stainless steel 1.4571</td>
</tr>
<tr>
<td>Electric connection (optional)</td>
<td>Voltage: 85 ... 264 V AC /DC</td>
</tr>
<tr>
<td></td>
<td>Frequency: 48 ... 62 Hz</td>
</tr>
<tr>
<td></td>
<td>Power consumption: 0.1 A</td>
</tr>
<tr>
<td></td>
<td>Temperature class A: -40... +85 °C</td>
</tr>
<tr>
<td></td>
<td>Cross-section: 3 x 1.5 mm²</td>
</tr>
<tr>
<td></td>
<td>L: Phoenix Contact ST 4-HESI (5 x 20)</td>
</tr>
<tr>
<td></td>
<td>N: Phoenix Contact ST 4-BU</td>
</tr>
<tr>
<td></td>
<td>PE: Phoenix Contact ST PE</td>
</tr>
<tr>
<td>Signal connection</td>
<td>Phoenix Contact ST TB 1.5</td>
</tr>
<tr>
<td>Index</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Scope of delivery</td>
<td>23</td>
</tr>
<tr>
<td>Serial number</td>
<td>9</td>
</tr>
<tr>
<td>Shielding</td>
<td>33</td>
</tr>
<tr>
<td>Shutdown</td>
<td>59</td>
</tr>
<tr>
<td>- Preparations</td>
<td>60</td>
</tr>
<tr>
<td>- Protective measures</td>
<td>60</td>
</tr>
<tr>
<td>- Safety information</td>
<td>60</td>
</tr>
<tr>
<td>- Switch-off procedure</td>
<td>60</td>
</tr>
<tr>
<td>- Technical knowledge, required</td>
<td>60</td>
</tr>
<tr>
<td>Signal Words</td>
<td>2</td>
</tr>
<tr>
<td>Spare parts</td>
<td>67</td>
</tr>
<tr>
<td>Special features</td>
<td>16</td>
</tr>
<tr>
<td>Specifications</td>
<td>73</td>
</tr>
<tr>
<td>Start-up</td>
<td></td>
</tr>
<tr>
<td>- Function test</td>
<td>43</td>
</tr>
<tr>
<td>Status</td>
<td>46</td>
</tr>
<tr>
<td>Status messages</td>
<td>46</td>
</tr>
<tr>
<td>Switch-off procedure</td>
<td>60</td>
</tr>
<tr>
<td>Symbols (explanation)</td>
<td>2</td>
</tr>
<tr>
<td>T</td>
<td></td>
</tr>
<tr>
<td>Target group (users)</td>
<td>8</td>
</tr>
<tr>
<td>TB-A1</td>
<td>15</td>
</tr>
<tr>
<td>TB-A2</td>
<td>15</td>
</tr>
<tr>
<td>Technical data</td>
<td>75</td>
</tr>
<tr>
<td>Technology</td>
<td>16</td>
</tr>
<tr>
<td>Terminal box, installing</td>
<td>26</td>
</tr>
<tr>
<td>Topology</td>
<td>40</td>
</tr>
<tr>
<td>Transport</td>
<td>61</td>
</tr>
<tr>
<td>Type plate</td>
<td>9</td>
</tr>
<tr>
<td>U</td>
<td></td>
</tr>
<tr>
<td>User</td>
<td></td>
</tr>
<tr>
<td>- Designated users</td>
<td>8</td>
</tr>
<tr>
<td>- Responsibility of user</td>
<td>8</td>
</tr>
<tr>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Warning symbols, warning levels</td>
<td>2</td>
</tr>
<tr>
<td>Wearing parts</td>
<td>67</td>
</tr>
<tr>
<td>Wiring diagram</td>
<td>35</td>
</tr>
</tbody>
</table>
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