OPERATING INSTRUCTIONS

TRANSIC111LP

Oxygen Transmitter

SICK
Sensor Intelligence.

Installation, Operation, Maintenance

Described Product

Product name: TRANSIC111LP
Variants: In-situ measurement
Extractive measurement
Ambient gas measurement

Manufacturer

SICK AG
Erwin-Sick-Str. 1 · D-79183 Waldkirch · Germany
Phone: +49 7641 469-0
Fax: +49 7641 469-1149
E-mail: info.pa@sick.de

Place of Manufacture

SICK AG
Nimburger Str. 11 · D-79276 Reute · Germany

Legal Information

Original document

This document is an original document of SICK AG.

Contents

1 Important Information

1.1 Main operating information

Observe the following safety precautions:

CAUTION: TRANSIC111LP is a protection class 1 laser product.
Normal handling and operation of the device is eye-safe, because laser radiation is collimated and maintained inside the probe. No laser radiation emerges from the probe.

- Do not place objects with reflecting surfaces (tools, etc.) directly onto the probe when the TRANSIC111LP is in operation to prevent the laser beam being reflected out of the probe.

NOTICE: Damage to device through electrostatic discharges
SICK products are adequately protected against ESD when used as intended. Observe the generally valid ESD regulations to avoid damaging the device through electrostatic discharges when touching parts within the enclosure.

1.1.1 Installation location

- Indoors and outdoors
- Altitude up to 2000 m above sea level
- Max. air humidity: 100% r.h., non-condensing

WARNING: Risk of explosion with inflammable substances

- TRANSIC111LP is *not* suitable for measurement of flammable and occasionally ignitable gases.

WARNING: Risk of fire through strong oxidation processes
High O_2 concentrations have strong oxidizing properties. These increase the risk of combustion and can trigger violent reactions with inflammable substances.

- Before installation, check the TRANSIC111LP is suitable for your application with regard to all ambient conditions.

1.2 Intended use

1.2.1 Purpose of device

The TRANSIC111LP is a stationary oxygen measuring device and serves continuous measurement of oxygen in the industrial sector.

Three application variants of the TRANSIC111LP are available from SICK:

1 In-situ measurement
2 Extractive measurement
3 Measurement in ambient air

The TRANSIC111LP has not been evaluated regarding the safety function as laid out in 94191 EC, Annex II, Section 1.5.

NOTICE: The TRANSIC111LP is not suitable for use in potentially explosive atmospheres.

1.3 Responsibility of user

- Read the Operating Instructions before putting the TRANSIC111LP into operation.
- Observe all safety instructions.
- If there is something you do not understand: Contact SICK Customer Service.

Designated users

All operators of the TRANSIC111LP should be specifically trained on this device, knowledgeable of relevant regulations, and able to assess potential hazards related to its operation.

Correct use

The basis of this manual is delivery of the TRANSIC111LP according to the order code. This code is created during order configuration by the customer and is identical with the type plate code. The type plate code documents the device configuration ex factory.

If you have questions concerning the configuration, please contact SICK Customer Service.

NOTICE: Check the device with respect to measuring range, configuration and specific measuring conditions before installation and start-up.

- Use the device only as described in these Operating Instructions.
  The manufacturer bears no responsibility for any other use.
- Carry out the specified maintenance work.
- Do not remove, add or change any components in or on the device unless such changes are officially allowed and specified by the manufacturer. Failure to observe these precautions could result in:
  - Causing the device to become dangerous
  - Voiding the manufacturer's warranty.

Special local conditions

- In addition to these Operating Instructions, observe all local laws, technical rules and company policies applicable at the respective installation location.

Retention of documents

These Operating Instructions and the System Documentation:

- Must be available for reference.
- Must be conveyed to new owners.
- Keep passwords in a separate, safe place and secure against unauthorized use.

2 Product Description

2.1 Product identification

Product name:	TRANSIC111LP
Manufacturer:	SICK AG Erwin-Sick-Str. 1 · D-79183 Waldkirch · Germany

Type plates

The type plate is located on the outer left hand side of the enclosure.

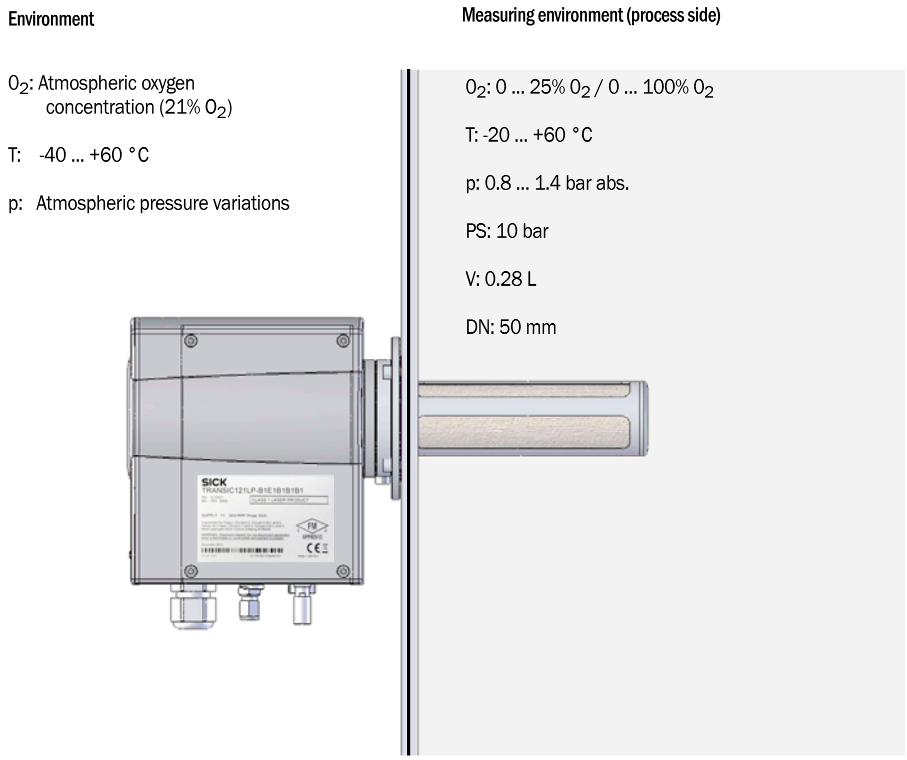
The type plate contains the type code.

Complete explanation on type codes in Annex, see “Type code”, page 101.

2.2 TRANSIC111LP Variants

2.2.1 Version for in-situ-measurement

Fig. 1: Flange mounted SICK oxygen measuring device TRANSIC111LP-A/-D/-F/-G/-H/-I/-J/-K



2.2.2 Version for extractive measurement

Fig. 2: TRANSIC111LP-C/-E with sample gas cell with wall bracket

Environment

O_2: Atmospheric oxygen concentration (21% O_2)

T: -40 ... +60 °C

p: Atmospheric pressure variations

Measuring environment (in sample gas cell)

O_2: 0 ... 25% O_2 / 0 ... 100% O_2

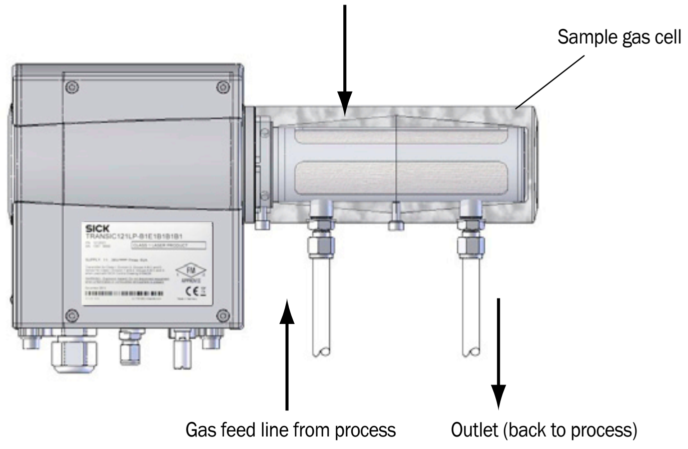
T: -20 ... +60 °C

p: 0.8 ... 1.4 bar abs.

PS: 10 bar

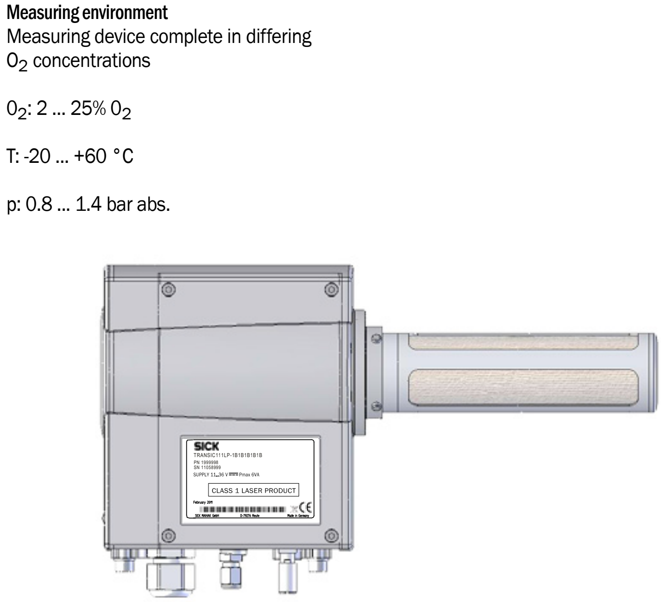
V: 0.28 L

DN: 50 mm



2.2.3 Version for ambient gas measurement

Fig. 3: TRANSIC111LP-B for ambient gas measurement with wall bracket



When configuring ambient gas measurements, the complete measuring device must be exposed to the varying O_2 concentration.

NOTICE: The O_2 concentration in the electronics housing is part of the O_2 measurement

The TRANSIC111LP configuration for ambient measurements measures oxygen concentration from 2 ... 25% O_2; the measuring function is lost for oxygen concentrations under 2%.

2.3 Functional principle/measuring principle

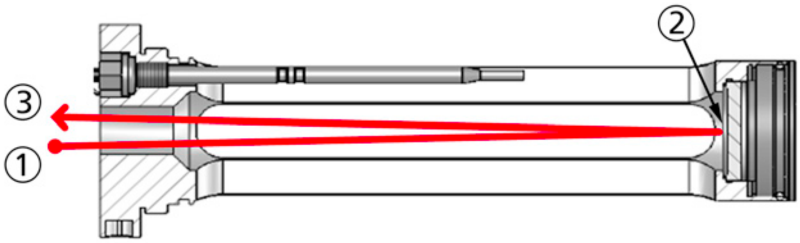
The TRANSIC111LP functions using light absorption of a tunable diode laser (Tunable Diode Laser Absorption Spectroscopy TDLAS). The gas concentration is measured using the damping of a laser beam sent from a tunable diode laser source in the gas sample. For oxygen measuring, the laser beam wavelength is set to match one of the characteristic absorption lines of oxygen in the wavelength range of around 760 nm in the near infrared range (NIR) of the electromagnetic spectrum. During measurement, the diode laser beam wavelength is continuously modulated to scan across one of the oxygen absorption lines. This generates a periodic signal in a photodetector, the amplitude of which is proportional to the amount of oxygen in the laser beam path..

The dust load in the process does not falsify the measured O_2 value. The transmitter outputs a maintenance signal when the dust load is too high.

2.3.1 Design of the TRANSIC111LP probe

The sensor is installed in a probe which can be directly fitting at the measuring location. The diode laser light source, and the photodetector that measures the light, are located in an electronics housing behind a protective window. The light is directed onto the photodetector using a focusing mirror at the far end of the probe.

Fig. 4: Probe design and laser beam guidance within the probe



1	= Light source
2	= Mirror
3	= Photodetector

Further information on components having contact with the sample gas sample, see “Dimensions and mechanics”, page 92.

3 Installation

3.1 Project planning

3.1.1 Chemical tolerance

The TRANSIC111LP contains several O-ring seals. Three material options are available for the seals:

– EPDM (ethylene propylene diene rubber)
– Kalrez® Spectrum 6375
– FKM (fluoro elastomer)

NOTICE: Specify correct seals when ordering
▶ Changing the seals later is work intensive and can only be done by SICK.

WARNING: Risk of fire through incorrect seal
Incorrect materials can cause fire or reactions with oxygen.
▶ Ensure the sealing material is compatible with the oxygen concentration.

WARNING: Toxic gases escaping
Incorrect sealing material leads to leaks.
▶ Ensure the seal used is compatible with the temperature of the process gas in your application.

+i Only use lubricants compatible with oxygen when installing seals.

3.1.2 Temperature conditions

The TRANSIC111LP probe contains a temperature probe. This measures the sample gas temperature. Changes are compensated.

Observe the temperature conditions in the various variants, see “Flange mounted SICK oxygen measuring device TRANSIC111LP-A/-D/-F/-G/-H/-I/-J/-K”, page 11, see “TRANSIC111LP-C/-E with sample gas cell with wall bracket”, page 12 and see “TRANSIC111LP-B for ambient gas measurement with wall bracket”, page 13.

In the in-situ version of TRANSIC111LP, (see “Flange mounted SICK oxygen measuring device TRANSIC111LP-A/-D/-F/-G/-H/-I/-J/-K”, page 11), the temperature probe and the measuring device enclosure are connected heat-conductive. Thus, the ambient temperature affects the measured value of the temperature probe. This causes measurement errors because the measured temperature value used in compensation deviates slightly from the actual process gas temperature.

Further information on the operating temperature range of the measuring device, see “Operating environment”, page 91.

NOTICE: The temperature gradient between process and surroundings influences the measured value.
▶ The ambient temperature of the measuring device enclosure at the installation location should correspond to the process temperature, whenever possible.

3.1.3 Strong light sources near the oxygen measuring probe

NOTICE: Strong light sources interfere with TRANSIC111LP operation

- Prevent strong light sources reaching the measuring probe.
- Observe the filter recommendation and the correct mounting bracket in Section Installation, see “TRANSIC111LP installation for in-situ measurement (with flange)”, page 18 and see “TRANSIC111LP installation - extractive”, page 20

3.1.4 Pressure

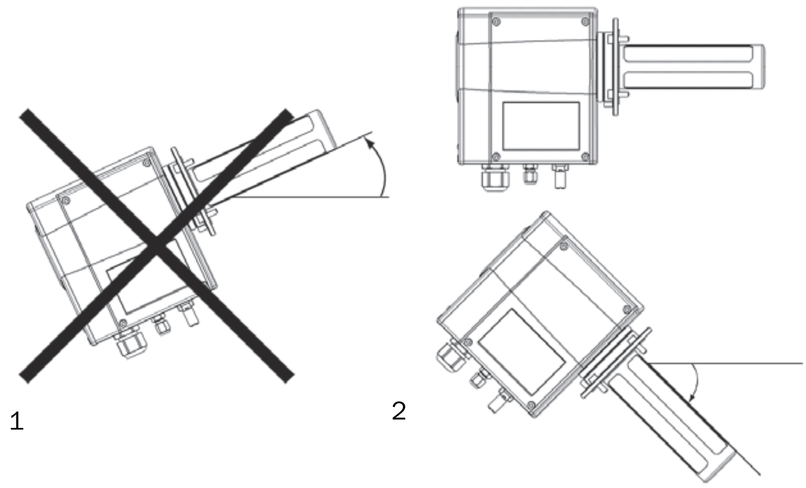
Observe the specifications on pressure conditions in Sections “Flange mounted SICK oxygen measuring device TRANSIC111LP-A/-D/-F/-G/-H/-I/-J/-K”, page 11, “TRANSIC111LP-C/-E with sample gas cell with wall bracket”, page 12 and “TRANSIC111LP-B for ambient gas measurement with wall bracket”, page 13

3.1.5 Installation angle

Install the device at a self-draining angle. When the processes are very wet, ensure no liquid can reach the beam path.

- Installation angle, see “Installation angle in high humidity”, page 16.
- The probe can be tilted freely when the process gas is dry (the process temperature is much higher than the dew point temperature of the gas) so that there is no risk of condensation.
- When using the sample gas cell: It is possible that measured values for high O_2 concentrations can depend to a certain degree on the flow rate when the probe and sampling cell are installed in vertical direction.
  - Do *not* install the measuring probe vertical.

Fig. 5: Installation angle in high humidity



1	=	The probe must not point upwards when there is a risk of condensation.
2	=	Install the probe aligned horizontally or at a maximum downward angle of 45 ° in high humidity.

3.2 Installation

3.2.1 Safety information for installation

NOTICE: Check the TRANSIC111LP for damage and completeness

- ▶ Check the TRANSIC151LP for completeness and damage (e.g., through transport) before start-up.

WARNING: Hazard through incorrect installation

All installers and operators of TRANSIC111LP should be specifically trained on this device, knowledgeable of relevant regulations concerning the gases used, and able to assess potential hazards related to its operation.

WARNING: Hazard by escaping acids and alkalis

- ▶ Check the complete installation for leaks.

WARNING: Toxic gases escaping

- ▶ Ensure the seals are fitted.
- ▶ Check the installation for gas leaks.

WARNING: Risk of fire through reaction with oxygen

- ▶ Check regularly that components that come in contact with the sample gas are free from oil, grease and dust.

Installation information: Process, materials and tools must be compatible with oxygen. Observe all regulations valid for your application for handling oxygen.

Installation information: Only use original SICK accessories and spare parts, see “Spare parts”, page 93.

WARNING: Hazard by escape of oxygen

- ▶ Install and remove the device only when there is no hazard caused by a high oxygen concentration.

WARNING: Risk of injury through pressure

- ▶ Install and remove the device only when there is no hazard caused by high pressure.

When necessary, provide separating elements to ensure safe installation and removal.

WARNING: High pressures

- ▶ Only use components designed for the process pressure in the application.

The device is available in two versions:

- Up to 0.5 bar overpressure
- Up to PS = 10 bar for TS_{max} = 80 °C

3.3 Installation options

3.3.1 Process conditions for installation options

The basic TRANSIC111LP version provides the following installation options:

1 In-situ measurement (flange installation)
2 Extractive measurement (installation with sample gas cell)

Information on process conditions for the various installation options can be found in the Technical Data Section, see “Operating environment”, page 91.

NOTICE: Installation of the TRANSIC111LP special version for ambient gas measurement is described in “Installation of the TRANSIC111LP version for ambient gas measurements”, page 24.

3.3.2 TRANSIC111LP installation for in-situ measurement (with flange)

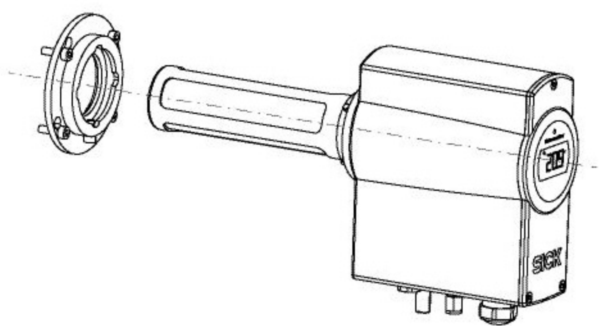
Filter recommendation

- Stainless steel mesh filter: Minimum protection against coarse dirt
- PTFE filter: Reduces the effects on oxygen measurements resulting from water, dust, other contamination and extremely strong ambient light. Gases and vapors are not filtered.

NOTICE: Filters influence the reaction time

- For short reaction times: Remove the filter.
  The optical components are then more susceptible to contamination and must therefore be cleaned more often, see “Cleaning the optical components”, page 83.
  Do not remove the filter when humidity or dirt can reach the optical components.
  Read “Strong light sources near the oxygen measuring probe”, page 16 before taking the filter out.
- Do not use a PTFE filter for measurements near the dew point.
- Short reaction times not required: SICK recommends using PTFE filters and stainless steel mesh filters.

Fig. 6: TRANSIC111LP measuring device with flange adapter



Suitable process flanges

Information on the diameter of the TRANSIC111LP flange adapter and flanges can be found in the Data Table, see “Dimensions and mechanics”, page 92.

The smallest DIN flange suited for the flange adapter of TRANSIC111LP is a DIN/ISO 1092 DN50 flange (fitted with M16 hex bolts). The flange adapter is fitted at the factory and is fastened to the bottom of the adapter with a screw.

Installation with clamping flange

A suitable counterflange must be present on the plant side in order to install the TRANSIC111LP with clamping flange 3"/ DN65 in accordance with DIN 32767. The scope of delivery does not include a seal. The customer must select the seal. The pressure, the chemical and thermal requirements must be considered when selecting the seal. Dimension drawing, see “Adapter flange, clamping flange DIN32676 3"/DN65 (suitable for PS= 10 bar) in mm”, page 97.

Installation with welding adapter

The welding adapter must be welded on in accordance with valid, regional regulations.

WARNING: Risk of toxic gases escaping

▶ Carry out a leakage test after installation to exclude the risk of process gas escaping.

Installation with flange adapter:

1 Drill the threads in the process flange. Flange adapter and drilling dimensions, see “Dimensions and drill holes, wall bracket in mm”, page 95.
2 Flange adapter with M5 screws:
   a) Screw the four M5 flange adapter fastening screws provided more or less halfway into the prepared threads.
   b) Push the TRANSIC111LP through the process flange. Check the correct position of the flange adapter seal to ensure a gas-tight connection between flange adapter and process flange.
   c) Turn the TRANSIC111LP clockwise so that the screws fit through the larger recesses of the flange adapter. Then turn the TRANSIC111LP counterclockwise to the stop.
3 Flange adapter with M8 screws:
   d) Push the TRANSIC111LP through the process flange.
   e) Check the correct position of the flange adapter seal to ensure a gas-tight connection between flange adapter and process flange.
   a) Screw the four M8 fastening screws provided for the flange adapter in the threads.
   b) Tighten the screws to finish installation.

The TRANSIC111LP can be removed from the process by loosening the screws holding the flange adapter in place. However, this is not recommended because fitting the TRANSIC111LP measuring device back on again is difficult.

Dimensions for flange installation of TRANSIC111LP, see “Adapter flange, weldable (suitable for PS = 10 bar) in mm”, page 97.

3.3.3 TRANSIC111LP installation - extractive

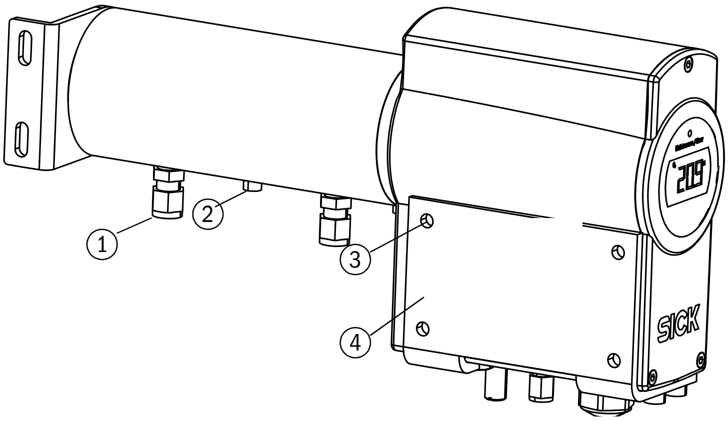
Filter recommendation

CAUTION: Risk of burns through hot gases
Attach the enclosed warning label to the sample gas cell surface when process temperatures are >65 °C.

- Stainless steel mesh filter: Minimum protection against dirt particles
- PTFE filter: For gas with humidity and/or fine dirt particles.

NOTICE: Preparing the gas sample for dirty and wet gas
- ▶ Filter and dry the gas sample before pumping it into the sample gas cell.
- ▶ Use a hydrophobic dust filter before the inlet opening of the sample gas cell to protect the optical components against particle and water.
- ▶ Replace the dust filter regularly to ensure sufficient throughflow.
- ▶ Dry the gas to guard against condensation in the sample gas cell.

Fig. 7: TRANSIC111LP measuring device with sample gas cell



1 = Swagelok connections for Ø 6 mm gas tubes or 1/8" NPT threads

2 = Drain opening

3 = Max. screw size M6

4 = Wall bracket

Installing the wall bracket

1 Fasten the wall bracket
Wall bracket dimensions, see “TRANSIC111LP, wall-mounted”, page 24.
2 Fasten the measuring device
   1 Install the TRANSIC111LP on the wall bracket using the four M6 screws provided.
   2 For easier installation, first fix the two outer screws to the threads at the bottom of the measuring device because the outer screw holes of the wall bracket are slotted. It is then easier to fasten the two inner screws when positioning the TRANSIC111LP on the wall bracket.

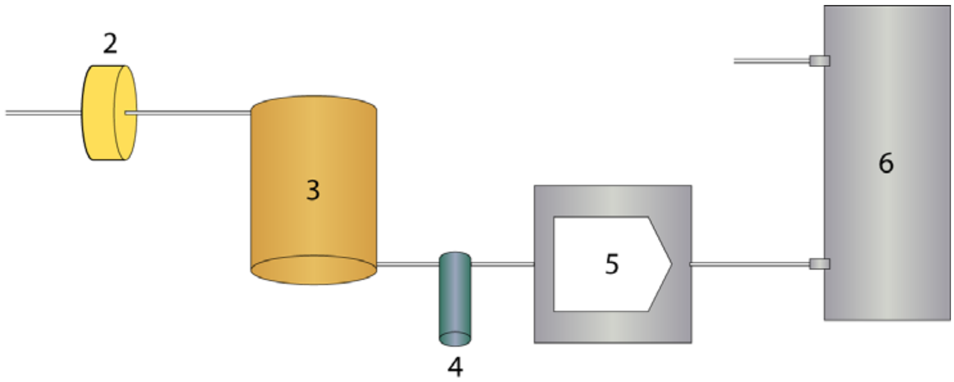
Tighten all four screws.

Drying the gases

In humid ambient conditions, condensation in the sample gas cell must be prevented. To do this, dry the gas sample through cooling and reheating. Use a cooling coil and a water trap. Switch a reheating system after the cooling process.

The humidity contained in the sample gas condenses on the walls of the stainless steel pipe; the water is collected. The relative humidity of the sample gas is reduced by reheating. If the temperature in the sample gas cell is significantly above the ambient temperature, the cooling coil and the water trap can be simply positioned outside the sample gas cell. For reheating, the heat generated by a pump system can sometimes be sufficient so that no additional heating is required. A simplified scheme of a sample gas treatment system for the removal of dirt and humidity is shown in "System for sample gas treatment", page 21.

Fig. 8: System for sample gas treatment



1 = Gas inlet

2 = Hydrophobic filter

3 = Stainless steel spiral tube

4 = Water trap

5 = Sample gas pump

6 = Oxygen sensor

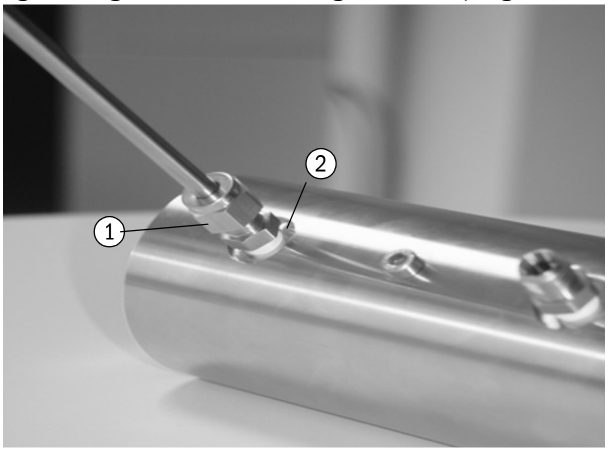
Installing the sample gas line

1 Provide adequate support for the tubing, for example by attaching it to the wall. The tube must not put any traction on the connection.

2 The sample gas cell has two gas connections. Use the gas connection closest to the measuring device as gas inlet. This provides a better gas exchange and shorter reaction times.

Installing the Swagelok tube screw fittings

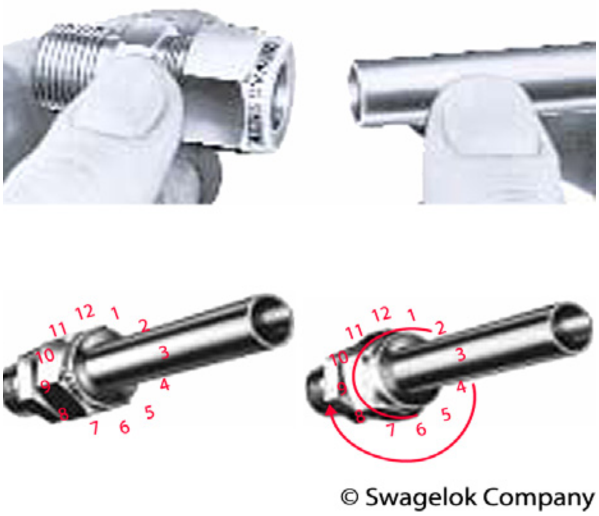
Fig. 9: Swagelok tube screw fitting on the sample gas cell of the TRANSIC111LP



1 Swagelok connection for Ø 6 mm gas tube
2 1/8 "NPT thread

1 Insert the tubing into the Swagelok tube screw fitting. The tube must sit tight on the screw fitting shoulder.
2 Tighten the nut hand-tight, see "Swagelok tube screw fitting Instructions", page 22.
3 Mark the nut in the 6 o'clock position.
4 Hold the tube screw fitting with a wrench and tighten the nut 1¼ turns.

Fig. 10: Swagelok tube screw fitting Instructions



Installing the sample gas cell

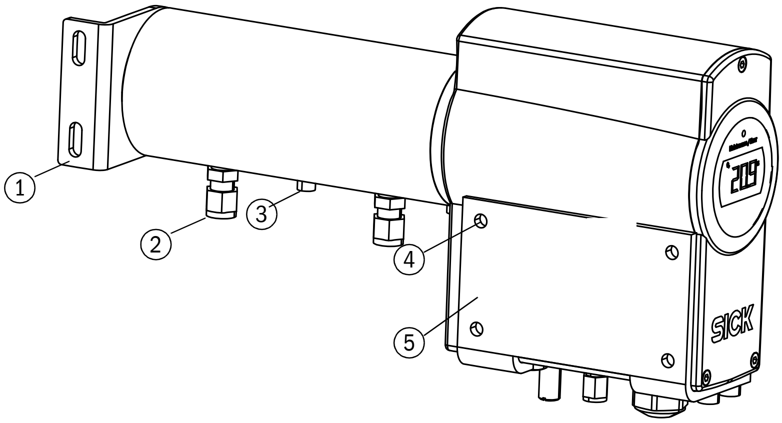
> **+i** Dimensions of the TRANSIC111LP with sample gas cell, see "TRANSIC111LP with wall bracket and sample gas cell", page 99.

When a TRANSIC111LP with sample gas cell is ordered, it is delivered with the cell fixed at the factory and prepared for wall fitting.

▶ Take the sample gas cell off to check and replace the filter, see "TRANSIC111LP with wall bracket and sample gas cell", page 99

1 Loosen the bayonet tube screw fitting, turn the sample gas cell and then pull it off the measuring device, see "Fastening the TRANSIC111LP probe in the sample gas cell", page 64.
2 Refit the bayonet screw fitting in the reverse sequence.
   Ensure the seal is located between the sample gas cell and measuring device enclosure. The Swagelok connections must point directly downwards.

Fig. 11: TRANSIC111LP with sample gas cell



1 = Optionally available mounting bracket

2 = Swagelok connections for Ø 6 mm gas tubes or 1/8" NPT threads

3 = Drain opening for condensation

4 = Max. screw size M6

5 = Wall bracket

Draining condensation

A drain opening for condensation is located in the center of the sample gas cell (see "TRANSIC111LP measuring device with sample gas cell", page 20).

+i Install a valve in the drain opening for high condensation.

WARNING: Acids and alkalis escaping
▶ Only open the valve screw when no acids or alkalis are present.

WARNING: Toxic gases escaping
▶ Only open the valve screw when no toxic gases are present.

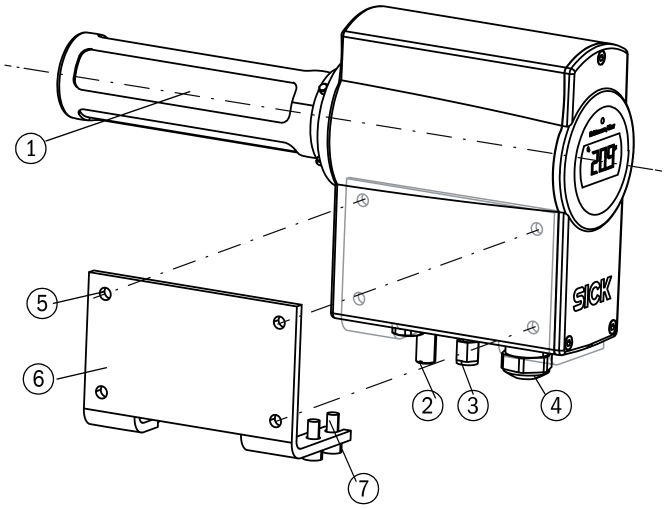
WARNING: Risk of injury through pressure
▶ Only open the valve screw when the system is not under pressure.

+i Check gas leak-tightness afterwards every time condensation is drained. Replace the seal when necessary.

3.3.4 Installation of the TRANSIC111LP version for ambient gas measurements

Installation Instructions

Fig. 12: TRANSIC111LP, wall-mounted



1 = Stainless steel mesh filter
2 = External grounding connection
3 = Test gas inlet with a Ø 6 mm Swagelok connection (optional)
4 = M20 × 1.5 cable gland for main power supply and signal lines
5 = Max. screw size M6
6 = Wall bracket
7 = Device screws

1 Fit the wall bracket to the 4 drill holes.
2 Fasten the measuring device to the wall bracket with the four M6 screws.

NOTICE: First fix both outer screws in the threads at the bottom of the measuring device. This simplifies fastening the two inner screws when positioning the TRANSIC111LP on the wall bracket.

3 Tighten the four screws.

Dimensions and drill holes for the wall bracket and flange adapter, see "Measured oxygen values in relative humidity", page 67

Ensure the device is installed in a representative air mixture.

3.4 Connections

3.4.1 Cabling of signal and voltage supply lines

WARNING: The signal and voltage supply lines of the TRANSIC111LP may be installed only by technicians.

CAUTION: Electrical voltages!
Always make sure the voltage supply lines are disconnected before starting any electrical work.

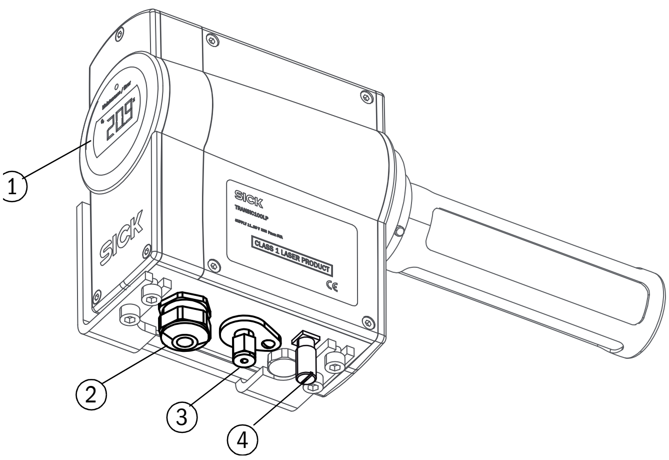
WARNING: Caution: Risk of fire caused by excessive energy input
A 24V PELV power supply unit with max. 60 W power output is mandatory for power supply. In addition, an output current limiter of the power supply unit or an external 2.5 A fuse is required to limit the max. energy input.
The installer/operating company is responsible for correct selection.
The installer of a system is responsible for the safety of a system in which the device is integrated.

WARNING: Endangerment of electrical safety
To disconnect the TRANSIC111LP from the power supply unit, a disconnecting device before the PELV power supply unit must be provided. Fit the disconnecting device as close as possible to the measuring device and easily accessible.

Voltage supply

- The supply voltage is 11 ... 36 VDC.
- The TRANSIC111LP does not operate with AC voltage.

Fig. 13: Connections



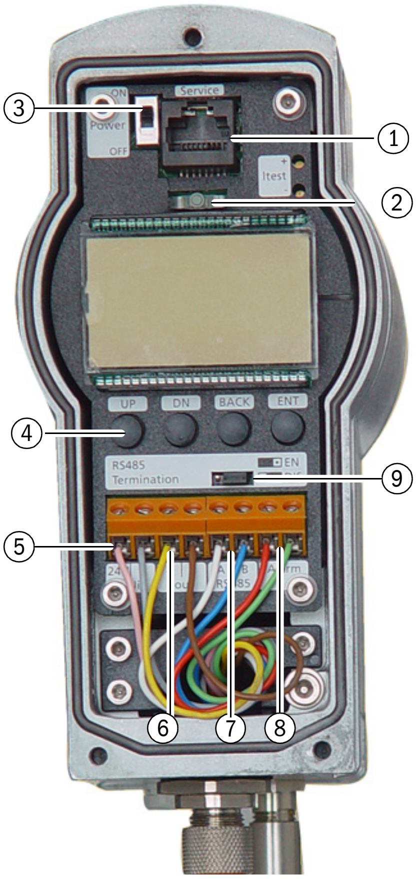
1 Cover
2 Cable duct
3 Test gas inlet (optional)
4 Ground terminal

Observe the cable specifications in the Technical Data, see “Operating environment”, page 91.

Grounding the transmitter

The transmitter must be grounded. Use conductors suitable for grounding. Connect the enclosure to the local ground. Lay the grounding as functional grounding.

Fig. 14: Connections at the integrated interface



1 Maintenance interface (RS-232)
2 LED lamp
3 ON/OFF switch
4 Keypad
5 Voltage supply
6 Power output terminals
7 Analog output
8 Digital output
9 Line termination RS-485

1 Remove the cover.
2 Set the *ON/OFF switch* to *OFF.*
3 Push the cable through the cable gland.
4 Connect power supply terminals *(24 V)* and *(0).*
5 Connect the current output: The current output is between terminals *Iout (+)* and *(-)*. The output can be checked with an amperemeter.
6 A two-wire RS-485 line is available between terminals *RS 485 (A)* and (B). Line termination can be enabled by changing the *RS-485 termination* jumper position to *EN*.
7 A potential-free relay contact is available between the two *Alarm* terminals. Further information, see "Display/set relay operating mode (command RELAY_MODE)", page 51.
8 Close the cable gland. Tightening torque: 10 Nm.
9 Ensure the cable gland seals the cable.
10 Switch the power supply on.
11 Switch the transmitter on using the *Power ON/OFF* switch.
12 The TRANSIC111LP performs a self-test. PASS is displayed after termination of the self-test. Shortly after the self-test, the device is ready for measurement and starts displaying measured oxygen values. A green LED lights when the transmitter has found the absorption line and can output valid measured values.
13 Close the device front panel.
14 Ensure the enclosure is closed tight.
15 The transmitter is now ready for use.

3.4.2 Connecting the TRANSIC111LP via an 8-pole plug connector

Fig. 15: Optional 8-pole plug connector

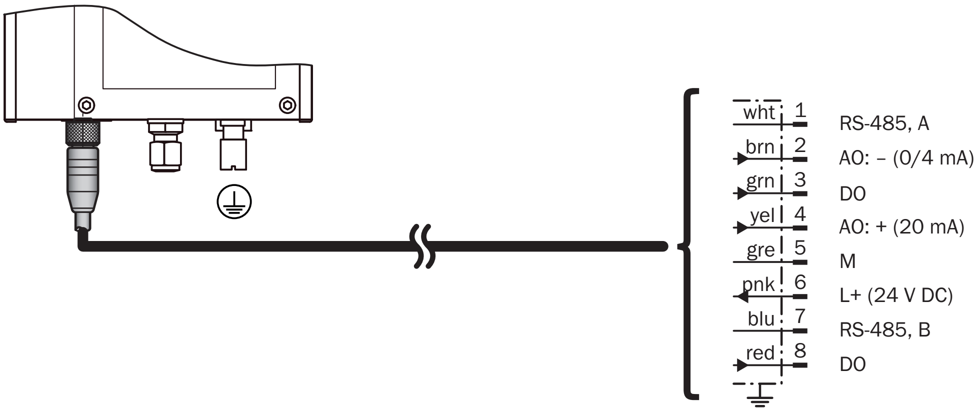


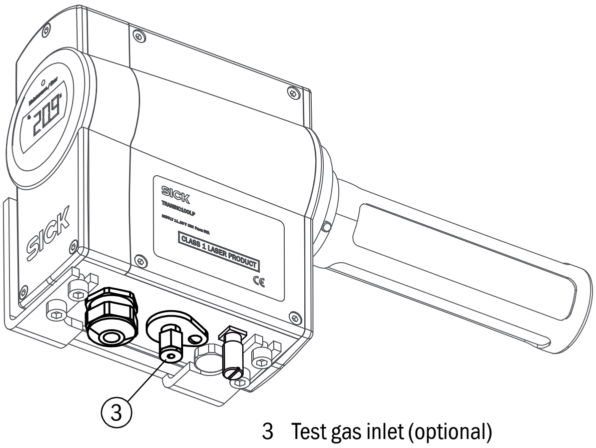
Table 1: Connections of 8-pole plug connector

Terminal	Color	Connection No.
24 V	pink	6
0 V	grey	5
Iout+	yellow	4
Iout-	brown	2
RS-485 A	white	1
RS-485 B	blue	7
Alarm	red	8
Alarm	green	3

3.4.3 Test gas connection (optional)

The optional test gas inlet is specified when ordering. Only SICK can retrofit this inlet later.

Fig. 16: Test gas inlet (optional)



The test gas inlet has a 6 mm Swagelok for tube or hose.

▶ Observe the suitability for:
  - Pressure
  - Gases
  - Temperatures
  - Oxygen

The test gas connection has a return valve, see "Connections and systems", page 65.

4 Operation

4.1 Safety instructions for operation

NOTICE: Read the instructions through carefully before making any settings or parameter changes. SICK accepts no responsibility for parameter or setting changes nor adjustments made by the user. Contact SICK Customer Service when you require technical support.

The password can be found in the Annex, see “Password”, page 104.

DANGER: Hazard through incorrect parameter settings

Incorrect settings for parameters can have severe consequences. This is why the password may only be available for authorized technicians.

▶ Note the password in the Manual and keep it safe somewhere else.

4.2 Device interfaces

There are 3 control interfaces

- Keypad (on the device front panel)
- Maintenance interface (RS-232)
- RS-485 interface.

The basic commands in the maintenance and RS-485 interface are available for all users.
Changes to parameters are password protected. The password allows access for 30 minutes after entry.

4.2.1 Control via keypad

A display and four pushbuttons are located on the front enclosure panel. The measured oxygen value is shown on the display. LEDs signal the operating mode of the measuring device. A green LED indicates normal operation.

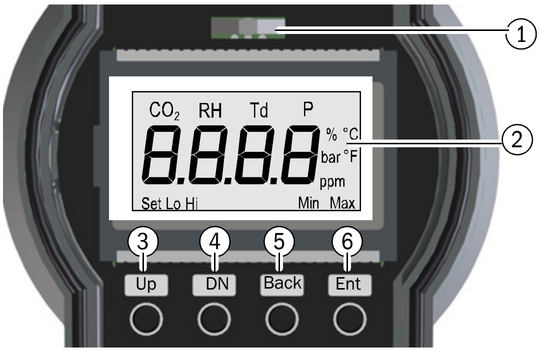
4.2.2 Characteristics

The main purpose of the integrated interface (keypad/display) is field calibration.

The following values can be set to attain higher measuring precision:

- Process pressure
- Humidity
- Carbon dioxide content

Fig. 17: Display and keypad



1 LED (red/green)
2 Seven-part display
3 *Up* - Upwards button
4 *Dn* - Downwards button
5 *Back* - Back button
6 *Ent* - Input button

Display modes

The display is in one of the following modes when no input is made:

Display modes	Display / LED	Process
Start (duration: 2.5 minutes)	Software version Self test PASS	Self-test starts Information: Self-test running Warming up phase starts
Normal operation	Green LED remains on Measured oxygen value	Measured oxygen value is shown continuously
Error state	Red LED remains on Error state number	Analog output in error status
Warning	Green LED blinks slowly Measured oxygen value is displayed	Select function *Err* in the menu or use serial interface commands to display error message. (Error Table, seesee “Error Table”, page 88)

Table 2: Display modes

4.3 Maintenance interface

The RS-232 interface is located on the connector block above the display. It serves:

- Maintenance
- Calibration
- Changing parameters.

All adjustable parameters can be accessed with a PC terminal program (e.g., Hyperterminal) via the serial RS-232 interface.

A serial RS-232 interface cable serves to connect the TRANSIC111LP and the PC.

The maintenance interface provides more configuration options for alarm threshold(s) or other settings than the keypad and display.

4.3.1 RS-485 interface

TRANSIC111LP has a two-wire, serial RS-485 port without electric isolation. There are also line termination resistors which can be switched on and off with a jumper.

Up to 32 measuring devices can be connected over a 1 km distance with a pair of twisted wires. The system can request oxygen data from the addressed measuring devices.

Three separate operating modes exist:

1 *POLL*: Standard operating mode

POLL mode for bus coupling:

Ensure that every device has a unique address:

a) To this purpose, the device must be opened with the *OPEN* command, the address assigned and closed again with the *CLOSE* command.
b) The devices connected to the RS-485 bus can then be addressed individually.
c) Address the required device by using the address of the device as command parameter.

2 *RUN*: Mode for continuous output of measured data. (The parameters to be output and the output interval are adjustable). Command S stops RUN mode. The device switches to STOP mode.

3 *STOP*: No output of measured values.

> +i The RS-485 interface supports SICK's standard command set with additional, device-specific commands.

4.3.2 Analog output

The TRANSIC111LP has a non-insulated current output. The configuration of the analog outputs (0 or 4 ... 20 mA) and the switching behavior in error states are determined at order time. These parameters can be updated via the maintenance interface.

4.3.3 Digital output relay

The contact relay can be configured at order time so that it signals limit value overflows or underflows, or device errors. These settings can be changed via the maintenance interface.

> +i The contact relay is momentary.

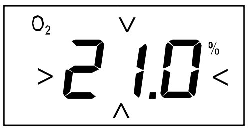
4.4 Settings using the keypad

4.4.1 Short description: Input of settings using the keypad

- Buttons *Up* or *Dn* serve to open and scroll through the menu.
- Button *Enter* activates the functions.
- Button *Back* cancels a process.
- Use the buttons *Up/Dn* to enter numeric values unless a different method is specified: Press *Up* to increment a digit by one. Press *Dn* to toggle through the digits in the display.

> The menu items are shown in the following Sections "Menu navigation without password authorization" and "Menu navigation with password authorization" in the same sequence as in the menu navigation.

Fig. 18: Blinking display



4.4.2 Safety information on using the password:

> **DANGER: Fatal consequences when parameters are changed without authorization**
> Unauthorized changing of parameters can have severe consequences. This is why the password may only be available for authorized technicians.

4.5 Menu navigation without password authorization

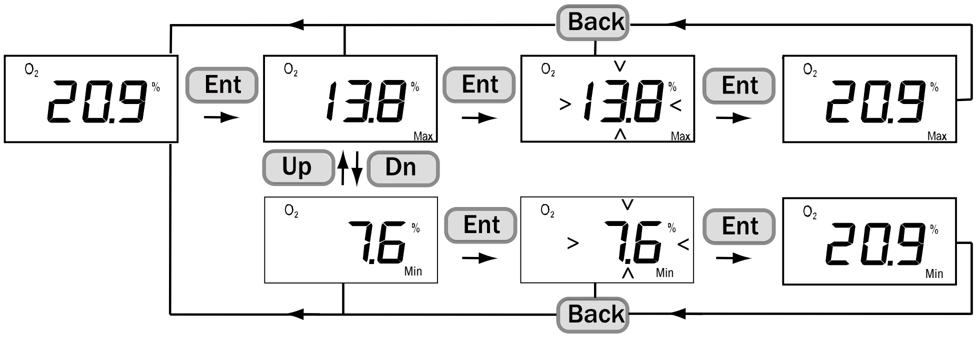
Values can only be read and reset in this part of menu navigation.

The sequence of the menu items described here is equivalent to the actual sequence via the keypad on TRANSIC111LP using the buttons *Up* and *Dn*. This part ends when the password is entered.

4.5.1 Display and settings of oxygen statistics (O_2)

This menu item displays the minimum and maximum oxygen values measured since the last reset. Please note that only displaying and resetting is possible under this menu item.

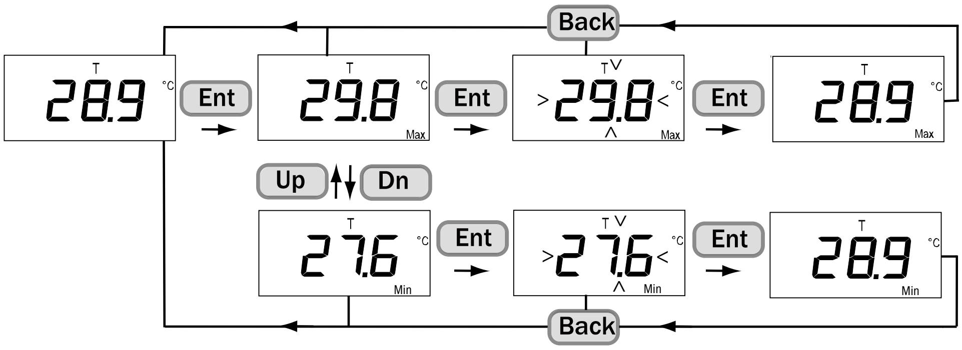
Fig. 19: Displaying and resetting the oxygen statistics



4.5.2 Displaying and resetting the temperature statistics (T)

This menu item displays the minimum and maximum temperature values measured since the last reset. Please note that only displaying and resetting is possible under this menu item.

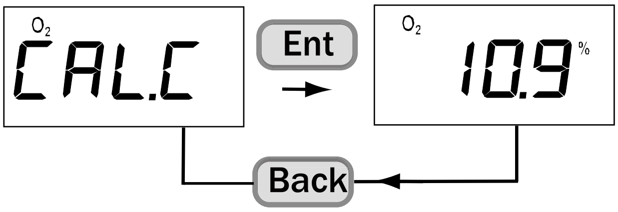
Fig. 20: Displaying and resetting the temperature statistics



4.5.3 Display of calibration gas, actual value (CAL.C)

1 Freezes the analog output.
2 Displays the current O2 concentration measured.

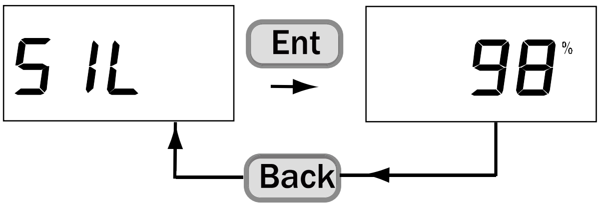
Fig. 21: Calibration gas, actual value display



4.5.4 Display of signal intensity (SIL)

1 Compares the current signal intensity of the laser on the receiver against the signal level from the factory calibration.
2 The signal intensity serves to determine contamination on the optics. Important: The laser signal can be amplified so that values above 100% are possible. More information, see “TRANSIC111LP behavior when errors occur”, page 87.

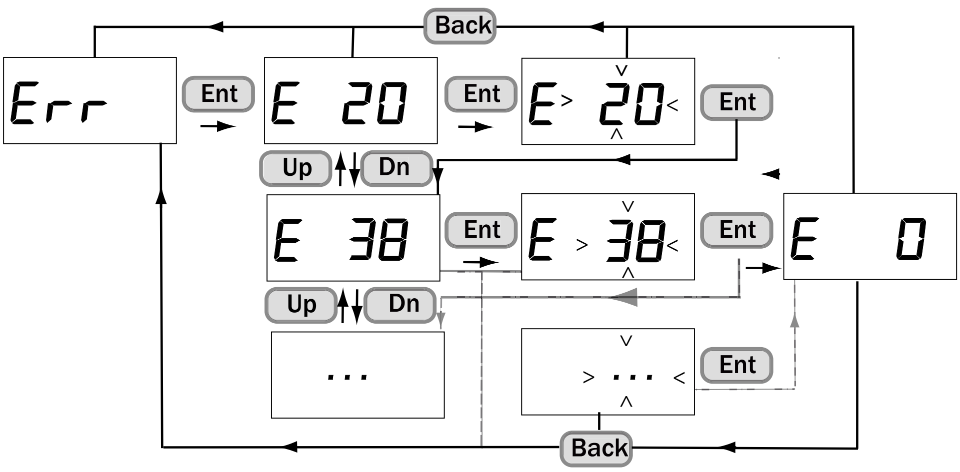
Fig. 22: Signal intensity display



4.5.5 Display of active and undeleted errors (ERR)

This menu displays all active error messages. The figure below describes how the errors are displayed and deleted. The display shows *E 0* when all errors have been deleted. Refer to the Error Table for significance of error numbers, see “Error Table”, page 88.

Fig. 23: Displaying all errors currently existing

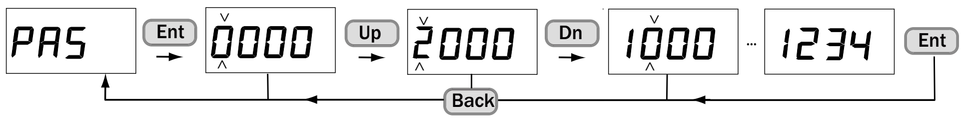


4.5.6 Entering the password (PAS)

1 Entering the password makes additional menu items available.
2 These additional menu items remain accessible for 30 minutes.
3 Observe the safety instructions, see "Safety information on using the password:", page 32.

> Menu navigation starts from the top again after the password is entered (measured value display).

Fig. 24: Entering the password



4.6 Menu navigation with password authorization

The maintenance level is open for all interfaces after the password has been entered.

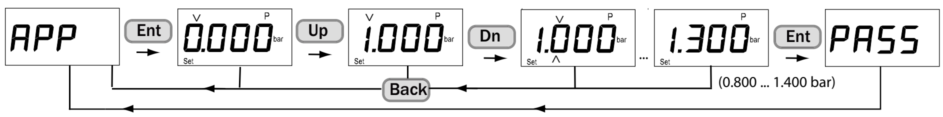
NOTICE:

- After entering the password via the keypad, it is recommended to return to the oxygen statistics display after completing password protected functions.
- Even though the password expires in 30 minutes, maintenance functions remain available until you return to the basic functions in the menu structure. A message is not sent via the keypad when the password expires.

4.6.1 Process pressure: Display and settings

1 Enter the average pressure in the sample gas. Further information, see "Pressure compensation", page 60. Adjustable range: 800 to 1400 mbar.

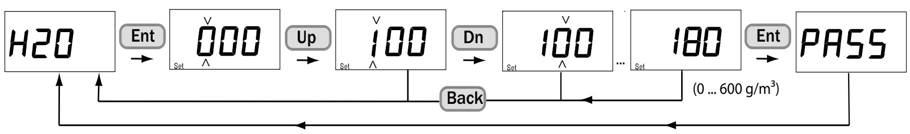
Fig. 25: Reading out and changing the process pressure



4.6.2 H_2O content in process gas: Settings (H2O)

1 Enter the average H_2O value in the sample gas. Further information, see "Compensation of ambient parameters", page 59. Adjustable range: 0 ... 600 g/m^3.

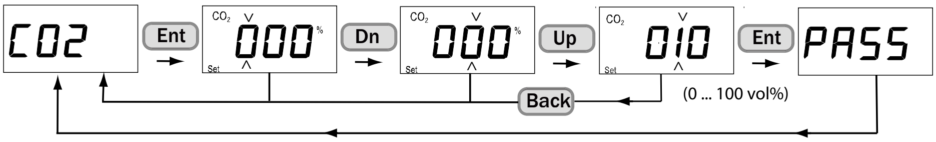
Fig. 26: Humidity in process gas setting



4.6.3 CO_2 content in process gas: Settings (CO2)

1 Enter the average CO_2 value in the sample gas.
Adjustable range: 0 ... 100 % vol.

Fig. 27: CO_2 sample gas setting



4.6.4 One-point calibration (CAL1)

Figure can be found in Section Adjustment, see “One-point adjustment using the keypad .0511-090”, page 70.

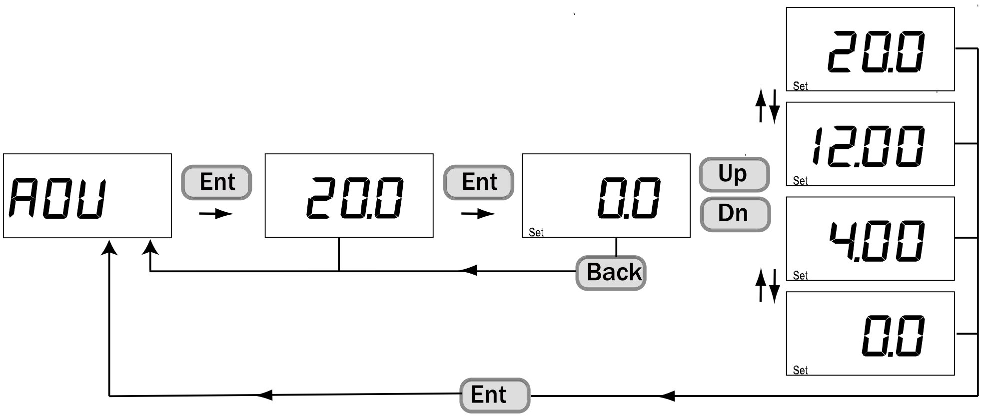
4.6.5 Two-point calibration (CAL2)

Figure can be found in Section Adjustment, see “Two-point adjustment using the keypad”, page 74.

4.6.6 Analog output display and settings (AOU)

1 Press *Ent* to display the current output value on the analog output.
2 To set fixed output values for the analog output (0, 4, 12, 20 mA), press Ent and use *Up* and *Dn* to select the analog output value.

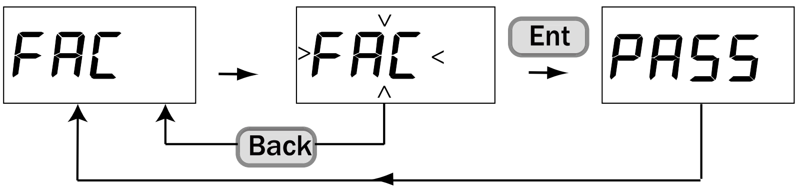
Fig. 28: Displaying and setting the analog output value



4.6.7 Resetting to the factory calibration (FAC)

The adjustment is reset to factory setting. (Gain value: 1, offset value: 0).

Fig. 29: Resetting to the factory setting for oxygen measurement

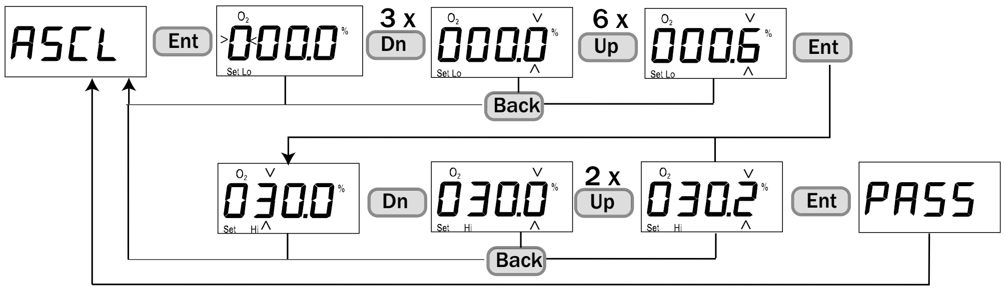


4.6.8 Scaling the analog output (ASCL)

The analog output can be scaled freely.

1 After pressing *Ent*, use submenu item *Set Lo* to set the oxygen value to be transferred with the lower mA value (4 mA or 0 mA).
2 Use submenu item *Set Hi* to set the oxygen value to be transferred with the upper mA value (20 mA).

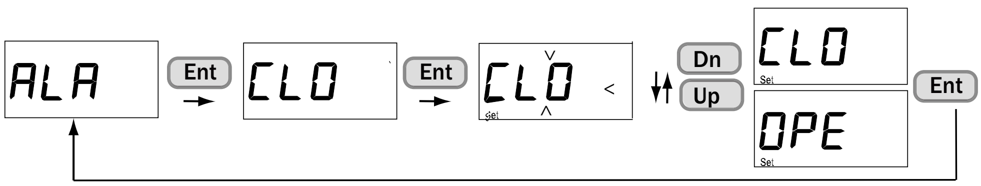
Fig. 30: Scaling the analog output



4.6.9 Digital output (ALA)

1 Press *Ent* to display the current switching position.
2 To check the switching function, press *Ent* and use *Dn* and *Up* to select the desired switching function *OPE* (open) or *CLO* (closed).

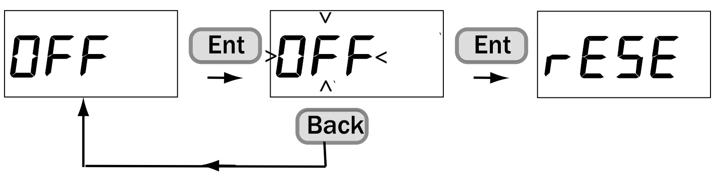
Fig. 31: Checking and changing the digital output state



4.6.10 Resetting the measuring device (rESE)

The device is restarted.

Fig. 32: Restarting the oxygen sensor TRANSIC111LP



4.7 Serial interface commands

The serial interface commands are valid for the maintenance interface and the RS-485 interface.

Element	Significance	Text style used
SAMPLE	Name of the command or utility program	UPPER CASE BOLD
{variable}	Specifies several options from which the user must select one, several or all options.	Lower case letters {in curly brackets}
[option]	Specifies optional elements.	Lower case letters in [square brackets]
. , : ;	Punctuation marks are part of the command and must be entered as such.	Lower case letters
<cr>	Stands for pressing Enter (on the computer keyboard)	Lower case letters

Table 3: Significance of command line elements

Property	Description / value
Baud rate	19200
Data bits	8
Parity	None
Stop bits	1

Table 4: Standard settings for the serial interface of the TRANSIC111LP

4.7.1 List of serial interface commands

Serial interface command	Description
?	Display device information
??	Display device information with overwriting in POLL mode
ADDR	Display/set device address
CALCS	Display measuring parameters
CINFO	Display calibration information
CLOSE	Close serial interface (POLL mode)
DATE	Display/set date
ECHO	Set Echo mode
ERRS	Display errors detected
FORM	Set output format
HELP	List commands
INTV	Display/set continuous output interval
OPEN	Open communication line
PARAM	Display all changeable parameter values
PASS	Output password
R	Start continuous output
S	Stop continuous output
SAVE	Save parameters in EEPROM
SEND	Send measuring results
SERI	Display/set serial communication settings

Table 5: List of serial interface commands without password

Serial interface command	Description
SERI2	Display/define serial communication settings for RS-485
SIL	Measure signal level
SMODE	Display/set serial communication mode
SMODE2	Display/set serial communication mode for RS-485
STATS	Display status information
TIME	Display/set time
VERS	Display product name and software version
XPRES	Set pressure for compensation

Table 5: List of serial interface commands without password

Serial interface command	Description
ADJUST	Freeze outputs for calibration
CO2	Display/set CO_2 for compensation
COXY1	Perform one-point adjustment
COXY2	Perform two-point adjustment
DB	Display status of display range
ENV	Set several/all ambient parameters with one command
ERR	Display error control status
ERRL	Display error protocol
ERRT	Display error Table
FCRESTORE	Reset factory calibration
H2O	Display/set H_2O for compensation
ICAL	Calibrate analog output
ITEST	Set test current for analog output
LTC	Display status of laser temperature controller
MEA	Display measuring status
OUT	Display output status
OUT_PARAMS	Display/set output parameters
PRES	Display/set pressure for compensation
RELAY_MODE	Display/set relay operating mode
RESET	Reset device
RSEL	Display/set relay switching point
SCI1	Display status of serial maintenance interface
SCI2	Display status of serial RS-485
STATUS	Display status of submenu item

Table 6: List of additional serial interface commands with password

4.8 Output of measuring results

4.8.1 Start continuous output (command R)

Starts RUN mode. Outputs values defined with the command *FORM*, see “Format measuring results (command FORM)”, page 43. Command *INTV*, see “Display/set continuous output interval (command INTV)”, page 40, defines the output interval. Command *S*, see “Stop continuous output (command S)”, page 40, stops RUN mode.

Syntax: `R<cr>`

Example:

```
>r
Oxygen =    21.0
Oxygen =    21.0
Oxygen =    21.0
```

4.8.2 Stop continuous output (command S)

Stops RUN mode and switches the serial output to STOP.

Syntax: `S<cr>`

Example:

```
>S
>
```

4.8.3 Display/set continuous output interval (command INTV)

Sets the frequency for measured value output in RUN mode, see “Start continuous output (command R)”, page 40.

Syntax: `INTV [Value] [Unit]<cr>`

Value	=	Time interval in which results are output (0 ... 255)
Unit	=	Interval time unit, S for seconds, MIN for minutes or H for hours

Example:

```
>intv
INTERVAL : 1   ? 5
UNIT S ? min
```

4.8.4 Send measuring results (command SEND)

Outputs the last results (in accordance with *FORM*, see “Format measuring results (command FORM)”, page 43) in STOP mode. The command can be used with an address in POLL mode.

Syntax:

`SEND [Address]<cr>`

`SEND [Formatting string]<cr`

Address	=	Device address
Formatting string	=	Character string specifying the output format for the measuring results

Example:

```
>send   20.9   20.8   24.5
```

4.8.5 Display/set serial communication mode (command SMODE)

Defines the mode of the serial interface via which the command is entered (maintenance or RS-485 interface). Possible modes are STOP, POLL and RUN. Command *SAVE* saves the setting,see “Save parameters (command SAVE)”, page 56.

Syntax: SMODE [Mode]<cr>

Mode	=	Serial communication mode, possible modes are STOP, POLL and RUN

Example:

```
>smode
SMODE          : STOP ?
>
```

4.8.6 Display/set serial communication mode for RS-485 (command SMODE2)

Defines the communication mode for the RS-485 interface. Possible modes are STOP, POLL and RUN. Command *SAVE* saves the setting,see “Save parameters (command SAVE)”, page 56.

Syntax: SMODE2 [Mode]<cr>

Mode	=	Serial communication mode, possible modes are STOP, POLL and RUN

Example:

```
>smode2
SMODE          : STOP ?
>
```

4.8.7 Display/define serial communication settings (command SERI)

Sets the parameters for serial communication.

NOTICE:
This command defines the parameters of the serial interface via which the command is entered (maintenance interface or RS-485 interface).

Valid baud rates for the maintenance interfaces are 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. The maximum baud rate for the RS-485 interface is 38400.

NOTICE:
To be able to use the new settings, save them in EEPROM with command *SAVE* (see “Save parameters (command SAVE)”, page 56) and then reset the device with command *RESET* (see “Reset (command RESET)”, page 57).

Syntax: *SERI* [Baud] [Data] [Parity] [Stop]<cr>

Baud	=	Valid baud rates are 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 (max. baud rate for the RS-485 interface is 38400)
Data	=	Number of data bits (7 or 8)
Parity	=	Parity (n = none, e = even, o = odd)
Stop	=	Number of stop bits (1 or 2)

Example:

```
>seri

BAUD RATE      : 19200 ?
DATA BITS      : 8        ?
PARITY         : NONE ?
STOP BITS      : 1        ?
```

4.8.8 Display/set serial communication mode for RS-485 (command SERI2)

Defines the parameters for the RS-485 interface. The command can be entered via the maintenance interface. Valid baud rates are 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400.

NOTICE:
To be able to use the new settings, save them in EEPROM with command *SAVE* (see “Save parameters (command SAVE)”, page 56) and then reset the device with command *RESET* (see “Reset (command RESET)”, page 57).

Syntax: SERI2 [Baud] [Data] [Parity] [Stop]<cr>

Baud	=	Valid baud rates are 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400.
Data	=	Number of data bits (7 or 8)
Parity	=	Parity (n = none, e = even, o = odd)
Stop	=	Number of stop bits (1 or 2)

Example:

```
>seri2

BAUD RATE      : 19200 ?
DATA BITS      : 8        ?
PARITY         : NONE ?
STOP BITS      : 1        ?
```

4.8.9 Display status of serial maintenance interface (command SCI1)

Displays and sets the status of the maintenance interface with the associated variables.

Syntax: SCI1<cr>

Example:

```
>sci1
*** SERVICE INTERFACE (SCI1) ***:
Mode          : STOP
Seri          : 19200 8 NONE 1

SERI          : 19200 8 NONE 1
ECHO          : ON
SMODE         : STOP
```

4.8.10 Display status of serial RS-485 interface (command SCI2)

Displays the status of the serial RS-485 interface with the associated variables.

Syntax: `SCI2<cr>`

Example:

```
>sci2
*** SERVICE INTERFACE (SCI2) ***:
Mode          : STOP
Seri          : 19200 8 NONE 1

SERI          : 19200 8 NONE 1
ECHO          : ON
SMODE         : STOP
```

4.8.11 Display measuring status (command MEA)

Displays the measurement status with the associated variables.

Syntax: MEA<cr>

Example:

```
>mea
*** OXYGEN MEASUREMENT (MEA) ***
Mode            : NORMAL
State           : PEAK_SEARCH
OP (DAC/mA)     : 20960 / 1.92
...
```

4.8.12 Format measuring results (command FORM)

Configures the output format for the commands *SEND*, see “Send measuring results (command SEND)”, page 40 and *R*, see “Start continuous output (command R)”, page 40, and can therefore also be changed as required.

Syntax: `FORM [x]<cr>`

X	=	Formatting string

The formatting string comprises the data to be shown and the associated formatting commands.

▶ Select one or more of the following variables by entering the abbreviation after the command *FORM*:

Table 7: Abbreviations and variables in the formatting string

Abbreviation	Data
O2	Filtered O_2 results
TGASC	Gas temperature (Centigrade)
TGASF	Gas temperature (Fahrenheit)
TIME	Time elapsed since last reset
DATE	Date (set by user, comes after the time elapsed since last reset)
ERR	Error category (0 = no error, 1 = non-fatal, 2 = fatal)
ADDR	Measuring device address (0 ... 99)

Following formatting commands are available:

Formatting command	Description
x.y	Change value for length (whole numbers and decimal places). The changed length parameters are used for all following variables.
\t	Tab stop
\r	Enter key
\n	Line feed

Table 8: Commands in formatting string

Formatting command	Description
\xxx	Any character code (decimal value with three digits)
""	String constant
U5	Field and length of the unit; units are output in standard width when U is entered without length specification

Table 8: Commands in formatting string

\# can be used for \\.

Examples:

Configuration of an output format comprising the oxygen measuring result (displayed with 3 decimal places) and the gas temperature in degrees Centigrade (also displayed with 3 decimal places). Text strings are inserted after the measured values for the output units. Tab stop \t separates the various formatting commands and character \r for Enter starts a new line after each measured result output. Command *SAVE*, see “Save parameters (command SAVE)”, page 56 saves the setting:

```
>form 2.3 O2 \t “%O2" \t 2.3 TGASC \t “C" \r \n
>save
EEPROM (basic) saved successfully
EEPROM (op) saved successfully
EEPROM (op_log1) saved successfully
EEPROM (op_log2) saved successfully
>send
2.504 %O2 28.065 C
```

Command *FORM* without parameters outputs the current formatting string:

```
>form
```

Example:

```
2.3 O2 \t “%O2" \t 2.3 TGASC \t “C" \r \n
The standard output format is used with command FORM /:
>form /
F0
>send
Oxygen =     21.0
```

4.8.13 Display/set date (command DATE)

Sets the date.

Syntax: `DATE [YYYY] [MM] [DD]<cr>`

YYYY	=	Current year
mm	=	Current month
DD	=	Current day

Example:

```
>date
YEAR     :  2003 ?
MONTH    :  7 ?
DAY      :  17 ?
>
```

NOTICE:
The device does not have a real-time clock so that the date set by the user is reset to 0000-01-01 after every switch-on.

4.8.14 Display/set time (command TIME)

Displays the time elapsed since the last device switch-on. The time can be set to the real time by entering the current time as a parameter. The time switch switches from 23:59:59 to 00:00:00.

+i The device does not have a real-time clock so that the time set by the user is reset to 00:00:00 after every switch-on.

`Syntax: TIME [hh:mm:ss]<cr>`

hh	=	Hours
mm	=	Minutes
ss	=	Seconds

Examples:

```
>time
03:28:32
>time 11:23:01
11:23:01
>
```

4.9 Network operation

4.9.1 Display/set device address (command ADDR)

NOTICE: A unique address must be assigned to each device before connecting using a bus.

Command *ADDR* is used to define the address of a device.

Command *CLOSE*: see “Close serial interface in Poll mode (command CLOSE)”, page 46. After closing communications, the address must be known for future communication with the device.

Command *SAVE*, see “Save parameters (command SAVE)”, page 56: Save.

Syntax: *ADDR* [Address]<cr>

Address	=	Address of device in the range from 0 ... 99 (standard = 0)

4.9.2 Open communication line (command OPEN)

Opens communication with a device with the specified address. The device switches serial mode from POLL to STOP. The address of the opened device is included in the reply message. In the example, the text in *Italics* is not echoed unless the user is using local echo.

Syntax: `OPEN {Address}<cr>`

Address	=	Device address

Example:

```
>open 4
TRANSIC100LP: 4 line opened for operator commands
>
```

4.9.3 Close serial interface in Poll mode (command CLOSE)

Closes the device and switches to POLL mode. Unless an addressable command is issued, all output is suppressed until the device is reset or the *OPEN* command used. If a serial mode is set to POLL with command *SMODE*, see “Display/set serial communication mode for RS-485 (command SMODE2)”, page 41, and the setting is saved to EEPROM with command *SAVE*, see “Save parameters (command SAVE)”, page 56, the device starts in POLL mode after a reset (with command *RESET*, *see “Reset (command RESET)”, page 57*), and output is also suppressed after the start.

Syntax: CLOSE<cr>

Example:

```
>close
line closed
```

4.9.4 Set Echo mode (command ECHO)

In RS232C mode, the device echoes everything back to the user as standard. The Echo function is automatically disabled in RS-485 mode. In the example below, the two commands in *Italics* are typed by the user but not seen on the screen unless using local echo.

Syntax: `ECHO [on/off]<cr>`

on	=	Echo on
off	=	Echo off

Example:

```
>echo on
VERS
TRANSIC100LP 9165087 0000 / 1.36
echo on
ECHO           : ON
```

4.10 Commands for access at maintenance level

DANGER: Hazard through incorrect parameter settings
Incorrect settings for parameters can have severe consequences. This is why the password may only be available for authorized technicians.

4.10.1 Enter password (example PASS)

Entering the password allows access to the maintenance level (SERVICE). The maintenance commands remain available for 30 minutes after the password has been entered. All other passwords or the command *PASS* without parameter activate the basic commands (BASIC).

Syntax: `PASS [Password]<cr>`

Example:

```
>pass 2020
>
(2020 is a password example)
```

The password allows access to the maintenance level via the serial interface and the integrated keypad. A message is sent via the serial interface when the password has expired (only in STOP mode):

NOTE: PASSWORD EXPIRED

4.11 Commands for calibration and adjustment

4.11.1 Freeze outputs for calibration (command ADJUST)

Retains the current values for all outputs or releases the outputs again.

This command serves to check the calibration based on a known span gas or for online adjustments so that measured value changes do not disturb process control.

Syntax: *ADJUST* [on/off]<cr>

Example:

```
>adjust on
Outputs (analog, relay, POLL/Run and MT300) frozen
>
```

4.11.2 Set water content for compensation (command H2O)

Allowable range is 0 ... 600 g/m³ H_2O.

Use the *SAVE* command to store the setting in EEPROM, see “Save parameters (command SAVE)”, page 56.

Syntax: *H_2O* [Water]<cr>

Water	=	Water content in measured gas (g/m³ H_2O)

Example:

```
>H2O 100
WATER(g/m3)   : 100      ?
```

4.11.3 Set carbon dioxide content for compensation (command CO2)

Use the *SAVE* command to store the setting in EEPROM, see “Save parameters (command SAVE)”, page 56. Allowable range is 0 ... 100 vol-% CO_2.

Syntax: *CO2* [Carbon dioxide]<cr>

Carbon dioxide	=	CO_2 concentration in measured gas (vol-% CO_2)

Example:

```
>co2 10
CO2(%)   : 10      ?
```

4.11.4 Set several/all ambient parameters with one single command (command ENV)

Syntax: *ENV* [Pressure] [Water] [Carbon dioxide]<cr>

Pressure	=	Pressure setting (bar_a)
Water	=	Water content in measured gas (g/m^3 H_2O)
Carbon dioxide	=	CO_2 concentration in measured gas (vol-% CO_2)

Example:

The ENV command without parameters displays the current values for ambient parameters and allows entering new values. Press *Enter*, to confirm the current setting:

```
>env
PRESSURE(bar)  : 1.013    ?
H2O (g/m3)       : 0        ?
CO2 (vol-%)      : 0        ?
>
Set pressure 1.000 bara, water content 50 g/m3 and CO2 content  20 vol-% CO2:
>env 1 50 20
PRESSURE(bar)    : 1.000
H2O (g/m3)       : 50
CO2 (vol-%)      : 20
>
```

4.11.5 Calibrate analog output (command ICAL)

Calibrates the current output. Calculates and sets the values for parameters Gain (GI) and Offset (OI).

Syntax: `ICAL<cr>`

Example:

```
>ical
 Ilow  (mA)  ? 3.42
 Ihigh (mA)  ? 17.6
>
```

4.12 Scaling and setting the analog output

4.12.1 Display/set output parameters (command OUT_PARAMS)

Syntax: *OUT_PARAMS*<cr>

Example:

```
>out_params
NONFATALI (mA)  : 3.000    ?
FATALI (mA)     : 3.000    ?
I4              : 1        ?
OUTMAXO2 (%)    : 20.000   ?
OUTMINO2 (%)    : 0.000    ?
```

NONFATALI	=	Current output (in mA) for non-fatal error
FATALI	=	Current output (in mA) for fatal error
I4	=	Parameter to determine whether the current output range starts with 0 or 4 mA: When I4 = 0, the current output is 0...20 mA When I4 = 1, the current output is 4...20 mA
OUTMAXO2 (%)	=	Oxygen concentration OUTMAXO2 (%) is set for current output 20 mA
OUTMINO2 (%)	=	Oxygen concentration OUTMINO2 (%) is set for current output 0/4 mA

4.12.2 Display/set pressure for compensation (command PRES)

1. Sets the pressure for compensation.
2. Use the SAVE command to store the setting in EEPROM, see “Save parameters (command SAVE)”, page 56.

Syntax: *PRES* [Pressure]<cr>

Pressure	=	Pressure of the measured gas (bar_a)

Saving the settings with command *SAVE* prevents the settings being lost at the next reset.

```
>pres 1.300
PRESSURE(bar)   : 1.300     ?
>save
EEPROM (basic) saved successfully
EEPROM (op) saved successfully
EEPROM (op_log1) saved successfully
EEPROM (op_log2) saved successfully
>
```

Set pressure for compensation (command XPRES)

This command is suitable for systems where the pressure value is measured continuously and sent to the oxygen measuring device.

NOTICE: The setting *CANNOT* be saved in EEPROM with command *SAVE*.

Syntax: *XPRES* [Pressure]<cr>

Pressure	=	Pressure setting (bar_a)

Example:

```
>xpres 1.300
PRESSURE(bar)   : 1.300     ?
```

4.13 Checking the analog output

4.13.1 Set test current for analog output (command ITEST)

Starts and stops the mode for checking the current output.

Syntax: `ITEST [Current]<cr>`

Where		
Current	=	test current (mA)

Example:

```
>itest 4
Test current set to 4 mA. Use ITEST to stop Test mode.
>itest
Current Test mode stopped.
>
```

4.14 Relay operation

4.14.1 Display/set relay operating mode (command RELAY_MODE)

Sets the relay operating mode, see “Display/set relay operating mode (command RELAY_MODE)”, page 51.

Syntax: *RELAY_MODE* [warn-alarm / fault_alarm / high_open / low_open]<cr>

warn_alarm	=	Relay open when maintenance request exists for error
fault_alarm	=	Relay open when error exists
high_open	=	Relay open when measuring result above upper point
		Relay closed when measuring result below lower point
low_open	=	Relay open when measuring result below lower point
		Relay closed when measuring result above upper point

NOTICE:
The contact relay is momentary.

4.14.2 Display/set relay switching point (command RSEL)

Sets the relay switching points.

Syntax: *RSEL*<cr>

Example:

```
>rsel
LO POINT (%02)  : 10.0     ?
HI POINT (%02)  : 11.0     ?
```

4.15 Device information and other general commands

4.15.1 Display device information (command ?)

Outputs basic device information. Command *STATUS* displays the status of various objects, see “Display status of submenu item (command STATUS)”, page 56.

Syntax: *?*<cr>

Example:

```
>?
*** SICK TRANSIC100LP ***
Device         : TRANSIC100LP
SW version     : 9165087 0000 / 1.36
SNUM           : 12345678
Calibrated     : 2009-11-24
Calib. text    : Normal
ADDR           : 0
```

4.15.2 Display device information with overwriting in POLL mode (command ??)

As in command *?*, command *??* outputs basic device information and the addressing can be overwritten with *??* in POLL mode. This allows accessing a device with an unknown address to determine the address.

Syntax: *??*<cr>

Example:

```
>??
*** SICK TRANSIC100LP ***
Device         : TRANSIC100LP
SW version     : 9165087 RC01 / 1.36
SNUM           : 12345678
Calibrated     : E2009-11-24
Calib. text    : Normal
ADDR           : 91
```

NOTICE:
The output is delayed with *??* depending on the address assigned to the device.

4.15.3 Display measuring parameters (command CALCS)

Displays all parameters the device can measure.

Syntax: *CALCS*<cr>

Example:

```
>calcs
O2         - Filtered O2 results
TGASC      - Gas temperature (centigrade)
TGASF      - Gas temperature (fahrenheit)
```

4.15.4 Display calibration information (command CINFO)

Displays information from the last adjustment.

Syntax: *CINFO*<cr>

Example:

```
Factory calibration:
Calibrated    : 2009-11-24
Calib. text   : Normal

Cal. point 1:
Given oxygen               : 0.00
Gas temperature (C)        : 20.81
Ref path temperature (C)   : 21.90

Cal. point 2:
Given oxygen            : 21.00
Gas temperature (C)     : 20.81
Ref path temperature (C): 21.90
...
```

4.15.5 Display status of display range (command DB)

Displays the status of the display range.

Syntax: *DB*<cr>

Example:

```
*** DISPLAY BOARD (DB) ***
Mode            : NORMAL
State           : NORMAL
Fault HW state  : OFF
Display state   : O2
Red led         : OFF
Green led       : SLOW
Relay           : CLOSE
RELAY_MODE      : FAULT_ALARM
LO POINT (%O2)  : 10.0
HI POINT (%O2)  : 11.0
...
```

4.15.6 List commands (command HELP)

Using this command without a parameter lists the commands accessible with the entered password. Using the command with a command name as parameter displays a detailed description of the respective command.

Syntax: *HELP* [Command]<cr>

Com-mand	=	Name of the desired command

Example:

```
>help
?       Prints information about the device
??      Prints information even in POLL mode
.
.
>
```

4.15.7 Display status of laser temperature controller (command LTC)

Displays the status of the laser temperature controller with the associated variables.

Syntax: *LTC*<cr>

Example:

```
>ltc
*** LASER TEMPERATURE CONTROLLER (LTC) ***
Mode           : ON
State          : TEMP_OK
Set Temp (C)   : 29.074
Temp (C)       : 29.073
Diff (C)       : -0.001
PID Output     : -773
DAC Output     : 29227
```

4.15.8 Display output status (command OUT)

Displays the status and settings of the analog output controller and the associated variables.

Syntax: *OUT*<cr>

Example:

```
>out
*** ANALOG OUTPUT (OUT) ***
Mode           : NORMAL
State          : NORMAL
Oxygen  (%)    : 0.00
Current (mA)   : 3.00
DAC Output     : 50000

GI             : 1.0000
OI             : 0.0000
NONFATALI (mA) : 3.000
FATALI (mA)    : 3.000
I4             : 1
OUTMAXO2 (%)   : 20.000
OUTMINO2 (%)   : 0.000
```

4.16 Display all changeable parameter values (command PARAM)

Displays the current values of all parameters that can be set by the user.

Syntax: *PARAM*<cr>

Example:

```
>param
Customer Interface
SERI            : 19200 8 NONE 1
ECHO            : ON
SMODE           : STOP
Service Interface
SERI            : 115200 8 NONE 1
ECHO            : ON
SMODE           : STOP
Common Serial parameters
ADDR            : 0
INTV            : 1 S
FORM            :  F0
Analog Output
OUTMINO2 (%)    : 0.000
OUTMAXO2 (%)    : 25.000
I4                           : 1
NONFATALI (mA) : 3.000
FATALI (mA)     : 3.000
Relay Output
RELAY_MODE      : FAULT_ALARM
LO POINT (%O2) : 10.0
HI POINT (%O2) : 11.0
Measurement parameters-
INSTALLATION    : Process measurement
PRESSURE(bar)  : 1.000
H2O (g/m3)      : 50
CO2 (vol-%)     : 20
```

4.16.1 Measure signal level (command SIL)

Tests the signal level. The laser signal intensity is compared to the signal intensity (factory calibration) originally set. The result is shown as 0 ... 100 % of the original signal intensity set. This allows measuring the contamination on optical surfaces.

Syntax: *SIL*<cr>

Example:

```
>sil
Signal level is 100% compared to signal level at factory
```

4.16.2 Display statistic information (command STATS)

Displays statistic information.

Syntax: *STATS*<cr>

Example:

```
>stats
All cleared     : 2006-01-18 13:40:04
Uptime (h)      : 140
Resets          : 7
O2 max:21.06
O2 min          : 4.91
Tg max          : 29.71
Tg min          : 23.39
Ti max          : 32.53
Ti min          : 24.55
```

4.16.3 Display status of submenu item (command STATUS)

Displays the settings and status of all submenu items.

Syntax: *STATUS*<cr>

Example:

```
>status
Submenu items are mode and status:

*** LASER TEMPERATURE CONTROLLER (LTC) ***
Mode           : ON
State          : TEMP_OK
*** OXYGEN MEASUREMENT (MEA) ***
Mode           : MODE2
State          : PEAK_LOCKED
Run Time Func.: OFF
*** ANALOG OUTPUT (OUT) ***
Mode           : NORMAL
State          : NORMAL
*** ERROR CONTROL (ERR) ***
Mode           : ON
State          : NO ERRORS
*** CUSTOMER INTERFACE (SCI2) ***:
Mode           : STOP
*** SERVICE INTERFACE (SCI1) ***:
Mode           : STOP
*** DISPLAY BOARD (DB) ***
Mode           : NORMAL
State          : NORMAL
>
```

4.16.4 Display product name and software version (command VERS)

Displays the device name and software version.

Syntax: *VERS*<cr>

Example:

```
>vers
TRANSIC100LP 9165087 0000 / 1.36>status
```

4.17 Using memory

4.17.1 Save parameters (command SAVE)

NOTICE:
Remember to save parameter changes with the command *SAVE* so that the changes are not lost.

Saves the parameters from RAM to EEPROM.

Syntax: *SAVE*<cr>

Example:

```
>save
EEPROM (basic) saved successfully
EEPROM (op) saved successfully
EEPROM (op_log1) saved successfully
EEPROM (op_log2) saved successfully
```

4.18 Resetting the measuring device

4.18.1 Reset (command RESET)

Resets the transmitter. This has the same effect as switching the transmitter off and on again.

Syntax: *RESET*<cr>

Example:

```
>reset
Resetting...
TRANSIC100LP 9165087 0000 / 1.36
SICK, 2011
...
```

4.18.2 Restoring factory calibration

Restore factory calibration (command FCRESTORE)

Open the Terminal program with the valid serial communication settings and enter the command with password:

Syntax: *FCRESTORE*<cr>

Example:

```
>fcrestore
Customer calibration removed - remember SAVE command
Save the changes by issuing the command:
>save
```

4.19 Errors

4.19.1 Display error control status (command ERR)

Displays the error control status and active errors.

Syntax: *ERR*<cr>

Example:

```
>err
*** ERROR CONTROL (ERR) ***
Mode           : ON
State          : WARNING
ERRORS:
WARNING        : WATCHDOG RESET OCCURRED
>
```

4.19.2 Display Error protocol (command ERRL)

Displays the events in the Error protocol.

Syntax: *ERRL*<cr>

Example:

```
>err
*** ERROR CONTROL (ERR) ***
Mode           : ON
State          : WARNING
ERRORS:
WARNING        : WATCHDOG RESET OCCURRED
>
```

4.19.3 Display errors detected (command ERRS)

Displays all errors active in the device.

Syntax: *ERRS*<cr>

Example:

```
>errs
ERROR: LOW SIGNAL
ERROR: FP SLOPE FAILURE
>
```

4.19.4 Display Error Table (command ERRT)

Displays the Error Table.

Syntax: *ERRT*<cr>

Example:

```
>errt
# :St :Cnt  :CategoryError text
 1:OFF:    0:FATALEEPROM BASIC PARAMS NOT AVAILABLE
 2:OFF:    0:FATALEEPROM OPERATION PARAMS NOT AVAILABLE
...
31:OFF:    0:NON FATALSIGNAL LEVEL LOW
32:OFF:    0:NON FATALSIGNAL CUT
...
52:OFF:    0:WARNINGEEPROM LOG&STATS CORRUPTED
53:OFF:    0:WARNINGWATCHDOG RESET OCCURRED
```

5 Setting Ambient Parameters

5.1 Compensation of ambient parameters

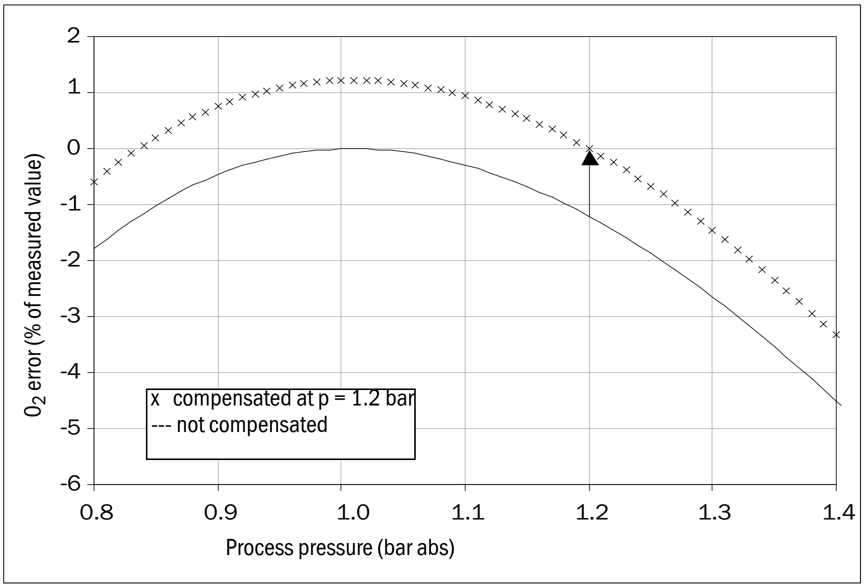
The TRANSIC111LP can compensate the temperature, pressure of the operating environment as well as water and CO_2 content of the background gas.

Table 9: Compensation of ambient parameters

Ambient parameters	Standard	Activated	Remarks
Operating pressure (process pressure)	Standard ambient parameters: Pressure 1013.25 hPa	Must be activated, ambient parameters must be set.	The pressure outside the process in which the measuring device enclosure is installed should be normal ambient air pressure. See see “Version for in-situ-measurement”, page 11 for further information.
Humidity	Water content 0 g/ m^3H_2O		
CO_2	Relative carbon dioxide concentration 0 vol-% CO_2, compensation is deactivated		
Temperature	2 integrated temperature sensors: Inner temperature Process temperature	Automatic, always active	A significant difference between process gas temperature and the temperature in the measuring device enclosure can influence the measured value result.

The typical effect of the error depending on the process pressure is shown in the non-compensated curve, see “Displaying and setting the analog output value”, page 36. The error magnitude is smallest at normal ambient air pressure.

Fig. 33: Effect of process pressure compensation



5.1.1 Pressure compensation

Setting the value of the average process pressure value compensates the measurement error more or less to zero in the immediate vicinity of the pressure value in question.

- Set the average pressure as parameter for the device. Either use the keypad, see “Process pressure: Display and settings”, page 35, or the serial interface, see “List of serial interface commands”, page 38.

“Effect of process pressure compensation”, page 59 illustrates the effect of pressure compensation where the average process pressure is set to 1.2 bar_a. The original error of approximately 1% of the measured value at 1.2 bar_a is compensated to zero. Pressure dependency remains for other values.

Pay particular attention that setting the pressure compensation does not shift the parabola-like curve in “Effect of process pressure compensation”, page 59 along the X-axis. This means, even with compensation activated, pressure changes of the compensation value have a more significant effect than with 1.013 bar_a.

NOTICE:
To disable pressure compensation, reset the average process pressure value to the standard ambient air pressure of 1.013 bar_a. The magnitude of pressure compensation is zero with this setting.

The allowable pressure range for compensation is 0.800 ... 1.400 bar_a

5.1.2 Background gas effects

Individual absorption line widths of O_2 gas are sensitive to intermolecular collisions between O_2 and background gas molecules. This affects the measured O_2 values. The magnitude of this effect depends on the amount and type of background gas molecules. TRANSIC111LP factory calibration is carried out using dry N_2 and O_2 mixtures. Humidity and CO_2 concentrations of the calibration gases are 0%. Apart from dry N_2, all background gases result in a percentage measured value error for O_2 measurement.

Carbon dioxide and water vapor are the most common gases requiring compensation. Compensation for the average water and CO_2 contents of the background gas is integrated. The compensation is based on manual user settings for the values for the water and CO_2 content of the background gas in the device. The water content is expressed in terms of absolute humidity in g/m_3 H_2O. Conversion Table, see “Humidity Conversion Table”, page 102. The conversion formulas can be found in Section “Water content of background gas”, page 61.

NOTICE: Adapting compensation values to ambient conditions

- When humidity and CO_2 compensation is/are activated, and when the ambient conditions deviate from the ambient conditions during adjustment:

1 Set the water and CO_2 content according to the adjustment environment.
2 These settings then have to be changed back to represent those of the operating conditions when the TRANSIC111LP is reinstalled in the process.

NOTICE: Deactivating humidity and CO_2 compensation

- Set the values for the water and CO_2 content of the background gas to zero (factory setting).

Water content of background gas

The dependency on water content is expressed as absolute humidity in g/m3 H_2O because relative humidity is strongly dependent on the temperature.

▶ Calculate the absolute humidity in g/m3 H_2O with the following equations:

$$H_2O\ (g/m^3) = C \times P_W / T$$

T	=	gas temperature in K (= 273.15 + T °C)
P_W	=	water vapor pressure in hPa
C	=	216.679 gK/J

$$P_W = P_{WS} \times RH(\%) / 100$$

RH(%)	=	relative humidity, and P_{WS} is the saturation pressure of the water vapor, or

$$P_{WS} = 1000 \text{ x } 10^{28.59051 - 8.2 \log T + 0.0024804 T - 3142/T}$$

T	=	as specified above

Example for calculating absolute humidity in g/m3:

Gas temperature is 40°C and relative humidity is 90%.

1 First calculate the water vapor pressure
P_W: P_W (hPa) = P_{WS} (40 °C) × 90/100 = 66.5
2 Use this result to calculate absolute humidity:
H_2O (g/m3) = 216.679 × 66.5 / (273.15 + 40 °C) = 46.0

The Table below gives a quick overview of the values for converting temperature and relative humidity into absolute humidity as well as the effect these conditions have on the O_2 measured value of the device.

Table 10: Conversion temp. and rel. humidity-> abs. humidity

			Effect of humidity on measured O_2 values (% measured value)	
T °C	%RH	g/m3 H_2O	Dependency	Dilution
-20	50	0.5	0.0	-0.1
-20	90	1.0	0.0	-0.1
0	50	2.4	-0.1	-0.3
0	90	4.4	-0.2	-0.5
25	50	11.5	-0.4	-1.6
25	90	20.7	-0.7	-2.8
40	50	25.6	-0.9	-3.6
40	90	46.0	-1.6	-6.6
60	50	64.9	-2.1	-9.8
60	90	116.8	-3.6	-17.7
80	50	145.5	-4.2	-23.4
80	90	262.0	-6.3	-42.1

The water content of the background gas influences the oxygen measuring result.

1 The water molecules contained by the background gas displace a certain amount of oxygen molecules.
2 Collisions between the water and oxygen molecules affect the shape of the oxygen absorption lines.

The first effect is the dilution of the oxygen concentration of the measured gas (water displaces oxygen so there is a lower oxygen concentration in the measured gas). This is not compensated during measurement. Only the second effect is due to the measuring principle and can be compensated.

The dependency due to the measuring principle is shown in the 4th column of "Conversion temp. and rel. humidity-> abs. humidity", page 61. This is compensated and eliminated when the water content of the measured gas is entered into the measuring device storage.

The 5th column of "Conversion temp. and rel. humidity-> abs. humidity", page 61 shows the dilution effect. This effect is much stronger than the measuring principle effect. This is also valid for the water content compensation because it is the actual decrease of oxygen content in the measured gas due to water displacing oxygen in the gas mixture.

Setting the water content for compensation

- Syntax for input via the serial interface, see "Set water content for compensation (command H2O)", page 48.
- Setting via the user interface, see "Humidity in process gas setting", page 35.

Setting the CO_2 concentration in background gas

The effect of CO_2 on the measured O_2 value is so small that in most circumstances CO_2 compensation is not necessary. The CO_2 dependency is expressed in terms of relative CO_2 concentration (percent per volume CO_2).

NOTICE:
The gas pressure value must be specified for CO_2 compensation.

Setting the carbon dioxide content for compensation

- Syntax for input via the serial interface, see "Set carbon dioxide content for compensation (command CO2)", page 48.
- Setting via the user interface, see "CO_2 sample gas setting", page 36.

Influence of further background gases

- For further information on the influence of further background gases on oxygen measurement, see "Influence of background gases on oxygen measurement", page 103.

6 Adjustment

Definition of calibration and adjustment for these Operating Instructions

- Calibration: The comparison between the measured value of the device and a reference concentration.
- Adjustment: Change the device measured value so that it corresponds to the reference concentration.

Read the instructions through carefully before making any settings or parameter changes. SICK accepts no responsibility for parameter or setting changes nor adjustments made by the user. Contact SICK Customer Service should you require technical support or assistance.

CAUTION: Differences between calibration and adjustment of the different TRANSIC111LP variants
Calibration and adjustment of the variants for installation in processes and with sample gas cells differ slightly from calibration and adjustment of the ambient gas measurement version. Make sure you read the correct Section. *Section 8 covers calibration and adjustment of the ambient gas measurement version.*

WARNING: Observe all safety instructions, see "Safety information for installation", page 17.

6.1 Hardware layouts for calibration and adjustment

Fig. 34: TRANSIC111LP in the process

1 = Front of the device

2 = Allen screws

Getting started

1 Switch the TRANSIC111LP on at least 15 minutes before calibration or adjustment.
2 Calibration: Simply observe the measured values displayed by the measuring device.
3 The serial interface as well as the keypad on the front of the device can be used for adjustment:
   - ▶ Open the front cover of the measuring device with a 4 mm hex socket (Allen) key.
   - – Serial interface
   - ▶ Connect the TRANSIC111LP with the computer via the serial interface cable.
   - ▶ Open the Terminal program with the respective serial communication setting (standard setting: 19200/8/N/1).
   - ▶ Connect the gas supply, see "Setting up the gas supply for calibration and adjustment", page 64, and calibrate/adjust, see "Calibration", page 76, and/or see "Adjustment", page 77.

6.1.1 Setting up the gas supply for calibration and adjustment

The TRANSIC111LP can be calibrated and adjusted with ambient air or bottled gas.

6.1.1.1 *Using ambient air*

See “Using ambient air”, page 76 for further information on this calibration method.

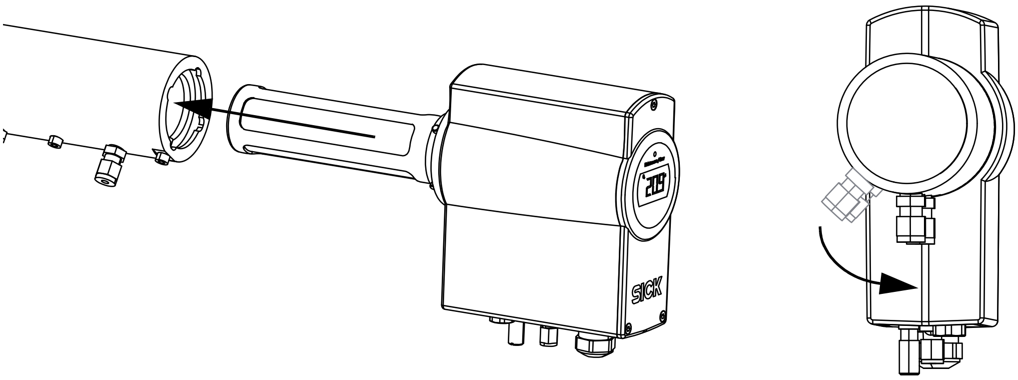
6.1.1.2 *Using bottled gas and with sample gas cell*

1 Ensure the O-ring is seated securely in the groove.
2 Insert the probe into the sample gas cell.
3 Make sure that no overpressure builds up in the sample gas cell.
4 Push the probe against the sample gas cell and turn it clockwise (see Figure 35).
5 The gas inlets of the sample gas cell are fitted with 1/8" NPT or Swagelok gas connections for Ø 6 mm tubes.
6 Let the gas flow out without hindrance. This avoids an overpressure in the chamber.

WARNING: Risk of poisoning by escaping gas
Damage to health is possible during calibration and adjustment with toxic gases.
▶ Ensure that escaping gas is safely discharged.

WARNING: Risk of oxidization by high oxygen concentration
Calibration and adjustment with oxygen enriched gases >25vol% could have an oxidizing effect.
Ensure that escaping gas is safely discharged.

Fig. 35: Fastening the TRANSIC111LP probe in the sample gas cell



6.1.1.3 *Calibration and adjustment in process*

NOTICE: For adjustment in process, fit an optional test gas inlet and PTFE filter on the TRANSIC111LP.

NOTICE: The PTFE filter is not suitable for >25 vol% oxygen.

WARNING: Danger of explosion when pressure >10 bar.
- ▶ Observe the specifications in the technical data for the two flange variants, see "Operating environment", page 91.

- ▶ The TRANSIC111LP does not have to be removed from the process with this adjustment method.
- ▶ Feed the span gas through the optional test gas inlet in the bottom of the electronics housing of the measuring device.

Typical calibration accuracy is within ±0.2% O_2 for a reference volume flow of 5 ... 9 l/min. Calibration uncertainty increases when the volume flow is significantly below 5 l/min. The effect of the process gas flow rate (in the range 0 ... 20 m/s) on adjustment precision is negligible. Adjustment precision decreases with a high process gas flow rate.

The strength of unwanted counter diffusion through the filter depends on the O_2 concentration difference between span gas and process gas. For example, if you are using 100%N_2 as a reference and the process gas has 2% O_2, the result is better than when the process gas has 21% O_2.

- Use a sufficiently high volume flow for optimum adjustment results.
- With low span gas volume flow, high adjustment precision is only achieved with process gas flow rates near zero.

6.1.1.4 *Connections and systems*

The calibration gas inlet of the TRANSIC111LP is fitted with a Swagelok screw fitting for pipes with 6 mm outer diameter. A return valve with an opening pressure of approx. 1.7 bar is used. The first opening pressure can be higher than 1.7 bar when the return valve has not been used for some time. SICK therefore recommends using a flow monitor, e.g., a rotameter, to monitor the calibration gas flow. This allows to set the gas flow to the required value.

WARNING: Escaping span gas can enter the process
- ▶ Ensure the span gas is compatible with the process gas.

6.1.1.5 *Connecting the gas*

1 Remove the plug of the TRANSIC111LP gas inlet.
2 Fasten the span gas tube to the gas inlet using a 14 mm wrench. Do not overtighten the inlet.

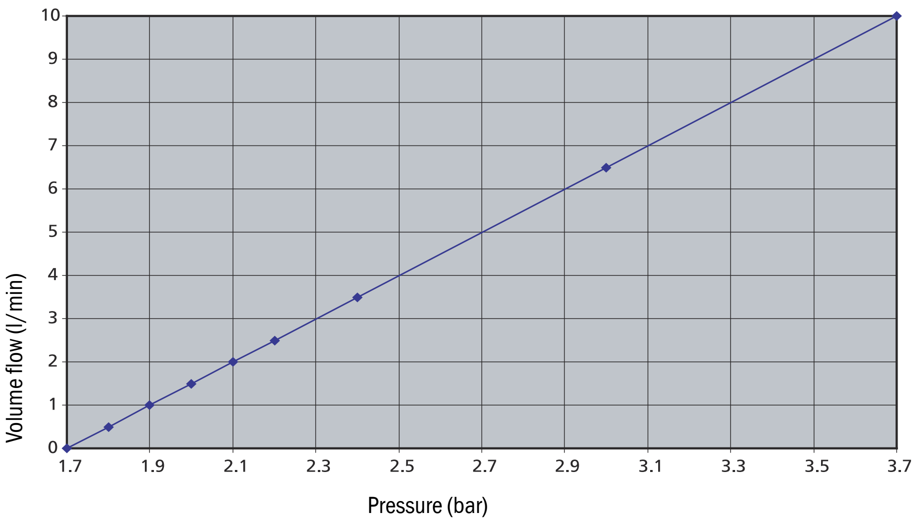
NOTICE: Prevent contamination of the gas inlet
If span gas is not connected:
- ▶ Use the plug for the optional TRANSIC111LP gas inlet.
  This prevents dust or dirt depositing on the gas inlet.

NOTICE: Prevent process gas escaping!
If span gas is not connected:
- ▶ Use a plug for the optional gas inlet.
  Although the return valve prevents process gas from escaping, the plug on the optional TRANSIC111LP gas inlet can also be used.

6.1.1.6 *Adjusting gas flow*

3 Open the gas cylinder valve with care to avoid pressure surges.
4 Completely open the flowmeter.
5 Slowly increase the pressure setting of the controller until the gas flow can be detected with the rotameter
6 Use the flowmeter to adjust the volume flow to the desired value.
7 Pay attention to the volume flow for optimum adjustment precision.
For further information on adjustment precision and volume flow, *see "Calibration and adjustment in process", page 65*.
8 For adjustment without flowmeter, see "Volume flow against pressure, Swagelok SS-CHSM2-KZ-25 return valve", page 66. Information on the relation between span gas volume flow and span gas pressure of the optional test gas inlet can be found there.

Fig. 36: Volume flow against pressure, Swagelok SS-CHSM2-KZ-25 return valve



6.1.2 **Information on calibration gases**

- Factory calibration: Mixtures of dry N_2 and O_2.
- Humidity / CO_2 concentration of calibration gases: 0 %.
- Gases recommend for adjustment: Nitrogen gas mixtures.
- A gas flow rate of about 5 l/min is adequate for TRANSIC111LP calibration and adjustment. Shorter response times during calibration and adjustment require a higher volume flow. The higher the gas volume, the higher the gas pressure. Select an adequate tubing size for the escaping gas.

NOTICE:
Allow enough time for the gas concentration to stabilize when doing calibrations/ adjustments.

6.2 Calibration

The analog output can be frozen for calibration. Use function *Cal.C,* see “Example:”, page 48 with the keypad. Use the command *Adjust,* see “Freeze outputs for calibration (command ADJUST)”, page 48 for input via the servial interface.

6.2.1 Using ambient air

- Normal ambient air provides a convenient way to calibrate the TRANSIC111LP because the oxygen concentration of dry ambient air is constant at 20.95 vol% O_2.
  - ▶ Ensure the sensor is completely in the ambient air. Important: Pay attention to measured oxygen value of 21.0 % O_2 ±0.2 % O_2 .
  - ▶ Correct the humidity.
    The following Figure (Figure 37) shows the calibration display expected for the ambient air as function of the temperature (°C) and relative humidity (% r.h.).

The following diagram shows the measured oxygen values (in % O_2) for a gas concentration of 20.95% O_2 with varying humidity values. The diagram shows examples for measured values when measuring wet gases without r.h. corrections having been entered in the TRANSIC111LP (i.e.the relative humidity is set to 0% r.h.). Both gas dilution effect and r.h. dependency effect are included in the Table.

Table 11: Measured oxygen values in relative humidity

	(% r.h.)										
Temp (°C)	0	10	20	30	40	50	60	70	80	90	100
0	21.0	21.0	21.0	21.0	20.9	20.9	20.9	20.9	20.9	20.9	20.8
5	21.0	21.0	21.0	20.9	20.9	20.9	20.9	20.8	20.8	20.8	20.8
10	21.0	21.0	20.9	20.9	20.9	20.8	20.8	20.8	20.7	20.7	20.7
15	21.0	21.0	20.9	20.9	20.8	20.8	20.7	20.7	20.6	20.6	20.6
20	21.0	20.9	20.9	20.8	20.8	20.7	20.6	20.6	20.5	20.4	20.4
25	21.0	20.9	20.8	20.8	20.7	20.6	20.5	20.4	20.3	20.3	20.2
30	21.0	20.9	20.8	20.7	20.6	20.4	20.3	20.2	20.1	20.0	19.9
35	21.0	20.9	20.7	20.6	20.4	20.3	20.1	20.0	19.8	19.7	19.6
40	21.0	20.8	20.6	20.4	20.2	20.1	19.9	19.7	19.5	19.3	19.1
45	21.0	20.8	20.5	20.3	20.0	19.8	19.5	19.3	19.1	18.8	18.6
50	21.0	20.7	20.4	20.1	19.7	19.4	19.1	18.8	18.5	18.2	17.9
55	21.0	20.6	20.2	19.8	19.4	19.0	18.6	18.3	17.9	17.5	17.2
60	21.0	20.5	20.0	19.5	19.0	18.5	18.1	17.6	17.1	16.7	16.2
65	21.0	20.4	19.7	19.1	18.5	17.9	17.3	16.8	16.2	15.6	15.1
70	21.0	20.2	19.4	18.7	17.9	17.2	16.5	15.8	15.1	14.4	13.8
75	21.0	20.0	19.1	18.2	17.3	16.4	15.5	14.7	13.8	13.0	12.2
80	21.0	19.8	18.7	17.5	16.5	15.4	14.4	13.4	12.4	11.4	10.4

6.2.2 Using bottled gas

- Preparations for calibration with bottled gas can be found in Section Gas flow adjustment, see “Setting up the gas supply for calibration and adjustment”, page 64.
- When calibration conditions (gas pressure, humidity and CO_2 concentration) are different from the operating conditions of the measuring device, set the ambient parameters of the measuring device to the adjustment environment for the adjustment duration. These settings must then be changed back to represent the process conditions when the TRANSIC111LP is reinstalled in its operating environment. Further information on setting the ambient parameters of the TRANSIC111LP can be found under “Calibrate analog output (command ICAL)”, page 49 (serial input) and “Process pressure: Display and settings”, page 35 and see “$H_2$0 content in process gas: Settings (H2O)”, page 35 (keypad).
- Let the gas flow in.
- Wait until the measured value has stabilized.
- Now compare the display value of the measuring device with the calibration gas specification.
- Set the parameters for pressure, humidity and temperature corresponding to the process conditions.
- Ensure the analog output is no longer frozen.

6.2.3 Adjustment

1. Enter the password. (Using the keypad, see “Entering the password (PAS)”, page 35, using the serial interface, see “Enter password (example PASS)”, page 48).
2. Access to the adjustment functions is open for 30 minutes after the password is entered. Functions in progress are not interrupted after expiry of 30 minutes. Enter the password again to execute more password-protected functions.
3. Make sure that no error messages are active as these could affect adjustment. Malfunction messages, see “Display Error protocol (command ERRL)”, page 57. (Serial interface) and “Display of active and undeleted errors (ERR)”, page 34 (keypad)
4. Make sure that the ambient parameters of the adjustment environment have been set before adjustment.
5. Set the values for pressure, humidity and CO_2 concentrations of the calibration gas. Calibration gases have a humidity of 0 g/m³ H_2O. The CO_2 concentration of nitrogen gas mixtures is 0 vol% CO_2.
6. Reset the ambient parameters after adjustment to the values of the process gas. Further information on the compensation of ambient parameters can be found on “Compensation of ambient parameters”, page 59.

6.2.4 Adjustment options

- One-point adjustment via the serial interface
- One-point adjustment using the keypad
- Two-point adjustment via the serial interface
- Two-point adjustment using the keypad
- Restoring factory calibration

+i
- The reference concentration used determines whether the gain or offset parameter value is changed.
  - Change to the offset value: Oxygen concentration < 10.5% O_2
  - Change to the gain value: Oxygen concentration > 10.5% O_2
- Two-point adjustment: Always returns new gain and offset values.

6.2.5 One-point adjustment via the serial interface

One-point adjustment procedure via the serial interface (command COXY1)

This adjustment calculates and sets a new gain or offset parameter value (depending on the reference concentration used).

1 Enter the password, see “Entering the password (PAS)”, page 35.
2 The analog output can be frozen during an online adjustment with the command *ADJUST ON*.
Input:

```
>adjust on
Outputs (analog, relay, POLL/Run and MT300) frozen
```

3 When adjustment conditions (gas pressure, humidity and CO_2 concentration) are different from the operating conditions of the measuring device, set the ambient parameters of the measuring device to the adjustment environment for the adjustment duration. These settings must then be changed back to represent the process conditions when the TRANSIC111LP is reinstalled in its operating environment. Further information on setting the ambient parameters of the TRANSIC111LP can be found in Section 5.
4 Enter command *COXY1* and confirm with the Enter button.
5 Connect the gas inlet and let the gas flow in.
6 The adjustment starts. The following commands are now available for selection:
   – *Enter* - output the most current measuring result
   – *R + Enter* - continuous output of measuring results. Press Enter to stop the output mode.
   – *Esc* - to terminate the calibration.
7 Wait until the measured value has stabilized. Enter the span gas concentration and press *Enter*. The new gain or offset parameter value is calculated and displayed.
The following is displayed after entering the command *COXY1*:

```
>coxy1

Customer calibration
Current condition/settings:
Pressure (bar)          : 1.013
H2O (g/m3)              : 0
CO2 (vol-%)             : 0
Gas temperature (C)     : 23.64
Internal temperature (C): 24.84

If parameters are not correct, cancel calibration with ESC and change parameters.
Connect ref gas to cuvette.

Connect ref gas to cuvette.
O2 (%):  20.52 Ref  ?
O2 (%):  20.51 Ref  ?
O2 (%):  20.51 Ref  ?
O2 (%):  20.51 Ref  ? 20.50

Calibration data:
Pressure setting (bar)        : 1.013
Measured oxygen               : 20.51
Given oxygen                  : 20.50
Gas temperature (C)           : 23.65
Ref path temperature (C)   : 24.85
New Gain                      : 1.000
Calibration ready - remember SAVE command
>save
```

8 Now enter command *SAVE*, see “Save parameters (command SAVE)”, page 56, and press *Enter*. The new values are stored in EEPROM.

```
>save
EEPROM (basic) saved successfully
EEPROM (op) saved successfully
EEPROM (op_log1) saved successfully
EEPROM (op_log2) saved successfully
```

9 Enter command *ADJUST OFF* and press *Enter*. The adjustment is completed and the measuring results are displayed again.

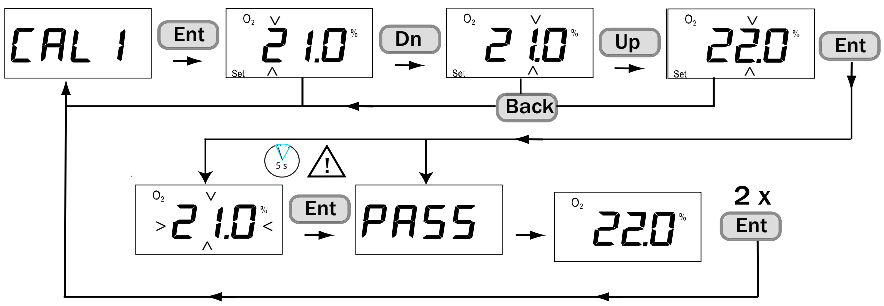
```
>adjust off
Outputs to normal state
```

6.2.6 One-point adjustment using the keypad

One-point adjustment (function CAL1)

1 Check that no error messages are active.
Active error messages influence adjustment. Malfunction messages, see “Error display”, page 88. (Serial interface) and “Display of active and undeleted errors (ERR)”, page 34 (keypad) Error Table, see “Error Table”, page 88.
2 Enter the password in menu *PAS*.
3 Select menu item *Cal1*. This freezes the analog output.
4 Connect the span gas.
5 Enter the known O_2 value and confirm with *Ent*.
6 The measured value display blinks.
7 Feed calibration gas.
8 Wait until the display shows a stable value.
9 Confirm with *Ent*.
PASS is displayed when the calibration is successful. The device now calculates the new gain and offset settings and starts to display the new measured value.
10 Press *Ent* twice to end the one-point adjustment.

Fig. 37: One-point adjustment using the keypad .0511-090



+i The adjustment can be aborted at any time with *Back*.

+i The reference concentration used determines whether the gain or offset parameter value is changed.
– Change to the offset value: Oxygen concentration < 10.5% O_2
– Change to the gain value: Oxygen concentration > 10.5% O_2

6.2.7 Two-point adjustment via the serial interface

Perform two-point adjustment (command COXY2)

This command starts a two-point adjustment.

Syntax: *COXY2*<cr>

Example:

```
>coxy2
Customer calibration

Current condition/settings:
Pressure (bar)            : 1.013
H2O (g/m3)                : 0
CO2 (vol-%)               : 0
Gas temperature (C)       : 23.66
Internal temperature (C)  : 24.85

If parameters are not correct, cancel calibration with ESC and change parameters

Connect ref gas #1 to cuvette
O2 (%)                    :  20.99 Ref1  ? 21

Connect ref gas #2 to cuvette
O2 (%)                    :  10.05  Ref2 ? 10

Calibration data:
Pressure setting (bar)    : 1.013

Point #1
Measured oxygen           : 20.99
Given oxygen              : 21.00
Gas temperature (C)       : 23.65
Ref path temperature (C): 24.84

Point #2
Measured oxygen            : 10.05
Given oxygen               : 10.00
Gas temperature (C)        : 23.66
Ref path temperature (C)   : 24.85
New Gain                   : 0.995
New Offset                 : 0.990

Calibration ready - remember SAVE command
>save
```

Two-point adjustment via the serial interface

This adjustment calculates and sets new gain and offset parameter values. A two-point adjustment uses one gas to adjust the lower limit value of the measuring range and a different gas to adjust the upper limit value of the measuring range. These can be, for example, pure nitrogen (0.0% O_2) and an N_2/O_2 mixture (for example, 21% O_2). The minimum difference between the two span gas concentrations in two-point adjustment should be at least 4% O_2. It makes no difference whether the gas is first used for the lower or upper span.

1 Enter command *PASS* XXXX (the password) and confirm with Enter.
2 Enter command *ADJUST ON* and confirm with Enter. The analog output can be frozen during an online adjustment.

```
>adjust on
Outputs (analog, relay, POLL/Run and MT300) frozen
```

3 When adjustment conditions (gas pressure, humidity and CO_2 concentration) are different from the operating conditions of the measuring device, set the ambient parameters of the measuring device to the adjustment environment for the adjustment duration. These settings must then be changed back to represent the process conditions when the TRANSIC111LP is reinstalled in its operating environment. Further information on setting the ambient parameters of the TRANSIC111LP can be found in Section 5 of this Manual.

4 Enter command *COXY1* and confirm with the Enter button.
5 Connect the gas inlet and let the gas flow in.
6 The adjustment starts. The following commands are now available for selection:
   – *Enter* - output the most current measuring result
   – *R + Enter* - continuous output of measuring results. Press Enter to stop the output mode.
   – *Esc* - to terminate the calibration.
7 Wait until the measured value has stabilized. Enter the span gas concentration for the first span and press *Enter*. The following is displayed after the command *COXY2* has been entered (example):

```
>coxy2
Customer calibration
Current condition/settings:
Pressure (bar)          : 1.013
H2O (g/m3)              : 0
CO2 (vol-%)             : 0
Gas temperature (C)     : 23.66
Internal temperature (C): 24.85
If parameters are not correct, cancel calibration with ESC and change parameters.
Connect ref gas #1 to cuvette

O2 (%):  20.99 Ref1  ?
O2 (%):  20.99 Ref1  ?
O2 (%):  20.99 Ref1  ?
O2 (%):  20.99 Ref1  ? 21
Connect ref gas #2 to cuvette
```

8 Now the second span gas has to be fed. Wait until the measured value has stabilized. Enter the span gas concentration for the second span and press *Enter*. The new gain and offset parameter values are now calculated and displayed.

```
Output:
O2 (%):  10.05  Ref2 ?
O2 (%):  10.05  Ref2 ?
O2 (%):  10.05  Ref2 ?
O2 (%):  10.05  Ref2 ? 10
Calibration data:
Pressure setting (bar)  : 1.013
Point #1
Measured oxygen         : 20.99
Given oxygen                  : 21.00
Gas temperature (C)     : 23.65
Ref path temperature (C): 24.84
Point #2
Measured oxygen         : 10.05
Given oxygen                  : 10.00
Gas temperature (C)     : 23.66
Ref path temperature (C): 24.85
New Gain         : 0.995
New Offset       : 0.990
Calibration ready - remember SAVE command>save
>
```

```
Output:
O2 (%):  10.05  Ref2 ?
O2 (%):  10.05  Ref2 ?
O2 (%):  10.05  Ref2 ?
O2 (%):  10.05  Ref2 ? 10
Calibration data:
Pressure setting (bar)  : 1.013
Point #1
Measured oxygen         : 20.99
Given oxygen                  : 21.00
Gas temperature (C)     : 23.65
Ref path temperature (C): 24.84
Point #2
Measured oxygen         : 10.05
Given oxygen                  : 10.00
Gas temperature (C)     : 23.66
Ref path temperature (C): 24.85
New Gain       : 0.995
New Offset     : 0.990
Calibration ready - remember SAVE command>save
>
```

9 It is possible that an error message can appear and new values are not calculated:
Error: Calibration points too close - Not calibrated
In this case, repeat the two-point adjustment with calibration gases that differ by at least 4 vol-% O2.

10 Enter command *SAVE* and confirm with *Enter*. The new values are stored in EEPROM.

```
>save
EEPROM (basic) saved successfully
EEPROM (op) saved successfully
EEPROM (op_log1) saved successfully
EEPROM (op_log2) saved successfully
```

11 Enter command *ADJUST OFF* and confirm with *Enter*. The adjustment is completed and the measuring results are displayed again.

```
>adjust off
Outputs to normal state
```

6.2.8 Two-point adjustment using the keypad

Two-point adjustment (function CAL2)

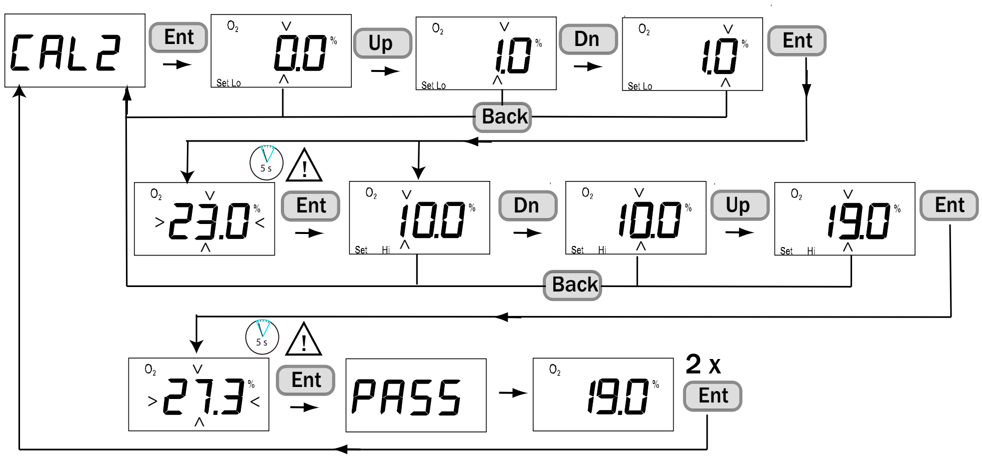
The procedure is the same as for one-point calibration but the adjustment continues automatically with the second reference point.

This adjustment calculates and sets new gain and offset parameter values. A two-point adjustment uses one gas to adjust the lower limit value of the measuring range and then a different gas to adjust the upper limit value of the measuring range. These can be, for example, pure nitrogen (0.0% O_2) and an N_2/O_2 mixture (for example, 21% O_2). The minimum difference between the two span gas concentrations in two-point adjustment should be at least 4% O_2.

When adjustment conditions (gas pressure, humidity and CO_2 concentration) are different from the operating conditions of the measuring device, set the ambient parameters of the measuring device to the adjustment environment for the adjustment duration. These settings must then be changed back to represent the process conditions when the TRANSIC111LP is reinstalled in its operating environment. Further information on setting the ambient parameters of the TRANSIC111LP can be found in Section 5 of these Operating Instructions.

1 Check that no error messages are active.
Active error messages influence adjustment. Malfunction messages, see “Error display”, page 88. (Serial interface) and see “Display of active and undeleted errors (ERR)”, page 34 (keypad). Error Table, see “Error Table”, page 88.
2 Select menu item *Cal2*. This freezes the analog output.
3 First close off the gas for the *first (lower limit)* reference point.
4 Enter the known span gas value and confirm with *Ent*.
5 The measured value display blinks.
6 Feed calibration gas.
7 Wait until the display shows a stable value.
8 Enter the known span gas value and confirm with *Ent*.
9 Now close off the gas for the second (*upper limit)* reference point.
10 Confirm with *Ent*. The display now shows *Set hi.* and the adjustment for the second (upper) reference point starts, and “Set Hi 10.0 %” is displayed.
PASS is displayed when the calibration is successful. The display now shows the O_2 value when no further input is made.
11 The device now calculates the new gain and offset settings and starts to display the new measured result.
12 Press *Ent* twice to end the two-point adjustment.

Fig. 38: Two-point adjustment using the keypad



The adjustment can be aborted at any time with *Back*.

The reference concentration used determines whether the gain or offset parameter value is changed.
– Change to the offset value: Oxygen concentration < 10.5% O_2
– Change to the gain value: Oxygen concentration > 10.5% O_2

6.3 Adjustment of TRANSIC111LP for ambient gas measurement

This Section solely describes the adjustment and calibration of the TRANSIC111LP device in the version for ambient gas measurement.
Please read the complete Section 6 for comprehensive information on the calibration and adjustment procedure for the TRANSIC111LP for ambient gas measurement.

NOTICE: Particular care for calibration and adjustment

With the ambient measurement configuration, it is assumed that the probe and measuring device enclosure are installed in an environment with a varying O_2 concentration.
This presents special demands on calibration and adjustment of the TRANSIC111LP version for ambient gas measurement because the calibration and adjustment gas should be present in both the probe and the measuring device enclosure. SICK recommends the following procedure for a simpler approach:

- For calibration (test of device): Use normal ambient air or 21.0 % O_2 calibration gas, see “Calibration”, page 76.
- For adjustment: Use one-point adjustment with 21.0% O_2 adjustment gas and sample gas cell, see “Adjustment”, page 77.

6.3.1 Setting up the gas supply

The calibration and adjustment gas must be in both the probe and the enclosure of the measuring device for this TRANSIC111LP version.

This requirement is most easily fulfilled by performing calibration and adjustment with gas that has an O_2 concentration close to normal ambient air O_2 concentrations (20.95% O_2).

When using calibration or adjustment gas concentrations significantly different from ambient air, it should be noted that:

- For calibration (test of device), it is possible to correct the TRANSIC111LP measured value for the error caused by the calibration configuration, see “Using calibration gas”, page 76.

Take the required measures for adjustment so that the adjustment gas concentration is also present in the measuring device enclosure.

Using ambient air

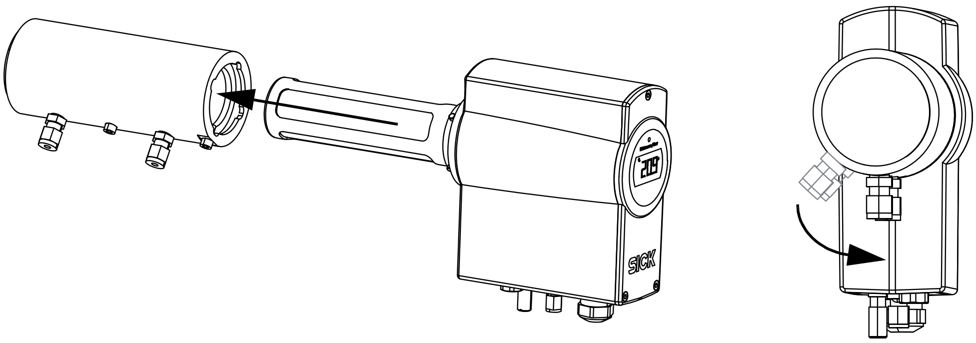
See “Using ambient air”, page 76 for further information on the calibration method.

Using bottled calibration and adjustment gas

1. Ensure the O-ring is seated securely in the groove.
2. Insert the probe into the sample gas cell.
3. Push it against the sample gas cell and turn it clockwise 45°, see “Fastening the TRANSIC111LP probe in the sample gas cell”, page 76.
4. The gas inlets of the sample gas cell are fitted with 1/8" NPT or Swagelok gas connections for Ø 6 mm tubes, see “Installing the sample gas line”, page 21.
5. Let the gas flow out without hindrance. This avoids an overpressure in the chamber.

The ambient gas measurement version of TRANSIC111LP requires the adjustment gas concentration to be present in the probe and inside the measuring device enclosure. In the configuration described above, the gas in the measuring device enclosure would be normal ambient air so calibration/adjustment gas O_2 concentration must be at or close to ambient air (20.95 %O_2).

Fig. 39: Fastening the TRANSIC111LP probe in the sample gas cell



6.3.2 Calibration

6.3.2.1 *Using ambient air*

See "Using ambient air", page 67 for information on calibration with ambient air.

6.3.2.2 *Using calibration gas*

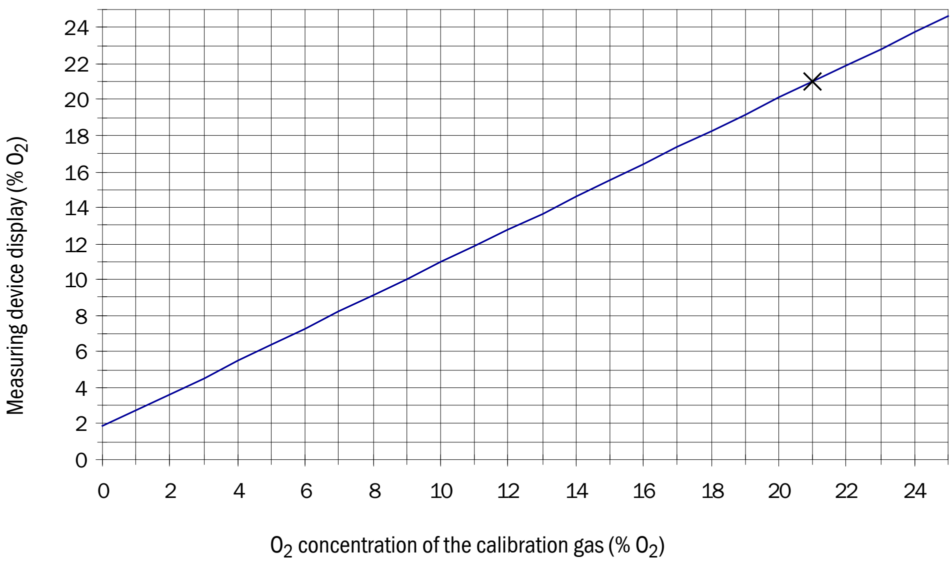
SICK recommends using normal ambient air for calibrating the TRANSIC111LP version for ambient gas measurement.

If a calibration gas (such as synthetic air or a gas with precise O_2 concentration) is used, refer to "Setting up the gas supply", page 75 cont.

The TRANSIC111LP does not show the calibration gas concentration correctly because only the probe is in the calibration gas. The correct measured value can be taken from the diagram below (Fig. 40).

The Figure shows the measured value when only the sample gas cell (and not the measuring device enclosure) is exposed to the calibration gas.

Fig. 40: TRANSIC111LP measured values depending on the O_2 concentration in the calibration gas



6.3.2.3 *Information on calibration gases*

- Factory calibration: Mixtures of dry N_2 and O_2.
- Humidity / CO_2 concentrations: 0%.
- Gases recommend for adjustment: Nitrogen gas mixtures.
- When using the sample gas cell: Volume flow for calibration and adjustment about 0.5 l/min higher volume flow for shorter reaction times. The higher the gas volume, the higher the gas pressure. Select an adequate tubing size for the escaping gas.

NOTICE:
Allow enough time for the gas concentration to stabilize when doing calibrations/adjustments.

6.3.3 Calibration method

Freeze outputs for calibration via serial interface (command ADJUST)

see “Freeze outputs for calibration (command ADJUST)”, page 48.

Check of calibration via keypad (function Cal.C)

see “Display of calibration gas, actual value (CAL.C)”, page 34.

6.3.4 Adjustment

SICK recommends a one-point adjustment with a dry O_2/N_2 gas mixture with an O_2 concentration of about 21% O_2 for this TRANSIC111LP variant.

The adjustment gas concentration must be in both the probe and the enclosure of the measuring device. Further information, see “Adjustment”, page 68 and see “Setting up the gas supply”, page 75.

6.3.5 Adjustment

1 Enter the password. (Using the keypad, see “Entering the password (PAS)”, page 35, using the serial interface, see “Enter password (example PASS)”, page 48).
2 Access to the adjustment functions is open for 30 minutes after the password is entered. Functions in progress are not interrupted after expiry of 30 minutes. Enter the password again to execute more password-protected functions.
3 Make sure that no error messages are active as these could affect adjustment. Malfunction messages see “Error display”, page 88. (Serial interface) and see “Display of active and undeleted errors (ERR)”, page 34 (keypad)
4 Make sure that the ambient parameters of the adjustment environment have been set before adjustment.
5 Set the values for pressure, humidity and CO_2 concentrations of the adjustment gas. Calibration gases have a humidity of 0 g/m³ H_2O. The CO_2 concentration of nitrogen gas mixtures is 0 vol% CO_2.
6 Reset the ambient parameters after adjustment to the values of the process gas. Further information on the compensation of ambient parameters can be found on “Compensation of ambient parameters”, page 59.

6.3.6 Adjustment options

- One-point adjustment (O_2 concentration at 21.0%) via the serial interface.
- One-point adjustment (O_2 concentration at 21.0%) via the keypad.
- Restoring factory calibration

6.3.7 One-point adjustment via the serial interface

One-point adjustment: Either the gain or offset value of the measurement is changed. When the O_2 concentration of the span gas is >10.5% O_2, the one-point adjustment returns a new gain value otherwise a new offset value.

6.3.8 One-point adjustment via the serial interface

One-point adjustment (command COXY1)

This command performs a one-point adjustment. While the program waits for the input of the O_2 concentration, command *R* can be used to trigger continuous output of the current O_2 measured value. Pressing *Enter* once (on the computer keyboard) terminates Print mode. Pressing *Esc* once cancels the adjustment. Syntax: *COXY1*<cr>

Example:

```
>coxy1
Customer calibration
Current condition/settings:
Pressure (bar)              : 1.013
H2O (g/m3)                  : 0
CO2 (vol-%)                 : 0
Gas temperature (C)         : 23.64
Internal temperature (C): 24.84
If parameters are not correct, cancel calibration with ESC and change parameters

Connect ref gas to cuvette.
O2 (%):  21.20 Ref  ?
O2 (%):  21.20 Ref  ?
O2 (%):  21.20 Ref  ?
O2 (%): 21.19 Ref  ? 21

Calibration data:
Pressure setting (bar)  : 1.013
Measured oxygen         : 21.20
Given oxygen            : 21.00
Gas temperature (C)     : 23.65
Ref path temperature (C)  : 24.85
New Gain                : 0.990
Calibration ready - remember SAVE command>save
```

One-point adjustment via the serial interface

This adjustment calculates and sets a new gain or offset parameter value (depending on the reference concentration used).

1 Enter command *PASS* XXXX (the password) and then press *Enter* (on the computer keyboard).
2 Enter command *ADJUST ON* and press *Enter*.

>adjust on

Outputs (analog, relay, POLL/Run and MT300) frozen

This command freezes the current values of all outputs. This command should be used during online adjustment so that measured value changes do not disturb process control. This step can be omitted when the device to be adjusted has been removed from the process or is separated from process control.

When adjustment conditions (gas pressure, humidity and CO_2 concentration) are different from the normal operating conditions of the measuring device, set the ambient parameters of the measuring device to the adjustment environment for the adjustment duration. These settings must then be changed back to represent the process conditions when the TRANSIC111LP is reinstalled in its operating environment. Further information on setting the ambient parameters of the TRANSIC111LP can be found in Section 5 of this Manual.

3 Enter command *COXY1* for one-point adjustment and press *Enter*.
4 Connect the gas inlet and let the gas flow in.

The calibration starts. The following commands are now available for selection:

- *Enter* - output the most current measuring results or terminate continuous Print mode.
- *R + Enter* - continuous output of measuring results with an interval of about 1 second. Press *Enter* to terminate Print mode.
- *Esc* - to terminate the calibration.

5 Wait until the measured value has stabilized. Enter the span gas concentration and press *Enter*.
The new gain or offset parameter value is calculated and displayed.
The following is displayed after entering the command *COXY1*:

```
>coxy1
Customer calibration
Current condition/settings:
Pressure (bar)          : 1.013
H2O (g/m3)              : 0
CO2 (vol-%)             : 0
Gas temperature (C)     : 23.64
Internal temperature (C): 24.84

If parameters are not correct, cancel calibration with ESC and change parameters

Connect ref gas to cuvette.
O2 (%):  20.52 Ref  ?
O2 (%):  20.51 Ref  ?
O2 (%):  20.51 Ref  ? 20.50

Calibration data:
Pressure setting (bar)   : 1.013
Measured oxygen          : 20.51
Given oxygen                   : 20.50
Gas temperature (C)       : 23.65
Ref path temperature (C)  : 24.85
New Gain                  : 1.000
Calibration ready - remember SAVE command
>save
```

6 Enter command *SAVE* and press *Enter*. The new values are stored in EEPROM.

```
>save
EEPROM (op) saved successfully
EEPROM (op_log1) saved successfully
EEPROM (op_log2) saved successfully
```

7 Enter command *ADJUST OFF* and press *Enter*.

```
>adjust off
Outputs to normal state
The adjustment is finished and the output returns to displaying the measurement
results.
```

6.3.9 One-point adjustment using the keypad (function CAL1)

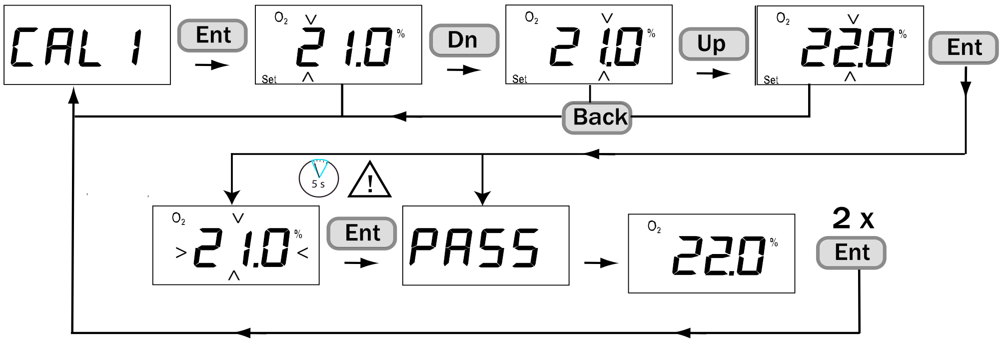
6.3.10 One-point adjustment using the keypad

One-point adjustment (function CAL1)

When adjustment conditions (gas pressure, humidity and CO_2 concentration) are different from the operating conditions of the measuring device, set the ambient parameters of the measuring device to the adjustment environment for the adjustment duration. These settings must then be changed back to represent the process conditions when the TRANSIC111LP is reinstalled in its operating environment. Further information on setting the ambient parameters of the TRANSIC111LP can be found in Section 5, see “Setting Ambient Parameters”, page 59.

1 Check that no error messages are active.
Active error messages influence adjustment. Malfunction messages, see “Error display”, page 88. (Serial interface) and see “Display of active and undeleted errors (ERR)”, page 34 (keypad). Error Table see “Error Table”, page 88.
2 Enter the password in menu *PAS*, see “Entering the password (PAS)”, page 35
3 Select menu item *Cal1*. This freezes the analog output.
4 Connect the span gas.
5 Enter the known O_2 value and confirm with *Ent*.
6 The measured value display blinks.
7 Feed adjustment gas.
8 Wait until the display shows a stable value.
9 Confirm with *Ent*.
PASS is displayed when the calibration is successful. The device now calculates the new gain and offset settings and starts to display the new measured value.
10 Press *Ent* twice to end the one-point adjustment.

Fig. 41: One-point adjustment using the keypad.



+i The adjustment can be aborted at any time with *Back*.

+i The reference concentration used determines whether the gain or offset parameter value is changed.
– Change to the offset value: Oxygen concentration < 10.5% O_2
– Change to the gain value: Oxygen concentration > 10.5% O_2

6.3.11 Restoring factory calibration

Restoring the factory calibration via the serial interface, see “Restoring factory calibration”, page 57, via the keypad, see “Resetting the measuring device (rESE)”, page 37.

7 Maintenance

7.1 Field maintenance

7.1.1 Assembly and disassembly

7.1.1.1 *Main safety information for assembly and maintenance work*

WARNING: Laser beam invisible
Cleaning tools positioned on the probe can reflect the laser beam coming out of the probe.
- ▶ Switch the TRANSIC111LP off during cleaning.

WARNING: Risk of burns through hot gases
- ▶ With process temperatures > 65 °C, let the device cool down before starting maintenance work.

WARNING: Contamination by acids and alkalis
- ▶ Always wear suitable protective clothing when handling the condensation drain plug.

DANGER: Toxic gases
- ▶ Assemble and disassemble the device only when there is no hazard by toxic gases.

WARNING: Toxic gases escaping
- ▶ Ensure the seals are fitted.
- ▶ Incorrect sealing materials lead to leaks.
- ▶ Check the installation regularly for leaks.

WARNING: Risk of fire through reaction with oxygen
- ▶ Ensure that all components with sample gas contact are free from oil, grease and dust.

+i Installation information: Process, materials and tools must be suitable for use together with oxygen. Observe the national regulations for handling oxygen.

WARNING: Hazard by escape of oxygen
- ▶ Assemble and disassemble the device only when there is no hazard with respect to high oxygen concentrations.

WARNING: Risk of fire through incorrect seal
- ▶ Incorrect materials can cause fire or reactions with oxygen. Ensure the sealing material is compatible with the oxygen concentration.

WARNING: Risk of injury through pressure
- ▶ Assemble and disassemble the device only when there is no hazard with respect to high pressures.

+i When necessary, provide separating elements to ensure safe installation and removal.

WARNING: High pressures
- ▶ Only use components designed for the process pressure in the application.

The device is available in two versions:

- Up to 0.5 bar overpressure
- Up to PS = 10 bar for TS_{max} = 80 °C

Installation information: Only use original SICK accessories and spare parts, see “Spare parts”, page 93.

7.1.2 Draining condensation

A drain opening for condensation is located in the center of the sample gas cell, see "TRANSIC111LP measuring device with sample gas cell", page 20.

Install a valve in the drain opening for high condensation.

WARNING: Acids and alkalis escaping

- Only open the valve screw when no acids or alkalis are present.

WARNING: Toxic gases escaping

- Only open the valve screw when no toxic gases are present.

WARNING: Risk of injury through pressure

- Only open the valve screw when the system is not under pressure.

Check gas leak-tightness afterwards every time condensation is drained. Replace the seal when necessary.

7.1.3 Cleaning the optical components

Please observe the safety information for the laser unit in "Main operating information", page 9 .

CAUTION: Laser beam invisible

The transmitter should be switched off during cleaning so that cleaning tools placed into the probe cannot cause the reflection of laser radiation out of the probe.

To clean the optical components, the user must access the optical surfaces in the probe.

- Check the signal intensity
  - TRANSIC111LP maintenance
  - Maintenance warning
  - Error signal that indicates excessive light loss in the sensor.
    Inquiry via keypad, see "Display of signal intensity (SIL)", page 34.

NOTICE: SICK recommends cleaning the optical components when the signal intensity is below 80%.

Using solvents to clean the optical components

When using solvents to clean the optical components, ensure the solvent used is compatible with the sealing material of the sensor.

WARNING: Hazard of reactions of cleaning agents with oxygen

Cleaning agent residues could react with oxygen.

- Make sure to rinse the optical components thoroughly when using cleaning agents.

Fig. 42: Location of the mirror in the oxygen measuring probe

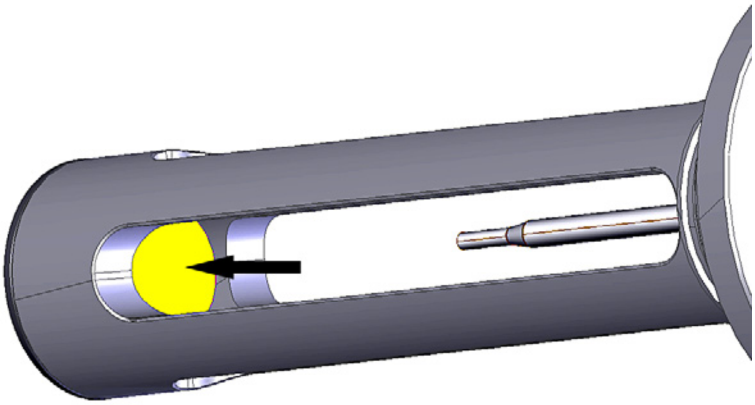
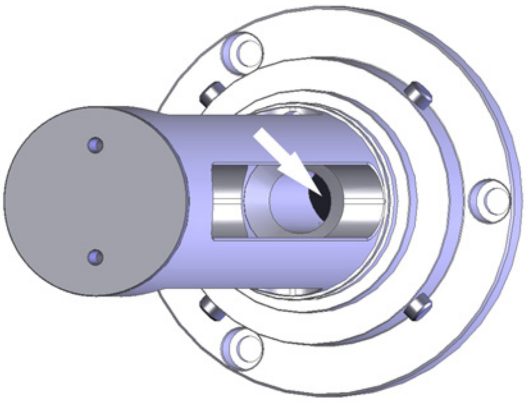


Fig. 43: Location of the lens in the oxygen measuring probe



NOTICE: Do not damage the lens
The lens is located in a ø 11.5 mm cavity and is hard to reach. (See arrow in Fig. 47)

1. Remove the filter. Instructions, see “Cleaning the TRANSIC111LP filter”, page 85.
2. Use a jet of clean air to clean loose particles off the mirror (instrument air or better). Continue with step 3 when the optics are still contaminated.
3. Tip distilled water with soap mixed in onto the mirror and let it work.
4. Then rinse with distilled water.
5. Dry with compressed air (instrument air or better quality).
6. If the surface is still contaminated, tip pure ethanol or isopropanol onto the surfaces. Let the chemicals work in for maximum 15 minutes.
7. Rinse the optical components with distilled water after cleaning.
8. Dry with compressed air (instrument air or better quality).

9 After cleaning, the surface should appear clean without oil stains, contamination or dust. Refit the filters after cleaning.

NOTICE: Damage to the lens and mirror through mechanical cleaning.
During the cleaning process described above, never attempt to clean the optical components by rubbing (e.g., with cotton swabs or cleaning a cloth).

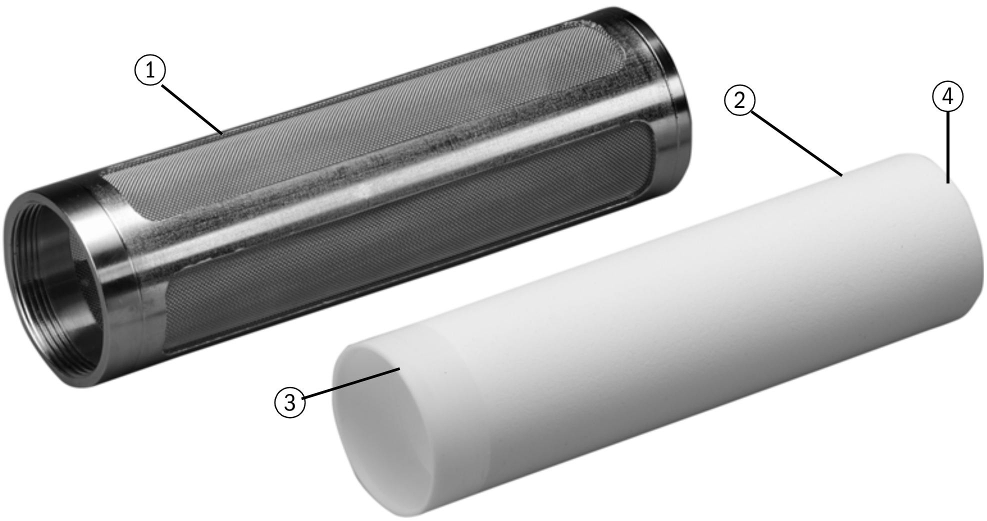
Cleaning the TRANSIC111LP optics is easiest with an optics cleaning set from SICK. Part No., see “”, page 92.

7.1.4 Cleaning the TRANSIC111LP filter

CAUTION: Control the filter regularly.
- Check the filter regularly.
- Change the filter when clogged.

CAUTION: The PTFE filter is not approved for >25 vol% oxygen

Fig. 44: Stainless steel mesh and PTFE filters



1	Stainless steel mesh filter
2	PTFE filter
3 + 4	Areas that can be touched by hand

7.1.5 Cleaning the filter

Cleaning the stainless steel mesh filter

1 Remove the filter from the measuring device.
2 Clean the filter.
3 Dry the filter thoroughly.
4 Ensure air can flow through the filter mesh.
5 Refit the filter.

The stainless steel filter needs to be replaced when it remains dirty or clogged despite thorough cleaning, see “Spare parts”, page 93.

PTFE filter

NOTICE: Never touch the PTFE filter surfaces

- Only touch the PTFE filter as marked in Figure, see “Stainless steel mesh and PTFE filters”, page 85. Avoid touching, rubbing or scraping the active surfaces of the PTFE filter as this can clog the filter.

NOTICE: Health risk through filters contaminated with toxic gases

The filter could be contaminated in processes with toxic gases.

- Wear the protective clothing specified for the application.

The PTFE filter protects the optical components against liquids and dust. It is permeable to water vapor and solvents.

Checking the PTFE filter

The PTFE filter needs to be checked and exchanged regularly to provide adequate gas flow to the sensor volume.

Exchanging the PTFE:

1 The PTFE filter is retained by an O-ring on the base of the transmitter probe. Grasp the filter firmly, slide it over the O-ring and pull the filter out. Only grip the filter as described above. Remove the used O-ring seal.

2 Replace the O-ring seal with a new one: Roll the seal carefully into the groove at the base of the oxygen measuring probe. Be careful not to damage the O-ring by excessive sliding or friction along the metal edges of the probe.

3 if the filter end is to be lubricated to ease installation, only use inert, oxygen-compatible lubricants suitable for seals and the process, such as, for example, DuPont Krytox®. Slide and lock the filter into place by holding the filter only by the solid part at the open end of the filter or (if necessary) by pressing at the closed tip of the filter with your fingers.

WARNING: Hazard of reactions of cleaning agents with oxygen

Cleaning agent residues could react with oxygen.

- Make sure to rinse the optical components thoroughly when using cleaning agents.

8 Troubleshooting

8.1 Function errors

The TRANSIC111LP monitors its operation. Monitoring includes:

1 Self-test
2 Error detection during operation
3 Error output

8.1.1 Self-test

A self-test is always carried out when the TRANSIC111LP is switched on.

External conditions can cause the self-test to fail, for example, when the lens or mirror are steamed up due to strong condensation in the probe. The signal level is insufficient. The TRANSIC111LP is reset after 10 minutes when the self-test fails due to external factors.

8.1.2 Error control and error categories

There are 3 error categories:

- Fatal errors: Lead to a permanent error state.
- Nonfatal errors: Deactivated automatically when certain conditions are fulfilled. These errors can also be deactivated manually.
- Warnings: Measurement continues but a maintenance request is reported. Warnings can be deactivated manually.

All errors are always cleared during a start.
All error events are stored in an EEPROM error memory.

8.1.3 TRANSIC111LP behavior when errors occur

TRANSIC111LP	Fatal error	Non-fatal error	Warnings
Analog output	Programmable, Fail High or Fail Low	Programmable, Fail High or Fail Low Standard = 3 mA	Normal operation
LED	Red LED blinks rapidly	Red LED blinks slowly	Yellow LED blinks
Digital output	Open	Open	Closed; optional: Open when the digital output is used for signaling warnings.
Display	Error codes are displayed	Error codes are displayed	Measured value is displayed
Maintenance interface	STOP mode: Sends error message RUN mode: O2 value = ***.** POLL mode: O2 value = ***.**	STOP mode: Sends error message RUN mode: O2 value = ***.** POLL mode: O2 value = ***.**	STOP mode: Sends error message RUN mode: Normal operation POLL mode: Normal operation
Error counter	Error counter(s) incremented	Error counter(s) incremented	Error counter(s) incremented
Error log	Error is written to log	Error is written to log	Error is written to log

Table 12: Device status for error and warnings

Emergency shutdown state

If a processor or memory error occurs, the TRANSIC111LP switches to the emergency shutdown state and cannot be started:

Analog output	0.0 mA
LED	Red LED on
Digital output	Open

8.1.4 Error display

Via keypad, see “Display of active and undeleted errors (ERR)”, page 34.

Via serial interface, see “Errors”, page 57.

8.1.5 Error Table

The Error Table shows the errors detected by the TRANSIC111LP software. The most severe errors are listed first. The error text associated with each error gives a description of the error cause.

Table 13: Error Table

Error No.	Error category	Error text	Cause
1	FATAL	EEPROM BASIC PARAMS NOT AVAILABLE (EEPROM basic parameters not available)	Error in EEPROM. (Contact SICK Customer Service)
2	FATAL	EEPROM OPERATION PARAMS NOT AVAILABLE	Error in EEPROM. (Contact SICK Customer Service)
3	FATAL	LASER CURRENT OUT OF RANGE	Error in laser control. (Contact SICK Customer Service)
4	FATAL	SIGNAL LEVEL HIGH	Signal level high Typical: Light incidence too strong Use a filter, see “Cleaning the TRANSIC111LP filter”, page 85
5	FATAL	LASER TEMPERATURE SENSOR FAILURE	Laser temperature sensor error (Contact SICK Customer Service)
6	FATAL	GAS 1 TEMPERATURE SENSOR FAILURE	Temperature sensor error, process gas (Contact SICK Customer Service)
7	FATAL	GAS 2 TEMPERATURE SENSOR FAILURE	Temperature sensor error, enclosure (Contact SICK Customer Service)
8	FATAL	IO-EXPANDER CONNECTION	Hardware error (Contact SICK Customer Service)
9	FATAL	LCD-DRIVER CONNECTION	No connection with display (Contact SICK Customer Service)
10	FATAL	ADC2	Hardware error (Contact SICK Customer Service)
11	FATAL	DIGIPOT CONNECTION	No connection with digital potentiometer (gain and offset control) (Contact SICK Customer Service)
12	FATAL	PELTIER	Error in laser block/hardware error (Contact SICK Customer Service)
13	FATAL	LASER CURRENT MEASUREMENT	Laser current error/hardware error (Contact SICK Customer Service)
14	FATAL	FRONT END CONTROLS	Hardware error (Contact SICK Customer Service)
15	FATAL	PELTIER CURRENT SENSE	Peltier current direction/hardware error (Contact SICK Customer Service)
16	FATAL	VAC LIMIT REACHED	Laser aging allows wavelength to drift/hardware error (Contact SICK Customer Service)
31	NONFATAL	SIGNAL LEVEL LOW	Signal level low. Check optical components for contamination.
32	NONFATAL	SIGNAL CUT	Signal interrupted. Check optical path. Check optical components for contamination.
33	NONFATAL	LASER TEMPERATURE NOT REACHED	Laser temperature has not been reached. Check ambient conditions (temperature).
34	NONFATAL	PEAK LOST	Absorption line lost. Not enough oxygen in enclosure.

Error No.	Error category	Error text	Cause
36	NONFATAL	ANALOG OUTPUT LOAD TOO HIGH	Analog output load too high. Check specifications for voltage supply unit and cables. (See Technical Data, see “Inputs and outputs”, page 91)
37	NONFATAL	NO MEASUREMENT RESULTS	No measuring results (results from other errors)
38	NONFATAL	ANALOG OUTPUT RANGE	Oxygen concentration value measured outside set output range. Adjust the output range settings when necessary.
51	WARNING	SIGNAL QUITE LOW	Transmission (SIL) <20 % Maintenance request for optical components, see “Cleaning the optical components”, page 83
52	WARNING	EEPROM LOG&STATS CORRUPTED	Non-critical hardware error: EEPROM protocol and statistics erroneous. (Contact SICK Customer Service)
53	WARNING	WATCHDOG RESET OCCURRED	Reset.

9 Shutdown

9.1 Safety information on shutting down

Open the display cover only for operation purposes. Never open the side cover when voltage is switched on.

CAUTION: Never divert the laser beam
Never insert an optical instrument into the measuring gap to possibly divert the laser beam while the device is switched on.

All safety regulations for shutdown can be found in Section *Installation* on "Installation", page 17 and in Section *Maintenance* on "Assembly and disassembly", page 81.

9.2 Preparations for shutdown

- Inform all connected locations.
- Passivate/deactivate the safety devices.
- Stop the inflow.
- Save the data.

9.2.1 Switching the TRANSIC111LP off

- Switch the voltage supply of the device off.

9.3 Protecting a shutdown TRANSIC111LP

- Store in a protected, dust-free and dry place.
- Observe the storage temperatures, see "Operating environment", page 91.

9.4 Disposal

- The device can easily be disassembled into its components which can then be sent to the respective raw material recycling facilities.
- Dispose of the device as industrial waste.

- Observe the respective valid local regulations for the disposal of industrial waste.

9.5 Shipping the TRANSIC111LP to SICK

NOTICE: Hazard through process residues on the device
- Clean the TRANSIC111LP before shipping to SICK.

10 Technical Data

10.1 Specifications

Measuring parameters	
Measuring ranges (scalable)	0 ... 25% O_2 or 0 ... 100% O_2
Precision	±0.2% O_2
Temperature dependence in T-range	±2% of measured value, max. dT/dt 1 °C/min
Stability	Zero point drift ±0.1% O_2 / year Span gas drift ±0.8% of measured value / year
Measurement reaction time (T_{63}/T_{90}) in *still* air without filter with stainless steel mesh with stainless steel mesh and PTFE	 10 s / 20 s 10 s / 25 s 30 s / 70 s
Operating pressure range	0.8 ... 1.4 bar_a
Start time	2.5 min
Warming up time (according to specification)	3 min

Table 14: Classification

Operating environment	
Operating temperature range for probe (installed in process) for electronics (housing) for measuring device (ambient air measurement) for cable	 -20 ... +80 °C -20 ... +60 °C -20 ... +60 °C -20 ... +60 °C
Storage temperature range	-40 ... +80 °C
Operating pressure range	0.8 ... 1.4 bar_a
Air humidity	100 % r.h. non-condensing
Altitude	Up to 2000 above sea level
Electrical compliance	In accordance with EN61010-1
Safety information	Laser product of protection class 1; Information on eye-safe use of the device can be found in "Assembly and disassembly", page 81.

Table 15: Operating environment

Interfaces	
Power supply (nominal) Allowed input range	24V DC, 500mA 11 .... 36V DC
Power input maximum	 6 W
Maximum power consumption U_{in} = 11 VDC U_{in} = 24 VDC	 550 mA 250 mA

Table 16: Inputs and outputs

Interfaces	
Analog output Maximum load Precision Temperature dependence	0/4 ... 20 mA, source 500 Ω ±0.05% of full-scale value ±0,005% / °C
Serial output (2-wire, not isolated)	RS-485
Alarm/control relay	30 VAC , 1 A/ 60 VDC, 0.5 A
Serial output (NOTE: Only for maintenance)	RS-232
Connections	Screw terminals, 0.5...1.5 mm^2 RJ45 connection for RS-232
Display	7-segment LCD
LED	Two-colored: Red/green
Resistance between signal ground and ground	10 MΩ

Table 16: Inputs and outputs

WARNING: TRANSIC111LP is not suitable for use in a potentially explosive atmosphere
The TRANSIC111LP is NOT designed or approved for use in potentially explosive atmospheres. Use of TRANSIC111LP in potentially explosive atmospheres is not permitted.

Dimensions	
Dimensions (H × W × D)	306 × 184 × 74 mm
Weight	2.2 kg
Enclosure material	G-AlSi10Mg (DIN 1725)
Enclosure classification	IP66
Flange diameter	96 mm Can be fitted on DIN/ANSI standard flanges. Minimum flange sizes: DIN EN 1092 DN50: Fitted with M16 DIN933 or similar ANSI ASME B16.5 (150) 2.5": Fitted with UNC 3/4"-10 or similar
Cable bushing	Cable gland M20×1.5
Filter	Stainless steel mesh, holes 0.31 mm, wire thickness 0.2 mm
Materials with sample gas contact	AISI 316L, EPDM, FKM or Kalrez® (optional), PTFE, MgF_2, polymer

Table 17: Dimensions and mechanics

Options	
Hydrophobic PTFE filter	Hydrophobic PTFE filter, average pore size 8 µm
Cable glands	Cable gland, M20×1.5 for cable diameter 8 ... 11 mm Pipe screw fitting ½" NPT (conduit)
User cable connection	8 pin M12 plug

Table 18: Options and accessories

Options	
Sample gas cell with wall bracket Gas connections Sample gas cell volumes T_{90} response time with 1 l/min flow rate of the gas sample Weight	1/8" NPT, for 6 mm tube 280 cm^3 11 s 2.2 kg
Test gas connection	Swagelok connection for 6 mm tubes

Table 18: Options and accessories

For plant design[1]	• TS_{min}: -20 °C • TS_{max}: 80 °C • PS: 10 bar • V: 0.28 L • DN: 50 mm

Table 19: Pressure suitability

[1] Outside the measuring range (e.g., in error case); valid for transmitter, seals, sample gas cell and flange adapter with M8 screws). Not valid for flange adapter with M5 screws (0.5 bar).

Set, flange seal, FKM	2064909
Set, flange seal EPDM	2060226
Set, flange seal, GYLON	2060195
Set, O-ring 47* 2, FKM (bayonet connection)	2064907
Set, O-ring 47* 2, EPDM (bayonet connection)	2060189
Set, O-ring 47* 2, KALREZ (bayonet connection)	2060193
Steel mesh filter	2060192
Set, steel mesh filter, PTFE filter, seal FKM	2064911
Set, steel mesh filter, PTFE filter, seal EPDM	2060230
Set, steel mesh filter, PTFE filter, seal Kalrez	2060191
Set, O-ring 33.05* 1.78 FKM (filter)	2064917
Set, O-ring 33.05* 1.78 FKM (EPDM)	2060179
Set, O-ring 33.05* 1.78 Kalrez (filter)	2060184
PTFE filter	2060181
Set, PTFE filter, seal FKM	2064918
Set, PTFE filter, seal EPDM	2060098
Set, PTFE filter, seal Kalrez	2060099
Screw fitting M20*1.5 D8-11	2060180
Screw fitting, M20*1.5 on 1/2"NPTf CUZN	2060179

Table 20: Spare parts

Set, flange assembly, M5 FKM 0.5 bar	2064905
Set, flange assembly, M5 EPDM 0.5 bar	2060227
Set, flange assembly, M5 Kalrez 0.5 bar	2060196
Set, flange assembly, M8 FKM PN10	2068216

Table 21: Accessories

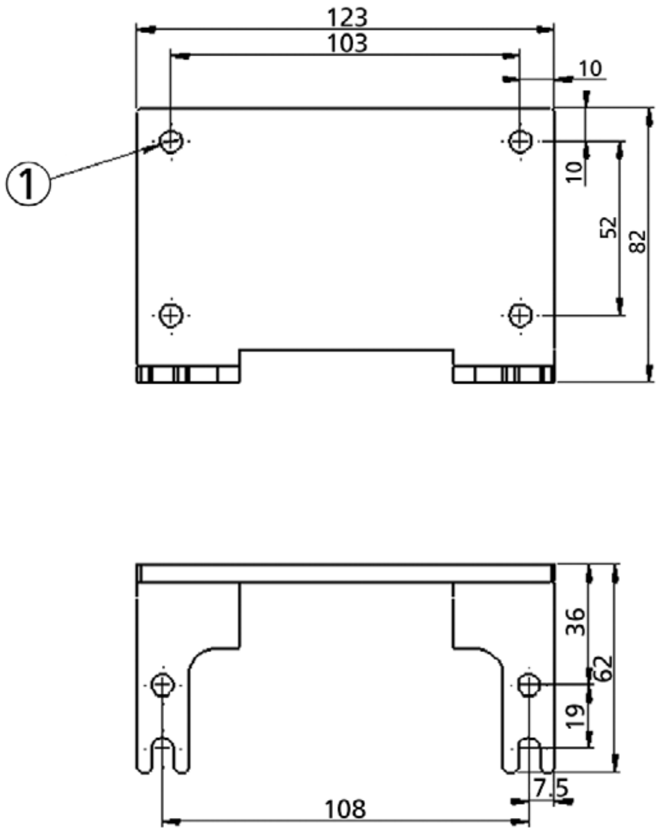
Set, flange assembly, M8 EPDM PN10	2068215
Set, flange assembly, M8 Kalrez PN10	2068214
Set, flange assembly, clamping flange, FKM PN10	2068359
Set, flange assembly, clamping flange EPDM PN10	2068361
Set, flange assembly, clamping flange, Kalrez PN10	2068225
Set, flange assembly, welding adapter, FKM PN10	2068358
Set, flange assembly, welding adapter EPDM PN10	2068360
Set, flange assembly, welding adapter, Kalrez PN10	2068224
Set, sample gas cell, with seal FKM	2064906
Set, sample gas cell, with seal EPDM	2060225
Set, sample gas cell, with seal Kalrez	2060194
Mounting bracket for sample gas cell wall fitting	4066692
Set, wall fitting	2060176
RS-232 serial service cable	2059595
Weather protection (flange assembly)	2065120
Weather protection (wall assembly)	2065084
Power supply unit, class II 100-240VAC/24V/50W	7028789
Connection line, plug (M12), 10 m	2059457
Connection line, plug (M12), 6 m	2059456
Connection line, plug (M12), 2 m	2059455
Plug M12	2060101
Optics, cleaning set	2072979

Table 21: Accessories

11 Annex

11.1 Dimensions of TRANSIC111LP

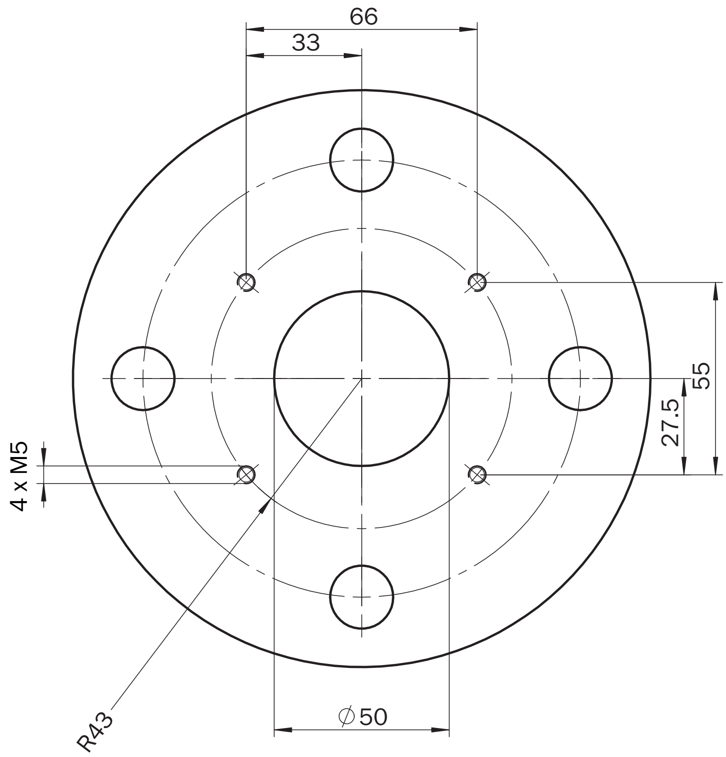
Fig. 45: Dimensions and drill holes, wall bracket in mm



1 = ø 6.5 mm, four pieces

Max. screw size: M6

Fig. 46: Dimensions for fitting the flange with M5 screws (suitable up to 0.5 bar) in mm



When installing with a tube with an outer diameter > 80 mm, do not drill M5 through-holes to prevent leakage from the process.

Fig. 47: Dimensions for fitting the flange with M8 screws (suitable for PS=10 bar) in mm

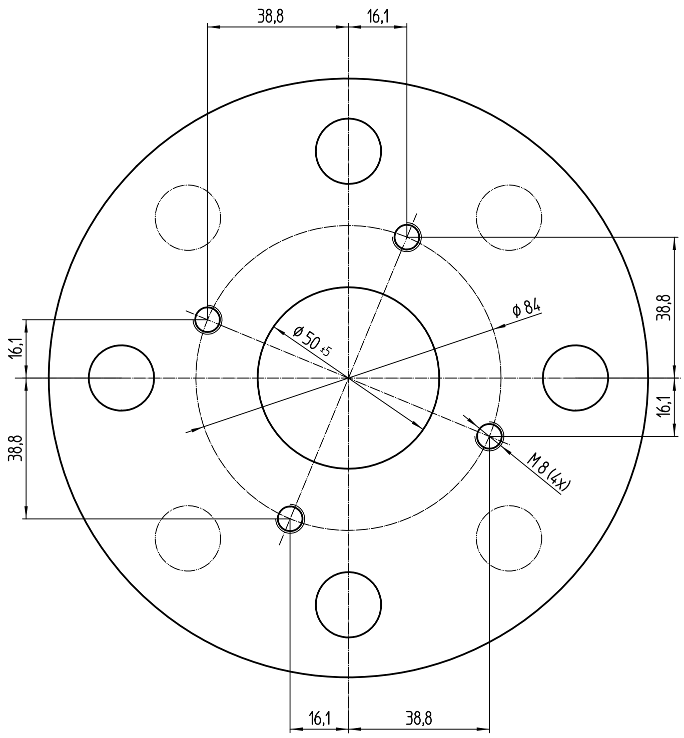


Fig. 48: Adapter flange, clamping flange DIN32676 3"/DN65 (suitable for PS= 10 bar) in mm

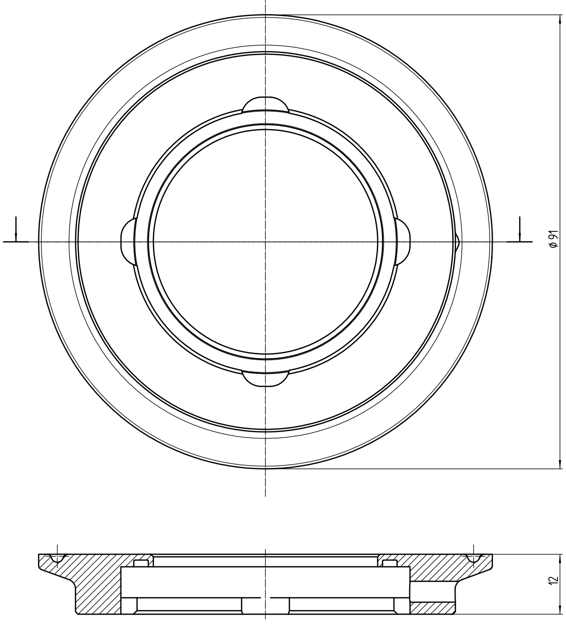


Fig. 49: Adapter flange, weldable (suitable for PS = 10 bar) in mm

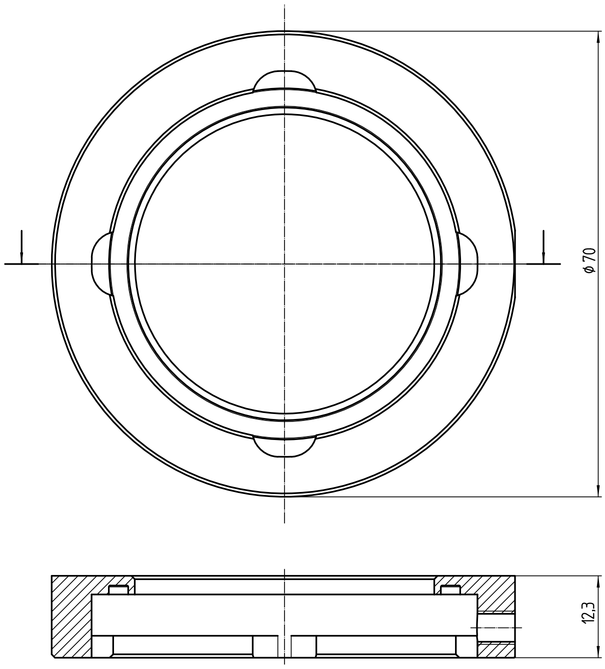


Fig. 50: TRANSIC111LP with flange adapter for process measurements

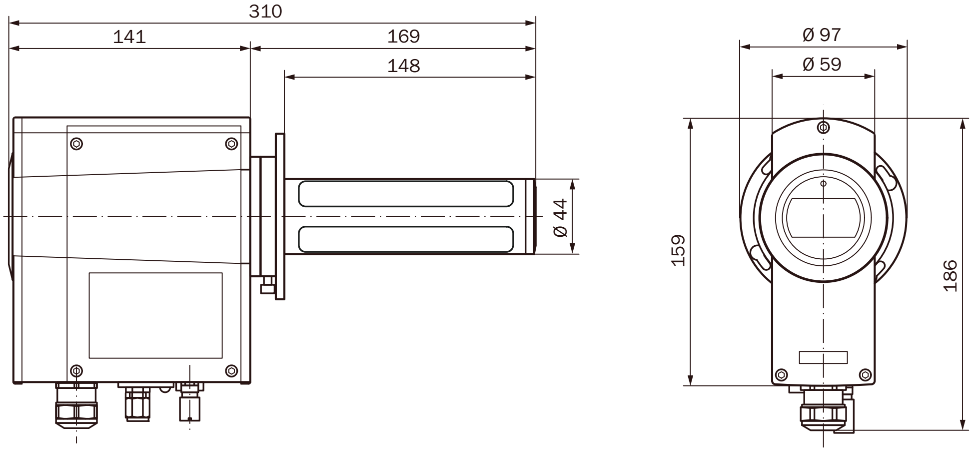


Fig. 51: TRANSIC111LP with wall bracket for ambient measurements

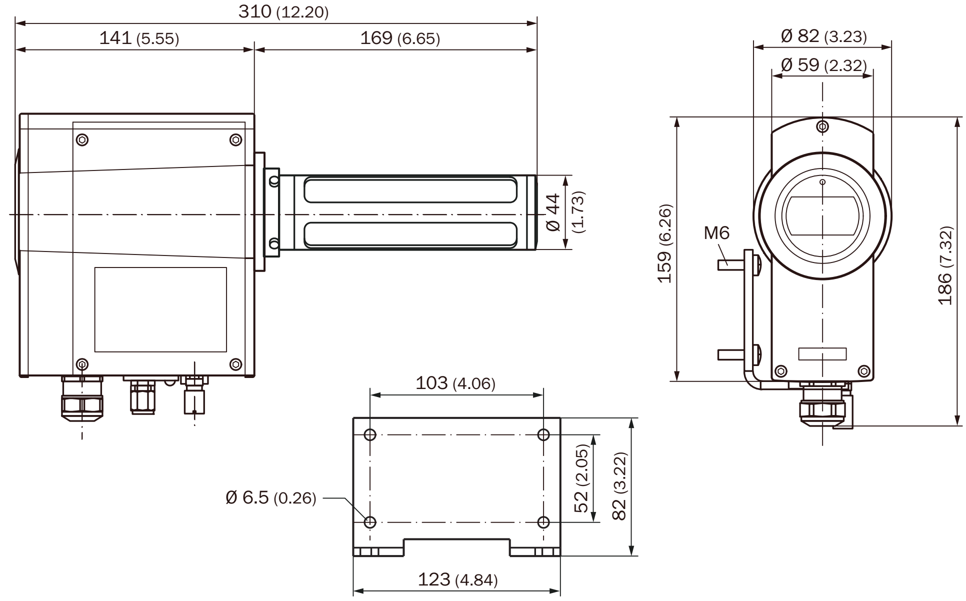


Fig. 52: TRANSIC111LP with wall bracket and sample gas cell

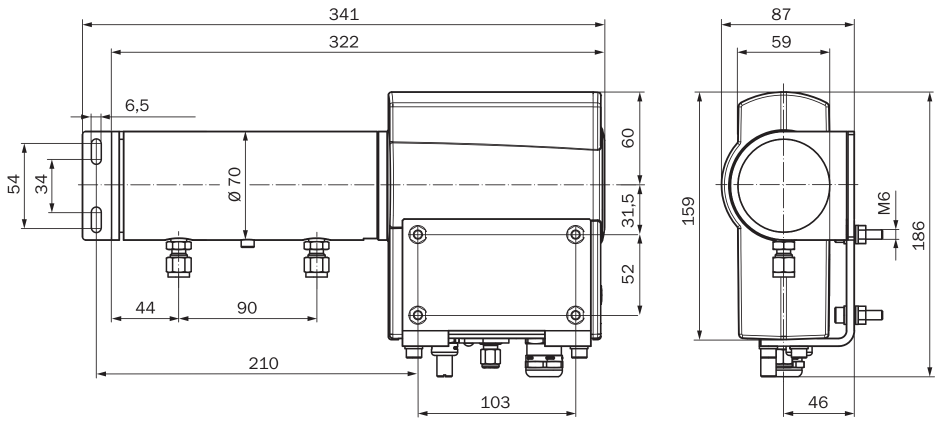


Fig. 53: TRANSIC111LP, weatherproof cover for wall fitting

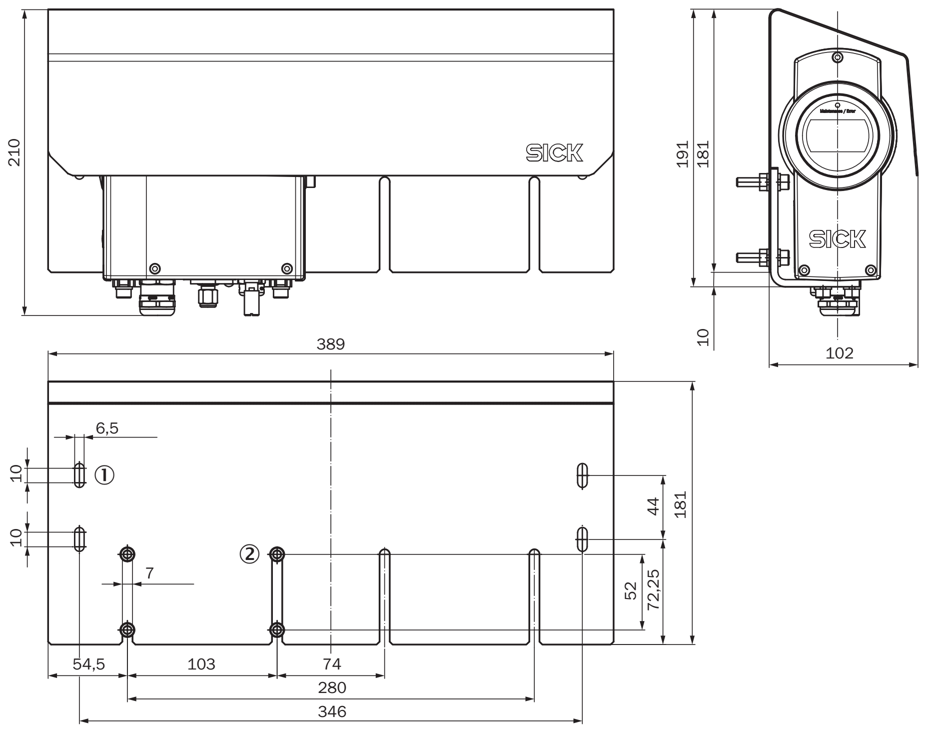
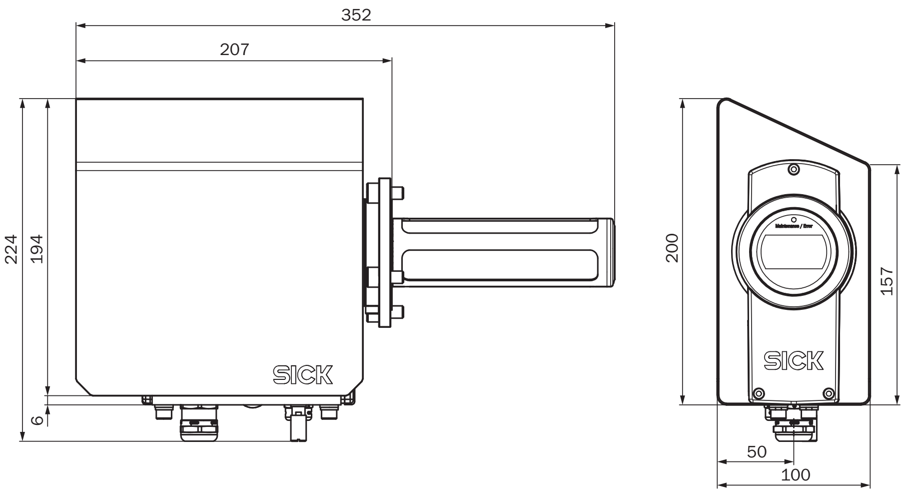


Fig. 54: TRANSIC111LP weatherproof cover for flange fitting



11.2 Type code

SICK TRANSIC Oxygen Transmitter		TS111LP-	1 A 1 A
Version	In-situ (measuring range: 0... 25 vol% O_2)	With flange adapter <0.5bar	A
	Ambient measurement (O_2 measuring range 2 ...25 vol% O_2)	With wall bracket	B
	sample gas cell (measuring range: 0... 25 vol% O_2)	With wall bracket and sample gas cell PN10	C
	In-situ (measuring range: 0... 100 vol% O_2)	With flange adapter <0.5bar	D
	sample gas cell (measuring range: 0... 100 vol% O_2)	With wall bracket PN10 and sample gas cell	E
	In-situ (measuring range: 0... 25 vol% O_2)	With flange adapter PN10	F
	In-situ (measuring range: 0... 25 vol% O_2)	With welding adapter PN10	G
	In-situ (measuring range: 0... 25 vol% O_2)	With 3" clamping flange PN10	H
	In-situ (measuring range: 0... 100 vol% O_2)	With flange adapter PN10	I
	In-situ (measuring range: 0... 100 vol% O_2)	With welding adapter PN10	J
	In-situ (measuring range: 0... 100 vol% O_2)	With 3" clamping flange PN10	K
Filter type[1]		No filter; [2]	1
		Stainless steel mesh	2
		PTFE filter with stainless steel mesh[3]	3
Output range[4] (configurable during start-up)[4]		O_2 (0...5 vol%)	A
		O_2 (0...10 vol%)	B
		O_2 (0...15 vol%)	C
		O_2 (0...20 vol%)	D
		O_2 (0...25 vol%)	E
		O_2 (0...100 vol%)	F
	Output range from	________vol% O_2 to________vol% O_2	X
Analog output[5] (configurable during start-up)[4]		4 ... 20 mA	1
		0 ... 20 mA	2
Error status for analog output (configurable during start-up)[4]		3 mA or lower	A
		21 mA	B
Digital output		Digital output only opens when error status occurs	1
Set value _____ vol% (hysteresis 1 vol% O_2)		Digital output opens when O_2 value underflows the set value	X
Configurable during start-up, standard setting 10 vol%, 1% hysteresis)		Digital output opens when O_2 value exceeds the set value	y
		Digital output open for maintenance request	4
Material of seals that come into contact with the process		PDM (ethylene propylene diene rubber)	A
		FFKM Kalrez® Spektrum 6xxxx	B
		FKM (fluoro elastomer)	C
Cable ducts[6]		Cable duct M20 x 1.5 cable ?: 8 ... 11mm	1
		Conduit screw fitting NPT 1/2"	2
		Cable gland (8 pin M12 male) with 2 m cable	3
		Cable gland (8 pin M12 male) with 6 m cable	4
		Cable gland (8 pin M12 male) with 10 m cable	5
Test gas inlet[7]		Without	A
		Test gas inlet with return valve	B
Accesso-ries		Without	1
		RS-232 service interface cable for PC	2
Operating Instructions language		English	B
		German	C
		Spanish	D
		Russian	E
		French	F
		Italian	G
		Portuguese	I
Calibration		Factory calibration in accordance with ISO 9001	1
Maintenance and repairs		Standard maintenance and repairs	A
		TS111LP-	A 3 E 1 A 1 C 2 A 1 B 1 A 2 A

[1] Note: PTFE filter recommended for wet gases close to the dew point
[2] Only for use in clean gas or with a sample gas cell
[3] Note: PTFE filters are not suitable or use with 100 vol% O_2
[4] Note: Standard value is 0 ... 25 vol% O_2, maximum can be between 5 vol% and 25 vol%
[5] Note: Error status 3 mA can only be selected for an analog output from 4 ... 20 mA
[6] Note: Observe maximum cable lengths, see Technical Data
[7] Note: With test gas inlet - PTFE filter recommended

11.3 Humidity Conversion Table

Table 22: Humidity Conversion Table

Humidity value (absolute) in g/m³ H_2O

T(°C) \ RH(%)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
-20	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
-15	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2
-10	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
-5	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
0	0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5
5	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7
10	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	8	9	9
15	1	1	2	3	3	4	4	5	6	6	7	8	8	9	10	10	11	12	12	13
20	1	2	3	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	16	17
25	1	2	3	5	6	7	8	9	10	12	13	14	15	16	17	18	20	21	22	23
30	2	3	5	6	8	9	11	12	14	15	17	18	20	21	23	24	26	27	29	30
35	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
40	3	5	8	10	13	15	18	20	23	26	28	31	33	36	38	41	43	46	49	51
45	3	7	10	13	16	20	23	26	29	33	36	39	42	46	49	52	56	59	62	65
50	4	8	12	17	21	25	29	33	37	41	46	50	54	58	62	66	70	75	79	83
55	5	10	16	21	26	31	36	42	47	52	57	62	68	73	78	83	88	94	99	104
60	6	13	19	26	32	39	45	52	58	65	71	78	84	91	97	104	110	117	123	130
65	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	161
70	10	20	30	39	49	59	69	79	89	99	108	118	128	138	148	158	168	177	187	197
75	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
80	15	29	44	58	73	87	102	116	131	146	160	175	189	204	218	233	247	262	277	291

11.4 Influence of background gases on oxygen measurement

Table for the influence of background gases on oxygen measurement

Gas	Coefficient	Unit
Acetone (C3H6O) (vol%)	-0.51	% of measured value/ (vol% acetone)
Acetylene (C2H2)	-0.47	% of measured value / (vol% acetylene)
Ar (vol%)	0.12	% of measured value / (vol% Ar)
C2H4 (ethylene)	-0.53	% of measured value / (vol% C2H4)
C2H6 (ethane (vol%)	-0.49	% of measured value / (vol% C2H6)
C3H8 (propane (vol%)	-0.75	% of measured value / (vol% propane)
C4H10 (butane (vol%)	-1.02	% of measured value / (vol% butane)
C4H8 (1-butene)	-0.89	% of measured value / (vol% 1-butene)
C5H12 (isopentane, 2-methyl butane)	-0.71	% of measured value / (vol% isopentane)
C6H14 (N hexane)	-0.90	% of measured value / (vol% C6H14)
CH4 (vol%)	-0.30	% of measured value / (vol% CH4)
CO (vol%)	-0,06	% of measured value / (vol% CO)
CO2 (vol%)	-0.15	% of measured value / (vol% CO2)
Cyclohexane (C6H12)	-0.80	% of measured value / (vol% C6H12)
Dichlormethane (DCM) CH2CL2	-0.38	% of measured value / (vol% CH2CL2)
Dimethyl ether	-0.44	% of measured value / (vol% Dimethyl ether)
Ethanol (C2H6O) (vol%)	-0.32	% of measured value / (vol% ethanol)
H2 (vol%)	-0.48	% of measured value / (vol% H2)
H20 (g/cm3)*	-0,03	% of measured value / (g/cm3 H20)
He (vol%)	0.26	% of measured value / (vol% He)
Methyl isobutyl ketone	-0.88	% of measured value / (vol% methyl isobutyl ketone)
NOVEC71	-0.61	% of measured value / (vol% NOVEC71)
Propanol (C3H8O)	-0.41	% of measured value / (vol% C3H8O)
Tetrahydrofuran	-0.58	% of measured value / (vol% Tetrahydrofuran)
Toluene (vol%)	-0.74	% of measured value / (vol% toluene)
Xylene (C8H10)	-0.62	% of measured value / (vol% C8H10)
C2H4 (ethen)	-0.53	% of measured value / (vol% C2H4)
Acetone (C3H6O) (vol%)	-0.51	% of measured value/ (vol% acetone)
Acetylene (C2H2)	-0.47	% of Reading / (vol% acetylene)

Example:

10 % O_2 in 80 % Argon

Relative error: 0.13 x 80 = 10.4 %

Absolute error: 10 % O_2 x 0.104 = 1.04 % O_2

+i If you have questions about further background gases which are not listed here, please contact SICK Service.

+i An up-to-date Table *"Influence of background gases on oxygen measurement"* can be requested from SICK Service.

11.5 Password

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V

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8014084/YNQ3/2015-09

Australia
Phone +61 3 9457 0600
1800 334 802 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0)22 36 62 28 8-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0)2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail marketing@sick.com.br

Canada
Phone +1 905 771 14 44
E-Mail information@sick.com

Czech Republic
Phone +420 2 57 91 18 50
E-Mail sick@sick.cz

Chile
Phone +56 2 2274 7430
E-Mail info@schadler.com

China
Phone +86 4000 121 000
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-2515 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Gemany
Phone +49 211 5301-301
E-Mail info@sick.de

Great Britain
Phone +44 (0)1727 831121
E-Mail info@sick.co.uk

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail office@sick.hu

India
Phone +91–22–4033 8333
E-Mail info@sick-india.com

Israel
Phone +972-4-6881000
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 (0)3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603 808070425
E-Mail enquiry.my@sick.com

Netherlands
Phone +31 (0)30 229 25 44
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 837 40 50
E-Mail info@sick.pl

Romania
Phone +40 356 171 120
E-Mail office@sick.ro

Russia
Phone +7-495-775-05-30
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 (0)1-47 69 990
E-Mail office@sick.si

South Africa
Phone +27 11 472 3733
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321
E-Mail info@sickkorea.net

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886 2 2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2645 0009
E-Mail tawiwat@sicksgp.com.sg

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail info@sick.ae

USA/Mexico
Phone +1(952) 941-6780
1 (800) 325-7425 – tollfree
E-Mail info@sick.com

Vietnam
Phone +84 8 62920204
E-Mail Ngo.Duy.Linh@sicksgp.com.sg

More representatives and agencies at **www.sick.com**

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