BA02195C/66/EN/04.26
70239061

Products Solutions Services

Operating Instructions

OXY5500 gas analyzer

ATEX/IECEx/UKEX: Zone 2
cCSAus: Class I, Division 2

Endress+Hauser
People for Process Automation

Table of Contents

1 About this document

1.1 Document function

The Endress+Hauser OXY5500 optical oxygen analyzer is a standalone device designed to measure oxygen in gases such as natural gas and air. The analyzer is based on fluorescence quenching technology, which provides stable and internally referenced measured values.

These Operating Instructions provide the information required to install, commission, and operate the OXY5500 optical oxygen analyzer safely and correctly.

The instructions describe the standard version of the OXY5500 analyzer and cover the most common options and accessories. Additional information for optional functions, advanced configuration, communication interfaces, or service activities is provided in separate documentation.

Visual elements such as figures, tables, and symbols support understanding of the operating procedures and safety-related information. Symbols highlight important information and must be observed to ensure safe and reliable operation.

1.2 Symbols

Instructional icons in this manual indicate potential hazards, important information, and useful guidance.

Structure of Information	Meaning
⚠ WARNING **Causes (/consequences)** Consequences of noncompliance (if applicable) ▸ Corrective action	Indicates a dangerous situation. Failure to avoid the situation can result in a fatal or serious injury.
⚠ CAUTION **Causes (/consequences)** Consequences of noncompliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** Consequences of noncompliance (if applicable) ▸ Action/note	This symbol alerts you to situations which may result in damage to property.

1.3 Associated documents

The analyzer shipment includes product safety instructions. Review all safety instructions before installing or operating the analyzer.

This document is part of a complete documentation package:

Part Number	Document Type	Description
BA02195C	Operating Instructions	Provides a comprehensive overview of the analyzer and step-by-step installation instructions
BA02196C	Sample Conditioning System (SCS) Operating Instructions	Commissioning, operation, and maintenance of the Sample Conditioning System
SD02868C	Service Software Instructions	Use of the OXY5500 Service software to diagnose and maintain OXY5500 Optical oxygen analyzer systems
TI01656C	Technical Information	Technical data and product overview
XA02754C	Safety Instructions	Safety instructions and requirements for the analyzer
	Calibration certificate (paper copy)	Provides sensor-specific calibration values required for setup and sensor replacement

For additional instruction manuals, please refer to the following:

- **For custom systems:** Order-specific documentation is located by analyzer serial number (SN). Refer to the Endress+Hauser website (https://endress.com/contact) for the list of local sales channels to request order-specific documentation.
- **For standard orders:** Refer to the product page to download the published manuals for the analyzer: www.endress.com.

1.4 U.S. export compliance

The policy of Endress+Hauser is strict compliance with U.S. export control laws as detailed in the website of the Bureau of Industry and Security at the U.S. Department of Commerce.

2 Basic safety instructions

2.1 Requirements for personnel

This document is intended for trained personnel responsible for installing, operating, and maintaining the analyzer. Personnel must be familiar with applicable safety requirements and regulations.

2.2 Workplace safety

This section describes required safety measures during operation and service. Not all hazards can be described. You are responsible for identifying and mitigating risks specific to your application.

⚠ CAUTION

Follow all site-specific safety procedures, including:

- Lockout/tagout procedures
- Toxic gas monitoring
- Personal protective equipment (PPE)
- Hot work permits
- Other precautions that address safety concerns related to performing service on process equipment located in hazardous areas

Refer to the instructions for each situation listed below to mitigate associated risks.

2.2.1 Electrocution hazard

1. Shut off power at the main disconnect external to the analyzer and open the enclosure.

   ⚠ CAUTION

   - Complete this step before performing any work near the main input power or electrical components.

2. Open enclosure door.

2.2.2 Explosion hazard

Work in hazardous areas must prevent ignition sources (heat, sparks, arcing).

Only use tools approved for the area classification.

Electrical connections must not be made or broken with power on (to avoid arcing).

2.2.3 Electrostatic discharge

Clean the display and keypad with a damp cloth to prevent electrostatic discharge.

Adhere to all warning labels to prevent damage to the unit. Refer to *General warnings and cautions* → 📄.

2.3 Operational safety

Symbol	Description
WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT. AVERTISSEMENT - NE PAS OUVRIR SI UNE ATMOSPHERE EXPLOSIVE PEUT ETRE PRESENTE	Follow instructions to avoid possible explosion.
WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS AVERTISSEMENT - DANGER DE CHARGE ELECTROSTATIQUE POTENTIELS - VOIR LES INSTRUCTIONS	Follow instructions to avoid electrostatic discharge.
WARNING - USE DAMP CLOTH TO CLEAN DISPLAY AND KEYPAD TO AVOID STATIC ELECTRICITY DISCHARGE. AVERTISSEMENT - AUX CHARGES ELECTROSTATIQUES. UTILISER UN CHIFFON HUMIDE POUR NETTOYER L'AFFICHEUR ET LE CLAVIER.	Use appropriate tools to avoid electrostatic discharge.

Symbol	Description
WARNING - EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2 OR ZONE 2 AVERTISSEMENT - RISQUE D'EXPLOSION – LA SUBSTITUTIOND E COMPOSANTSP EUTR ENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2 ou ZONE 2	Substitution of components may void certification.
WARNING - EXPLOSION HAZARD - DO NOT REPLACE _______ UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS AVERTISSEMENT - RISQUE D'EXPLOSION - COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX AVANT DE REMPLACER LE ______	Switch off power before replacing components to avoid explosion risk.
WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX	Switch off power before disconnecting system to avoid explosion risk.
CAUTION: DO NOT OPERATE MACHINE WITH GROUNDING WIRE DISCONNECTED ATTENTION: NE PAS METTRE L'APPAREIL EN MARCHE QUAND LE CON DUCTEUR DE MISE A LA TERRE EST DEBRANCHE.	Ensure grounding wire is connected at all times during operation.

2.4 Product safety

NOTICE

▶ Read these instructions and the *OXY5500 Safety Manual (XA02754C)* before operating the analyzer.

All device functions have been tested and comply with safety requirements before shipment. Safe operation is ensured only when these instructions are followed.

- Ensure that the operating voltage stated on the power supply corresponds to the main voltage input before connection. Refer to *Technical data* → 🗎.
- Allow the analyzer to reach ambient temperature before operation. If the instrument is moved from cold to warm surroundings, condensation may form and interfere with the functioning of the system.
- Only qualified personnel may perform calibration, maintenance, and repair.
- If the analyzer condition is uncertain, return it for service. Consult with *Service* → 🗎.

3 Product description

3.1 Device overview

The OXY5500 is a stand-alone oxygen analyzer housed in an ingress-protected stainless steel enclosure. The analyzer is suitable for indoor or outdoor applications and is approved for use in Class I, Division 2, Groups A, B, C, and D, T3. In addition, the analyzer is also marked as ⟨Ex⟩ II 3 G, Ex ec IIC T3 Gc IP66.

The analyzer supports the following measurement ranges:

- 0 to 1000 ppmv
- 0 to 5 % O_2
- 0 to 20 % O_2

This device measures oxygen concentration using a flow-through fiber-optic oxygen sensor installed in a ¼ in. compression tee.

The analyzer includes:

- Integrated LCD user interface
- Internal data logger
- Programmable analog outputs for oxygen concentration and temperature
- Digital interface for communication and data transfer

All calibration and configuration tasks can be performed via PC software.

3.1.1 Temperature measurement

Operation of the optical oxygen sensor requires a Pt100 RTD probe within the specified temperature ranges (see *Appendix A* → 🗎).

Each device is supplied with an RTD probe for:

- Temperature compensation
- Monitoring of process temperature variations

3.1.2 Cross-sensitivity and chemical compatibility

The sensor is suitable for use in:

- Methanol-water mixtures
- Ethanol-water mixtures
- Pure methanol
- Pure ethanol

The use of other organic solvents (for example, acetone, chloroform, or methylene chloride) is not recommended, as these may damage the sensor material.

No cross-sensitivity effects are expected with:

- CO_2
- H_2S
- SO_2

3.2 Product design

3.2.1 Analyzer overview

The analyzer housing contains the measurement electronics, user interface, and connection ports.

Key features include:

- Signal and power connections are located on the side of the housing.
- The front panel includes a keypad and graphical display.
- Internal electronics control the sensor, process signals, and generate output signals.

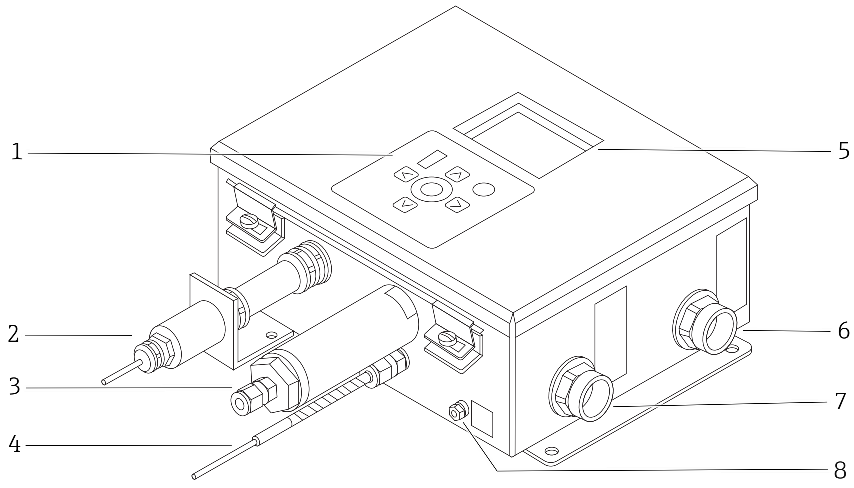

Figure 1. OXY5500 analyzer

#	Description	#	Description
1	Keypad	5	Graphic display
2	Oxygen probe	6	Signaling port
3	Pressure sensor (optional)	7	Analyzer power port
4	RTD probe (pt100)	8	Chassis ground stud

3.2.2 Internal design

The analyzer contains an electro-optical module that:

- Powers the sensor
- Processes measurement signals
- Provides internal connections

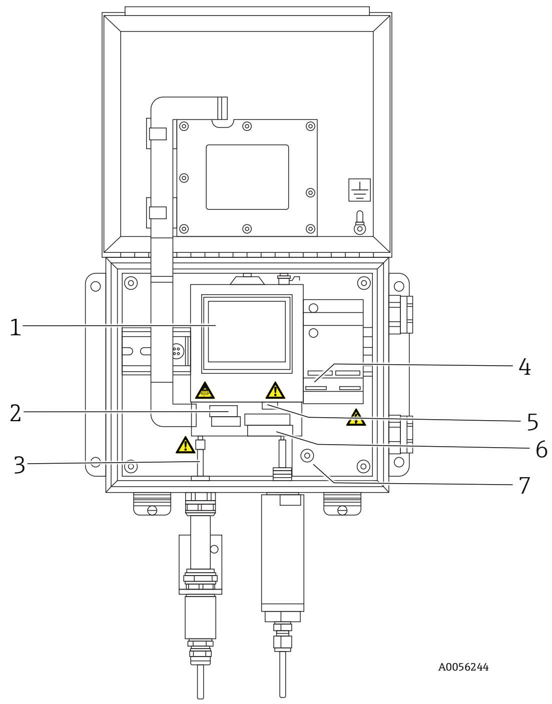

Figure 2. Inside cabinet view (AC version)

#	Description	#	Description
1	Electro-optical module	5	RJ-45 and USB connectors

#	Description
2	Fuse enclosure
3	SMA connector
4	AC/DC power connection

#	Description
6	Relay connections
7	Protective earth ground

The optional sample conditioning system (SCS):

- Controls sample flow
- Includes pressure reduction
- May include heating and temperature control

Refer to the *OXY5500 SCS Operating Instructions* (BA02196C) for more information.

3.2.3 Oxygen sensor

The oxygen sensor consists of:

- A polymer optical fiber (POF)
- A polished sensor tip coated with oxygen-sensitive material
- A protective stainless steel tube

The sensing element is designed to minimize interference from ambient light.

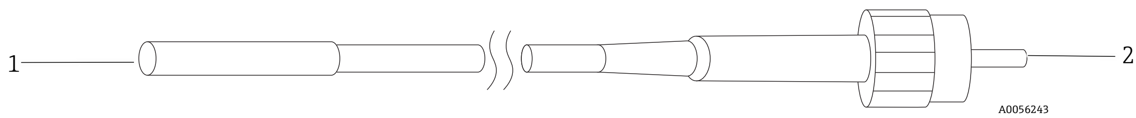

Figure 3. Trace oxygen probe with sensor spot (1) and SMA connector (2)

Standard sensor configuration includes:

- 2 mm polymer optical fiber
- 4 mm stainless steel sensing probe
- Installation via ¼ in. Swagelok union tee with ¼ in. × 4 mm adapter

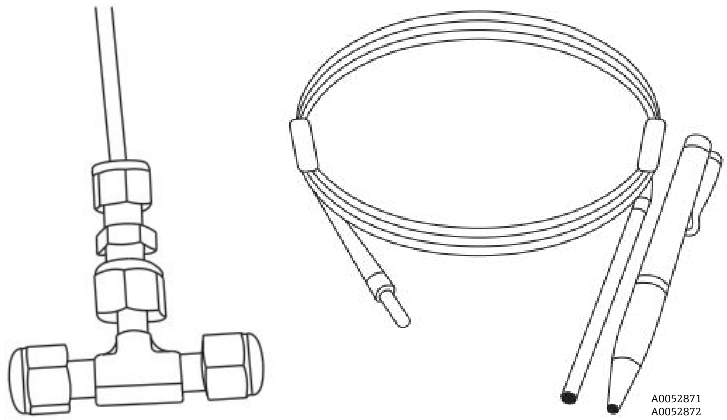

Figure 4. Standard fiber-optic oxygen sensors fittings

3.3 Measurement principle

The analyzer measures oxygen concentration using fluorescence quenching.

Without oxygen:

- Light excites the sensor material.
- The sensor emits fluorescence.
- Emitted light is measured.

With oxygen present:

- Oxygen molecules reduce fluorescence intensity.
- Energy is transferred to oxygen molecules.
- Emitted light decreases.

The reduction in fluorescence is proportional to the oxygen partial pressure.

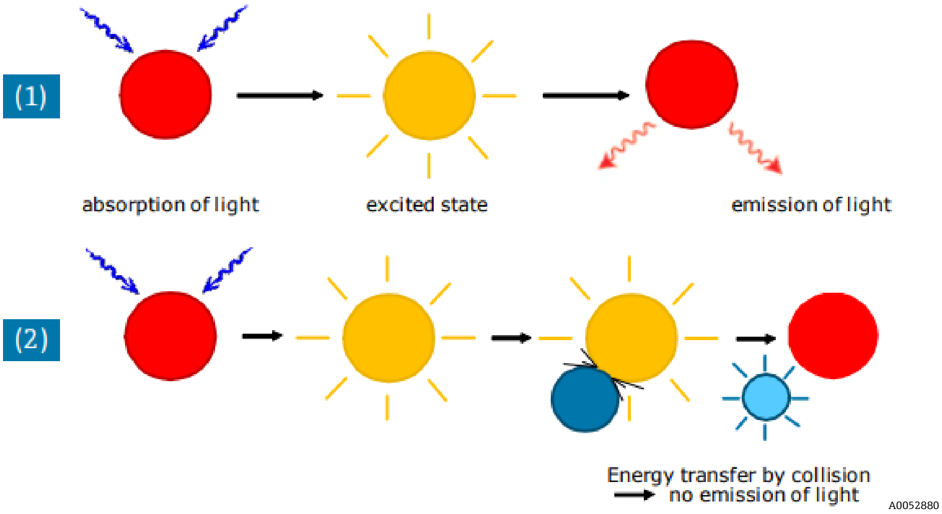

Figure 5. Principle of dynamic quenching of luminescence by molecular oxygen

4 Incoming acceptance and product verification

4.1 Incoming acceptance

Verify that the shipment contents are complete. The shipment should include:

- Endress+Hauser OXY5500 analyzer
- Optional sample conditioning system (SCS), if ordered
- USB cable (Service use)

If any items are missing, refer to *Service* → 🖹.

Unpack the analyzer and place it on a flat surface. Inspect all components as follows:

- Inspect enclosures for dents, dings, or general damage.
- Inspect the supply and return connections for deformation (for example, bent tubing).

Report any damage to the carrier immediately.

⚠ CAUTION

▶ Avoid mechanical shock. Do not drop the instrument or subject it to impact.

Each analyzer is configured according to the order specification. If the delivered configuration does not match the order, contact your Endress+Hauser sales organization.

4.2 Product identification

4.2.1 Manufacturer address

Endress+Hauser
11027 Arrow Route
Rancho Cucamonga, CA 91730
United States
www.endress.com

4.2.2 Symbols on the device

Symbol	Description
	Indicates the presence of hazardous electrical voltage that can cause injury or equipment damage. Follow all applicable safety procedures.
	Indicates that the product must not be disposed of as unsorted waste. Use designated recycling facilities.
	Indicates conformity with applicable EU directives (for example, Directive 2014/34/EU).
	Indicates conformity with applicable UK regulations (UKSI 2016:1107).

4.3 Storage and transport

4.3.1 Transport

The OXY5500 weighs approximately 5.44 kg (12 lb) without the sample conditioning system.

- Lift and carry the analyzer using the enclosure only.
- Do not lift the analyzer by probes, cables, or fittings.

If the analyzer is equipped with an integrated SCS, two persons may be required to move the unit safely.

For additional information, refer to the *OXY5500 SCS Operating Instructions* (BA02196C).

4.3.2 Packing and storage

The analyzer is shipped in protective packaging suitable for transport. Packaging types include:

- Cardboard containers
- Wooden crates

All process connections are sealed to prevent contamination during shipment.

If the equipment is stored or shipped after use:

- Use the original packaging whenever possible
- Decontaminate the system before storage or shipment

4.3.3 Preparing the analyzer for shipment or storage

To prepare the analyzer for shipment or storage

1. Shut off the process gas flow and allow residual gas to dissipate.
2. Connect the purge gas supply:
   a. Prepare a purge gas supply regulated to the specified sample supply pressure.
   b. Connect the purge gas supply to the sample supply port.
3. Open all discharge/vent valves to the low-pressure flare or atmospheric vent.
4. Purge the system to remove residual gases.
5. Turn off the purge supply and allow remaining gas to dissipate.
6. Close discharge/vent valves.
7. Disconnect power and connections:
   a. Disconnect power.
   b. Disconnect tubing and signal connections, then cap all inlets and outlets to prevent contamination.
8. Pack the analyzer securely. If original packaging is not available, use suitable materials to prevent shock and vibration.

If returning the analyzer:

- Complete the Endress+Hauser decontamination form.
- Attach the form to the outside of the package.

4.3.4 Storage

Store the packaged analyzer under the following conditions:

- −20 °C (−4 °F) to 70 °C (158 °F)
- Protected from direct sunlight, rain, snow, and condensation
- Free from corrosive environments

5 Installation

This section describes how to install and set up the OXY5500 analyzer.

Inspect the shipment contents before installation (see *Incoming acceptance* →📄).

NOTICE

Compliance with installation codes

- For Class I Division 2 applications, the analyzer uses a non-incendive protection method.
- For Zone 2 applications, the analyzer uses an increased safety (Ex ec) protection method.
- All applicable local electrical installation codes must be followed.
- The maximum inductance-to-resistance ratio (L/R) for the field wiring interface must be less than 25 µH/Ω.

The safety of the analyzer is the responsibility of the installer and the organization he/she represents.

Installation includes the following steps:

- Preparing hardware and tools
- Mounting the analyzer
- Connecting electrical power
- Connecting analog inputs and outputs

5.1 Installation requirements

The following components are supplied with the analyzer:

- Flow-through tee fitting with oxygen sensor
- Flow-through tee fitting for temperature probe and pressure sensor (pressure sensor optional)

Depending on the configuration, additional hardware and tools may be required.

5.1.1 Hardware

- Unistrut® (or equivalent) bolts and spring nuts, ¼ in. (~6 mm)
- Stainless steel tubing (¼ in. (~6 mm) outer diameter, 0.035 in. wall thickness, seamless recommended)
- ¾ in. conduit or Ex e M20 cable gland
- ¼ in. (~6 mm) mounting screws (M6), suitable for the wall material

5.1.2 Tools

- Drill and bits
- Tape measure
- Level
- Pencil
- Screw driver (Philips)
- Screw driver, small (Flat-head)
- Needle-nose pliers

5.1.3 Sample system requirements for trace oxygen measurement

Avoid plastic tubing. Plastic tubing is gas permeable and allows oxygen to enter the sample system.

Use electropolished stainless steel tubing for all sample connections.

Use small-diameter tubing (3 mm or ⅛ in.) and minimize tubing length.

5.2 Installing the OXY5500

The analyzer is designed for wall mounting or installation on Unistrut® (or equivalent) framing.

Depending on the configuration, the analyzer may be mounted on:

- A mounting plate
- A Unistrut frame

Refer to *Technical data* → for mounting dimensions.

NOTICE

Accessibility

- ▶ Ensure sufficient clearance for operation and maintenance.
- ▶ Provide at least 1 m (3 ft) clearance in front of the analyzer and associated devices.

NOTICE

Load requirements for mounting

- ▶ Mounting structures for loads exceeding 18 kg must support at least four times the maximum static load.

⚠ CAUTION

Risk of mechanical stress on sample lines

- ▶ Route supply and return lines so that connections are not under tension.
- ▶ Avoid excessive mechanical stress on tubing and fittings.

⚠ CAUTION

Risk of leaks due to improper ferrule installation

- ▶ The plastic ferrule used to secure the oxygen sensor can be overtightened.
- ▶ Overtightening may create a leak path in the sample system.
- ▶ Tighten only as required to secure the probe.

⚠ CAUTION

Power disconnection

- ▶ The circuit breaker or switch is the primary means of disconnecting the analyzer from power.
- ▶ Install the breaker:
  - within easy reach of the operator
  - within 3 m (10 ft) of the analyzer

5.2.1 Mounting location

Select a suitable installation location:

- Protected from direct sunlight
- Within the specified ambient temperature range (see *Technical data* →)

Use an analyzer hood or equivalent protection if required.

⚠ CAUTION

Risk of overheating

- ▶ Direct sunlight can increase the analyzer temperature beyond the specified limits.

5.2.2 Mounting the analyzer

To mount the analyzer

1. Identify the mounting hole locations.

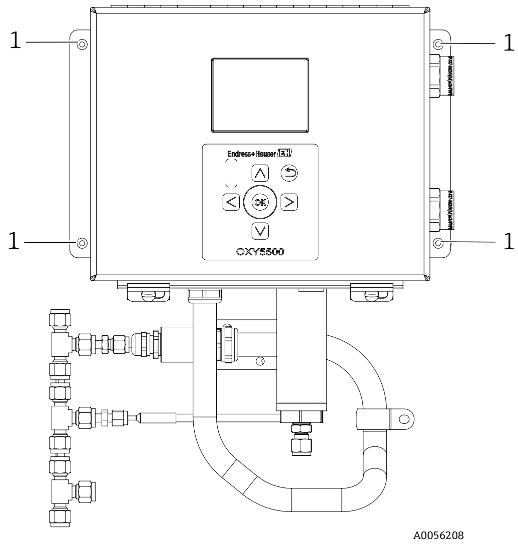

Figure 6. Analyzer mounting hole locations (1)

2. Mark the positions of the top mounting holes.
3. Drill holes suitable for the selected fasteners.
4. Position the analyzer and secure the top screws.
5. Install the bottom screws.
6. Tighten all screws.

After installation, verify that the analyzer is securely mounted.

5.2.3 Considerations for trace oxygen applications

Trace oxygen measurement considerations

Trace oxygen measurements (< 100 ppm) are sensitive to system design.

Oxygen adsorption on tubing surfaces can affect measurement accuracy and response time. Electropolished tubing reduces adsorption effects.

Gas permeability in plastic tubing can introduce trace oxygen into the sample system, resulting in measurement error.

6 Electrical Connection

The OXY5500 supports either AC or DC power input.

NOTICE

Power input

- The OXY5500 is available with one of the following power options:
  - 108 to 253 VAC
  - 9 to 30 VDC (CSA)
  - 18 to 30 VDC (IEC/ATEX/UKEx)
- For DC-powered units, connect the power source directly to the input terminals of the DC/DC converter.
- For AC-powered units, connect power directly to the power supply mounted on the backplate.

⚠ CAUTION

Hazardous-location wiring requirements

- Interconnect the analyzer enclosure using wiring methods approved for Class I, Division 2 or Zone 2 hazardous locations, in accordance with the Canadian Electrical Code (CEC), Appendix B or J, or the National Electrical Code (NEC), Article 501 or 505.
- The installer is responsible for compliance with all local installation codes.

6.1 Protective chassis and ground connections

Before connecting signal wiring or power, connect the protective ground and chassis ground.

Requirements for the protective and chassis grounds:

- Use protective and chassis ground conductors that are equal to or larger than any other current-carrying conductor, including the heater conductor in the sample conditioning system.
- Keep the protective and chassis grounds connected until all other wiring has been removed.
- If the protective or chassis ground conductor is insulated, use green/yellow insulation.

Refer to Figure 1 and Figure 2 for the locations of the protective and chassis ground connections.

6.2 Connecting the power supply

6.2.1 AC connection

Connect AC power to the AC power supply terminals L1, N, and GND. Refer to Figure 1 for the analyzer power port location and Figure 79 for the wiring diagram.

6.2.2 DC connection

Connect DC power to the DC power supply terminals VI+ and −. Refer to Figure 1 for the analyzer power port location and Figure 80 for the wiring diagram.

⚠ WARNING

Risk of electric shock

- Before connecting any wiring to the analyzer, switch off the main breaker or power switch.

⚠ CAUTION

Grounding

- Ground the unit correctly. Connect the main ground lead to the protective grounding stud marked with the ground symbol.
- Connect the chassis ground stud to plant ground using 6 mm^2 or 10 AWG wire.

NOTICE

Maximum DC voltage

- Do not exceed 36 VDC. Higher voltage can damage the electronics.

6.2.3 Connecting electrical power to the analyzer

⚠ WARNING

Risk of electric shock

- Failure to ground the analyzer correctly can create a hazardous voltage condition.

⚠ CAUTION

Cable entry protection

- Use conduit seals or an Ex e cable gland where required by local regulations.

⚠ CAUTION

Disconnect device accessibility

- The breaker or switch in the power distribution panel is the primary disconnect device for the analyzer.
- Locate the power distribution panel within easy reach of the operator and within 3 m (10 ft) of the analyzer.

⚠ CAUTION

Transient protection

- Protect the electrical installation against transients.
- Set the protective device to no more than 140 % of the peak rated voltage at the power supply terminals.

⚠ CAUTION

Disconnect device rating

- Use an approved switch or circuit breaker rated for 15 A.
- Clearly mark the device as the disconnecting device for the analyzer.

To connect electrical power to the analyzer

1. Open the electronics enclosure door of the OXY5500 analyzer. Do not disturb the electrical assembly inside.
2. Route conduit or armored braided cable from the power distribution panel to the conduit hub on the right side of the analyzer enclosure marked for power input.
3. For AC systems, route the ground, neutral (**N**), and **L1** conductors into the electronics enclosure.

   For DC systems, route the **VI+**, **–**, and ground conductors into the electronics enclosure.

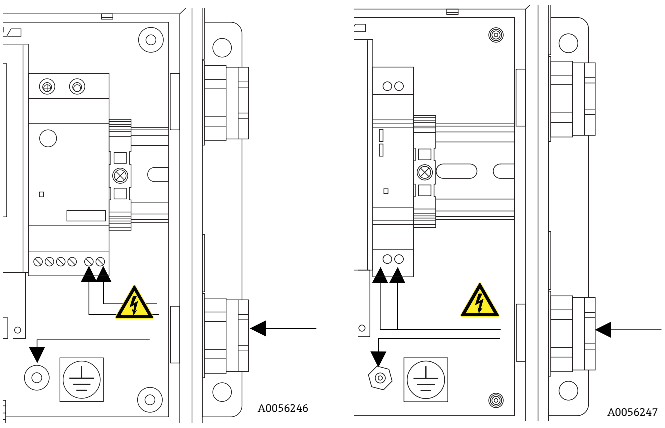

Figure 7. Power connections: AC (left) and DC (right)

4. Strip the jacket and insulation only as much as needed to connect the conductors to the terminal block.
5. Connect the main ground conductor to the protective ground terminal ⊜.
6. Close and tighten the enclosure door.

   NOTICE

   Enclosure door torque

   - Tighten each bolt to 2.25 Nm (20 lbf-in) to maintain the required ingress protection.

6.3 Communication connections

The fiber-optic oxygen cable is connected at the factory to the SMA connector at the bottom of the OXY5500. Additional connectors are shown below.

NOTICE

RS-232/RS-485 Interface

- The analyzer provides standard RS-232 communication using the Modbus protocol.
- Make all connections as described in *Modbus Communication* → 🖹 to avoid communication problems or damage to the unit.

NOTICE

Optical Module with SMA Connector

- The optical module with SMA connector is used to connect the oxygen probe.
- This connection is installed at the factory.

NOTICE

USB Connection

- Use the USB connection only for service and troubleshooting.
- Do not connect a USB cable during normal operation.
- To avoid damage to the port, use only a USB Mini-B cable.
- Refer to the Service Software Operations Manual (SD02868C) for system requirements.

NOTICE

Ethernet

- The analyzer uses standard Modbus TCP/IP communication.
- Use a CAT5 cable or better, and wire the connection in accordance with IEEE 802.3.

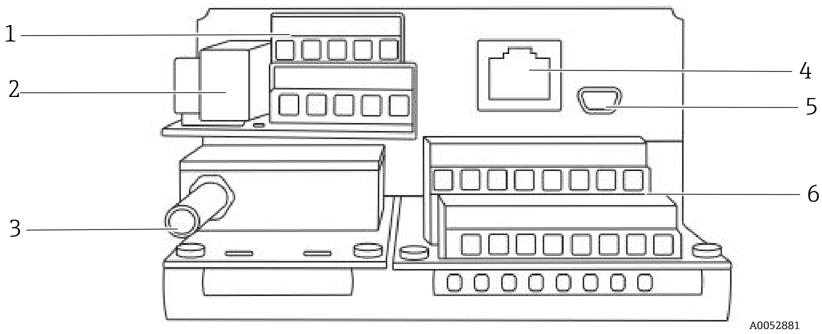

Figure 8. Analyzer connections

#	Description	#	Description
1	TB1	4	RJ-45
2	Fuse Box	5	USB
3	Optical module with SMA Connector	6	TB2

6.4 Analog input/output connections

The OXY5500 provides 2 independent analog outputs and 1 analog input. The 4-20 mA current loops and serial outputs are connected to terminal blocks inside the electronics enclosure. By default, analog outputs IOUT1 and IOUT2 are inactive.

The analog outputs are configurable for oxygen concentration and temperature. One analog input is available for external data collection, such as an external pressure sensor.

Use customer-supplied cables for current loop and alarm connections. Refer to Figure 9.

⚠ WARNING

Risk of equipment damage and electric shock

- The analog outputs are not protected against external input voltage.
- Applying voltage to an analog output can permanently damage the circuit.
- Turn off and lock out system power before opening the electronics enclosure and making connections.

⚠ CAUTION

Hazardous-location wiring requirements

- For Class I, Division 2 applications, the analyzer uses a non-incendive protection method.
- For Zone 2 applications, the analyzer uses an increased safety (Ex ec) non-arcing protection method.
- Follow all applicable local electrical installation codes.
- The maximum allowable inductance-to-resistance ratio (L/R) for the field wiring interface is 25 μH/Ω.
- Zone 2 uses an increased safety ec non-arcing protection method; as such, all portions of the local electrical installation codes apply. The maximum allowed inductance to resistance ratio (L/R ratio) for the field wiring interface must be less than 25 μH/Ω.

NOTICE

4-20 mA loop power

- The 4-20 mA outputs are configured as sourcing outputs and provide loop power.
- If a PLC or HMI also provides loop power, install an isolator that complies with the specifications in the table.
- Install the isolator in accordance with the applicable non-incendive or non-arcing protection method.

NOTICE

Cable entry protection

- Use certified Ex e cable glands and cables, or conduit seals and conduit, where required by local regulations.

6.4.1 Connecting the analog inputs and outputs

To connect analog inputs and outputs

1. Disconnect power from the analyzer and open the electronics enclosure cover. Do not disturb the electrical assembly inside.
2. Route conduit or rated armored cable with the appropriate cable glands (minimum Ex e rated) from the receiving station for the analog outputs/inputs to the conduit hub at the right outer corner of the electronics enclosure.
3. If using conduit, route the customer-supplied cables for the outputs through the conduit into the electronics enclosure.

   If using rated armored cable, the conductors are already provided. Continue with step 4.
4. Strip the jacket and insulation of the current loop and serial cables only as much as needed for the terminal block connection.
5. Connect the wiring according to the tables:
   - Connect IOUT1 and IOUT2 (4-20 mA) to terminals 6 and 8 (see Figure 9 and Table 1. Terminal block TB2).
   - Connect the serial cable to TB1 (see Table 2).
   - Connect the current loop wiring to the receiver.
   - Connect the serial cable to the appropriate serial port.

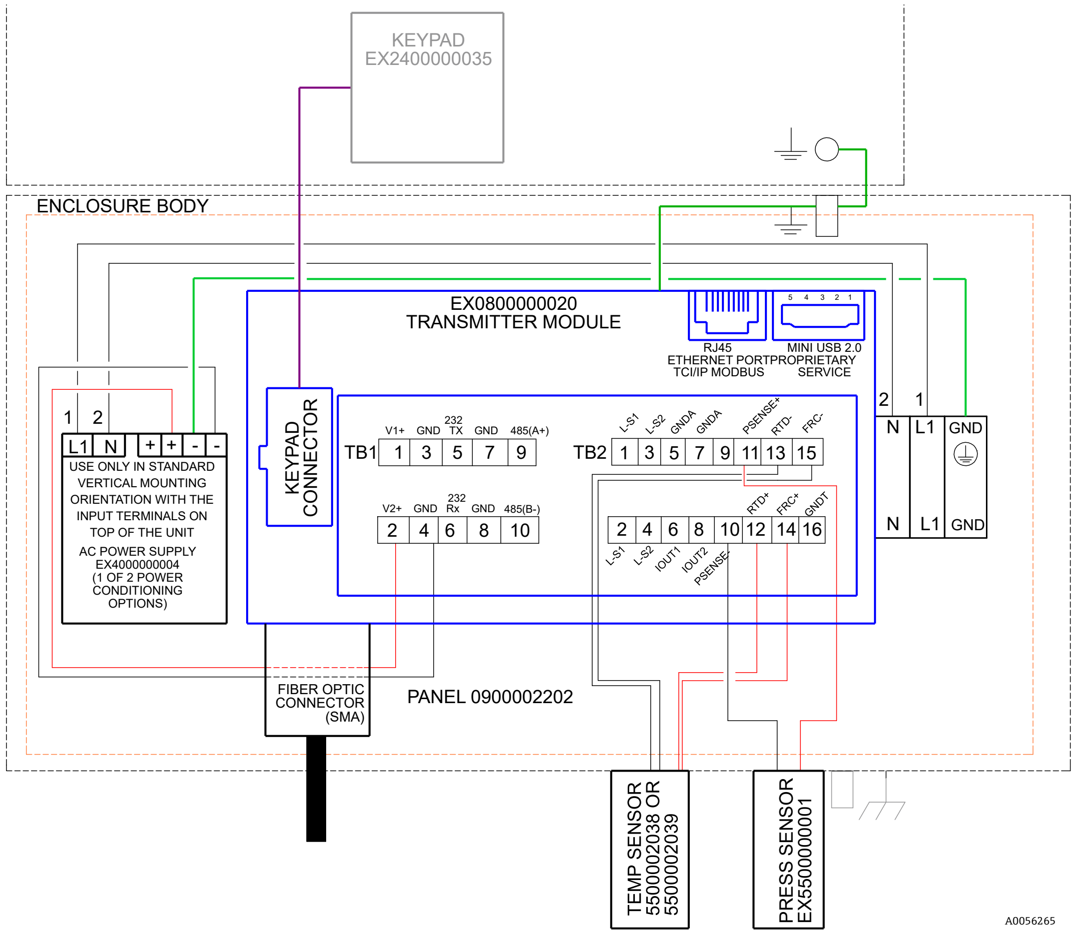

Figure 9. TB1/TB2 connections

Pin	Label	Description	Function
1	L-S1	Relay output, switch 1 (400 V / 250 mA; R max 8 Ω)	General fault alarm; normally closed
2	L-S1	Relay output, switch 1 (400 V / 250 mA; R max 8 Ω)	
3	L-S2	Relay output, switch 2 (400 V / 250 mA; R max 8 Ω)	Concentration alarm; normally closed
4	L-S2	Relay output, switch 2 (400 V / 250 mA; R max 8 Ω)	
5	GNDA	Analog output 1 ground	Configurable analog output 1
6	IOUT1	Analog output 1 (4-20 mA); max load 800 Ω	
7	GNDA	Analog output 2 ground	Configurable analog output 2
8	IOUT2	Analog output 2 (4-20 mA); max load 800 Ω	
9	NC	Not connected	–
10	Psense-	Analog input (4-20 mA), sense (-)	Pressure sensor input
11	Psense+	Analog Input (4-20 mA), sense (+); loop power 16 to 24 VDC; max current 32 mA	
12	RTD +	4-wire RTD Pt100, sense (+)	Temperature probe
13	RTD -	4-wire RTD Pt100, sense (-)	Temperature probe
14	FRC+	4-wire RTD Pt100, force (+)	
15	FRC-	4-wire RTD Pt100, force (-)	
16	GNDT	RTD ground (Shield)	

Table 1. Terminal block TB2

[1] *The 4-20 mA outputs are configured as sourcing outputs and provide loop power. If a PLC or HMI provides loop power, an isolator is required.*

Pin	Label	Description	Function
1	V1+	Power supply 24 VDC, factory connection	DC power input
2	V2+	Power supply 24 VDC, factory connection	DC power input
3	GND	Power supply GND, factory connection	Power ground
4	GND	Power supply GND, factory connection	Power ground
5	232TX	RS-232 transmitter output (typical signal level ± 6 V)	RS-232 signal transmit
6	232Rx	RS-232 receiver input (typical signal level ± 6 V)	RS-232 signal receive
7	GND	RS-232/RS-485 ground	RS-232/RS-485 signal ground
8	GND	RS-232/RS-485 ground	RS-232/RS-485 signal ground
9	485(A)+	RS-485 non-inverting receiver input and non-inverting driver	RS-485 signal
10	485(B)-	RS-485 inverting receiver input and inverting driver output	RS-485 signal

Table 2. Terminal block TB1

7 Commissioning

This section describes how to start the analyzer and prepare it for first measurement.

Before commissioning, verify all electrical and sensor connections (see *Technical data* → 🗎).

7.1 Turning on the device

To turn on the device

1. Apply power to the analyzer.
   The analyzer performs an automatic self-test.

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   After the self-test, the display switches to the main measurement screen.
2. Allow the analyzer to warm up before use. Allow approximately 5 minutes for warm-up.
   ℹ Warm-up may increase to 15 minutes if the sensor has been exposed to high oxygen concentrations.

After the warm-up, complete an initial calibration to achieve accurate measurements.

7.2 Performing initial measurement setup

Perform calibration before starting measurement.

Initial measurement setup enables operation. Before performing the two-point gas calibration, set the following:

- Temperature compensation
- Pressure compensation
- Measurement interval

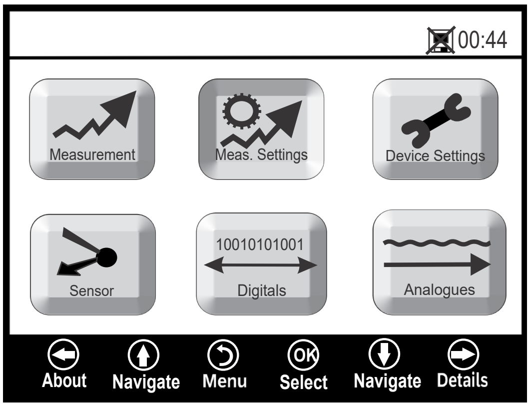
After these initial settings, perform a two-point gas calibration to achieve accurate measurement results. Refer to *Calibration* → 🗎.

7.2.1 Setting temperature compensation

ℹ When setting temperature compensation, use **Manual** mode only if the temperature probe is not functioning correctly. Refer to *Service* → 🗎 before using the Manual setting.

To set temperature compensation

1. Select **Meas. Settings** from the main menu.



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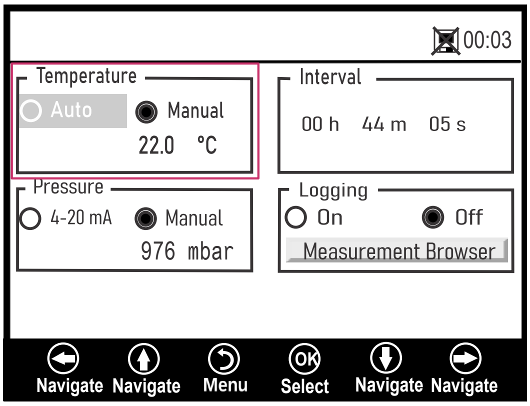
A message window prompts for confirmation to abort the current measurement.

2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Use the Navigation buttons to select the **Temperature** box.



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4. Select one of the following modes:
   - **Auto**. Temperature is measured using the RTD (Pt100) sensor.
   - **Manual**. Enter a fixed temperature value if the temperature at the oxygen sensor is known and constant throughout the measurement.
5. If **Manual** is selected:
   - Select the temperature unit (°C, °F, or K).
   - Enter the temperature value.

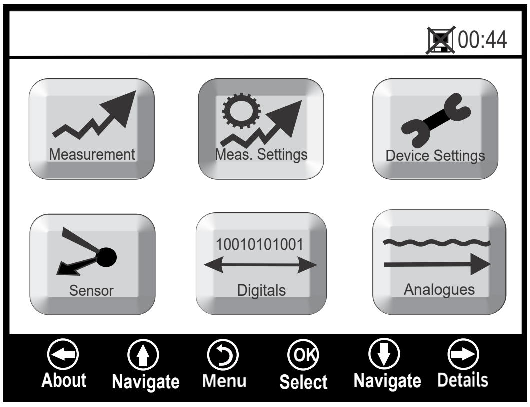
   ℹ Temperature values can be input in °C, °F, or K, in a range from -99 °C to 199 °C. Values are automatically recalculated in the respective unit.
6. Select **OK** to confirm.
7. Select **Menu** to cancel or exit.

7.2.2 Setting pressure compensation

If the OXY5500 was purchased with a pressure sensor, the analyzer is configured to use the pressure sensor from the factory. If the pressure sensor is purchased separately, use the following steps for configuring the pressure sensor.

To set pressure compensation

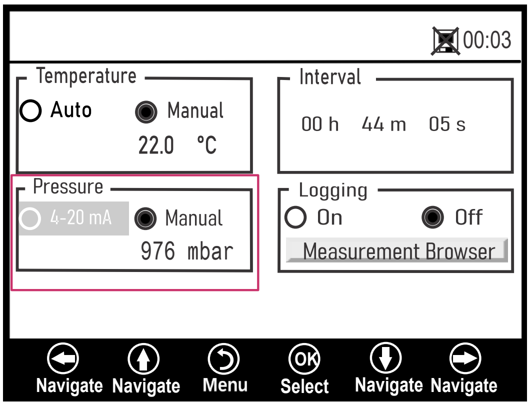
1. Connect a pressure sensor to the analyzer. The display shows the interpreted pressure value from the 4-20mA input. Refer to *Calibrating the input* → 🖹.
2. Select **Meas. Settings** from the main menu.



A0062366

A message window prompts for confirmation to abort the current measurement.

3. Confirm the prompt to stop the active measurement by selecting **Yes**.
4. Use the Navigation buttons to select the **Pressure** box.



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If no pressure sensor is connected, the display shows 1013 mbar.

5. Select one of the following modes:
   - **4–20 mA**. Select when the atmospheric pressure will be measured with a connected pressure sensor.
   - **Manual**. Enter a fixed pressure value if the atmospheric pressure during measurement is known.
6. If **4–20 mA** is selected:
   a. Ensure the pressure sensor is connected.
   b. Verify that the measured pressure value is displayed.
7. If **Manual** is selected:
   a. Select the pressure unit (hPa, mbar, psi, atm, or torr).
   b. Enter the pressure value.
8. Select **OK** to confirm the setting.
9. Select **Menu** to cancel or exit.

7.2.3 Set measurement intervals

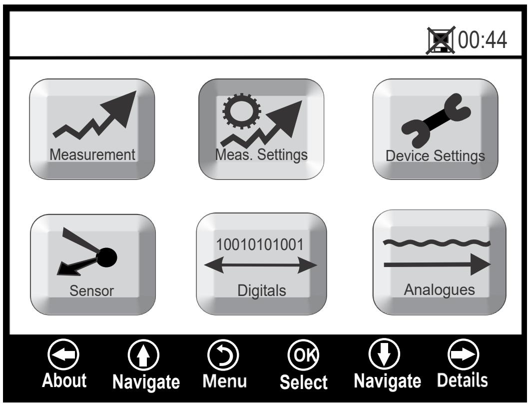
The measurement interval defines how frequently measurements are recorded: shorter intervals provide higher data resolution but increase file size and calibration frequency, while longer intervals reduce data volume and extend the time between recalibration.

The interval determines sensor calibration frequency. For example, a sensor with an interval sampling rate of 30 seconds would produce 100,000 measurement points at 34.7 days.

Endress+Hauser recommends 35 days as a starting point for re-calibration or as the application requires it. Refer to *Calibrating the analyzer* →.

To set the measurement interval

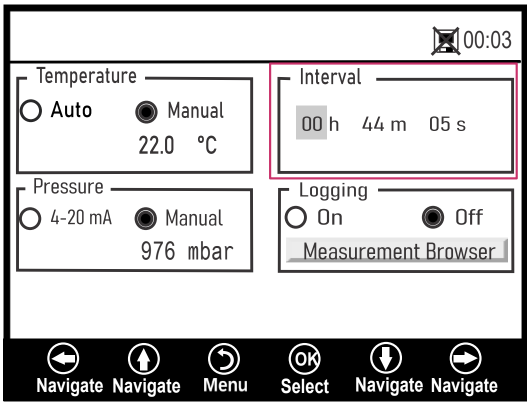
1. Select **Meas. Settings** from the main menu.



A0062366

A message window prompts for confirmation to abort the current measurement.

2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Use the Navigation buttons to select the **Interval** box.



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4. Select one of the following modes:
   - **Single Scan**. Perform one measurement
   - **Interval**. Perform measurements at a defined interval
5. If **Interval** is selected, enter the interval time:
   - Hours
   - Minutes
   - Seconds

   The recommended default interval value is “30 s” (30 seconds). The fastest possible interval for OP-3 is “1 s”. For OP-6 and OP-9, it is “3 s”.

   NOTICE

   ▶ Interval values set to less than 30 seconds can reduce the lifespan of the probe. Please refer to *Signal drift due to photo decomposition* → 🗎 for more information.
6. Select **OK** to confirm the value.
7. Select **Menu** to cancel or exit.

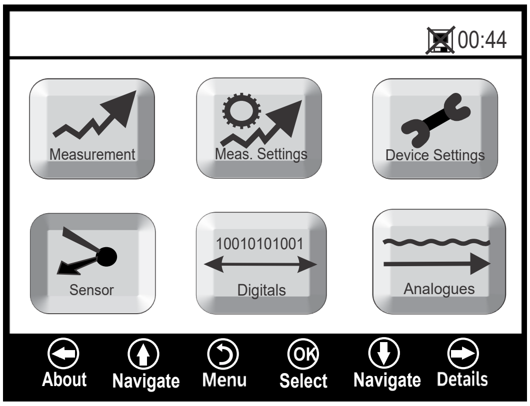
7.2.4 Calibrating the sensor (stored values)

If the sensor has not been calibrated with the analyzer (e.g., first use or after sensor replacement), enter values from the *Calibration Certificate* → 🗎.

Gas calibration provides higher accuracy and is an essential part of commissioning and operation. For gas calibration, refer to *Calibration* → 🗎.

To perform an initial calibration using stored sensor values

1. Select **Sensor** from the main menu.



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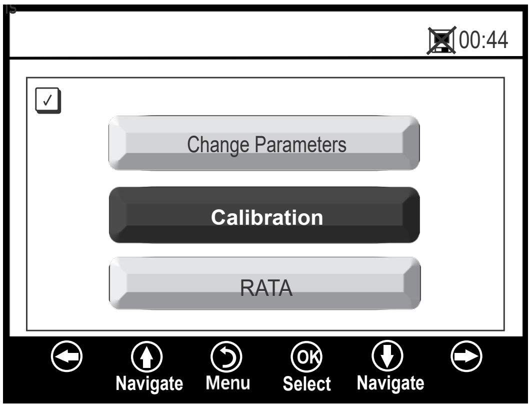
2. Select **Calibration** then click **OK**.



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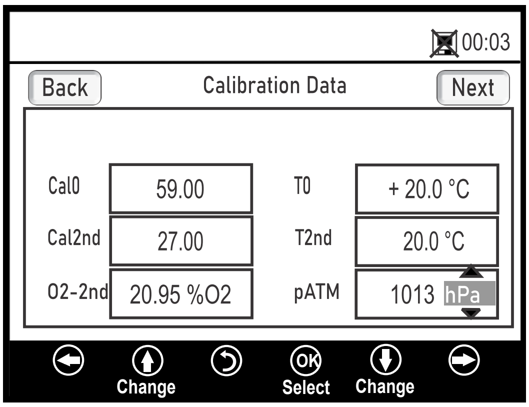
3. When prompted, select **Yes** to stop the measurement.
4. Enter the following values according to the Calibration Certificate:

   Use the **Up** and **Down Arrow** buttons to navigate between input fields. Change the setting or value (one digit at a time) by clicking the **Up** and **Down Arrow** buttons.

   - Cal0
   - T0
   - Cal2nd
   - T2nd
   - pATM: On the Calibration Certificate, "pATM" is shown as "Atmospheric Pressure" under Calibration Specifications during Cal0 and Cal2nd.
   - O2-2nd: Change the O2-2nd value according to the value shown below the cal2nd column.

5. Verify that the correct units are selected for:
   - O2-2nd
   - pATM

6. Click **OK** to save the values.



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7. Click **Save** to complete calibration.

8. Click **Menu** to exit.

The display automatically switches to the measurement screen.

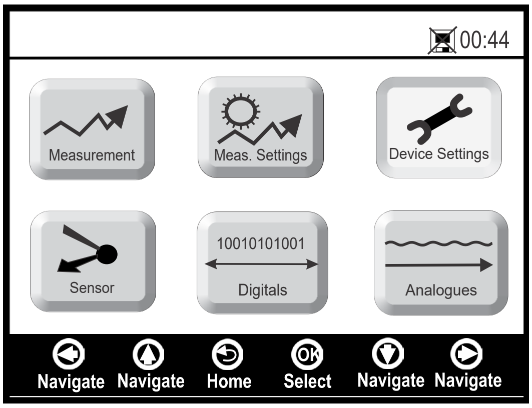
If a different sensor type is selected, a message indicates that the sensor type change resets RATA. Refer to *Relative accuracy test audit (RATA)* → 🖹.

7.3 Setting date and time

Set the correct date and time before starting measurement. Additionally, if power is lost the date and time reset to zero. Ensure Time and Date are set before starting a new measurement so the correct time is stored with the data.

To set date and time

1. From the main menu, select **Device Settings**.



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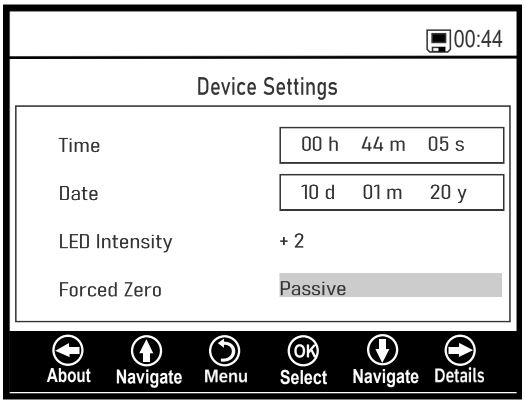
1. Enter the current date and time:
   - **Time:** Set the current time in hour (h), minute (m), and seconds (s). The OXY5500 uses 24-hour time settings.
   - **Date:** Set the current date in day (d), month (m), and year (y).



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2. Confirm the entries then select **OK**.
3. Select **Menu** to return to the main menu.

7.4 Configuring digital communication

Use the **Digitals** menu to configure the digital communication settings for the analyzer. The menu includes the following screens:

- RS-232 settings
- RS-485 settings
- TCP/IP settings

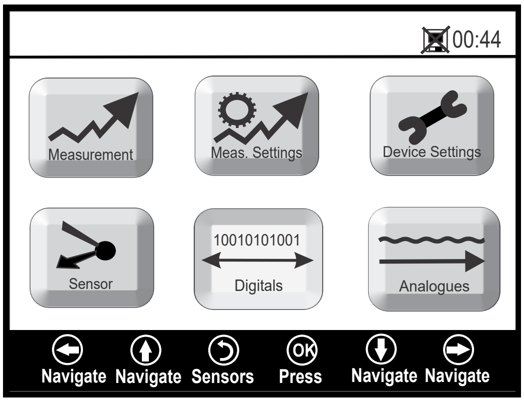


Figure 10. Main menu - Digitals selected

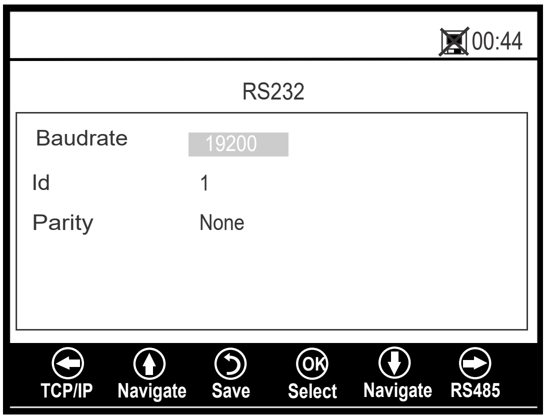
For **RS-232** and **RS-485**, the configurable parameters are **Baudrate**, **ID**, and **Parity**. For **TCP/IP**, the configurable parameters are **DHCP/Static**, **IP**, **Subnet Mask**, **Port**, and **ID**. The **ID** is used in Modbus communication.

7.4.1 Configuring RS-232 settings

Use this screen to set the baud rate of the RS-232 channel.

To configure RS-232 settings

1. Select **Digitals** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Select **RS-232 settings**.



4. Navigate to the required field.
5. Select **OK** to enter editing mode.
6. Set the required value:
   - **Baudrate:** 9600, 19200, 38400, 57600, or 115200
   - **ID:** 1 to 32
   - **Parity:** Even, Odd, or None

   If **Parity** is set to **None**, the number of stop bits is set to 2. If **Parity** is set to **Odd** or **Even**, the number of stop bits is set to 1.
7. Select **OK** to save the change.
8. Select **Save** to apply the settings.

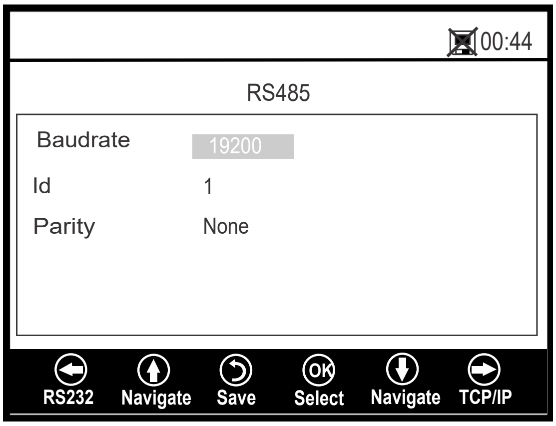
7.4.2 Configuring RS-485 settings

Use this screen to set the baud rate of the RS-485 channel.

To configure RS-485 settings

1. Select **Digitals** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.

3. Select **RS-485 settings**.



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4. Navigate to the required field.
5. Select **OK** to enter editing mode.
6. Set the required value:
   - **Baudrate:** 9600, 19200, 38400, 57600, or 115200
   - **ID:** 1 to 32
   - **Parity:** Even, Odd, or None

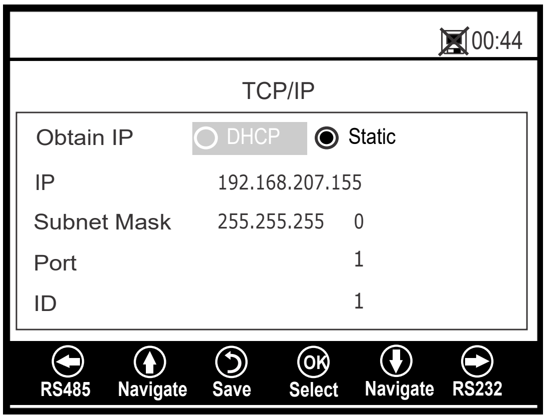
   If **Parity** is set to **None**, the number of stop bits is set to 2. If **Parity** is set to **Odd** or **Even**, the number of stop bits is set to 1.
7. Select **OK** to save the change.
8. Select **Save** to apply the settings.

7.4.3 Configuring TCP/IP settings

Use this screen to set TCP/IP.

To configure TCP/IP settings

1. Select **Digitals** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Select **TCP/IP settings**.



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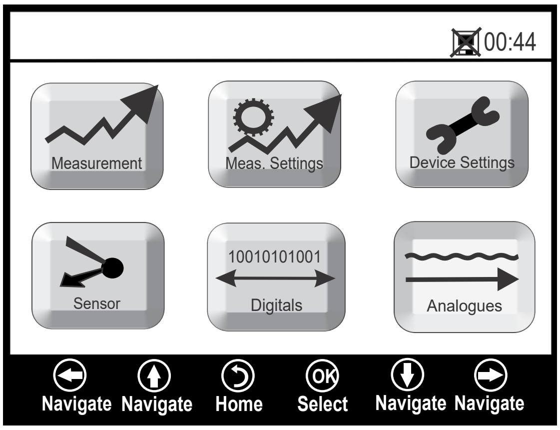
4. Navigate to the required field.
5. Select **OK** to enter editing mode.
6. Set the required value:
   - **DHCP** or **Static**. If **DHCP** is selected, the **IP** and **Subnet Mask** are assigned by the DHCP server and are not editable. If **Static** is selected, the **IP** and **Subnet Mask** must be entered manually.
   - **IP address**. Enter if **Static** is selected.
   - **Subnet Mask**. Enter if **Static** is selected.
   - **Port**. The default **Port** value for most Modbus applications is 502.
   - **ID**. The **ID** can be set to any value from 1 to 32.

7. Select **OK** to save the change.
8. Select **Save** to apply the settings.

7.5 Configuring analog outputs and inputs

Use the **Analogues** menu to configure analog outputs, inputs, and alarms.



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The Analoges menu includes the following screens:

- 4–20 mA Interface Settings
- 4–20 mA Values
- Concentration Alarm Relay (LS2)
- 4–20 mA Calibration

All changes are applied after the next measurement period.

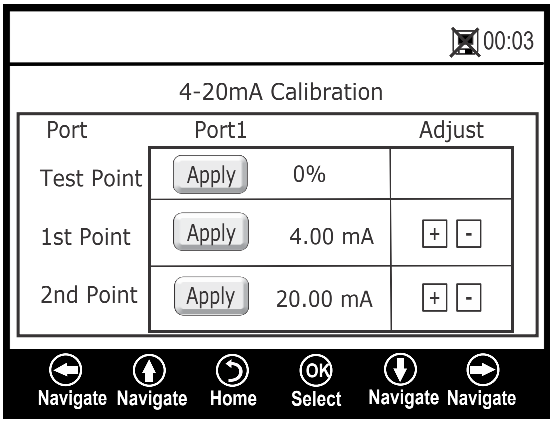
7.5.1 Calibrating analog outputs

Use the **4–20 mA Calibration** screen to calibrate the outputs.

The device is factory-calibrated but can be adjusted to match external devices in your measurement system. Recalibration overwrites the factory calibration.

To calibrate an output

1. Select **Analogues** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Select **4–20 mA Calibration**.



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4. Connect a current measurement device to the output.
5. Set the first point:
   a. Set the **1st Point** to a low value (for example, 4.00 mA). Click **Apply**.
   b. Read the measured value on the reference device.
   c. Use the **Adjust (+/–)** controls to match the reference value.

6. Set the second point:
   a. Set the **2nd Point** to a high value (for example, 20.00 mA). Click **Apply**.
   b. Read the measured value on the reference device.
   c. Use the **Adjust (+/–)** controls to match the reference value.
7. Verify the calibration using test points:
   - 0 % → 4 mA
   - 25 % → 8 mA
   - 50 % → 12 mA
   - 75 % → 16 mA
   - 100 % → 20 mA
8. Compare the values with the reference device.
9. Select **Save** to apply the calibration.

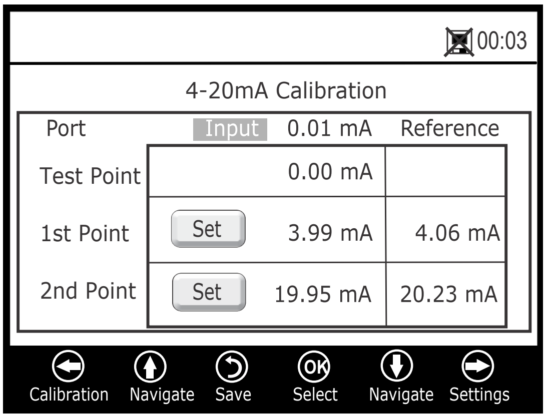
7.5.2 Calibrating analog inputs

Use the **4–20 mA Calibration** screen to calibrate the input signal.

To calibrate the input

1. Select **Analogues** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Select **4–20 mA Calibration**.
4. Set the uncalibrated reference for the 1st Point:
   a. Apply a low current to the device.
   b. Enter the value in the **Reference** column for the **1st Point**.
   c. Select **Set** when the reading is stable.

   The last measured value displays in the top row next to the selected port.



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5. Set the uncalibrated reference for the 2nd Point:
   a. Apply a higher current.
   b. Enter the value in the **Reference** column for the **2nd Point**.
   c. Select **Set** when the reading is stable.
6. Check the **Test Point** value.
   - The displayed value is the calibrated signal used for calculating the pressure value.
   - The deviation from the reference device should be less than 0.05 mA.
7. Select **Save** to apply the calibration.

7.6 Configuring analog outputs and alarms

Use this section to configure analog outputs, scaling, and alarm limits. This menu includes the following screens:

- 4–20 mA Interface Settings
- 4–20 mA Values
- Concentration Alarm Relay (LS2)
- 4–20 mA Calibration

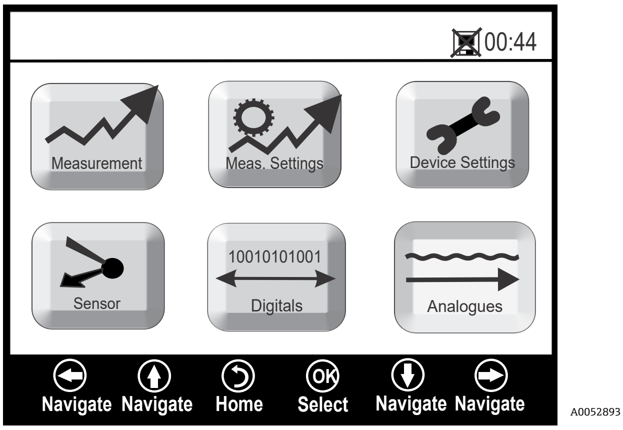


Figure 11. Main menu - Analogues selected

7.6.1 Configuring 4–20 mA interface settings

Use this procedure to configure the 4–20 mA interface parameters for the selected port.

The following parameters are available for **Port1**, **Port2**, and **Input**:

- **Output** (Port1/Port2 only)
  - Oxygen
  - Temperature
  - The **Input** is always pressure and cannot be changed.
- **Mode** (Port1/Port2 only)
  - **Off**: no input reading or output writing
  - **Linear**: low and high values correspond to 4 mA and 20 mA

  ℹ Values between these two settings are calculated linearly. Values outside this range initiate the error trigger level.

  - **Bilinear**: low, mid, and high values correspond to 4 mA, 12 mA, and 20 mA. This mode allows higher resolution in a certain range.

    In bilinear mode, the output is defined by configured values that correspond to 4 mA, 12 mA, and 20 mA. Values outside the configured range are limited by the output behavior (for example, oxygen values above 50 correspond to 20 mA).

    In the following example, the gray curve shows higher resolution at low oxygen concentrations. The yellow curve shows higher resolution at high oxygen concentrations.

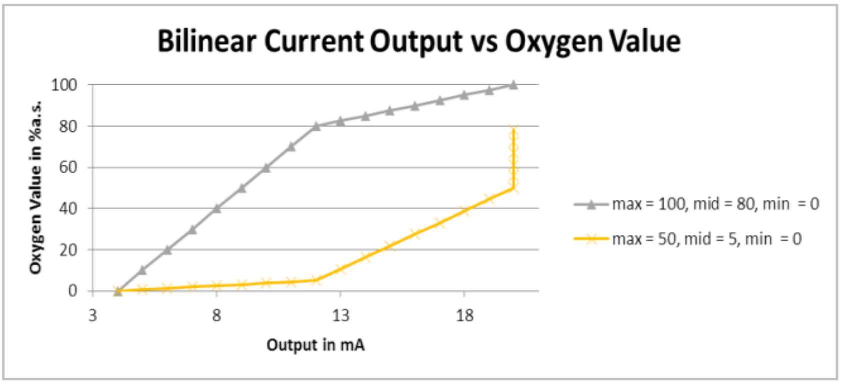


Figure 12. Bilinear current output vs oxygen value A0052930

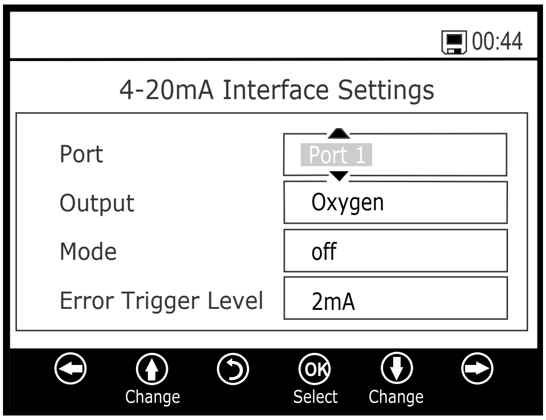
- **Error trigger level**
  - 2 mA
  - 22 mA

  The error trigger level defines the output value when the analyzer enters an error state. The No timestamp error (NTE) option excludes timestamp errors caused by power loss. This option is recommended for installations with an unstable power supply.

  If an error occurs, the output is set to the configured error trigger level (2 mA or 22 mA) for the selected port. Input values outside the 4–20 mA range are interpreted as not valid.

To configure 4–20 mA interface settings

1. Select **Analogues** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Select **4–20 mA Interface Settings**.



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4. Navigate to the required port (Port1, Port2, or Input).
5. Select **OK** to enter editing mode.
6. Set the required parameters:
   - Select **Output (Port1/Port2)**
   - Select **Mode (Port1/Port2)**
   - Select **Error trigger level**
7. Select **OK** to save each value.
8. Select **Save** to apply the settings.

7.6.2 Configuring 4–20 mA scaling values

Use the **4–20 mA Values** screen to define the measurement values that correspond to the output current levels. The available fields depend on the selected mode.

The configured values are used to calculate the output or input signal during measurement.

Modes that can be selected include:

Off

- Scaling values cannot be entered
- No output scaling is applied

Linear

- Enter the **low value** and **high value**.
- The values correspond to:
  - low value → 4 mA
  - high value → 20 mA
- The unit depends on the selected output:
  - Temperature → °C
  - Oxygen → depends on the installed sensor:
    - OP-3: % O_2
    - OP-6: % O_2
    - OP-9: ppmv
- The values are used for signal calculation during measurement.

Bilinear

- Enter the **low value**, **mid value**, and **high value**.
- The values correspond to:
  - low value → 4 mA
  - mid value → 12 mA
  - high value → 20 mA
- The unit is the same as for Linear mode.
- The values are used for signal calculation during measurement.

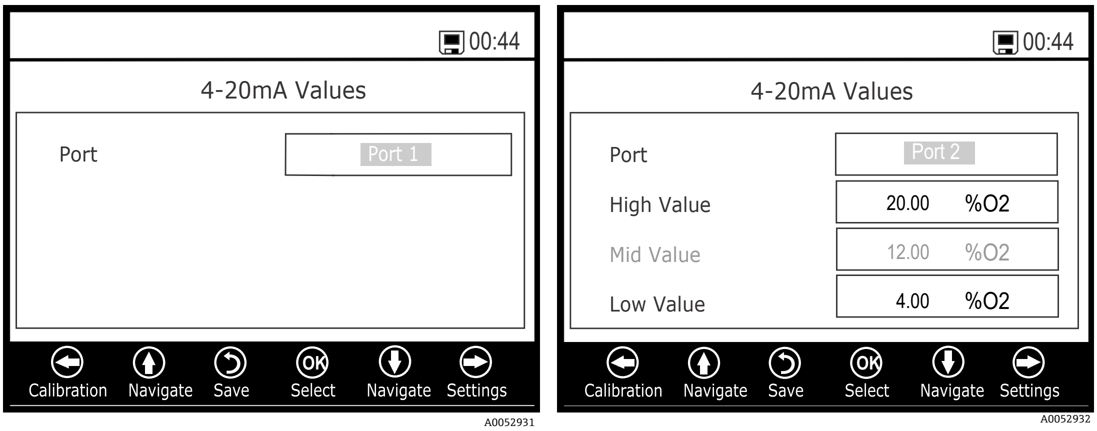


Figure 13. 4-20mA values for mode "Off" (left) and 4-20mA values for mode "Linear" (right)

7.6.3 Configuring the concentration alarm relay (LS2)

This screen is used to define the range of the concentration alarm relay (LS2). If the oxygen value is outside this range, the relay is switched with low impedance and triggers an error. Select the Alarm Low Level to enable or disable the setting.

The unit depends on the currently selected oxygen sensor:

- **OP-3:** % O_2
- **OP-6:** % O_2
- **OP-9:** ppmv

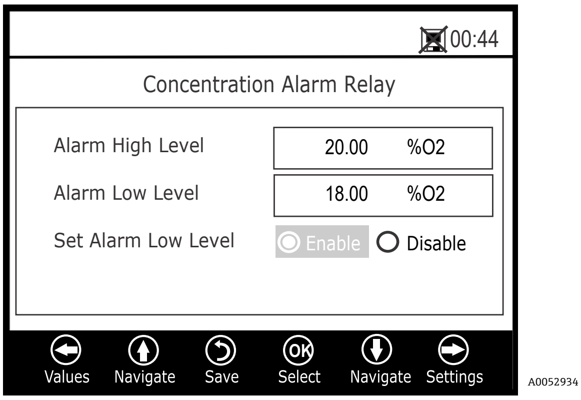


Figure 14. Concentration alarm relay

8 Operation

The chapter describes normal operation of the OXY5500 after commissioning. The analyzer front panel includes an LCD that displays programming menus and measurement data. Refer to Figure 1 for an overview of external components.

After initialization, the main menu displays.

8.1 Operating the user interface

This section gives a review of the menu structure.

Menu level 1	Menu level 2	Menu level 3	Description/function
Measurement	Simple		Displays basic measurements
	Details	Error codes	Displays detailed data and errors
	Graph		Displays trend graph
Meas. Settings	Temperature		Temperature settings
	Interval		Measurement interval
	Pressure		Pressure settings
	Logging & data management		Data storage options
Device settings	Device settings	Time, date, LED intensity, Forced Zero	General configuration
		About	Device information
		Sensor details	Sensor information
Sensor	Change Parameters	Sensor type and sensor constraints	Configure sensor
		Calibration data	View/edit data
	Calibration	Calibration settings-Pressure	Calibration setup
		Calibration settings-Temperature	Calibration setup
		Calibration	Perform calibration
	RATA	Pressure/Temperature for RATA calculation	RATA settings
		Reliable Accuracy Test Audit	RATA calculation
Digitals	RS-232 settings		Communication settings
	RS-485 settings		
	TCP/IP settings		
Analogues	4-20 mA Interface settings		Analog output settings
	4-20 mA Values		
	Concentration alarm relay		
	4-20 mA Calibration		

Table 3. Menu structure

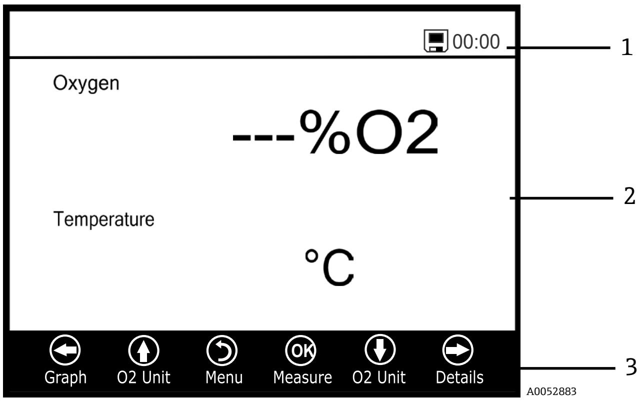


Figure 15. Main menu

The display consists of:

- **Status bar (1)**
  - Displays Time (24-hour format)
  - Indicates logging status:
    - **Monitor** symbol: logging is activated.
    - **Monitor (X)** symbol: logging is not activated.
- **Main display (2)**
  - Shows measurement values and system information.
- **Navigation bar (3)**
  - Use arrow buttons to navigate.
  - Click **Menu** to open the main menu.

To navigate between screens

1. Choose one of the following options:
   - Click the **Right Arrow** to display the detailed measurement screen. Refer to *Details screen* → 🗎.
   - Click the **Left Arrow** to display the measurement graph. Refer to *Graph screen* → 🗎.
2. Click **Menu** to return to the main menu.

8.2 Starting and stopping measurements

8.2.1 Start or stop an active measurement

Start measurement from the **Measurement menu**. If a measurement is active and a configuration or calibration function is selected:

- A message prompts to stop the measurement.
- Select **Yes** to continue.

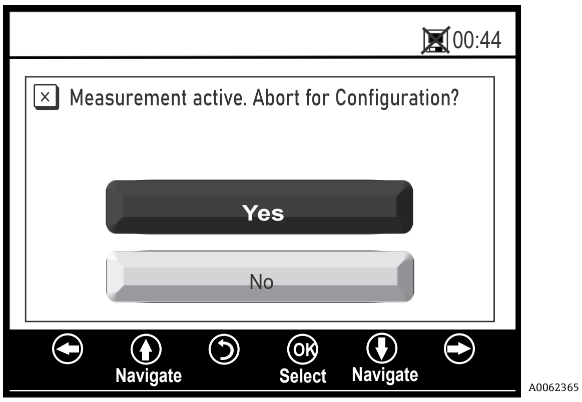


Figure 16. Message window - Stop measurements during configuration

8.3 Calibration

Calibration is required to ensure accurate measurement results. Complete the calibration procedures in this section before starting the measurement.

The sensor uses a fluorescent measurement principle. Over time, the emitted light shifts in wavelength. Calibration offsets this shift to maintain measurement accuracy.

Calibration includes:

- Zero-point calibration (Cal0)
- Span-point calibration (Cal2nd)

The accuracy of trace oxygen measurements (< 100 ppm) depends strongly on correct calibration, particularly the zero-point calibration.

Use high-purity calibration gases and follow all setup and purging procedures exactly to achieve reliable results. Research-grade nitrogen (6.0, 99.9999% purity) is required for zero-point calibration. The gas supplier must provide a composition certificate. Even high-purity nitrogen may contain trace oxygen at the ppb level.

Typical stabilization time for zero calibration is 45 to 60 minutes.

Trace oxygen calibration sensitivity. Incorrect zero calibration or contamination in the sample system can result in significant measurement error.

To complete calibration, perform the following tasks:

- Prepare equipment and materials
- Connect calibration gas
- Purge system
- Configure calibration settings
- Perform pre-calibration purge
- Set calibration points (Cal0 / Cal2nd)
- Save calibration data

8.3.1 Calibration frequency

Calibration frequency depends on the measurement interval.

As a guideline, perform calibration after approximately 100,000 measurements. Short measurement intervals increase calibration frequency, while longer intervals reduce it.

Use Table 4 to determine the recommended calibration interval. Refer to *Set measurement intervals* → for configuration details.

Sampling Rate	Points	Calibration Frequency (Days)
30 seconds	100,000	34.7
1 minute	100,000	69.4
1 hour	100,000	4,166
10 hours	100,000	41,666

Table 4. Interval sampling rate/calibration frequency

8.3.2 Equipment and materials

Use the equipment and materials listed in below to perform calibration.

Figures 49 to 51 show the recommended setup and component locations for the calibration system and cylinder regulator purge process.

Material/ Equipment	Specifications	Vendor; P/N (if available)	Notes
Nitrogen gas (Cal 0)	6.0 research grade (99.9999 %)	Airgas, Inc.; P/N NI ISP 300 (or equivalent)	Use for measurement ranges 0 to 100 ppmv and lower. Suitable for OP-3 or OP-6 probes.

Material/ Equipment	Specifications	Vendor; P/N (if available)	Notes
Nitrogen gas (Cal 0)	5.0 high purity grade (99.999 %)	–	Use for calibration ranges > 100 ppmv. Suitable for OP-3, OP-6, or OP-9 probes, or OP-9 probe with O_2 >100 ppm.
200 ppm O_2 in N_2 gas (Cal 2nd)	200 ppm oxygen in nitrogen	Airgas, Inc.; P/N X02NI99P15A0122 (or equivalent)	Use with OP-9 probe.
2 % O_2 in N_2 gas (Cal 2nd)	2 % oxygen in nitrogen	Airgas, Inc.; P/N X02NI98C15A0614 (or equivalent)	Use with OP-6 probe.
21 % O_2 in N_2 gas (Cal 2nd)	20 to 21 % oxygen (ambient air)	N/A	Use with OP-3 probe.
Cylinder dual stage pressure regulators	High purity, dual-stage, regular, stainless steel diaphragm	Genstar Technologies; R31BQK-DIK-C580-00-DR (or equivalent)	Use for N_2, 200 ppm O_2 in N_2, and 2 % in O_2 in N_2 (quantity: 2).
Stainless steel tubing	3 mm (⅛ in.) tube, 316L, electropolished, seamless	–	Connect cylinders to calibration port. Minimize tubing length between cylinder and port.
Three-way ball valve	0.35 Cv, ¼ in. TF, PTFE, 316SS or 0.35 Cv, 6 mm TF, PTFE, 316SS	Swagelok; SS-42GXS4 SS-42GXS6MM	Connect N_2 and O_2 cylinders to cal port (quantity: 1).
Tube reducer	Stainless steel ⅛ in. × ¼ in. OD or 6 mm × 3 mm OD	Swagelok; SS-200-R-4 SS-6M0-R-3M	Quantity: 2
Port connector	316SS; ¼ TF OD or 6 mm TF OD	Swagelok; SS-401-PC SS-6M1-PC	Quantity: 2

8.3.3 Connecting the calibration gas

Connect the calibration gas cylinders using a three-way valve to minimize exposure of the OXY5500 to ambient oxygen. This arrangement reduces calibration time.

Use small-diameter (3 mm or ⅛ in.) electropolished stainless steel tubing for zero calibration gas connections. Minimize tubing length.

The following procedures apply to analyzers with and without an integrated sample conditioning system (SCS). If the SCS was supplied by a manufacturer other than Endress+Hauser, contact the manufacturer for connection details.

Use a three-way valve configuration for low-range calibrations (0 to 100 ppmv and lower). For higher measurement ranges, connect the N_2 and calibration gases sequentially without a three-way valve (see Figure 50).

Ensure all equipment is installed and leak-checked before starting calibration.

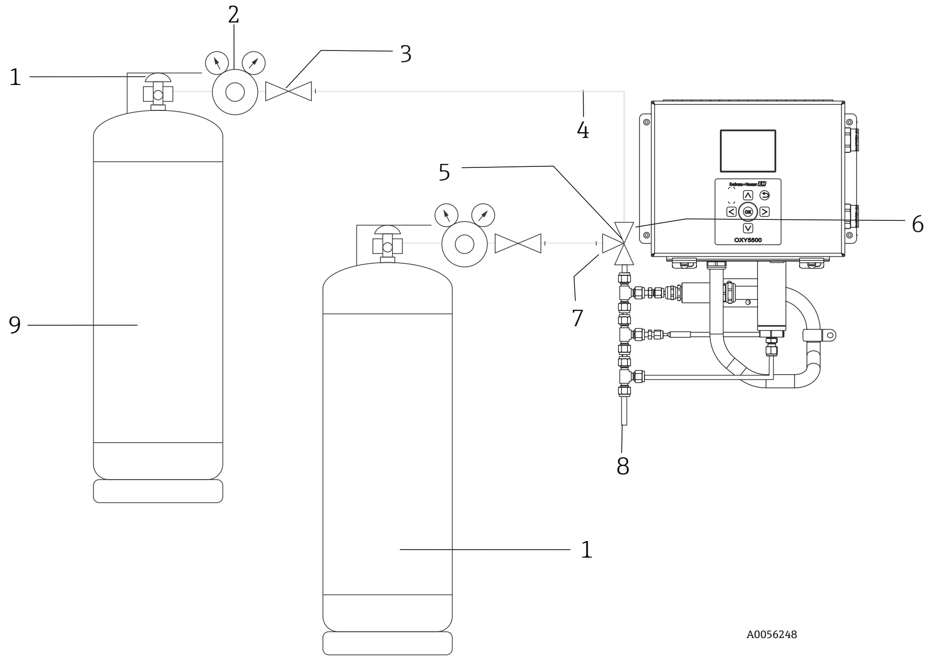


Figure 17. General layout for calibration cylinder and OXY5500 analyzer connections

#	Description
1	Cylinder valve
2	Dual stage pressure regulator
3	Shut off valve
4	Stainless steel tubing
5	Three-way ball valve

#	Description
6	Port 1
7	Port 2
8	To vent
9	Cal 0
10	Cal 2nd

8.3.3.1 Connecting the gas inlet

To connect the gas inlet (without SCS)

1. Connect the three-way valve to a port connector.
2. Install the reducers on both sides of the three-way valve.
3. Connect each gas cylinder to the reducers using 3 mm (⅛ in.) stainless steel tubing.
4. Connect the OXY5500 probe to the port connector.

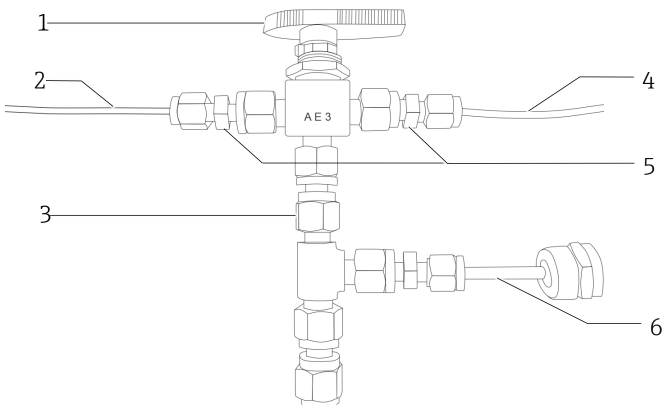


Figure 18. Gas inlet connections without SCS

#	Description
1	Three-way valve
2	Tubing to gas cylinder

#	Description
4	Tubing to gas cylinder
5	Reducers

#	Description	#	Description
3	Port connector	6	OXY5500

To connect the gas inlet (with Endress+Hauser SCS)

1. Attach the port connector to the SCS enclosure.
2. Connect the three-way valve to the port connector.
3. Install reducers on both sides of the three-way valve.
4. Connect each gas cylinder to the reducers using 3 mm (⅛ in.) stainless steel tubing.

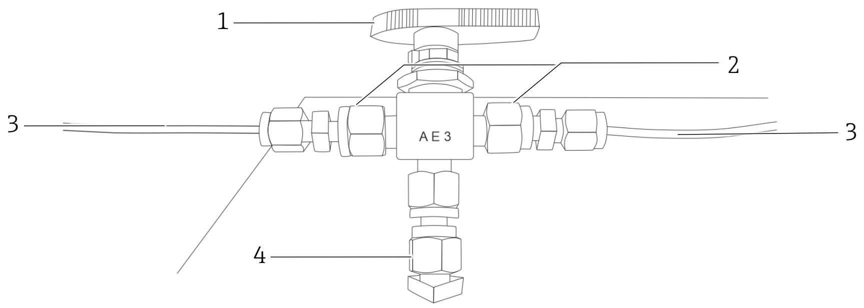


Figure 19. Gas inlet connections with SCS

#	Description	#	Description
1	Three-way valve	3	Tubing to gas cylinder
2	Reducers	4	Port connector

8.3.4 Purging regulators and analyzer

To purge the regulators and analyzer

1. Install pressure regulators:
   - Install a pressure regulator on the nitrogen (N_2) zero gas cylinder.
   - Install a pressure regulator on the O_2 calibration gas cylinder.
2. Perform the initial purge:
   a. Purge the pressure regulator with the O_2 cylinder.
   b. Purge the pressure regulator with the N_2 cylinder.
   c. Allow gas to flow into the analyzer during purging.
3. Pressurize the regulators:
   a. Close the pressure regulator outlet valve.
   b. Open the cylinder valve.
   c. Set the regulator pressure to 200 kPaG (30 psig).
4. Depressurize the regulators:
   a. Close the cylinder valve.
   b. Slightly open the regulator outlet valve.
   c. Allow pressure to discharge until both the primary and secondary pressures approach zero.
   d. Close the outlet valve before the remaining pressure is fully released.
5. Repeat steps 3 and 4 fifteen times for each regulator.

   For best results, discharge the regulator as much as possible during each purge cycle without releasing all of the pressure.
6. Re-establish operating pressure:
   a. Open the cylinder valve.
   b. Confirm the regulator is set to 200 kPaG (30 psig).

7. Complete the purge:
   a. Open the regulator outlet valve fully.
   b. Ensure the sample return is not restricted and does not cause back pressure.

8.3.5 Performing a two-point calibration with gases

Use this procedure to calibrate the analyzer using two calibration gases.

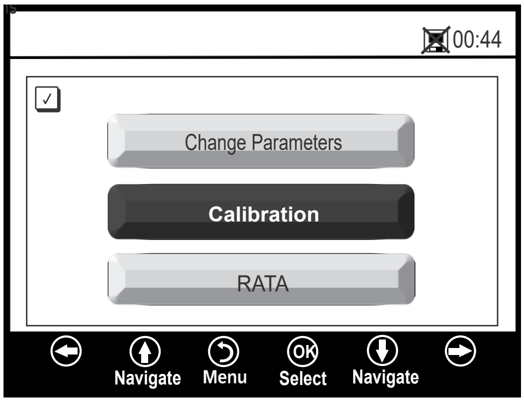
Before you begin:

- Calibration gas is connected
- System and regulators are purged
- Measurement is active or ready to stop
- Calibration values and gas concentrations are available

8.3.5.1 Set calibration conditions

To set calibration pressure

1. Select **Sensor** from the main menu.



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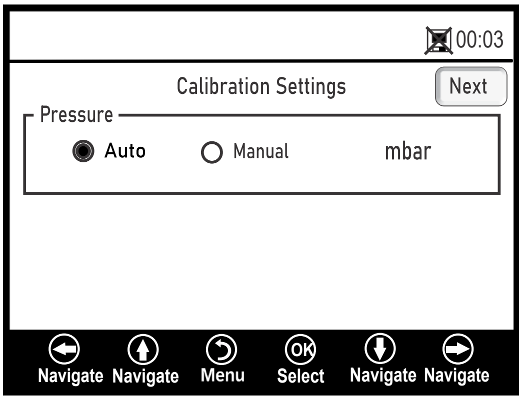
2. Select **Calibration** then select **OK**.
3. When prompted, select **Yes** to stop the active measurement.
4. Open **Calibration settings - Pressure**.



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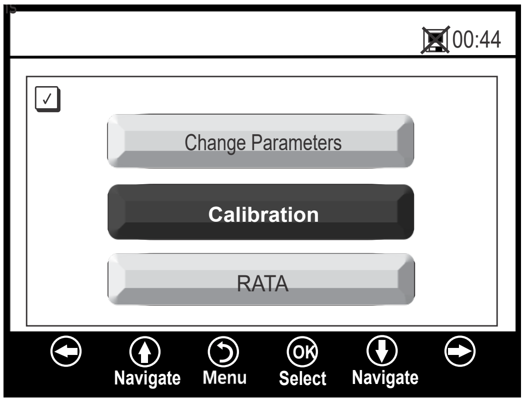
5. Select:
   - Auto (4–20 mA input)
   - Manual:
     - Enter the atmospheric pressure.
     - Select the unit (hPa, mbar, psi, atm, or torr).
6. Select **OK**, then select **Next**.

To set calibration temperature

1. Select **Sensor** from the main menu.



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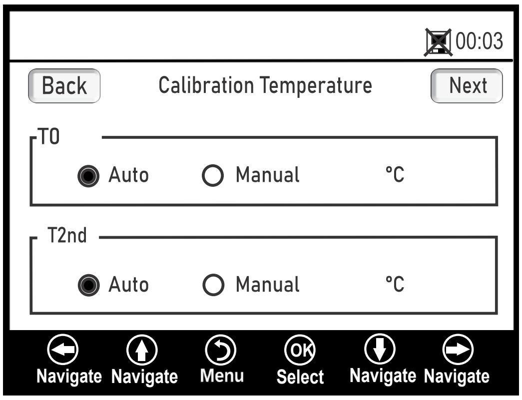
2. Select Calibration then select **OK**.
3. When prompted, select **Yes** to stop the active measurement.
4. Open **Calibration settings - Temperature**.



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5. Set **T0** (first calibration point):
   - **Auto**. Select **Auto** to measure the temperature at the first calibration point with the RTD probe (Pt100 temperature sensor).
   - **Manual**. Select **Manual** if the first calibration point is known and remains constant through the calibration process. If Manual:
     - Select unit (°C, °F, K).
     - Enter value.
6. Select **OK**, then select **Next**.
7. Set T2nd (second calibration point):
   - **Auto**. Select **Auto** at the first calibration point for automatic temperature measurement.
   - **Manual**. Select **Manual** to insert the changes to the calibration temperature manually.
8. Select **OK**, then select **Next**.

8.3.5.2 Perform the pre-calibration purge

To perform the pre-calibration purge

1. Connect the analyzer to nitrogen (Cal0).
2. Set flow to **1.5 SLPM**.
3. Confirm settings for the specified probe being used.

   ⚠ **CAUTION**

   ▶ Use the calibration conditions specified in the calibration certificate. Refer to *Calibration Certificate* → 🖹.
4. Allow gas to flow for 45 to 60 minutes. Refer to the following table.

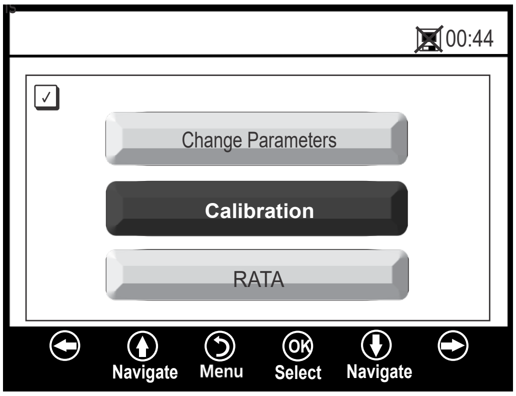
5. **Item**	**OP-3**	**OP-6**	**OP-9**
Cal 0	Calibration with oxygen-free environment (e.g., nitrogen).	Calibration in oxygen-free environment (nitrogen).	Calibration in oxygen-free environment (99.9999 % nitrogen).
Cal 2nd	Calibration value optimal at 20.9 % O_2 in N_2 (or ambient air).	Calibration value optimal between 1 % and 2 % oxygen.	Calibration value optimal between 100 to 200 ppm O_2 in N_2.
Storage Stability	2 years provided the sensor material is stored in the original packaging.		

Table 5. Calibration gas specifications

8.3.5.3 Set calibration points

To set the first calibration point (Cal0)

1. Continue flowing Cal0 gas.
2. Select **Sensor** from the main menu.



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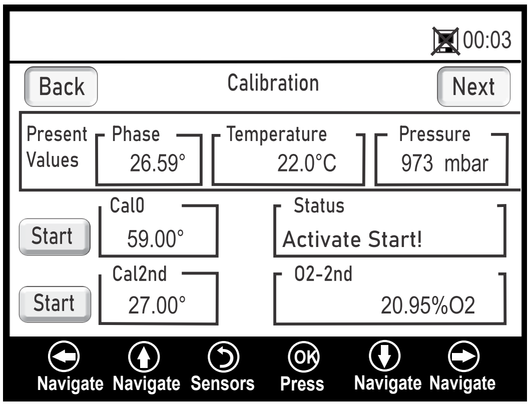
3. Select **Calibration** then select **OK**.
4. When prompted, select **Yes** to stop the active measurement.
5. Open **Calibration**.
   In the upper section of the main screen, the Present Values measured by the OXY5500 are displayed.



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6. Select **Start** for Cal0.
   The Status field displays the message ‘Wait - Stabilizing!’ Wait for the phase values to stabilize within ± 0.01°.

   A “Ready to set value” message displays. Disregard.

7. Run Cal0 gas until the phase is stable within 0.01 (approximately 45 to 60 minutes).
8. Select **Set**, then select **OK**.

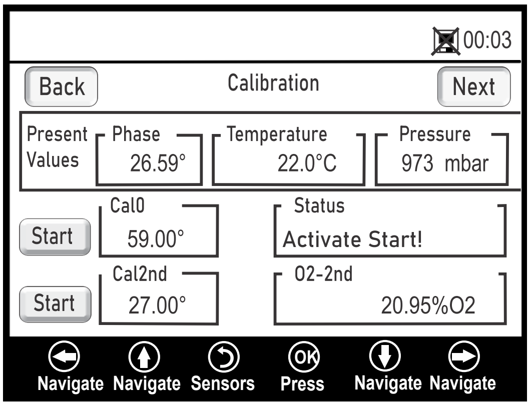
If the zero value is negative, this may indicate one or more of the following:

- The previous calibration was incorrect
- The calibration gas contains trace oxygen levels
- Pressure changes at the sensor are affecting the measurement

If required, use the Forced Zero "Active Stored" function to stabilize the zero value. Refer to *Setting Forced Zero mode* → 🗎.

To set the second calibration point (Cal2nd)

1. Switch to Cal2nd gas.



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2. Enter the oxygen concentration in the **O2-2nd** field.
3. Select **Start** for Cal2nd.

   The Status field displays the message 'Wait - Stabilizing!' Wait for the phase values to stabilize within ± 0.01°.

   ℹ A "Ready to set value" message displays. Disregard.
4. Run Cal2nd gas until the phase is stable within 0.01 (approximately 45 to 60 minutes).
5. Select **Set**, then select **OK**.
6. Save the calibration. Select **Save**, then select **OK**.

8.4 Viewing measurements

Selecting **Measurement** opens the **Simple** screen. From this screen, select **Details** or **Graph** views.

Views can be selected for simple, detailed, or graphical presentations of the measurements. Use the buttons to switch between screens. Refer to *Measurement Menu Options* → 🗎 for more information on accessing screen views from this menu selection.

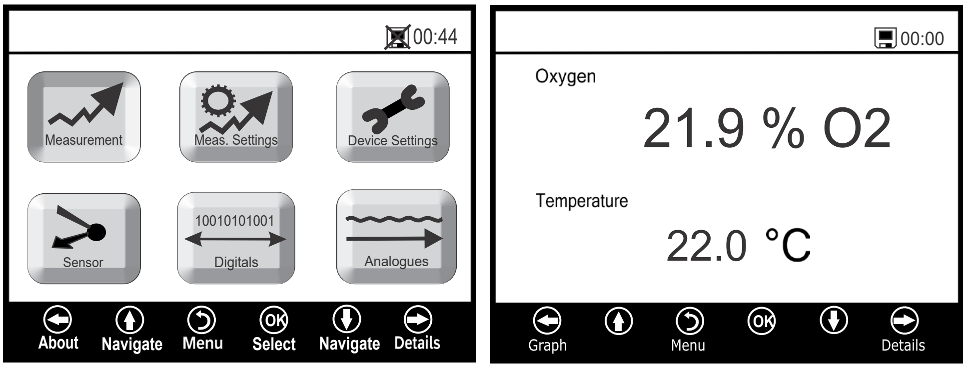

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Figure 20. Main menu - Measurement selected (left) and Simple measurement screen (right)

The Simple screen shows oxygen and temperature values from the start of the measurement.

- If temperature is set manually, the value is displayed before starting the measurement. Refer to *Temperature compensation* → 🗎.
- If automatic temperature measurement is selected and the sensor is missing or faulty, an error message is displayed.
- If the sensor signal cannot be read when measurements are started, an error message displays in the status bar.

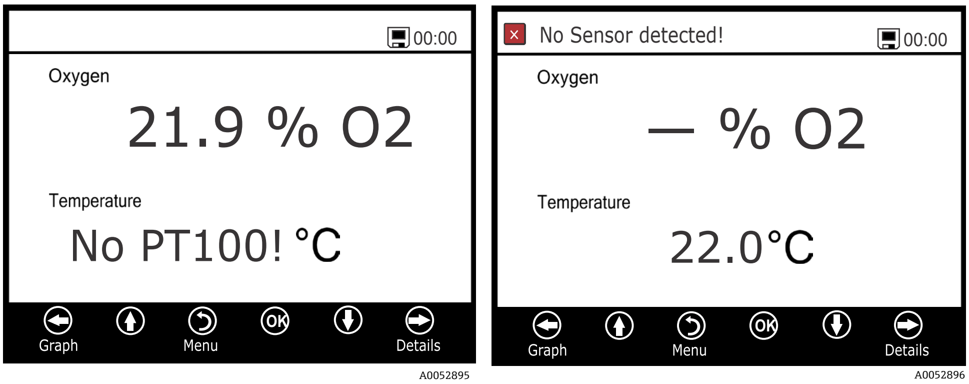

Figure 21. Temperature sensor error (left) and Sensor cannot be detected error (right)

The oxygen values are displayed in the following units:

- **For OP-3 sensor:** % O_2
- **For OP-6 sensor:** % O_2, ppmv
- **For OP-9 sensor:** ppmv

To change the oxygen unit

1. Click the **Up** and **Down Arrow** buttons.
   The display updates immediately.
2. Click **Menu** to return to the main menu.

8.4.1 Viewing detailed measurement information

The Details screen provides additional measurement information.

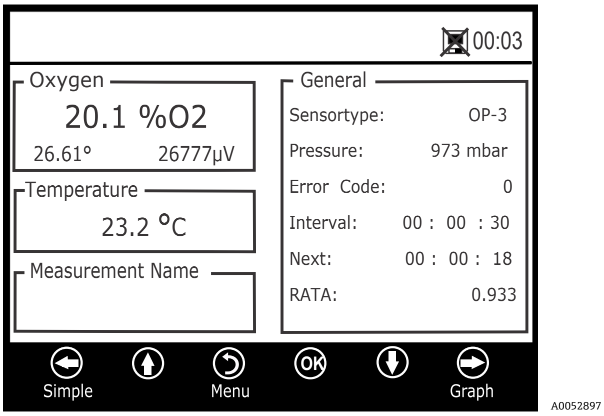

Figure 22. Details measurement screen

Information is grouped into:

- **Oxygen**
  - Last measured value. Change the oxygen unit by clicking the button.
  - Phase angle and amplitude
- **Temperature**
  - Current or manually set value. The temperature unit can be changed in Manual mode. Values ranging from -99 °C to 199 °C can be input into the MEAS. SETTINGS window. Refer to *Temperature compensation* → 🗎.
- **Measurement name**
  - File used for data logging. The measurement file can be changed in the MEAS. SETTINGS menu. Refer to *Logging and data management* → 🗎.
- **General**
  - Sensor type

- Pressure value (current or manual). For automatic measurement, the display shows the interpreted pressure value from the 4-20mA input. If no pressure sensor is connected, the display reads 1013 mbar.
- Measurement interval
- Time until next measurement
- RATA value
- Error codes (0 = no error)

Error Codes are displayed under the General box. Error codes are also logged together with measurement data. During error-free measurements, a 0 value displays.

- Click the **Left Arrow** to return to Simple view.
- Click the **Right Arrow** to display the measurement graph. Clicking the button switches to the graphical presentation of the current measurements. Refer to *Graph screen* → 🖹.
- Click **Menu** to return to the main menu.

8.4.2 Viewing measurement trends

The **Graph** screen displays oxygen values for the current measurement session:

- Latest value shown at top
- Graph shows recorded measurement points
- Lower right area shows displayed measurement points relative to the total dataset (x of y)
- Progress bar indicates processing status

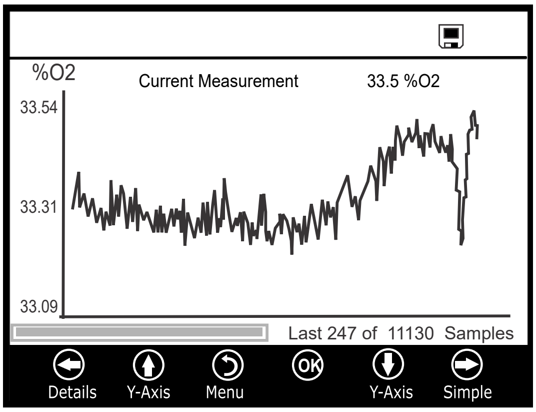

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Figure 23. Graph screen

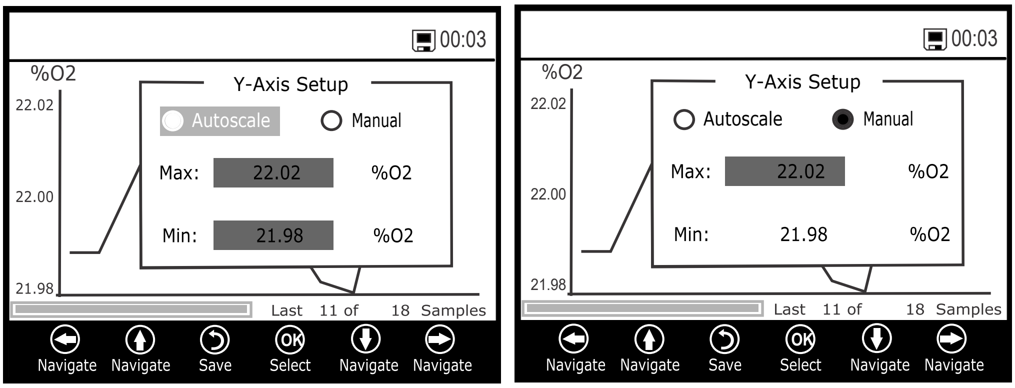
When opening large measurement files, a pop-up window appears: “You are about to open a very large file.”

- Select **No** to return to the current graph.
- Select **Yes** to display the last 248 measurement points of the selected file.

If logging is disabled, only values measured after opening the graph are shown.

To set the Y-axis minimum and maximum values

1. On the **Graph** screen, select the **Up** and **Down** arrows to open the Y-axis setup window.
2. Select one of the following options:
   - **Autoscale**. Automatically sets the Y-axis limits based on measured values.
   - **Manual**. Sets the minimum and maximum Y-axis values manually.



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ℹ Values outside the selected display range are shown as minimum or maximum values.

3. Do one of the following:
   - Click the **Left Arrow** to return to DETAILS view.
   - Click the **Right Arrow** to return to SIMPLE view.
   - Click **Menu** to return to the main menu.

8.4.3 Viewing sensor details

The **Sensor Details** screen provides information about the currently selected sensor.

- Sensor type is displayed at the top of the screen.
- Calibration data and sensor constants are displayed below.

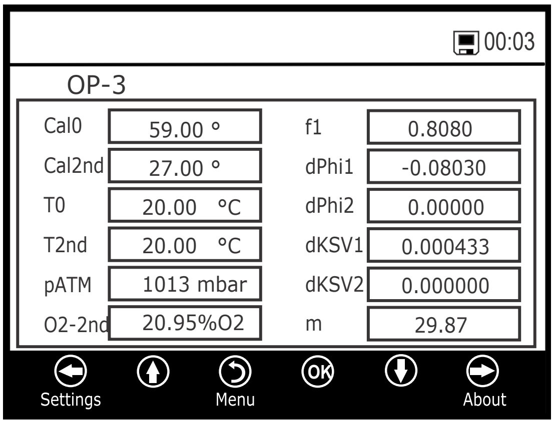

Figure 24. Sensor details screen

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8.5 Device settings

Select **Device Settings** from the main menu to open the analyzer settings.

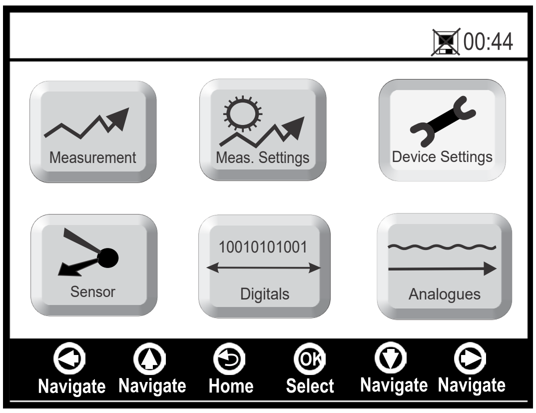

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Figure 25. Main menu - Device settings selected

The Device Settings menu includes:

- Device Settings
- Sensor Details
- About

The Device Settings screen is used to configure:

- Date and Time. Refer to *Setting date and time* → 🗎.
- LED intensity (user signal intensity). Adjusts the signal strength of the probe.
- Forced Zero mode

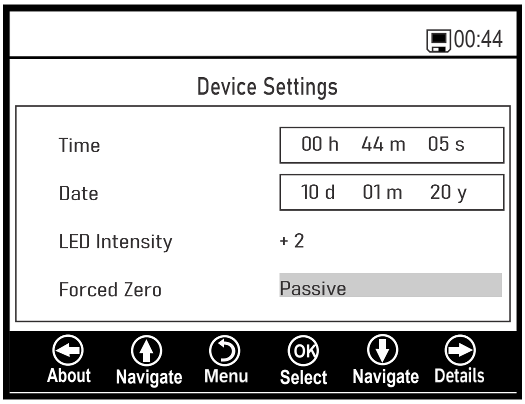


Figure 26. Device settings screen

8.5.1 Resetting date and time after power loss

If power is lost, date and time reset to zero. Reset Time and Date before starting a new measurement so that the correct time is stored with the data. Refer to *Setting date and time* → 🗎.

ℹ A timestamp warning displays in the Status bar.

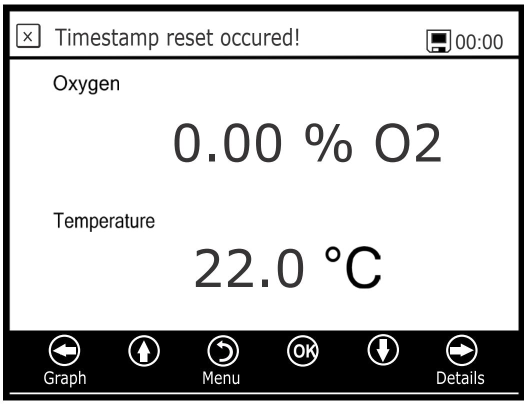


Figure 27. Warning: Timestamp reset

8.5.2 Changing LED settings

To change LED settings for the probe

1. Select **Device Settings** from the main menu.
   A message window prompts for confirmation to abort the current measurement.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Use the Navigation buttons to select the **LED Intensity**.
4. Enter the **LED intensity** (User Signal Intensity):
   - **Range**. −5 to 5
   - **Default**. 0
5. Select **OK** to confirm the setting.
6. Select **Menu** to cancel or exit.

8.5.3 Setting Forced Zero mode

Forced Zero mode defines how negative oxygen values are handled. When Forced Zero is active, negative values caused by calibration errors are not displayed. When enabled, analog output also outputs minimum (4 mA) for negative values.

When Forced Zero feature is active, this behavior applies to the main measurement screen and the analog 4-20 mA output. Negative oxygen values are output as 4 mA.

NOTICE

▶ The OXY5500 requires regular calibration as discussed in *Calibrating the analyzer* → 🖹. Negative oxygen values which may be due to an inaccurate calibration are not displayed when Forced Zero is active.

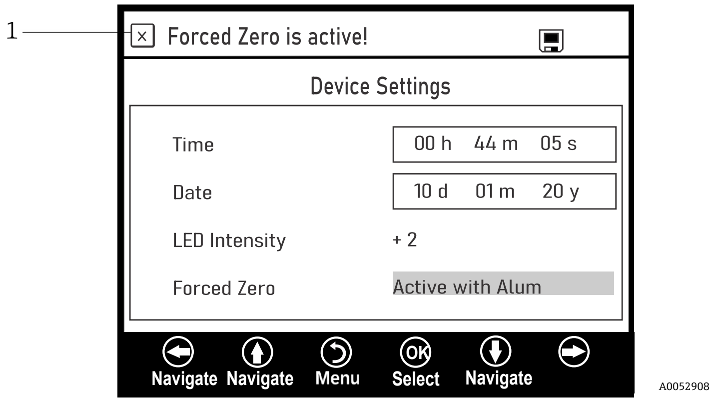


Figure 28. Forced Zero alarm signal (1)

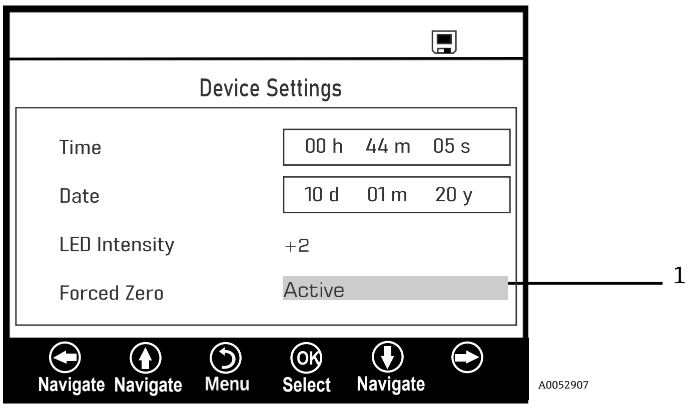
Forced Zero Settings	Negative Oxygen Value Display	Alarm Signal "Forced Zero is Active"	Forced Zero Active After Reset
Passive	yes	no	no
Active	no	no	no
Active with alarm	no	yes	no
Active stored (default setting)	no	no	yes
Active with alarm stored	no	yes	yes

To set Forced Zero mode

1. Select **Device Settings** from the main menu.

   A message window prompts for confirmation to abort the current measurement.

2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Use the Navigation buttons to select **Forced Zero**.



4. Select the desired mode from the list:
   - **Passive (default).** Negative values are displayed (forced zero inactivated).
   - **Active.** Negative values are set to 0 % [ppm] O_2. After rebooting the device, passive mode reactivates.

- **Active alarm.** Negative values set to 0 % [ppm] O_2 with alarm. An alarm signal “Forced Zero is active” displays at the top of the window. After rebooting the device, passive mode reactivates.
- **Active stored.** Negative values set to 0 % [ppm] O_2; persists after restart.
- **Active with alarm stored.** Negative values set to 0 % [ppm] O_2 with alarm; persists after restart.

5. Select **OK** to confirm.

8.6 Configuring the sensor

Select **Sensor** from the main menu to open the **Sensor options** window.

In the **Sensor options** window, the following functions are available:

- **Change Parameters**. Configure sensor type and constants
- **Calibration**. Perform sensor calibration
- **RATA**. Perform Relative Accuracy Test Audit

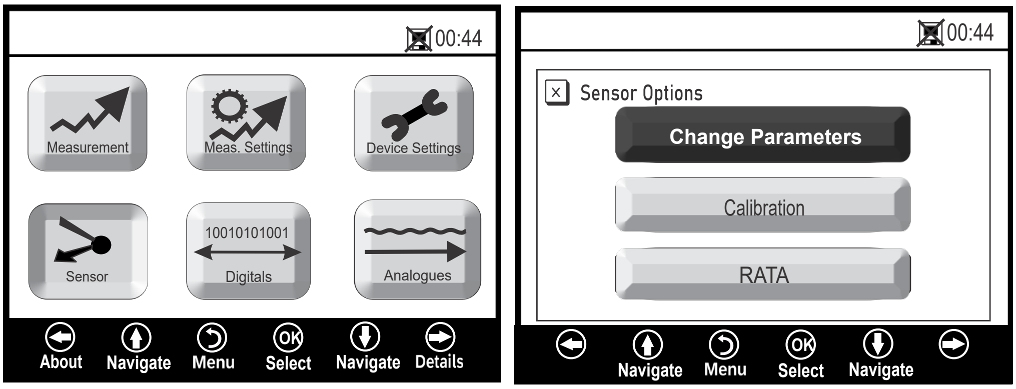


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Figure 29. Main Menu - Sensor selected (left) and Sensor options (right)

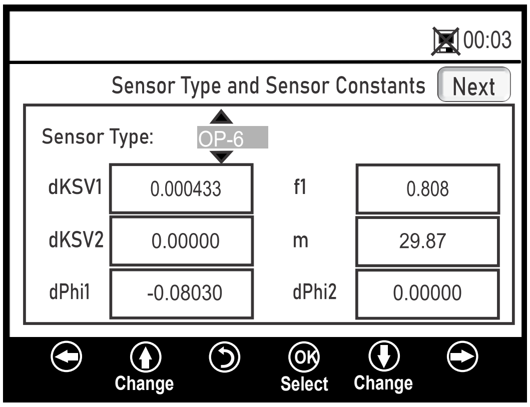
Refer to *Calibration* → 🖹 and *Performing a Relative Accuracy Test Audit (RATA)* → 🖹 for more information about these functions.

8.6.1 Changing sensor type

Change the sensor type to match the connected probe (OP-3, OP-6, or OP-9). The sensor constants (dKSV1, dKSV2, dPhi1, dPhi2, f1, m) update automatically according to the selected sensor type.

To change sensor type

1. Select **Sensor** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Use the Navigation buttons to select **Change Parameters**.



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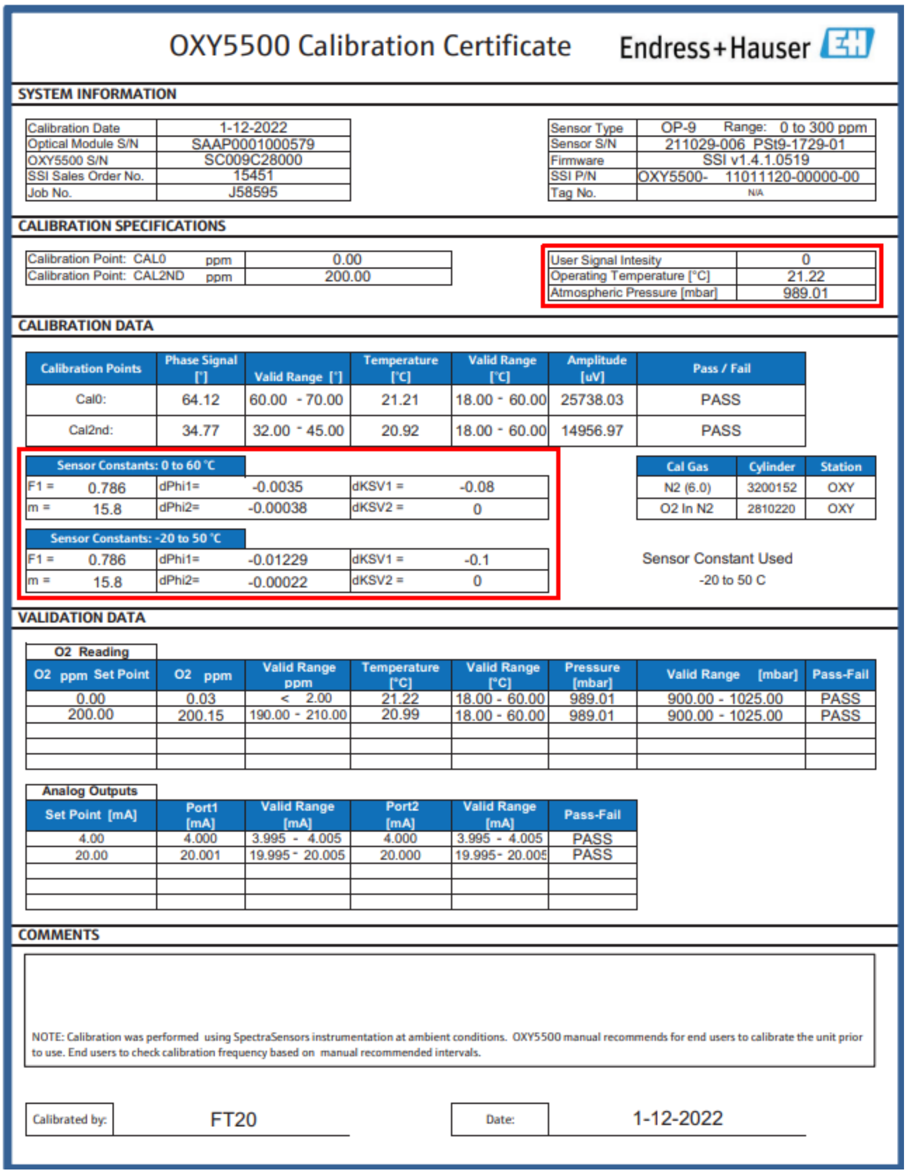
4. Change the sensor type to match the connected probe (OP-3, OP-6, or OP-9).
5. Select **OK** to confirm. Select **Menu** to cancel or exit.

8.6.2 Changing the sensor constants values

Sensor constant values are provided on the calibration certificate supplied with the sensor.

- On the *Calibration Certificate* → 🖹, “T0” is shown under the Calibration Data section, Temperature column as Cal0 and Cal2nd.
- On the Calibration Certificate, “pATM” is shown as “Atmospheric Pressure” under the Calibration Specifications section during Cal0 and Cal2nd.



OXY5500 Calibration Certificate — Endress+Hauser

SYSTEM INFORMATION

Calibration Date	1-12-2022
Optical Module S/N	SAAP0001000579
OXY5500 S/N	SC009C28000
SSI Sales Order No.	15451
Job No.	J58595

Sensor Type	OP-9 Range: 0 to 300 ppm
Sensor S/N	211029-006 PSt9-1729-01
Firmware	SSI v1.4.1.0519
SSI P/N	OXY5500- 11011120-00000-00
Tag No.	N/A

CALIBRATION SPECIFICATIONS

Calibration Point: CAL0	ppm	0.00
Calibration Point: CAL2ND	ppm	200.00

User Signal Intesity	0
Operating Temperature [°C]	21.22
Atmospheric Pressure [mbar]	989.01

CALIBRATION DATA

Calibration Points	Phase Signal [°]	Valid Range [°]	Temperature [°C]	Valid Range [°C]	Amplitude [uV]	Pass / Fail
Cal0:	64.12	60.00 - 70.00	21.21	18.00 - 60.00	25738.03	PASS
Cal2nd:	34.77	32.00 - 45.00	20.92	18.00 - 60.00	14956.97	PASS

Sensor Constants: 0 to 60 °C

F1 =	0.786	dPhi1=	-0.0035	dKSV1 =	-0.08
m =	15.8	dPhi2=	-0.00038	dKSV2 =	0

Sensor Constants: -20 to 50 °C

F1 =	0.786	dPhi1=	-0.01229	dKSV1 =	-0.1
m =	15.8	dPhi2=	-0.00022	dKSV2 =	0

Cal Gas	Cylinder	Station
N2 (6.0)	3200152	OXY
O2 In N2	2810220	OXY

Sensor Constant Used
-20 to 50 C

VALIDATION DATA

O2 Reading

O2 ppm Set Point	O2 ppm	Valid Range ppm	Temperature [°C]	Valid Range [°C]	Pressure [mbar]	Valid Range [mbar]	Pass-Fail
0.00	0.03	< 2.00	21.22	18.00 - 60.00	989.01	900.00 - 1025.00	PASS
200.00	200.15	190.00 - 210.00	20.99	18.00 - 60.00	989.01	900.00 - 1025.00	PASS

Analog Outputs

Set Point [mA]	Port1 [mA]	Valid Range [mA]	Port2 [mA]	Valid Range [mA]	Pass-Fail
4.00	4.000	3.995 - 4.005	4.000	3.995 - 4.005	PASS
20.00	20.001	19.995 - 20.005	20.000	19.995 - 20.005	PASS

COMMENTS

NOTE: Calibration was performed using SpectraSensors instrumentation at ambient conditions. OXY5500 manual recommends for end users to calibrate the unit prior to use. End users to check calibration frequency based on manual recommended intervals.

Calibrated by: FT20 Date: 1-12-2022

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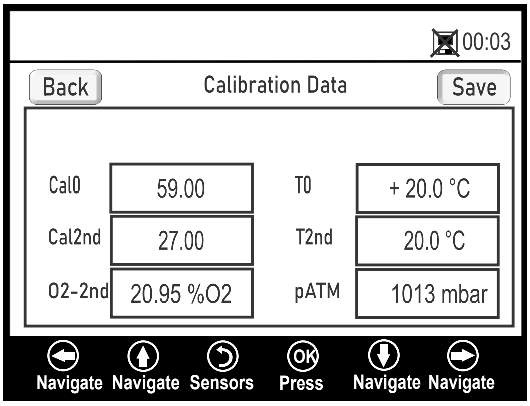
Figure 30. Calibration certificate example: Calibration data and sensor constants

To change the sensor constants

1. Select **Sensor** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.
3. Use the Navigation buttons to select **Calibration**.

   The calibration data screen displays. If a calibration was performed with a previously connected sensor, the data from that calibration is shown.



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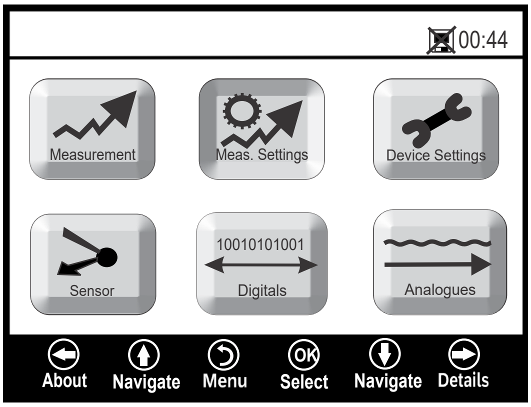
4. Enter the sensor constants:
   a. Navigate to the desired constant field.
   b. Select **OK** to enter editing mode.
   c. Adjust the value using the arrow buttons.
   d. Select **Save** to save the value.
5. Select **OK** to confirm.
6. Select **Menu** to cancel or exit.

8.7 Data and logging

Use the **Meas. Settings** screen to configure data logging.



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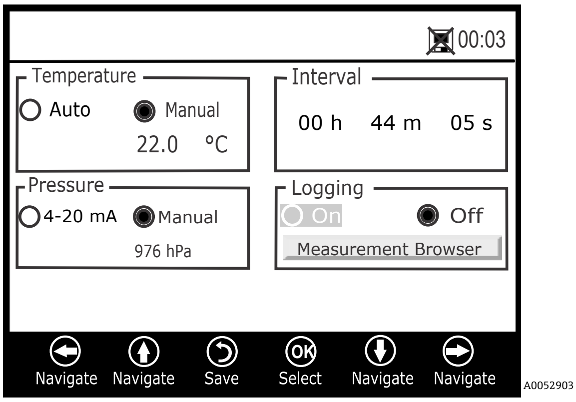
8.7.1 Turning logging on and off

The monitor icon in the status bar symbol indicates:

- Logging is on 
- Logging is off 

To enable or disable data logging

1. Select **Meas. Settings** from the main menu.
2. Confirm the prompt to stop the active measurement by selecting **Yes**.



3. Use the Navigation buttons to select **Logging**.
4. Enable or disable data logging:
   - Select **On** to store measurement data.
   - Select **Off** to disable data storage.
5. Select **OK** to confirm.
6. Select **Menu** to cancel or exit.

When logging is enabled, the **Measurement browser** window opens automatically.

8.7.2 Storing data in a measurement file

When logging is enabled, the screen switches to the measurement data screen automatically. The measurement data screen displays a list of measurement files, including:

- File name
- Number of measurement points
- Last used date

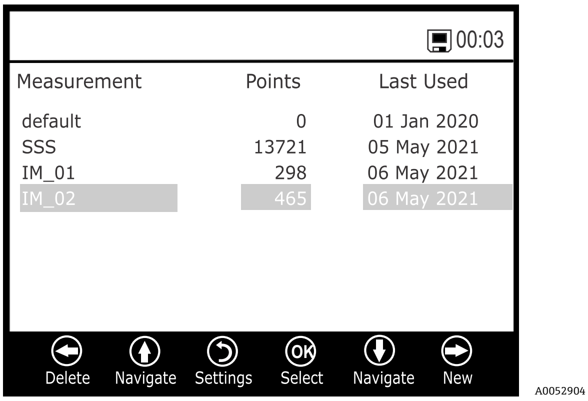


Figure 31. Measurement data screen - List of measurement files

To store measurement data in an existing file

1. Ensure data logging is enabled.
2. Navigate to the desired file. Use the **Up** and **Down** arrow to navigate through the list.
3. Select **OK**.

   New measurement data is added to the selected file.

   The display returns to the **Meas. Settings** screen automatically.

8.7.3 Deleting a measurement file

The following data cannot be deleted:

- The active measurement file
- The default measurement file (default)

Select a different file before attempting deletion.

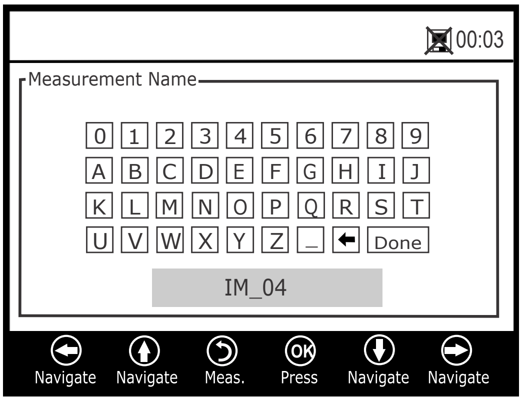
To delete a measurement file

1. In the measurement data screen, navigate to the file to be deleted. Use the **Up** and **Down** arrow to navigate through the list.
2. Select the **Left arrow**.
3. Confirm the prompt: “Really delete this measurement?” by selecting **Yes**.
   The selected file is deleted.
4. Select **Menu** to cancel or exit.

8.7.4 Creating a new measurement file

To create a new file

1. In the measurement data screen, select the **Right arrow**.
   A keyboard screen displays.



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2. Enter the file name using the keyboard screen.
   a. Use the arrow buttons to navigate the keyboard.
   b. Select **OK** to enter each character.
   c. Select **Done**, then **OK**, to save the file name.

The new file is added to the file list.

To select the new file for logging

1. Navigate to the new file.
2. Select **OK**.
   The display returns to the **Measurement Settings** screen.
3. Select **Menu** to return to the main menu.

9 Communication (Modbus)

Modbus is a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). It has become a de facto standard communications protocol in industry and is now the most commonly available means of connecting industrial electronic devices. Modbus is used extensively in lieu of other communications protocols because it is openly published and royalty-free, relatively easy to deploy, and capable of moving raw bits or words without placing many restrictions on vendors.

This chapter covers the protocols, formats, and register data used to communicate with the OXY5500.

9.1 Protocol definition

9.1.1 General specification

The following general specifications apply to the Modbus protocol:

- The protocol is Modbus RTU conform.
- The protocol is a client-server arrangement with the host controller acting as the server and each individual module as a client.
- Each module on the bus needs to have a unique device ID (see register 4095).
- The device has no command buffer, so the host must always wait until the command is processed.

Read commands need 10ms processing time over RS-232 and RS-485 and 300ms over LAN.
After a write process, certain time consuming tasks are started. After a write process, a fixed timeslot of 150ms over RS-232 and RS-485 and 300ms over LAN after the transmitted response should be kept.

- RX Input Buffer is 256 bytes.
- A CRC16 error checking method is implemented. Starting value is 0xFFFF and polynomial type is 0xA001.
- Some registers are read only. When writing to those, a Modbus error 2 occurs (illegal data address). This also happens when 4 registers should be written, but the last 2 are read-only. No register is changed afterward.
- All registers between 1023 and 5708 can be read, as there is no read-protection.

9.1.2 Function codes

Available public functions are

- **3:** Read Holding Registers
- **4:** Read Input Registers
- **16:** Write Multiple Registers

Please note that function codes 3 and 4 are fully interchangeable as they behave in the same way.

Function code 16 may be used with broadcast (device ID = 0). Codes 3 and 4 may not be used with broadcast.

9.1.3 Data formats

9.1.3.1 Float

The Float refers to the floating point according to IEEE 754 (Single Precision). This format requires two registers obtaining 32 bit where each register contains the high byte in its first bit.

For example, if the float value is 20.56 (int32), represented as 0x41A47AE1 (hexaint32), it is written in two consecutive registers, where the first register is 3499. Therefore, the value must be transmitted in the following way:

Register	Value
Register 3499, high byte	0x7A
Register 3499, low byte	0xE1
Register 3500, high byte	0x41
Register 3500, low byte	0xA4

9.1.3.2 Int32

All int32 values are 32 bit-wide integer values. The example given in the previous section applies here as well.

9.1.3.3 Character

The definition is as follows:

8 bit ASCII-Code table according to ISO-8859-1 (Latin-1 Western European)

A register always holds exactly 2 characters. Unused bytes are filled with zeros (ASCII: 0x00).

9.1.3.4 Boolean

Boolean registers are 16bit int32 registers with only 0 and 1 as allowed values.

9.1.4 Error response

The error response follows the Modbus definition, but only four exception codes are implemented:

- **1 (Illegal function):** An unsupported function code was used.
- **2 (Illegal data address):** The requested register is either not available or write-protected.
- **3 (Illegal data value):** The value could not be set. The value was out of range. The last correct value is restored.
- **6 (Slave device busy):** This code appears when there is an “active” USB connection (communication via software is active).

9.1.5 Different communication channels

The OXY5500 has multiple ways to read and set its settings and measurement values:

- Modbus Communication

RS-485
RS-232

- Ethernet
- USB Service Port
- Via keypad and LCD

All options share the same fundamental memory. Changing the settings via one communication channel alters the expected result on another channel.

9.1.5.1 Recommendation

One channel should be used to set up the device completely. As the device saves every setting and allows immediate checking of the results, it is recommended to do this via keypad and LCD and to use the other channels as simple data-polling options.

If there is a Service Software connected (via USB), the Modbus write command 16 (“Write multiple registers”) always returns error code 6.

9.1.6 Holding registers

Refer to the table for table register definitions. When reviewing the table, it is important to remember:

- The register addresses referred to in the table show the first address of multiple addresses available per register (see “Size” column for number of addresses per register). Do not add or subtract “1” from the first address register number as this could cause conflict with other register assignments.
- The analyzer does not check for correct ranges. The host must ensure that valid numbers are used. Any wrong value may lead to unexpected performance.

Register Name	Address	Size	Variable Type	Description	Write Access
Firmware Date	1023	8	Character	Firmware creation date, e.g., “2014-11-18\0\0” (November 18, 2014)	No
Firmware Version	1031	8	Character	Firmware version, e.g., “SSI v1.0.1.0287\0”	No
Serial Number	1063	8	Character	Serial number, e.g., “SAAP0000000001\0\0”	No

Register Name	Address	Size	Variable Type	Description	Write Access
Oxygen Unit	2089	2	Int32	The oxygen unit that displays on the LCD of the analyzer and also in measurement register 4909	Yes
Compensation Temperature	2411	2	Float	Sets the compensation temperature.	Yes
Interval Rate	3499	2	Mixed	Sets the oxygen measurement interval rate and also deactivates oxygen measurement. Range: 1 to 359999 seconds.	Yes
Device ID RS-485	4095	2	Int32	Sets the device ID that is used in Modbus RTU communication (range 1-32).	Yes
Device ID Minimum RS-485	4097	2	Int32	Device ID Address Limit: Minimum	No
Device ID Maximum RS-485	4099	2	Int32	Device ID Address Limit: Maximum	No
Baud rate RS-485	4101	2	Int32	Code for Baud rate where: 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200	Yes
Baud rate Minimum RS-485	4103	2	Int32	Minimum code for baud rate	No
Baud rate Maximum RS-485	4105	2	Int32	Maximum code for baud rate	No
Parity RS-485	4107	2	Int32	Parity for the RS-485 output where: 0x00 = Even Parity 0x01 = Odd Parity 0x02 = No Parity	Yes
Device ID RS-232	4109	2	Int32	Sets the device ID used in the Modbus RTU communication (range 1-32).	Yes
Device ID Minimum RS-232	4111	2	Int32	Device ID Address Limit: Minimum	No
Device ID Maximum RS-232	4113	2	Int32	Device ID Address Limit: Maximum	No
Baud Rate RS-232	4115	2	Int32	Code for baud rate where: 0x03 = 9600 0x04 = 19200 0x05 = 38400 0x06 = 57600 0x07 = 115200	Yes
Baud Rate Minimum RS-232	4117	2	Int32	Minimum code for baud rate	No
Baud Rate Maximum RS-232	4119	2	Int32	Maximum code for baud rate	No
Parity RS-232	4121	2	Int32	Parity for the RS-232 output where: 0x00 = Even Parity 0x01 = Odd Parity 0x02 = No Parity2	Yes

Register Name	Address	Size	Variable Type	Description	Write Access
4-20mA Port1 Output Interface	4359	2	Int32	Code for 4-20mA Port1 Output Mode where: 0x00 = Off 0x01 = Fixed 0x02 = Linear 0x04 = Bilinear	Yes
4-20mA Port1 Output Channel	4363	2	Int32	Code for 4-20mA Port1 Output Interface where: 0x01 = Oxygen 0x20 = Temperature	Yes
4-20mA Port1 Low Value	4377	2	Float	The 4mA output value.	Yes
4-20mA Port1 Mid Value	4379	2	Float	The 12mA output value, which is used in bilinear mode only.	Yes
4-20mA Port1 High Value	4381	2	Float	The 20mA output value.	Yes
4-20mA Port1 Fixed Value	4383	2	Float	In fixed output mode, this value is applied to the output. Unit is mA.	Yes
4-20mA Port1 Error Trigger Level Value	4389	2	Int32	Output current in the event of an error, where: 0x00 = 22mA 0x01 = 2mA 0x03 = 22mA NTE 0x04 - 2mA NTE	Yes
4-20mA Port1 Calibration Values	4329	8	Float	2 calibration values for a low point and a high point (each with a reference value and device output).	
4-20mA Port2 Output Interface	4945	2	Int32	Code for 4-20mA Port1 Output Mode where: 0x00 = off 0x01 = fixed 0x02 = linear 0x04 = bilinear	Yes
4-20mA Port2 Output Channel	4949	2	Int32/	Code for 4-20mA Port1 Output Interface where: 0x01 = Oxygen 0x20 = Temperature	Yes
4-20mA Port2 Low Value	4963	2	Float	The 4mA output value.	Yes
4-20mA Port2 Mid Value	4965	2	Float	The 12mA output value is only used in bilinear mode.	Yes
4-20mA Port2 High Value	4967	2	Float	The 20mA output value.	Yes
4-20mA Port2 Fixed Value	4969	2	Float	In fixed output mode, this value is applied to the output.	Yes
4-20mA Port2 Error Trigger Level Value	4975	2	Int32	Output current in the event of an error, where: 0x00 = 22mA 0x01 = 2mA 0x03 = 22mA NTE 0x04 - 2mA NTE	Yes
4-20mA Port2 Calibration Values	4979	8	Float	Two calibration values for a low point and a high point, each with a reference value and device output.	Yes
4-20mA Input Interface	5633	2	Int32	This register is reserved for future use.	Yes

Register Name	Address	Size	Variable Type	Description	Write Access
4-20mA Input Channel	5637	2	Int32	Code for 4-20mA Port1 Output Interface where: 0x02 = Pressure.3	No
4-20mA Input Low Value	5651	2	Float	The 4mA corresponding input value.	Yes
4-20mA Input Mid Value	5653	2	Float	The 12mA input value is only used in bilinear mode.	Yes
4-20mA Input High Value	5655	2	Float	The 20mA input value.	Yes
4-20mA Input Fixed Value	5657	2	Float	This register is reserved for future use.	Yes
4-20mA Input Error Trigger Level Value	5663	2	Float	This register is reserved for future use.	Yes
4-20mA Input Calibration Values	5667	8	Float	Two calibration values for a low and a high point, each with reference value and device output.	Yes
Measurement Values	4895	14	Mixed	Refer to *Measurement values* → 🗎 for details.	No
Sensor Constant f1	4911	2	Float	Sensor constant f1. Allowed range: 0.000 to 9.999	Yes
Sensor Constant dPhi1	4913	2	Float	Sensor constant dPhi1. Allowed range: -9.99999 to +9.99999	Yes
Sensor Constant dPhi2	4917	2	Float	Sensor constant dPhi2. Allowed range: -9.99999 to +9.99999	Yes
Sensor Constant dKSV1	4919	2	Float	Sensor constant dKSV1. Allowed range: -9.99999 to +9.99999	Yes
Sensor constant DKSV2	4921	2	Float	Sensor constant dKSV2. Allowed range: -9.99999 to +9.99999	Yes
Sensor Constant m	4923	2	Float	Sensor constant m. Allowed range: 0.00 to +999.99	Yes
Sensor Type	4925	2	Int32	Sensor Type where: 0x00 = OP-3 0x01 = OP-6 0x02 = OP-94	Yes
Manual Temperature Compensation	5611	1	Boolean	Activates the temperature measurement of the Pt100 sensor by setting and uses the manual temperature value by deleting this Boolean register. After writing this register, the manual temperature value has to be set (register 2411).	Yes
Cal0	5521	2	Float	Calibration value: Phase shift of low oxygen calibration point (Default: 59.9).	Yes
T0	5523	2	Float	Calibration value: Temperate at the low oxygen calibration point in °C (Default: 20.0).	Yes
O2-2nd	5527	2	Float	Calibration value: Oxygen concentration of the high oxygen calibration point in the unit defined in register 5535 (O2-2nd Unit).	Yes
Cal-2nd	5529	2	Float	Calibration value: Phase shift of high oxygen calibration point (Default: 26.3).	Yes
T2nd	5531	2	Float	Calibration value: Temperature at the high calibration point in °C.	Yes
pATM	5533	2	Float	Calibration value: Pressure at the high oxygen calibration in mbar.	Yes

Register Name	Address	Size	Variable Type	Description	Write Access
O2-2nd Unit	5535	2	Int32	The unit for the O2-2nd value, where: 0x4000.0000 = ppmv 0x0000.0010 = % O_2	Yes
Ethernet Obtain IP Mode	5675	2	Int32	Activates or deactivates DHCP. Entering “1” obtains IP automatically.	Yes
Ethernet IP	5677	8	Int32	The Ethernet IP. Each pair of registers holds one octet of the address. This register is only used if register 5675 is set to “0” (DHCP off).	Yes
Subnet Mask	5685	8	Int32	The Subnet Mask. Each pair of registers holds one octet of the address. See “Ethernet subnet mask” on page 5-18 for details. This register is only used if register 5675 is set to “0” (DCHP off).	Yes
Ethernet Port for Modbus	5693	2	Int32	The Ethernet Port used in the Modbus Protocol. (Default: 502)	Yes
Ethernet Modbus ID	5695	2	Int32	The Ethernet Modbus ID (range: 0 to 32).	Yes
Alarm Relay High Level	5697	2	Float	The High Level which triggers the Level Alarm Relay.	Yes
Alarm Relay Level Low	5699	2	Float	The Low Level which triggers the Level Alarm Relay.	Yes
Pressure Mode	5705	1	Boolean	Sets the measurement mode to either acquisition via 4-20mA or fixed value where: 0x00 = fixed value 0x01 = 4-20mA	Yes
Measurement Mode	5707	2	Int32	This is a bit-coded register to configure the measurement mode and to trigger the measurement start. Bit 0: Reserved. Bit 1: Read only. Set when a measurement is already active. Bit 2: Performs a single scan.	Yes
Set Concentration Alarm Low Level	5709	2	Int32	Enables/disables the Low Level Alarm of the Concentration Alarm Relay: 0x00: Disable (Low Level is ignored) 0x01: Enable	Yes
LED Intensity	5711	2	Int32	The signal LED intensity. The allowed range is 0x00 (lowest) to 0x0A (highest)	Yes
Timestamp	8231	2	Int32	This is the current system time, defined as the number of seconds that have elapsed since 00:00:00, Thursday, 1 January 1970 (Unix time, ISO8601). NOTE: Values below 1493050000 lead to error code “illegal value”.	Yes

9.1.7 Measurement control

Definition of register 5707

Start Register	Number of Registers	Reg3 / Reg4	Write Access
5707	2	Int32: Bit codes control register.	Yes

This register is used to activate interval measurement and to trigger a measurement. It is bit-coded as shown in the table.

Bit	Description
0	Interval on/off (delete to turn off, set to turn on)
1	Status-Bit: Set when a measurement is currently performed. The bit is deleted after completing the
2	Start measurement (single scan or continuous)
3 - 31	Reserved

9.1.8 Compensation temperature

This value is used for compensation of the oxygen calculation.

Start Register	Number of Registers	Reg3 / Reg4	Write Access
2411	2	Float: Temperature value in °C	Yes

9.1.9 Measurement interval

The oxygen measurement interval can be set between 1 and 359999. Setting the interval to “0” leads to Modbus error response with code 3.

The measurement values may be read any time but are updated only with the interval set in these registers. Hence, polling the measurement values in a higher rate than the measurement interval should be omitted as it leads to unnecessary traffic on the bus.

Start Register	Number of Registers	Reg3/Reg4	Write Access
3499	2	Int32: Interval value in seconds	Yes

9.1.10 Device ID RS-485, RS-232 and Ethernet

Sets the device ID used in the Modbus RTU communication. If a value over 32 is set, the device resets its ID to 1, which may lead to communication errors. If no ID is set, or the ID is not known, set the ID via broadcast (ID=0).

Start Register	Number of Registers	Reg3/Reg4	Write Access
4095	2	Int32: Device ID of RS-485. Minimum 1, Maximum 32	Yes

Table 6. Definition of register 4095

Start Register	Number of Registers	Reg3/Reg4	Write Access
4109	2	Int32: Device ID of RS-232. Minimum 1, Maximum 32.	Yes

Table 7. Definition of register 4109

Start Register	Number of Registers	Reg3/Reg4	Write Access
5695	2	Int32: Device ID of Ethernet. Minimum 1, Maximum 32.	Yes

Table 8. Definition of register 5695

9.1.11 Measurement values

Start Register	# of Registers	Reg1/ Reg2	Reg3/ Reg4	Reg5/ Reg6	Reg7/ Reg8	Reg9/ Reg10	Reg11/ Reg12	Reg13/ Reg14	Write Access
4895	14	Float: Pressure in mbar	Float: Reference Amplitude in mV	Float: Oxygen Amplitude in mV	Float: Oxygen Phase shift in degrees	Float: Temperatu re in °C	Float: Oxygen Value defined in register 2089	Int32: Error Register.	No

It is not necessary to read out all 14 registers. For simple applications, reading out registers 9 to 14 (starting with Register 4903) may be all that is required.

Bit	2N Value	Error
0	1	No RTD (Pt100)
1	2	No sensor selected
2	4	Amplitude too low
3	8	SD card defect
4	16	Reference amplitude out of range
5	32	Photo diode saturated
6	64	Signal overflow
7	128	Signal overflow
8	256	Reserved
9	512	Critical error.
10	1024	No pressure sensor / pressure sensor out of range
11	2048	Reserved
12	4096	Storage space full

Table 9. Error codes for the error register

9.1.12 4-20mA port1 calibration values

All values are transmitted in mA.

Start Register	# of Registers	Reg1/Reg2	Reg3/Reg4	Reg5/Reg6	Reg7/Reg8	Write Access
4329	8	Float: Device Value Low Point	Float: Reference Value Low Point	Float: Device Value High Point	Float: Reference Value High Point	Yes

9.1.13 4-20mA port2 calibration values

All values are transmitted in mA.

Start Register	# of Registers	Reg1/Reg2	Reg3/Reg4	Reg5/Reg6	Reg7/Reg8	Write Access
4979	8	Float: Device Value Low Point	Float: Reference Value Low Point	Float: Device Value High Point	Float: Reference Value High Point	Yes

9.1.14 4-20mA input calibration values

All values are transmitted in mA.

Start Register	# of Registers	Reg1/Reg2	Reg3/Reg4	Reg5/Reg6	Reg7/Reg8	Write Access
5667	8	Float: Device Value Low Point	Float: Reference Value Low Point	Float: Device Value High Point	Float: Reference Value High Point	Yes

9.1.15 Analog input and output value ranges

The values that define the range of the analog outputs/inputs (Low, Mid, and High Values of Analog Port1 and 2, and Analog Input) always use the units shown in the table.

Output	Unit	Sensor/Condition
Oxygen	% O_2	OP-3
Oxygen	% O_2/ppm gas	OP-6
Oxygen	ppm gas	OP-9
Temperature	°C	Always
Pressure	Mbar	Always

Endress+Hauser recommends deactivating the current measurement before changing any settings. The device holds its last analog output value until the next measurement.

9.1.16 Ethernet IP

Start Register	# of Registers	Reg1/Reg2	Reg3/Reg4	Reg5/Reg6	Reg7/Reg8	Write Access
5677	8	Int32: Ethernet IP Octet 1	Int32: Ethernet IP Octet 2	Int32: Ethernet IP Octet 3	Int32: Ethernet IP Octet 4	Yes

Example:

Writing the following bytes:

0x 01 10 16 2D 00 08 10 00 C0 00 00 00 A8 00 00 00 01 00 00 00 0A 00 00 1F B1 results in the IP 192.168.1.10

In detail:

0x 01	Slave address (int32 “01”)
0x 10	Function Code
0x 16 2D	Starting Address (5677 in int32 representation)
0x 00 08	Quantity of registers
0x 00 C0 00 00	Octet 1 (int32 192)
0x 00 A8 00 00	Octet 2 (int32 168)
0x 00 01 00 00	Octet 3 (int32 1)
0x 00 0A 00 00	Octet 4 (int32 10)
0x 1F B1	CRC16

9.1.17 Ethernet subnet mask

Start Register	# of Registers	Reg1/Reg2	Reg3/Reg4	Reg5/Reg6	Reg7/Reg8	Write Access
5685	8	Int32: Ethernet Subnet Mask Octet 1	Int32: Ethernet Subnet Mask Octet 2	Int32: Ethernet Subnet Mask Octet 3	Int32: Ethernet Subnet Mask Octet 4	Yes

9.2 Examples

9.2.1 Configuration of a continuous measurement

Precondition: Sensor is connected, and sensor constants and calibration values are already set up correctly (OP-9).

The goal for this configuration is a continuous measurement with a 1-minute interval with the pressure sensor and RTD (Pt100) are deactivated. Instead, a manual fixed value is transmitted. Refer to the table.

Step	Description	Register(s)	Value
1	Stop the measurement, if it is running.	5707, 5708	0 (Int32)
2	Set pressure mode to “Manual”.	5705	0 (Boolean)
3	Set manual pressure to “1006.23”.	3147, 3148	1006.23 (Float)
4	Set temperature mode to “Manual”.	5611	0 (Boolean)
5	Set manual temperature to “20.56”.	2409, 2410	20.56 (Float)
6	Set the interval rate to 1 min. (“60” seconds).	3499, 3500	60 (Int32)
7	Activate the interval mode and start the continuous measurement immediately.	5707, 5708	5 (Int32 translates to 00000101 binary)
8	Read measurement control register. If bit 1 is deleted, see step 9. If bit 1 is set or the display has timed out, repeat step 7 until value shows ‘0’ (max. 400 ms after which time-out detection should be implemented).	5707, 5708	/
9	Read out the last measurement.	4895 to 4908	Refer to the table.

Step	Description	Register(s)	Value
10	Read out the oxygen unit.	2089, 2090	1073741824 (Int32 translates to 0x40000000 hex, meaning

Table 10. Configuration for a continuous measurement

Register 4895/4896	Register 4897/4898	Register 4899/4900	Register 4901/4902	Register 4903/4904	Register 4905/4906	Register 4907/4908
Float: Pressure in mbar	Float: Reference Amplitude mV	Float: Oxygen Amplitude in mV	Float: Oxygen Phase shift in degrees	Float: Temperature in °C	Float: Calculated Oxygen Value in unit	Int32: Error Register (refer to the table)
1006.23	35000.00 (a value between 10 and 60000)	10562.12 (Sensor and environment dependent value)	44.32 (Sensor and environment dependent value)	20.56	100 (Sensor and environment dependent value)	0 (Error code. Should be 0 if a sensor is connected)

Table 11. Reading measurement example

9.2.2 Configuration of an analog output

- **Precondition:** Sensor is connected, and sensor constants and calibration values are already set up correctly (OP-9). 4-20mA Output is already in a calibrated state.

The goal for this configuration is to set up the analog output 1 for a linear oxygen value output between 10 and 110 ppm gas, with an error level of 2mA.

Step	Description	Register(s)	Value
1	Deactivate the current measurement, otherwise the output may generate false values.	5707, 5708	0 (Int32)
2	Set the Mode to “linear”.	4359, 4360	2 (Int32)
3	Set the Output to “oxygen”.	4363, 4364	1 (Int32)
4	Set the Error Level to “2mA”.	4389, 4390	2 (Int32)
5	Set the Low Level to “10.00”.	4377, 4378	10.00 (Float)
6	Set the High Level to “110.00”.	4381, 4382	110.00 (Float)

The oxygen value does not have to be set. This is done automatically when setting the sensor type.

9.2.3 1-Point calibration of an OP-9 sensor

Precondition: Sensor is connected and put in a low oxygen environment. Sensor constants are already set correctly (OP-9).

The goal for this example is to calibrate the oxygen sensor.

Step	Description	Register(s)	Value
1	Read the current measurement values.	4899 to 4908	Refer to the table.
2	Check to confirm there are no errors, especially error bits 1, 2, 4, 5, and 6. Refer to the table. Proceed only when there are no errors present.		
3	Set the calibration values cal0 and T0.	5521 to 5524	1st Float: 66.32 2nd Float: 21.98

Measurement reading for calibration process example

Register 4899/4900	Register 4901/4902	Register 4903/4904	Register 4905/4906	Register 4907/4908
Float: Oxygen Amplitude in mV	Float: Oxygen Phase shift in degrees	Float: Temperature in °C	Float: Calculated Oxygen Value in unit	Int32: Error Register. Refer to the table.
50592.62 (Sensor and environment dependent value)	66.32 (Sensor and environment dependent value)	21.98	This value can be ignored while calibration process takes place.	0 (Error code. Should be 0 if a sensor is connected)

10 Diagnostics and troubleshooting

10.1 Error indications

During operation, the analyzer displays error codes in the status bar and on measurement screens if a fault occurs. Error codes provide information about the device status and possible malfunctions.

For a description of error codes, their meaning, and recommended actions, refer to *Diagnostics and troubleshooting*.

10.2 Error codes

The error code is a bit combination of multiple errors. The table shows a list of error bits. Some examples of error codes are shown below:

- **Error code: 1** = No RTD (Pt100) (bit O)
- **Error code: 5** = No RTD (Pt100) and amplitude too low (bit 0 [2N Value 1], bit 2 [2N Value 4)=5)
- **Error code: 1024** = No pressure sensor connected (bit 10)
- **Error code: 1029** = No RTD (Pt100), amplitude too low, no pressure sensor connected (bit 0 [2N Value 1], bit 2 [2N Value 4], bit 10 [2N Value 1024] = 1029)

Bit	2N Value	Error
0	1	No RTD (Pt100)
1	2	No sensor selected
2	4	Amplitude too low
3	8	SD card defect
4	16	Reference amplitude out of range
5	32	Photo diode saturated
6	64	Signal overflow
7	128	Signal overflow
8	256	Reserved
9	512	Critical error. Refer to *Repair*.
10	1024	No pressure sensor / pressure sensor out of range
11	2048	Reserved
12	4096	Storage space full

10.3 Error code examples

Refer to the table for frequently asked questions related to troubleshooting the OXY5500 before contacting the service department. To contact the service department, refer to *Repair*.

Indication	Suspected Cause	Solution
No Sensor detected!	Amplitude < 1000.	Make sure that the SMA connector is connected properly to the connector.
Signal too low!	Amplitude < 3000.	Check sensor connections or POF for any irregularities.
		Refer to *Low signal strength: High O_2 on OP-3, OP-6, or OP-9 probe* → 🗎.
Signal Overflow!		Refer to *High signal strength: Low O_2 or no O_2 on OP-3, OP-6, or OP-9 probe* → 🗎.
Critical Error 16!	Reference signal exceeds specified range.	Refer to *Repair*.
No Pt100!	Pt100 sensor has wrong cable or is broken.	Check temperature sensor connection.
Critical Error 512!	Measurement system defect.	Refer to *Repair*.

Indication	Suspected Cause	Solution
SD Card Error!	SD card cannot be read or cannot be written on.	Refer to *Repair*.
Pressure Sensor out of range!	Pressure sensor is either not connected or provides a current less than 4 mA or higher than 20 mA.	Check the pressure sensor and its connection.
Flash Error!	Writing on Flash was not successful.	Refer to *Repair*.
Storage space full!	No more measurement files can be created and no more measurement entries can be saved.	Delete measurement files via Measurement Browser or Service Software.

10.4 Signal issues

If a signal overflow error is received, follow the steps below to resolve the error.

10.4.1 High signal strength: Low O_2 or no O_2 on OP-3, OP-6, or OP-9 probe

1. Decrease the LED intensity of the O_2 probe by single increments.
2. Refer to *Device settings screen* → 🖹 for more information on LED Intensity settings.

10.4.2 Low signal strength: High O_2 on OP-3, OP-6, or OP-9 probe

1. Increase the LED intensity of the O_2 probe by single increments.
2. Refer to *Device settings screen* → 🖹 for more information on LED Intensity settings.

10.5 Corrective actions

Calibrate the sensor before each new application. As an alternative, use the calibration values from the previous measurement.

If temperature compensation is not used, ensure that the sample temperature is known and remains constant during measurement.

If temperature compensation is used, position the Pt100 temperature sensor (RTD probe) as close as possible to the oxygen sensor to minimize temperature differences.

10.5.1 Signal drifts due to oxygen gradients

The sensor measures the oxygen concentration only at its surface. During long-term measurements, deposits such as biofilm, oil, or solid particles may form on the sensor and create oxygen gradients.

These gradients can affect measurement accuracy.

10.5.2 Signal drifts due to temperature gradients

Insufficient temperature compensation can lead to measurement errors.

If temperature compensation is used, ensure that no temperature gradients exist between the oxygen sensor and the temperature sensor.

If temperature compensation is not used, ensure that:

- The sample temperature is constant during measurement
- The sample temperature matches the temperature set at the start of the measurement

A temperature deviation of 0.3 °C results in a measurement error of approximately ±1% of the reading.

The temperature probe provides high accuracy. However, large temperature gradients in the gas can create an offset between the oxygen sensor and the temperature sensor. To minimize this effect, allow the gas temperature to stabilize before it reaches the oxygen sensor.

Endress+Hauser sample conditioning systems (SCS) are designed to minimize temperature gradient effects.

10.5.3 Signal drift due to photo-decomposition

The oxygen-sensitive material may undergo photo-decomposition, resulting in signal drift.

Photo-decomposition occurs only when the sensor is illuminated and depends on the intensity of the excitation light. Minimize the excitation light where possible.

Continuous illumination of an OP-3 sensor for 24 hours may result in a phase drift of up to +0.4% of the reading at 20 °C. Use interval measurement mode (for example, 30-second or 1-minute intervals) to reduce photo-decomposition. In interval mode, the system switches off the excitation light between measurements.

Use interval mode whenever possible to extend sensor life. Refer to the table below.

Name	Drift per 3600 Points	Drift per 50000 Points	Drift per 100000 Points
OP-3	<0.15 % air-sat.	<0.15 % air-sat.	<0.25 % air-sat.
OP-6	<1 ppb	<2 ppb	< 3 ppb

10.6 Performance improvement

To improve the performance over past measurements, check the calibration values by using the calibration test gases for “0” (UHP nitrogen 99.9999 %), and the Span test gas (100 ppm oxygen/N_2). This can be completed by using a

3-way valve connected to the test gas enabling the user to switch back and forth between bottles. This can assist in verifying proper operation.

10.7 Performing a Relative Accuracy Test Audit (RATA)

RATA is accessible from the **RATA** button on the SENSOR / SENSOR OPTIONS menu screen.

10.7.1 Starting RATA

1. Select **RATA** in the SENSOR OPTIONS window.
2. Click **OK** to perform a Relative Accuracy Test Audit (RATA).
   This opens a message window with the question, “Measurement Active. Abort for calibration?”
3. Select **Yes** and stop the measurement to move to the CALIBRATION screen.
4. Use the **Up** and **Down Arrow** buttons to navigate between input fields.

To enter editing mode

1. Click **OK**.
2. Change the setting or value (one digit at a time) by clicking the **Up** and **Down Arrow** buttons.
3. Make the desired change to an input field.
4. Click **OK** again to save the changes.

To exit editing mode

1. Click **Menu** to cancel and exit.

10.7.2 Setting pressure for RATA calculation

After stopping the currently running measurement, the PRESSURE FOR RATA CALCULATION screen displays.

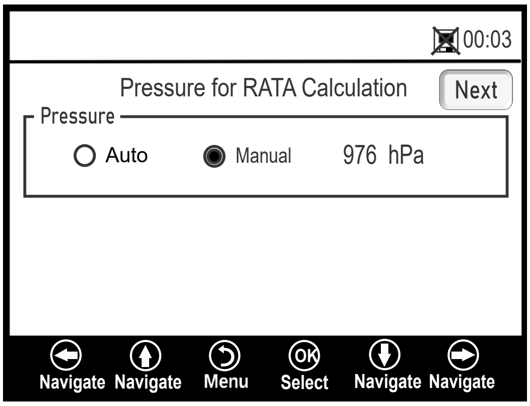

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Figure 32. Pressure for RATA calculation

- Select **Auto** and the atmospheric pressure is measured via the 4-20mA Input.
- Select **Manual** if there is no pressure sensor connected to the analyzer.

Type in the current atmospheric pressure value in the respective unit (hPa, mbar, PSI, atm, or torr).
Click **OK** to save changes.

10.7.3 Setting temperature for RATA calculation

- Select **Auto** to measure the temperature for RATA calculation with the RTD probe (Pt100 temperature sensor).
- Select **Manual** if the temperature for RATA calculation is known. Temperature values can be input in °C, °F, or K.

Switch to the desired temperature unit and change the temperature value in the input field.
Click **OK** to save changes.

Click **Next** at the top right of the screen followed by **OK**. The following screens display.

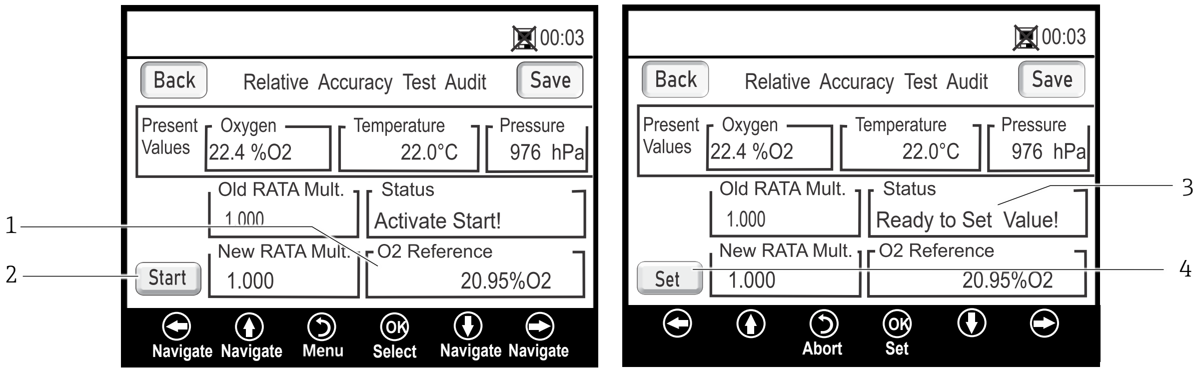

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Figure 33. Relative accuracy test audit (RATA) screen

At the top of the screen, the currently measured Oxygen, Temperature, and Pressure values are displayed. Below this, the Old RATA Mult. value is shown.

ℹ If RATA has not been changed, the display reads 1.000.

10.7.4 Setting RATA reference values

1. Enter the reference oxygen value (oxygen concentration of certified test gas lead into the vessel with the oxygen sensor or the oxygen value of a reference device) in the O2 Reference field (1) at the bottom of the screen.
2. Click **Start** next to the New RATA Mult. field (2), as shown in the Status field, to display current sensor phase values. Wait while the sensor values stabilize until the Status field displays "Ready to Set Value!" (3).
3. Click the **Set** button (4) next to the New RATA Mult. field and the new value displays.

   The New RATA Mult. can also be set manually. Refer to *Setting new RATA mult. manually* → 📄.
4. Click **Save** at the upper right of the screen.
5. Click **OK**.

   The display switches to the MEASUREMENT screen automatically.

There is no automatic reset for RATA. This feature cannot be manually reset to ‘off’ (1).

10.7.5 Setting RATA multiplier manually

1. Navigate to the New RATA Mult. box and click **OK**.
2. Use the **Up** and **Down Arrow** buttons to change the value (between 0.001 to 9.999) one digit at a time.
3. Click **OK** again.

11 Maintenance

The OXY5500 is a maintenance-free instrument, although some components may need cleaning or replacement. This chapter contains instruction for cleaning, replacement, and general troubleshooting information.

11.1 Cleaning

The housing should be cleaned only with a moist cloth to avoid electro-static discharge.

NOTICE

▶ Never use benzene, acetone, isopropyl alcohol, or other organic solvents to clean the sensor tip.

11.1.1 SMA-fiber connector

The SMA connector is a high precision optical component. For optimal performance, keep it dry and clean. Always use the rubber cap to close the output when not in use.

The SMA-fiber connector of the sensor can be cleaned only with a lint-free cloth. The sensor tip may be rinsed only with distilled water or ethanol.

11.1.2 Oxygen probe

This procedure applies to the OP-3, OP-6, and OP-9 probes.

The sensor tip can be cleaned as needed. Use caution when using this cleaning procedure to avoid removing the protective coating and causing possible damage.

Tools and materials

- Ethanol (or equivalent)
- Clean container
- Lint-free wipes

To clean the oxygen probe

1. Remove the probe from the analyzer. Refer to *Removing the oxygen probe* → 🗎.
2. Pour enough ethanol into a clean container to cover the probe tip when submerged.
3. Submerge probe tip into container with ethanol.

   Leave the probe tip submerged for 5 to 30 minutes depending on amount of visible contaminant.
4. Remove probe from container.
5. Place lint-free wipe on flat surface and gently tap the probe tip against the wipe to remove excess liquid and any contaminant residue.

   Repeat steps 3 to 5 if contaminant is still visible on the probe tip.
6. Replace oxygen probe in the analyzer. Refer to *Installing the new oxygen probe* → 🗎.
7. Recalibrate analyzer. Refer to *Calibrating the analyzer* → 🗎.

11.2 Temperature probe lifespan

The temperature probe is estimated to last as long as the analyzer itself, therefore does not require replacement.

11.3 Fuse replacement

Use the following instructions to replace a fuse.

To replace the fuse

1. Turn off power to the analyzer and open the enclosure door using a standard flathead screwdriver to unlatch the lock.
2. Using a flat-head screwdriver (or comparable), remove the cover from the fuse enclosure.

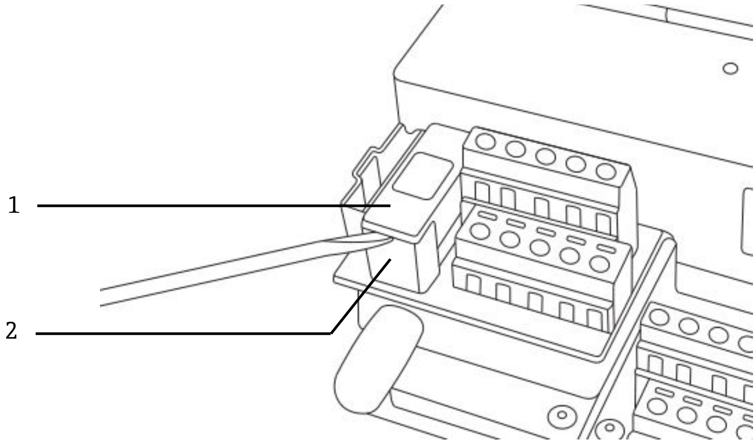

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Figure 34. Removing the fuse cover

#	Description
1	Fuse cover
2	Fuse enclosure

3. Lift the fuse cover off and turn it over. The fuse is held in the slot in the cover.
4. Remove the fuse from the fuse cover.

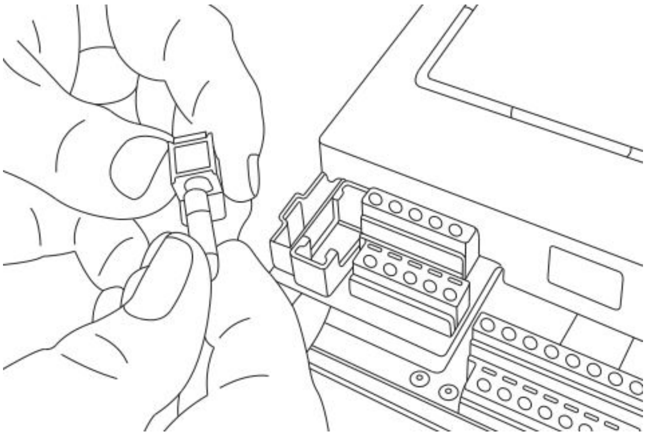

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Figure 35. Removing the fuse

5. Replace the expired fuse with a new fuse.
6. Turn the fuse cover over (fuse side down) and place onto the fuse enclosure.
7. Snap fuse cover onto fuse enclosure.

NOTICE

▶ Use only the same type and rating of fuse for replacements. Refer to the specifications listed in the table.

Description	Rating
Cartridge fuse, 216 Series, 5 × 20 mm, Fast Act	800 mA, 250 V

Table 12. Fuse specifications

11.4 Replacing the electro-optical module

Use the following procedure to replace and install the electro-optical module in the OXY5500 analyzer.

NOTICE

▶ Drawings shown in this instruction are used to provide a clearer illustration of the required steps only. DO NOT REMOVE the base plate from the analyzer enclosure to complete this instruction.

11.4.1 Required tools and hardware

- Flathead screwdriver
- Philips screwdriver
- Electro-optical module (P/N EX0800000020)

11.4.2 Removing the electro-optical module

1. Turn off power to the analyzer and open the enclosure door using a standard flathead screwdriver to unlatch the lock.
2. Disconnect the ribbon cable from the keypad and set aside.
3. Disconnect the probes, power supply, and pressure sensor from the terminal blocks, as necessary. Refer to *Installation* → 🖹.
4. Insert a flathead screwdriver in the clip extension at the top of the electro-optical module as shown in Figure 77.

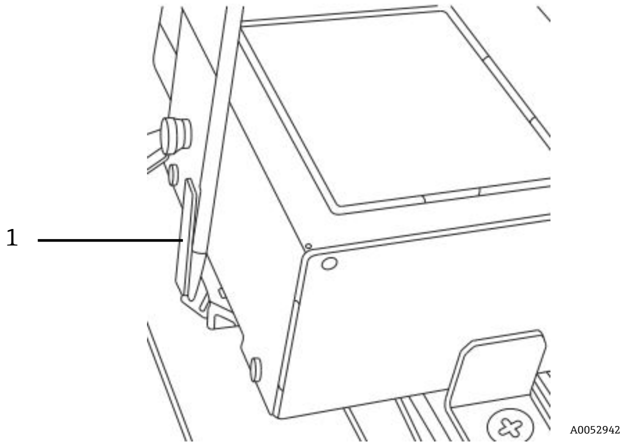

Figure 36. Inserting screwdriver into clip extension (1)

5. Press down on the corner of the electro-optical module and hold.
6. With the screwdriver, press down on the clip extension and away from the top of the module. The electro-optical module should pop up.

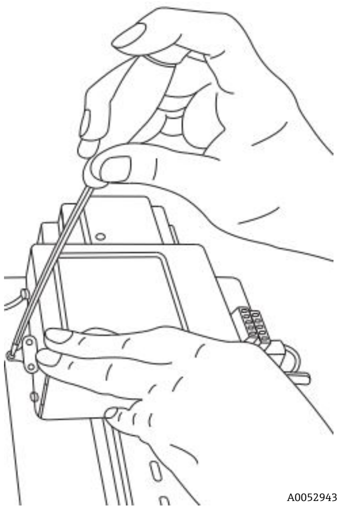

Figure 37. Disconnecting the electro-optical module from the DIN rail

7. Tilt the electro-optical module forward and lift away from the DIN rail.
8. Remove the ground cable from the module.

   Using the Philips screwdriver, remove the screw and cable.

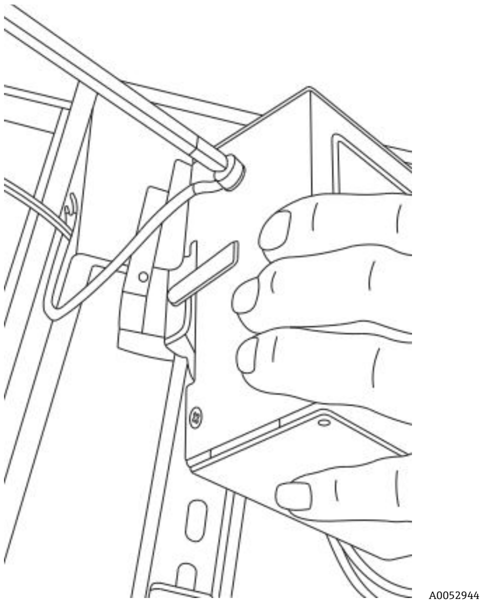

Figure 38. Removing the ground cable

9. Remove the electro-optical module from the enclosure and set aside.

11.4.3 Replacing the electro-optical module

1. Connect the ground cable to the replacement module.
2. Position the electro-optical module above the DIN rail and snap down into place.
3. Re-wire the terminal blocks as shown in Figure 73 or Figure 74.
4. Re-connect the probe.
5. Re-connect the ribbon cable to the keypad.
6. Close the analyzer enclosure door.

11.5 Installing/replacing the pressure sensor

The pressure sensor is optional on the OXY5500 analyzer. Use this procedure to install or replace the pressure sensor.

Refer to the procedure called *Installing the pressure sensor* → 🗎 and *Spare parts* → 🗎 for the pressure sensor kit part number to install this option.

11.5.1 Required tools

- Flathead screwdriver (standard size and mini)
- 9/16 in. open-ended wrench
- Adjustable wrench
- 10 in. crescent wrench

11.5.2 Removing the pressure sensor

1. Turn off the power to the analyzer and open the enclosure door using a standard flathead screwdriver to unlatch the lock.
2. With a 9/16 in. wrench, loosen the Swagelok nut closest to the pressure sensor.
3. Using the same wrench, loosen the Swagelok nut on the T-fitting.

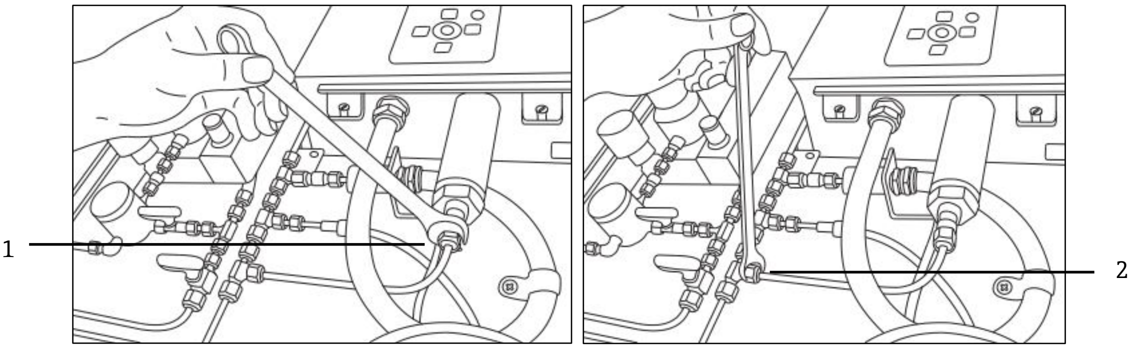

Figure 39. Removing the Swagelok nuts

#	Description
1	Pressure Sensor Nut
2	T-Fitting Nut

4. Remove the tubing between the pressure sensor and T-fitting.

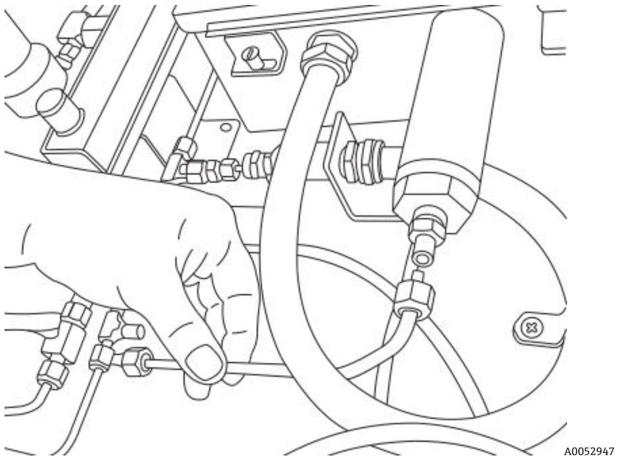

Figure 40. Removing the tubing

5. Loosen both hinge screws from the OXY5500 analyzer enclosure and open the door.
6. Disconnect the red and black wires labeled “psens-” and “psens+” from terminal block TB2 using the mini screwdriver as shown in Figure 82.

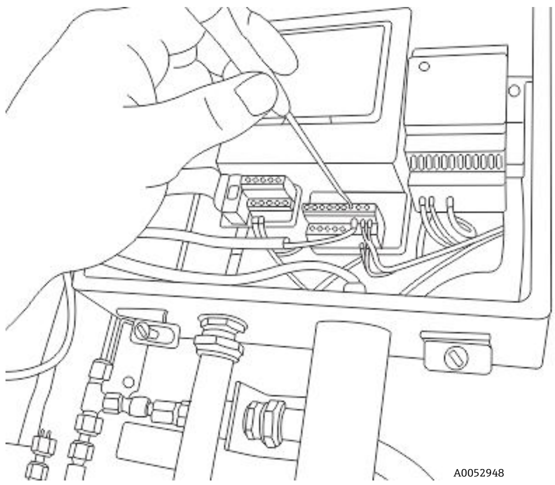

Figure 41. Removing the wiring

7. Hold the pressure sensor using the crescent wrench to secure the hex nut on the external end.
8. Loosen the panel mount nut from the pressure sensor on the inside of the enclosure with the adjustable wrench.

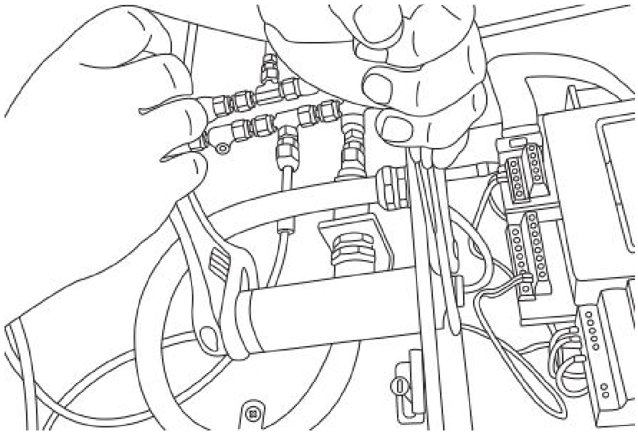

Figure 42. Removing the pressure sensor

9. Remove the panel nut with fingers and extract the pressure sensor from the enclosure. Leave the green sealing washer in place.

11.5.3 Installing the pressure sensor

1. Remove the new pressure sensor from the bag and insert into the opening with the green sealing washer with the same orientation as the one removed.
2. Secure the panel nut to the top of the pressure sensor inside the OXY5500 enclosure.
   Tighten the panel nut sufficiently to avoid possible leaks from entering the analyzer enclosure.
3. Connect the pressure sensor wiring as shown in Figure 73 or Figure 74.
4. Close the OXY5500 enclosure door and secure with the hinge screws.
5. Connect the pressure sensor tubing to the pressure sensor using the Swagelok nut.
6. Connect the tubing to the T-fitting using the Swagelok nut.
7. Tighten the Swagelok nuts at both ends of the tubing until tubing is secure.
8. Close the SCS enclosure cover.

11.6 Removing and replacing the oxygen probe

Use the following instructions to remove and replace an oxygen probe on the OXY5500.

11.6.1 Tools/parts

- OXY5500 replacement oxygen probe
- Adjustable Crescent wrench
- Philips screwdriver
- 5/32 in. Hex driver
- 7/16 in. Open-end wrench
- ½ in. Open-end wrench

Refer to *Spare parts* → 🗎 for a complete list of replaceable probe parts and part numbers.

11.6.2 Removing the oxygen probe

To remove the oxygen probe

1. Prepare the analyzer:
   a. Purge the analyzer with nitrogen (99.9999%) for 30 minutes.
   b. Shut off the gas flow.
   c. Turn off power to the analyzer.
2. Loosen the enclosure screws and remove the clamps to open the enclosure door.
3. Loosen external connections:
   a. Loosen the cable gland cap (do not remove).

b. Remove the tube nut from the panel (½ in. open-end wrench).

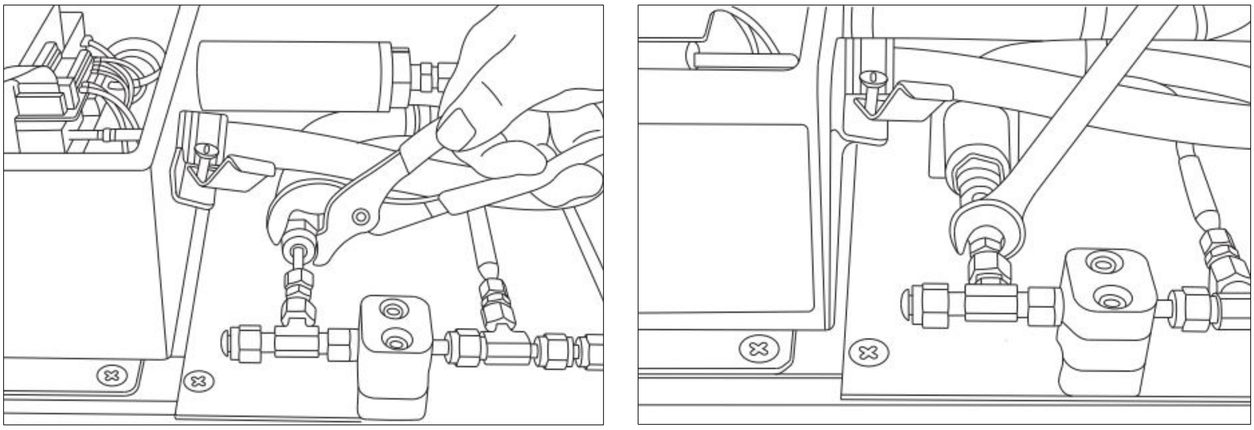

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Figure 43. Loosen the cable gland cap (left) and remove tube nut (right)

4. Remove conduit supports:
   a. Remove the conduit bracket screws (x2) (5/32 in. hex driver).
   b. Remove the conduit clamp screw (Philips screwdriver).

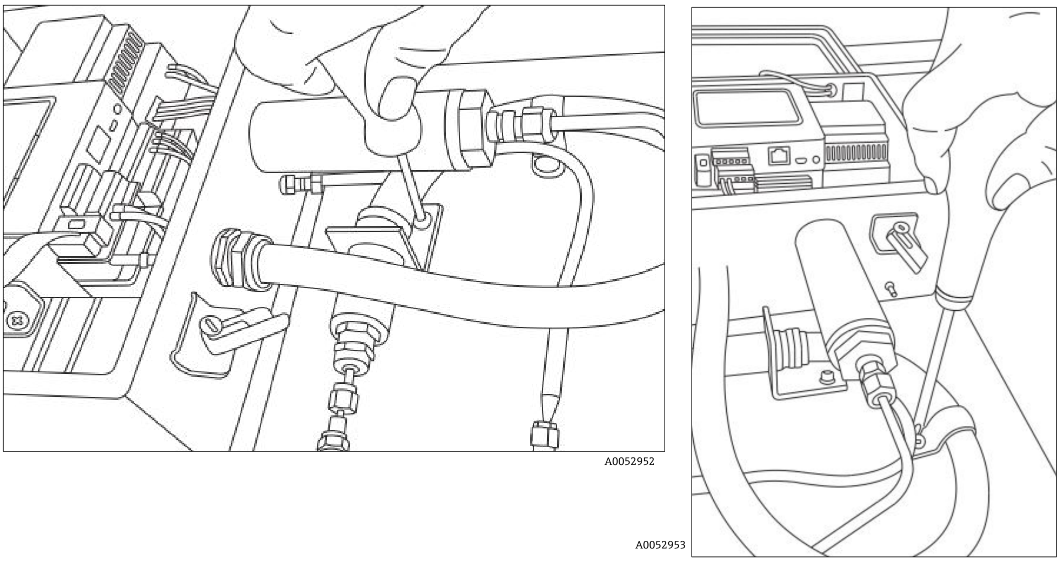

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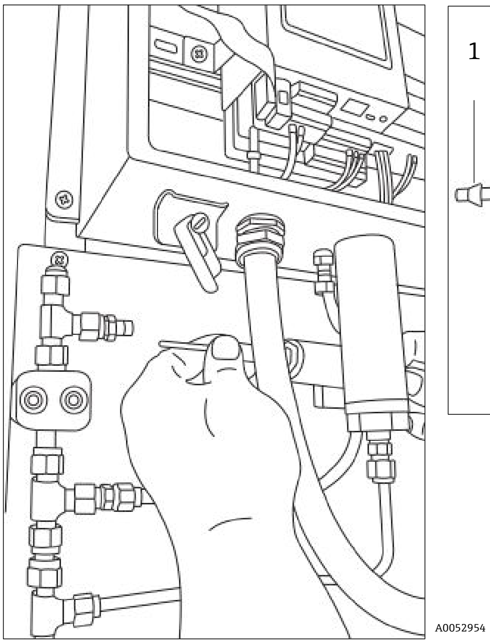
Figure 44. Remove conduit bracket (left) and clamp (right)

5. Disconnect the probe at the process:
   a. Rotate the conduit bracket parallel to the panel.
   b. Carefully remove the probe from the tee union.
   c. Extend the conduit away from the panel.
   d. Remove fittings from the probe tip.

NOTICE

▶ Do not disturb the temperature probe while removing the oxygen probe conduit.



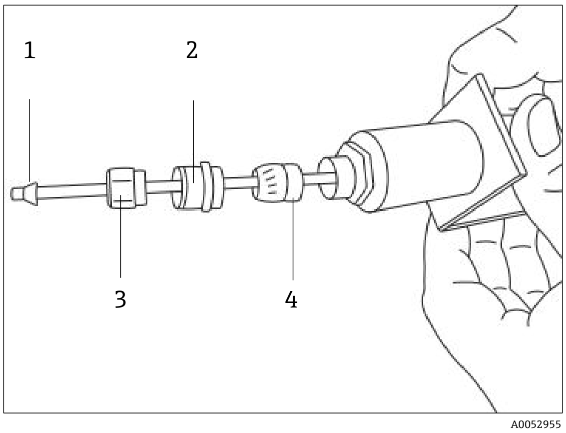


Figure 45. Panel side: remove probe from tee union (left) and fittings on oxygen probe (right)

#	Description	#	Description
1	Plastic Ferrule	3	Tube Nut
2	Cable Gland Cap	4	Cable Gland

NOTICE

- Retain the tube nut, cable gland cap, and plastic ferrules for use with the replacement probe.

6. Loosen the connector nut at the SMA connector.

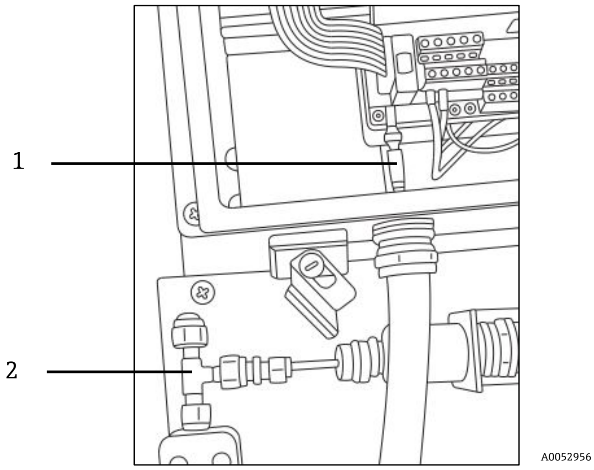


Figure 46. Remove connector nut (analyzer side): Oxygen Probe and SMA Connector Nut (1) and Tee Union (2)

7. Carefully pull the probe out through the conduit and discard.

11.6.3 Installing the new oxygen probe

To install a new oxygen probe

1. Remove the protective plunger from the analyzer side probe end.

NOTICE

- Do not touch the optical fiber tip.

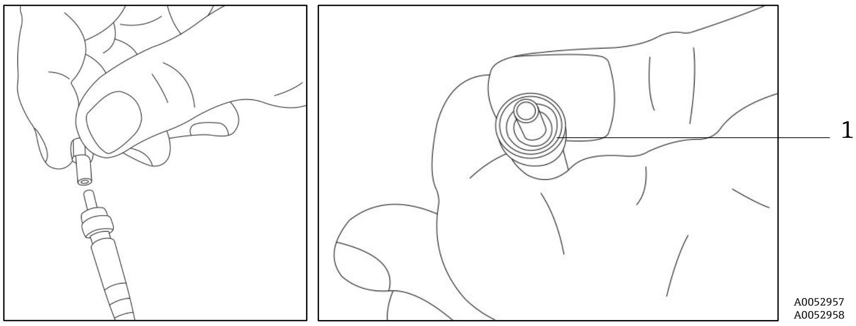


Figure 47. Preparing the new oxygen probe with the fiber optic tip (1)

2. Route the new probe through the conduit with the SMA connector end entering first.
3. Insert the probe tip into the SMA connector and tighten the connector nut.

NOTICE

▶ Do not bump the probe tip against the opening sides.

4. Prepare the panel-side probe end:
   a. Remove the red safety cap.
   b. Reinstall fittings on the probe tip.

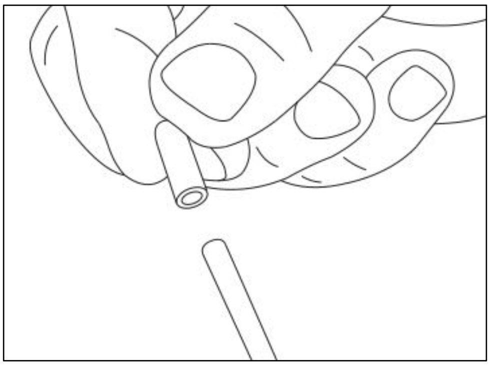


Figure 48. Remove probe safety cap (analyzer side)

NOTICE

▶ Install plastic ferrules correctly.

5. Install the probe in the process connection:
   a. Route the conduit so the probe aligns with the tee union.
   b. Insert the probe tip into the tee union.
   c. Tighten the tube nut.
6. Secure the conduit and fittings:
   a. Attach the conduit bracket using two screws (5/32 in. hex driver).
   b. Attach the conduit clamp using the screw (Phillips screwdriver).
   c. Tighten the cable gland cap with an adjustable wrench.

NOTICE

▶ Do not overtighten the cable gland cap.

7. Complete the installation:
   a. Close the analyzer enclosure and secure the clamps.
   b. Perform a leak test. Refer to *Repair*.
   c. Calibrate the analyzer. Refer to *Calibrating the analyzer* → 🗎.

12 Repair

For Service, refer to our website (https://endress.com/contact) for the list of local sales channels in your area.

To return the unit for service or replacement, refer to *Return*.

12.1 Device information

The ABOUT screen provides the Serial Number, LED Status, and Firmware Version of the OXY5500.

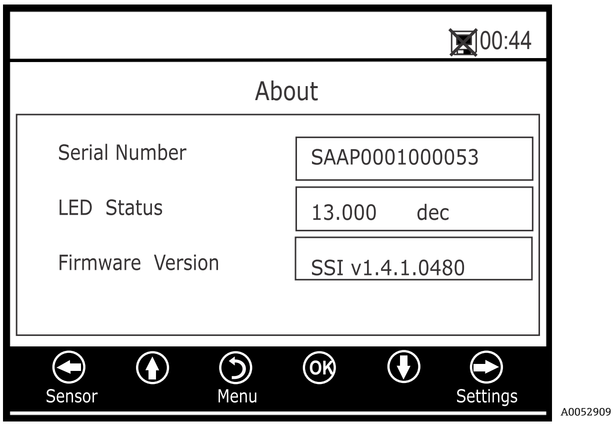


Figure 49. About screen

⚠ CAUTION

Make sure to have the analyzer information found in the ABOUT screen before contacting *Service* → 🗎.

12.2 General notes

Before contacting Technical Services, prepare the following information to send with your inquiry:

- Contact information
- Description of the problem or questions

Access to the information above greatly expedites our response to your technical request.

12.3 Return

If returning the unit is required, obtain a Service Repair Order (SRO) Number from Customer Service before returning the analyzer to the factory. Your representative can determine whether the analyzer can be serviced on site or should be returned to the factory. All returns should be shipped to:

11027 Arrow Rte.
Rancho Cucamonga, CA 91730-4866
United States of America
www.endress.com

12.3.1.1 Renewity returns

Returns can also be made inside the USA through the Renewity system. From a computer, navigate to https://endress.com/returns and complete the online form.

12.4 Spare parts

Below is a list of spare parts for the OXY5500 Optical oxygen analyzer with recommended quantities for 2 years of operation. Not all parts listed are included on every analyzer. When ordering, please specify the system serial number to ensure that the correct parts are identified.

Part Number	Description	2 YR QTY
Electronics Assembly Components		
70157019	Window, Enclosure	–
70157020	Window Gasket, Enclosure	–
70175074	OXY5500 Display	–
70175071	Replacement Kit, Transmitter, OXY5500	–
EX4000000004	Power Supply, Module, AC 100-240 V to DC 24 V 1.3A	1
70157025	Power Supply, DC/DC Conv., 15W, 24V, DIN	1
70157026	Cartridge Fuse, 216 Series, 5 × 20mm, Fast Act 800 mA, 250V	1
70157027	Communication Board	–
Optical Fiber Probes and Installation Accessories		
70163999	Optical Fiber Assembly, OP-9 Sensor Probe, 1000ppm, 0.7 m, SMA	1
70164000	Optical Fiber Assembly, OP-9 Sensor Probe, 1000ppm, 2.5 m, SMA	1
70164001	Optical Fiber Assembly, OP-9 Sensor Probe, 1000ppm, 5.0 m, SMA	1
70164002	Optical Fiber Assembly, OP-6 Sensor Probe, 5 %, 0.7 m, SMA	1
70164003	Optical Fiber Assembly, OP-6 Sensor Probe, 5 %, 2.5 m, SMA	1
70164004	Optical Fiber Assembly, OP-6 Sensor Probe, 5 %, 5.0 m, SMA	1
70164005	Optical Fiber Assembly, OP-3 Sensor Probe, 20 %, 0.7 m, SMA	1
70164006	Optical Fiber Assembly, OP-3 Sensor Probe, 20 %, 2.5 m, SMA	1
70164007	Optical Fiber Assembly, OP-3 Sensor Probe, 20 %, 5.0 m, SMA	1
70164008	OXY5500 Fiber Probe Conduit Kit (all lengths) (includes all parts associated with fiber probe installation)	–
70157039	Front Ferrule, 4 mm, Teflon	–
70157040	Back Ferrule, 4 mm, Teflon	–
70157041	Tube Reducer, 4 mm TX ¼ TSTUB, BT, SS	–
Temperature Probes and Installation Accessories		
70157042	RTD Probe, 100 Ω, ⅛ × 2, SS armored, 9 in. length	–
70157043	RTD Probe, 100 Ω, ⅛ × 2, SS armored, 200 in. length	–
70157044	Tube Reducer, ⅛ TX ¼ TA, SS, Bored	–
70164009	OXY5500 Temperature Sensor Kit (0.7 m) (includes temperature sensor and all parts associated with installation)	–
70164010	OXY5500 RTD Probe Kit (2.5 m, 5.0 m) (includes temperature sensor and all parts associated with installation)	–
Pressure Transmitter and Installation Accessories		
70157047	Pressure Transmitter	1
70157048	Male Connector, ¼ TFX, ¼ MNPT, 316 SS	–
70164011	OXY5500 Pressure Sensor Kit (includes pressure sensor and all parts associated with installation)	–

Part Number	Description	2 YR QTY
General		
BA02195C	OXY5500 Operating Instruction, additional copies	–
BA02196C	OXY5500 Sample Conditioning System (SCS) Operating Instruction, additional copies	–
XA02754C	OXY5500 Safety instruction, additional copies	–
SD02868C	OXY5500 Service Software Operation Instruction, additional copies	–
70157051	Cable, USB, 2.0A to Mini-B 5 Pin, 28/28 AW, 6 Ft.	–

12.5 Disclaimers

Endress+Hauser accepts no responsibility for consequential damages arising from the use of this equipment. Liability is limited to replacement and/or repair of defective components.

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12.6 Warranty

For a period of 18 months from date of shipment or 12 months in operation, whichever comes first, Endress+Hauser warrants that all products sold by it must be free from defects in material and workmanship under normal use and service when correctly installed and maintained. Endress+Hauser’s sole liability and Customer’s sole and exclusive remedy for a breach of warranty is limited to Endress+Hauser’s repair or replacement (at Endress+Hauser’s sole option) of the product or part thereof which is returned at Customer’s expense to Endress+Hauser’s plant. This warranty must apply only if Customer notifies Endress+Hauser in writing of the defective product promptly after the discovery of the defect and within the warranty period. Products may only be returned by Customer when accompanied by a return authorization reference number (SRO) issued by Endress+Hauser. Freight expenses for products returned by Customer is be prepaid by Customer. Endress+Hauser must pay for shipment back to Customer for products repaired under warranty. For products returned for repair that are not covered under warranty, Endress+Hauser’s standard repair charges must be applicable in addition to all shipping expenses.

13 Technical data

Application Data			
Target Components	O_2		
Principle of Measurement	Fluorescent Quenching		
	OP-9	OP-6	OP-3
Typical Measurement Ranges	0 to 200 ppmv (default) 0-10 to 10-1,000 ppmv User setting	0 to 5 % 0-1 to 0-5 % User setting	0-20 % 0-10 to 0-20 % User setting
Lower Limit of Detection	0.5 ppmv	20 ppmv	300 ppmv
Accuracy at 20 to 25 °C	±5 % of Reading	±3 % of Reading	±2 % of Reading
Repeatability	±1 % of Reading		
Measurement Update Time	Programmable Sampling Rate (default 30 seconds)		
Temperature Range (Configurable)	1) 0 °C to 60 °C (0 °F to 140 °F) 2) -20 °C to 50 °C (-4 °F to 122 °F)		
Sample Inlet Pressure	140 to 275 kPaG (20 to 40 psig) to sample panel regulator		
Sample Pressure Range	800 to 1400 mbara		
Maximum Probe Pressure	275 kPaG (40 psig)		
Sample Flow Rate	Typical 1.0 SLPM (2.1 SCFH)		
Recommended Calibration	Two-point calibration in oxygen-free environment (nitrogen) and a second span point (cylinder gas). Validate with O_2 in N_2 reference (cylinder gas).		
Electrical & Communications			
Input Power (Voltage and Max. Power)	AC 108 to 253 V, 50/60 Hz; 5.3W at AC 120 V; 6.6W at AC 240 V or DC 9 to 30 V (CSA), 18 to DC 30 V (IEC/ATEX); 4.7 W at DC 24 V		
Communication	▪ Analog: Qty 2) 4-20mA sourcing power outputs and (1) 4-20 mA input (sample pressure) ▪ Fieldbus: RS-232C, RS-485, Ethernet 10/100 with Modbus ▪ Output Relays: Qty (2) 250 mA max load (Concentration and Fault Alarms) USB 2.0 works with Service Software only 4 GB Internal Memory with Internal Data Logging		
LCD Display	Concentration, Temperature, Sample Rate, Data Logging, Diagnostics, plus Full Menu for Setup, Calibration, etc.		
Service Software	▪ Windows software. ▪ Connected via USB port. ▪ Download data logs, trend and monitor, calibrate and troubleshoot.		
Physical			
Enclosure Type	Type 4X and IP66 rated, 304 and 316 (optional) Stainless Steel		
Analyzer Dimensions	280 × 230 × 114 mm (11 × 9 × 4.5 in.) H × W × D (not including Sample Conditioning		
Controller to Probe Cable Length	0.7 m (2.3 ft.) - Standard 2.5 m (8.2 ft.) and 5.0 m (16.4 ft.) - Optional		
Weight	2.2 Kg (4.9 lb) - analyzer without sample conditioning system 14 kg (31 lb) - analyzer on a panel 35.4 (78 lb) - analyzer in enclosure		
Sample Probe Construction	316 Stainless Steel		
Area Classification - Certification	CSA: Class I, Div. 2, Groups A, B, C, and D, T3, NEMA 4X ATEX/IECEx/UKEX: Ex II 3 G, Ex ec IIC T3 Gc IP66 NOTE: Certification applies to the analyzer only. The enclosure versions of this product are considered accessories for the product and not included as part of the certification.		

⚠ CAUTION

- Probe assemblies and other such equipment required for analyzer operation must meet with all manufacturer specifications.

13.1 Technical notes

ANALYZER ENCLOSURE: The enclosure and fittings are designed for IP66/Type 4X ratings. In order to maintain this rating, all connections must be made with proper hardware and adhering to suggested procedures. Use of incorrect materials can compromise the integrity of the environmental seals.

NOTICE

- For a complete listing of new or updated certificates, please visit the product page at www.endress.com.

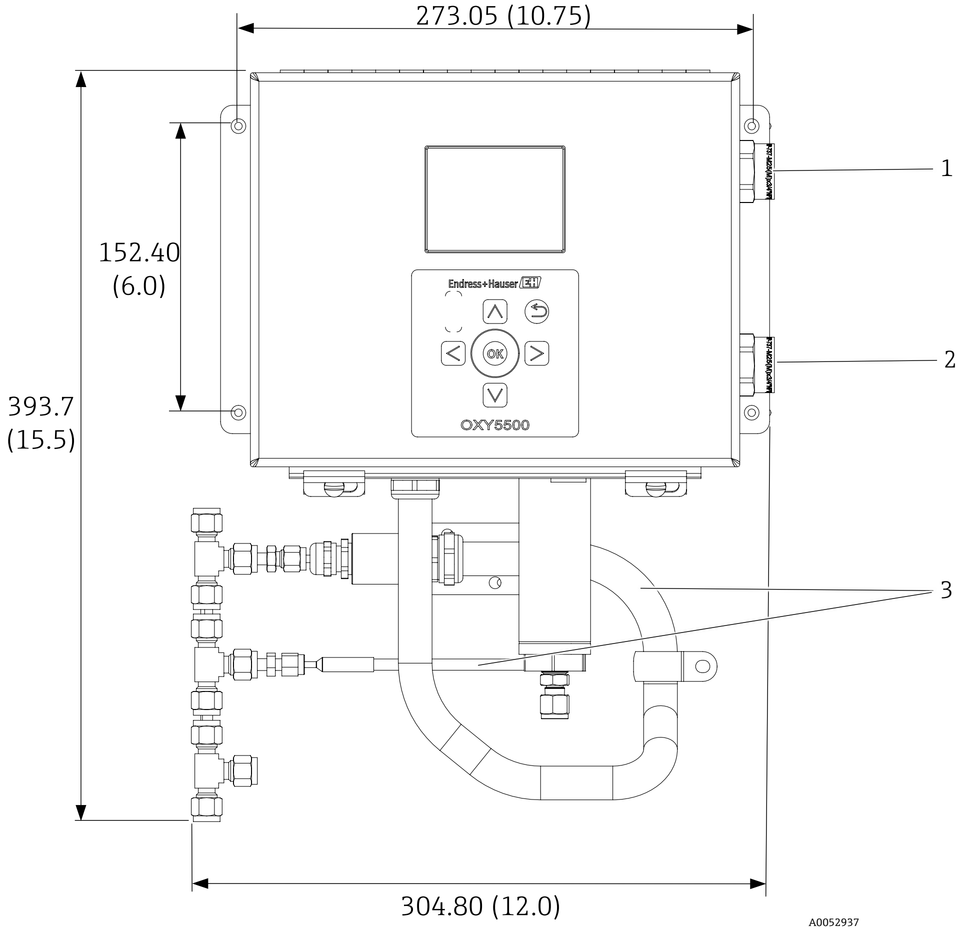
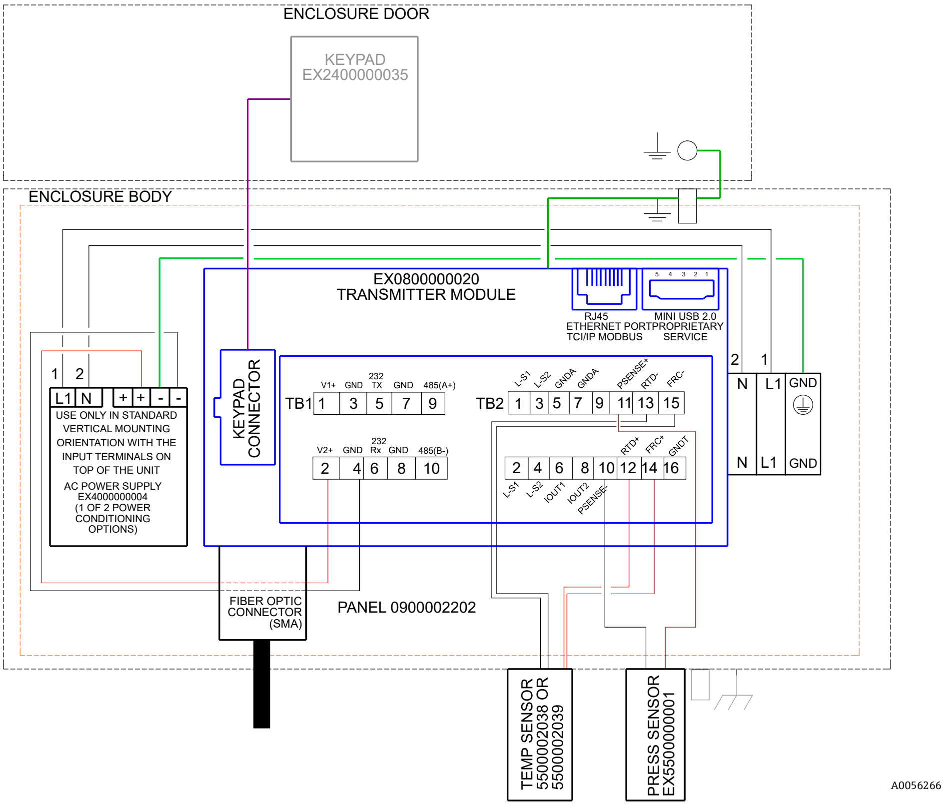


Figure 50. Outline and mounting dimensions - panel mount. Dimensions: mm(in)

#	Description
1	Communication signal connections
2	Power connections
3	Conduit and armor routing (for illustrative purposes only)



POWER WIRE CONNECTION			
	L1 (H)	N	GND
NEC	BLK (WIRE 1)	WHT (WIRE 2)	Y/G
ATEX	BRN (WIRE 1)	BLU (WIRE 2)	Y/G

Figure 51. Interconnect diagram (AC)

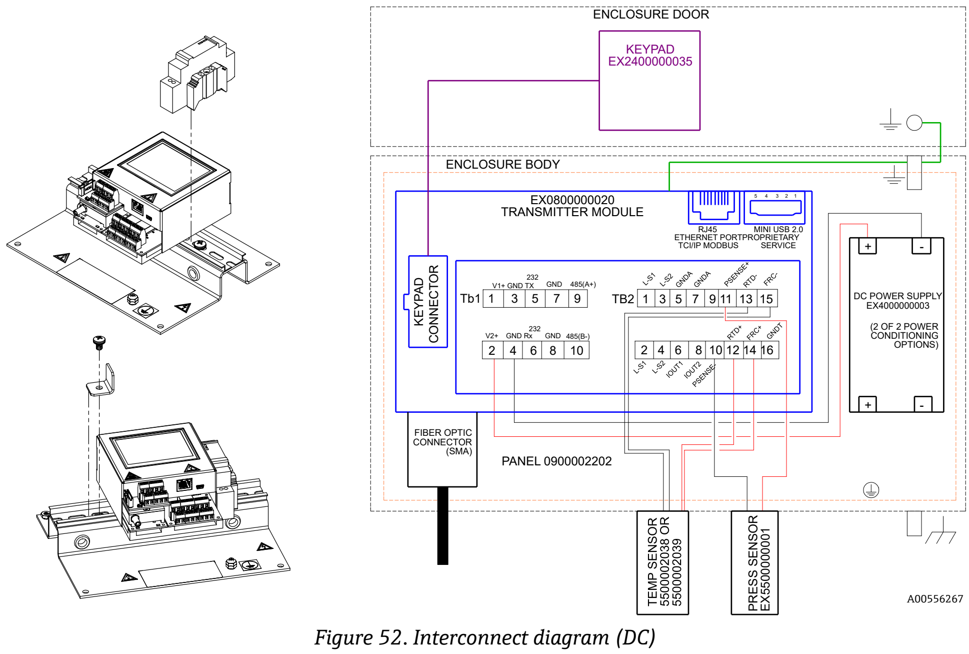


Figure 52. Interconnect diagram (DC)