Operating Instructions

Optical O_2 Sensor InPro 6860i/mA

HART communication

METTLER TOLEDO

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1 Introduction

1.1 Information Regarding the Operating Instructions

These operating instruction is an addition to the product operation manual of the sensor, which is delivered with the product. This document offers important notes of how to build up a direct HART communication between the optical O_2 sensor InPro 6860i/mA and a control system using the HART communication protocol. A prerequisite for safe work is compliance with all indicated safety notes and instructions described in the sensor manual.

Furthermore, local work safety regulations and general safety provisions applicable for the application of the sensor must be complied with.

The operating instructions must be read carefully before starting any work! It is part of the product and must be kept in direct proximity of the sensor, accessible for the staff at all times.

When passing on the sensor to third parties, the operating instructions must be passed on as well.

Observe also the safety regulations and instructions of the connected components from other suppliers.

1.2 Explanation of Symbols

Warning notes are marked by symbols in these operating instructions. The notes are initiated by signal words that express the scope of the danger.

Always comply with the notes and act carefully to prevent accidents, personal injury and property damage.

Warning notes

⚠ DANGER

DANGER indicates a directly dangerous situation that will lead to death or serious injury if not avoided.

⚠ WARNING

WARNING indicates a potentially dangerous situation that may lead to death or serious injury if not avoided.

⚠ CAUTION

CAUTION indicates a potentially dangerous situation that may lead to slight or minor injury if not avoided.

ATTENTION

ATTENTION indicates a potentially harmful situation that may lead to property damage if not avoided.

Advice and recommendations

NOTE emphasizes useful advice and recommendations, as well as information for efficient and interference-free operation.

1.3 Scope of Delivery

Each sensor is supplied fully assembled and factory tested and calibrated for correct function together with

– a quality control certificate

– inspection certificates 3.1 (complying with EN10204.3/1B)

The DD for AMS, PDM and the HART handheld terminal as well as the DTM for PACTware can be downloaded from the Internet: www.mt.com

1.4 Customer Service

Our customer service is available for technical information.

You can find your local office on the last page.

NOTE!

For quick processing of the call, note the data on the product's label, such as serial number, part number, etc.

1.5 Environmental Protection

ATTENTION

Danger for the environment by improper disposal of the sensor or components!

In case of improper disposal of the sensor or components, damage to the environment may result.

– Observe the local and national laws and directives.

– Disassemble the sensor according to its components (plastic, metal, electronics). Supply sorted components for recycling.

2 Safety

2.1 Intended Use

METTLER TOLEDO optical O_2 sensors are intended solely for inline measurements of the oxygen partial pressure. It is possible to operate and calilbrate the sensor via the inbuild HART communication capability.

Any use of these sensors which differs from or exceeds the scope of use described in this instructin manual will be regarded as inappropriate and incompatible with the intended use.

The manufacturer/supplier accepts no responsibility whatsoever for any damage resulting from such improper use. The risk is borne entirely by the user/operator.

2.2 General Safety Instructions

The following is a list of general safety instructions and warnings. Failure to adhere to these instructions can result in damage to the equipment and/or personal injury to the operator.

- The plant operator must be fully aware of the potential risks and hazards attached to operation of the particular process or plant. The operator is responsible for correct training of the workforce, for signs and markings indicating sources of possible danger, and for the selection of appropriate, state-of-the-art instrumentation.
- It is essential that personnel involved in the commissioning, operation or maintenance of these sensors or of any of the associated equipment (e.g.housings etc.) be properly trained in the process itself, as well as in the use and handling of the associated equipment. This includes having read and understood this instruction manual.
- The safety of personnel as well as of the plant itself is ultimately the responsibility of the plant operator. This applies in particular in the case of plants operating in hazardous zones.
- The oxygen sensors and associated components have no effect on the process itself and cannot influence it in the sense of any form of control system.
- Maintenance and service intervals and schedules depend on the application conditions, composition of the sample media, plant equipment and significance of the safety control features of the measuring system. Processes vary considerably, so that schedules, where such are specified, can only be regarded as tentative and must in any case be individually established and verified by the plant operator. Where specific safeguards such as locks, labels, or redundant measuring systems are necessary, these must be provided by the plant operator.
- A defective sensor must neither be installed nor put into service.
- Only maintenance work described in this operating instruction may be performed on the sensors.
- When changing faulty components, use only original spare parts obtainable from your METTLER TOLEDO supplier
- No modifications to the sensors and the accessories are allowed. The manufacturer accepts no responsibility for damages caused by unauthorised modifications. The risk is borne entirely by the user. Installation of cable connections and servicing of this product requires access to shock hazard voltage levels.
- Mains power wired to a separate power source must be disconnected before servicing. Switch or circuit breaker shall be in close proximity to the equipment and within easy reach of the operator; it shall be marked as the disconnecting device for the equipment..

3 Function and Design

3.1 Function

The optical oxygen sensors with HART communication capability are used for oxygen measurements. The measured value can be directly integrated into the control system via the 4-20 mA output of the sensor. Additionally a HART signal is available on this analog output. A transmitter is not needed! The sensor signal can be directly integrated into a control system.

The sensors are sterilizable and compatible with CIP (cleaning in place). The sensors are autoclavable.

The sensor can be configured and callibrated via the direct integrated HART communcation protocol. The process variables (PV, SV, TV and QV) can be accessed from common used asset management or configuration tools e.g. AMS, PDM or the Handheld terminal from Emerson.

3.2 Design

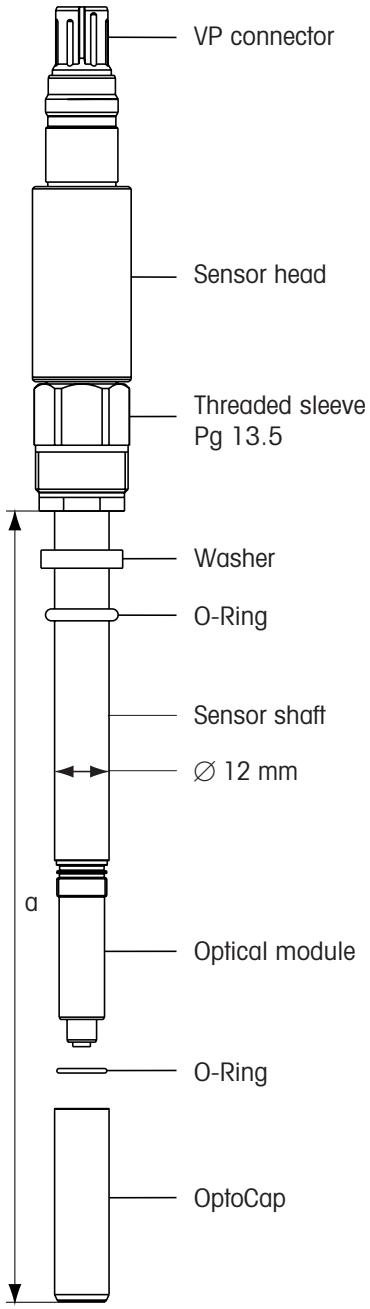

Fig. 1: InPro 6860i

4 Installation

4.1 Mounting the Sensor

Remove the green protection cap before mounting the sensor.

Mounting the sensor in a housing

Please refer to the instruction manual of your housing explaining on how to mount the sensor in place.

Mounting the sensor directly on a pipe or a vessel

The 12 mm sensors can be mounted directly through a socket with inside thread PG13.5 and securely tightened via the PG13.5 threaded sleeve. The sensor can be mounted in any orientation.

Attention! Do NOT turn the sensor anti-clockwise when installing or removing it from a housing/ process connection. Use the turning nut to secure or unsecure the sensor from the housing/ process connection and, if required, turn the sensor clockwise.

Turning the sensor anti-clockwise can result in loosening or removal of the OptoCap allowing ingress of luid into the OptoCap. A proper measurement can not be obtained in this case.

5 Wiring

5.1 Connecting the optical sensor to a cable

The InPro 6860i/mA is able to communicate the oxygen value as a 4-20 mA signal plus HART information directly to any control system without the need of a transmitter. The sensor is connected to the control system via a VP6/VP8 cable.

The data cable ensures a secure connection between the controller and the sensor under harsh industrial conditions.

The robust watertight IP67 connector housing guarantees maximum process safety.

To connect the data cable to the sensor align the slit of the connector with the pin in the plug. Then tightly screw the plug to fasten the two parts.

The cables are available from METTLER TOLEDO in various lengths.

	VP6 cable	**VP8 cable**
Color	**Function**	**Function**
Black/transparent	4–20 mA+, HART+	4–20 mA+, HART+
Red	4–20 mA-, HART-	4–20 mA-, HART-
Gray	24 V DC+	24 V DC+
Blue	24 V DC–	24 V DC–
White	NTC 22 kOhm	NTC 22 kOhm
Green	NTC 22 kOhm (GND)	NTC 22 kOhm (GND)
Pink	–	nc
Brown	–	nc
Green/yellow	shield	shield

VP8 and VP6 cable connection

5.2 HART System Architecture

Configure the sensor either via a configuration tool, an asset management tool or via a HART handheld terminal.

The DD and the DTM files can be downloaded via the Internet "www.mt.com".

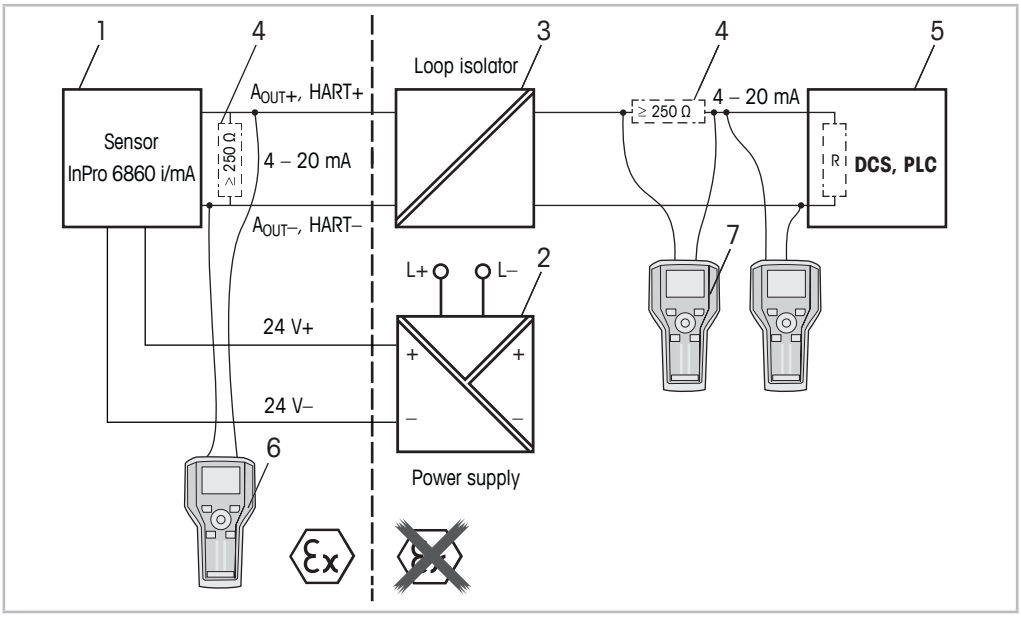

Fig. 2: HART® connection with HART handheld terminal

1 Sensor InPro 6860i/mA
2 24V DC (50 mA) power supply, e.g. Stahl 9143/10-244-060-20s
3 Loop isolator, e.g. from Knick IsoTrans 36/37
4 Load resistor
5 DCS (Distributed Control System) or PLC (Programmable Logic Controller)
6 HART handheld terminal, e.g. 475 Field Communicator from Emerson directly connected to the device
7 HART handheld terminal e.g. 475 Field Communicator from Emerson

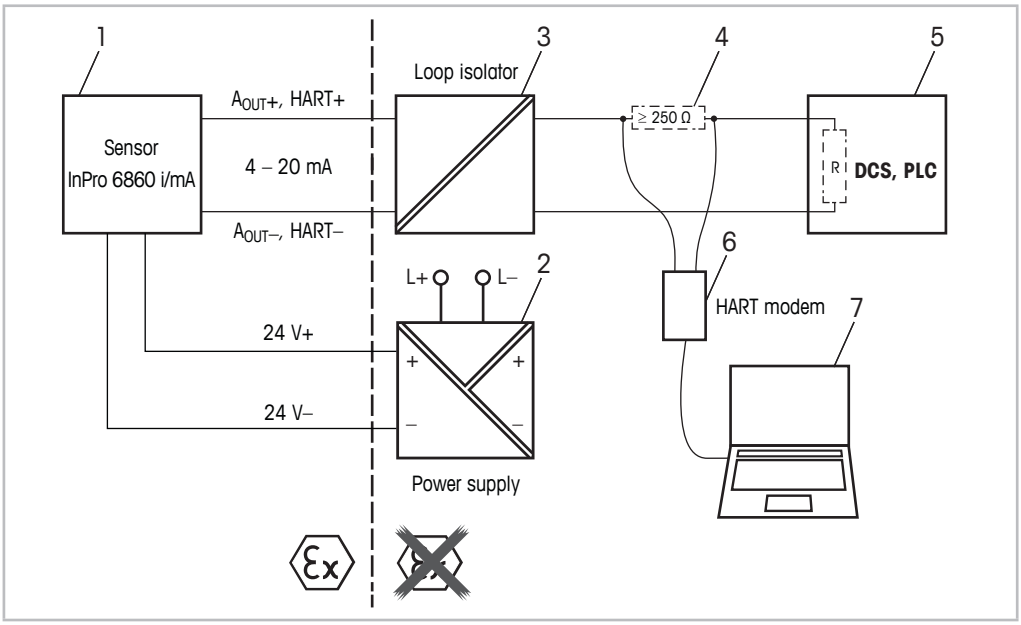

Fig. 3: HART® connection with HART modem and asset management or configurationtool

1 Sensor InPro 6860i/mA
2 24V DC (50 mA) power supply, e.g. Stahl 9143/10-244-060-20s
3 Loop isolator, e.g. from Knick IsoTrans 36/37
4 Load resistor, is not required if one is installed in the repeater power supply
5 DCS (Distributed Control System) or PLC (Programmable Logic Controller)
6 HART modem
7 PC with asset management tool, e.g. PACTware, AMS or PDM..

6 Operation

Configure the sensor either via an asset management tool or via a HART handheld terminal.

6.1 Start-up Operation via Configuration Tool or Asset Management Tool

NOTE!

You can download the DD/DTM via the Internet "www.mt.com".

Prerequisite: The sensor is mounted and electrically connected.

For steps 1 to 5 and for step 12 refer to the documentation of the configuration tool or asset management tool.

1. Install configuration tool e.g. PACTWare™ or asset management tool.
2. Install DD or DTM of the sensor.
3. Update device catalog.
4. Make a connection between the sensor and the PC. Check COM port settings if necessary.
5. Define the process variables **PV**, **SV**, **TV** and **QV**
   Menu path: Device Setup > Detailed Setup > Measurements > Channel Setup
6. Define the **sample rate, LED off temperature, Process Pressure, Humidity and Salinity**.
   Menu path: Detailed Setup > Measurements > Measurement Setup
7. Set **Hold Mode**. Menu path: Detailed Setup > Output conditions > Analog Output > Hold Mode
8. Set **Alarms**. Set the current output value to either 22 mA or 3.6 mA in case of an alarm.
   Menu path: Detailed Setup > Output conditions > Analog Output > Alarm > Alarm Current
9. Select the **Alarms.** Activate or deactive alarm conditions.
   Detailed Setup > Output conditions > Analog Output > Alarm > Alarm Selection
10. Set range of the analog output signal.
    Menu path: Detailed setup > Output Condition > Analog Output > Range
    - **URV** (Upper Range Value) and **LRV** (Lower Range Value)
      The values have to be within the measurement limits of the sensor.
    - **USL** (Upper Sensor Limit) and **LSL** (Lower Sensor Limit)
      The limits are defined by the sensor and cannot be changed.
11. Set a tag or long tag.
    Menu path: Detailed setup > HART info
12. For further settings refer to chapter 8.4 on page 25
13. Store configuration to device.

6.2 Start-up Operation via HART Handheld Terminal

NOTE!

The DD can be downloaded via the Internet "www.mt.com".

Prerequisite: The sensor is mounted and electrically connected.

For step 1 refer to the documentation of the HART handheld terminal.

1. Check if the DD of the InPro 6860i/mA has already been installed on the HART handheld terminal. Install the DD if necessary.
2. The communication is made automatically.
3. Define the process variables **PV**, **SV**, **TV** and **QV**
   Menu path: Device Setup > Detailed Setup > Measurements > Channel Setup
4. Define the **sample rate, LED off temperature, Process Pressure, Humidity and Salinity**.
   Menu path: Detailed Setup > Measurements > Measurement Setup
5. Set **Hold Mode**. Menu path: Detailed Setup > Output conditions > Analog Output > Hold Mode
6. Set **Alarms**. Set the current output value to either 22 mA or 3.6 mA in case of an alarm.
   Menu path: Detailed Setup > Output conditions > Analog Output > Alarm > Alarm Current
7. Select the **Alarms.** Activate or deactive alarm conditions.
   Detailed Setup > Output conditions > Analog Output > Alarm > Alarm Selection
8. Set range of the analog output signal.
   Menu path: Detailed setup > Output Condition > Analog Output > Range
   - **URV** (Upper Range Value) and **LRV** (Lower Range Value)
     The values have to be within the measurement limits of the sensor.
   - **USL** (Upper Sensor Limit) and **LSL** (Lower Sensor Limit)
     The limits are defined by the sensor and cannot be changed.
9. Set a tag or long tag.
   Menu path: Detailed setup > HART info
10. For further settings refer to chapter 8.4 on page 25
11. Store configuration to device.

7 Sensor Calibration

A detailed Information about the calibration, you find also in the manual of the InPro 6000 optical O_2 sensors (52206256).

Calibration should be performed at least after each change of the OptoCap, sterilizing or after autoclaving the sensor.

Since the correlation between the measured phase and the oxygen value is not linear, a calibration of an optical sensor must be performed very accurately. Wrong calibrations may significantly reduce the measurement accuracy and result in incorrect calculation of the Dynamic Lifetime Indicator (DLI) and the Adaptive Calibration Timer (ACT).

Each oxygen sensor has its own individual phase angle at zero oxygen (phi 0) and hundred percent air saturation (phi 100). Both values are subject to change, for example, after exchange of OptoCap or because of normal ageing of the OptoCap.

Several methods for calibration are available for the optical oxygen sensors.

The highest measurement accuracy is achieved by performing a 2-point calibration with air and a zero gas e.g. N_2 or CO_2 with a purity of at least 99.9%.

NOTE!

Via configuration tool, asset management tool or HART handheld terminal you can calibrate the sensor with the "1-point", "2-point", "Process calibration" and "Scaling" method.

For calibrating the sensor in the lab or in non-hazardous areas you can also use iSense. Contact your local sales representative for information about the iSense software and the iLink cable.

NOTE!

As soon as the calibration is in progress no other calibration can be started.

7.1 Factory Calibration

The sensor is delivered pre calibrated and ready for use. The factory calibration data are stored in the sensor and can not be changed by the user. During this calibration all sensor specific parameters are determined.

For continuous applications, we recommend periodic recalibration in line with your requirements on accuracy, the type of process in operation and your own experience. The frequency of the need for recalibration depends very much on the specific application, and therefore appropriate intervals cannot be exactly defined here.

7.2 Perform Sensor Calibration via Configuration Tool or Asset Management Tool

1. Select **Sensor Calibration** menu. Menu path: Device Setup > Sensor Calibration
2. Select calibration type, either "1-point", "2-point", "Process" or "Scaling".
   Depending on the selected calibration type the calibration procedure may be different.
   The description below refers to the 1-point calibration.
3. Select calibration mode, either "Adjust" or "Calibrate"
4. Set air concentration value. Either use the preset value or enter a new value. Click [Enter] to start the calibration.

⇒ The current measured values for "Phi" and "Tm" are shown.

5. Click [OK].
6. Set Pcal pressure value. Either use the preset value or enter a new value. Click [Enter]
7. Set Pcal humidity value. Either use the preset value or enter a new value. Click [Enter]
8. Set Pcal salinity value. Either use the preset value or enter a new value. Click [Enter].
9. A message appears "Checking calibraton values".

⇒ If the calculated values are within the valid range, "Phi0" and "Phi100" are shown.

10. Click [OK].
11. Enter the current date and time. Date and time are stored together with the new calibration date as a reference. The format for the date is YY/MM/DD.
12. The following message appears "This will change the sensor adjustment/calibration". Select either "Ok" or "Abort"
13. Calibration is done after pressing [Ok]".

7.3 Perform Sensor Calibration via HART Handheld Terminal

1. Select **Sensor Calibration** menu. Menu path: Device Setup > Sensor Calibration
2. Select calibration type, either "1-point", "2-point", "Process" or "Scaling".
   Depending on the selected calibration type the calibration procedure may be different.
   The description below refers to the process calibration.
3. Select calibration mode, either "Adjust" or "Calibrate"
4. A message appears "You are going to adjust the sensor".
5. Set air concentration value, e.g. 80%. Either use the preset value or enter a new value.
6. A message appears "Put sensor into e.g. 80% air concentration"
7. Click [OK] after placing the sensor in the requested concentration.

⇒ The current measured values for "Phi" and "Tm" are shown.

8. Click [OK].
9. Set Pcal pressure value. Either use the preset value or enter a new value. Click [Enter]
10. Set Pcal humidity value. Either use the preset value or enter a new value. Click [Enter]
11. Set Pcal salinity value. Either use the preset value or enter a new value. Click [Enter].
12. A message appears "Checking calibraton values".

⇒ If the calculated values are within the valid range, "Phi0" and "Phi100" are shown.

13. Click [OK].
14. Enter the current date and time. Date and time are stored together with the new calibration date as a reference. The format for date is YY/MM/DD
15. The following message appears "This will change the sensor adjustment/calibration".
    Select either "Ok" or "Abort"
16. Calibration is done after pressing [Ok].

8 Menu Overview and Menu Description

8.1 Menu Overview

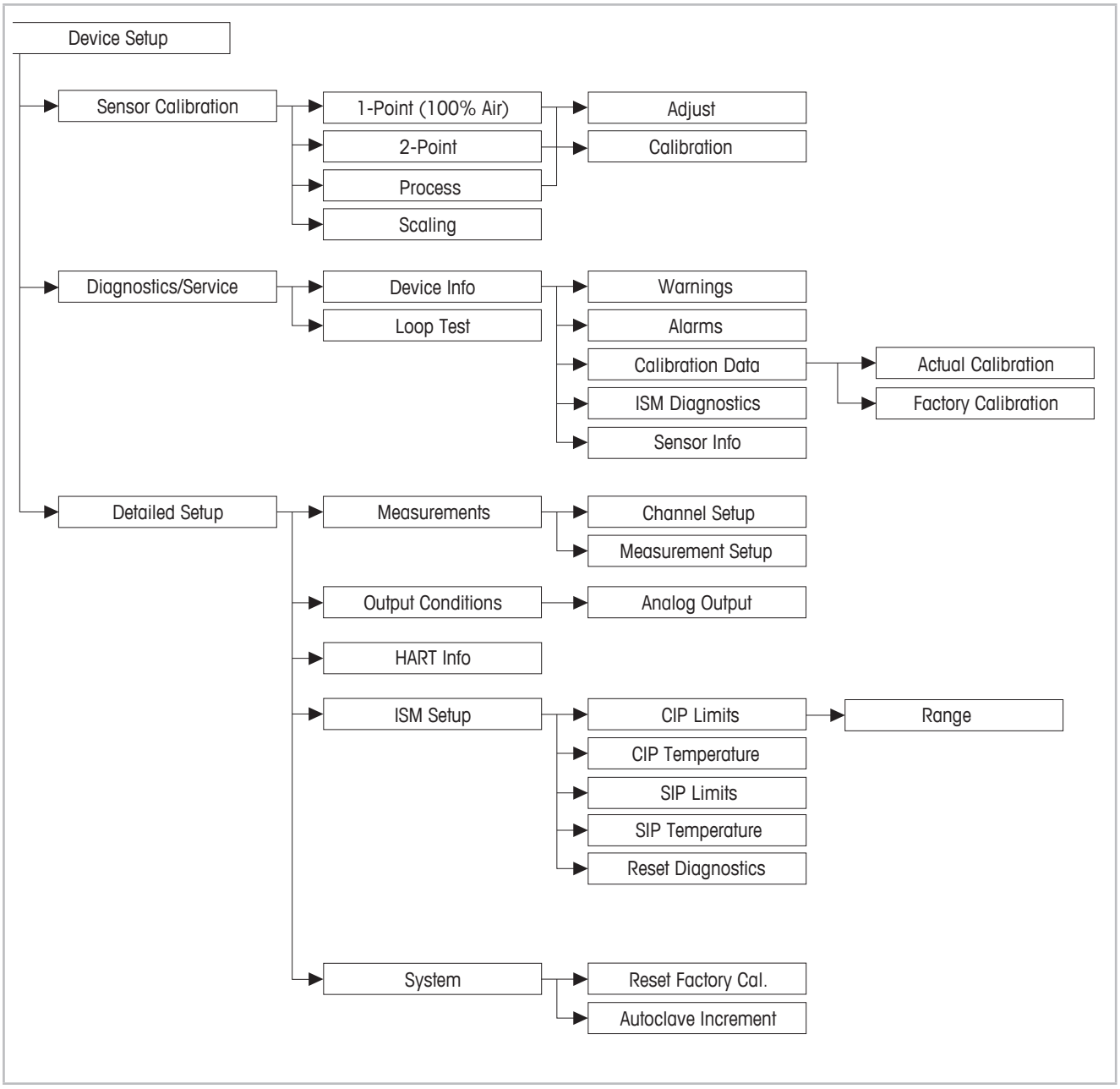

Fig. 4: Menu overview

8.2 Menu “Sensor Calibration”

This menu guides you through the sensor calibration process. See Chapter 7 ″Sensor Calibration″ on Page 16.

Before you start the calibration procedure you have to select either ″Adjust″ or ″Calibration″.

- **Adjust:** Calibration values are adapted and used for the measurement. Additionally, the calibration values are stored in the sensor.
- **Calibrate:** Calibration values are stored in the sensor for documentation, but cannot be used for the measurement. The calibration values from the last valid adjustment are further used for the measurement.
- **Abort:** Calibration is cancelled and values are discarded.

8.2.1 1-point Calibration

Menu path: Device setup > Sensor Calibration

This menu will perform a 1-point calibration. For most applications, a 1-point calibration should be sufficient, as long as not the whole measuring range of the sensor is used. By carring out a 1-point calibration , the factual phase at the desired oxygen value e.g. at 100 % oxygen (phi 100) of the sensor can be established. The corresponding calibration curve is calculated.

8.2.2 2-point Calibration

To receive a maximum accuracy of the measured values over the full measuring range, a 2-point calibration is required.

A 2-point calibration is required after replacement of the OptoCap.

By carrying out a dual point calibration both phase angles at zero oxygen (phi 0) and at hundred percent oxygen (phi 100) of the sensor can be established.

Point 1: Slope correction (with air or other calibration media with known O_2 value)

After the sensor signal has stabilized, the complete measuring system can then be calibrated to the 100% value of the desired measurable variable, e.g. 100% air, 20.95% O_2, or 8.26 ppm at 25°C (77°F) and normal pressure.

Point 2: Zero point

After the sensor signal has stabilized, the sensor can be calibrated to the 0% value of the desired measurable variable, e.g. 0% air, 0.0% O_2, or 0 ppm at 25°C/77°F.

Note: Incorrect zero point calibration is a frequent source of measurement error. For correct calibration, we recommend the use of nitrogen gas or otheroxygen-free medium with a level of purity of at least 99.995%.

8.2.3 Process Calibration / Scaling

A process calibration is needed in a situation when the sensor can not be removed from the process.

Two different routines for process calibration are possible:

– Process calibration

– Scaling

Process calibration is performed when a reliable control value is available and process pressure is known. Process pressure is only needed if the system is measuring in saturation (% air or % O_2) or gas (ppm gas) units. During this calibration the phase values of the calibration curve are adjusted.

Scaling is performed mainly in biopharma applications after sterilization (autoclaving) when the user desires to set the system to an initial value. During this calibration the phase values of the sensor are not adjusted, only the displayed values are rescaled to the desired value.

Note: For process calibration the operator has to enter the exact process calibration pressure value depending on how the reference value is taken. After the sensor signal has stabilized, the complete measurement system can be calibrated to the desired variable.

Note: For this type of calibration an accurate reference value and correct pressure settings are essential.

8.3 Menu "Diagnostics/Service"

Menu path: Device Setup > Diagnostics/Service

The **Diagnostics/Service** menu shows information about the sensor and supports you in troubleshooting.

8.3.1 Loop Test

Menu	Description
Loop Test	With the **Loop Test** function you can check the hardware of the analog output by defining a constant analog output value. During the test we recommend to remove the loop from automatic control. – 4 mA: The analog output is set to 4 mA. – 20 mA: The analog output is set to 20 mA. – Other: The analog output is set to the entered current value. – End: The test is terminated.

Table 1: Loop test

8.3.2 Device Info

8.3.2.1 Warnings

Menu path: Device > Diagnostics/Service > Device Info > Warnings

The **Warnings** menu shows current active warnings. ON indicates an active warning. OFF means that the warning is not active.

Menu	Description
Maintenance	Replace OptoCap Calibrate sensor

Table 2: Warnings

8.3.2.2 Alarms

Menu path: Device Setup > Diagnostics/Service > Device Info > Alarms > Alarm Status.

You can deactivate some alarms in the **Analog Output >Alarm selection** menu. If an alarm occurs but is deactivated in the menu, the alarm will not shown in the "Alarm Status" menu.

Meaning	Prerequisite
CIP counter expired	CIP counter enabled.
SIP counter expired	SIP counter enabled
Autoclave ctr. expired	Autoclave counter enabled
ACT expired	ACT enabled.
DLI expired	In "Alarm" menu enabled.
Temperature error	In "Alarm" menu enabled.
Hardware error	In "Alarm" menu enabled.
Signal error	In "Alarm" menu enabled.

Table 3: Alarms

8.3.2.3 Calibration Data

Menu path: Device Setup > Diagnostics/Service > Device Info > Calibration Data

Parameter	Description
Calibration Data	Display of the current zero point (Phi0), saturation (Phi100). The actual KSV factor and the used values for pressure, humidity, salinity and date are displayed additionally. **Note!** The **Calibration Data** function requires the correct setting of **Date** and **Time**.

Table 4: Calibration Data

8.3.2.4 Factory Calibration

Menu path: Device > Diagnostics/Service > Device Info > Calibration Data > Factory Calibration

Parameter	Description
Zero point (Phi0)	Display of the calculated Phi0 during factory calibration.
Saturation (Phi100)	Display of the calculated Phi100 during factory calibration..
KSV	Display of the KSV during factory calibration.
Pressure	Display of the pressure used during factory calibration.
Humidity	Display of the humidity used during factory calibration.
Salinity	Display of the salinity used during factory calibration.
Date	Display of the factory calibration date

Table 5: Factory Calibration

8.3.2.5 ISM Diagnostics

Menu path: Device Setup > Diagnostics/Service > Device Info > ISM Diagnostics

The ISM Diagnostic menu shows the limits and the current counts of the cleaning cycles counters as well as the maximum temperature and operation time. You can configure the cleaning cycles counter in theISM Setup menu. See Chapter 8.4.4 "ISM Setup" on Page 30.

Parameter	Description
CIP Limit	Display of the limit for the CIP cycles counter.
CIP Counter	Display of the current amount of executed CIP cycles.
SIP Limit	Display of the limit for the SIP cycles counter.
SIP Counter	Display of the current amount of executed SIP cycles.
Max Temperature	Display of the maximum temperature of the sensor. During autoclaving the Max. Temp. is not recorded.

Parameter	Description
Operation Time	Display of the total opertion time in hours
ACT (d)	Display of the Adaptive Cal Timer in days. The Adaptive Cal Timer estimates when the next calibration should be performed to keep the best possible measurement performance. The Adaptive Cal timer is reset to its initial value after a successful adjustment or calibration.
DLI (d)	Display of the remaining days for the Dynamic Lifetime Indicator. The days are set by the manufacturer.
Autoclave Limit	Display of the limit for the autoclave cycles counter.
Autoclave Counter	Display of the current amount of executed autoclave cycles.

Table 6: ISM Diagnostics

8.3.2.6 Sensor Info

Menu path: Device Setup > Diagnostics/Service > Device Info > Sensor Info

Parameter	Description
Sensor Type	Display of the sensor type.
Date	Display of the current date (YY/MM/DD).
Article Number	Display of the article number of the sensor.
Serial Number	Display of the serial number.
Firmware Version	Display of the actual firmware version of the connected sensor.

Table 7: Sensor Info

8.4 Detailed Setup

8.4.1 Measurements

The **Measurements** menu is required to set the sensor specific parameters and to select the process variables.

8.4.1.1 Channel Setup

Menu path: Device Setup > Detailed Setup > Measurements > Channel Setup

Parameter	Description
PV is	Select a measured variable as Primary Value.
SV is	Select a measured variable as Secondary Value.
TV is	Select a measured variable as Tertiary Value.
QV is	Select a measured variable as Quaternary Value.

Table 8: Channel Setup

8.4.1.2 Measurement Setup

Menu path: Device Setup > Detailed Setup > Measurement Setup

For optical O_2 measurement you can set the following parameters.

Parameter	Description
Sample Rate	Set the sample rate for the measurement in the range of 1sec to 60 sec. Optical oxygen sensors do not measure permanently. Each measurement cycle has a duration of approx.1 second. To prolong the lifetime of an OptoCap, the measurement interval can be set to any value between 1 and 60 seconds. Recommended setting is 10 seconds which is sufficient for most applications.
LED off Temperature	LED will be switched off automatically as soon as a specific process temperature is reached. The default temperature set point is 60°C/140°F. This limit can be set to an individual value by the user. The switch off temperature should be set at least 5° higher then the highest process temperature. For example, if the process temperature is 37°C/99°F, 42°C/ 104°F should be the minimum set-point. In this situation, as soon as the temperature exceeds 42°C/ 104°F the sensor will stop measuring and the LED will be switched off. For the switch on, a hysteresis of 3° is implemented, meaning that the sensor (and LED) will be switched on as soon as the temperature drops below 39°C/101°F..
Process Pressure	Set the pressure for measuring mode.
Process Humidity	Set relative humidity of the calibration gas. When no humidity measurement is available use 50 %
Process Salinity	Set salinity of the measured solution.

Table 9: Measurment Setup

8.4.2 Output Conditions

8.4.2.1 Analog Output

Menu path: Device Setup > Detailed Setup > Output Conditions > Analog Output

Menu / Function	Description
Loop Current Mode	Configure the signal of the analog output. – Enabled: The output current depends on the current measured value and the settings for the analog output. – Disabled: The output current is set to 4 mA. Use this setting e.g. for multi-drop applications.
Hold Mode	Select the output current of the analog output during Hold state. – Last Value: The output current is the last valid output. – Fixed: The output current is set to the defined value of the **Hold Fixed** parameter. – Alarm Value: The output current is as defined in the setting of the alarm value .
Hold Fixed	Set the output current of the analog output during Hold state for the **Hold Mode** parameter, option "Fixed".

Table 10: Analog Output

Alarm

Menu path: Device Setup > Detailed Setup > Output Conditions > Analog Output > Alarm

With the **Alarm** menu you can configure the alarm conditions for the 4 mA and 20 mA output values.

Menu	Description
Alarm current	Select the output current for the case of an alarm – High: Output current is 22.0 mA. – Low: Output current is 3.6 mA
Alarm selection	Activate or deactive an alarm monitoring by switching it "ON" or "OFF" – No alarm used – CIP counter expired – SIP counter expired – Autoclave counter expired – ACT expired – DLI expired – Temperature error – Hardware error – Signal error

Table 11: Alarm

Range

Menu path: Device Setup > Detailed Setup > Output Conditions > Analog Output > Range

With the **Range** menu you can configure the upper and lower measurement value for the 4 mA and 20 mA output values.

Menu	Description
PV URV	Set the Upper Range Value for the Primary Value. The Upper Range Value corresponds to the 20 mA output value. The value has to be within the measurement limits of the sensor.
PV LRV	Set the Lower Range Value for the Primary Value. The Lower Range Value corresponds to the 4 mA output value. The value has to be within the measurement limits of the sensor.
PV USL	Display of the Upper Sensor Limit of the connected sensor. This value cannot be changed.
PV LSL	Display of the Lower Sensor Limit of the connected sensor. This value cannot be changed.

Table 12: Range

8.4.3 HART Info

Menu path: Device Setup > Detailed Setup > HART Info

Parameter	Description
Tag	Identifies the transmitter. 8 packed ASCII characters
Long Tag	Identifies the transmitter. 32 ISO Latin-1 characters
Write Protection	Display of the status of the write protection.
Descriptor	Enter a description for describing the sensor.
Message	Enter a message.
Final assembly number	Displays a number to identify the sensor.

Table 13: HART Info

HART Output

Menu path: Device Setup > Detailed Setup > HART Info > HART Output

Menu	Description
Poll addr	Set the polling address of the transmitter. – 0: Point-to-point installations. The digital signal is overlaid on the 4 to 20 mA output current. – A number between 1 and 63: Multidrop installations. Each sensor needs to have a unique address to allow automatic identification by a master. In multidrop only the digital signal is used. The analog output current is fixed at 4 mA. In multidrop mode it is possible to have more than one sensor on one signal cable.
Num req preams	Display of the number of requested preambles.
Num resp preams	Set number of preambles.

Table 14: HART Output

8.4.4 ISM Setup

Menu path: Device Setup > Detailed Setup > ISM Setup

With the **ISM Setup** menu you configure the CIP cycle counter, SIP cycle counter. You can reset the DLI in the **Reset Diagnostics** menu.

CIP or SIP cycles are automatically recognized by the sensor. The algorithm of the counter recognizes an increase of the measured temperature above the set temperature. If the temperature remains for longer than five minutes at the set temperature, the transmitter is locked for the next two hours. The counter is incremented by one.

Menu	Description
CIP Limit	Set limit of the CIP cycle counter. If the counter exceeds the set value, the message "CIP cycle counter expired" is shown. The function is switched off by entering the value "000".
CIP Temperature	Set the temperature at which the sensor recognizes CIP cleaning. If the sensor measures the entered temperature or higher, the CIP cycle counter is incremented by one.
SIP Limit	Set limit of the SIP cycle counter. If the counter exceeds the set value, the message "SIP cycle counter expired" is shown. The function is switched off by entering the value "000".
SIP Temperature	Set the temperature at which the sensor recognizes SIP cleaning. If the sensor measures the entered temperature or higher, the SIP cycle counter is incremented by one.
Reset Diagnostics	You can reset the DLI of the sensor after the change of the OptoCap.
Reset CIP/SIP	You can reset the CIP/SIP counter of the sensor.
Reset Autoclave	You can resert the autoclave counter of the sensor.

Table 15: ISM Setup

8.4.5 System

Menu path: Device Setup > Detailed Setup > System

Parameter	Description
Reset Factory Calibration	Resets the calibration to factory values. Enter first date and time to record the reset with the corresponding time and date.
Autoclave Increment	By clicking on "Autoclave increment" the value will be incremented immediately by one.

Table 16: System

9 Troubleshooting

If the sensor is used in a manner not specified by METTLER TOLEDO the protection may be impaired.

Review the table below for possible causes of common problems.

Problem	Possible cause	Action
HART communication error	Wiring is incorrect	– Check wiring. See Chapter 5 "Wiring" on Page 12. – Notice polarity of supply voltage. See Chapter 5 "Wiring"
	Device is in multi-drop mode	Set for the polling address "0". See Chapter "HART Output" on Page 29.
Current output is always 22 mA or 3.6 mA	Sensor alarm is active.	– Check alarm conditions.
Incorrect measurement readings	Sensor is incorrectly configured.	– Configure sensor correctly. See Chapter 8 "Menu Overview and Menu Description" on Page 19.
Long response time	Sample rate of LED is high	– Reduce the sample rate for the LED. See Chapter 8.4.2.1 Measurement Setup on Page 25

Table 17: Troubleshooting

NOTE!

The **Diagnostics/Service** menu shows information about the connected sensor and supports you in troubleshooting. See Chapter 8.3 "Menu "Diagnostics/Service"" on Page 21.

Alarms are shown in the **Alarm Status** menu. See Chapter 8.3.2.1 "Warnings" on Page 22.

10 Default Values

Menu	Sub menu	Parameter	Value	Unit
Measurements	Channel Setup	PV is	O_2	%air
		SV is	Temperature	°C
		TV is	ACT	days
		QV is	DLI	days
	Measurement Setup	Sample rate	10	seconds
		LED off Temperatue	60	°C
		Process Pressure	980	mbar
		Process Humidity	0	%
		Process Salinity	0	g/kg
Output Condition	Analog Output	Loop Current Mode	Enabled	–
		Hold Mode	Last Value	–
		Hold Fixed	4	mA
	Analog Ooutput > Alarm	Alarm Alarm Current	22	mA
	Analog Output > Alarm	Alarm selection	All OFF	
	Analog Output > Range	PV URV	212	% air
		PV LRV	0	% air
		PV USL	300	% air
		PV LSL	0	% air
HART Info		Tag		
		Long Tag		
		Write Protect	No	
		Description		
		Message		
		Final assembly num		
	HART Output	Poll address	0	
		Num req preams	5	
		Num resp preams	5	
ISM Setup	–	CIP Limit	254	–
		CIP Temperature	60	°C
		SIP Limit	254	–
		SIP Temperature	100	°C

Table 18: Default values

11 Warranty

METTLER TOLEDO warrants this product to be free from significant deviations in material and workmanship for a period of one year from the date of purchase. If repair is necessary and not the result of abuse or misuse within the warranty period, please return by freight pre-paid and amendment will be made without any charge. METTLER TOLEDO's Customer Service Dept. will determine if the product problem is due to deviations or customer abuse. Out-of-warranty products will be repaired on an exchange basis at cost.

The above warranty is the only warranty made by METTLER TOLEDO and is lieu of all other warranties, expressed or implied, including, without limitation, implied warranties of merchantability and fitness for a particular purpose. METTLER TOLEDO shall not be liable for any loss, claim, expense or damage caused by, contributed to or arising out of the acts or omissions of the Buyer or Third Parties, whether negligent or otherwise. In no event shall METTLER TOLEDO's liability for any cause of action whatsoever exceed the cost of the item giving rise to the claim, whether based in contract, warranty, indemnity, or tort (including negligence).

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