

Head Mount Transmitter

M100



METTLER TOLEDO

Contents

| | | | |
|----------|----------------------------|--|-----------|
| 1 | Introduction | | 7 |
| | 1.1 | Information Regarding the Operating Instructions | 7 |
| | 1.2 | Explanation of Symbols | 8 |
| | 1.3 | Scope of Delivery | 9 |
| | 1.4 | Customer Service | 9 |
| | 1.5 | Environmental Protection | 9 |
| 2 | Safety | | 10 |
| | 2.1 | Intended Use | 10 |
| | 2.2 | General Safety Instructions | 10 |
| | 2.3 | Changes and Conversions | 11 |
| | 2.4 | IECEX and ATEX Instructions | 11 |
| | 2.5 | CSA Instructions | 12 |
| | 2.5.1 | CSA Markings | 12 |
| | 2.5.2 | Applicable Requirements | 12 |
| | 2.5.3 | Condition of Certificate | 12 |
| | 2.6 | Labels M100 2XH | 13 |
| 3 | Function and Design | | 14 |
| | 3.1 | Function | 14 |
| | 3.2 | Design | 15 |
| 4 | Installation | | 16 |
| | 4.1 | Safety Instructions for Installation | 16 |
| | 4.2 | Assembly of Sensor and Transmitter | 16 |
| 5 | Wiring | | 17 |
| | 5.1 | Safety Instructions for Wiring | 17 |
| | 5.2 | HART System Architecture | 17 |
| | 5.3 | Terminal Block (TB) Definition | 19 |
| 6 | Operation | | 20 |
| | 6.1 | Start-up Operation via Configuration Tool or Asset Management Tool | 20 |
| | 6.2 | Start-up Operation via HART Handheld Terminal | 21 |
| | 6.3 | Change Sensor Type | 21 |
| 7 | Sensor Calibration | | 22 |
| | 7.1 | Terminate Sensor Calibration | 22 |
| | 7.2 | Perform Sensor Calibration via Configuration Tool or Asset Management Tool | 23 |
| | 7.3 | Perform Sensor Calibration via HART Handheld Terminal | 23 |
| | 7.4 | Perform Calibration for Current Input Ain | 24 |

| | | | |
|-----------|---|---|----|
| 8 | Menu Overview and Menu Description | 25 | |
| | 8.1 | Menu Overview | 25 |
| | 8.2 | Menu "Sensor Calibration" | 26 |
| | 8.2.1 | Verify | 26 |
| | 8.2.1.1 | pH/ORP and pH/pNa | 26 |
| | 8.2.1.2 | O ₂ | 26 |
| | 8.2.1.3 | Conductivity | 26 |
| | 8.3 | Menu "Diagnostics & Service" | 27 |
| | 8.3.1 | Device Info | 27 |
| | 8.3.1.1 | Messages | 27 |
| | 8.3.1.2 | ISM Sensor Info | 29 |
| | 8.3.1.3 | Calibration Data and Calibration History | 29 |
| | 8.3.1.4 | ISM Diagnostics and Sensor Monitoring | 30 |
| | 8.3.1.5 | Model/Software Revision | 31 |
| | 8.3.2 | Test Device | 32 |
| | 8.3.3 | HW Diagnostics | 32 |
| | 8.4 | Detailed Setup | 32 |
| | 8.4.1 | Load Configuration | 32 |
| | 8.4.2 | Measurements | 33 |
| | 8.4.2.1 | Channel Setup | 33 |
| | 8.4.2.2 | pH (pH/ORP and pH/pNa) | 33 |
| | 8.4.2.3 | O ₂ | 34 |
| | 8.4.2.4 | Cond 4e (Conductivity 4e) | 35 |
| | 8.4.2.5 | Analog Input | 36 |
| | 8.4.3 | Output Conditions | 37 |
| | 8.4.3.1 | Analog Output | 37 |
| | 8.4.3.2 | Hold Output | 38 |
| | 8.4.4 | HART Info | 39 |
| | 8.4.4.1 | HART Output | 39 |
| | 8.4.5 | ISM Setup | 40 |
| | 8.4.5.1 | Sensor Monitoring Setup | 41 |
| | 8.4.5.2 | Reset ISM Counter/Timer | 41 |
| | 8.4.6 | System | 42 |
| | 8.4.6.1 | Reset | 42 |
| | 8.4.6.2 | Date & Time | 42 |
| | 8.4.7 | Alarm Setup | 43 |
| | 8.5 | Review | 43 |
| 9 | Troubleshooting | 44 | |
| 10 | Technical Data | 45 | |
| 11 | Default Values | 48 | |
| | 11.1 | Default Values for pH/ORP or pH/pNa Sensors | 48 |
| | 11.2 | Default Values for O ₂ Sensors | 49 |
| | 11.3 | Default Values for Conductivity Sensors | 50 |

| | | | |
|-----------|----------------------|---|-----------|
| 12 | Buffer Tables | | 51 |
| | 12.1 | Buffers for pH/ORP Sensors | 51 |
| | 12.1.1 | Mettler-9 | 51 |
| | 12.1.2 | Mettler-10 | 52 |
| | 12.1.3 | NIST Technical | 52 |
| | 12.1.4 | NIST Standard (DIN and JIS 19266: 2000–01) | 53 |
| | 12.1.5 | Hach | 54 |
| | 12.1.6 | Ciba (94) | 54 |
| | 12.1.7 | Merck Titrisole, Riedel-de-Haën Fixanale | 55 |
| | 12.1.8 | WTW | 55 |
| | 12.1.9 | JIS Z 8802 | 56 |
| | 12.1.10 | Buffer for Dual Membrane pH Electrodes (pH/pNa) | 56 |
| | 12.1.10.1 | Mettler-pH/pNa (Na+ 3.9M) | 56 |
| 13 | Warranty | | 57 |

1 Introduction

1.1 Information Regarding the Operating Instructions

These operating instructions offer important notes on handling of the M100 transmitter of METTLER TOLEDO. A prerequisite for safe work is compliance with all indicated safety notes and instructions.

Furthermore, local work safety regulations and general safety provisions applicable for the application of the transmitter 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 transmitter, accessible for the staff at all times.

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

Observe also the safety regulations and instructions of the connected sensor or of 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

The following is included in the scope of delivery:

- M100 Transmitter
- iLink cable for iSense software
- Quick Setup Guide
- CD-ROM with documentation, device description (DD), iSense software and configuration tool PACTWare™

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 transmitter or components!

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

- Observe the local and national laws and directives.
 - Disassemble the transmitter according to its components (plastic, metal, electronics). Supply sorted components for recycling.
-

2 Safety

2.1 Intended Use

The M100 transmitter is designed for use in the process industries and is certified intrinsically safe for installation in hazardous areas.

METTLER TOLEDO accepts no liability for damages resulting from incorrect use or use other than that intended.

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.

- 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.
- Mains power must employ a switch or circuit breaker as the disconnecting device for the equipment.
- Electrical installation must be in accordance with the National Electrical Code and/or any other applicable national or local codes.
- The transmitter should be installed and operated only by personnel familiar with the transmitter and who are qualified for such work.
- The transmitter must only be operated under the specified operating conditions. See Chapter 10 “Technical Data” on Page 45.
- Repair of the transmitter must be performed by authorized, trained personnel only.
- With the exception of routine maintenance, cleaning procedures or fuse replacement as described in these operating instructions, the transmitter must not be tampered with or altered in any manner.
- METTLER TOLEDO accepts no responsibility for damage caused by unauthorized modifications to the transmitter.
- Follow all warnings, cautions, and instructions indicated on and supplied with this product.
- Install equipment as specified in these operating instructions. Follow appropriate local and national codes.
- The transmitter’s protective lid must be in place at all times during normal operation.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.

2.3 Changes and Conversions

Changes or conversions of the transmitter or the installation may cause unexpected dangers.

The manufacturer's written approval is required before any technical changes and expansions of the transmitter can be carried out.

2.4 IECEx and ATEX Instructions

M100 multi-parameter transmitters are produced by Mettler-Toledo GmbH.

The M100 transmitter has passed the inspection of IECEx and ATEX and conforms to the following standards:

- IEC 60079-0 Explosive atmospheres –
Part 0: Equipment – General requirements
- IEC 60079-1 Explosive atmospheres –
Part 1: Equipment protection by flameproof enclosures "d"
- IEC 60079-11 Explosive atmospheres –
Part 11: Equipment protection by intrinsic safety "i"
- IEC 60079-26 Explosive atmospheres –
Part 26: Equipment with equipment protection level (EPL) Ga
- IEC 60079-31 Explosive atmospheres –
Part 1: Equipment dust ignition protection by enclosure "t"

Ex Marking:

- II 2(1) G Ex ib [ia Ga] IIC T4 Gb
- II 2(1) D Ex ib [ia Da] IIIC T80°C/ T90°C Db
- II 2(1) G Ex d [ia Ga] IIC T4 Gb
- II 2(1) D Ex tb [ia Da] IIIC T80°C/ T90°C Db

Certification No.:

- ATEX: SEV 14 ATEX 0128 X
- IECEx: IECEx CQM 14.0020 X
- NEPSI: GYB14.1194X



NOTE!

For the special conditions of use refer to the corresponding certificate supplied on the CD.

2.5 CSA Instructions

2.5.1 CSA Markings

- Class I, Division 1, Groups A, B, C and D T4
- Class II, Division 1, Groups E, F and G and
- Class III
- Ex ia IIC T4 Ga; Class I, Zone 0, AEx ia IIC T4 Ga

2.5.2 Applicable Requirements

- CSA C22.2 No. 0 –
General Requirements – Canadian Electrical Code Part II
- CSA C22.2 No. 61010-1-12 –
Safety Requirements for Electrical equipment for measurement, Control and Laboratory use –
Part 1: General requirements
- UL61010-1 3rd Ed –
Safety Requirements for Electrical equipment for measurement, Control and Laboratory use –
Part 1: General requirements
- CSA-C22.2 No. 60079-0:11 –
Explosive atmospheres – Part 0: Equipment – General requirements
- CSA-C22.2 No.60079-11:14 –
Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”
- ANSI/UL 913 8th Ed. –
Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II and III, Division 1,
Hazardous (Classified) Location
- UL60079-0:2013 –
Explosive atmospheres – Part 0: Equipment - General requirements
- UL60079-11:2013 –
Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”

2.5.3 Condition of Certificate

1. Installation per the Canadian Electrical Code Part 1 C22.1-15. , Section 18 and National Electrical Code NFPA70, Article 504 and Article 505
2. Intrinsically safe with entity parameter when installed per control drawing, drawing number is 30127727
3. When installed in combustible dust atmosphere, the end user shall take care of the influence of process temperature and ensure the maximum surface temperature on enclosure does not exceed 165 °C.
4. Avoid ignition hazard due to impact or friction to Aluminum alloy enclosure.
5. When transmitter is used in Class I, Division 1 or Class 1, Zone 0, or Class II and Class III cable gland or blanking plug of transmitter shall be used to ensure degree of protection IP 66 and the sensor shall be connected to transmitter via AK9 connector to ensure the degree of protection of transmitter complied with IP 66.

2.6 Labels M100 2XH

EU

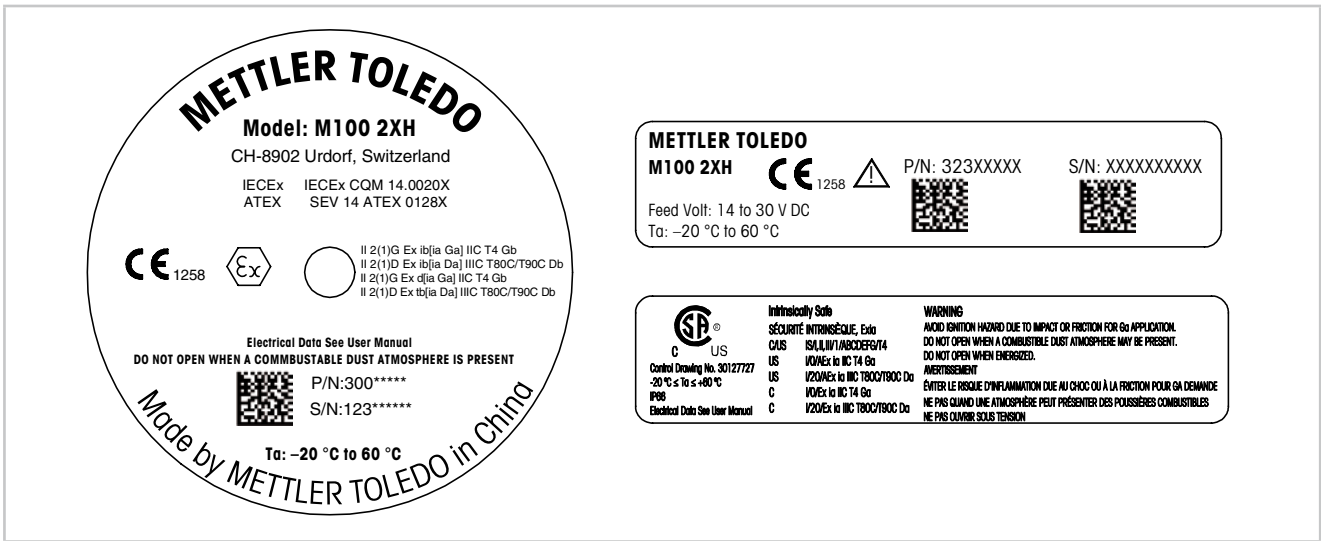


Fig. 1: Labels M100 2XH, EU

Left: Placed on the top of the housing
 Upper right: Placed inside the housing
 Lower right: Placed outside the housing

Address: Mettler-Toledo GmbH Process Analytics, Im Hackacker 15, CH-8902 Urdorf, Switzerland
www.mt.com/pro

US

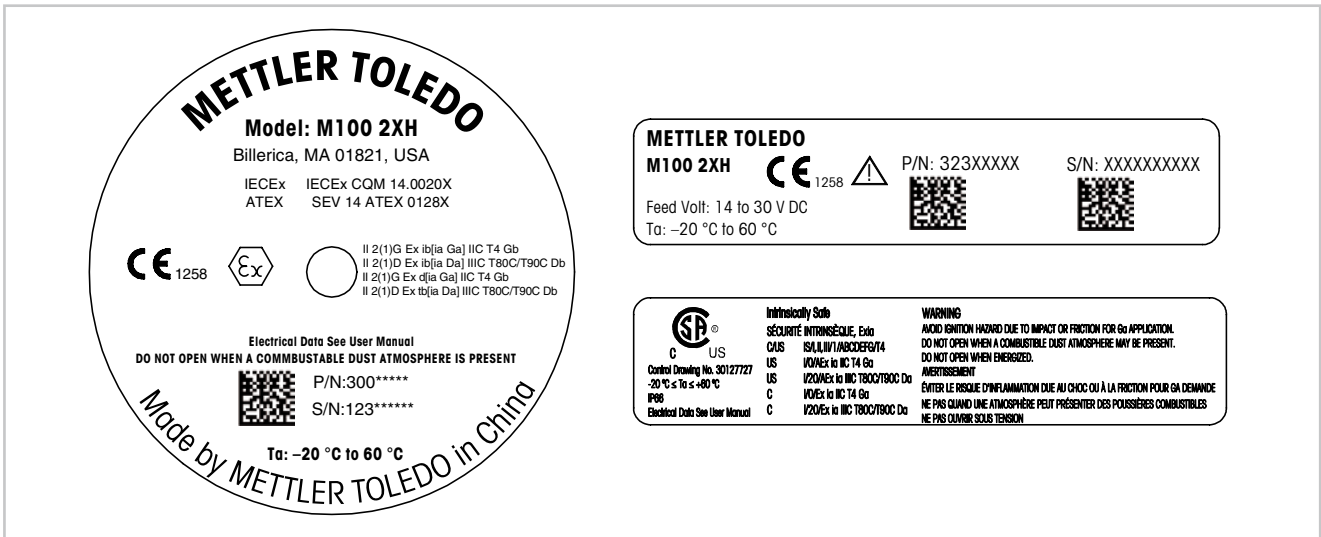


Fig. 2: Labels M100 2XH, US

Left: Placed on the top of the housing
 Upper right: Placed inside the housing
 Lower right: Placed outside the housing

Address: Mettler-Toledo, Thornton Inc, Billerica, MA 01821, USA

3 Function and Design

3.1 Function

The M100 is a 2-wire head mount transmitter with HART communication capability for analytical measurements. The M100 is a single-channel, multi-parameter transmitter for pH/ORP, pH/pNa, dissolved oxygen and conductivity measurement. It is only compatible with ISM sensors. The M100 transmitter is designed for use in the process industries and is certified intrinsically safe for installation in hazardous areas.

The M100 is available with M20 metric cable glands or NPT 3/4" cable conduits.

M100 parameter fit guide

| Parameter | M100 2XH |
|---|----------|
| | ISM |
| pH/ORP | • |
| pH/pNa | • |
| Conductivity 4-e | • |
| Amp. DO ppm ¹⁾ / ppb ²⁾ / trace ²⁾ | • |

1) Ingold and Thornton sensors

2) Ingold sensors

Table 1: M100 parameter fit guide

3.2 Design

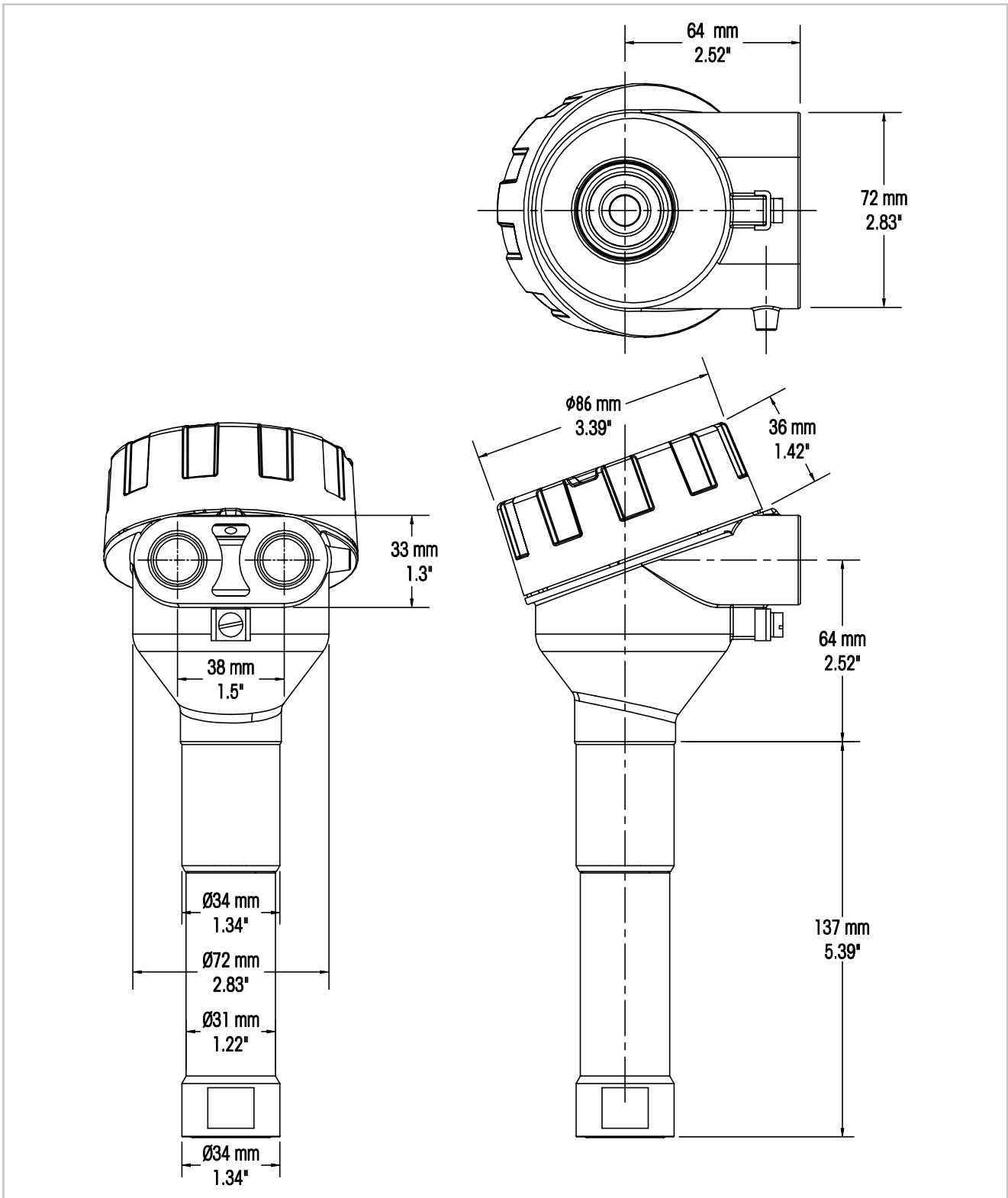


Fig. 3: Dimensions M100 transmitter

4 Installation

4.1 Safety Instructions for Installation

- Power off transmitter during installation.
- The transmitter tolerates harsh environments. However, for best results, install the transmitter in an area where temperature extremes, vibrations, and electromagnetic and radio frequency interference are minimized or absent.
- To prevent unintentional exposure of the transmitter circuitry to the plant environment, keep the security lock in place over the circuit end cap. To remove the circuit end cap, loosen the lock nut until the tab disengages from the end cap, then unscrew the cover.

4.2 Assembly of Sensor and Transmitter

1. Install sensor housing (4) as described in the documentation of the sensor housing.
2. Carefully insert sensor (3) into the sensor housing. Screw in sensor hand-tight.
3. Screw sensor housing and extension tube (2) hand-tight. Do not turn the M100 transmitter (1). Turn extension tube only.
4. Unscrew cover of the M100 transmitter.
5. Perform wiring. See Chapter 5.3 "Terminal Block (TB) Definition" on Page 19.
6. Screw cover of the M100 transmitter.

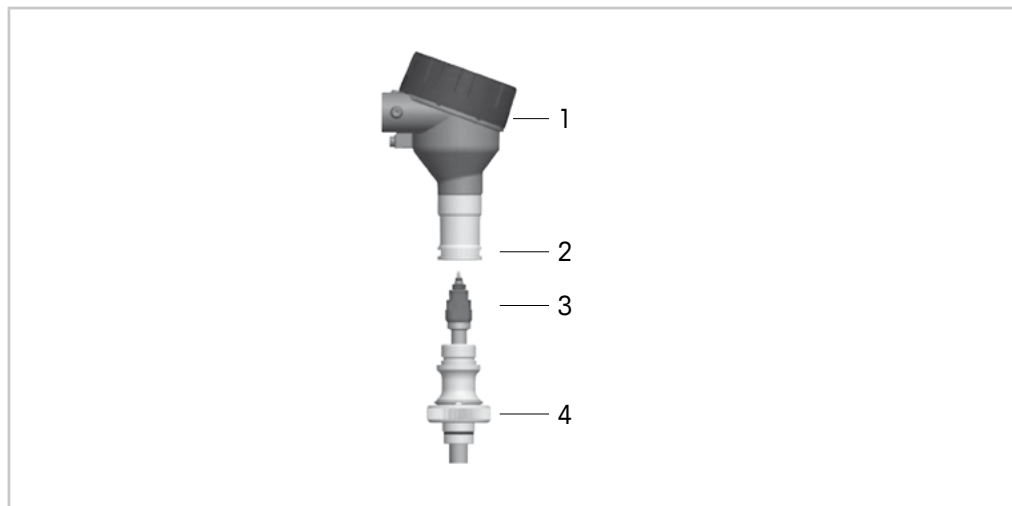


Fig. 4: Assembly of sensor and transmitter

- 1 M100 transmitter
- 2 Extension tube
- 3 Sensor or electrode
- 4 Sensor housing

5 Wiring

5.1 Safety Instructions for Wiring

- Power off transmitter during wiring.
- Use water-tight cable glands to keep moisture out of the transmitter. If conduit is used, plug and seal the connections at the transmitter housing to prevent moisture from getting inside the transmitter.
- Connect wires firmly to the connection terminals.
- Screw cover properly after wiring.
- The Ingress Protection degree will no longer apply in the event of damage to the transmitter or the threads, seals, or cable glands on the transmitter head.

5.2 HART System Architecture

Configure the M100 transmitter either via a configuration tool, an asset management tool or via a HART handheld terminal.

The DD and the DTM files are on the supplied CD-ROM or can be downloaded via the Internet “www.mt.com/M100”.

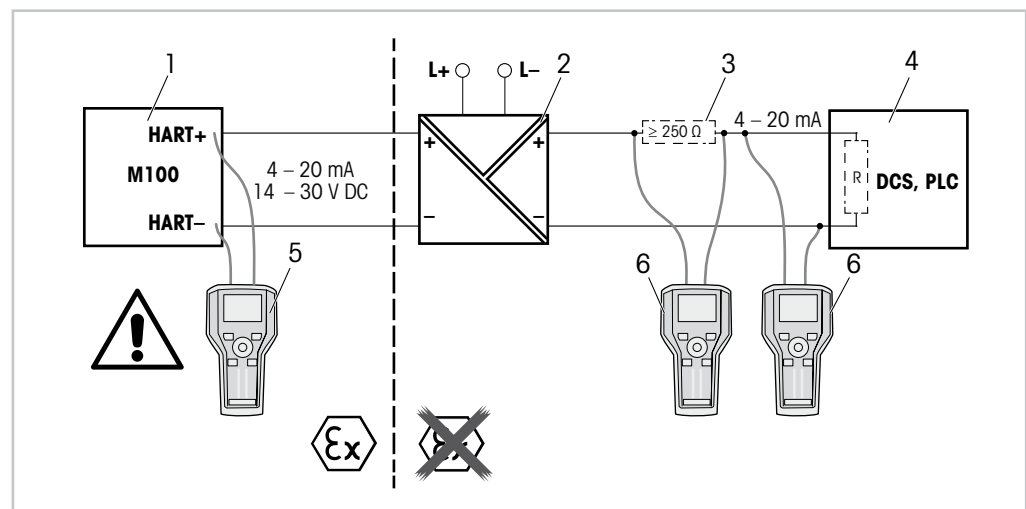


Fig. 5: HART® connection with HART handheld terminal

- 1 M100 transmitter
- 2 Repeater power supply, preferably HART transparent
- 3 Load resistor, is not required if one is installed in the repeater power supply
- 4 DCS (Distributed Control System) or PLC (Programmable Logic Controller)
- 5 HART handheld terminal, directly connected to the device even in the Ex i-area
- 6 HART handheld terminal e.g. 475 FieldCommunicator from Emerson

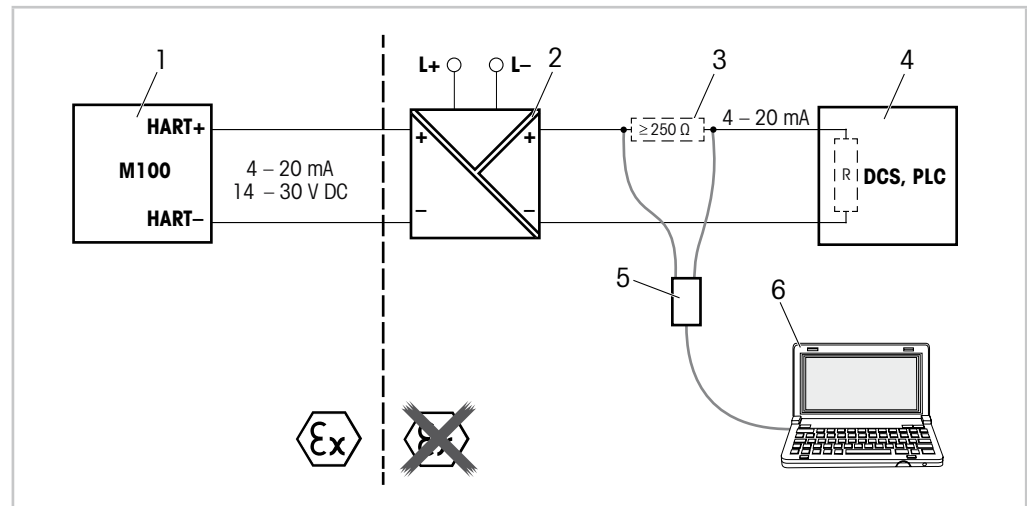


Fig. 6: HART® connection with HART modem and configuration tool

- 1 M100 transmitter
- 2 Repeater power supply, preferably HART transparent
- 3 Load resistor, is not required if one is installed in the repeater power supply
- 4 DCS (Distributed Control System) or PLC (Programmable Logic Controller)
- 5 HART modem
- 6 PC with configuration tool, e.g. PACTWare™ from Pepperl+Fuchs.
PACTWare™ is on supplied CD-ROM or available as freeware.

5.3 Terminal Block (TB) Definition

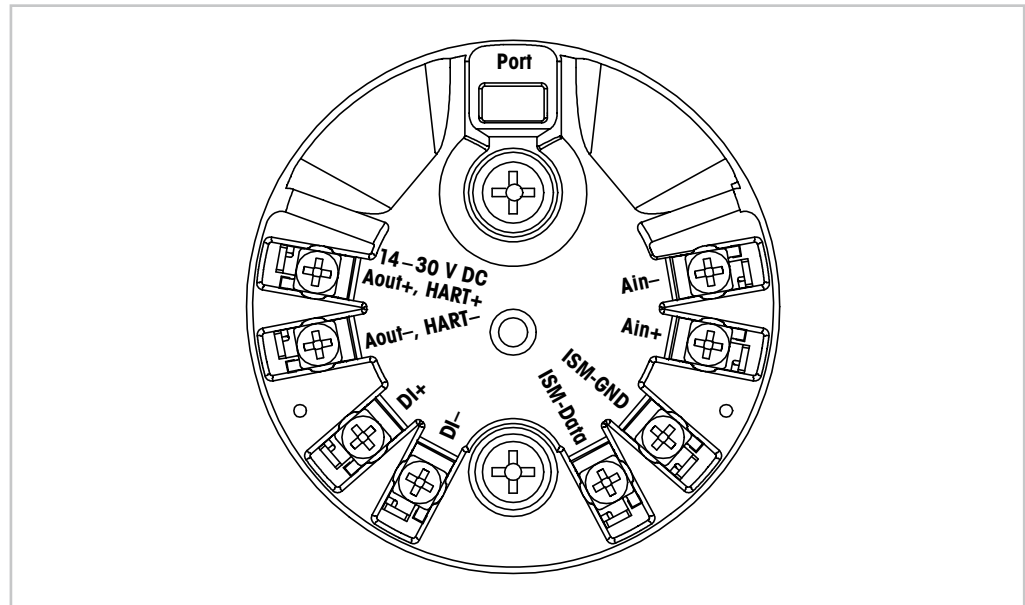


Fig. 7: Terminal block (TB) definition

| Terminal | Description |
|------------------------------|---|
| Port | Interface for service e.g. firmware update |
| Aout+, HART+ Aout-, HART- | Notice polarity. – Power connection: 14 to 30 V DC – Analog output – HART signal |
| DI+, DI- | Digital input (for switching transmitter in Hold state) |
| ISM-DATA, ISM-GND | Sensor input, see Table 1 on Page 14 and Fig. 4 on Page 16. Wired by factory. Do not disconnect. |
| Ain+, Ain- | Analog input: 4 to 20 mA (for pressure compensation) |

Table 2: Terminal block (TB) definition

6 Operation

Configure the M100 transmitter either via a configuration tool, an asset management tool or via a HART handheld terminal.

The DD is on the supplied CD-ROM or can be downloaded via the Internet "www.mt.com/M100".

You can calibrate the sensor via iSense software.

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



NOTE!

The configuration tool PACTWare™ is on the supplied CD-ROM. You can download the DTM via the Internet "www.mt.com/M100".

Prerequisite: The M100 transmitter and the sensor are 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 DTM for HART interface and DTM for M100 transmitter.
3. Update device catalog.
4. Make a connection between the transmitter and the software. Check COM port settings if necessary.
5. Select **Sensor Type**.
Menu path: Detailed Setup > Measurements > Channel Setup > Sensor Setup.
6. Load configuration from device.
7. Set **Tag** or/and **Long Tag**. Menu path: Device Setup > Detailed Setup > HART Info
8. Set **Date** and **Time**. Set the time in the 24 hour format. The time format cannot be changed. Menu path: Device Setup > Detailed Setup > System
9. 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.
10. Define the process variables **PV**, **SV**, **TV** and **QV**
Menu path: Device Setup > Detailed Setup > Measurements > Channel Setup
11. Calibrate sensor. Menu path: Device Setup > Sensor Calibration
See Chapter 7 "Sensor Calibration" on Page 22.
12. Perform further settings. See Chapter 8 "Menu Overview and Menu Description" on Page 25.
13. Store configuration to device.

6.2 Start-up Operation via HART Handheld Terminal



NOTE!

The DD "008E8E7D0101.hhd" is on the supplied CD-ROM. You can also download the DD via the Internet "www.mt.com/M100".

Prerequisite: The M100 transmitter and the sensor are mounted and electrically connected.

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

1. Check if the DD of the M100 transmitter has already been installed on the HART handheld terminal. Install the DD if necessary.
2. The communication is made automatically.
3. Select **Sensor Type**.
Menu path: Detailed Setup > Measurements > Channel Setup > Sensor Setup.
4. Load configuration from device. Menu path: Device Setup > Detailed Setup
5. Set **Tag** or/and **Long Tag**. Menu path: Device Setup > Detailed Setup > HART Info
6. Set **Date** and **Time**. Set the time in the 24 hour format. The time format cannot be changed. Menu path: Device Setup > Detailed Setup > System
7. 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.
8. Define the process variables **PV**, **SV**, **TV** and **QV**
Menu path: Device Setup > Detailed Setup > Measurements > Channel Setup
9. Calibrate sensor. Menu path: Device Setup > Sensor Calibration
See Chapter 7 "Sensor Calibration" on Page 22.
10. Perform further settings. See Chapter 8 "Menu Overview and Menu Description" on Page 25.

6.3 Change Sensor Type

If you change the sensor type e.g. a conductivity sensor with a pH sensor, perform the following procedure:

Prerequisite: The M100 transmitter and another sensor type are mounted and electrically connected.

1. Make a connection between the transmitter and the software/HART device.
 2. Select **Sensor Setup**.
Menu path: Detailed Setup > Measurements > Channel Setup > Sensor Setup.
 3. Start "Sensor Setup".
 4. Select the new sensor type for the **Sensor Type** parameter.
 5. Load configuration from device.
- ⇒ The configuration in the configuration tool or in the HART handheld is updated.
If you have selected the correct sensor type, the **Verify** menu will be shown.

7 Sensor Calibration



NOTE!

For best process calibration results observe the following points:

- Take grab sample as close as possible to the measurement point of the sensor.
 - Measure the sample at process temperature.
-



NOTE!

Via configuration tool, asset management tool or HART handheld terminal you can calibrate the sensor with the “Process calibration” method. For other calibration methods use the iSense™ software.

For calibrating the sensor in the lab or in non-hazardous areas you can use iSense. The scope of delivery comprises the iSense software on CD-ROM and the iLink cable.



NOTE!

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

7.1 Terminate Sensor Calibration

After every successful calibration the following options are available:

- **Adjust:** Calibration values are adopted and used for the measurement. Additionally, the calibration values are stored in the calibration history.
- **Calibrate:** Calibration values are stored in the calibration history 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 values are discarded.

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 method. Click [Step 1: Capture current measured value].
3. For O₂ calibration select calibration unit.
⇒ The current "Sensor Value" and "Status" are shown.
4. Click [Next] to store the measured value.
⇒ The following message appears: "Captured value is stored. Take a grab sample to measure in the lab or perform parallel measurement."
5. Click [OK].
6. Click [Step 2: Enter reference value]. NOTE! You can perform "Step 2" at any time.
⇒ The captured value of "Step 1" is shown.
7. Enter the measured reference value.
8. Click [Next] to store the reference value.
⇒ If the reference value is within the valid range, the Slope and Offset are shown.
9. Click [OK].
⇒ The following message appears "Complete calibration procedure. Select either Adjust, Calibrate or Abort".
10. Select Adjust, Calibrate or Abort.
11. Click [OK].

7.3 Perform Sensor Calibration via HART Handheld Terminal

1. Select **Sensor Calibration** menu. Menu path: Device Setup > Sensor Calibration
2. Select calibration method.
⇒ The following message appears: "Capture act. value".
⇒ For O₂ calibration the following message appears: "Select calibration unit".
3. For O₂ calibration select calibration unit. Press [ENTER].
⇒ The current "Sensor Value" and "Status" are shown.
4. Press [Next] to capture the current measured value.
⇒ The following message appears: "Captured value is stored. Take a grab sample to measure in the lab or perform parallel measurement."
5. Press [OK].
⇒ The following message is shown "Enter reference value". You can perform this step at any time.
6. Enter the measured reference value.
7. Press [ENTER] to store the reference value.
⇒ If the reference value is within the valid range, the Slope and Offset are shown.

8. Press [OK].
- ⇒ The following message appears "Select process, select either Adjust, Calibrate or Abort".
9. Select Adjust, Calibrate or Abort.
10. Press [ENTER].

7.4 Perform Calibration for Current Input Ain

For O₂ measurement you can connect an external pressure sensor for pressure compensation. The pressure sensor is connected to **Ain** terminals.

To improve the accuracy of the O₂ measurement we recommend to calibrate the current input Ain.

1. Connect reference meter to **Ain** terminals.
2. Select **Sensor Calibration** menu. Menu path: Device Setup > Sensor Calibration
3. Select calibration method. Click [Ain Calibration].
- ⇒ The following message appears: "Set output to 4 mA".
4. Click [OK].
- ⇒ **Reference Value 1:** The old value for the 4 mA value is shown.
5. Enter the new reference value measured with the reference meter.
6. Click [OK] to store the new reference value for 4 mA.
- ⇒ "Reference Value", "Sensor Value" and "Status" are shown.
7. Click [Next].
- ⇒ The following message appears "Set output to 20 mA".
8. Click [OK].
- ⇒ **Reference value 2:** The old value for the 20 mA value is shown.
9. Enter the new reference value measured with the reference meter.
10. Click [OK] to store the new reference value for 20 mA.
- ⇒ "Reference Value", "Sensor Value" and "Status" are shown.
11. Click [Next].
- ⇒ The following message appears "Complete calibration procedure. Select either Adjust or Abort".
12. Select Adjust or Abort.

8 Menu Overview and Menu Description

8.1 Menu Overview

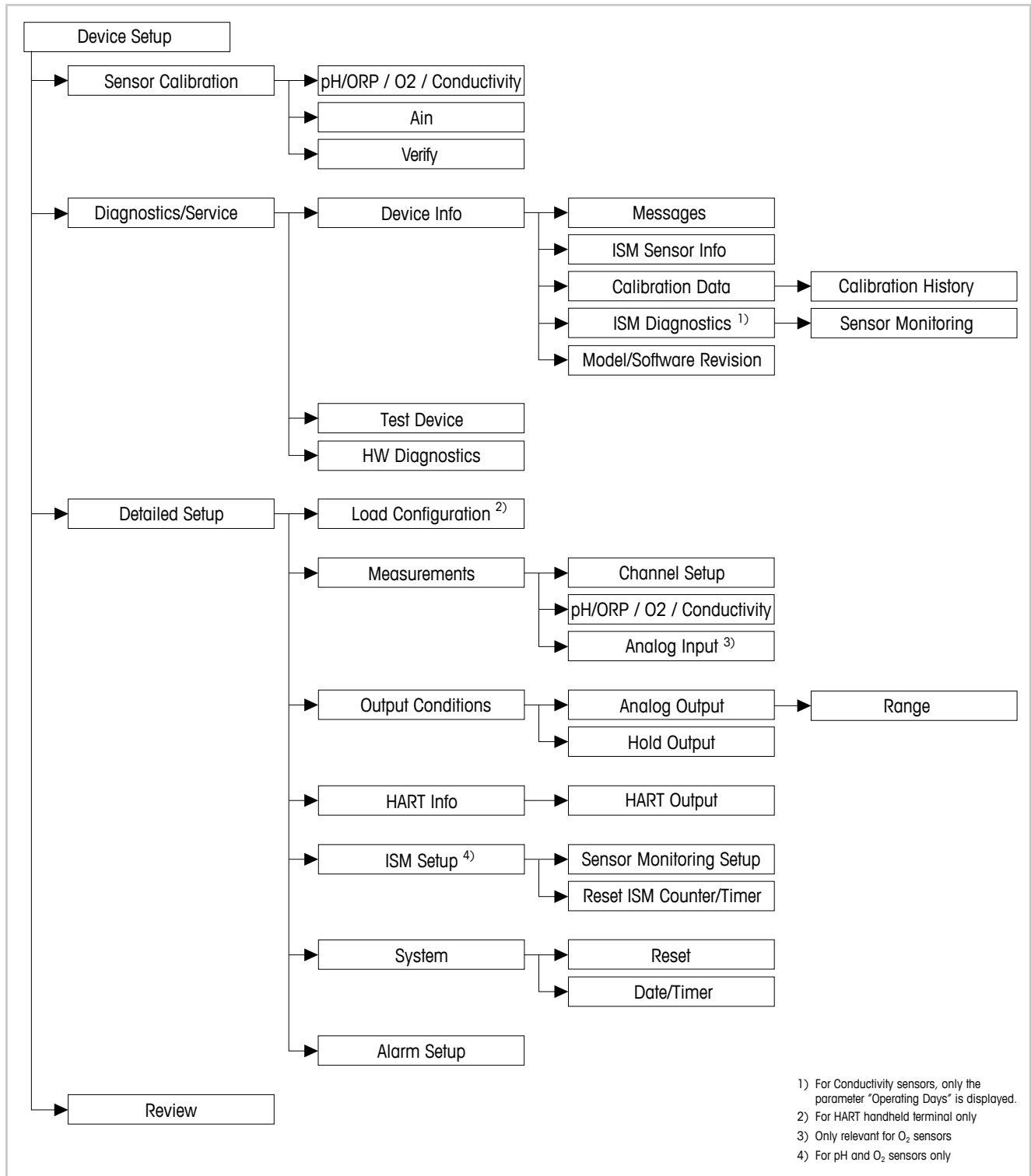


Fig. 8: Menu overview

8.2 Menu “Sensor Calibration”

The **Sensor Calibration** menu is dependent on the connected sensor. This menu guides you through the sensor calibration process. See Chapter 7 “Sensor Calibration” on Page 22.

The **Ain Calibration** function is only applicable for O₂ sensors. See Chapter 7.4 “Perform Calibration for Current Input Ain” on Page 24.

8.2.1 Verify

The **Verify** menu is dependent on the connected sensor. This menu shows the raw signals of the connected sensor.

8.2.1.1 pH/ORP and pH/pNa

| Menu | Description |
|-------------|--|
| UpH | Display of the raw voltage signal for pH measurement. |
| UORP | Display of the raw voltage signal for ORP measurement. |
| Rref | Display of the raw reference electrode resistance. |
| Rglass | Display of the raw glass electrode resistance. |
| Temperature | Display of the raw temperature signal. |

Table 3: Menu “Verify” – pH/ORP and pH/pNa

8.2.1.2 O₂

| Menu | Description |
|------------------|--|
| Measured current | Display of the measured current. |
| Temperature | Display of the raw temperature signal. |

Table 4: Menu “Verify” – O₂

8.2.1.3 Conductivity

| Menu | Description |
|-------------|--|
| Resistivity | Display of the raw resistance signal without temperature compensation. |
| Resistance | Display of the raw resistance signal with temperature compensation. |
| Temperature | Display of the raw temperature signal. |

Table 5: Menu “Verify” – Conductivity

8.3 Menu “Diagnostics & Service”

Menu path: Device > Diagnostics & Service

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

| Menu | Description |
|-----------|---|
| Loop Test | <p>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.</p> <ul style="list-style-type: none"> – 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. |
| D/A Trim | <p>With the D/A Trim function you can calibrate the hardware of the analog output. During the trim we recommend to remove the loop from automatic control. For the D/A Trim, connect a reference meter to the Aout terminals and enter for the 4 mA and 20 mA values the values of the reference meter.</p> |

Table 6: Diagnostics & Service

8.3.1 Device Info

8.3.1.1 Messages

Menu path: Device > Diagnostics & Service > Device Info > Messages

The **Messages** menu shows current active alarms or current status returned in HART Command #48.

You can deactivate some alarms in the **Alarm Setup** menu. If an alarm occurs but is deactivated in the “Messages” menu, the alarm will not shown in the “Messages” menu. See Chapter 8.4.7 “Alarm Setup” on Page 43.

Some messages are only displayed for certain sensors or for specific settings. The column “Pre-requisites” of the following table shows the dependencies.

| Status group (Byte) | Bit | Meaning | Prerequisites |
|---------------------|--------|--|---|
| 0 | 0 | Software failure | In "Alarm Setup" menu enabled. |
| | 1 | Sensor disconnected | – |
| | 2 | Wrong sensor connected | – |
| | 3 | Broken sensor (Rg, RpNa < 5 MOhm) | In "Alarm Setup" menu enabled. |
| | 4 | Open circuit (Rg, RpNa > 2000 MOhm) | In "Alarm Setup" menu enabled. |
| | 5 | Dry cond sensor | – Conductivity sensors – In "Alarm Setup" menu enabled. |
| | 6 | Shorted cell | – Conductivity sensors – In "Alarm Setup" menu enabled. |
| | 7 | Electrolyte level too low | – Amperometric O ₂ sensors – In "Alarm Setup" menu enabled. |
| 1 | 0 | Rg < 0.3 Rgcal | pH/ORP sensors |
| | 1 | Rg > 3 Rgcal | pH/pNa sensors |
| | 2 | Rr or RpNa < 0.3 Rrcal | pH/ORP sensors |
| | 3 | Rr or RpNa > 3 Rrcal | pH/pNa sensors |
| | 4 | Maintenance required (TTM expired) ¹⁾ | TTM monitoring enabled. |
| | 5 | Calibration required (ACT expired) ¹⁾ | ACT monitoring enabled. |
| | 6 | Change sensor (DLI expired) ¹⁾ | DLI monitoring enabled. |
| | 7 | Cell constant deviation | – Conductivity sensors – In Alarm Setup menu enabled. |
| 2 | 0 | CIP cycle counter expired ¹⁾ | CIP Limit enabled. |
| | 1 | SIP cycle counter expired ¹⁾ | SIP Limit enabled. |
| | 2 | Autoclave cycle counter expired ¹⁾ | – |
| | 3 | Hold activated | – |
| | 4 | Calibration values out of range | – |
| | 5 to 7 | Not used | – |
| | 3 | 0 | Change parameter |
| 1 | | Change sensor type | – |
| 2 | | Autoclave cycle counter increment | – |
| 3 | | Process calibration active | – |
| 4 to 7 | | Not used | – |

1) In the "Reset ISM Counter/Timer" menu you can reset ISM Counter and Timer. See Chapter 8.4.5.2 "Reset ISM Counter/Timer" on Page 41.

Table 7: Messages

Clear Status Group

With the **Clear Status Group** function you can refresh the reading of the status. The status of the transmitter and the sensor is read constantly.

8.3.1.2 ISM Sensor Info

Menu path: Device > Diagnostics & Service > ISM Sensor Info

| Parameter | Description |
|-------------|---|
| Sensor Type | Display of the connected sensor type. |
| Cal. Date | Display of the date of the last adjustment or calibration. |
| Part-No | Display of the part number (order number) of the transmitter. |
| Serial-No | Display of the serial number of the transmitter. |
| Master | Display of the firmware revision number of the transmitter. |
| Comm | Display of the firmware revision number of the communication PCB. |

Table 8: ISM Sensor Info

8.3.1.3 Calibration Data and Calibration History

Menu path: Device > Diagnostics & Service > Device Info > Calibration Data

| Parameter | Description |
|------------------|---|
| Calibration Data | <p>Display of the current Slope and Offset. For ORP sensors the OPR Offset is displayed additionally.</p> <p>Note! The Calibration Data function requires the correct setting of Date and Time. See Chapter 8.4.6.2 "Date & Time" on Page 42.</p> |

Table 9: Calibration Data

Calibration History

Menu path: Device > Diagnostics & Service > Device Info > Calibration Data > Calibration History

Definitions:

- "S" means "Slope". "Z" means "Offset".
- **Adjustment:** The calibration procedure is completed with the "Adjust" command. The calibration values are adopted and used for measurement. Additionally, the calibration values are stored in the calibration history. The dataset "Act" and "Cal1" are identical. The current calibration dataset "Act" moves to "Cal2".
- **Calibration:** The calibration procedure is completed with the "Calibrate" command. The calibration values are stored in the calibration history as dataset "Cal1" for documentation, but cannot be used for the measurement. The measurement continues with the last valid adjustment dataset "Act".

| Parameter | Description |
|---------------------|---|
| Calibration History | <p>The Calibration History parameter shows the history of calibration data.</p> <ul style="list-style-type: none"> – Fact (Factory calibration): This is the original dataset, determined in the factory. This dataset remains stored in the sensor for reference and cannot be overwritten. – Act (Actual adjustment): This is the current calibration dataset which is used for the measurement. This dataset moves to "Cal2" position after the next adjustment. – 1. Adj (First adjustment): This is the first adjustment after the factory calibration. This dataset remains stored in the sensor for reference and cannot be overwritten. – Cal1 (latest calibration/adjustment): This is the latest executed calibration/adjustment. This dataset moves to "Cal2" when a new calibration/adjustment is performed. – Cal2 and Cal3: After calibration/adjustment the "Cal1" dataset moves to "Cal2" and "Cal2" moves to "Cal3". The former "Cal3" dataset is not available anymore. |

Table 10: Calibration History

8.3.1.4 ISM Diagnostics and Sensor Monitoring

Menu path: Device > Diagnostics & Service > Device Info > ISM Diagnostics

The **ISM Diagnostics** menu is not available for Conductivity sensors.

The **ISM Diagnostics** menu shows the limits and the current counts of the cleaning cycles counter as well as the maximum temperature. You can configure the cleaning cycles counter in the **ISM Setup** menu. See Chapter 8.4.5 "ISM Setup" on Page 40.



NOTE!

This function requires the correct setting of **Date** and **Time**. See Chapter 8.4.6.2 "Date & Time" on Page 42.

| Parameter | Description |
|------------------|--|
| CIP Limit | Display of the limit for the CIP cycles counter. |
| CIP Cycles | Display of the current amount of executed CIP cycles. |
| SIP Limit | Display of the limit for the SIP cycles counter. |
| SIP Cycles | Display of the current amount of executed SIP cycles. |
| Autoclave Limit | Display of the limit for the Autoclave cycles counter. |
| Autoclave Cycles | Display of the current amount of executed Autoclave cycles. |
| Max. Temp. | Display of the maximum temperature of the sensor. During autoclaving the Max. Temp. is not recorded. |
| Max. Temp. Date | Display of the date of the maximum temperature. |

Table 11: ISM Diagnostics

Sensor Monitoring

Menu path: Device > Diagnostics & Service > Device Info > ISM Diagnostics > Sensor monitoring

The **Sensor Monitoring** menu shows the status of the different timers.

| Parameter | Description |
|----------------|---|
| DLI (d) | Display of the remaining days for the Dynamic Lifetime Indicator . The days are set by the manufacturer. |
| DLI (%) | Display of the remaining time for the Dynamic Lifetime Indicator in percentage. The days are set by the manufacturer. |
| TTM (d) | Display of the remaining days for the Time To Maintenance indicator. You can set the days with the Max TTM parameter in the Sensor Monitoring Setup menu. See Chapter 8.4.5.1 "Sensor Monitoring Setup" on Page 41. |
| TTM (%) | Display of the remaining time for the Time To Maintenance indicator in percentage. 100 percent corresponds to the set days for the Max TTM parameter. |
| 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. You can set the days with the Max ACT parameter in the Sensor Monitoring Setup menu. See Chapter 8.4.5.1 "Sensor Monitoring Setup" on Page 41. |
| ACT (%) | Display of the Adaptive Cal Timer in percentage. 100 percent corresponds to the set days for the Max ACT parameter. |
| Operating Days | Display of the operating days of the connected sensor. |

Table 12: Sensor Monitoring

8.3.1.5 Model/Software Revision

Menu path: Device > Diagnostics & Service > Device Info > Model/Software Revision

| Parameter | Description |
|-----------|---|
| Part-No | Display of the part number of the transmitter. |
| Serial-No | Display of the serial number of the transmitter. |
| Master | Display of the firmware revision number of the transmitter. |
| Comm | Display of the firmware revision number of the communication PCB. |
| Sensor FW | Display of the firmware version of the sensor. |
| Sensor HW | Display of the hardware version of the sensor. |

Table 13: Model/Software Revision

8.3.2 Test Device

Menu path: Device > Diagnostics & Service > Test Device

| Function | Description |
|--------------|--|
| Self Test | With the Self Test a diagnostic routine is performed. This test detects electronics failures or other failures that affect performance. |
| Device Reset | With the Device Reset a reset is performed. This reset is identical to a power reset, switching power off and on again. |

Table 14: Test Device

8.3.3 HW Diagnostics

Menu path: Device > Diagnostics & Service > HW Diagnostics

| Menu | Description |
|--------------|--|
| Analog Input | Display of the current analog input value. |
| Din1 Status | Display of the current status of the digital input. Options: High and Low |

Table 15: HW Diagnostics

8.4 Detailed Setup

8.4.1 Load Configuration

Menu path: Device > Detailed Setup > Measurement > Load Configuration

The **Load Configuration** menu is only available via HART handheld terminal.

With this function you load the latest configuration data from the transmitter to the HART handheld terminal.

8.4.2 Measurements

The **Measurements** menu is dependent on the connected sensor.

8.4.2.1 Channel Setup

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

| Parameter | Description |
|-----------------------------|---|
| Sensor Setup | Select the measured variable of the connected sensor type. Options: pH/ORP, pH/pNa, Cond 4e, O ₂ Hi, O ₂ Lo, O ₂ Trace |
| Sensor Channel | The Sensor Channel parameter is set to "ISM" and cannot be changed. |
| 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. |
| PV / SV / TV and QV Average | With the Average parameters you set the averaging method (noise filter) for the corresponding value. <ul style="list-style-type: none"> – None: No averaging or filtering – Low: Equivalent to 3 point moving average – Medium: Equivalent to 6 point moving average – High: Equivalent to 10 point moving average – Special (Default): Averaging dependent on the signal change, normally High averaging but Low averaging for large changes in input signal |

Table 16: Channel Setup

8.4.2.2 pH (pH/ORP and pH/pNa)

If a pH/ORP or pH/pNa sensor is connected, the pH menu is shown.

Menu path: Device > Detailed Setup > Measurements > pH

For pH measurement you can set the following parameters.

| Parameter | Description |
|-----------|---|
| pH Buffer | Select pH Buffer . Options: Mettler-9, Mettler-10, Nist-Tech, Nist-Std, Hach, Ciba, Merck, WTW, None, JIS Z 8802, Na+3.9 For dual membrane pH electrodes (pH/pNa) select buffer Na+3.9. See Chapter 10 "Technical Data" on Page 45. |
| IP | Set the Isothermal Point value. For most applications use the default value. For specific compensation requirements or non-standard inner buffer values change the value. |

| Parameter | Description |
|--------------|---|
| STC Ref Mode | Use the STC Ref Mode parameter for STC compensation. <ul style="list-style-type: none"> – Yes: The measured pH value is compensated with values of the STC Value and STC Ref Temp parameter. – No: The measured pH value is compensated with the current measured temperature. |
| STC Value | Set the STC Value . The STC Value is the Solution Temperature Coefficient in pH/°C. The coefficient is referred to the temperature set with the STC Ref Temp. |
| STC Ref Temp | Set the reference temperature for the STC Value parameter. |

Table 17: pH

8.4.2.3 O₂

If a O₂ Lo, O₂ Hi or O₂ Trace sensor is connected, the **O₂** menu is shown.

Menu path: Device > Detailed Setup > Measurement > O2

For O₂ measurement there is a difference between measuring mode and calibration mode. Measuring mode means that the sensor is placed in the real process. Calibration mode means that the sensor is placed in a reference medium outside the real process.

For O₂ measurement you can set the following parameters.

| Parameter | Description |
|-----------------------------|---|
| Pcal_Pres Unit | Select the pressure unit for process calibration. |
| Pcal_Pressure | Set the pressure for process calibration. |
| Process Cal Pressure Source | Select the pressure source for process calibration. <ul style="list-style-type: none"> – Pcal_Pressure: The pressure is set with the Pcal_Pressure parameter. – Proc_Pressure: The pressure is set with the Process_Pressure Mode and Process_Pressure parameters. |
| Process_Pressure Mode | Select mode for entering the pressure during the measuring mode. <ul style="list-style-type: none"> – Edit: The process pressure is set manually with the Process_Pressure parameter. – Ain: The pressure is given by the input signal at the analog input terminals Ain. |
| Process_Pressure Unit | Select the pressure unit for measuring mode. |
| Process_Pressure | Set the pressure for measuring mode. For the Process_Pressure Mode parameter the option "Edit" has been selected. |
| Salinity | Set salinity of the measured solution. |
| Rel Humidity | Set relative humidity of the calibration gas. When no humidity measurement is available use 50 %. |

| Parameter | Description |
|-----------|--|
| UpolMeas | <p>Set the polarization voltage of amperometric oxygen sensors in the measuring mode.</p> <p>NOTE: During a process calibration, the polarization voltage UpolMeas, defined for the measuring mode, will be used.</p> <ul style="list-style-type: none"> – 0 to –550 mV: The connected sensor is set to a polarization voltage of –500 mA. – Less than 550 mV: The connected sensor is set to a polarization voltage of –674 mA. |
| UpolCal | <p>Set the polarization voltage of amperometric oxygen sensors for the calibration mode.</p> <ul style="list-style-type: none"> – 0 to –550 mV: The connected sensor is set to a polarization voltage of –500 mA. – Less than 550 mV: The connected sensor is set to a polarization voltage of –674 mA. |

Table 18: O₂

8.4.2.4 Cond 4e (Conductivity 4e)

If a conductivity sensor is connected, the **Conductivity** menu is shown.

Menu path: Device > Detailed Setup > Measurement > Conductivity

For conductivity measurement you can set the following parameters.

| Parameter | Description |
|-------------------------------|--|
| PV / SV / TV / QV Comp Mode | Select temperature compensation mode for the corresponding value. See table "Compensation Mode". |
| PV / SV / TV / QV Linear Coef | Set linear coefficient in %/°C for the compensation mode "Linear 25 °C" and "Linear 20 °C" of the corresponding value. |

Table 19: Conductivity

Compensation Mode

| Compensation Mode | Description |
|-------------------|--|
| Standard | The Standard compensation mode includes compensation for non-linear high purity effects and conventional neutral salt impurities. This mode conforms to ASTM standards D1125 and D5391. |
| Linear 25°C | The Linear 25°C compensation mode adjusts the reading by a coefficient expressed as %/°C, deviation from 25 °C. Use this mode only if the solution has a well-characterized linear temperature coefficient. The coefficient is set with the Linear Coef parameter. |
| Linear 20°C | The Linear 20°C compensation mode adjusts the reading by a coefficient expressed as %/°C, deviation from 20 °C. Use this mode only if the solution has a well-characterized linear temperature coefficient. The coefficient is set with the Linear Coef parameter. |

| Compensation Mode | Description |
|-------------------|--|
| Light 84 | The Light 84 compensation mode matches the high purity water research results of Dr. T.S. Light published in 1984. Use this mode only if your institution has standardized on that work. |
| Std 75°C | The Std 75°C compensation mode is the Standard compensation algorithm referenced to 75 °C. |
| Glycol 0.5 | The Glycol 0.5 compensation mode matches the temperature characteristics of 50 % ethylene glycol in water. Compensated measurements using this solution may go above 18 Mohm-cm. |
| Glycol 1.0 | The Glycol 1.0 compensation mode matches the temperature characteristics of 100 % ethylene glycol. Compensated measurements may go well above 18 Mohm-cm. |
| Cation | The Cation compensation mode is used in power industry applications measuring the sample after a cation exchanger. This mode takes into account the effects of temperature on the dissociation of pure water in the presence of acids. |
| Alcohol | The Alcohol compensation mode provides for the temperature characteristics of a 75 % solution of isopropyl alcohol in pure water. Compensated measurements using this solution may go above 18Mohm-cm. |
| Ammonia | The Ammonia compensation mode is used in power industry applications for specific conductivity measured on samples using ammonia and/or ETA (ethanolamine) water treatment. This mode into account the effects of temperature on the dissociation of pure water in the presence of these bases. |
| None | The None compensation mode does not make any compensation of the measured conductivity value. |

Table 20: Conductivity – Compensation Mode

8.4.2.5 Analog Input

Menu path: Device > Detailed Setup > Measurement > Analog Input

For O₂ measurement you can connect an external pressure sensor for pressure compensation. The pressure sensor is connected to Ain terminals. To improve the accuracy of the O₂ measurement we recommend to calibrate the current input Ain. See Chapter 7.4 "Perform Calibration for Current Input Ain" on Page 24.

| Parameter | Description |
|-------------|--|
| 4 mA Unit | Select pressure unit for the 4 mA analog input value. |
| 4 mA Value | Set value for the 4 mA analog input value. |
| 20 mA Unit | Select pressure unit for the 20 mA analog input value. |
| 20 mA Value | Set value for the 20 mA analog input value. |

Table 21: Analog Input

8.4.3 Output Conditions

8.4.3.1 Analog Output

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

| Menu / Function | Description |
|-------------------|---|
| Loop Current Mode | <p>Configure the signal of the analog output.</p> <ul style="list-style-type: none"> – 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. |
| Alarm Type | <p>Select the output current for the case of an alarm for an alarm of the "Status group 0". See Chapter 8.3.1.1 "Messages" on Page 27.</p> <ul style="list-style-type: none"> – High: Output current is 22.0 mA. – Low: Output current is 3.6 mA. |
| Hold Mode | <p>Select the output current of the analog output during Hold state.</p> <p>You can change in the Hold state either by the parameter Manual Hold or by a signal at the digital input terminals. See Chapter 8.4.4.1 "HART Output" on Page 39.</p> <ul style="list-style-type: none"> – 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. – Off: The output current is calculated by the PV, PV LRV and PV URV parameters. |
| Hold Fixed | <p>Set the output current of the analog output during Hold state for the Hold Mode parameter, option "Fixed".</p> |

Table 22: Analog Output

Range

Menu path: Device > 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. Default: PV USL |
| 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. Default: PV LSL |
| 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 23: Range

8.4.3.2 Hold Output

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

With the **Hold Output** menu you start and stop the Hold state. The behavior of the analog output during the Hold state you configure with the **Analog Output** menu.

| Parameter | Description |
|-----------------|--|
| Manual Hold | Start and stop the Hold state manually. <ul style="list-style-type: none"> – Start: The transmitter changes in the Hold state. – Stop: The Manual Hold mode is determined. |
| Din1 Hold State | Set the signal level to start and stop the Hold state with the signal at the digital input terminals (Din). <ul style="list-style-type: none"> – Low: The transmitter changes in Hold state when the signal is Low. When the signal is High the Hold state is stopped. – High: The transmitter changes in Hold state when the signal is High. When the signal is Low the Hold state is stopped. – Off: A signal at the digital input terminals will not be evaluated. |

Table 24: Hold Output

8.4.4 HART Info

Menu path: Device > Detailed Setup > HART Info

| Parameter | Description |
|-----------------------|--|
| Tag | Identifies the transmitter. 8 packed ASCII characters |
| Long Tag | Identifies the transmitter. 32 ISO Latin-1 characters |
| Date | Enter a date. The date is used for record keeping. |
| Write Protection | Display of the status of the write protection. |
| Descriptor | Enter a description for describing the transmitter. |
| Message | Enter a message. |
| Final assembly number | Enter a number to identify materials and electronics of the transmitter. |

Table 25: HART Info

8.4.4.1 HART Output

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

| Menu | Description |
|-----------------|--|
| Poll addr | <p>Set the polling address of the transmitter.</p> <ul style="list-style-type: none"> – 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 transmitter needs to have a unique address to allow automatic identification by a master. <p>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 transmitters on one signal cable.</p> |
| Num req preams | Display of the number of requested preambles. |
| Num resp preams | Set number of preambles. |

Table 26: HART Output

8.4.5 ISM Setup

The **ISM Setup** menu is not available for Conductivity sensors.

Menu path: Device > Detailed Setup > ISM Setup

With the **ISM Setup** menu you configure the CIP cycle counter, SIP cycle counter and the Auto-clave cycle counter. You can reset each counter in the **Reset ISM Counter** menu. See Chapter 8.4.5.2 "Reset ISM Counter/Timer" on Page 41.

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 |
|-----------------------|---|
| DLI Stress Adjustment | <p>With the DLI Stress Adjustment parameter you can adapt DLI, TTM and ACT to application requirements and/or experiences. This parameter is available for pH sensors only.</p> <ul style="list-style-type: none"> – Low: DLI, TTM and ACT are increased approximately 25% compared to "Medium" – Medium (default): No change for DLI, TTM and ACT – High: DLI, TTM and ACT are reduced approximately 25% compared to "Medium". |
| 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. |
| Autoclave Limit | Set limit of the Autoclave cycle counter. If the counter exceeds the set value, the message "Autoclave cycle counter expired" is shown. The function is switched off by entering the value "000". |

Table 27: ISM Setup

8.4.5.1 Sensor Monitoring Setup

Menu path: Device > Detailed Setup > ISM Setup > Sensor Monitoring Setup

| Parameter | Description |
|----------------|---|
| DLI Monitoring | Switch on or off the Dynamic Lifetime Indicator . The Dynamic Lifetime Indicator estimates the remaining lifetime to ensure a reliable measurement. For amperometric oxygen sensors, the Dynamic Lifetime Indicator is related to the inner-body of the sensor. |
| TTM Monitoring | Switch on or off the Time To Maintenance indicator. The Time To Maintenance indicator estimates when the next cleaning cycle should be performed to keep the best possible measurement performance. The indicator is influenced by significant changes on the DLI parameters. For amperometric oxygen sensors, the Time To Maintenance indicator shows the maintenance cycle for the membrane and electrolyte. |
| ACT Monitoring | Switch on or off the Adaptive Calibration Timer . 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. |
| Max TTM | Set the interval for the Time to Maintenance indicator. As soon as the timer reaches the set interval a message is shown in the Message menu. |
| Max ACT | Set the interval for the Adaptive Cal Timer . As soon as the timer reaches the set interval a message is shown in the Message menu. |

Table 28: Sensor Monitoring Setup

8.4.5.2 Reset ISM Counter/Timer

Menu path: Device > Detailed Setup > ISM Setup > Reset ISM Counter/Timer

With the **Reset ISM Counter/Timer** menu you can reset each counter and timer individually. The view of this menu is dependent on the connected sensor.

8.4.6 System

Menu path: Device > Detailed Setup > System

| Parameter | Description |
|--------------------|---|
| Lock/Unlock Device | Lock or unlock the transmitter. In the "Lock" state no other master can write to the transmitter. |

Table 29: System

8.4.6.1 Reset

Menu path: Device > Detailed Setup > System > Reset

| Parameter | Description |
|-------------------|--|
| Reset System | Reset all parameters to the default values. The meter calibration is not affected. |
| Reset MeterCal | Reset electronics factors to default values. Use this function after an incorrect analog input calibration. |
| ResetAnalogOutCal | Reset analog output factors to default values. Use this function after an incorrect analog output calibration. |

Table 30: Reset

8.4.6.2 Date & Time

Menu path: Device > Detailed Setup > System > Date & Time

| Parameter | Description |
|-----------------------------|--|
| Get Current Date and Time | Display of the Date and Time stored in the transmitter. |
| YY / MM / DD / HH / MM / SS | Set Date and Time. – Date: YY-MM-DD – Time: HH-MM-SS in 24 hour format |

Table 31: Date & Time

8.4.7 Alarm Setup

Menu path: Device > Detailed Setup > Alarm Setup

Tick checkbox for activating option. Multiple selection is possible.

If an alarm is activated and the alarm occurs, the alarm will be shown in the **Message** menu. See Chapter 8.3.1.1 "Messages" on Page 27.

| Parameter | Description |
|--------------|---|
| Alarm Byte 0 | Diagnostic functions for pH sensors: <ul style="list-style-type: none"> – Rg: Rg is out of tolerance, e.g. a broken measuring electrode. – Rr, RpNa: Rr is out of tolerance, e.g. coated or depleted reference electrode. |
| Alarm Byte 1 | General <ul style="list-style-type: none"> – Software Failure: Watchdog time-out function. Diagnostic functions for conductivity sensors: <ul style="list-style-type: none"> – Dry Cond Sensor: The conductivity sensor is in air e.g. in an empty pipe. – Cell Constant Deviation: Cell constant is out of tolerance, i.e. has changed too much compared to the value thru factory calibration. – Cond Sensor Shorted: Conductivity sensor has a short circuit. Diagnostic function for amperometric oxygen sensors <ul style="list-style-type: none"> – Electrolyte Level: Electrolyte in the membrane body reaches such a low level that the connection between cathode and reference electrode is disturbed. |

Table 32: Alarm Setup

8.5 Review

Menu path: Device > Review

The **Review** menu shows important information of the transmitter and of the connected sensor.

9 Troubleshooting

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

Review the table below for possible causes of common problems.

| Problem | Possible cause | Action |
|--------------------------------|--|--|
| HART communication error | Wiring is incorrect | <ul style="list-style-type: none"> – Check wiring. See Chapter 5 “Wiring” on Page 17. – Notice polarity of supply voltage. See Chapter 5.3 “Terminal Block (TB) Definition” on Page 19. |
| | Device is in multi-drop mode | Set for the polling address “0”. See Chapter 8.4.4.1 “HART Output” on Page 39. |
| Current output is always 22 mA | Sensor is disconnected or incorrectly connected. | Connect sensor. See Chapter 4.2 “Assembly of Sensor and Transmitter” on Page 16. |
| Incorrect measurement readings | Sensor is incorrectly configured. | <ul style="list-style-type: none"> – Configure sensor correctly. See Chapter 8 “Menu Overview and Menu Description” on Page 25. – Perform reset. See Chapter 8.4.6.1 “Reset” on Page 42. |
| Settings cannot be changed. | Transmitter is locked | Unlock transmitter. See Chapter 8.4.6 “System” on Page 42. |

Table 33: Troubleshooting



NOTE!

The **Diagnostics & Service** menu shows information about the transmitter and the connected sensor and supports you in troubleshooting. See Chapter 8.3 “Menu “Diagnostics & Service”” on Page 27.

Alarms are shown in the **Messages** menu. See Chapter 8.3.1.1 “Messages” on Page 27.

10 Technical Data

pH/ORP (incl. pH/pNa)

| | |
|-----------------------------|---|
| Measurement parameters | pH, mV and temperature |
| pH measuring range | -2.00 to +20.00 pH |
| ORP input range | -1500 to +1500 mV |
| Temperature measuring range | -30 to 130 °C (-22 to 266 °F) |
| Calibration | - Configuration tool: Process - iSense software: 1-point and 2-point |

Amperometric oxygen

| | |
|-----------------------------|--|
| Measurement parameters | Dissolved oxygen: Saturation or concentration and temperature |
| Oxygen measuring ranges | - Saturation: 0 to 500% air, 0 to 200% O ₂ - Concentration: 0 ppb (µg/L) to 50.00 ppm (mg/L) |
| Polarization voltage | -550 mV or -674 mV (configurable) |
| Temperature input | NTC 22 kΩ, Pt1000, Pt100 |
| Temperature compensation | Automatic |
| Temperature measuring range | -10 to +80 °C (+14 to +176 °F) |
| Calibration | - Configuration tool: Process - iSense software: 1-point and 2-point |

Conductivity 4-e

| | |
|-------------------------------|---|
| Measurement parameters | Conductivity/resistivity and temperature |
| Conductivity ranges | 0.01 to 650 mS/cm (1.54 Ω x cm to 0.1 MΩ x cm) |
| Chemical concentration curves | NaCl: 0-26% @0 °C to 0-28% @+100 °C NaOH: 0-12% @0 °C to 0-16% @+40 °C to 0-6% @+100 °C HCl: 0-18% @-20 °C to 0-18% @0 °C to 0-5% @+50 °C HNO ₃ : 0-30% @-20 °C to 0-30% @0 °C to 0-8% @+50 °C H ₂ SO ₄ : 0-26% @-12 °C to 0-26% @+5 °C to 0-9% @+100 °C H ₃ PO ₄ : 0-35% @+5 °C to +80 °C |
| TDS ranges | NaCl, CaCO ₃ |
| Temperature input | Pt1000 |
| Temperature measuring range | -40 to +200 °C (-40 to +392 °F) |
| Calibration | - Configuration tool: Process - iSense software: 1-point and 2-point |

General electrical specifications

| | |
|------------------------|---|
| Output | Analog output 4 to 20 mA with HART® |
| HART Communication | Digital communication via FSK modulation of the analog output, device identification, measured values, status and messages, parameters, calibration, ISM diagnostics (DLI, ACT and TTM) |
| Operation | Via configuration tool, Asset Management Tool or HART handheld terminal |
| Supply voltage | 14 to 30 V DC |
| Connection terminals | Spring cage terminals, appropriate for wire cross section 0.2 to 1.5 mm ² (AWG 16 – 24) |
| Galvanic isolation | Inputs, output and earth/ground are galvanically isolated up to 500 V. |
| Analog output | Loop current 4 to 20 mA, protected against wrong polarity |
| Accuracy analog output | < ±0.05 mA over 4 to 20 mA |
| Analog input | 4 to 20 mA (for pressure compensation) |
| Digital input | For switching transmitter in Hold state Switching voltage (selectable): – Low: 0.0 to 1.0 V DC – High: 2.3 to 30.0 V DC |
| Alarm | For sensor disconnected, 22 mA |
| Real time clock | Fixed time and date format. The format cannot be changed. Power reserve: > 5 days |

Environmental specifications

| | |
|-------------------------------------|---|
| Storage temperature | –40 to +70 °C (–40 to +158 °F) |
| Ambient temperature operating range | –20 to +60 °C (–4 to +140 °F) |
| Relative humidity | 0 to 95 % non-condensing |
| EMC | According to EN 61326-1 (general requirements) Emission: Class B, Immunity: Class A |
| Certificates and approvals | ATEX/IECEX , NEPSI Zone 1 – II 2(1) G Ex ib [ia Ga] IIC T4 Gb – II 2(1) D Ex ib [ia Da] IIIC T80°C/ T90°C Db – II 2(1) G Ex d [ia Ga] IIC T4 Gb – II 2(1) D Ex tb [ia Da] IIIC T80°C/ T90°C Db CSA – Class I, Division 1, Groups A, B, C and D T4 – Class II, Division 1, Groups E, F and G and – Class III – Ex ia IIC T4 Ga; Class I, Zone 0, AEx ia IIC T4 Ga |
| CE mark | The measuring system is in conformity with the statutory requirements of the EC Directives. METTLER TOLEDO confirms successful testing of the device by affixing to it the CE mark. |

Mechanical specifications

| | |
|------------------|---|
| Dimensions | See Chapter 3.2 "Design" on Page 15. |
| Cable glands | – M100 2xH (30 026 578): 2 pieces M20 x 1.5 – M100 2xH (30 0xx xxx): 2 pieces NPT 3/4" |
| Weight | 1.2 kg |
| Material | – Die cast aluminum for top housing – Stainless steel 304 for lower parts |
| Enclosure rating | IP 66/NEMA4X |

11 Default Values

11.1 Default Values for pH/ORP or pH/pNa Sensors

| Menu | Sub menu | Parameter | Value | Unit |
|------------------|-------------------------|---------------------------|-----------------------|-------|
| Measurements | Channel Setup | PV is | pH | pH |
| | | SV is | Temperature | °C |
| | | TV is | DLI | days |
| | | QV is | TTM | days |
| | | PV / SV / TV / QV Average | Special | – |
| | pH | pH Buffer | pH/ORP: Mettler-9 | – |
| | | | pH/pNa: Na+3.9M | – |
| | | IP | 7.0 | pH |
| | | STC Ref Mode | No | – |
| | | STC Value | 0.00 | pH/°C |
| | | STC Ref Temp | 25 | °C |
| Output Condition | Analog Output | Loop Current Mode | Disabled | – |
| | | Alarm Type | Hi (22.0 mA) | – |
| | | Hold Mode | Last Value | – |
| | | Hold Fixed | 3.6 | mA |
| | Analog Output > Range | PV LRV = PV LSL | 2 | pH |
| | | PV URV = PV USL | 12 | pH |
| | Hold Output | Manual Hold | Stop (when power on) | – |
| | | Din1 Hold State | Off | – |
| ISM Setup | – | CIP Limit | 0 | – |
| | | SIP Limit | 0 | – |
| | | Autoclave Limit | 0 | – |
| | Sensor Monitoring Setup | DLI Monitoring | On | – |
| | | TTM Monitoring | On | – |
| | | ACT Monitoring | On | – |
| Alarm Setup | – | Alarm Byte 0 | Rg diagnostics = Yes | – |
| | | | Rr diagnostics = Yes | – |
| | | Alarm Byte 1 | Software Failure = No | – |

11.2 Default Values for O₂ Sensors

| Menu | Sub menu | Parameter | Value | Unit | |
|-----------------------|-------------------------|-----------------------------|--|--|---|
| Measurements | Channel Setup | PV is | O ₂ | O ₂ Hi: %air O ₂ Lo and O ₂ Trace: ppb | |
| | | SV is | Temperature | °C | |
| | | TV is | DLI | days | |
| | | QV is | TTM | days | |
| | | PV / SV / TV / QV Average | Special | – | |
| | O ₂ | Pcal Pressure | 759.8 | mmHg | |
| | | Process Cal Pressure Source | Pcal_Pressure | – | |
| | | Process Pressure Mode | Edit | – | |
| | | Process Pressure | 759.8 | mmHg | |
| | | Salinity | 0 | g/kg | |
| | | Humidity | 100 | % | |
| | | Umeaspol | Reading from sensor | mV | |
| | Output Condition | Analog Output | Loop Current Mode | Disabled | – |
| | | | Alarm Type | Hi (22.0 mA) | – |
| Hold Mode | | | Last Value | – | |
| Hold Fixed | | | 3.6 | mA | |
| Analog Output > Range | | PV LRV = PV LSL | 0 | Same as PV is | |
| | | PV URV = PV USL | 100 | Same as PV is | |
| Hold Output | | Manual Hold | Stop (when power on) | – | |
| | Din1 Hold State | Off | – | | |
| ISM Setup | – | CIP Limit | 0 | – | |
| | | SIP Limit | 0 | – | |
| | | Autoclave Limit | 0 | – | |
| | Sensor Monitoring Setup | DLI Monitoring | On | – | |
| | | TTM Monitoring | On | – | |
| Alarm Setup | – | Alarm Byte 1 | Software Failure = No Electrolyte Level = Yes | – – | |

11.3 Default Values for Conductivity Sensors

| Menu | Sub menu | Parameter | Value | Unit |
|------------------|-----------------------|---------------------------|------------------------------|-------|
| Measurements | Channel Setup | PV is | Conductivity | mS/cm |
| | | SV is | Temperature | °C |
| | | TV is | None | – |
| | | QV is | None | – |
| | | PV / SV / TV / QV Average | Special | – |
| | Conductivity | Compensation Mode | Standard | – |
| | | Linear Coefficient | 2.0 %/°C | – |
| Output Condition | Analog Output | Loop Current Mode | Disabled | – |
| | | Alarm Type | Hi (22.0 mA) | – |
| | | Hold Mode | Last Value | – |
| | | Hold Fixed | 3.6 | mA |
| | Analog Output > Range | PV LRV = PV LSL | 0 | mS/cm |
| | | PV URV = PV USL | 500 | mS/cm |
| Alarm Setup | – | Alarm Byte 1 | Software Failure = No | – |
| | | | Dry Cond Sensor = No | – |
| | | | Cell Constant Deviation = No | – |
| | | | Cond Sensor Shorted = No | – |

12 Buffer Tables

M100 transmitters have the ability to do automatic pH buffer recognition. The following tables show different standard buffers that are automatically recognized.

12.1 Buffers for pH/ORP Sensors

12.1.1 Mettler-9

| Temp (°C) | pH of buffer solutions | | | |
|-----------|------------------------|------|------|------|
| 0 | 2.03 | 4.01 | 7.12 | 9.52 |
| 5 | 2.02 | 4.01 | 7.09 | 9.45 |
| 10 | 2.01 | 4.00 | 7.06 | 9.38 |
| 15 | 2.00 | 4.00 | 7.04 | 9.32 |
| 20 | 2.00 | 4.00 | 7.02 | 9.26 |
| 25 | 2.00 | 4.01 | 7.00 | 9.21 |
| 30 | 1.99 | 4.01 | 6.99 | 9.16 |
| 35 | 1.99 | 4.02 | 6.98 | 9.11 |
| 40 | 1.98 | 4.03 | 6.97 | 9.06 |
| 45 | 1.98 | 4.04 | 6.97 | 9.03 |
| 50 | 1.98 | 4.06 | 6.97 | 8.99 |
| 55 | 1.98 | 4.08 | 6.98 | 8.96 |
| 60 | 1.98 | 4.10 | 6.98 | 8.93 |
| 65 | 1.98 | 4.13 | 6.99 | 8.90 |
| 70 | 1.99 | 4.16 | 7.00 | 8.88 |
| 75 | 1.99 | 4.19 | 7.02 | 8.85 |
| 80 | 2.00 | 4.22 | 7.04 | 8.83 |
| 85 | 2.00 | 4.26 | 7.06 | 8.81 |
| 90 | 2.00 | 4.30 | 7.09 | 8.79 |
| 95 | 2.00 | 4.35 | 7.12 | 8.77 |

12.1.2 Mettler-10

| Temp (°C) | pH of buffer solutions | | | | |
|-----------|------------------------|------|------|-------|--|
| 0 | 2.03 | 4.01 | 7.12 | 10.65 | |
| 5 | 2.02 | 4.01 | 7.09 | 10.52 | |
| 10 | 2.01 | 4.00 | 7.06 | 10.39 | |
| 15 | 2.00 | 4.00 | 7.04 | 10.26 | |
| 20 | 2.00 | 4.00 | 7.02 | 10.13 | |
| 25 | 2.00 | 4.01 | 7.00 | 10.00 | |
| 30 | 1.99 | 4.01 | 6.99 | 9.87 | |
| 35 | 1.99 | 4.02 | 6.98 | 9.74 | |
| 40 | 1.98 | 4.03 | 6.97 | 9.61 | |
| 45 | 1.98 | 4.04 | 6.97 | 9.48 | |
| 50 | 1.98 | 4.06 | 6.97 | 9.35 | |
| 55 | 1.98 | 4.08 | 6.98 | | |
| 60 | 1.98 | 4.10 | 6.98 | | |
| 65 | 1.99 | 4.13 | 6.99 | | |
| 70 | 1.98 | 4.16 | 7.00 | | |
| 75 | 1.99 | 4.19 | 7.02 | | |
| 80 | 2.00 | 4.22 | 7.04 | | |
| 85 | 2.00 | 4.26 | 7.06 | | |
| 90 | 2.00 | 4.30 | 7.09 | | |
| 95 | 2.00 | 4.35 | 7.12 | | |

12.1.3 NIST Technical

| Temp (°C) | pH of buffer solutions | | | | |
|-----------|------------------------|-------|-------|-------|-------|
| 0 | 1.67 | 4.00 | 7.115 | 10.32 | 13.42 |
| 5 | 1.67 | 4.00 | 7.085 | 10.25 | 13.21 |
| 10 | 1.67 | 4.00 | 7.06 | 10.18 | 13.01 |
| 15 | 1.67 | 4.00 | 7.04 | 10.12 | 12.80 |
| 20 | 1.675 | 4.00 | 7.015 | 10.07 | 12.64 |
| 25 | 1.68 | 4.005 | 7.00 | 10.01 | 12.46 |
| 30 | 1.68 | 4.015 | 6.985 | 9.97 | 12.30 |
| 35 | 1.69 | 4.025 | 6.98 | 9.93 | 12.13 |
| 40 | 1.69 | 4.03 | 6.975 | 9.89 | 11.99 |
| 45 | 1.70 | 4.045 | 6.975 | 9.86 | 11.84 |
| 50 | 1.705 | 4.06 | 6.97 | 9.83 | 11.71 |
| 55 | 1.715 | 4.075 | 6.97 | | 11.57 |
| 60 | 1.72 | 4.085 | 6.97 | | 11.45 |
| 65 | 1.73 | 4.10 | 6.98 | | |
| 70 | 1.74 | 4.13 | 6.99 | | |
| 75 | 1.75 | 4.14 | 7.01 | | |
| 80 | 1.765 | 4.16 | 7.03 | | |
| 85 | 1.78 | 4.18 | 7.05 | | |
| 90 | 1.79 | 4.21 | 7.08 | | |
| 95 | 1.805 | 4.23 | 7.11 | | |

12.1.4 NIST Standard (DIN and JIS 19266: 2000–01)

| Temp (°C) | pH of buffer solutions | | | |
|-----------|------------------------|-------|-------|-------|
| 0 | | | | |
| 5 | 1.668 | 4.004 | 6.950 | 9.392 |
| 10 | 1.670 | 4.001 | 6.922 | 9.331 |
| 15 | 1.672 | 4.001 | 6.900 | 9.277 |
| 20 | 1.676 | 4.003 | 6.880 | 9.228 |
| 25 | 1.680 | 4.008 | 6.865 | 9.184 |
| 30 | 1.685 | 4.015 | 6.853 | 9.144 |
| 35 | 1.694 | 4.028 | 6.841 | 9.095 |
| 40 | 1.697 | 4.036 | 6.837 | 9.076 |
| 45 | 1.704 | 4.049 | 6.834 | 9.046 |
| 50 | 1.712 | 4.064 | 6.833 | 9.018 |
| 55 | 1.715 | 4.075 | 6.834 | 8.985 |
| 60 | 1.723 | 4.091 | 6.836 | 8.962 |
| 70 | 1.743 | 4.126 | 6.845 | 8.921 |
| 80 | 1.766 | 4.164 | 6.859 | 8.885 |
| 90 | 1.792 | 4.205 | 6.877 | 8.850 |
| 95 | 1.806 | 4.227 | 6.886 | 8.833 |



NOTE!

The pH(S) values of the individual charges of the secondary reference materials are documented in a certificate of an accredited laboratory. This certificate is supplied with the respective buffer materials. Only these pH(S) values shall be used as standard values for the secondary reference buffer materials. Correspondingly, this standard does not include a table with standard pH values for practical use. The table above only provides examples of pH(PS) values for orientation.

12.1.5 Hach

Buffer values up to 60 °C as specified by Bergmann & Beving Process AB.

| Temp (°C) | pH of buffer solutions | | |
|-----------|------------------------|------|-------|
| 0 | 4.00 | 7.14 | 10.30 |
| 5 | 4.00 | 7.10 | 10.23 |
| 10 | 4.00 | 7.04 | 10.11 |
| 15 | 4.00 | 7.04 | 10.11 |
| 20 | 4.00 | 7.02 | 10.05 |
| 25 | 4.01 | 7.00 | 10.00 |
| 30 | 4.01 | 6.99 | 9.96 |
| 35 | 4.02 | 6.98 | 9.92 |
| 40 | 4.03 | 6.98 | 9.88 |
| 45 | 4.05 | 6.98 | 9.85 |
| 50 | 4.06 | 6.98 | 9.82 |
| 55 | 4.07 | 6.98 | 9.79 |
| 60 | 4.09 | 6.99 | 9.76 |

12.1.6 Ciba (94)

| Temp (°C) | pH of buffer solutions | | | |
|-----------|------------------------|-------|-------|-------|
| 0 | 2.04 | 4.00 | 7.10 | 10.30 |
| 5 | 2.09 | 4.02 | 7.08 | 10.21 |
| 10 | 2.07 | 4.00 | 7.05 | 10.14 |
| 15 | 2.08 | 4.00 | 7.02 | 10.06 |
| 20 | 2.09 | 4.01 | 6.98 | 9.99 |
| 25 | 2.08 | 4.02 | 6.98 | 9.95 |
| 30 | 2.06 | 4.00 | 6.96 | 9.89 |
| 35 | 2.06 | 4.01 | 6.95 | 9.85 |
| 40 | 2.07 | 4.02 | 6.94 | 9.81 |
| 45 | 2.06 | 4.03 | 6.93 | 9.77 |
| 50 | 2.06 | 4.04 | 6.93 | 9.73 |
| 55 | 2.05 | 4.05 | 6.91 | 9.68 |
| 60 | 2.08 | 4.10 | 6.93 | 9.66 |
| 65 | 2.07* | 4.10* | 6.92* | 9.61* |
| 70 | 2.07 | 4.11 | 6.92 | 9.57 |
| 75 | 2.04* | 4.13* | 6.92* | 9.54* |
| 80 | 2.02 | 4.15 | 6.93 | 9.52 |
| 85 | 2.03* | 4.17* | 6.95* | 9.47* |
| 90 | 2.04 | 4.20 | 6.97 | 9.43 |
| 95 | 2.05* | 4.22* | 6.99* | 9.38* |

* Extrapolated

12.1.7 Merck Titrisole, Riedel-de-Haën Fixanale

| Temp (°C) | pH of buffer solutions | | | | |
|-----------|------------------------|------|------|------|-------|
| 0 | 2.01 | 4.05 | 7.13 | 9.24 | 12.58 |
| 5 | 2.01 | 4.05 | 7.07 | 9.16 | 12.41 |
| 10 | 2.01 | 4.02 | 7.05 | 9.11 | 12.26 |
| 15 | 2.00 | 4.01 | 7.02 | 9.05 | 12.10 |
| 20 | 2.00 | 4.00 | 7.00 | 9.00 | 12.00 |
| 25 | 2.00 | 4.01 | 6.98 | 8.95 | 11.88 |
| 30 | 2.00 | 4.01 | 6.98 | 8.91 | 11.72 |
| 35 | 2.00 | 4.01 | 6.96 | 8.88 | 11.67 |
| 40 | 2.00 | 4.01 | 6.95 | 8.85 | 11.54 |
| 45 | 2.00 | 4.01 | 6.95 | 8.82 | 11.44 |
| 50 | 2.00 | 4.00 | 6.95 | 8.79 | 11.33 |
| 55 | 2.00 | 4.00 | 6.95 | 8.76 | 11.19 |
| 60 | 2.00 | 4.00 | 6.96 | 8.73 | 11.04 |
| 65 | 2.00 | 4.00 | 6.96 | 8.72 | 10.97 |
| 70 | 2.01 | 4.00 | 6.96 | 8.70 | 10.90 |
| 75 | 2.01 | 4.00 | 6.96 | 8.68 | 10.80 |
| 80 | 2.01 | 4.00 | 6.97 | 8.66 | 10.70 |
| 85 | 2.01 | 4.00 | 6.98 | 8.65 | 10.59 |
| 90 | 2.01 | 4.00 | 7.00 | 8.64 | 10.48 |
| 95 | 2.01 | 4.00 | 7.02 | 8.64 | 10.37 |

12.1.8 WTW

| Temp (°C) | pH of buffer solutions | | | |
|-----------|------------------------|------|------|-------|
| 0 | 2.03 | 4.01 | 7.12 | 10.65 |
| 5 | 2.02 | 4.01 | 7.09 | 10.52 |
| 10 | 2.01 | 4.00 | 7.06 | 10.39 |
| 15 | 2.00 | 4.00 | 7.04 | 10.26 |
| 20 | 2.00 | 4.00 | 7.02 | 10.13 |
| 25 | 2.00 | 4.01 | 7.00 | 10.00 |
| 30 | 1.99 | 4.01 | 6.99 | 9.87 |
| 35 | 1.99 | 4.02 | 6.98 | 9.74 |
| 40 | 1.98 | 4.03 | 6.97 | 9.61 |
| 45 | 1.98 | 4.04 | 6.97 | 9.48 |
| 50 | 1.98 | 4.06 | 6.97 | 9.35 |
| 55 | 1.98 | 4.08 | 6.98 | |
| 60 | 1.98 | 4.10 | 6.98 | |
| 65 | 1.99 | 4.13 | 6.99 | |
| 70 | | 4.16 | 7.00 | |
| 75 | | 4.19 | 7.02 | |
| 80 | | 4.22 | 7.04 | |
| 85 | | 4.26 | 7.06 | |
| 90 | | 4.30 | 7.09 | |
| 95 | | 4.35 | 7.12 | |

12.1.9 JIS Z 8802

| Temp (°C) | pH of buffer solutions | | | |
|-----------|------------------------|-------|-------|-------|
| 0 | 1.666 | 4.003 | 6.984 | 9.464 |
| 5 | 1.668 | 3.999 | 6.951 | 9.395 |
| 10 | 1.670 | 3.998 | 6.923 | 9.332 |
| 15 | 1.672 | 3.999 | 6.900 | 9.276 |
| 20 | 1.675 | 4.002 | 6.881 | 9.225 |
| 25 | 1.679 | 4.008 | 6.865 | 9.180 |
| 30 | 1.683 | 4.015 | 6.853 | 9.139 |
| 35 | 1.688 | 4.024 | 6.844 | 9.102 |
| 38 | 1.691 | 4.030 | 6.840 | 9.081 |
| 40 | 1.694 | 4.035 | 6.838 | 9.068 |
| 45 | 1.700 | 4.047 | 6.834 | 9.038 |
| 50 | 1.707 | 4.060 | 6.833 | 9.011 |
| 55 | 1.715 | 4.075 | 6.834 | 8.985 |
| 60 | 1.723 | 4.091 | 6.836 | 8.962 |
| 70 | 1.743 | 4.126 | 6.845 | 8.921 |
| 80 | 1.766 | 4.164 | 6.859 | 8.885 |
| 90 | 1.792 | 4.205 | 6.877 | 8.850 |
| 95 | 1.806 | 4.227 | 6.886 | 8.833 |

12.1.10 Buffer for Dual Membrane pH Electrodes (pH/pNa)

12.1.10.1 Mettler-pH/pNa (Na⁺ 3.9M)

| Temp (°C) | pH of buffer solutions | | | |
|-----------|------------------------|------|------|------|
| 0 | 1.98 | 3.99 | 7.01 | 9.51 |
| 5 | 1.98 | 3.99 | 7.00 | 9.43 |
| 10 | 1.99 | 3.99 | 7.00 | 9.36 |
| 15 | 1.99 | 3.99 | 6.99 | 9.30 |
| 20 | 1.99 | 4.00 | 7.00 | 9.25 |
| 25 | 2.00 | 4.01 | 7.00 | 9.21 |
| 30 | 2.00 | 4.02 | 7.01 | 9.18 |
| 35 | 2.01 | 4.04 | 7.01 | 9.15 |
| 40 | 2.01 | 4.05 | 7.02 | 9.12 |
| 45 | 2.02 | 4.07 | 7.03 | 9.11 |
| 50 | 2.02 | 4.09 | 7.04 | 9.10 |

13 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).

Index

Symbole

| | |
|------------------|----|
| 4 mA Unit..... | 36 |
| 4 mA Value..... | 36 |
| 20 mA Unit..... | 36 |
| 20 mA Value..... | 36 |

A

| | |
|--------------------------------------|--------|
| Abort (Sensor Calibration)..... | 22 |
| ACT | |
| ACT (%)..... | 31 |
| ACT (d)..... | 31 |
| Adaptive Cal Timer..... | 31 |
| ACT Monitoring..... | 41 |
| Adjust (Sensor calibration)..... | 22 |
| Alarm Byte 0..... | 43 |
| Alarm Byte 1..... | 43 |
| Alarm Setup..... | 43 |
| Alarm Type..... | 37 |
| Analog Input..... | 32, 36 |
| Analog Output..... | 37 |
| Assembly sensor and transmitter..... | 16 |
| Asset management tool | |
| Operation..... | 20 |
| Sensor calibration..... | 23 |
| Autoclave Limit..... | 40 |

C

| | |
|-------------------------------------|--------|
| Cal. Dat..... | 29 |
| Calibrate (Sensor calibration)..... | 22 |
| Calibration | |
| Current input Ain..... | 24 |
| Sensor..... | 22 |
| Calibration Data..... | 29 |
| Calibration History..... | 29, 30 |
| Channel Setup..... | 33 |
| Ciba (94)..... | 54 |
| CIP Limit..... | 40 |
| CIP Temperature..... | 40 |
| Clear Status Group..... | 28 |
| Comm..... | 29, 31 |
| Compensation Mode | |
| Alcohol..... | 36 |
| Ammonia..... | 36 |
| Cation..... | 36 |
| Glycol 0.5..... | 36 |
| Glycol 1.0..... | 36 |
| Lienar 20°C..... | 35 |
| Light 84..... | 36 |
| Lineat 25°C..... | 35 |
| None..... | 36 |
| Standard..... | 35 |
| Std 75°C..... | 36 |
| Cond 4e | |
| Menu..... | 35 |
| Conductivity specifications..... | 45 |
| Configuration tool | |
| Operation..... | 20 |
| Sensor calibration..... | 23 |

D

| | |
|---------------------------------|----|
| Date..... | 39 |
| Date & Time..... | 42 |
| Default values..... | 48 |
| Descriptor..... | 39 |
| Design..... | 15 |
| Detailed Setup..... | 32 |
| Device Info..... | 27 |
| Device Reset..... | 32 |
| Diagnostics..... | 27 |
| Din1 Hold State..... | 38 |
| Din1 Status..... | 32 |
| DLI | |
| DLI (%)..... | 31 |
| DLI (d)..... | 31 |
| Dynamic Lifetime Indicator..... | 31 |
| DLI Monitoring..... | 41 |
| DLI Stress Adjustment..... | 40 |

E

| | |
|-----------------------------------|----|
| Electrical specifications..... | 46 |
| Environmental specifications..... | 46 |
| Ex instructions..... | 11 |

F

| | |
|----------------------------|----|
| Final assembly number..... | 39 |
| Function..... | 14 |

G

| | |
|--------------------------------|----|
| Get Current Date and Time..... | 42 |
|--------------------------------|----|

H

| | |
|-------------------------------|----|
| Hach..... | 54 |
| HART handheld terminal | |
| Opeation..... | 21 |
| Sensor calibration..... | 23 |
| HART Info..... | 39 |
| HART Output..... | 39 |
| HART system architecture..... | 17 |
| Hazardous areas..... | 11 |
| Hold Fixed..... | 37 |
| Hold Mode..... | 37 |
| Hold Output..... | 38 |
| HW Diagnostics..... | 32 |

I

| | |
|----------------------|----|
| Installation..... | 16 |
| Intended use..... | 10 |
| IP..... | 33 |
| iSense software..... | 22 |
| ISM Diagnostics..... | 30 |
| ISM Sensor Info..... | 29 |
| ISM Setup..... | 40 |

J

| | |
|-----------------|----|
| JIS Z 8802..... | 56 |
|-----------------|----|

| | | | |
|-----------------------------------|--------|------------------------------------|--------|
| L | | Q | |
| Load Configuration | 32 | QV Average | 33 |
| Lock/Unlock Device | 42 | QV Comp Mode | 35 |
| Long Tag | 39 | QV is | 33 |
| Loop Current Mode | 37 | QV Linear Coef | 35 |
| M | | R | |
| Manual Hold | 38 | Range | 38 |
| Master | 29, 31 | Rel Humidity | 34 |
| Max ACT | 41 | Reset | 42 |
| Max TTM | 41 | ResetAnalogOutCal | 42 |
| Measurements | 33 | Reset ISM Counter/Timer | 41 |
| Mechanical specifications | 47 | Reset MeterCal | 42 |
| Menu description | 25 | Reset System | 42 |
| Menu overview | 25 | Review | 43 |
| Merck Titrisole | 55 | S | |
| Message | 39 | Safety | 10 |
| Messages | 27 | Salinity | 34 |
| Mettler-9 | 51 | Scope of delivery | 9 |
| Mettler-10 | 52 | Self Test | 32 |
| Model/Software Revision | 31 | Sensor calibration | 22 |
| N | | Abort | 22 |
| Na+ 3.9M | 56 | Adjust | 22 |
| NIST Standard | 53 | Asset-management-tool | 23 |
| NIST Technical | 52 | Calibrate | 22 |
| Num req preams | 39 | Configuration tool | 23 |
| Num resp preams | 39 | HART handheld terminal | 23 |
| O | | Sensor Calibration | 26 |
| O2 | | Sensor Channel | 33 |
| Menu | 34 | Sensor FW | 31 |
| O2 specifications | 45 | Sensor HW | 31 |
| Operating Days | 31 | Sensor Monitoring | 31 |
| Operation | | Sensor Monitoring Setup | 41 |
| Asset-management-tool | 20 | Sensor Setup | 33 |
| Configuration tool | 20 | Serial-No. | 29, 31 |
| HART handheld terminal | 21 | Service | 27 |
| Output Conditions | 37 | SIP Limit | 40 |
| P | | SIP Temperature | 40 |
| Part-No | 29, 31 | STC Ref Mode | 34 |
| Pcal_Pressure | 34 | STC Ref Temp | 34 |
| Pcal_Pres Unit | 34 | STC Value | 34 |
| pH | | SV Average | 33 |
| Menu | 33 | SV Comp Mode | 35 |
| pH Buffer | 33 | SV is | 33 |
| pH/pNa specifications | 45 | SV Linear Coef | 35 |
| Poll addr | 39 | Symbols | 8 |
| Process Cal Pressure Source | 34 | System | 42 |
| Process_Pressure | 34 | T | |
| Process_Pressure Mode | 34 | Tables | |
| Process_Pressure Unit | 34 | Technische Daten | 45 |
| PV Average | 33 | Tag | 39 |
| PV Comp Mode | 35 | Technical data | |
| PV is | 33 | Amperometric oxygen | 45 |
| PV Linear Coef | 35 | Conductivity 4-e | 45 |
| PV LRV | 38 | Electrical specification | 46 |
| PV LSL | 38 | Environmental specifications | 46 |
| PV URV | 38 | Mechanical specifications | 47 |
| PV USL | 38 | pH/ORP | 45 |
| | | pH/pNa | 45 |

| | |
|---------------------------|----|
| Terminal block | 19 |
| Test Device | 32 |
| Troubleshooting | 44 |
| TTM | |
| Time To Maintenance | 31 |
| TTM (%) | 31 |
| TTM (d) | 31 |
| TTM Monitoring | 41 |
| TV Average | 33 |
| TV Comp Mode | 35 |
| TV is | 33 |
| TV Linear Coef | 35 |
| Type | 29 |
| U | |
| UpolCal | 35 |
| UpolMeas | 35 |
| V | |
| Verify | 26 |
| Conductivity | 26 |
| O2 | 26 |
| pH/ORP | 26 |
| pH/pNa | 26 |
| W | |
| Warning notes | 8 |
| Caution | 8 |
| Danger | 8 |
| Warning | 8 |
| Warranty | 56 |
| Wiring | 17 |
| Write Protection | 39 |
| WTW | 55 |

Sales and Service:

Australia

Mettler-Toledo Limited
220 Turner Street
Port Melbourne, VIC 3207
Australia
Phone +61 1300 659 761
e-mail info.mtaus@mt.com

Austria

Mettler-Toledo Ges.m.b.H.
Laxenburger Str. 252/2
AT-1230 Wien
Phone +43 1 607 4356
e-mail prozess@mt.com

Brazil

Mettler-Toledo Ind. e Com. Ltda.
Avenida Tamboré, 418
Tamboré
BR-06460-000 Barueri/SP
Phone +55 11 4166 7400
e-mail mettler@mettler.com.br
service@mettler.com.br

Canada

Mettler-Toledo Inc.
2915 Argenta Rd #6
CA-ON L5N 8G6 Mississauga
Phone +1 800 638 8537
e-mail Proinsidesales@mt.com

China

Mettler-Toledo International Trading
(Shanghai) Co. Ltd.
589 Gui Ping Road
Cao He Jing
CN-200233 Shanghai
Phone +86 21 64 85 04 35
e-mail ad@mt.com

Croatia

Mettler-Toledo d.o.o.
Mandlova 3
HR-10000 Zagreb
Phone +385 1 292 06 33
e-mail mt.zagreb@mt.com

Czech Republic

Mettler-Toledo s.r.o.
Trebohosticka 2283/2
CZ-100 00 Praha 10
Phone +420 2 72 123 150
e-mail sales.mtcz@mt.com

Denmark

Mettler-Toledo A/S
Naverland 8
DK-2600 Glostrup
Phone +45 43 27 08 00
e-mail info.mtdk@mt.com

France

Mettler-Toledo
Analyse Industrielle S.A.S.
30, Boulevard de Douaumont
FR-75017 Paris
Phone +33 1 47 37 06 00
e-mail mtpro-f@mt.com

Germany

Mettler-Toledo GmbH
Prozeßanalytik
Ockerweg 3
DE-35396 Gießen
Phone +49 641 507 444
e-mail prozess@mt.com

Great Britain

Mettler-Toledo LTD
64 Boston Road, Beaumont Leys
GB-Leicester LE4 1AW
Phone +44 116 235 7070
e-mail enquire.mtuk@mt.com

Hungary

Mettler-Toledo Kereskedelmi KFT
Teve u. 41
HU-1139 Budapest
Phone +36 1 288 40 40
e-mail mthu@axelero.hu

India

Mettler-Toledo India Private Limited
Amar Hill, Saki Vihar Road
Powai
IN-400 072 Mumbai
Phone +91 22 2857 0808
e-mail sales.mtin@mt.com

Indonesia

PT. Mettler-Toledo Indonesia
GRHA PERSADA 3rd Floor
Jl. KH. Noer Ali No.3A,
Kayuringin Jaya
Kalimalang, Bekasi 17144, ID
Phone +62 21 294 53919
e-mail mt-id.customersupport@mt.com

Italy

Mettler-Toledo S.p.A.
Via Vialba 42
IT-20026 Novate Milanese
Phone +39 02 333 321
e-mail customercare.italia@mt.com

Japan

Mettler-Toledo K.K.
Process Division
6F Ikenohata Nisshoku Bldg.
2-9-7, Ikenohata
Taito-ku
JP-110-0008 Tokyo
Phone +81 3 5815 5606
e-mail helpdesk.ing.jp@mt.com

Malaysia

Mettler-Toledo (M) Sdn Bhd
Bangunan Electroscon Holding, U 1-01
Lot 8 Jalan Astaka U8/84
Seksyen U8, Bukit Jelutong
MY-40150 Shah Alam Selangor
Phone +60 3 78 44 58 88
e-mail MT-MY.CustomerSupport@mt.com

Mexico

Mettler-Toledo S.A. de C.V.
Ejército Nacional #340
Polanco V Sección
C.P. 11560
MX-México D.F.
Phone +52 55 1946 0900
e-mail mt.mexico@mt.com

Norway

Mettler-Toledo AS
Ulvenveien 92B
NO-0581 Oslo Norway
Phone +47 22 30 44 90
e-mail info.mtn@mt.com

Poland

Mettler-Toledo (Poland) Sp.z.o.o.
ul. Poleczki 21
PL-02-822 Warszawa
Phone +48 22 545 06 80
e-mail polska@mt.com

Russia

Mettler-Toledo Vostok ZAO
Sretenskij Bulvar 6/1
Office 6
RU-101000 Moscow
Phone +7 495 621 56 66
e-mail inforus@mt.com

Singapore

Mettler-Toledo (S) Pte. Ltd.
Block 28
Ayer Rajah Crescent #05-01
SG-139959 Singapore
Phone +65 6890 00 11
e-mail mt.sg.customersupport@mt.com

Slovakia

Mettler-Toledo s.r.o.
Hattalova 12/A
SK-831 03 Bratislava
Phone +421 2 4444 12 20-2
e-mail predaj@mt.com

Slovenia

Mettler-Toledo d.o.o.
Pot heroja Trtnika 26
SI-1261 Ljubljana-Dobrunje
Phone +386 1 530 80 50
e-mail keith.racman@mt.com

South Korea

Mettler-Toledo (Korea) Ltd.
1 & 4F, Yeil Building 21
Yangjaecheon-ro 19-gil
SeoCho-Gu
Seoul 06753 Korea
Phone +82 2 3498 3500
e-mail Sales_MTKR@mt.com

Spain

Mettler-Toledo S.A.E.
C/Miguel Hernández, 69-71
ES-08908 L'Hospitalet de Llobregat
(Barcelona)
Phone +34 902 32 00 23
e-mail mtemkt@mt.com

Sweden

Mettler-Toledo AB
Virkesvägen 10
Box 92161
SE-12008 Stockholm
Phone +46 8 702 50 00
e-mail sales.mts@mt.com

Switzerland

Mettler-Toledo (Schweiz) GmbH
Im Langacher, Postfach
CH-8606 Greifensee
Phone +41 44 944 47 60
e-mail ProSupport.ch@mt.com

Thailand

Mettler-Toledo (Thailand) Ltd.
272 Soi Soonvijai 4
Rama 9 Rd., Bangkok
Huay Kwang
TH-10320 Bangkok
Phone +66 2 723 03 00
e-mail MT-TH.CustomerSupport@mt.com

Turkey

Mettler-Toledo Türkiye
Haluk Türksöy Sokak No: 6 Zemin ve 1.
Bodrum Kat 34662 Üsküdar-İstanbul, TR
Phone +90 216 400 20 20
e-mail sales.mtr@mt.com

USA

METTLER TOLEDO
Process Analytics
900 Middlesex Turnpike, Bld. 8
Billerica, MA 01821, USA
Phone +1 781 301 8800
Freephone +1 800 352 8763
e-mail mtprous@mt.com

Vietnam

Mettler-Toledo (Vietnam) LLC
29A Hoang Hoa Tham Street, Ward 6
Binh Thanh District
Ho Chi Minh City, Vietnam
Phone +84 8 35515924
e-mail MT-VN.CustomerSupport@mt.com



Management System
certified according to
ISO 9001 / ISO 14001

Subject to technical changes.
© Mettler-Toledo GmbH, Process Analytics
01/2016 Printed in Switzerland. 30 130 604

Mettler-Toledo GmbH, Process Analytics
Im Hackacker 15, CH-8902 Urdorf, Switzerland
Tel. +41 44 729 62 11, Fax +41 44 729 66 36

www.mt.com/pro