METTLER TOLEDO

O$_2$ Transmitter 4050 e
Instruction manual
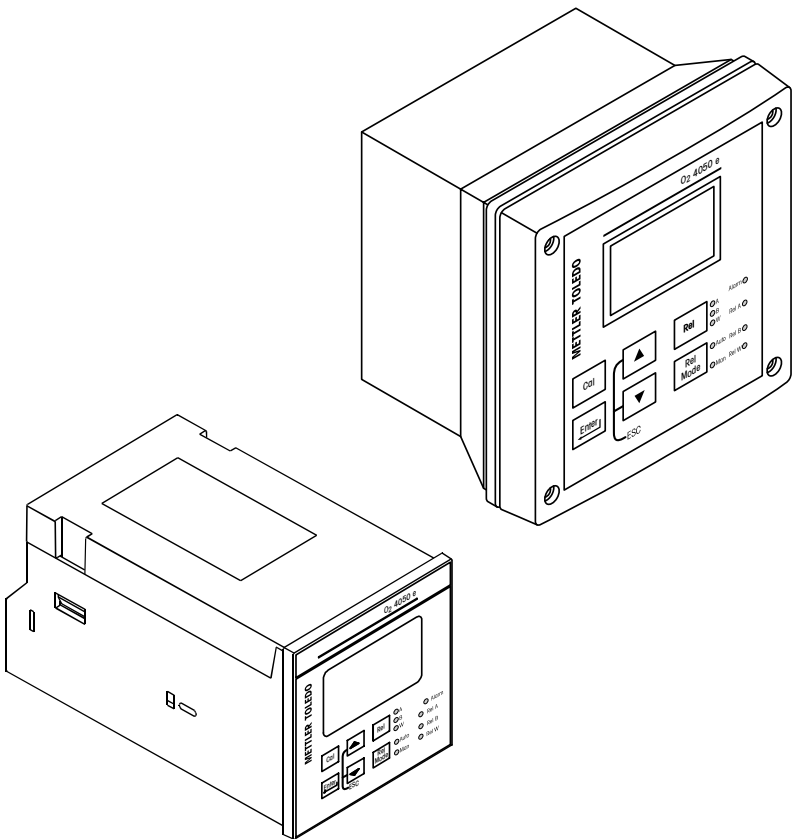
Preface

This manual serves to explain the use of the O_2 Transmitter 4050 e Series. The manual functions in two ways, firstly as a step by step guide to help the user operate the instrument, and secondly as a handy reference guide. This instruction manual is written to cover as many anticipated applications of the O_2 Transmitter 4050 e as possible. If you have any doubts concerning the use of the instrument, please do not hesitate to contact the nearest METTLER TOLEDO Authorized Distributor.

The information presented in this manual is subject to change without notice as improvements are made, and does not represent any commitment whatsoever on the part of METTLER TOLEDO.

METTLER TOLEDO cannot accept any responsibility for damage or malfunction of the unit due to improper use of the instrument.

Contents

1   Introduction

1.1   At the very beginning

We thank you for having purchased the **METTLER TOLEDO O$_2$ Transmitter 4050 e**.

The construction of the O$_2$ Transmitter 4050 e employs leading edge technology and complies with safety regulations currently in force. Notwithstanding this, improper use could lead to hazards for the user or a third-party, and/or adverse effects on the plant or other equipment. **Therefore, the operating instructions must be read and understood by the persons involved before work is started with the O$_2$ Transmitter 4050 e**.

This instruction manual identifies safety instructions and additional information by means of the following symbols:

– This symbol draws attention to **safety instructions and warnings of potential danger** which, if neglected, could result in injury to persons and/or damage to property.

– This symbol identifies **additional information and instructions** which, if neglected, could lead to inefficient operation and possible loss of production.

The instruction manual must always be stored close at hand, in a place accessible to all people working with the O$_2$ Transmitter 4050 e.

If you have questions, which are not or insufficiently answered in this instruction manual, please contact your METTLER TOLEDO supplier. He will be glad to assist you.

1.2   Intended use

METTLER TOLEDO O$_2$ Transmitter 4050 e are intended solely for dissolved oxygen and temperature measurement, as described in this instruction manual.
Any other use, or use not mentioned here, that is incompatible with the technical specifications is deemed inappropriate. The operator is solely responsible for any damage arising from such use.

Other prerequisites for appropriate use include:

– observing the instructions, notes and requirements set out in this instruction manual.
– observing all local safety regulations concerning safety at work.
– observing all information and warnings in the documentation dealing with the products used together with the transmitter (housings, sensors, etc.).
– observing the prescribed environmental and operational conditions.

1.3   Safety intsructions

–   The O$_2$ Transmitter 4050 e should be installed and operated only by personnel familiar with
    the transmitter and who are qualified for such work.

–   A defective transmitter must neither be installed nor put into service.

–   The O$_2$ Transmitter 4050 e must only be operated under the specified operating conditions
    (see section 8).

–   The O$_2$ Transmitter 4050 e must not be repaired by the customer.

–   The O$_2$ Transmitter 4050 e must only be opened to replace the unit fuse. This work must be
    carried out only by personnel familiar with the transmitter and who are qualified for such work.
    Make sure the mains cable is separated from the power supply before opening the unit.

–   No modifications to the O$_2$ Transmitter 4050 e are allowed. The manufacturer/supplier accepts
    no responsibility for damage caused by unauthorised modifications. The risk is borne entire-
    ly by the user.

2   Product description

2.1   Description of unit

The METTLER TOLEDO O$_2$ Transmitter 4050 e is used for measuring dissolved oxygen (in % saturation, mg/l or ppm) and temperature values. The dissolved oxygen values can be measured using limit or P/PI control.

The transmitter is available in two versions, one for panel mounting and one for wall mounting in a enclosure. The transmitter can be used for applications such as water treatment and monitoring, chemical and food processing, clean and wastewater control and fish farming.

 This transmitter has many user-friendly and safety features which include:

• Menu-driven program that simplifies set-up.

• Built-in memory backup to ensure that calibration and other information are not erased if power supply fails.

• Push-button for calibration and electrode offset adjustment from the keypad.

• Automatic temperature compensation (ATC).

• Manual temperature compensation setting without the ATC probe, with independent setting for calibration and process temperature.

• Two galvanically isolated current outputs 0/4...20mA.

• 0 to 1999 seconds time delay adjustment on all relays – minimizes false alarms.

• Separately adjustable high and low set-point hysteresis (dead bands) prevent chattering of relays around the set points.

• Three control modes: limit controller, P controller and PI controller (P/PI controller as pulse length or pulse frequency).

• Large dual display LCD for easy reading with clear multiple annunciators, alarm status, operational and error messages.

• Two switching contacts as set-point relays.

• Separate alarm relay alerting you to set point limits exceeded for a certain time and if the NTC wires are broken or disconnected during the ATC function.

• Wash relay.

• Hold function to freeze output current (0/4...20mA) and release control relays.

• LED indicators signal control activities to visually monitor transmitter status from a distance.

• Protection against electromagnetic interference.

• Back lighted and UV light protected LC display.

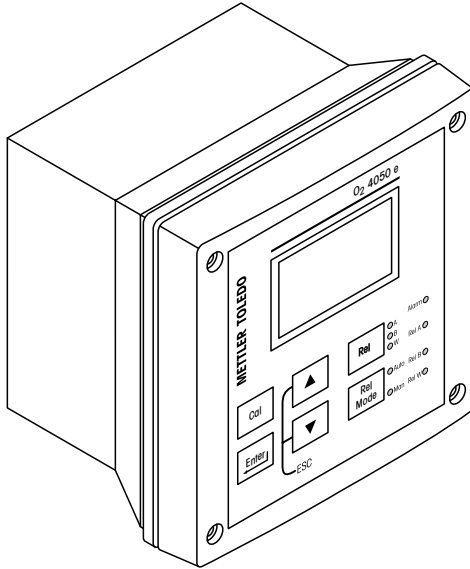## 2.2 Measurement and control system

A typical measurement system consists of:

- an O_2 4050 e series transmitter
- an O_2 sensor with integrated or separate temperature sensor
- an appropriate O_2 measurement cable
- an immersion, flow or process assembly
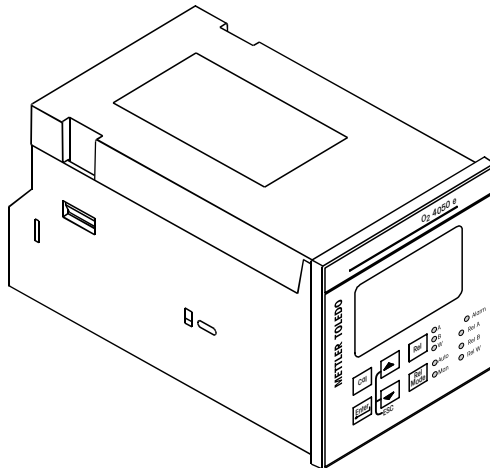- a final control element such as pump or valve
- a chart recorder
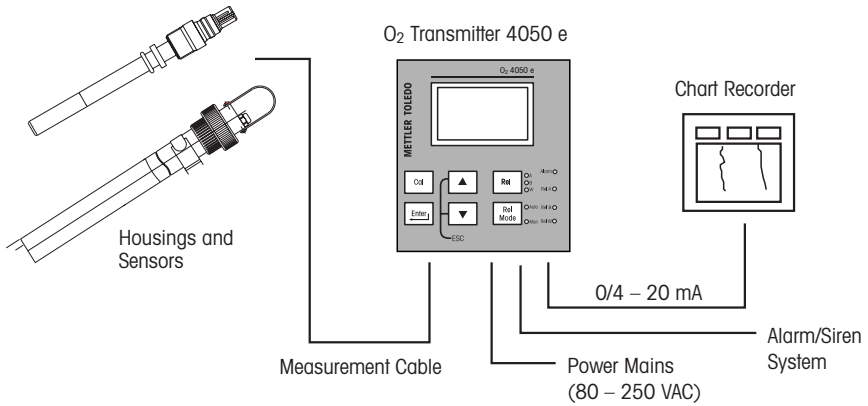
2.3   Unit overview
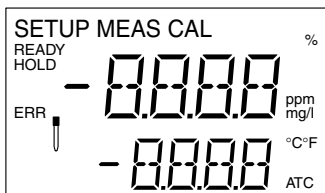
Wall mounting version

Panel mounting version

2.3.1   Display Overview

The LC display shows two alpha-numerical fields for parameters and measured values as well as various mode and status indicators.

```
SETUP MEAS CAL        %
READY
HOLD   -8.8.8.8  ppm
                  mg/l
ERR              °C°F
       -8.8.8.8
                 ATC
```

Mode indicators:
– **MEAS**: Measurement mode
– **SETUP**: Set-up mode
– **CAL**: Calibration mode

Status indicators:
– **READY**: Visible after successful calibration
– **HOLD**: Relay position and current output are frozen
– **ATC**: Visible in ATC (Automatic Temperature Compensation) mode. Not visible in the Manual temperature compensation mode. "ATC" flashes if the temperature probe is faulty in its ATC mode
– **ERR**: Error or alarm indicator

2.3.2   Key functions

Key	Description
Cal	• Enter Calibration mode (requires access code)
Enter	• Enter Set-up mode (requires access code) • Access sub functions (parameters) within a function group of Set-up mode • Confirm (store) set-up parameters and numerical values • Start calibration in Calibration mode
▲ ▼	• Select function group in the Set-up mode. • Set parameters and numerical values (if key is pressed continuously, the setting speed increases) • Control the relays in MANUAL relay operation • Returns to "Measurement mode" when both keys are pressed simultaneously
Rel	• Display limit values for SP1 and SP2 and settings for wash contact in AUTO relay operation • Toggle between RELAY A, RELAY B or Wash relay in MANUAL relay operation
Rel Mode	• Switch from AUTO to MANUAL relay operation (requires access code)

2.3.3 LED indicators

Relay indicators

| Rel | ○ A ○ B ○ W | If REL key is pressed the LED (A, B or W) indicates to which Relay (A, B or Wash) the displayed limit values refer |

Relay mode indicators
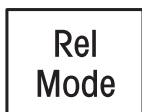
| Rel Mode | ○ Auto | Auto LED lights if relay operation is set to automatic mode. |
| | ○ Man | Man LED lights if relay operation is set to manual mode. |

Relay status indicators

Alarm ○   Alarm: LED lights if limit value is exceeded or the ATC probe fails.

Rel A ○   Rel A: LED lights green if measured value is within limit for Relay A
LED lights red if measured value exceeds limit for Relay A

Rel B ○   Rel B: LED lights green if measured value is within limit for Relay B
LED lights red if measured value exceeds limit for Relay B

Rel W○   Rel W: LED lights if cleaning cycle is on.

2.3.4 Security codes

The access to **Calibration mode**, **Setup mode** and **Manual relay operation mode** is protected with security codes. The security codes are set at the factory and cannot be changed by the user. The following security codes are used:

Security code	Mode/Description
000	**View only mode** to view actual settings
11	**Calibration mode** to start calibration
22	**Setup mode** to configure parameters
22	**Manual relay operation** to switch relay operation mode from automatic to manual

2.3.5 Menu overview

```
                              MEAS
                             100.0  %
                              25.0  °C

         ┌─────┐          ┌───────┐
         │ Cal │          │ Enter │
         └─────┘          └───────┘

      000 **            000 ***           **  CCD "000"= Check calibration parameters (View only mode)
       CCD               SCD                   CCD "11"= Calibration

      ┌───────┐        ┌───────┐           *** SCD "000"= Check setup parameters (View only mode)
      │ Enter │        │ Enter │               SCD "22"= Setup mode
      └───────┘        └───────┘
```

SETUP HOLD	OFS	Enter → Offset setting **--> see section 6.2**
SETUP HOLD	SET oCoF	Enter → Temperature settings **--> see section 6.3**
SETUP HOLD	SP 1	Enter → Relay A (set point 1) settings **--> see section 6.4**
SETUP HOLD	SP2	Enter → Relay B (set point 2) settings **--> see section 6.4**
SETUP HOLD	CNTR	Enter → Controller settings **--> see section 6.5**
SETUP HOLD	CUR.1	Enter → Current output 1 settings **--> see section 6.6**
SETUP HOLD	CUR.2	Enter → Current output 2 settings **--> see section 6.7**
SETUP HOLD	WASH	Enter → Wash contact settings **--> see section 6.8**
SETUP HOLD	CNFG	Enter → Unit settings **--> see section 6.9**
SETUP HOLD	CAL DO	Enter / Cal → Calibration **--> see section 5**

3   Assembly and installation

3.1   Mounting the unit

Wall mounting version
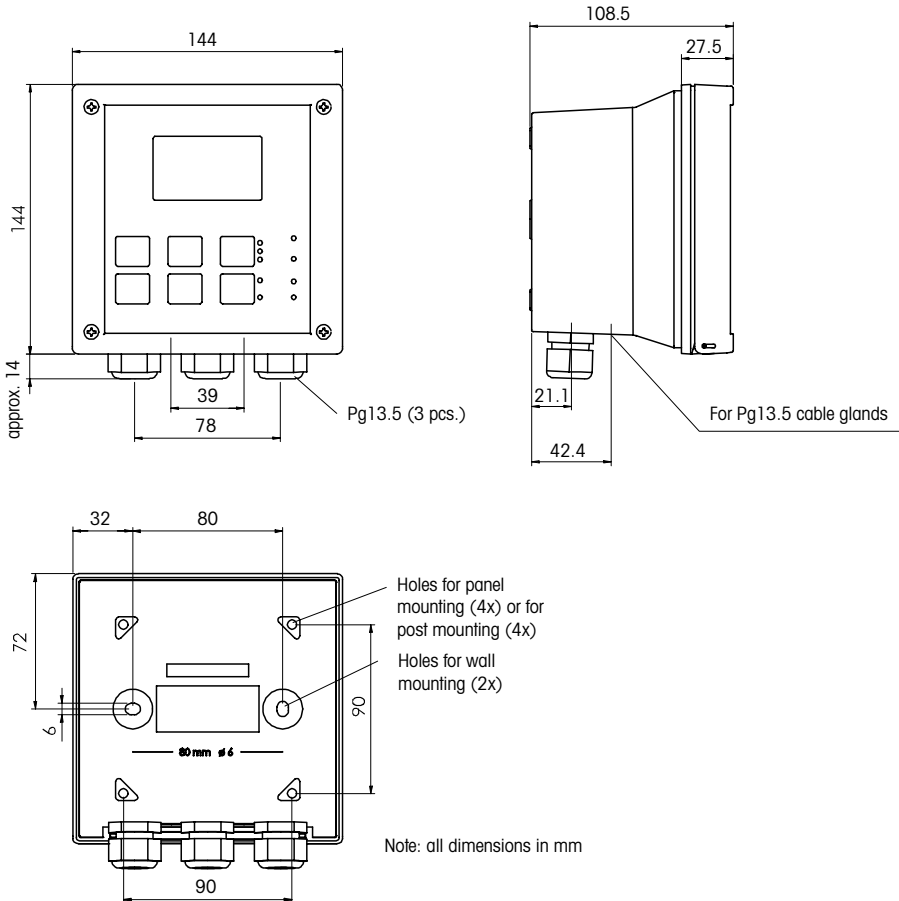
Transmitter housing for wall mounting: protection class IP 65

Panel mounting version

Flat gasket (1mm)
(to be inserted by customer)
Note: The taped corners have to be on top

92 +0.5

92 +0.5

Panel cut-out

92

56

32

96

max. 45

max. 175
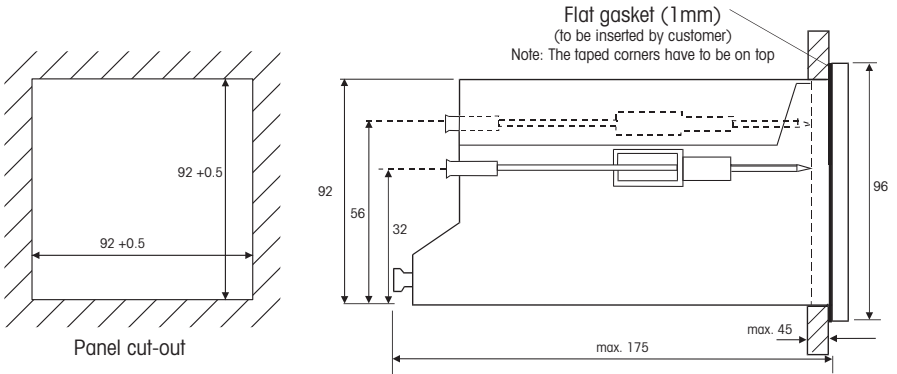
Transmitter housing for panel mounting: protection class IP 54 (front), IP 40 (housing)

3.2 Connection diagram

Connectors wall mounting version
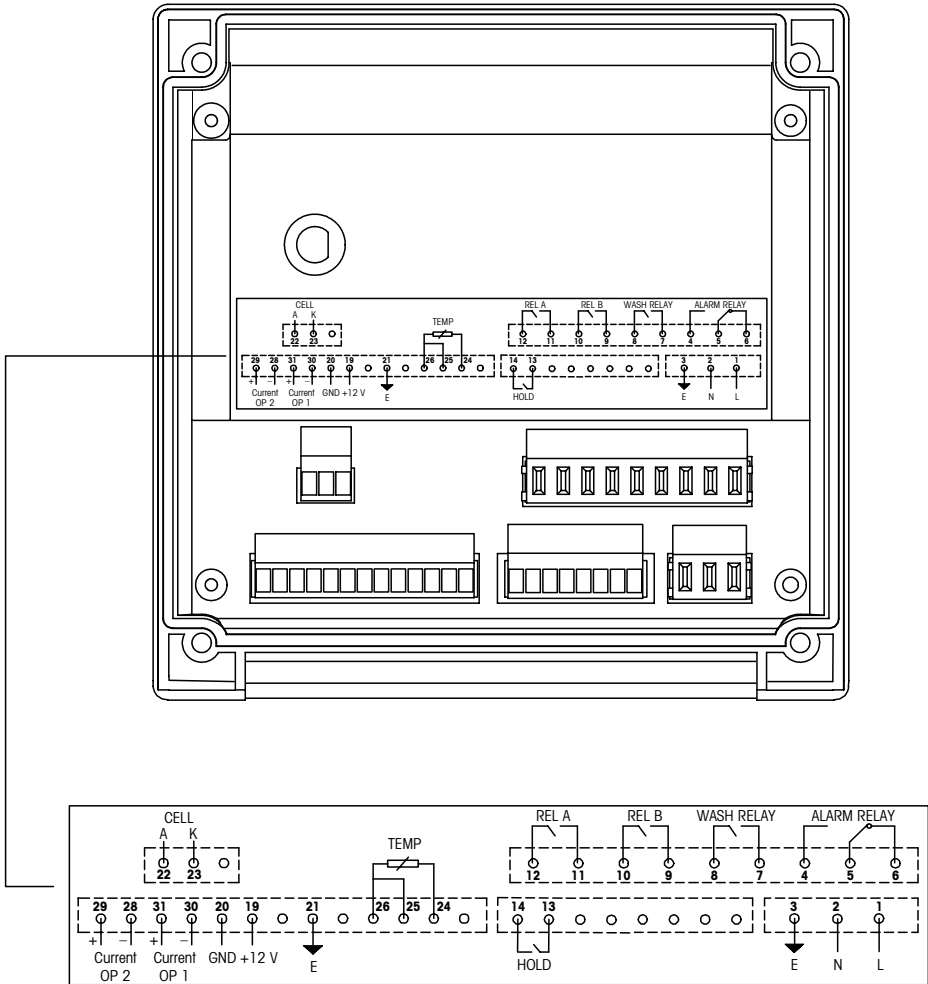
Connectors panel mounting version
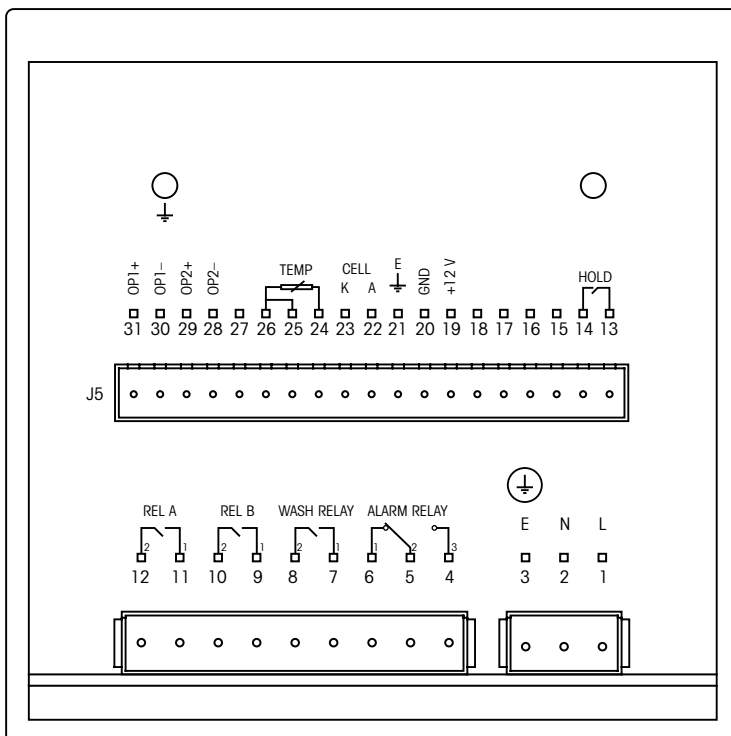
VP cable connection

VP cable	Transmitter terminal
A transparent (Cathode)	K (23)
B red (Anode)	A (22)
E white (T1)	RTD (26)
F green (T2)	RTD (24)
G green/yellow (cable shield)	E (21)

Note: Grey and blue wire are not connected

4   Normal operation

Measurement mode

When the transmitter is powered on, the display first shows all segments briefly, then the transmitter automatically enters into the **Measurement mode**.

☞ **Please note**: To guarante accurate readings the measuring system (transmitter and sensor) must be calibrated.

<div style="float:left;">

```
   MEAS          %
  100.0
    25.0   °C
```

</div>
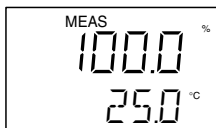
The mode indicator "MEAS" at the top of the display indicates that the transmitter is in Measurement mode. The upper alpha-numerical display shows the measured O$_2$ value (in %, mg/l or ppm), while the lower display shows the temperature value (in °C or °F).

The annunciators "%", "mg/l" or "ppm" at the upper right side of the display indicate the current measurement mode setting whether the transmitter is set for %, mg/l or ppm measurement.

From Measurement mode you can access **Calibration mode** and **Setup mode** by pressing the CAL key or ENTER key followed by the corresponding security code. For detailed information refer to **section 5 "Calibration mode"** or **section 6 "Setup mode"**, respectively.

By pressing the **REL** key in Measurment mode you can view the actual relay set points. By pressing the **REL MODE** key in Measurment mode you can switch relay operation mode from automatic to manual. For detailed information refer to **section 7 "Relay operation".**

5 Calibration Mode

You can access the Calibration mode directly from the Measurement mode by pressing the CAL key and entering the Calibration security code "11". Calibration mode may also accessed via the Setup mode (see section 6.1).

5.1 Entering Calibration mode
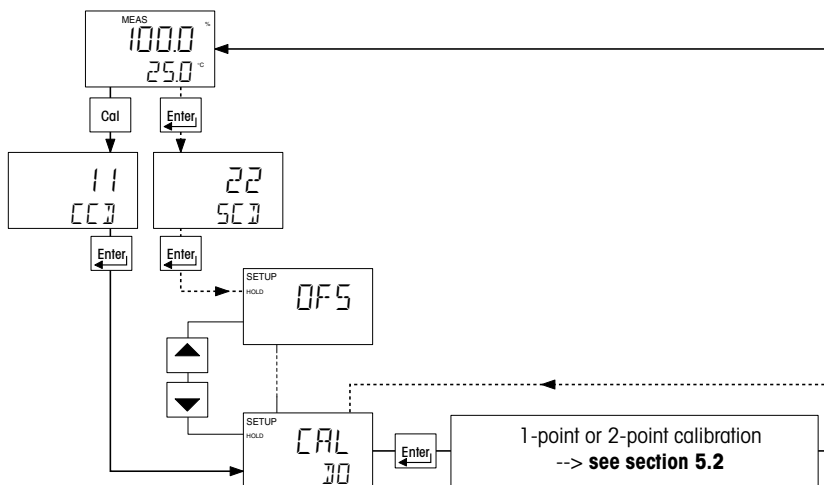
1. While in Measurement mode **press the CAL key** (direct access) or **ENTER key** (access via Setup mode).

2. If **CAL key** was pressed: The display prompts you to enter the calibration security code. **Press the ▲ or ▼ key** to set the calibration security code to **"11"**, then **press the ENTER key** to confirm the calibration security code.

   If **ENTER key** was pressed: The display prompts you to enter the security code. **Press the ▲ or ▼ key** to set the security code to **"22"**. **Press the ENTER key** to confirm the security code, then **press the ▲ or ▼ key** to select the calibration subfunction.

   The display shows "CRL $J0$". To start calibration refer to the corresponding section (see illustration above).

☞ **Note**: to exit Calibration mode at any time **press the ▲ and ▼ key simultaneously** (escape). The transmitter returns to the Measurement mode and the old calibration values remain active. The calibration security code automatically resets from "11" to "000" after the transmitter returns to Measurement mode.

5.2   Calibration

☞ **Note**: Calibration is always carried out in the units (%, mg/l or ppm) selected in the Setup mode. The O$_2$ transmitter allows a 1-point or 2-point calibration.

1-point calibration
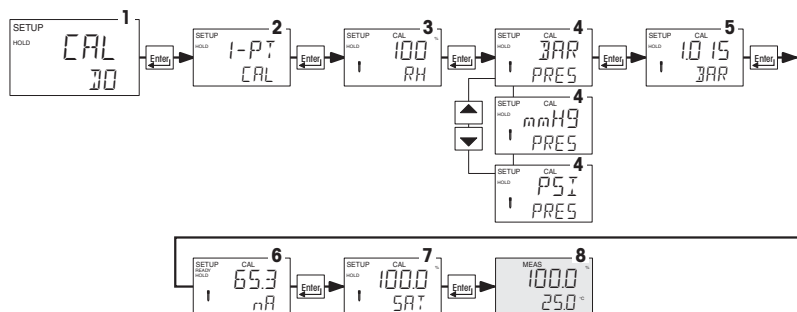
1. **Enter Calibration mode** as described in section 5.1. The display shows "*CAL JO*".

2. **Press the ENTER key**. The display shows "*1-PT CAL*" (1-point calibration). **Press the ENTER key** to confirm 1-point calibration.

3. **Press the ▲ or ▼ key** to set the relative humidity. **Press the ENTER key** to confirm.

4. **Press the ▲ or ▼ key** to select the desired unit for barometric pressure ("*JAR*", "*mmHG*" or "*PSI*"). **Press the ENTER key** to confirm.

5. **Press the ▲ or ▼ key** to set the barometric pressure according to the preselected unit. **Press the ENTER key** to confirm.

6. Put sensor in the calibration solution or air. The temperature compensated sensor current (in nA) will be displayed. The "**CAL**" and "**ELECTRODE SYMBOL**" start flashing. Once the reading stabilizes, the flashing symbols disappear and "**READY**" comes on. **Press the ENTER key** to confirm the value.

7. Default calibration values for saturation or concentration are shown. **Press the ▲ or ▼ key** to select the desired saturation ("SAT %") or concentration ("Con ppm" or "Con mg/l"). **Press the ENTER key** to confirm.

8. The transmitter will return to the Measurement mode.
   ☞ **Note**: If you entered the Calibration mode from the Setup mode, the transmitter will return to the setup menu.

☞ **Note**: If there is a calibration error the transmitter displays "ERR". In this case, **press the ▲ and ▼ keys** simultaneously (escape) to restart the calibration beginning from step 1.

Note: When calibrating with manual temperature compensation, the transmitter automatically changes from the preset process temperature to the calibration temperature. After leaving the Calibration mode, the transmitter switches back to the process temperature (for setting the calibration temperature and the process temperature, see section 6.3).

2-point calibration
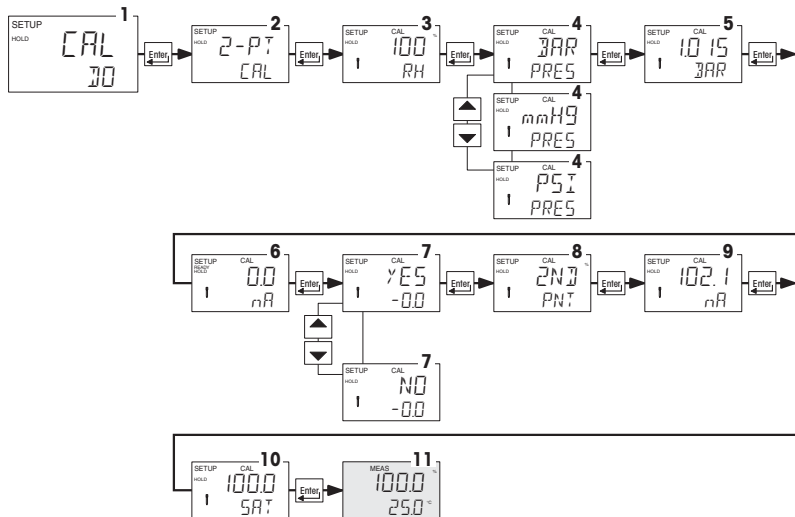
1. **Enter Calibration mode** as described in section 5.1. The display shows "*CAL DO*".

2. **Press the ENTER key**. The display shows "*1-PT CAL*" (1-point calibration). **Press the ▲ or ▼ key** to select "*2-PT CAL*" (2-point calibration). **Press the ENTER key** to confirm 2-point calibration.

3. **Press the ▲ or ▼ key** to set the relative humidity. **Press the ENTER key** to confirm.

4. **Press the ▲ or ▼ key** to select the desired unit for barometric pressure (bar, mmHG or PSI). **Press the ENTER key** to confirm.

5. **Press the ▲ or ▼ key** to set the barometric pressure according to the preselected unit. **Press the ENTER key** to confirm.

6. Put sensor in zero point solution or nitrogen. The temperature compensated sensor current for zero point (in nA) will be displayed. The "**CAL**" and "**ELECTRODE SYMBOL**" start flashing. Once the reading stabilizes, the flashing symbols disappear and "**READY**" comes on. **Press the ENTER key**.

7. **Press the ▲ or ▼ key** to accept new zero current with "*YES*" or to reject the new calibration value with "*NO*". **Press the ENTER key** to confirm your selection.

Note: Accepting the zero point will reset the zero offset settings made in OFS menu.

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8. The display shows "*2ND PNT*". **Press the ENTER key** to proceed with the calibration of slope.

9. Put sensor in the calibration solution or air. The temperature compensated sensor current (in nA) for the second point will be displayed. The "**CAL**" and "**ELECTRODE SYMBOL**" start flashing. Once the reading stabilizes, the flashing symbols disappear and "**READY**" comes on. **Press the ENTER key**.

10. Default calibration values for saturation or concentration are shown. **Press the ▲ or ▼ key** to select the desired saturation ("SAT %") or concentration ("Con ppm" or "Con mg/l"). **Press the ENTER key** to confirm.

11. The transmitter will return to the Measurement mode.
    Note: If you entered the Calibration mode from the Setup mode, the transmitter will return to the setup menu.

☞ **Note**: If there is a calibration error the transmitter displays "ERR". In this case, **press the ▲ and ▼ keys** simultaneously (escape) to restart the calibration beginning from step 1.

☞ **Note**: When calibrating with manual temperature compensation, the transmitter automatically changes from the preset process temperature to the calibration temperature. After leaving the Calibration mode, the transmitter switches back to the process temperature (for setting the calibration temperature and the process temperature, see section 6.3).

5.3   View actual zero and slope
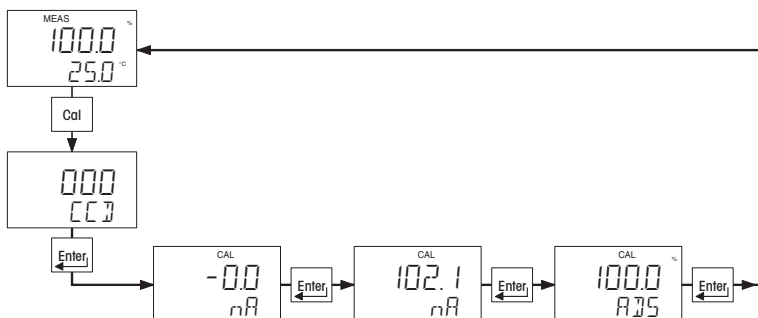
1. While in Measurement mode **press the CAL key**. The display will prompt you to enter a se-
   curity code. Leave the **security code** at "**000**" (view only mode).

2. **Press the ENTER key**. The display shows the zero point current in nA.

3. **Press the ENTER key**. The display shows the current in nA for the second calibration point.

4. **Press the ENTER key**. The display shows the selected measuring range in %.

☞ **Note**: If no key is pressed for 30 seconds the transmitter automatically returns to the Measure-
   ment mode.

   Press the ENTER key to return to the Measurement mode.

6   Setup mode

6.1   Enter Setup mode

In the Setup mode the transmitter can be configured to your individual requirements.

1. While in Measurement mode **press the ENTER key**.

2. The display prompts you to enter the security code. Set the security code with **▲ or ▼ key** to:
   – "SCd 22" if you want to **change parameter settings**
   – "SCd 000" if you want to view only parameter settings (**view only mode)**

3. **Press the ENTER key**.

OFS	Enter	Offset setting **--> see section 6.2**
SET orOF	Enter	Temperature settings **--> see section 6.3**
SP1	Enter	Relay A (set point 1) settings **--> see section 6.4**
SP2	Enter	Relay B (set point 2) settings **--> see section 6.4**
CNTR	Enter	Controller settings **--> see section 6.5**
CUR.1	Enter	Current output 1 settings **--> see section 6.6**
CUR.2	Enter	Current output 2 settings **--> see section 6.7**
WASH	Enter	Wash contact settings **--> see section 6.8**
CNFG	Enter	Unit settings **--> see section 6.9**
CAL dO	Enter / Cal	Calibration **--> see section 6.10**

☞ **Note**: to exit Setup mode at any time **press the ▲ and ▼ key simultaneously** (escape). The transmitter returns to the Measurement mode.

6.2   Electrode Offset (OFS) sub-function

The electrode offset sub-function allows you to zero the transmitter without a sensor. The use of
a simulator is recommended. For real zero calibration, use the calibration procedure as descri-
bed in section 5. If no simulator is used, a 22 kΩ NTC must be connected to pins 24 and 25 of
the terminal connector on the backside of the unit (see section 3.2).
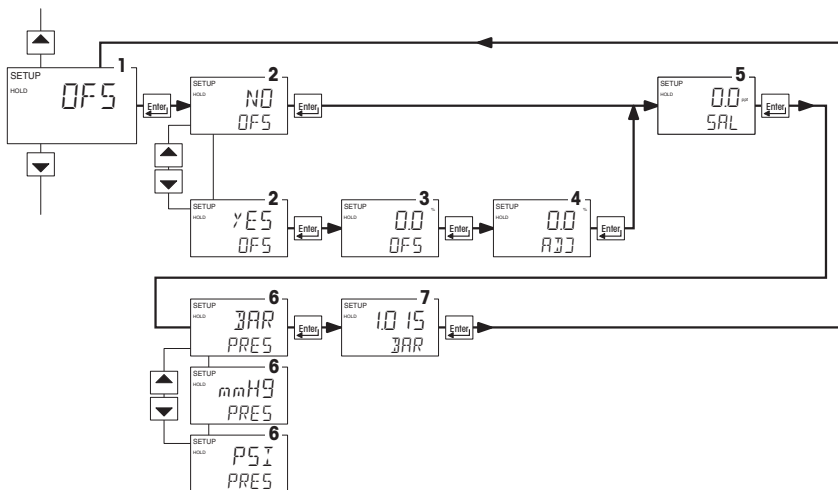
1. Select the "OFS" subfunction, then **press the ENTER key**.
2. **Press the ▲ or ▼ key** to perform offset adjustment with "YES" or to skip offset adjustment
   with "NO". **Press the ENTER key** to confirm your selection.

   If "YES" was selected:

   3. The display shows the offset from zero current of the saturation or concentration. If this is
      within the range of -0.2 nA to 1.1 nA, then the correction can be accepted. **Press the
      ENTER key** to confirm.
      Note: If the value is out of the acceptable range, the offset adjustment is rejected and the
      error symbol "ERR" is displayed.
   4. The display shows the offset. **Press the ENTER key** to confirm.
5. **Set the salinity of the solution**: This display only appears if the measurement unit is set to
   to "mg/l" or "ppm". **Press the ▲ or ▼ key** to set the salinity of the solution. **Press the ENTER
   key** to confirm.
6. **Set barometric pressure unit**: Press the ▲ or ▼ key to set unit ("BAR", "$mmHG$", "PSI") of
   the barometric pressure. **Press the ENTER key** to confirm.
7. **Set the barometric pressure**: **press the ▲ or ▼ key** to set the barometric pressure accord-
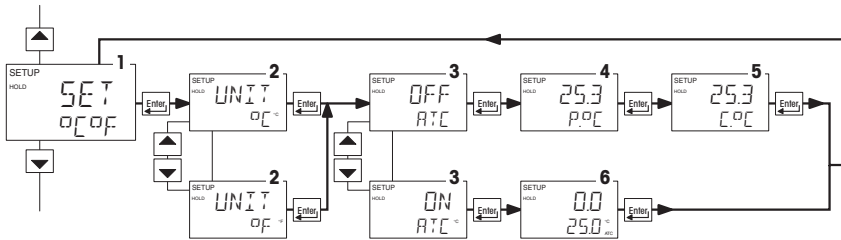   ing to the preselected unit. **Press the ENTER key** to confirm.

Continue with additional Setup procedures, or return to the Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.

Note: The offset value is reset during 2-point calibration. See section 5 for full calibration instructions.

## 6.3   Setting temperature (Set °C°F) sub-function

1. Select the "SET $°C°F$" subfunction, then **press the ENTER key**.

2. **Selecting temperature unit**: **press the ▲ or ▼ key** to select the desired temperature unit "$°C$" or "$°F$". **Press the ENTER key** to confirm your selection.

3. **Enable/disable ATC mode**: **press the ▲ or ▼ key** to enable (ATC ON) or disable (ATC OFF) automatic temperature compensation. **Press the ENTER key** to confirm your selection.

   – **ATC disabled** (ATC OFF):
     For manual temperature compensation you can set the process and calibration temperatures. This allows calibration at a temperature other than the process temperature.

     4. **Set process temperature**: **press the ▲ or ▼ key** to adjust the process temperature (upper value, setting range: –9.9 to 125°C / 15 to 257 °F). **Press the ENTER key** to confirm process temperature.

     5. **Set calibration temperature**: **press the ▲ or ▼ key** to adjust the calibration temperature (upper value, setting range: –9.9 to 125°C / 15 to 257 °F). **Press the ENTER key** to confirm the calibration temperature.

   – **ATC enabled** (ATC ON):

     6. **Set temperature offset**: The display shows the current temperature offset (upper value) and the temperature currently measured (lower value). Compare the current temperature displayed on the transmitter to a thermometer known to be accurate. Note down the correct temperature value. **Press the ▲ or ▼ key** to adjust the lower value. The upper number indicates the offset value. You can offset the temperature by up to ±10°C/±18°F. **Press the ENTER key** to confirm your setting.

Continue with additional Setup procedures, or return to the Measurement mode by pressing the ▲ and ▼ keys (escape) simultaneously.

6.4   Control Relay A / Relay B (SP1/SP2) sub-function

The SP1 sub-function determines the operating parameters for Relay A; while SP2 defines the operating parameters for Relay B. Since these groups have the same set-up parameters, they are described together.
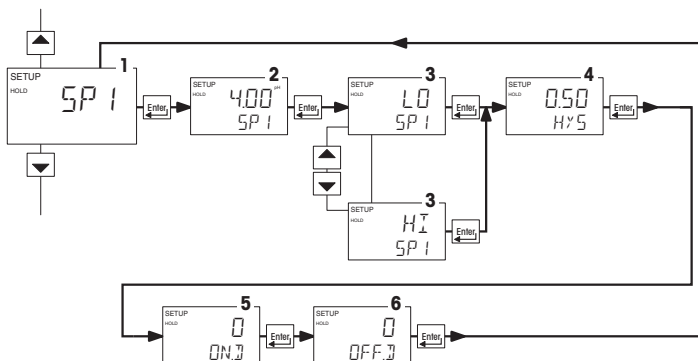
1. Select the "$SP\,1$" (Relay A) or "$SP2$" (Relay B) subfunction, then **press the ENTER key**.

2. **Setting set point value**: **press ▲ or ▼ key** to enter the value for set point 1 (set point 2) at which your controller will activate. **Press the ENTER key** to confirm your setting.

3. **Selecting relay function**: **press the ▲ or ▼ key** to select the desired relay function ("LO"= low or "HI"= high). **Press the ENTER key** to confirm your selection.

   Note: This parameter lets you choose the relay function. Select "LO" to activate the relay when the DO value undershoots the low set point; select "HI" to activate the relay when the value overshoots the high set point. SP1 and SP2 can be selected as "Lo/Lo", "Lo/Hi", "Hi/Lo", or "Hi/Hi".

4. **Setting a hysteresis value**: **press the ▲ or ▼ key** to select the desired hysteresis (setting ranges: 0.1 to 1.0 mg/l, 1 to 10%) for set point 1 (set point 2). **Press the ENTER key** to confirm your setting.

   Note: Hysteresis prevents rapid contact switching if your value is fluctuating near the set point. **Please refer to Appendix 2 for a graphical representation of the hysteresis**.

   Example: You have set your low set point at 6.20 mg/l and your hysteresis value at 0.5 mg/l. If your measured value undershoots 6.20 mg/l, the controller's relay activates. The actions of the external device will cause the value to rise above 6.20 mg/l. The relay will deactivate, when the DO value has increased to 6.70 mg/l (6.20 + 0.50).

5. **Setting the on-delay time lag**: **press the ▲ or ▼ key** to enter the on-delay time for set point 1 (set point 2). The controller will delay activation of the relay for the number of seconds (0 to 1999 seconds) you select. **Press the ENTER key** to confirm your setting.

Note: You can set a time delay for each relay, which stops the relay from switching on the moment the set point is exceeded. This controller lets you set a 0 to 1999 second time delay before your relay activates.

6. **Setting the off-delay time lag**: **press the ▲ or ▼ key** to enter the off-delay time for set point 1 (set point 2). Your controller will delay deactivation of the relay for the number of seconds (0 to 1999) you select. **Press the ENTER key** to confirm your setting.

Note: You can set a time delay for each relay, which stops the relay from switching off the moment the value reaches the set point and hysteresis. This controller lets you set a 0 to 1999 second time delay before your relay deactivates.

Continue with Setup mode procedures, or return to Measurement mode by pressing the ▲ and ▼ keys simultaneously (escape).

6.5 Controller (CNTR) sub-function

The CNTR sub-function determines the **controller's parameters**.
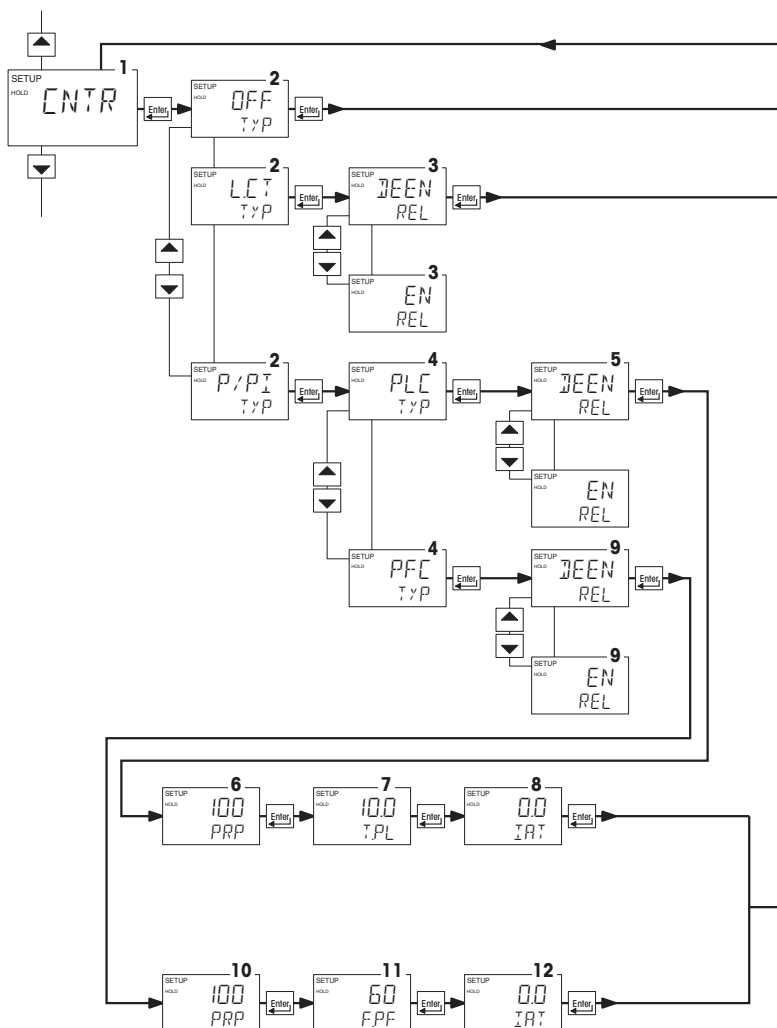
1. Select the "CNTR" subfunction, then **press the ENTER key**.

2. **Selecting the controller type**: **press the ▲ or ▼ key** to select the suitable controller type:
   - OFF = controller off
     Use control Off to operate controller as a monitor only or to prevent relays from switching.
   - $\mathit{L.CT}$ = limit value control (on/off control).
     Use limit control with pumps or values for fast response
   - $\mathit{P/PI}$ = proportional/integral control
     Use proportional control to operate your pumps smoothly or for precise control of proportioning valves. Use PI controller to eliminate steady state error.

☞ **Note**: **please refer to Appendix 3** for detailed information on controller settings.
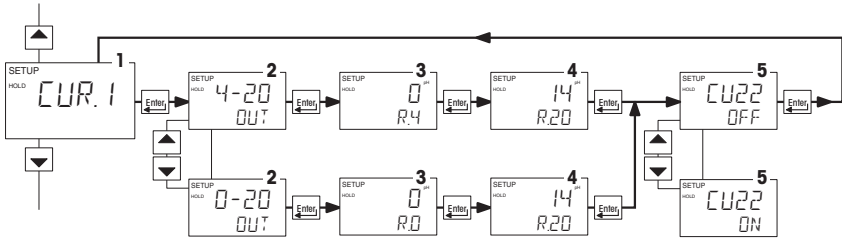
Press the ENTER key to confirm your selection.

   - If the controller is set to **limit value control** ($\mathit{L.CT}$):
     3. **Selecting the relay status under Non-Alarm condition**: **press the ▲ or ▼ key** to choose the desired relay status (de-energized = "DEEN" or energized = "En"). **Press the ENTER key** to confirm your selection.
   - If the controller is set to **proportional control** ($\mathit{P/PI}$):
     4. **Selecting the proportional controller type**: **press the ▲ or ▼ key** to select the suitable controller type ("PLC" = pulse length control, "PFC" = pulse frequency control).

        Press the ENTER key to confirm your selection.

        - If the proportional controller type is set to **pulse length control** (PLC):
          5. **Selecting the relay status under Non-Alarm condition**: **press the ▲ or ▼ key** to choose the desired relay status (de-energized = "DEEN" or energized = "En"). **Press the ENTER key** to confirm your selection.
          6. **Setting the proportional range**. **Press the ▲ or ▼ key** to set the proportional range (setting range: 10 to 500%). **Press the ENTER key** to confirm your setting.
          7. **Setting the pulse length**. **Press the ▲ or ▼ key** to set the pulse length (setting range: 0.5 to 20 seconds). **Press the ENTER key** to confirm your setting.
          8. **Setting the integral action time**. **Press the ▲ or ▼ key** to set the integral action time (setting range: 0.0 to 999.9 minutes). **Press the ENTER key** to confirm your setting.

–   If the proportional controller type is set to **pulse frequency control** (PFC):

9. **Selecting the relay status under Non-Alarm condition**: **press the ▲ or ▼ key** to choose the desired relay status (de-energized = "$\exists EEN$" or energized = "En"). **Press the ENTER key** to confirm your selection.

10. **Setting the proportional range**: **press the ▲ or ▼ key** to set the proportional range (setting range: 10 to 500%). **Press the ENTER key** to confirm your setting.

11. **Setting the pulse frequency**: **press the ▲ or ▼ key** to set the pulse frequency (setting range: 60 to 120 pulses per minute). **Press the ENTER key** to confirm your setting.

12. **Setting the integral action time**: **press the ▲ or ▼ key** to set the integral action time (setting range: 0.0 to 999.9 minutes). **Press the ENTER key** to confirm your setting.

Continue with Setup mode procedures, or return to Measurement mode by pressing the ▲ and ▼ keys simultaneously (escape).

6.6   Current Output 1 sub-function

In this subfunction you set the current output range of the transmitter for DO values.

1. Select the "*CUR.1*" subfunction, then **press the ENTER key** .
2. **Selecting the output type**: **press the ▲ or ▼ key** to select the desired output type: 0-20 mA or 4-20 mA. **Press the ENTER key** to confirm your selection.
3. **Setting the DO value at which the transmitter output will be 4 mA (or 0 mA)**: **press the ▲ or ▼ key** to set the DO value to be equivalent to 4 mA or 0 mA, respectively. **Press the ENTER key** to confirm your setting.
4. **Setting the DO value at which the transmitter output will be 20 mA**: **press the ▲ or ▼ key** to set the DO value to be equivalent to 20 mA. **Press the ENTER key** to confirm your setting.
5. **Selecting out of range current**: **Press the ▲ or ▼ key** to switch "*CU22*" on or off. If "*CU22*" is on, the output signal will jump to 22 mA when the measuring range is overshoot. **Press the ENTER key** to confirm your setting.
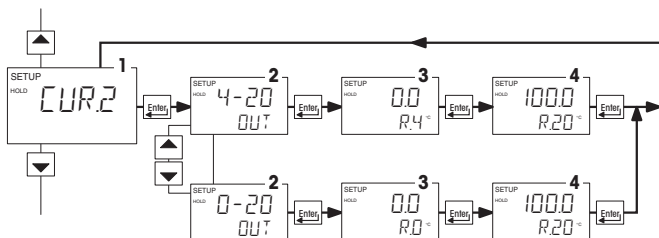
    Note: the "*CU22*" setting (on/off) of current output 1 applies to current output 2 as well.

Continue with Setup mode procedures, or return to Measurement mode by pressing the ▲ and ▼ keys simultaneously (escape).

6.7   Current Output 2 sub-function

In this subfunction you set the current output range of the transmitter for temperature values.

1. Select the "*EUR.2*" subfunction, then **press the ENTER key**.

2. **Selecting the output type**: **press the ▲ or ▼ key** to select the desired output type: 0-20 mA or 4-20 mA. **Press the ENTER key** to confirm your selection.

3. **Setting the temperature value at which the transmitter output will be 4 mA (or 0 mA)**: **press the ▲ or ▼ key** to set the temperature value (setting range: -9.9 to 115°C or 15 to 237 °F) to be equivalent to 4 mA (or 0 mA). **Press the ENTER key** to confirm your setting.

4. **Setting the temperature value at which the transmitter output will be 20 mA**: **press the ▲ or ▼ key** to set the temperature value (setting range: -0.1 to 125°C or 35 to 257 °F) to be equivalent to 20 mA. **Press the ENTER key** to confirm your setting.

Continue with Setup mode procedures, or return to Measurement mode by pressing the ▲ and ▼ keys simultaneously (escape).

6.8   Wash relay (WASH) sub-function

In this subfunction you set the parameters for the wash relay.
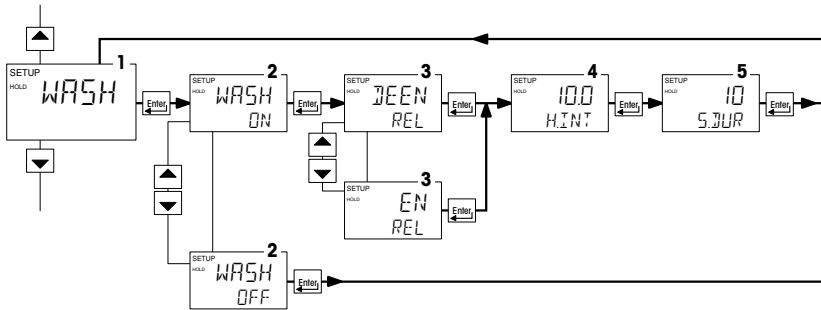
1. Select the "*WASH*" subfunction, then **press the ENTER key**.
2. **Enabling/disabling wash function**: **press the ▲ or ▼ key** to enable (*WASH ON*) or disable (*WASH OFF*) wash function. **Press the ENTER key** to confirm your selection.
3. **Selecting the relay status condition**: **press the ▲ or ▼ key** to choose desired relay status (de-energized = "*DEEN*" or energized = "*En*"). **Press the ENTER key** to confirm your selection.
4. **Setting the wash interval in hours**: **Press the ▲ or ▼ key** to set the desired wash interval (setting range: 0.1 to 199.9 hours). **Press the ENTER key** to confirm your setting.
5. **Setting the wash duration in seconds**: **Press the ▲ or ▼ key** to set the desired wash duration (setting range: 1 to 1999 seconds). **Press the ENTER key** to confirm your setting.
   **Note**: During wash cycle the transmitter is set to HOLD. For safety reasons, the HOLD function is activated 5 seconds prior and deactivated 10 seconds after the wash cycle.

Continue with Setup mode procedures, or return to Measurement mode by pressing the ▲ and ▼ keys simultaneously (escape).

6.9   Configuration (CNFG) sub-function

In this subfunction you configure the transmitter to suit your requirements.
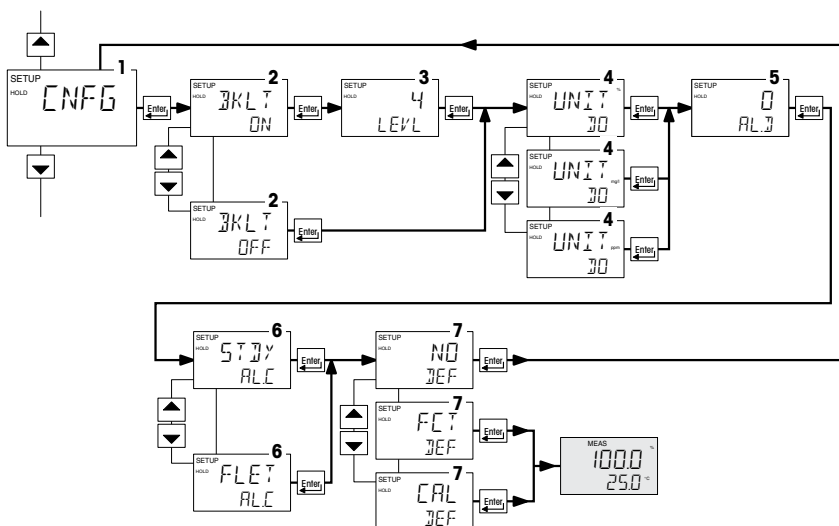
1. Select the "CNFG" subfunction, then **press the ENTER key**.

2. **Enabling/disabling the display backlight**: **press the ▲ or ▼ key** to switch display backlight on (BKLT ON) or off (BKLT OFF). **Press the ENTER key** to confirm your selection.

3. **Setting the backlight intensity** (appears only If backlight is on): **press the ▲ or ▼ key** to set backlight intensity (setting range: minimum 1 to maximum 4). **Press the ENTER key** to confirm your setting.

4. **Selecting the DO measurement unit**: **press the ▲ or ▼ key** to select DO measurement unit (%, mg/l or ppm). **Press the ENTER key** to confirm your selection.

5. **Setting the alarm delay time in seconds**: **press the ▲ or ▼ key** to set the alarm delay time (setting range: 0 to 1999 seconds). **Press the ENTER key** to confirm your setting.
    Note: With this parameter you set the period of time before the alarm activates when your set point has been overshoot.

6. **Selecting the alarm contact type**: **press the ▲ or ▼ key** to select the alarm contact type:

    – "STDY" = steady contact
    – "FLET" = fleeting (single pulse) contact

    Press the ENTER key to confirm your selection.

    Note: With this parameter you select whether the alarm contact will operate as a steady contact or a fleeting (single pulse) contact. Pulse contact closing time is 1 second.

7. **Resetting the transmitter settings to factory defaults**: The display shows "$N\!\Box\ \exists E F$". **Press the ▲ or ▼ key** to select:

    – "$N\!\Box\ \exists E F$" = keeps old values active, when confirmed with ENTER
    – "$F\!\mathrel{\Box\!T}\ \exists E F$" = resets all settings to factory defaults, when confirmed with ENTER
    – "$\mathrel{\Box\!R\!L}\ \exists E F$" = resets calibration settings to factory defaults, when confirmed with ENTER

Press the ENTER key. The selected function will be executed and the transmitter returns automatically to the Measurement mode.

Continue with Setup mode procedures, or return to Measurement mode by pressing the ▲ and ▼ keys simultaneously (escape).

6.10 Calibration (CAL) sub-function

The calibration procedure in Setup mode is identical to the procedure in the Calibration mode (see section 5). The only difference is that the transmitter remains in Setup mode (instead of Measurement mode) after calibration is completed.

7   Relay Modes

You can control devices connected to Relay A, Relay B or wash relay via the front panel of the transmitter. In Automatic mode, the transmitter's set point values activate the relays. In Manual mode, you can manually turn "on" and "off" the control devices connected to relay A or relay B.
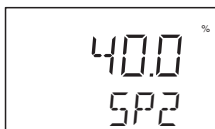
7.1   View relay set points

To view relay setpoints, the relay mode must be set to automatic (standard mode after switch-on, relay mode LED "Auto" lights).

While in Measurement mode press the REL key.

```
        %
  60.0
    SP 1
```

The display shows the set point value for Relay A and LED "A" lights.

```
        %
  40.0
    SP2
```

After two seconds the display shows the set point value for Relay B and LED "B" lights).

```
  WASH
    OFF
```

After two seconds the display shows the status of the Wash relay and LED "W" lights. If Wash relay is "off" the display shows "WASH OFF". If Wash relay is "on" the wash interval time and wash duration is displayed.

After an additional two seconds the transmitter will return to Measurement mode.

7.2   Manual relay mode

In manual relay mode, you can manually turn "on" and "off" the control devices connected to Relay A, Relay B or Wash relay.

1. While in Measurement mode **press the REL MODE key**.
2. The display prompts you to enter the security code. **Press the ▲ or ▼ key** to set security code to "22".
3. **Press the ENTER key**. The Manual relay mode is activated and the relay mode LED "MANU" lights.
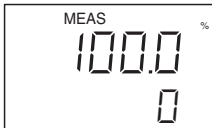
☞ **Note**: Pressing ENTER key at a value other than "22" will cause the transmitter to revert to Measurement mode, and the relays will remain in automatic mode.

4. **Press the REL key** to select either Relay A, Relay B or Wash relay. The corresponding LED (A, B, or W) turns to red.
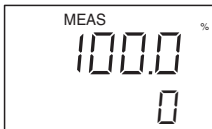
The manual control options now available depend on the control type (limit, pulse frequency, or pulse length) you selected and set in section 6.5.
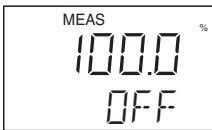
| MEAS %
100.0
OFF | If you selected Limit control: The display shows the current measured value and "*OFF*" or "*ON*" depending on the relay status of the currently selected relay. |

| MEAS %
100.0
0 | If you selected Pulse length control: The display shows the current measured value (upper value) and the current duration (lower value). |

| MEAS %
100.0
0 | If you selected Pulse frequency control: The display shows the current measured value (upper value) and the pulse frequency (lower value). |

5. **Press the ▲ or ▼ key** to change the Relay on/off status, pulse length, pulse frequency or wash function. The relay status LED at the right of the transmitter will also change from Red to Green.

☞ **Note**: If you wish to manually change the status of relays, press the **REL key** at this point and repeat step 5 for the other two relays. The relay(s) will remain under manual control while you are setting a relay.

6. **Press the REL MODE key** to return to Measurement mode. The relays are now back to automatic control.

8   Technical specifications

8.1   General specifications

DO Range	0.00 to 20.00 mg/l or ppm 0.0 to 200.0 %
Resolution	0.01 mg/l or 0.1%
Relative Accuracy	± 1% of full scale reading
Temperature	- 9.9 to + 125.0 °C (15.0 to 257.0 °F)
Resolution	0.1
Relative Accuracy	± 0.5 °C (± 1.0 °F)
Sensor	NTC 22 kΩ thermistor
Temperature compensation	Auto / manual
Salinity compensation	0.0 to 50.0 ppt (manual setting/automatic correction)
Pressure compensation	bar, mmHG or PSI (manual setting/automatic correction)

Set-point and Controller Functions

Function (switchable)	limit control P/PI control (pulse length/pulse frequency)
Integral time	0 to 999.9 minutes
Adjustable period with pulse length controller	0.5 to 20 sec.
Adjustable period with pulse frequency controller	60 to 120 pulses/min
Pickup / Dropout delay	0 to 1999 seconds
Wash cycle	0.1 to 199.9 hours
Wash duration	1 to 1999 seconds
Switching DO hysteresis	0.1 to 1.0 mg/l or 1.0 to 10.0 %
Contact outputs, controller	1 SPDT, 3 SPST relays
Switching voltage	max. 250 VAC
Switching current	max. 3A
Switching power	max. 600 VA

Alarm Functions

Function (switchable)	Latching / pulse
Pickup delay	0 to 1999 seconds
Switching voltage	max. 250 VAC
Switching current	max. 3A
Switching power	max. 600 VA

Display

LCD	UV coat, backlit 14 segments display with symbols for status information
Backlight	On/Off selectable with four level of brightness controll

EMC Specifications

Emissions	According to EN 50081-1
Susceptibility	According to EN 50082-1

Environmental Conditions

Ambient temp. operating range	0 to +50 °C
Relative humidity	10 to 95%, non-condensing

8.2   Specifications for wall mount version

Electrical Data and Connections

Power Requirements	80 to 250 V AC/DC
Frequency	48 to 62 Hz
Signal Output	Two 0/4 to 20 mA outputs for DO values and temperature, galvanically isolated
Load	max. 600 Ω
DO input	screw terminals
Connection terminal	2x3-pin, 8-pin, 9-pin and 13-pin terminal blocks
Mains fuse	250 mA anti surge

Mechanical Specifications

Dimensions (L x H x W)	144 x 144 x 110 mm
Weight	950 g
Material	PBT
Insulation	NEMA 4X, IP 65

8.3   Specifications for panel mount version

Electrical Data and Connections

Power requirements	80 to 250 V AC/DC
Frequency	48 to 62 Hz
Signal output	Two 0/4 to 20 mA outputs for DO values and temperature, galvanically isolated
Load	max. 600 Ω
DO input	screw terminals
Connection terminal	3-pin, 9-pin and 19-pin terminal blocks
Mains fuse	250 mA anti surge

Mechanical Specifications

Dimensions (L x H x W)	175 x 96 x 96 mm
Weight	700 g
Material	ABS
Insulation	IP 54 (front) / IP 40 (housing)

9   General Information

9.1   Warranty

METTLER TOLEDO warrants this product to be free from significant deviations in material and work-manship 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.

9.2   Packaging / Scope of delivery

The instrument is packaged in a corrugated box with an instruction manual and the following accessories:
–   Wall mount version:
    –   Plug, nylon, black, 2 pcs
    –   PG13.5, cable gland, 3 pcs
    –   Connectors, one each of 3 way (5.08 mm), 9 way (5.08mm), 13 way (3.5mm),
        8 way (3.5mm), 3 way (3.5mm)
–   Panel mount version:
    –   Rubber gasket, 1pc
    –   Catch, 2pcs
    –   Rod, thread, 2 pcs
    –   Connector, one each of 19 way (3.5 mm), 3 way (5.08 mm) and 9way (5.08 mm)

9.3   Return of goods

Before returning goods for any reason whatsoever, METTLER TOLEDO's Customer Service Dept. have to be informed in advance. Items must be carefully packed to prevent damage during shipment, and insured against possible damage or loss. METTLER TOLEDO will not be responsible for any damage resulting from careless or insufficient packing.

Warning: Shipping damage as a result of inadequate packaging is the user's/distributor's responsibility, whoever applicable. Please follow the guidelines below before shipment.

9.4   Guidelines for returning unit for repair

Use the original packaging material if possible when shipping the unit for repair. Otherwise wrap it with bubble pack and use a corrugated box for better protection. Include a brief description of any faults suspected for the convenience of Customer Service Dept., if possible.
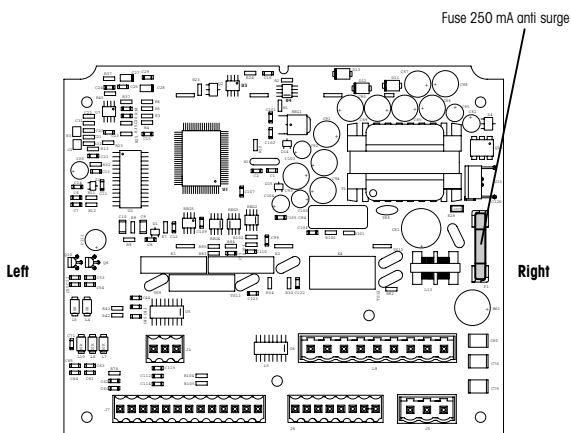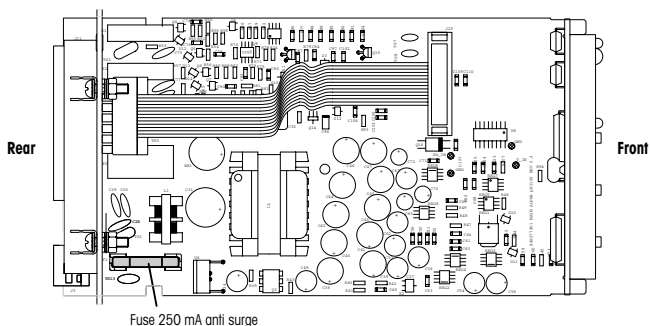
10   Appendices

10.1   Appendix 1 – Unit fuse

⚠ **Caution!** Before opening the unit to replace the unit fuse, make sure the mains cable is separated from the power supply.

Wall mounting version (view from the backside)

Fuse 250 mA anti surge

Left   Right

Panel mounting version (view from top)

Rear   Front

Fuse 250 mA anti surge

O$_2$ Transmitter 4050 e
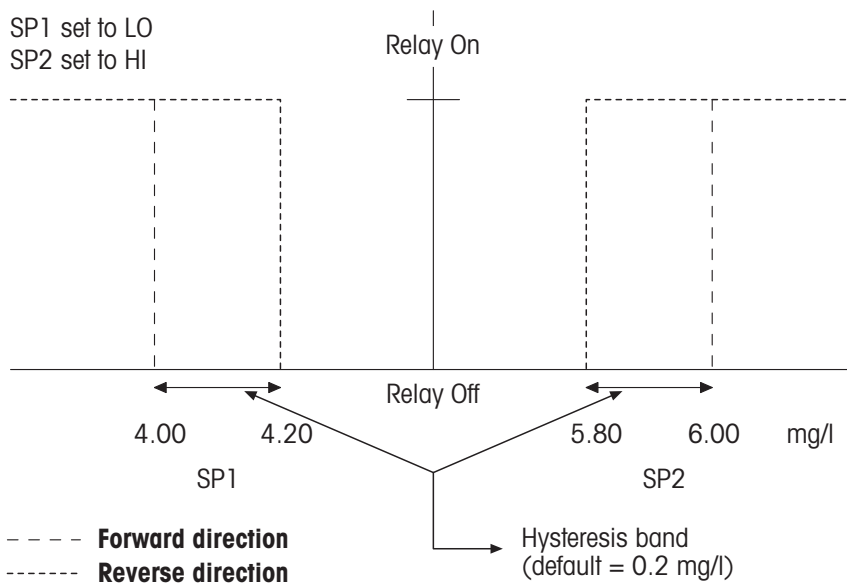52 121 142

10.2   Appendix 2 – Dissolved oxygen values

The following table shows the Dissolved Oxygen values at different salinity values, at different temperatures, at barometric pressure of 760 mmHg. For other pressure levels, the transmitter automatically corrects the value based on the pressure value input.

Temperature		Salinity in ppt				
°C	°F	0	10	20	30	40
0	32.0	14.6	13.8	13.0	12.1	11.3
1	33.8	14.2	13.4	12.6	11.8	11.0
2	35.6	13.8	13.1	12.3	11.5	10.8
3	37.4	13.4	12.7	12.0	11.2	10.5
4	39.2	13.1	12.4	11.7	11.0	10.3
5	41.0	12.7	12.1	11.4	10.7	10.0
6	42.8	12.8	11.8	11.1	10.5	9.8
7	44.6	12.1	11.5	10.9	10.2	9.6
8	46.4	11.8	11.2	10.6	10.0	9.4
9	48.2	11.5	11.0	10.4	9.8	9.2
10	50.0	11.3	10.7	10.1	9.6	9.0
11	51.8	11.0	10.5	9.9	9.4	8.8
12	53.6	10.7	10.3	9.7	9.2	8.6
13	55.4	10.5	10.1	9.5	9.0	8.5
14	57.2	10.3	9.9	9.3	8.8	8.3
15	59.0	10.1	9.7	9.1	8.6	8.1
16	60.8	9.8	9.5	9.0	8.5	8.0
17	62.6	9.6	9.3	8.8	8.3	7.8
18	64.4	9.4	9.1	8.6	8.2	7.7
19	66.2	9.2	8.8	8.5	8.0	7.6
20	68.0	9.1	8.7	8.3	7.8	7.4
21	69.8	8.9	8.6	8.1	7.7	7.3
22	71.6	8.7	8.4	8.0	7.6	7.1
23	73.4	8.6	8.3	7.9	7.4	7.0
24	75.2	8.4	8.1	7.7	7.3	6.9
25	77.0	8.2	8.0	7.6	7.2	6.7
26	78.8	8.1	7.8	7.4	7.0	6.6
27	80.6	8.0	7.7	7.3	6.9	6.5
28	82.4	7.8	7.6	7.1	6.8	6.4
29	84.2	7.7	7.4	7.0	6.6	6.3
30	86.0	7.6	7.3	6.9	6.5	6.1
31	87.8	7.4	7.1	6.7	6.4	6.0
32	89.6	7.3	7.0	6.6	6.3	5.9
33	91.4	7.2	6.9	6.5	6.2	5.8
34	93.2	7.1	6.8	6.5	6.1	5.7

10.3   Appendix 3 – Simple explanation on the function of hysteresis

SP1 set to LO
SP2 set to HI

Relay On

Relay Off

4.00   4.20   5.80   6.00   mg/l

SP1   SP2

– – – – **Forward direction**   Hysteresis band
------- **Reverse direction**   (default = 0.2 mg/l)

The controller relay activates when the set-point is reached. In the reverse direction, it does not de-activate when the value reaches the set-point. Instead, it continues to be active till the value reaches the amount set by the Hysteresis band.

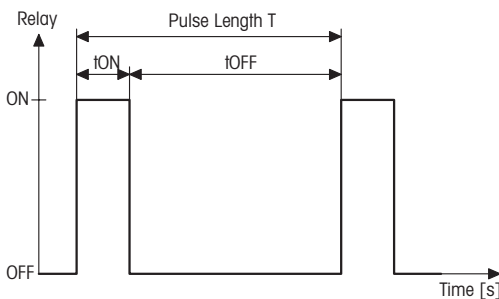## 10.4   Appendix 4 – General instructions concerning controller setting

Control characteristic of Controllers used as limit value switch
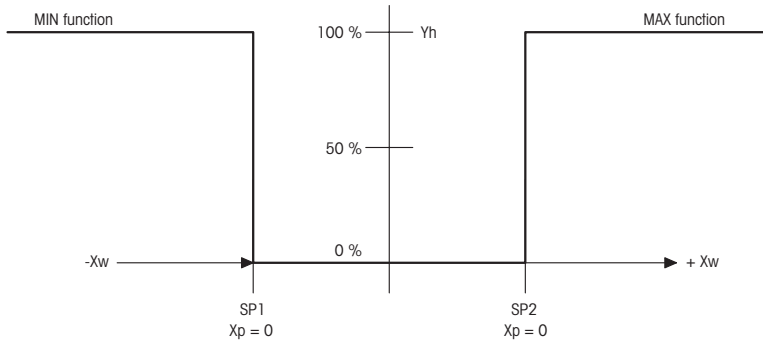
Control characteristic of P-Controllers
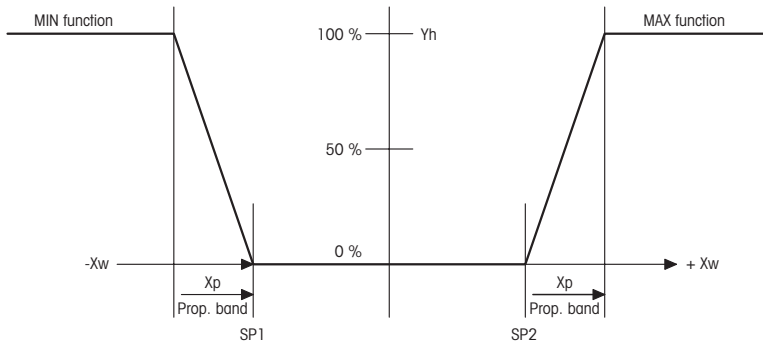
Control signal of Pulse length Controllers

The output relay of the pulse length controller is clock-timed. The switching period T remains constant. Depending on the divergence from the limit value, the switch-on time t$_{ON}$ is increased or decreased in accordance with the proportional range Xp.
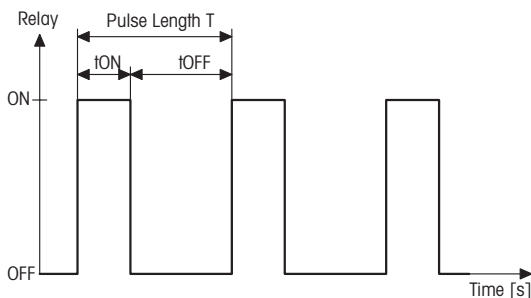
The following applies:

$t_{ON} + t_{OFF} = T$ (Const.)
greater divergence ➔ greater t_{ON}
Xp exceeded ➔ $t_{ON} = T$ (**relay remains picked up**)

Control signal of Pulse Frequency Controllers

The output relay of the pulse frequency controller is clock-timed. The pulse duration t$_{ON}$ remains constant at 250mS. Depending on the divergence from the limit value, the frequency (1/T) is increased or decreased in accordance with the proportional range Xp.

The following applies:

t_{ON} = Const. (250 msec.)
greater divergence ➔ greater f (greater frequency)
Xp exceeded ➔ max. frequency

10.5   Appendix 5 – Abbreviations used in menu displays

Abbreviation	Meaning
MEAS	Measurement
CAL	Calibration
ENT	Enter
OFS	Offset
C.CD	Calibration security code
S.CD	Setup security code
SET	Setting
ATC	Automatic temperature compensation
SP1	Setpoint 1
SP2	Setpoint 2
LO	Low limit
HI	High limit
HYS	Hysteresis
ON.D	On delay
OF.D	Off delay
CNTR	Controller
L.CT	Limit control
PLC	Pulse length control
PFC	Pulse frequency control
PROP	Proportional control
EN	Energized
DEEN	Deenergized

Abbreviation	Meaning
REL	Relay
PRP	Proportional band
T.PL	Pulse length time
F.PF	Pulse frequency time
IAT	Integral action time
RNG	Range
OUT	Outputsignal
CNFG	Configuration
AIr	Alarm
CIn	Clean
STDY	Steady
FLET	Fleet, impulse
DEF	Default
FCT DEF	Factory default
CAL DEF	Calibration default
MANU	Manual
CUR.1	Output current 1
CUR.2	Output current 2
WASH	Wash
CU22	Output current 22mA
SAL	Salinity
PRES	Barometric pressure
UNIT	DO measuring unit