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# Instruction manual

$CO_2$ Transmitter 5100 e

Order number: 52 121 170



**Warranty**
Defects occurring within 1 year from delivery date shall be remedied free of charge at our plant (carriage and insurance paid by sender).
Sensors, fittings, and accessories: 1 year.

Subject to change without notice.

**Return of goods**
Please contact your nearst Mettler-Toledo distributer. Return the goods well cleaned to Mettler-Toledo. If the goods were in contact with process media, please decontaminate the goods and enclose a corresponding confirmation.

**Correct disposal of the unit**
(Dircetion 2002/96/EG, dated 27.1.2003)
Wehen the unit is finally taken out of order, observe the local environmental regulations for correct disposal.

Mettler-Toledo GmbH, Process Analytics, Industrie Nord,
CH-8902 Urdorf, Tel. +41 (01) 736 22 11 Fax +41 (01) 736 26 36
Subject to technical changes. Mettler-Toledo GmbH, 07/03.
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# Safety information

**Be sure to read and observe the following instructions!**

The device has been designed in accordance with the state of the art and complying with the applicable safety regulations. When operating the device, certain conditions may nevertheless lead to danger for the operator or damage to the device.

**Caution!**
Commissioning may only be carried out by trained experts. Whenever it is likely that protection has been impaired, the device shall be made inoperative and secured against unintended operation.

The protection is likely to be impaired if, for example:
- the device shows visible damage
- the device fails to perform the intended measurements
- after prolonged storage at temperatures above 70 °C (158 °F)
- after severe transport stresses

Before recommissioning the device, a professional routine test in accordance with EN 61010-1 must be performed. This test should be carried out by the manufacturer.

**Caution!**
Before commissioning it must be proved that the device may be connected with other equipment.

## Intended use

The Model $CO_2$ 5100 e is used to measure partial pressure $CO_2$ in biotechnological processes.
The rugged molded enclosure can be fixed into a control panel or mounted on a wall or at a post. The protective hood provides additional protection against direct weather exposure and mechanical damage.
The transmitter is designed to be used together with the Mettler-Toledo $CO_2$ sensor InPro 5000.

## Trademarks

The following names are registered trademarks. For practical reasons they are shown without trademark symbol in this manual.

Sensocheck
Sensoface
Calimatic
GainCheck
EasyClean®
InPro®



# EC Declaration of Conformity

Mettler-Toledo GmbH

**Declaration of conformity**
**Konformitätserklärung**
**Déclaration de conformité**

CE

| | |
|---|---|
| **We/Wir/Nous** | Mettler-Toledo GmbH, Process Analytics<br>Im Hackacker 15<br>8902 Urdorf<br>Switzerland<br><br>declare under our sole responsibility that the product,<br>erklären in alleiniger Verantwortung, dass dieses Produkt,<br>déclarons sous notre seule responsabilité que le produit, |
| **Description**<br>**Beschreibung/Description** | **$CO_2$ 5100 e**<br>to which this declaration relates is in conformity with the following standard(s) or other normative document(s).<br>auf welches sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder Richtlinie(n) übereinstimmt.<br>auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou au(x) document(s) normatif(s). |
| **Low-voltage directve/Nieder-spannungs-Richtlinie/ Directive basse tension** | **73/23/EWG** |
| **Norm/Standard/Standard** | **DIN EN 61010-1 / VDE 0411 Teil 1: 2008-08** |
| **EMC Directive/EMV-Richtlinie Directive concernant la CEM** | **89/336/EWG** |
| **Norm/Standard/Standard** | **DIN EN 61326 / VDE 0843 Teil 20: 1998-01**<br>**DIN EN 61326/A1 / VDE 0843 Teil 20/A1: 1999-05** |
| **Place and Date of issue**<br>**Ausstellungsort / - Datum**<br>**Lieu et date d´émission** | Urdorf, August 20, 2003 |

Mettler-Toledo GmbH, Process Analytics

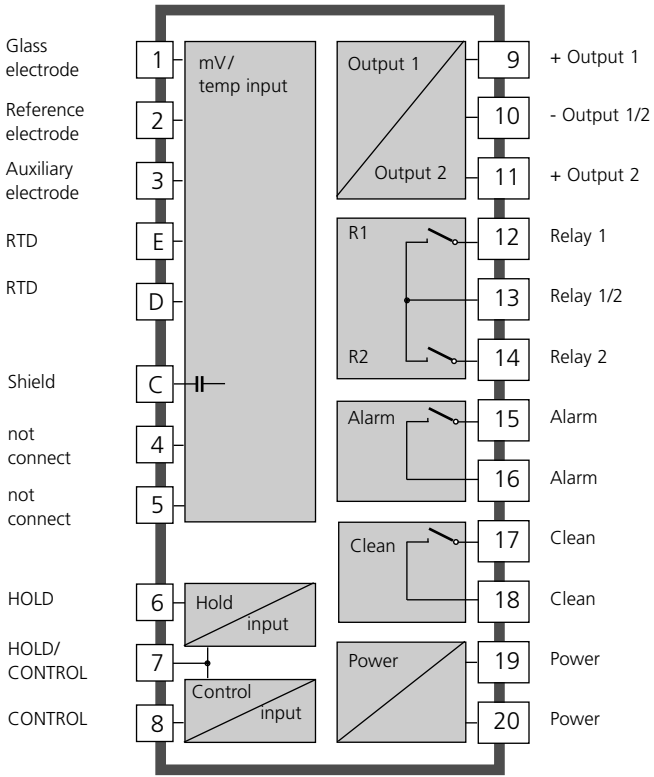
Waldemar Rauch
General Manager PO Urdorf

Christian Zwicky
Head of Marketing

Artikel Nr.: 52960315KE Dateiname: 52960315KE-5100e-internet.dc

METTLER TOLEDO

## Overview of pH Transmitter $CO_2$ 5100 e



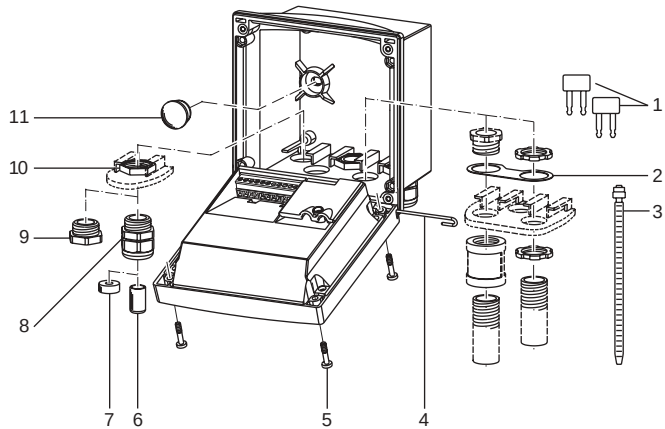





### Package contents

Check the shipment for transport damage and completeness.
The package should contain:

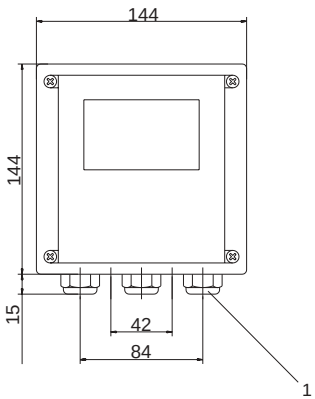
- Front unit
- Lower case
- Bag containing small parts
- Instruction manual
- Specific test report

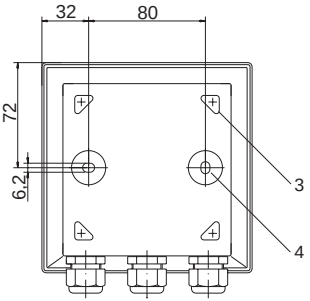



1 Jumper (2 pieces)
2 Washer (1 piece), for conduit mounting: Place washer between enclosure and nut
3 Cable ties (3 pieces)
4 Hinge pin (1 piece), insertable from either side
5 Enclosure screws (4 pieces)
6 Sealing inserts (1 piece)
7 Rubber reducer (1 piece)
8 Cable glands (3 pieces)
9 Filler plugs (3 pieces)
10 Hexagon nuts (5 pieces)
11 Sealing plugs (2 pieces), for sealing in case of wall mounting

Fig.: Assembling the enclosure

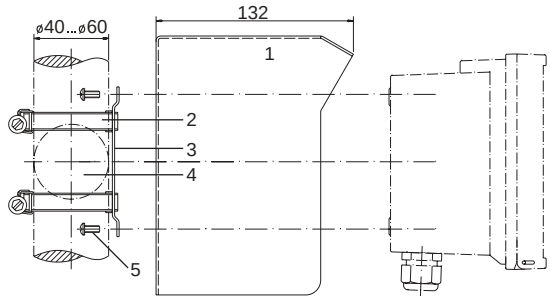
**Pipe mounting, panel mounting**




1 Cable gland (3 pieces)
2 Breakthroughs for cable gland or conduit 1/2", dia 21.5 mm (2 breakthroughs) Conduits not included!
3 Breakthroughs for pipe mounting (4 breakthroughs)
4 Breakthroughs for wall mounting (2 breakthroughs)

Fig.: Mounting plan




1 Protective hood (if required)
2 Hose clamps with worm gear drive to DIN 3017 (2 pieces)
3 Pipe-mount plate (1 piece)
4 For vertical or horizontal posts or pipes
5 Self-tapping screws (4 pieces)

Fig.: Pipe-mount kit

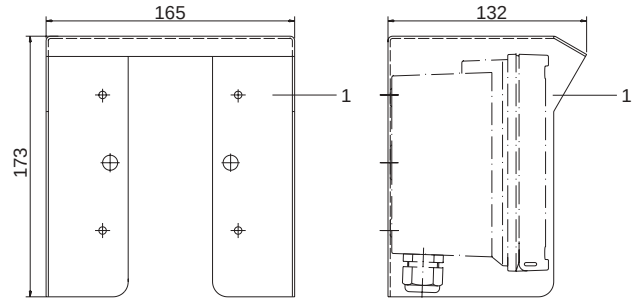
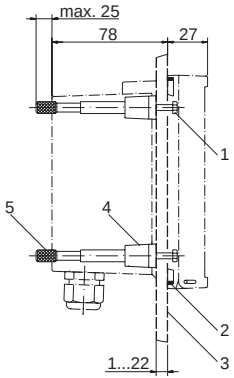



Fig.: Protective hood for wall and pipe mounting




1 Screws (4 pieces)
2 Gasket (1 piece)
3 Control panel
4 Span pieces (4 pieces)
5 Threaded sleeves (4 pieces)

Fig.: Panel-mount kit





### Information on installation

**Caution!**

- Installation may only be carried out by trained experts in accordance with this instruction manual and as per applicable local and national codes.
- Be sure to observe the technical specifications and input ratings.
- Be sure not to notch the conductor when stripping the insulation.
- Before connecting the device to the power supply, make sure that its voltage lies within the range 20.5 to 253 V AC/DC.
- When commissioning, a complete configuration must be carried out by the system administrator.

The terminals are suitable for single wires and flexible leads up to 2.5 mm² (AWG 14).

**Warning!**

Additional safety precautions have to be taken for applications in hazardous locations to CSA (CLI DIV2 GPA,B,C,D T4, Ex nA IIC T4)!

### Terminal assignments

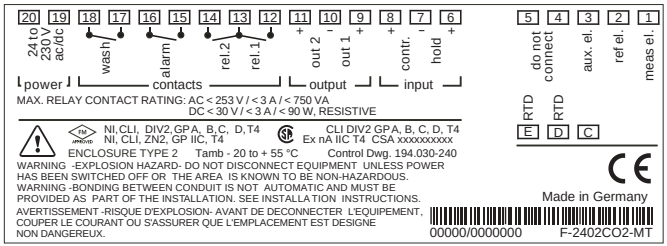
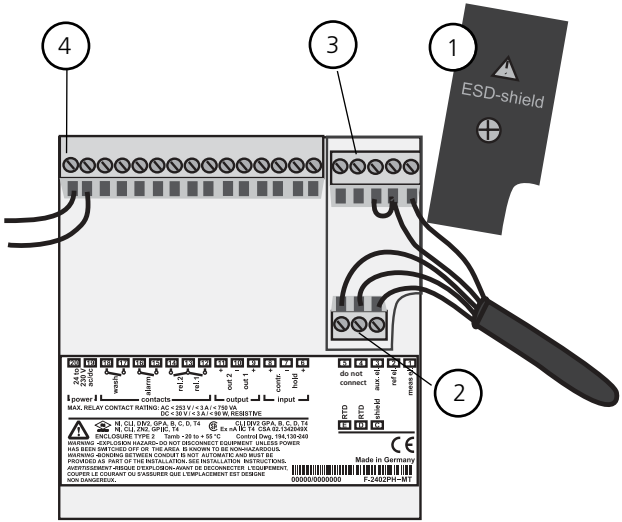



Fig.: Terminal assignments $CO_2$ 5100 e




**1** ESD shield covering the signal inputs (Screw off for assembly)
**Note:** The cable shield must end under the ESD shield.
(Cut lines if required)
**2** Terminals for temperature probe and outer shield
**3** Terminals for electrode
**4** Connection of power supply

Fig.: Information on installation, rear side of device

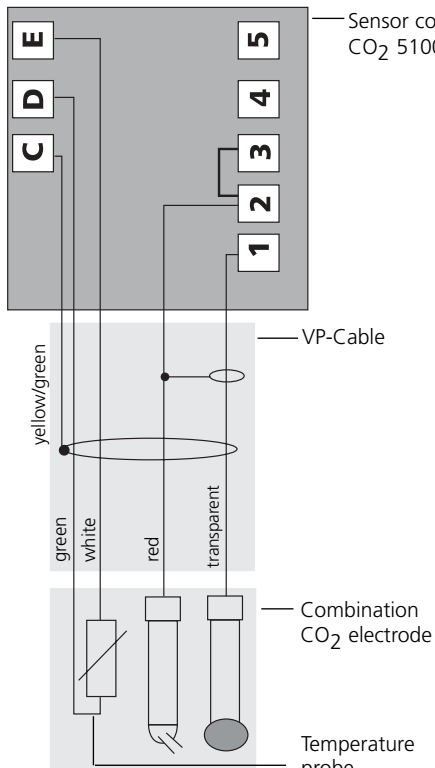
## Division 2 wiring

FM

The connections to the Transmitter are incendive and must be installed in accordance with the National Electric Code (ANSI-NFPA 70) Division 2 hazardous (classified) location incendive wiring techniques.

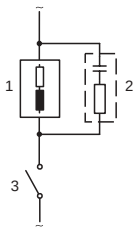
## Wiring diagram

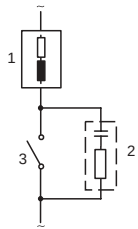
$CO_2$ measurement with monitoring of glass electrode. Connection with VP cable.



### Protective wiring of switching contacts

Relay contacts are subjected to electrical erosion. Especially with inductive and capacitive loads, the service life of the contacts will be reduced. For suppression of sparks and arcing, components such as RC combinations, nonlinear resistors, series resistors and diodes should be used.

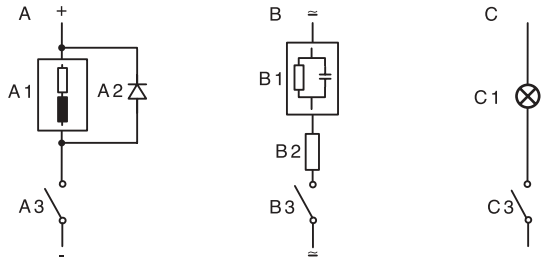



### Typical AC applications with inductive load

1 Load
2 RC combination, e.g. RIFA PMR 209
Typical RC combinations for 230 V AC:
Capacitor 0.1µF / 630V,
Resistor 100 Ohms / 1 W
3 Contact

### Typical protective wiring measures

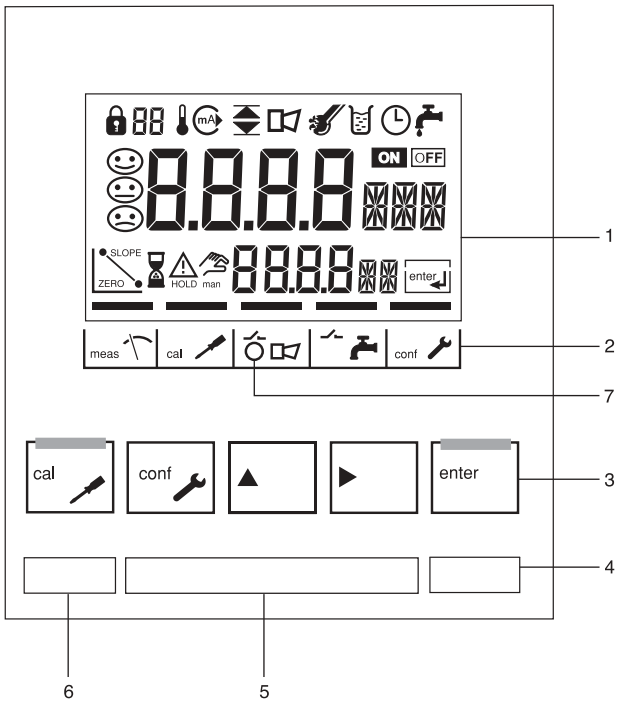



**A: DC application with inductive load**
**B: AC/DC applications with capacitive load**
**C: Connection of incandescent lamps**

| | |
|---|---|
| A1 | Inductive load |
| A2 | Free-wheeling diode, e.g. 1N4007 (Observe polarity) |
| A3 | Contact |
| B1 | Capacitive load |
| B2 | Resistor, e.g. 8 Ohms/1 W at 24 V / 0.3 A |
| B3 | Contact |
| C1 | Incandescent lamp, max 60 W / 230 V, 30 W / 115 V |
| C3 | Contact |

**Warning!**
**Make sure that the maximum ratings of the relay contacts are not exceeded even during switching!**

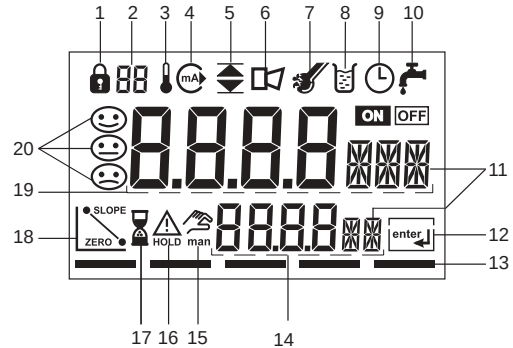
## User interface




1 Display
2 Mode indicators (no keys), from left to right:
- Measuring mode
- Calibration mode
- Alarm
- Wash contact
- Configuration mode

3 Keypad
4 Coding
5 Rating plate
6 Model designation
7 Alarm LED

## Display




1 Mode code entry
2 Display of measured variable*
3 Temperature
4 Current output
5 Limit values
6 Alarm
7 Sensocheck
8 Calibration
9 Interval/response time
10 Wash contact
11 Measurement symbols
12 Proceed with enter
13 Bar for identifying the device status, above mode indicators, from left to right:
- Measuring mode
- Calibration mode
- Alarm
- Wash contact
- Configuration mode

14 Lower display
15 Manual temp indicator
16 Hold mode active
17 Waiting time running
18 Electrode data
19 Main display
20 Sensoface

* Not in use

## Operation: Keypad

| | |
|---|---|
| cal | Start, end calibration |
| conf | Start, end configuration |
| ▶ | Select digit position<br>(selected position flashes) |
| ▲ | Edit digit |
| enter | • Calibration:<br>Continue in program sequence<br>• Configuration: Confirm entries,<br>next configuration step<br>• Measuring mode: Display output current |

| | |
|---|---|
| cal ➔ enter | Cal Info, display of asymmetry potential and slope |
| conf ➔ enter | Error Info, display last error message |
| ▶ + ▲ | Start GainCheck device self-test |

## Safety features

**Sensocheck, Sensoface sensor monitoring**
Sensocheck continuously monitors the sensor and wirings. Sensocheck can be switched off (configuration p.45).



Sensoface provides information on the electrode condition. The asymmetry potential (zero), slope and response time during calibration are evaluated. The three Sensoface indicators provide the user with information about wear and required maintenance of the sensor.

**GainCheck device self test**
A display test is carried out, the software version is displayed and the memory and measured value transfer are checked.

Start GainCheck device self-test: ▶ + ▲

**Automatic device self-test**
The automatic device self-test checks the memory and measured-value transfer. It runs automatically in the background at fixed intervals.

# Safety functions

### Hold mode

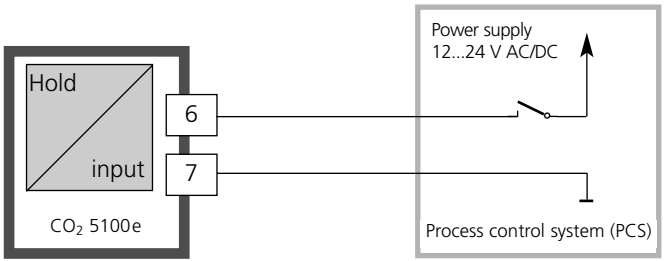
Display:

HOLD

The Hold mode is a safety state during configuration and calibration. Output current is frozen (Last) or set to a fixed value (Fix). Alarm and limit contacts are disabled.
If the calibration or configuration mode is exited, the Transmitter remains in the Hold mode for safety reasons.
This prevents undesirable reactions of the connected peripherals due to incorrect configuration or calibration. The measured value and "HOLD" are displayed alternately. The Transmitter only returns to measuring mode after **enter** is pressed and a waiting time of 20 s has passed.

### To activate the Hold mode from outside

The Hold mode can be activated from outside by sending a signal to the Hold input (e.g. from the process control system).




| Hold active | Hold inactive |
|---|---|
| 10 ... 30 V AC/DC | 0 ... 2 V AC/DC |



# Mode codes



The mode codes allow fast access to the functions.

### Calibration

| Key + Code | Description |
|---|---|
| cal 0000 | **Cal Info**<br>Display of asymmetry potential and slope |
| cal 1001 | **Zero adjustment**<br>of a nominal zero point |
| cal 1100 | **Calibration**<br>Adjustment of asymmetry potential and slope (electrode) |
| cal 1105 | **Product calibration 1**<br>Adjustment of asymmetry potential (ref.messurement) |
| cal 1106 | **Product calibration 2**<br>Adjustment of asymmetry potential (aeration) |
| cal 1015 | **Adjusting temp probe** |

| Key + Code | Description |
|---|---|
| conf 0000 | **Error Info** Display last error and erase |
| conf 1200 | **Configuring** |
| conf 2222 | **Sensor monitor** Display of uncorrected measured voltage (mV) |
| conf 7654 | **Parameter set 1/2** Switchover internal / external |
| conf 5555 | **Current source 1** Output current 1 specified |
| conf 5556 | **Current source 2** Output current 2 specified |
| conf 5557 | **Relay test** Manual test of contacts |
| conf 5559 | **Manual controller** Manual specification of controller output |



# Configuration



In the Configuration mode you set the device parameters.

**Activate**

conf

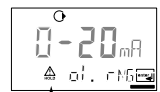
Activate with **conf**




Enter mode code "1200"
Edit parameter with ► and ▲, confirm/continue with **enter**.
(End with **conf enter**.)

**Hold**

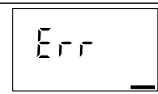
HOLD




HOLD icon

During configuration the Transmitter remains in the Hold mode for reasons of safety. The output current is frozen (at its last value or at a preset fixed value, depending on the configuration), limit and alarm contacts are inactive. The controller is in the configured state, Sensoface is off, mode indicator "Configuration" is on.

**Input errors**




The configuration parameters are checked during the input. In the case of an incorrect input "Err" is displayed for approx. 3 s. The incorrect parameters cannot be stored. Input must be repeated.

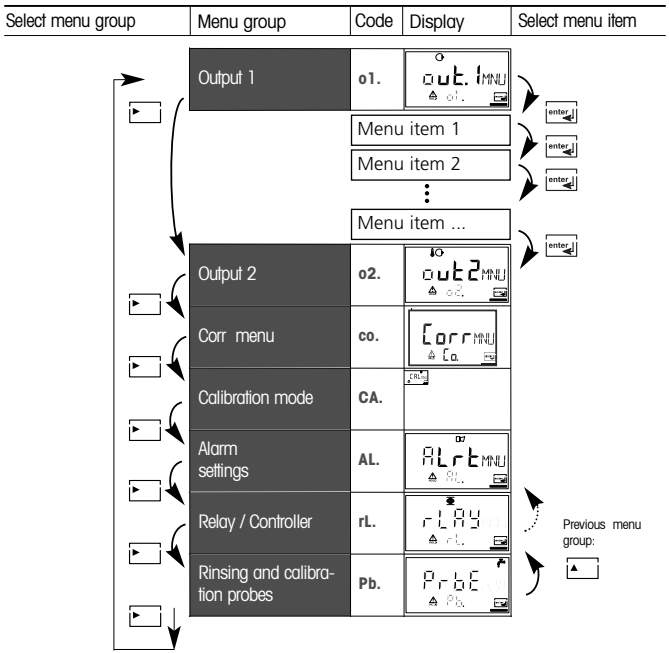
**End**

conf enter

End with **conf**. The measured value and Hold are displayed alternately, "**enter**" flashes. End Hold mode with **enter**. The display shows the measured value. The output current remains frozen for another 20 s (HOLD icon on, "hourglass" flashes).

### Menu structure of configuration

The configuration steps are assigned to different menu groups.
With the arrow keys you can jump between the individual menu groups.
Each menu group contains menu items for setting the parameters.
Pressing **enter** opens a menu item. The values are edited using the arrow keys. Pressing **enter** confirms/stores the settings.
Return to measurement: Press **conf**.








## Overview of configuration steps

| Code | Menu | Selection / Default |
|---|---|---|
| **out1** | **Output 1** | |
| **o1.** | Select measured variable | hPa, mg/l, % $CO_2$, mV |
| | Select current range | 0-20 mA / 4-20 mA |
| | Enter current beginning | xxxx |
| | Enter current end | xxxx |
| | Time constant of output filter | xxxx SEC |
| | 22 mA signal in the case of error | ON / OFF |
| | Signal behavior during HOLD | Last / Fix |
| | Enter fixed value | xxx.x mA |
| **out2** | **Output 2** | |
| **o2.** | Select temperature unit | °C / °F |
| | Select temperature probe | Pt1000 / NTC30 |
| | Select current range | 0-20 mA / 4-20 mA |
| | Enter current beginning | xxx.x |
| | Enter current end | xxx.x |
| | Time constant of output filter | xxxx SEC |
| | 22 mA signal in the case of temp error | ON / OFF |
| | Signal behavior during HOLD | Last / Fix |
| | Enter fixed value | xxx.x mA |
| **co.** | **Correction** | |
| **co.** | Select correction, pressure, unit | bar/kPa/psi |
| | Enter, correction, pressure | psi |
| | Enter conc. hydrogen carbonate | mol/l |
| **CAL** | **Calibration mode** | |
| **CA.** | Select calibration mode | aut/man/dat |
| | Enter cal timer interval | xxxx h |

| Code | Menu | | Selection / Default |
|---|---|---|---|
| **ALrt** | **Alarm settings** | | |
| **AL.** | Select Sensocheck | | ON / OFF |
| | Enter alarm delay | | xxxx s |
| | LED in HOLD mode | | ON / OFF |
| **rLAY** | **Relay 1/2: Limit values, controller** | | |
| **rL.** | Select limit function / controller | | LiMIT / CtROL |
| | **L1.** | Select contact function | Lo / Hi |
| | | Select contact response | N/O / N/C |
| | | Enter switching point | xxxx |
| | | Enter hysteresis | xxxx |
| | | Enter delay | xxxx SEC |
| | **L2.** | Select contact function | Lo / Hi |
| | | Select contact response | N/O / N/C |
| | | Enter switching point | xxxx |
| | | Enter hysteresis | xxxx |
| | | Enter delay | xxxx SEC |
| | **Ct.** | Enter controller setpoint | xxxx |
| | | Enter neutral zone | xxxx |
| | | (P) Controller gain $K_P$ | xxxx % |
| | | (I) Reset time $T_R$ | xxxx SEC |
| | | (D) Rate time $T_D$ | xxxx SEC |
| | | Controller | PLC / PFC |
| | | PLC: Pulse length | xxxx SEC |
| | | PFC: Pulse frequency | xxxx /min |
| | | Select HOLD behavior | Y Last / Y Off |
| **PrbE** | **Rinsing and cleaning probes** | | |
| **Pb.** | Select cleaning / calibration probe | | EASYCLN / rinse |
| | rinse | Rinsing interval | xxx.x h |
| | | Rinse duration | xxxx SEC |
| | | Contact response | N/O / N/C |
| | EASYCLN | Cleaning interval | xxx.x h |
| | | Calibration interval | xxx.x h |
| | Lock cleaning / calibration interval | | ON / OFF |



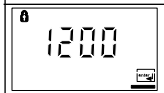


# Configuration

## Output 1

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 1 | o1. |  | Select measured variable |
| | | | Select 0-20 / 4-20 mA |
| | | | Enter current beginning |
| | | | Enter current end |
| | | | Set output filter |
| | | | 22 mA in the case of error |
| | | | Hold mode |

**End:**
Press **conf**, then **enter**

| code | Display | Action | Choices |
|---|---|---|---|
| **o1.** | | Select configuration<br>(Press **conf**.) | |
| | <br>After correct input a welcome text is displayed for approx. 3 s | Enter mode code "1200"<br>(Select position with ► key and edit number with ▲ key.<br>When the display reads "1200", press **enter** to confirm.) | |
| |  | The Transmitter is in HOLD mode (HOLD icon is on). | |
| |  | Select measured variable<br>Select with ► key<br>Proceed with **enter** | %, hPa, mg/l, mV |

**Note:** Characters represented in gray are flashing and can be edited.





**Output 1**

**Output current range. Current beginning. Current end.**

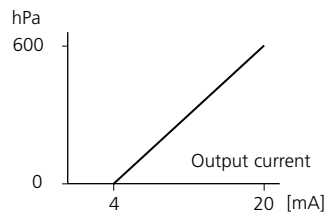
| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 1 | o1. |  | Select measured variable<br>Select 0-20 / 4-20 mA<br>Enter current beginning<br>Enter current end<br>Set output filter<br>22 mA in the case of error<br>Hold mode |

**End:**
Press **conf**, then **enter**

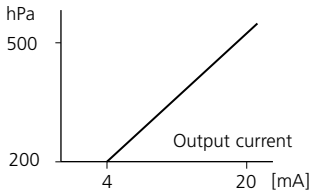
| Code | Display | Action | Choices |
|---|---|---|---|
| **o1.** |  | Set output current range<br>Select with ► key<br>Proceed with **enter** | **4-20 mA**<br>(0 - 20 mA) |
| |  | Current beginning<br>Enter lower end of scale, depending on measured variable selected<br>Select with ► key,<br>edit number with ▲ key,<br>proceed with **enter** | 0%-160%,<br>–999mV…<br>+1500 mV<br>0-2000 hPa |
| |  | Current end<br>Enter upper end of scale, depending on measured variable selected<br>Select with ► key,<br>edit number with ▲ key,<br>proceed with **enter** | 0%-160%,<br>–999mV…<br>+1500 mV<br>0-2000 hPa |

### Assignment of measured values: Current beginning and current end

Example 1: Range hPa




Example 2: Range 200-500 hPa
Advantage: Higher resolution in range of interest






# Configuration

**Output 1**
**Time constant of output filter.**

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 1 | **o1.** |  | Select measured variable |
| | | | Select 0-20 / 4-20 mA |
| | | | Enter current beginning |
| | | | Enter current end |
| | | | **Set output filter** |
| | | | 22 mA in the case of error |
| | | | Hold mode |

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **o1.** | 0000 SEC<br>o1.FCtF | Time constant of output filter<br>Default setting: 0 s (inactive).<br>To specify a time constant:<br>Select with ► key,<br>edit number with ▲ key,<br>proceed with **enter** | **0 s**<br>0 - 120 s |

**Time constant of output filter**

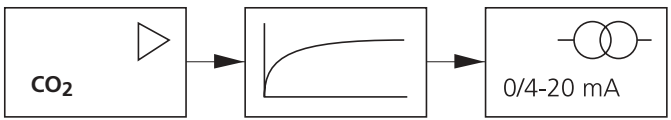
To smoothen the current output, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is 63 % after the time constant has been reached.

The time constant can be set from 0 to 120 s.

If the time constant is set to 0 s, the current output follows the input.

**Note:**

The filter only acts on the current output, not on the display, the limit values, or the controller!



Time constant 0 to 120 s





**Output 1**

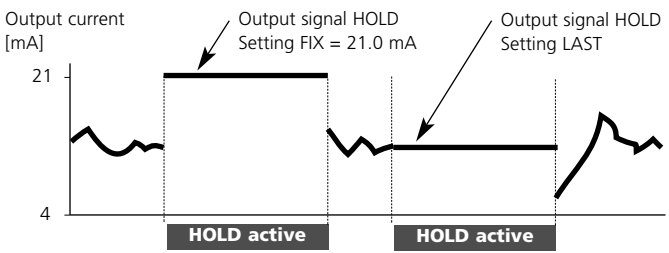
**Output current during Error and HOLD.**

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 1 | **o1.** | out. 1 MNU<br>o1. | Select measured variable<br>Select 0-20 / 4-20 mA<br>Enter current beginning<br>Enter current end<br>Set output filter<br>22 mA in the case of error<br>Hold mode |

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **o1.** |  | 22 mA signal for error message<br>Select with ► key<br>Proceed with **enter** | **OFF**<br>**(ON)** |
| |  | Output signal during HOLD<br>LAST: During HOLD the last measured value is maintained at the output.<br>FIX: During HOLD a value (to be entered) is maintained at the output.<br>Select with ► key<br>Proceed with **enter** | **LAST**<br>(FIX) |
| | <br> | Only with FIX selected:<br>Enter current which is to flow at the output during HOLD<br>Select position with ► key and edit number with ▲ key<br>Proceed with **enter** | **21.0 mA**<br>(00.0 to 21.0 mA |

**Output signal during HOLD:**





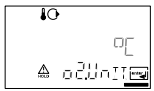



**Output 2**

**Temperature unit and probe. Output current.**

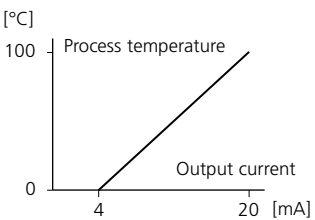
| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 2 | **o2.** |  | Select °C/°F |
| | | | Select 0-20 / 4-20 mA |
| | | | Enter current beginning |
| | | | Enter current end |
| | | | Set output filter |
| | | | 22 mA for temp error |
| | | | Hold mode |

**End:**
Press **conf**, then **enter**

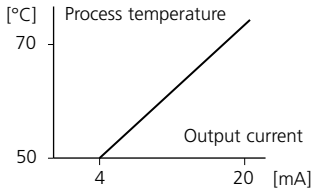
| Code | Display | Action | Choices |
|---|---|---|---|
| **o2.** |  | Specify temperature unit<br>Select with ► key<br>Proceed with **enter** | **°C**<br>(°F) |
| |  | Select temperature probe<br>Select with ► key<br>Proceed with **enter** | **Pt 1000**<br>(PT1000,<br>NTC30) |
| |  | Set output current range<br>Select with ► key<br>Proceed with **enter** | **4 - 20 mA**<br>(0 - 20 mA) |
| |  | Current beginning:<br>Enter lower end of scale.<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **000.0 °C** |
| |  | Current end:<br>Enter upper end of scale.<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **100.0 °C** |

**Process temperature: Current beginning and current end**

Example 1: Range 0 to 100 °C




Example 2: Range 50 to 70 °C.
Advantage: Higher resolution in range of interest








**Output 2**
**Time constant of output filter.**

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 2 | **o2.** |  | Select °C/°F |
| | | | Select 0-20 / 4-20 mA |
| | | | Enter current beginning |
| | | | Enter current end |
| | | | **Set output filter** |
| | | | 22 mA for temp error |
| | | | Hold mode |

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **o2.** |  | Time constant of output filter<br>Default setting: 0 s (inactive).<br>To specify a time constant:<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0 s**<br>(0 - 120 s) |

**Time constant of output filter**

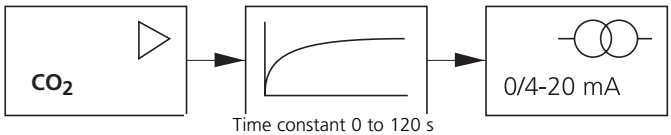
To smoothen the current output 2, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is 63 % after the time constant has been reached.

The time constant can be set from 0 to 120 s.

If the time constant is set to 0 s (default), the current output follows the input.

**Note:**

The filter only acts on the current output, not on the display!





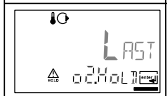
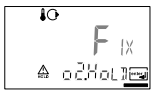
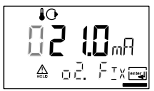



**Output 2**

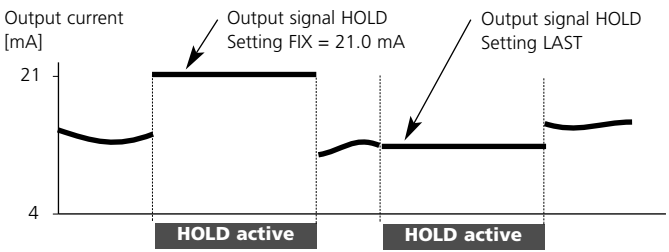
**Temperature error. Output current during HOLD.**

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Output 2 | **o2.** |  | Select °C/°F |
| | | | Select 0-20 / 4-20 mA |
| | | | Enter current beginning |
| | | | Enter current end |
| | | | Set output filter |
| | | | 22 mA for temp error |
| | | | Hold mode |

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **o2.** |  | 22 mA signal for error message<br>Select with ► key.<br>Proceed with **enter** | **OFF**<br>(ON) |
| |  | Output signal during HOLD<br>LAST: During HOLD the last measured value is maintained at the output.<br>FIX: During HOLD a value (to be entered) is maintained at the output.<br>Select with ► key.<br>Proceed with **enter** | **LAST**<br>(FIX) |
| | <br> | Only with FIX selected:<br>Enter current which is to flow at the output during HOLD.<br>Select position with ► key and edit number with key.<br>Proceed with **enter** | **21.0 mA**<br>(00.0 to 21.0 mA) |

**Output signal during HOLD:**








**Correction**
**Process pressure Hydrogencarbonate.**

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Calibration mode | **co.** |  | Meas. unit (pressure)<br>Process pressure<br>Hydrogencarbonate |

**End:**
Press **conf**, then **enter**

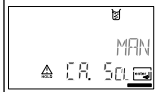
# Configuration
## Calibration mode

| Code | Display | Action | Choices |
|---|---|---|---|
| **CA.** |  | Select pressure unit<br>Select with ► key<br>Proceed with **enter** | **bar**<br>(kPa, psi) |
| |  | *Enter process pressure. This value is used to convert partial pressure (pCO2) to % $CO_2$.*<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **1.013 bar** |
| |  | *Hydrogen carbonate.*<br>*Enter hydrogen carbonate concentration.*<br>Select position with ► key and edit number with ▲ key<br>Proceed with **enter** | **0.050 mol/l**<br>(Electrolyte InPro 5000) |

* ppt (parts per thousand) - corresponds to g/kg

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Calibration mode | CA. |  | Calibration mode<br>Cal timer interval |

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **CA.** |  | AUT: Calibration with Calimatic automatic buffer selection. | |
| |  | MAN: Calibration with manual buffer entry | |
| |  | DAT: Entry of asymmetry potential and slope of premeasured electrodes<br>Select with ► key<br>Proceed with **enter** | |
| |  | Enter calibration interval:<br>Entry of time interval within which the Transmitter is to be calibrated.<br>With a time interval of 0000 hrs the calibration timer is not active.<br>Select with key, edit number with ▲ key, proceed with **enter** | **0000 h**<br>(0000 to 9999 h) |





| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Alarm settings | AL. |  | Select Sensocheck<br>Delay<br>LED in HOLD mode |

**End:**
Press **conf**, then **enter**

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **AL.** |  | Select Sensocheck<br>(continuous monitoring of glass and reference electrode)<br>Select with ► key<br>Proceed with **enter** | ON / **OFF** |
| |  | Alarm delay<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0010 s**<br>(xxxx s) |
| |  | LED in HOLD mode<br>Select with ► key<br>Proceed with **enter** | ON / **OFF** |

| | Alarm | HOLD |
|---|---|---|
| LED HOLD:ON | on | flashes |
| LED HOLD:OFF | flashes | off |

| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Relay / Controller | **rL.** |  | **L1.** Contact function<br>Contact response<br>Enter switching point<br>Enter hysteresis<br>Delay |
| | | | **L2.** Relay 2 menu group |
| | | | **Ct.** Controller menu group |

**End:**
Press **conf**, then **enter**

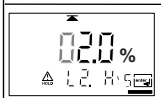
| Code | Display | Action | Choices |
|---|---|---|---|
| **rL.** |  | Use of relays:<br>• Limit function (LiMIT)<br>• Controller (CtROL)<br>Select with ► key<br>Proceed with **enter**<br><br>**Note:** Selecting CtROL leads to Controller menu group **Ct.** | **LiMIT**<br>(CtROL) |
| |  | | |
| **L1.** |  | For Limit 1 function, see Pg 53.<br>Select with ► key<br>Proceed with **enter** | **Lo**<br>(Hi) |
| |  | Limit 1 contact response<br>N/C: normally closed contact<br>N/O: normally open contact<br>Select with ► key<br>Proceed with **enter** | **N/C**<br>(N/O) |
| |  | Limit 1 switching point<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **100.0 %**<br>(xx.xx%) |
| |  | Limit 1 hysteresis<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0.5 %**<br>(xx.x %) |
| |  | Limit 1 delay<br>The contact is activated with delay (deactivated without delay)<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0010 s**<br>(0 to 9999 s) |



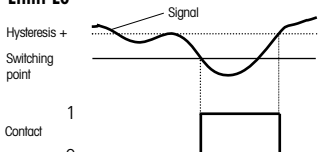
| Menu group | Code | Display | Select menu item | |
|---|---|---|---|---|
| Relay / Controller | rL. |  | **L1.** | Relay 1 menu group |
| | | | **L2.** | Contact function |
| | | | | Contact response |
| | | | | Enter switching point |
| | | | | Enter hysteresis |
| | | | | Delay |
| | | | **Ct.** | Controller menu group |



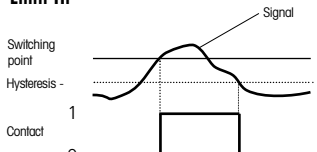

**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **L2.** |  | Select Limit 2, see Fig. below.<br>Select with ► key<br>Proceed with **enter** | **Hi**<br>(Lo) |
| |  | Limit 2 contact response<br>N/C: normally closed contact<br>N/O: normally open contact<br>Select with ► key<br>Proceed with **enter** | **N/C**<br>(N/O) |
| |  | Limit 2 switching point<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **100.0 %**<br>(xx.xx%) |
| |  | Limit 2 hysteresis<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **00.5 %**(xx.xx%) |
| |  | Limit 2 delay<br>The contact is activated with delay (deactivated without delay)<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0010 s**<br>(0 to 9999 s) |

**Limit Lo**




**Limit Hi**



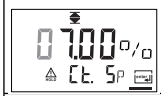





**Controller**
**(for description see Pg 75 and the following)**
**Setpoint. Neutral zone**

| Menu group | Code | Display | Select menu item | |
|---|---|---|---|---|
| Relay / Controller | rL. |  | **L1.** | Relay 1 menu group |
| | | | **L2.** | Relay 2 menu group |
| | | | Ct. | Controller setpoint |
| | | | | Enter neutral zone |
| | | | | (P) Controller gain |
| | | | | (I) Reset time $T_R$ |
| | | | | D) Rate time $T_D$ |
| | | | | Pulse length/Pulse frequency |
| | | | | PLC: Pulse length |
| | | | | PFC: Pulse frequency |
| | | | | HOLD behavior |

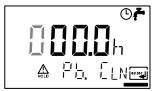
**End:**
Press **conf**, then **enter**

| Code | Display | Action | Choices |
|---|---|---|---|
| **Ct.** |  | Setpoint<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **50.0 %** |
| |  | Neutral zone (dead band)<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **10.00 %** |
| |  | Controller: Proportional action<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0100 %** |
| |  | Controller: Integral (reset time):<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0000 s**<br>(xxxx s) |
| |  | Controller: Derivative (rate time)<br>Select with ► key, edit number with ▲ key, proceed with **enter**. | **0000 s**<br>(xxxx s) |
| |  | Pulse length /Pulse frequency<br>Select with ► key<br>Proceed with **enter** | **PLC**<br>(PFC) |
| |  | PLC: Pulse length<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0010 s**<br>(xxxx s) |
| |  | PFC: Pulse frequency<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0060/min**<br>(xxxx /min) |
| |  | Behavior during HOLD<br>Select with ► key<br>Proceed with **enter** | **Y Last**<br>(Y Off) |

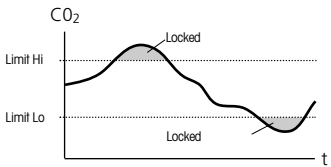


| Menu group | Code | Display | Select menu item |
|---|---|---|---|
| Rinsing and calibration probes | **Pb.** |  | Rinsing/calibration probe<br>Rinsing interval<br>Rinse duration<br>Contact response<br>Cleaning interval<br>Calibration interval |

| Code | Display | Action (rinsing probe) | Selection |
|---|---|---|---|
| **Pb.** |  | Control of:<br>• Rinsing probe (rinse)<br>• Calibration probe (EasyClean)<br>Select with ► key<br>Proceed with **enter** | **rinse**<br>(EASYCLN)<br>EASYCLN:<br>see opposite page |
| |  | Rinsing interval<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **000.0 h**<br>(xxx.x h) |
| |  | Rinse duration<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **0060 s**<br>(xxxx s) |
| |  | Contact type<br>Select with ► key<br>Proceed with **enter** | **N/C**<br>(N/O) |

| Code | Display | Action (calibration probe) | Selection |
|---|---|---|---|
| **Pb.** |  | Calibration probe (EasyClean)<br>Select with ► key<br>Proceed with **enter** | **EASYCLN**<br>(rinse) |
| |  | Cleaning interval<br>(EasyClean only)<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **000.0 h**<br>(xxx.x h) |
| |  | Calibration interval<br>(EasyClean only)<br>Select with ► key, edit number with ▲ key, proceed with **enter** | **000.0 h**<br>(xxx.x h) |
| |  | Lock cleaning (calibration) interval*<br><br>**On**: The Transmitter only starts a cleaning (calibration) interval if the measured value lies within the tolerated range (Limit Lo/Limit Hi). | **Off**<br>(On) |

***"Lock cleaning (calibration) interval" function:**




The Transmitter only starts a cleaning (calibration) interval if the measured value lies within the tolerated range (Limit Lo/Limit Hi). (For limit setting, refer to pages 47-50)

| Display | Action | Remark |
|---|---|---|
| | Switch between parameter sets<br>Press **conf** key,<br>enter code 7654<br>Select with ► key, edit number with ▲ key, proceed with **enter** | Wrong settings change the measurement properties!<br><br>If an invalid code is entered, the Transmitter returns to measuring mode. |
|  | | Welcome text is displayed for approx. 3 sec |
|  | Select parameter set 1 or 2.<br>Select with ► key<br>Proceed with **enter** | |
| <br> | Since the complete device configuration is changed in one step, there is a security prompt (No/Yes).<br>When pressing **enter** directly, the selection is not stored. | |

## Default settings of parameter sets

Two complete parameter sets are stored in the EEPROM.
As delivered, the two sets are identical but can be edited.

**Note:**
Fill in your configuration data on the following pages.

| Code. Parameter | Default setting |
|---|---|
| o1. Unit | .hPa |
| o1. 0/4-20 mA | .4-20 mA |
| o1. Current beginning | .1 hPa |
| o1. Current end | .1000 hPa |
| o1. Filter time | .0 s |
| o1. 22mA signal | .OFF |
| o1. Hold behavior | .Last |
| o1. Fix current | .021.0 mA |
| o2. Pt1000/NTC30 | .Pt1000 |
| o2. Unit °C / °F | .°C |
| o2. 0/4...20mA | .4-20 mA |
| o2. Current beginning | .000.0 °C |
| o2. Current end | .100.0 °C |
| o2. Filter time | .0 s |
| o2. 22mA signal | .OFF |
| o2. Hold behavior | .Last |
| o2. Fix current | .021.0 mA |
| Co. Pression unit | .bar |
| Co. Pression | .1.013 bar |
| Co. Hydrogen carbonate | .0.05 |
| CA. Cal interval | .0000 h |
| AL. Sensocheck | .OFF |
| AL. Alarm delay | .0010 s |
| AL. LED Hold | .ott |

| Code. Parameter | Default setting |
|---|---|
| rL. Relay function | .Limit |
| L1. Contact function | .Lo |
| L1. Contact response | .N/C |
| L1. Switching point | .% |
| L1. Hysteresis | .% |
| L1. Delay | .0010 s |
| L2. Contact function | .Hi |
| L2. Contact response | .N/C |
| L2. Switching point | .50 % |
| L2. Hysteresis | .10 % |
| L2. Delay | .0010 s |
| Ct. Setpoint | .% |
| Ct. Neutral zone | .% |
| Ct. P action | .0100 % |
| Ct. I action | .0000 s |
| Ct. D action | .0000 s |
| Ct. PLC/PFC controller | .PLC |
| Ct. Pulse length | .0010 s |
| Ct. Pulse frequency | .0060 /min |
| Ct. Hold behavior | .Last |
| Pb. EasyCLN/Rinse | .rinse |
| Pb. Rinsing interval | .000.0 h |
| Pb. Rinse duration | .0060 s |
| Pb. Cleaning interval | .000..0 h |



## Parameter set – user settings

| Code. Parameter | Setting | |
|---|---|---|
| o1. Unit: %, hPa, mg/l, mV | | |
| o1. 0/4-20 mA | | |
| o1. Current beginning | | |
| o1. Current end | | |
| o1. Filter time | | |
| o1. 22mA signal | | |
| o1. Hold behavior | | |
| o1. Fix current | | |
| o2. Unit °C / °F | | |
| o2. 0/4...20mA | | |
| o2. Current beginning | | |
| o2. Pt 1000 / NTC30 | | |
| o2. Current end | | |
| o2. Filter time | | |
| o2. 22mA signal | | |
| o2. Hold behavior | | |
| o2. Fix current | | |
| o2. Hydrogen carbonate | | |
| co. Pression unit | | |
| co. Pression | | |
| co. Hydrogen carbonate | | |
| CA. Cal interval | | |

**Code. Parameter Setting**

| | | |
|---|---|---|
| AL. Sensocheck | | |
| AL. Alarm delay | | |
| AL. LED-Hold | | |
| rL. Relay function | | |
| L1. Contact function | | |
| L1. Contact response | | |
| L1. Switching point | | |
| L1. Hysteresis | | |
| L1. Delay | | |
| L2. Contact function | | |
| L2. Contact response | | |
| L2. Switching point | | |
| L2. Hysteresis | | |
| L2. Delay | | |
| Ct. Setpoint | | |
| Ct. Neutral zone | | |
| Ct. P action | | |
| Ct. I action | | |
| Ct. D action | | |
| Ct. PLC/PFC controller | | |
| Ct. Pulse length | | |
| Ct. Pulse frequency | | |
| Ct. Hold behavior | | |
| Pb. EasyCLN/Rinse | | |





# Calibration

Calibration adjusts the device to the electrode.

**Activate**

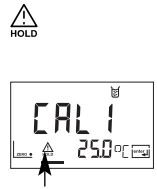



Activate with **cal**




Enter mode code: 1100
Select with ► key, edit number with ▲ key, proceed with **enter**
(End with **cal enter**.)

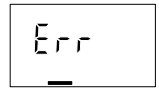
**Hold**




HOLD icon

During calibration the Transmitter remains in the Hold mode for reasons of safety. Output current is frozen (last value or preset fixed value, depending on configuration), limit and alarm contacts are inactive. The controller is in the configured state, Sensoface is off, mode indicator "Configuration" is on.

**Input errors**




The calibration parameters are chekked during the input. In the case of an incorrect input "Err" is displayed for approx. 3 sec. The incorrect parameters cannot be stored. Input must be repeated.

**End**




End with **cal**.
The measured value and Hold are displayed alternately, "enter" flashes. Press **enter** to end the Hold mode. The measured value is displayed. The output current remains frozen for another 20 sec (HOLD icon on, "hourglass" flashes).

**pH calibration**

Calibration is used to adapt the device to the individual electrode characteristics, namely asymmetry potential and slope. Calibration can be performed with Calimatic automatic buffer recognition, with manual buffer input, by entering premeasured electrode data.

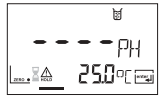
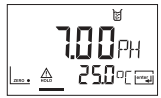
**Caution**

- All calibration procedures must be performed by trained personnel. Incorrectly set parameters may go unnoticed, but change the measuring properties.
- The response time of the electrode and temperature probe is considerably reduced if the electrode is first moved about in the buffer solution and then held still.

.

**Automatic calibration with Calimatic**

The Transmitter can only operate properly when the buffer solutions used correspond to the configured set. Other buffer solutions, even those with the same nominal values, may demonstrate a different temperature behavior. This leads to measurement errors.

| Display | Action | Remark |
|---|---|---|
|  | Press **cal** key, enter code 1100. Select with ► key, edit number with ▲ key, proceed with **enter** | If an invalid code is entered, the Transmitter returns to measuring mode. |
|  | Remove the electrode with temperature probe, clean it and immerse it in the first buffer solution (in any order). | Transmitter in Hold mode, measured value frozen. Sensoface inactive. |
|  | Buffer recognition<br>While the "hourglass" icon flashes, the electrode and temperature probe remain in the first buffer solution. | The response time of the electrode and temperature probe is considerably reduced if the electrode is first moved about in the buffer solution and then held still. |
|  | Buffer recognition terminated, the nominal buffer value is displayed. | |

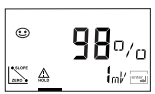
| Display | Action | Remark |
|---|---|---|
|  | Stability check:<br>The measured mV value is displayed. | To abort stability check: Press **cal**.<br>(accuracy reduced) |
|  | Calibration with the first buffer is terminated. Remove the electrode from the first buffer solution and rinse it thoroughly. | |
| | • Two-point calibration:<br>Immerse electrode in the second buffer solution pH 9.21.<br>Start with **enter**. | The calibration process runs again as for the first buffer. |
|  | Retract electrode and temp probe out of second buffer, rinse off, re-install.<br>Repeat calibration: **cal**,<br>End calibration: **enter**. | Slope and asymmetry potential of electrode (related to 25 °C) are displayed.<br>Hold is deactivated after 20 sec. |



## Manual calibration

For calibration with manual buffer specification, you must enter the pH value of the buffer solution used in the Transmitter for the proper temperature. This presetting enables calibration with any desired buffer solution. The MAN calibration mode in the configuration mode.

| Display | Action | Remark |
|---|---|---|
| | Press **cal** key,<br>enter code 1100<br>Select with ► key, edit number with ▲ key, proceed with **enter** | If an invalid code is entered, the Transmitter returns to measuring mode. |
|  | Remove the electrode, clean and immerse it in the first buffer solution.<br>Start with **enter**. | Transmitter in Hold mode, measured value frozen.<br>Sensoface inactive. |
|  | Enter the pH value of your buffer solution for the proper temperature. While the "hourglass" icon flashes, the electrode remains in the first buffer solution. | The response time of the electrode and temperature probe is considerably reduced if the electrode is first moved about in the buffer solution and then held still. |

| Display | Action | Remark |
|---|---|---|
|  | Stability check:<br>The measured mV value is displayed. | To abort stability check: Press **cal**.<br>(accuracy reduced) |
|  | Calibration with the first buffer is terminated.<br>Remove the electrode from the first buffer solution and rinse it thoroughly. | |
| | • Two-point calibration:<br>Immerse electrode in the second buffer solution.<br>Enter the pH value of the second buffer solution.<br>Start with **enter**. | The calibration process runs again as for the first buffer. |
|  | Retract electrode out of second buffer, rinse off, re-install.<br>Repeat calibration: **cal**,<br>End calibration: **enter**. | Slope and asymmetry potential of electrode (related to 25 °C) are displayed.<br>Hold is deactivated after 20 sec. |



## Data entry of premeasured electrodes

You can directly enter the values for slope and asymmetry potential of an electrode. The values must be known, e.g. determined beforehand in the laboratory. The DAT calibration mode must be preset in the configuration mode.

| Display | Action | Remark |
|---|---|---|
| | Press **cal** key, enter code 1100<br>Select with ► key, edit number with ▲ key, proceed with **enter** | If an invalid code is entered, the Transmitter returns to measuring mode. |
|  | Ready for calibration<br>Start with **enter**. | Transmitter in Hold mode, measured value frozen.<br>Sensoface inactive. |
|  | Enter asymmetry potential [mV].<br>Select with ► key, edit number with ▲ key, proceed with **enter** | |
|  | Enter slope [%].<br>Select with ► key, edit number with ▲ key, proceed with **enter** | |
|  | The Transmitter displays the new slope and asymmetry potential (at 25 °C).<br>Proceed with **enter**. | |
|  | $pCO_2$ and Hold are displayed alternately.<br>Proceed with **enter**.<br>Hold is deactivated after 20 s. | Security prompt. |

**Converting slope [%] to slope [mV/pH] at 25 °C:**

| % | mV/pH |
|---|---|
| 78 | 46.2 |
| 80 | 47.4 |
| 82 | 48.5 |
| 84 | 49.7 |
| 86 | 50.9 |
| 88 | 52.1 |
| 90 | 53.3 |
| 92 | 54.5 |
| 94 | 55.6 |
| 96 | 56.8 |
| 98 | 58.0 |
| **100** | **59.2** |
| 102 | 60.4 |

**Converting asymmetry potential in electrode zero point:**

$$ZERO = 7 - \frac{V_{AS}\,[mV]}{S\,[mV / pH]}$$

ZERO Electrode zero point
$V_{AS}$ Asymmetry potential
S Slope



**Process calibration 1**
Calibration by sampling

The electrode remains in the measured media during the process calibration. The measuring process will be interrupted only during a short time.
Procedure: During the sampling the currently measured value is stored in the transmitter. The transmitter immediately returns to the measuring mode. The calibration mode indicator flashes and reminds that the calibration has not been terminated. The sample is now measured in the lab using a reference method. The measured sample value is then entered in the transmitter. The transmitter will now calculate the asymmetry potential from the difference between the stored value and the sample value (one point calibration).
If the sample value is invalid, you can take over the value stored during the sampling. In this case, the old calibration values are stored.
Afterwards, you can start a new process calibration.

| Display | Action | Remark |
|---|---|---|
|   | Product calibration, step 1:<br>Press **cal** key,<br>enter code 1105<br>(Select with ► key, edit number with ▲ key, proceed with **enter** | If an invalid code is entered, the Transmitter returns to measuring mode. |
|   | Take sample and store value.<br>Proceed with **enter** | Now the sample can be measured in the lab. |

| Display | Action | Remark |
|---|---|---|
|  | Measuring mode:<br><br>From the flashing CAL mode indicator you see that sample calibration has not been terminated. | While the sample value is determined, the Transmitter is in measuring mode. |
|  | Product calibration, step 2:<br>When the sample value has been determined, call up the product calibration once more (**cal**, code 1105). | Display<br>(approx. 3 sec) |
|  | Enter lab value. The new asymmetry potential is calculated. | |
|  | Display of slope and new asymmetry potential<br>(related to 25 °C).<br>End calibration with **enter**. | New calibration:<br>Press **cal**. |
|  | The measured value is shown in the main display alternately with "Hold"; "enter" flashes.<br>End with **enter**. | After end of calibration, the outputs remain in Hold mode for approx. 20 sec. |



**Process calibration 2**
Aeration

The electrode remains in the process during the calibration with standard gas. The measuring process will be interrupted only during a short time.
Procedure: The system is exposed to a standard calibration gas with a defined $CO_2$ partial pressure (consider pressure dependence) and calibrated accordingly. This method allows two calibration possibilities. The aeration procedure may take place directly in the reactor, or in the flushing chamber of a retractable housing like InTrac 797. In both cases, it is important to flush the reactor or the flushing chamber with standard gas until a stable reading is displayed on the transmitter. The process calibration can be started as soon as the reading is stable. When a stable reading is displayed, proceed with entering the correct partial pressure, after the correction with the process pressure. The transmitter will calculate the new asymmetry potential of the $CO_2$ sensor.

| Display | Aktion | Bemerkung |
|---|---|---|
|  | Product calibration, step 2:<br>Press **cal** key,<br>enter code 1106<br>(Select with ► key, edit number with ▲ key, proceed with **enter** | If an invalid code is entered, the Transmitter returns to measuring mode. |
|  | Store value.<br>Proceed with **enter** | The value must be stable displayed. |

| Display | Action | Remark |
|---|---|---|
|  | Manual input of the known $CO_2$ partial pressure. Calculation of the new asymetric potential. | |
|  | Display of slope and new asymmetry potential (related to 25 °C). End calibration with **enter**. | New calibration: Press **cal**. |
|  | The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End with **enter**. | After end of calibration, the outputs remain in Hold mode for approx. 20 sec. |



## Temperature probe adjustment

| Display | Action | Remark |
|---|---|---|
|  | Activate calibration (Press **cal**, enter m, ode code 1015) Select with ► key, edit number with ▲ key, proceed with **enter** | Wrong settings change the measurement properties! If an invalid code is entered, the Transmitter returns to measuring mode. |
|  | Measure the temperature of the process medium using an external thermometer | The Transmitter is in Hold mode. |
|  | Enter measured temperature value. Select with ► key, edit number with ▲ key, proceed with **enter** End adjustment with **enter**. HOLD will be deactivated after 20 sec. | Default: Current value of secondary display. |

## Measurement

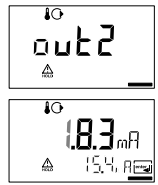
| Display | Remark |
|---|---|
|  | In the measuring mode the main display shows the configured process variable , the secondary display shows the temperature.. During calibration you can return to measuring mode by pressing the **cal**, during configuration by pressing **conf**. (Waiting time for meas. value stabilization approx. 20 s). |

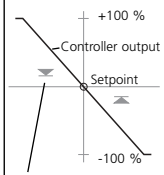
# Diagnostics functions

| Display | Remark |
|---|---|
|  | **Display of output currents**<br>Press **enter** while in measuring mode.<br>The current at output 1 is shown in the main display, the current at output 2 in the secondary display.<br>After 5 sec the Transmitter returns to measuring mode. |
|  | **Display of calibration data (Cal Info)**<br>Press **cal** while in measuring mode and enter code 0000.<br>The slope is shown in the main display, the asymmetry potential in the secondary display.<br>After 20 sec the Transmitter returns to measuring mode (immediate return at pressing **cal**). |
|  | **Display of electrode potential**<br>(Sensor monitor)<br>Press **conf** while in measuring mode and enter code 2222. The (uncompensated) electrode potential is shown in the main display, the measuring temperature in the secondary display.<br>Press **enter** to return to measurement. |
|  | **Display of last error message**<br>(Error Info)<br>Press **conf** while in measuring mode and enter code 0000. The last error message is displayed for approx. 20 sec.<br>After that the message will be deleted (immediate return to measurement at pressing **enter**). |



These functions are used for testing the connected peripherals.

| Display | Action / Remarks |
|---|---|
|  | **Specify current at output 1**<br>• Press **conf**, enter code 5555<br>The current indicated in the main display for output 1 can be edited.<br>Select with ► key, edit number with ▲ key, proceed with **enter**<br>The actually measured current is shown in the secondary display. The Transmitter is in Hold mode.<br>Press **enter** to return to measurement (Hold remains active for another 20 sec). |
|  | **Specify current at output 2**<br>• Press **conf**, enter code 5556<br>The current indicated in the main display for output 2 can be edited.<br>Select with ► key, edit number with ▲ key, proceed with **enter.**<br>The actually measured current is shown in the secondary display. The Transmitter is in Hold mode.<br>Press **enter** to return to measurement. |
| <br>Select a relay<br>Test 0/1<br>Return to measurement | **Relay test (manual test of contacts)**<br>• Press **conf**, enter code 5557<br>The relays are frozen. This state is indicated in the display. The 4 digits in the display correspond to the 4 relays (as on terminal plate):<br>1st digit: R1<br>2nd digit: R2<br>3rd digit: AL<br>4th digit: CLN<br>Function test using arrow keys – see left column.<br>When exiting the function (**enter**), the relays are set corresponding to the measured value. |

| Display | Action / Remarks |
|---|---|
| <br><br>**Controller characteristic**<br><br>The arrows indicate which relay (valve) is active:<br>▲ Relay 2 active (Meas. value > setpoint)<br>▼ Relay 1 active (Meas. value < setpoint)<br> | **Controller test (manual specification of controller output)**<br>• Press **conf**, enter code 5559<br>After function activation "Ctrl" is displayed for approx. 3 sec.<br>With controller turned off, "OFF" is displayed in addition, then return to measuring mode.<br>The function is used to start up control loops or check the actuators.<br>For bumpless changeover to automatic operation (exiting this function), configure an I-action component (reset time).<br><br>Specify value:<br>Select with ► key, edit number with ▲ key, proceed with **enter**<br><br>The Transmitter is in Hold mode.<br>Press **enter** to return to measurement (Hold remains active for another 20 sec).<br><br>Controller output -100 to 0 %: Relay 2 active<br><br>Controller output 0 to +100 %: Relay 1 active<br><br>Momentary controller output (adjusted value has not been stored yet) |





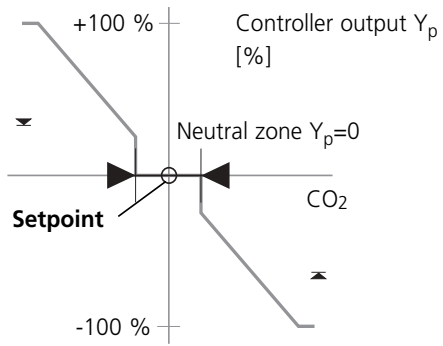
**PID controller**

**P controller**
Application in integrating systems
(e.g. closed tank, batch processes).

**PI controller**
Application in non-integrating systems
(e.g. drains).

**PID controller**
The additional derivative action compensates for measurement peaks.

**Controller characteristic**




**Note:**
In Hold mode the controller output acts as configured (Y = const. or Y = 0).

## Controller equations

Controller output Y = $Y_P + \frac{1}{T_R}\int Y_P dt + T_D \frac{dY_P}{dt}$

P action I action D action

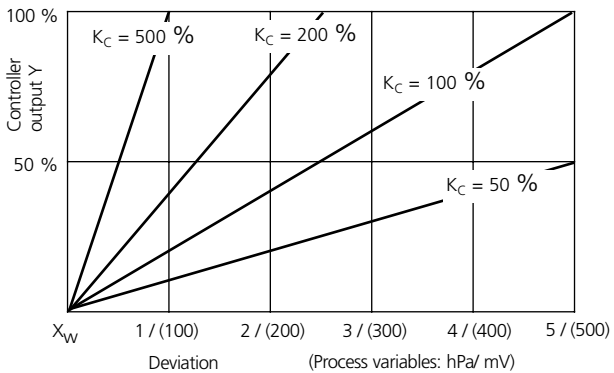
Proportional action $Y_P$

$Y_P = \frac{\text{Setpoint - Meas. value}}{\text{hPa}} * K_p$ $Y_P = \frac{\text{Setpoint - Meas. value}}{\text{500mV}} * K_p$

with:

| | | | |
|---|---|---|---|
| $Y_P$ | Proportional action | $T_D$ | Rate time [s] |
| $T_R$ | Reset time [s] | $K_C$ | Controller gain [%] |

### Proportional action (Gradient $K_C$ [%])




### Neutral zone (Y=0)

Tolerated deviation from setpoint.
The setting , for example, permits a deviation of ± 0.5 % from the desired value without activating the controller.

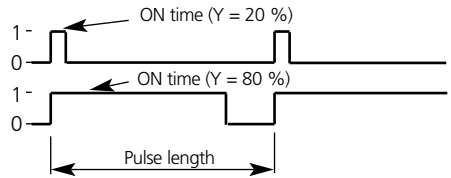


## Pulse length / pulse frequency controller

### Pulse length controller (PLC)

The pulse length controller is used to operate a valve as an actuator. It switches the contact on for a time that depends on the controller output. The period is constant. A minimum ON time of 0.5 sec is maintained even if the controller output takes corresponding values.

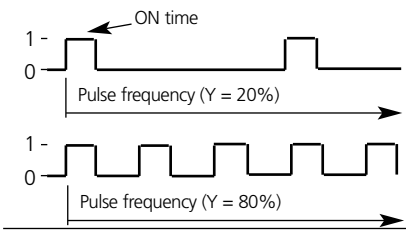
**Output signal (switching contact)of pulse length controller**




### Pulse frequency controller (PFC)

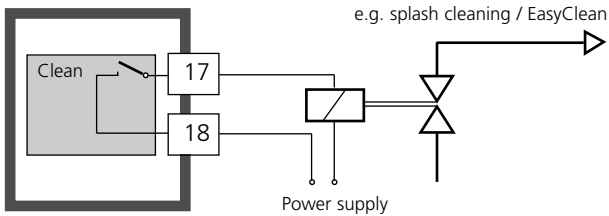
The pulse frequency controller is used to operate a frequency-controlled actuator. It varies the frequency with which the contacts are switched on. The maximum pulse frequency [pulses/ min] can be defined. It depends on the actuator.
The contact ON time is constant. It is automatically calculated from the user-defined maximum pulse frequency.

**Output signal (switching contact) of pulse frequency controller**

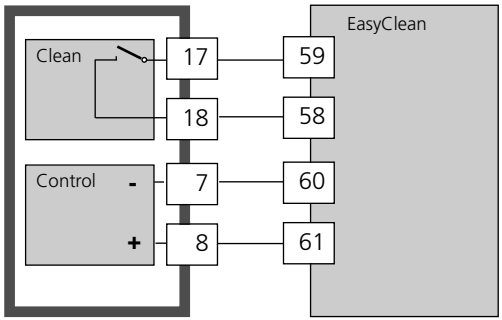


## Connecting a rinsing system

The "Clean" contact can be used to connect a simple splash cleaning system. Rinse duration and rinsing interval are defined during configuration. (page 53)




**Operation with automatic cleaning system**
"EasyClean" is a separate automatic cleaning system. The cleaning cycle is activated according to the cleaning interval defined during configuration (Pg 56).
Also see EasyClean Manual.






## Error messages (Error Codes)



| Errors | Display | Problem<br>Possible causes | Alarm contact | Red LED | Out 1 (22 mA) | Out 2 (22 mA) |
|---|---|---|---|---|---|---|
| **ERR 01** | Measured value flashes | **pH electrode**<br>• Electrode defective<br>• Too little electrolyte in electrode<br>• Electrode not connected<br>• Break in electrode cable<br>• Incorrect electrode connected | x | x | x | |
| **ERR 02** | Measured value flashes | **Measure range**<br>• >0.00 pH>14.00<br>• Electrode not connected<br>• Break in electrode cable<br>• Incorrect electrode connected<br>• Electrode potential < 1500 mV | x | x | x | |
| **ERR 98** | "Conf" flashes | **System error**<br>Configuration or calibration data defective; completely reconfigure and recalibrate the device.<br>Memory error in device program (PROM defective) | x | x | x | x |
| **ERR 99** | "FAIL" flashes | **Factory settings**<br>EEPROM or RAM defective<br>This error message only occurs in the case of a complete defect. The Transmitter must be repaired and recalibrated at the factory. | x | x | x | x |

| Errors | Symbol (flashing) | Problem<br>Possible causes | Alarm contact | Red LED | Out 1 (22 mA) | Out 2 (22 mA) |
|---|---|---|---|---|---|---|
| **ERR 03** |  | **Temperature probe**<br>Open or short circuit<br>Temperature range exceeded | x | x | x | x |
| **ERR 11** |  | **Current output 1**<br>Current below 0 (3.8) mA | x | x | x | |
| **ERR 12** |  | **Current output 1**<br>Current above 20.5 mA | x | x | x | |
| **ERR 13** |  | **Current output 1**<br>Current span too small / too large | x | x | x | |
| **ERR 21** |  | **Current output 2**<br>Current below 0 (3.8) mA | x | x | | x |
| **ERR 22** |  | **Current output 2**<br>Current above 20.5 mA | x | x | | x |
| **ERR 23** |  | **Current output 2**<br>Current span too small / too large | x | x | | x |
| **ERR 41**<br>**ERR 42** |  | **Rinsing probe**: Communication<br>Calibration error | x | x | x | x |
| **ERR 33**<br>**ERR 34** |  | **Sensocheck**: Glass electrode<br>Reference electrode | x | x | x | Sensoface active |
| |  | • Zero error, Sensoface active, see Pg 84 | | | | |
| |  | • Slope error, Sensoface active, see Pg 84 | | | | |
| |  | • Response time exceeded, Sensoface active, see Pg 84 | | | | |
| |  | • Cal interval expired, Sensoface active, see Pg 84 | | | | |





# Error messages (during calibration)

| Symbol flashes: | Problem<br>Possible causes |
|---|---|
|  | **Asymmetry potential out of range (±60 mV)**<br>• Electrode worn out<br>• Buffer solution contaminated<br>• Buffer does not belong to buffer set<br>• Nominal electrode zero point ≠ pH 7 |
|  | **Electrode slope out of range (80 – 103 %)**<br>• Electrode worn out<br>• Buffer solution contaminated<br>• Buffer does not belong to buffer set<br>• electrode used, has different nominal slope |
|  | **Problems during recognition of the buffer solution**<br>• Same or similar buffer solution was used for both calibration steps<br>• Buffer solution used does not belong to buffer set device |

| Symbol flashes: | Problem<br>Possible causes |
|---|---|
|  | **Problems during recognition of the buffer solution (continued)**<br>• During manual calibration the buffer solutions were not used in the specified order<br>• Buffer solutions contaminated<br>• Electrode defective<br>• Electrode not connected<br>• Electrode cable defective |
|  | **Calibration was canceled after approx. 2 min because the electrode drift was too large.**<br>• Electrode defective<br>• Electrode dirty<br>• No electrolyte in the electrode<br>• Electrode cable insufficiently shielded or defective<br>• Strong electric fields influence the measurement<br>• Major temperature fluctuation of the buffer solution<br>• No buffer solution or extremely diluted |





| Operating state | Out 1 | Out 2 | Rel.1/2 Controller | Rel.1/2 Limit value | Cleaning contact | Alarm contact | LED | Time out |
|---|---|---|---|---|---|---|---|---|
| Measurement | | | | | | | | |
| Cal Info<br>(cal) 0000 | | | | | | | | 20 s |
| Error Info<br>(conf) 0000 | | | | | | | | 20 s |
| Calibration<br>(cal) 1100 | | | | | | | | |
| Temp adjustment<br>(cal) 1015 | | | | | | | | |

| Operating state | Out 1 | Out 2 | Rel.1/2 Controller | Rel.1/2 Limit value | Cleaning contact | Alarm contact | LED | Time out |
|---|---|---|---|---|---|---|---|---|
| Process cal 1 (cal) 1105 | ■ | ■ | ■ | ■ | ■ | ■ | | |
| Process cal 2 (cal) 1106 | ■ | ■ | ■ | | | | | |
| Configuration (conf) 1200 | ■ | ■ | ■ | | | | | 20 min |
| Parameter set 1/2 (conf) 7654 | ■ | ■ | ■ | | | | | 20 min |
| Sensor monitor (conf) 2222 | ■ | ■ | ■ | ■ | ■ | ■ | | 20 min |
| Current source 1 (conf) 5555 | ■ | ■ | ■ | | | | | 20 min |
| Current source 2 (conf) 5556 | ■ | ■ | ■ | | | | | 20 min |
| Relay test (conf) 5557 | ■ | ■ | ■ | ■ | ■ | ■ | | 20 min |
| Manual controller (conf) 5559 | ■ | ■ | ■ | | | | | 20 min |
| Rinsing function | ■ | ■ | ■ | | ■ | | | |
| HOLD input | ■ | ■ | ■ | | | | | |

Explanation:

■ active

■ as configured (Last/Fix or Last/Off)





# Sensoface

(Sensocheck must have been activated during configuration.)

The little smiley in the display (Sensoface) alerts for electrode problems (defective sensor, defective cable, maintenance required). The permitted calibration ranges and the conditions for a friendly, neutral, or sad Sensoface are summarized in the following chart. Additional icons refer to the error cause.

**Sensocheck**

Continuously monitors the electrodes and wires for short circuits or open circuits. Critical values make the Sensoface "sad" and the corresponding icon flashes:



The Sensocheck message is also output as error message Err 33. The alarm contact is active, the red LED is lighted, output current 1 is set to 22 mA (when configured correspondingly). Sensocheck can be switched off during configuration (then Sensoface is also disabled). Exception: After a calibration the "friendly" Smiley is always displayed for confirmation.

**Note**

The worsening of a Sensoface criterion leads to the devaluation of the Sensoface indicator (Smiley becomes "sad"). An improvement of the Sensoface indicator can only take place after calibration or removal of am electrode defect.

| Display | Problem | Status |
|---|---|---|
|   | Asymmetry potential and slope | Asymmetry potential (zero) and slope of the electrode are still okay, However, the electrode should be replaced soon.<br><br>Asymmetry potential (zero point) and/or slope of the electrode have reached values which no longer ensure proper calibration. Replace the electrode. |
|  | Calibration timer | Over 80 % of the calibration interval has already past.<br>The calibration interval has been exceeded. |
|  | Electrode defective | Check the electrode and its connections (also see error messages Err 33 and Err 34, Page 78. |





# Appendix

## Specifications

| | | |
|---|---|---|
| **pH/mV input** | Input | Glass electrode |
| | Input | Reference electrode |
| | Input | Auxiliary electrode |
| **Measuring range** | pH: 0.00 ... 14.00 | |
| **Display range $CO_2$** | | |
| Saturation | 0.0 ... 200.0 % (0 ... 60 °C / 32…140 °F) | |
| Concentration | 0.0 ... 999.9 mg/l (0 ... 60 °C / 32…140 °F) | |
| | 0000 ... 4000 mg/l (0 ... 60 °C / 32…140 °F) | |
| Partial pressure | 0,0 ... 999.9 ... 2000 hPa | |
| | Input glass electrode1) | |
| Input resistance | > 0.5 x $10^{12}$ Ω | |
| Input current | < 2 x $10^{-12}$ A | |
| Input reference electrode1) | Input resistance > 1 x $10^{10}$ Ω | |
| | Input current < 1 x $10^{-10}$ A | |
| Measuring error1,2,3) | < 5 % of measured value +2 mg/l, | |
| | resp. 0.2 %, resp. 2 hPa | |
| Process pressure*) | 0.000 ... 4.000 bar | |
| | Electrolytes concentration *) | |
| | 0.000 ... 1.000 mol/l | |
| **Electrode standardization pH/$CO_2$** | pH-calibration | |
| | operating modes | |
| | AUT | Auto-calibration with buffer pH 7.00, 9.21 |
| | MAN | manual calibration with input induvidual buffer values |
| | DAT | data input of premeasured sensors |
| | $CO_2$-calibration | |
| | Product calibration (with separat Mode-Code) | |
| | max. calibration range | |
| | asymmetry potential ±60 mV | |
| | slope | 80 ... 103 % (47.5 ... 61 mV/pH) |
| | (possibly restrictive hints by Sensoface) | |
| **Caltimer** | 0000 ... 9999 h | |

## Specifications

| | |
|---|---|
| **Sensocheck** | Automatic monitoring of glass and reference electrode (can be disabled). Delay time approx. 30 s |
| **Sensoface** | Provides information on the electrode condition. Evaluation of zero/slope, response, calibration interval, Sensocheck |
| **Temperature input** | Pt 1000 / NTC 30 |
| 2-wire connection, adjustable | |
| Measurement range | –20.0 ... 150.0 °C / –4 ... 302 °F |
| Adjustment range | 10 K |
| Resolution | 0.1 °C / 1 °F |
| Meas. error1,2,3) | < 0.5 K |
| **HOLD input** | Galv. separated (OPTO coupler) |
| Function | Switches device to HOLD mode |
| Switching volatage | 0 ... 2 V (AC/DC) inaktive<br>10 ... 30 V (AC/DC) HOLD aktive |
| **CONTROL input** | Galv. separated (OPTO coupler) |
| Function | Control input for automatic cleaning/ calibration system |
| Switching voltage | 0 ... 2 V (AC/DC) inactive<br>10 ... 30 V (AC/DC) active |
| **Output 1** | 0/4 ... 20 mA, max. 10 V, floating (galv. connected to output 2) |
| Measured variable *) | $CO_2$ value (%, mg/l, hPa) |
| Overrange *) | 22 mA In the case of error messages |
| Output filter *) | PT1-filter, filter time constant 0 ... 120 s |
| Meas. error1) | < 0.3 % current value +0.05 mA |
| Start / end of scale | as desired within ranges |
| Adm. span | 2 ... 200 % / 50 ... 4000 mg/l /50 ... 2000 hPa |
| **Output 2** | 0/4 ... 20 mA, max. 10 V, floating ( galv. connected to output 1) |
| Measured variable | Temperature |
| Overrange *) | 22 mA In the case of error messages |
| Output filter *) | PT1-filter, filter time constant 0 ... 120 s |



| | |
|---|---|
| Meas. error1) | < 0.3 % current value +0.05 mA |
| Start / end of scaale*) | as desired within ranges |
| Adm. span | 10 ... 100 K |
| **Alarm contact** | Relay contact, floating |
| Contact ratings | AC < 250 V / < 3 A / < 750 VA<br>DC < 30 V / < 3 A / < 90 W |
| Contact response | N/C (fail-safe type) |
| Alarm delay | 0000…0600 s |
| **Limit values** | Output via relay contacts R1, R2 (see PID process contoller) Contacts R1, R2 floating, but inter-connected |
| Contact ratings | AC < 250 V / < 3 A / < 750 VA<br>DC < 30 V / < 3 A / < 90 W |
| Contact response *) | N/C or N/O<br>Delay *) 0000 … 9999 s<br>Switching points *) |
| As desired within range | |
| Hysteresis *) | max. 40 % of MR floating |
| **PID-Process controller** | Output via relay contacts R1, R2 (see limit values) R1 base valve, R2 acid valve specification *) |
| Set point specification*) | 0 ... 100,0 % / 0 ... 1999 mg/l /<br>0 ... 999,9 hPa |
| Neutral zone *) | 0 ... 20,0 % / 0 ... 400 mg/l /<br>0 ... 200,0 hPa |
| P-action *) controller gaine | Kr: 0010 ... 9999 % |
| I-action *) reset time | Tr: 0000 ... 9999 s<br>(0000 s = no integral action) |
| D-action *) derivative time | Td: 0000 ... 9999 s<br>(Os= no derivative action) |
| Controller type *) | pulse length controller or pulse frequency controller |
| Pulse periode *) | 0001 ... 0600 s, min. ON time 0,5 s<br>(pulse length controller) |
| max. pulse frequency *) | 0001 ... 0180 min-1<br>(pulse frequency controller) |
| **Cleaning function*)** | Relay contact, floating for controlling a simple rinsing system or an automatic cleaning system |
| Contact ratings | AC < 250 V / < 3 A / < 750 VA |

| | |
|---|---|
| | DC < 30 V / < 3 A / < 90 W |
| Contact response *) | N/C or N/O |
| Rinsing interval *) | 000.0 ... 999,9 h<br>(000.0 h …= cleaning function switched off) |
| Cleaning interval *) | 0000 ... 1999 s |
| Post-delay | 20 s |

| | |
|---|---|
| **Display** | LC display, 7-segment with icons |
| Main display | Characters height 17 mm, unit symbols 10 mm<br>Secondary display |
| Characters height 10 mm, unit symbols 7 mm | |
| Sensoface | 3 status indicators (friendly, neutral, sad smily) |
| Mode indication | 5 status bars:<br>"meas", "cal", "alarm", "cleaning", "config"<br>18 further icons for configuration and messages |
| Alarm indication | red LED in case of alarm or HOLD, user defined |

| | |
|---|---|
| **Keypad** | 5 keys: [cal] [conf] [►] [▲] [enter] |

| | |
|---|---|
| **Service functions** | |
| Current source | Current adjustable for output 1 and 2<br>00.00 to 22.00mA) |
| Manual controller | Controller output entered directly<br>(startup of control process) |
| Device self-test | Automatic memory test<br>(RAM, FLASH, EEPROM)<br>Display test<br>Display of all segments<br>Last Error |
| Display of last error occurred | |
| | Sensor monitor<br>Display of direct, uncorrected sensor signal<br>(electrode)<br>Relay test |
| Manual control of the four switching contacts | |

| | |
|---|---|
| **Parameter sets** *) | Two selectable parameter sets for different applications |

| | |
|---|---|
| **Explosion protection** | NI, Class I, Div 2, Group A, B, C, D<br>(USA/Canada) |

| | |
|---|---|
| **Data retention** | Parameters and calibration > 10 years (EEPROM) |
| **EMV** | DIN EN 61326 VDE 0843 part 20 /01.98<br>DIN EN 61326/A1 VDE 0843 part 20/A1 /05.99 |
| Lightning protection | DIN EN 61000-4-5, installation class 2 |

| | |
|---|---|
| **Protection against against electrical shock** | Protective separation of all extra-low-voltage circuits mains by double insulation as per EN 61010-1 |

| | |
|---|---|
| **Power supply** | 24 (-15%) ... 230 (+15%) V AC/DC;<br>ca. 2 VA AC: 45 ... 65 Hz<br>Overvolatage category II, Class II |

| | |
|---|---|
| **Nominal operatings condition** | Ambient temperature –20 ... +55 °C (–4…131 °F) |
| Transport/Storage temp | –20 ... +70 °C (–4…158 °F) |
| Relative humidity | 10 ... 95 % not condensing |
| Power supply | 24 (–15%) ... 230 (+15%) V AC/DC |
| Frequency for AC | 45 ... 65 Hz |

| | |
|---|---|
| **Enclosure** | Molded enclosure made of PBT<br>(polybutylene terephtalate) |
| Color | bluish gray RAL 7031 |
| Assembly | Wall mounting<br>Pipe mounting: dia 40 to 60 mm, dia 30 to 45 mm<br>Panel mounting, cutout to DIN 43 700<br>Sealed against panel |
| Dimensions | H 144 mm, W 144 mm, D 105 mm |
| Ingress protection | IP 65 / NEMA 4X (USA/Canada: interioer use) |
| Cable glands | 3 breakthroughs for cable glands M20x1.5<br>2 breakthroughs for NPT 1/2" 1 and 2 or<br>Rigid Metallic Conduit |
| Weight | Approx. 1 kg |

*) User-defined
1) To IEC 746 Part 1, at nominal operating conditions
2) ± 1 count
3)Plus sensor error

# Buffer table

Mettler-Toledo technical buffers

| °C | pH | pH |
|---|---|---|
| 0 | 7.12 | 9.52 |
| 5 | 7.09 | 9.45 |
| 10 | 7.06 | 9.38 |
| 15 | 7.04 | 9.32 |
| 20 | 7.02 | 9.26 |
| **25** | **7.00** | **9.21** |
| 30 | 6.99 | 9.16 |
| 35 | 6.98 | 9.11 |
| 40 | 6.97 | 9.06 |
| 45 | 6.97 | 9.03 |
| 50 | 6.97 | 8.99 |
| 55 | 6.98 | 8.96 |
| 60 | 6.98 | 8.93 |
| 65 | 6.99 | 8.90 |
| 70 | 7.00 | 8.88 |
| 75 | 7.02 | 8.85 |
| 80 | 7.04 | 8.83 |
| 85 | 7.06 | 8.81 |
| 90 | 7.09 | 8.79 |
| 95 | 7.12 | 8.77 |





**Product line and accessories**

| **Devices** | **Order No.** |
|---|---|
| **$CO_2$ Transmitter 5100 e** | **52 121 105** |
| **Mounting accessories** | |
| Pipe-mount kit | 52 120 741 |
| Panel-mount kit | 52 120 740 |
| Protective hood | 52 120 739 |

**Asymmetry potential** — The voltage which a pH electrode provides at a pH of 7. The asymmetry potential is different for each electrode and changes with age and wear.

**Buffer set** — Contains selected buffer solutions which can be used for automatic calibration with the Knick Calimatic.

**Buffer solution** — Solution with an exactly defined pH value for calibrating a pH meter.

**Calibration** — Adjustment of the transmitter to the current electrode characteristics. The asymmetry potential and slope are adjusted. You can conduct either a one or a two-point calibration. With one-point calibration only the asymmetry potential (zero point) is adjusted.

**Calimatic** — Automatic buffer recognition. The patented Calimatic then automatically recognizes the buffer solutions used during calibration.

**Combination electrode** — Combination of glass and reference electrode in one body.

**Electrode slope** — Is indicated in % of the theoretical slope (59.2 mV/pH at 25 °C). The electrode slope is different for every electrode and changes with age and wear.

**Electrode zero point** — See asymmetry potential

**GainCheck** — Device self-test which runs automatically in the background at fixed intervals. The memory and measured-value transmission are checked. You can also start the GainCheck manually. Then a display test is also conducted and the software version displayed.

**Mode code** — Preset four-digit number to select certain modes.

**One-point calibration** Calibration with which only the asymmetry potential (zero point) is taken into account. The previous slope value is retained. Only one buffer solution is required for a one-point calibration.

**pH electrode system** A pH electrode system consists of a glass and a reference electrode. If they are combined in one body, they are referred to as combination electrode.

**Response time** Time from the start of a calibration step to the stabilization of the electrode potential.

**Sensocheck** Sensocheck continuously monitors the glass and reference electrodes. The resulting information is indicated by the Sensoface smileys. Sensocheck can be switched off.

**Sensoface** Provides information on the electrode condition. The zero point, slope, and response time are evaluated. In addition, the Sensocheck information is indicated.

**Slope** See Electrode slope

**Two-point calibration** Calibration with which the electrode asymmetry potential (zero point) and slope are determined. Two buffer solutions are required for two-point calibration.

**Zero point** See asymmetry potential

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