Instruction manual

pH Transmitter 2100 e

METTLER TOLEDO

Warranty

Defects occurring within 1 year from delivery date shall be remedied free of charge at our plant (carriage and insurance paid by sender).

Subject to change without notice

Return of products under warranty

Please contact METTLER TOLEDO's Customer Service Dept. before returning a defective device. Ship the cleaned device to the address you have been given. If the device has been in contact with process fluids, it must be decontaminated/disinfected before shipment. In that case, please attach a corresponding certificate, for the health and safety of our service personnel.

Disposal (Directive 2002/96/EC of January 27, 2003)
Please observe the applicable local or national regulations concerning the disposal of "waste electrical and electronic equipment".

CE

FM

CSA

Mettler-Toledo GmbH, Process Analytics, Industrie Nord,
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Subject to technical changes. Mettler-Toledo GmbH, 09/04.
Printed in Germany.

Contents

Contents

Safety information

Be sure to read and observe the following instructions!

The device has been designed using state of the art technologies and it complies 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
- 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 pH 2100 e is used for pH/mV, ORP, and temperature measurement in industry, environment, food processing and sewage treatment.
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 can be easily replaced and it accepts commercially available electrodes with a nominal zero point at pH 7 and ISFET electrodes.

Trademarks

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

EasyClean®
InPro®

EC Declaration of Conformity

Mettler-Toledo GmbH
Process Analytics

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Declaration of conformity
Konformitätserklärung CE
Déclaration de conformité

We/Wir/Nous	**Mettler-Toledo GmbH, Process Analytics** Im Hackacker 15 8902 Urdorf Switzerland declare under our sole responsibility that the product, erklären in alleiniger Verantwortung, dass dieses Produkt, déclarons sous notre seule responsabilité que le produit,
Description **Beschreibung/Description**	**pH 2100e**
	to which this declaration relates is in conformity with the following standard(s) or other normative document(s). auf welches sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder Richtlinie(n) übereinstimmt. auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou au(x) document(s) normatif(s).
Low-voltage directive/ **Nieder-spannungs-Richtlinie/** **Directive basse tension**	**73/23/EWG**
Norm/Standard/Standard	**EN 61010-1** / **VDE 0411 Teil 1:** **2002-08**
EMC directive/EMV-Richtlinie **Directive concernant la CEM**	**89/336/EWG**
Norm/Standard/Standard	**DIN EN 61326** / **VDE 0843 Teil 20** **1998-01** **DIN EN 61326/A1** / **VDE 0843 Teil 20/A1:** **1999-05**
Place and Date of issue **Ausstellungsort / - Datum** **Lieu et date d'émission**	**Urdorf, 26.11.2002**

Mettler-Toledo GmbH, Process Analytics

Waldemar Rauch
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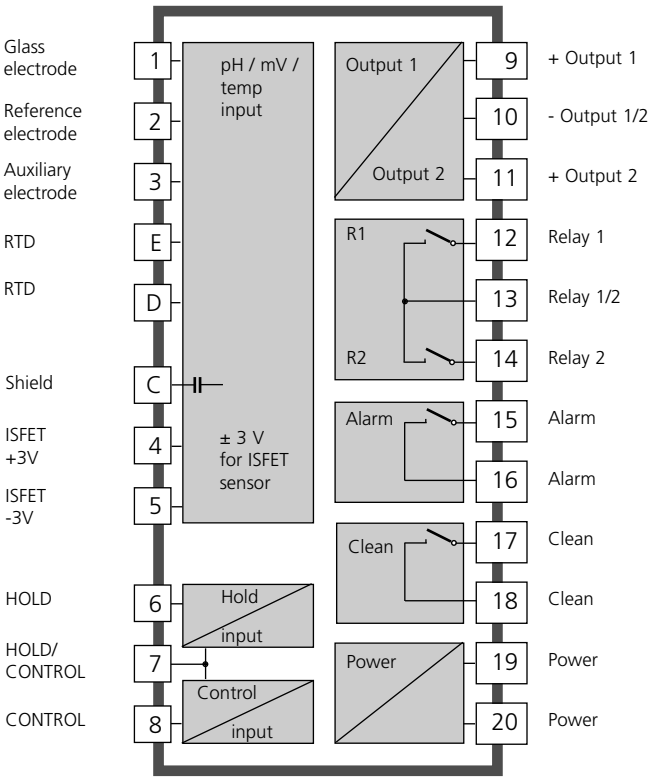
Nr. 52 999 999C FL

Artikel Nr. 52960283 KE 52960283KE-2100e.doc METTLER TOLEDO Version a

Corporate headquarters Mettler-Toledo GmbH, Im Langacher, CH-8606 Greifensee

Overview of pH Transmitter 2100 e

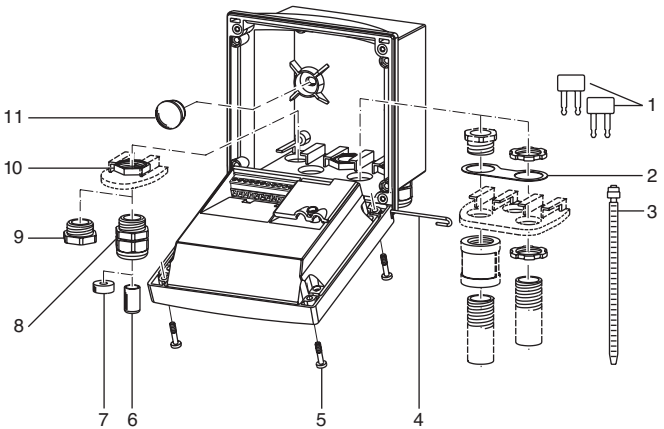


Assembly

Package contents

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

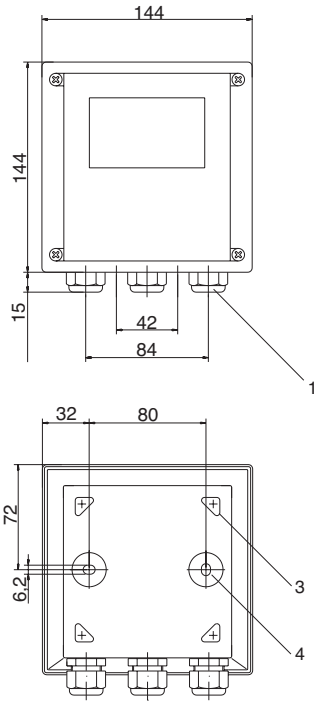
- Front unit
- Lower case
- Bag containing small parts
- Instruction manual
- Specific test report



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

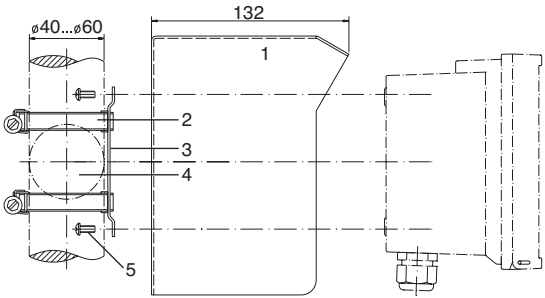
Mounting plan



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

Pipe mounting, panel mounting



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

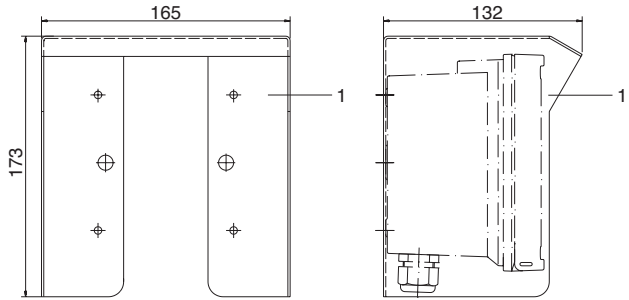


Fig.: Protective hood for wall and pipe mounting

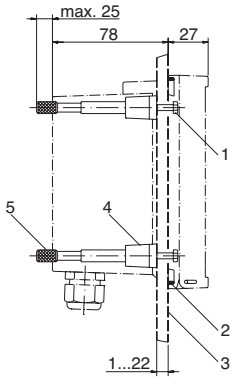


Fig.: Panel-mount kit

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

Installation and connection

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)! (See Pg 111.)

Terminal assignments

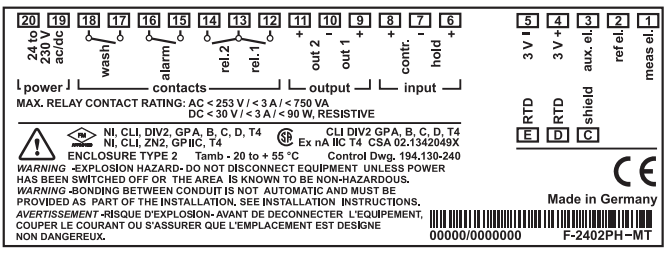
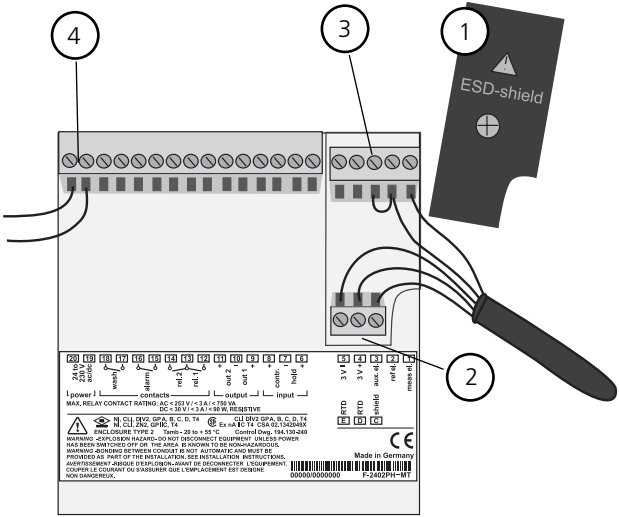


Fig.: Terminal assignments pH 2100 e



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

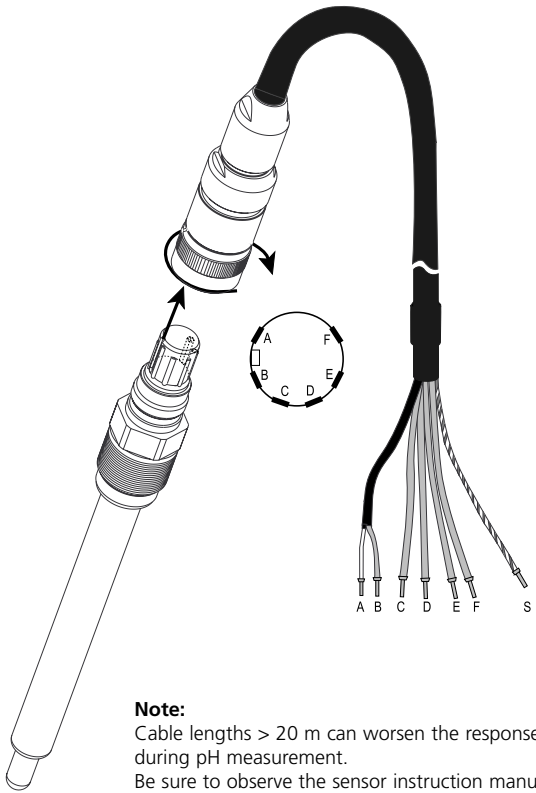
Division 2 wiring

FM

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

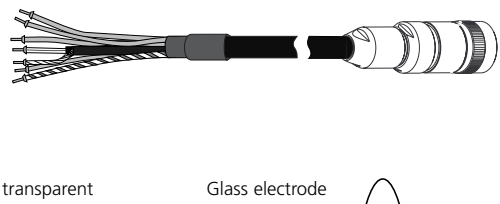
Connecting the VP cable

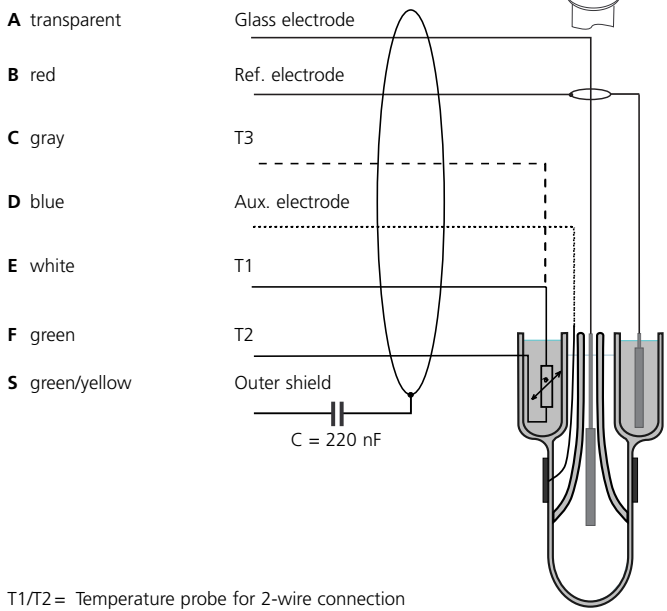
Connecting the sensor to the VP cable



Note:
Cable lengths > 20 m can worsen the response during pH measurement.
Be sure to observe the sensor instruction manual.

VP cable assignment

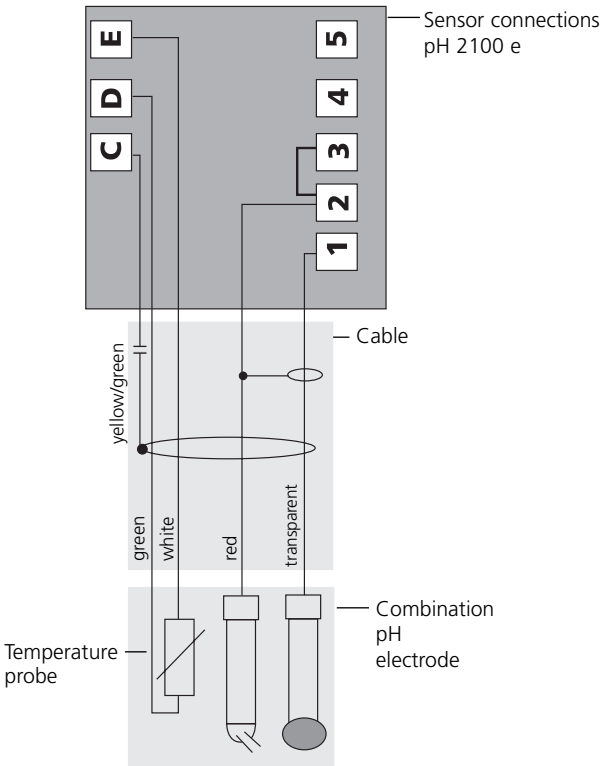




T1/T2 = Temperature probe for 2-wire connection
T1 = Additional connection for temperature probe (3-wire connection)

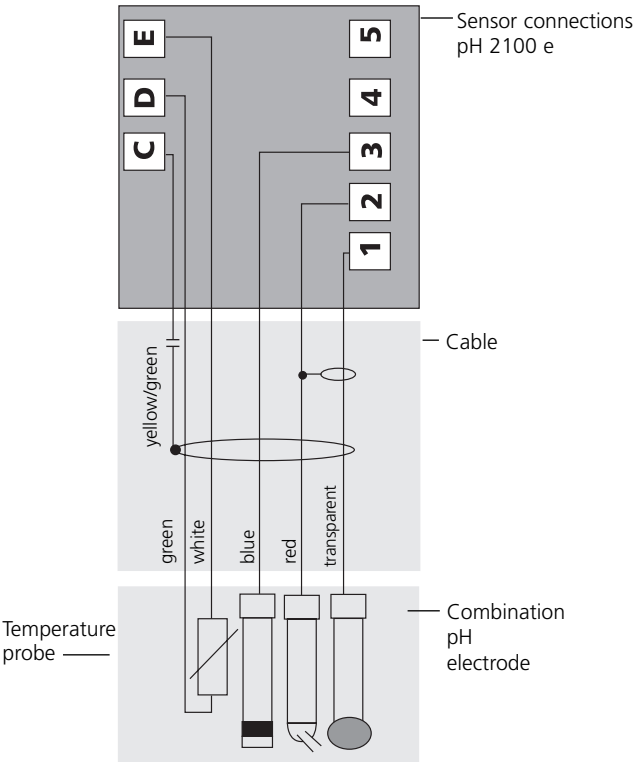
Typical wirings

Example 1:
pH measurement with monitoring of glass electrode
Connection with VP cable

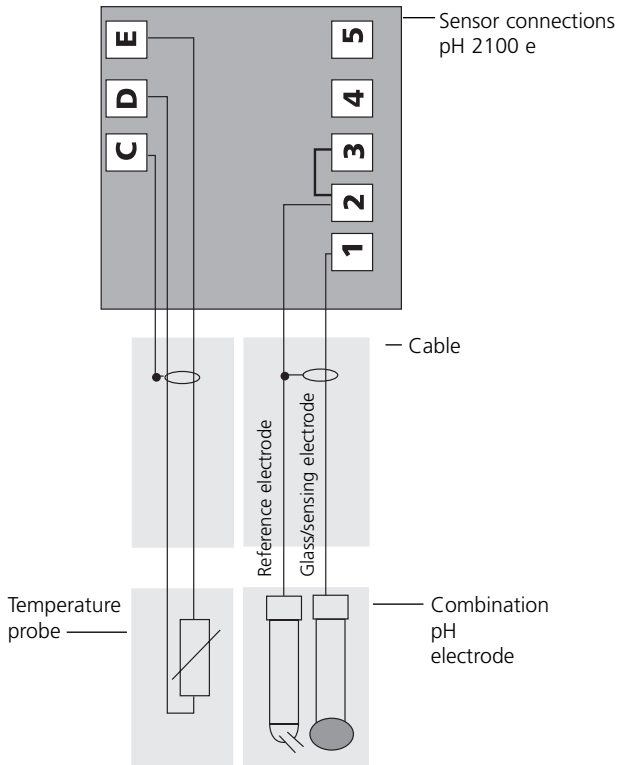


Typical wirings

Example 2:
pH measurement with monitoring of glass and reference electrode
Connection with VP cable

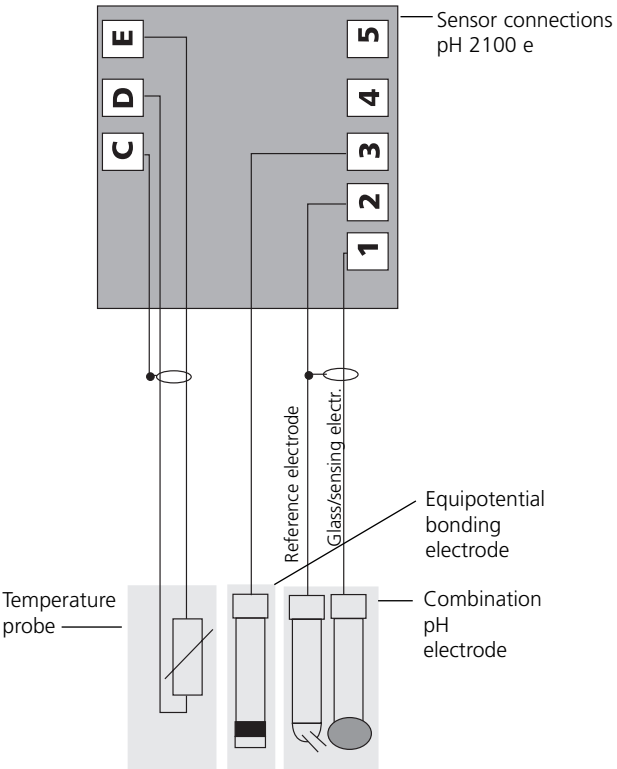


Example 3:
pH measurement with monitoring
of glass electrode

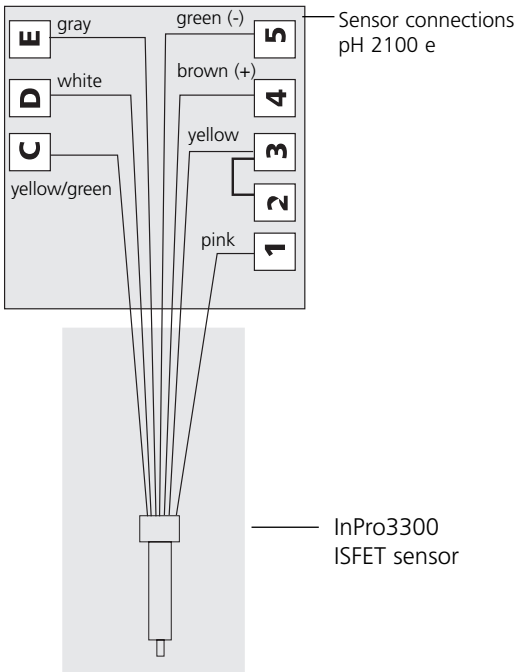


Typical wirings

Example 4:
pH measurement with monitoring
of glass and reference electrode

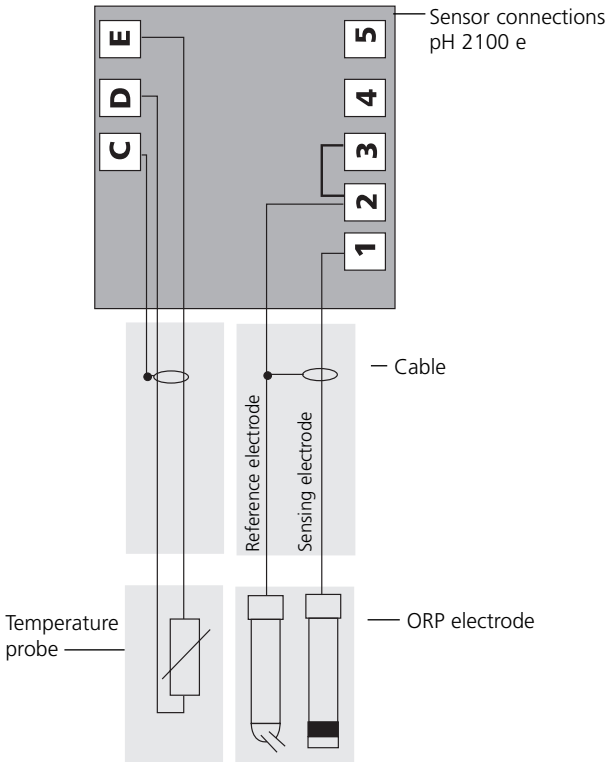


Example 5:
pH measurement with InPro3300 ISFET electrode
(For details see ISFET/Preamp Manual)

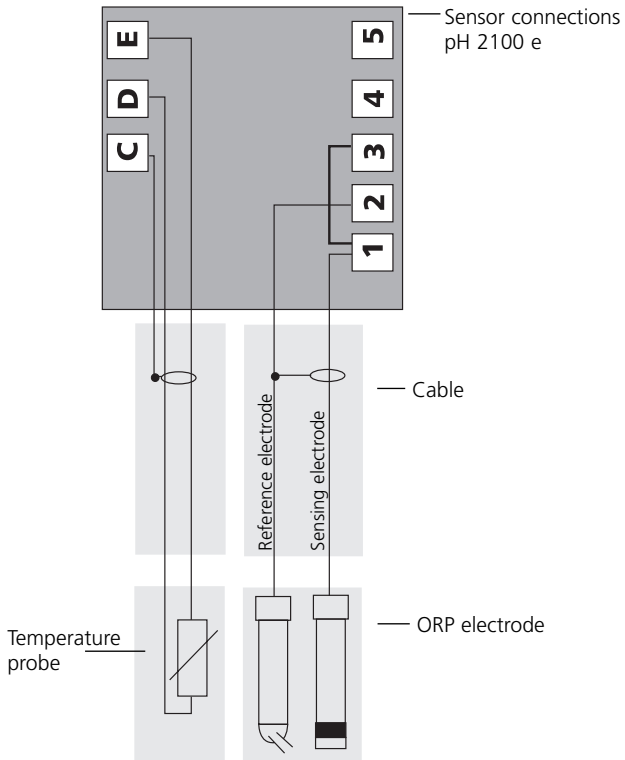


ORP wirings

Example 6:
ORP measurement without monitoring
of reference electrode



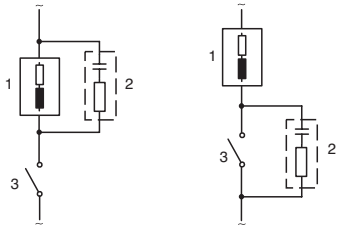
Example 7:
ORP measurement with monitoring of reference electrode



Protective wiring of switching outputs

Protective wiring of switching contacts

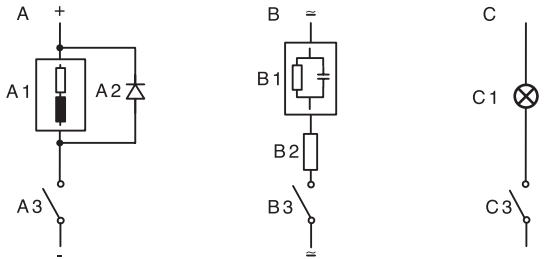
Relay contacts are subjected to electrical erosion. Especially with inductive and capacitive loads, the service life of the contacts will be reduced. For suppression of sparks and arcing, components such as RC combinations, nonlinear resistors, series resistors and diodes should be used.



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



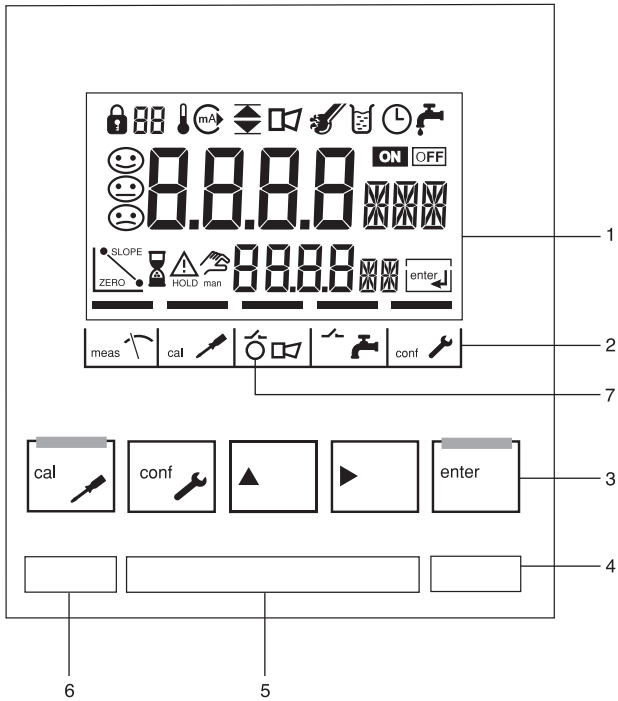
A: DC application with inductive load
B: AC/DC applications with capacitive load
C: Connection of incandescent lamps

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 and display

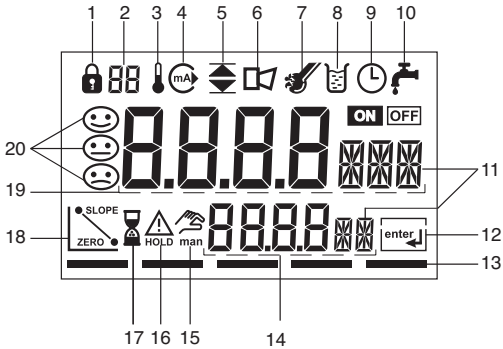
User interface



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



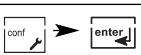
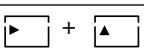
1 Mode code entry
2 Display of measured variable*
3 Temperature
4 Current output
5 Limit values
6 Alarm
7 Sensocheck
8 Calibration
9 Interval/response time
10 Wash contact
11 Measurement symbols
12 Proceed with **enter**
13 Bar for identifying the device status, above mode indicators, from left to right: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

	Start, end calibration
	Start, end configuration
	Select digit position (selected position flashes)
	Edit digit
	• Calibration: Continue in program sequence • Configuration: Confirm entries, next configuration step • Measuring mode: Display output current

	Cal Info, display of asymmetry potential and slope
	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, Pg 59).

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 features

Hold mode

Display: 

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 20 seconds have passed.

Configuration mode is also exited automatically 20 minutes after the last keystroke (timeout). The Transmitter returns to measuring mode.

Timeout is not active during calibration.

Behavior of output signal:

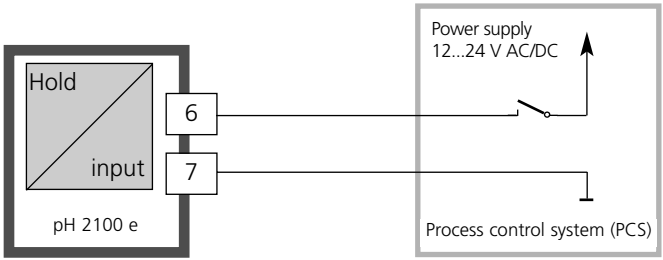
LAST: The output current is frozen at its last value. (Advisable for quick configuration changes.) The process should not change decisively during configuration/calibration. Changes are not noticed with this setting!

FIX: The output current is set to a value that is noticeably different from the process value in order to signal the control system that the Transmitter is being worked at.

For configuration, see Pg 47, 53.

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

Alarm

The alarm delay is configurable.
In the case of an error message, the alarm LED lights or flashes. Error messages can also be signaled by a 22 mA output current.

The alarm contact is activated by alarm and power failure, cf Pg 58.

The alarm LED on the front panel can be configured as follows:
HOLD off: Alarm: LED flashing
HOLD on: Alarm: LED on. HOLD: LED flashing.
(see Configuration, Pg 59).

Mode codes

The mode codes allow fast access to the functions.

Calibration

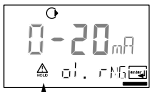
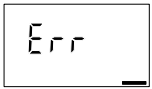
Key + Code	Description
cal 0000	**Cal Info** Display of asymmetry potential and slope
cal 1001	**Zero adjustment (ISFET)** Adjusting zero point (ISFET sensor only)
cal 1100	**Calibration** Adjustment of asymmetry potential and slope (electrode)
cal 1105	**Product calibration** Adjustment of asymmetry potential (product)
cal 1015	**Temp probe adjustment**

Configuration

Key + Code	Description
conf 0000	**Error Info** Display last error and erase
conf 1200	**Configuring**
conf 2222	**Sensor monitor** Display of uncorrected electrode potential (mV)
conf 7654	**Parameter set 1/2** Switchover
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

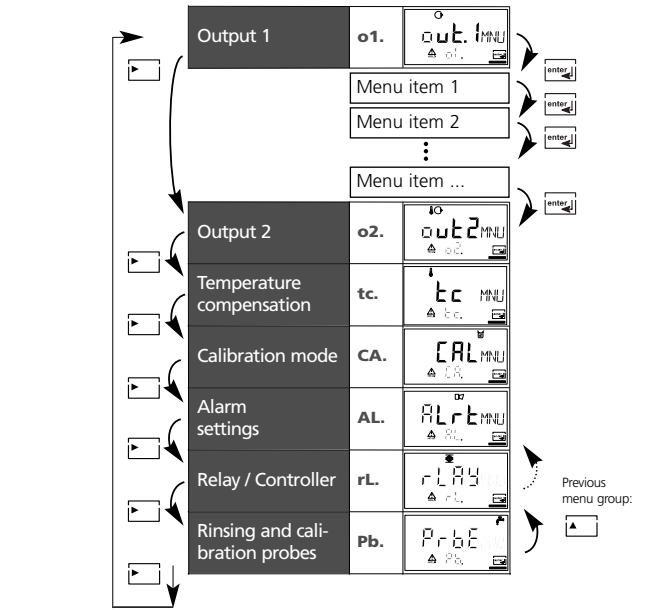
Configuration

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**, then **enter**.)
Hold During configuration the Transmitter remains in the Hold mode.	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. Red LED flashes when "HOLD ON" has been set.
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	pH / ORP
	Select electrode type	(GLAS EL / FEt EL)
	Select current range	0-20 mA / 4-20 mA
	Enter current start	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	Pt100/Pt1000/NTC30/NTC8.55
	Select current range	0-20 mA / 4-20 mA
	Enter current start	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
tc.	**Temperature compensation**	
tc.	Temp detection during meas	Auto/man (man: xxx.x °C)
	Temp detection during cal	Auto/man (man: xxx.x °C)
	Enter TC process medium	xx.xx %/K
CAL	**Calibration mode**	
CA.	Select calibration mode	BUF/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

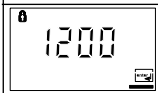
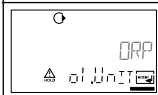
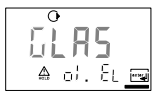
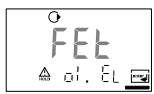
Configuration

Output 1

Select type of electrode. Measurement procedure.

Menu group	Code	Display	Select menu item
Output 1	o1.		Select measured variable
			Select electrode type
			Select 0-20 / 4-20 mA
			Enter current start
			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 (Press **conf**.)	
	 After correct input a welcome text is displayed for approx. 3 s	Enter mode code "1200" (Select position with ► key and edit number with ▲ key. When the display reads "1200", press **enter** to confirm.)	
		The Transmitter is in HOLD mode. (HOLD icon is on. Red LED flashes when "HOLD ON" has been set.)	
		Select measured variable pH/ORP Select with ► key Proceed with **enter**	**pH**/ORP
	 	Only with pH selected: Select electrode type: • Glass electrode • ISFET electrode Select with ► key Proceed with **enter**	**Glass** (FEt EL)

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

Configuration

Output 1

Output current range. Current start. Current end.

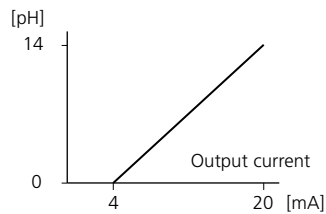
Menu group	Code	Display	Select menu item
Output 1	o1.		Select measured variable
			Select electrode type
			Select 0-20 / 4-20 mA
			Enter current start
			Enter current end
			Set output filter
			22 mA in the case of error
			Hold mode

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

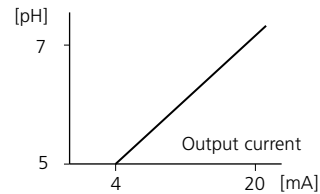
Code	Display	Action	Choices
o1.		Set output current range Select with ► key Proceed with **enter**	**4-20 mA** (0 - 20 mA)
		Current start Enter lower end of scale, depending on measured variable selected (pH or ORP) Select with ► key, edit number with ▲ key, proceed with **enter**	**pH -2 to 16** (-1500 mV to +1500mV, -1999 mV to +1999mV)
		Current end Enter upper end of scale, depending on measured variable selected (pH or ORP) Select with ► key, edit number with ▲ key, proceed with **enter**	**pH -2 to 16** (-1500 mV to +1500mV, -1999 mV to +1999mV)

Assignment of measured values: Current start and current end

Example 1: Range pH 0 – 14



Example 2: Range pH 5 – 7
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 electrode type
			Select 0-20 / 4-20 mA
			Enter current start
			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.		Time constant of output filter Default setting: 0 s (inactive). To specify a time constant: Select with ► key, edit number with ▲ key, proceed with **enter**	**0000 SEC** (0000 to 0120 SEC)

Time constant of output filter

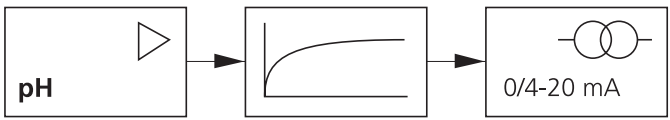
To smoothen the current output, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is 63 % after the time constant has been reached.

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

Configuration

Output 1

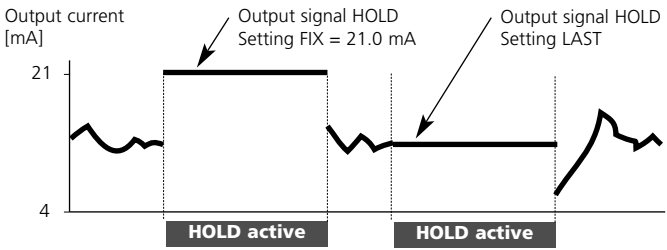
Output current during Error and HOLD.

Menu group	Code	Display	Select menu item
Output 1	o1.		Select measured variable
			Select electrode type
			Select 0-20 / 4-20 mA
			Enter current start
			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.		22 mA signal for error message Select with ► key Proceed with **enter**	**OFF** (ON)
		Output signal during HOLD LAST: During HOLD the last measured value is maintained at the output. FIX: During HOLD a value (to be entered) is maintained at the output. Select with ► key Proceed with **enter**	**LAST** (FIX)
	 	Only with FIX selected: Enter current which is to flow at the output during HOLD Select position with ► key and edit number with ▲ key Proceed with **enter**	**021.0 mA** (000.0 to 022.0 mA)

Output signal during HOLD:



Configuration

Output 2

Temperature unit and probe. Output current.

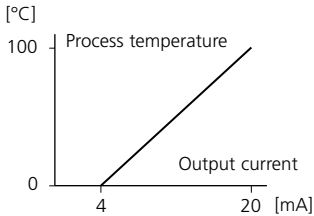
Menu group	Code	Display	Select menu item
Output 2	o2.		Select °C/°F
			Select temp probe
			Select 0-20 / 4-20 mA
			Enter current start
			Enter current end
			Set output filter
			22 mA for temp error
			Hold mode

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

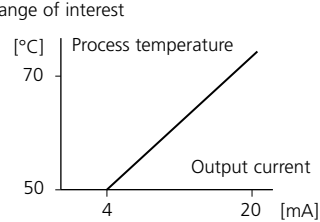
Code	Display	Action	Choices
o2.		Specify temperature unit Select with ► key Proceed with **enter**	**°C** (°F)
		Select temperature probe Select with ► key Proceed with **enter**	**Pt 100** (PT1000, NTC30, NTC8.55)
		Set output current range Select with ► key Proceed with **enter**	**4 - 20 mA** (0 - 20 mA)
		Current start: Enter lower end of scale. Select with ► key, edit number with ▲ key, proceed with **enter**	**000.0 °C** (xxx.x °C)
		Current end: Enter upper end of scale. Select with ► key, edit number with ▲ key, proceed with **enter**	**100.0 °C** (xxx.x °C)

Process temperature: Current start and current end

Example 1: Range 0 to 100 °C



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



Configuration

Output 2

Time constant of output filter.

Menu group	Code	Display	Select menu item
Output 2	o2.		Select °C/°F
			Select temp probe
			Select 0-20 / 4-20 mA
			Enter current start
			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 Default setting: 0 s (inactive). To specify a time constant: Select with ► key, edit number with ▲ key, proceed with **enter**	**0 SEC** (0000 - 0120 SEC)

Time constant of output filter

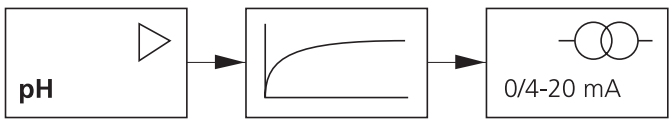
To smoothen the current output 2, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is 63 % after the time constant has been reached.

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!



Time constant 0 to 120 s

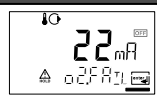
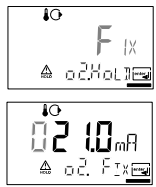
Configuration

Output 2

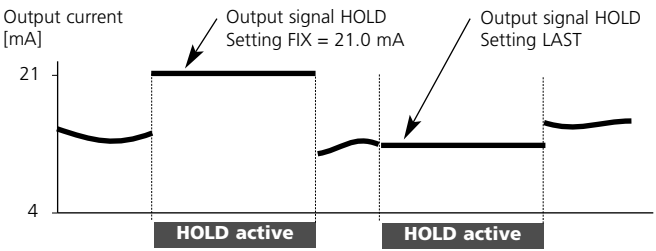
Temperature error. Output current during HOLD.

Menu group	Code	Display	Select menu item
Output 2	o2.		Select °C/°F
			Select temp probe
			Select 0-20 / 4-20 mA
			Enter current start
			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 Select with ► key. Proceed with **enter**	**OFF** (ON)
		Output signal during HOLD LAST: During HOLD the last measured value is maintained at the output. FIX: During HOLD a value (to be entered) is maintained at the output. Select with ► key. Proceed with **enter**	**LAST** (FIX)
		Only with FIX selected: Enter current which is to flow at the output during HOLD. Select position with ► key and edit number with key. Proceed with **enter**	**021.0 mA** (000.0 to 022.0 mA)

Output signal during HOLD:



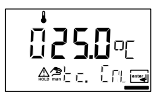
Configuration

Temperature compensation

Temp detection for meas/cal. TC process medium

Menu group	Code	Display	Select menu item
Temperature compensation	tc.		Temp during measurement Temp during calibration Enter TC process medium

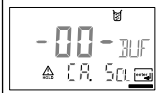
End:
Press **conf**, then **enter**

Code	Display	Action	Choices
tc.		Select temp detection during measurement (AUTO/MAN) **AUTO:** Temp detection with temperature probe **MAN:** Manual temp input Select with ► key Proceed with **enter**	**AUT** (MAN)
		Only with manual temp detection selected (MAN) Enter temperature. Select position with ► key and edit number with ▲ key. Proceed with **enter**	**25.0 °C** (xxx.x °C)
		Select temp detection during calibration (Auto/MAN) Select with ► key Proceed with **enter**	**AUT** (MAN)
		Only with manual temp detection selected (MAN) Enter temperature. Select position with ► key and edit number with ▲ key. Proceed with **enter**	**25.0 °C** (xxx.x °C)
		For pH measurement only: Enter temperature compensation of process medium Select position with ► key and edit number with ▲ key. Proceed with **enter**	**00.00 %/K** (xx.xx %/K)

Configuration
Calibration mode

Menu group	Code	Display	Select menu item
Calibration mode	CA.		Calibration mode Cal timer interval

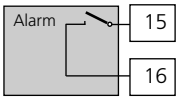
End:
Press **conf**, then **enter**

Code	Display	Action	Choices
CA.		For pH measurement only: Select calibration mode BUF: Calibration with Calimatic automatic buffer selection. To do so, you must select your buffer set: -01- BUF: Mettler-Toledo -02- BUF: Merck Titrisols, Riedel Fixanals -03- BUF: Ciba (94) -04- BUF: NIST technical buffers -05- BUF: NIST standard buffers -06- BUF: HACH buffers -07- BUF: WTW technical buffers	**-O1-BUF** (-02-BUF/ -03-BUF/ -04-BUF/ -05-BUF/ -06-BUF/ -07-BUF/ MAN/ DAT)
		MAN: Calibration with manual buffer entry	
		DAT: Entry of asymmetry potential and slope of premeasured electrodes Select with ► key Proceed with **enter**	
		Enter calibration interval: Entry of time interval within which the Transmitter is to be calibrated. With a time interval of 0000 hrs the calibration timer is not active. Select with ► key, edit number with ▲ key, proceed with **enter**	**0000 h** (0000 to 9999 h)

Configuration
Alarm settings

Menu group	Code	Display	Select menu item
Alarm settings	AL.	ALrt MNU	Select Sensocheck Delay LED in HOLD mode

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



Alarm contact

The alarm contact is closed during normal operation (N/C). It opens in the case of alarm or power outage. As a result, a failure message is provided even in the case of line breakage (fail-safe behavior).
For contact ratings, see Specifications.

Error messages can also be signaled by a 22 mA output current (see Pg 47, 53, 94).

The operating behavior of the alarm contact is shown on Pg 98.

The **alarm delay** acts on the LED, the 22 mA signal and the alarm contact.

Code	Display	Action	Choices
AL.		Select Sensocheck (continuous monitoring of glass and reference electrode) Select with ► key Proceed with **enter**	ON / **OFF**
		Alarm delay Select with ► key, edit number with ▲ key, proceed with **enter**	**0010 SEC** (0000 - 0600 SEC)
		LED in HOLD mode Select with ► key Proceed with **enter**	ON / **OFF**

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

Configuration
Limit function
Relay 1

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

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

Code	Display	Action	Choices
rL.	 	Use of relays: • Limit function (LiMIT) • Controller (CtROL) Select with ► key Proceed with **enter** **Note:** Selecting **CtROL** leads to Controller menu group **Ct.**	**LiMIT** (CtROL)
L1.		For Limit 1 function, see Pg 63. Select with ► key Proceed with **enter**	**Lo** (Hi)
		Limit 1 contact response N/C: normally closed contact N/O: normally open contact Select with ► key Proceed with **enter**	**N/C** (N/O)
		Limit 1 switching point Select with ► key, edit number with ▲ key, proceed with **enter**	**00.00 pH** (xx.xx pH / xxxx mV)
		Limit 1 hysteresis Select with ► key, edit number with ▲ key, proceed with **enter**	**00.50 pH** (xx.xx pH / xxxx mV)
		Limit 1 delay The contact is activated with delay (deactivated without delay) Select with ► key, edit number with ▲ key, proceed with **enter**	**0010 SEC** (0000 to 9999 SEC)

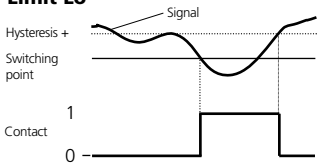
Configuration
Limit function
Relay 2

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

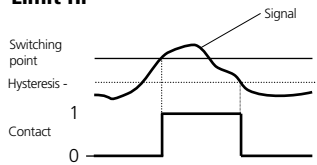
End:
Press **conf**, then **enter**

Code	Display	Action	Choices
L2.		Select Limit 2, see Fig. below. Select with ► key Proceed with **enter**	**Hi** (Lo)
		Limit 2 contact response N/C: normally closed contact N/O: normally open contact Select with ► key Proceed with **enter**	**N/C** (N/O)
		Limit 2 switching point Select with ► key, edit number with ▲ key, proceed with **enter**	**14.00 pH** (xx.xx pH / xxxx mV)
		Limit 2 hysteresis Select with ► key, edit number with ▲ key, proceed with **enter**	**00.50 pH** (xx.xx pH / xxxx mV)
		Limit 2 delay The contact is activated with delay (deactivated without delay) Select with ► key, edit number with ▲ key, proceed with **enter**	**0010 SEC** (0000 to 9999 SEC)

Limit Lo



Limit Hi



Configuration

Controller
(for description see Pg 90 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

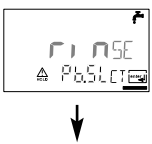
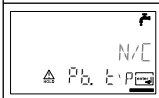
End:
Press **conf**, then **enter**

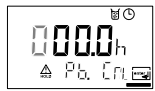
Code	Display	Action	Choices
Ct.		Setpoint Select with ► key, edit number with ▲ key, proceed with **enter**	**07.00 pH** (xx.xx pH / xxxx mV)
		Neutral zone (dead band) Select with ► key, edit number with ▲ key, proceed with **enter**	**01.00 pH** (xx.xx pH / xxxx mV)
		Controller: Proportional action Select with ► key, edit number with ▲ key, proceed with **enter**	**0100 %** (0010 to 9999 %)
		Controller: Integral (reset time): Select with ► key, edit number with ▲ key, proceed with **enter**	**0000 SEC** (xxxx SEC)
		Controller: Derivative (rate time) Select with ► key, edit number with ▲ key, proceed with **enter**.	**0000 SEC** (xxxx SEC)
		Pulse length /Pulse frequency Select with ► key Proceed with **enter**	**PLC** (PFC)
		PLC: Pulse length Select with ► key, edit number with ▲ key, proceed with **enter**	**0010 SEC** (0001 to 0600 SEC)
		PFC: Pulse frequency Select with ► key, edit number with ▲ key, proceed with **enter**	**0060/min** (0001 to 0180 /min)
		Behavior during HOLD Select with ► key Proceed with **enter**	**Y Last** (Y Off)

Configuration

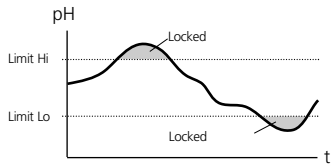
Control of rinsing and calibration probes

Menu group	Code	Display	Select menu item
Rinsing and calibration probes	Pb.		Rinsing/calibration probe Rinsing interval Rinse duration Contact response Cleaning interval Calibration interval

Code	Display	Action (rinsing probe)	Selection
Pb.		Control of: • Rinsing probe (rinse) • Calibration probe (EasyClean) Select with ► key Proceed with **enter**	**rinse** (EASYCLN) EASYCLN: see opposite page →
		Rinsing interval Select with ► key, edit number with ▲ key, proceed with **enter**	**000.0 h** (xxx.x h)
		Rinse duration Select with ► key, edit number with ▲ key, proceed with **enter**	**0060 SEC** (0000 to 1999 SEC)
		Contact type Select with ► key Proceed with **enter**	**N/C** (N/O)

Code	Display	Action (calibration probe)	Selection
Pb.		• Calibration probe (EasyClean) Select with ► key Proceed with **enter**	**EASYCLN** (rinse)
		Cleaning interval (EasyClean only) Select with ► key, edit number with ▲ key, proceed with **enter**	**000.0 h** (xxx.x h)
		Calibration interval (EasyClean only) Select with ► key, edit number with ▲ key, proceed with **enter**	**000.0 h** (xxx.x h)
		Lock cleaning (calibration) interval* **On**: The Transmitter only starts a cleaning (calibration) interval if the measured value lies within the tolerated range (Limit Lo/Limit Hi).	**Off** (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 61, 63)

Parameter set 1/2

Display	Action	Remark
	Switch between parameter sets Press **conf** key, enter code 7654 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.
		Welcome text is displayed for approx. 3 sec
	Select parameter set 1 or 2. Select with ► key Proceed with **enter**	
 	Since the complete device configuration is changed in one step, there is a security prompt (No/Yes). 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	Code. Parameter	Default setting
o1. pH/ORP unit	pH	rL. Relay function	Limit
o1. Electrode type	GLAS	L1. Contact function	Lo
o1. 0/4-20 mA	4-20 mA	L1. Contact response	N/C
o1. Current start	00.00 pH	L1. Switching point	00.00 pH
o1. Current end	14.00 pH	L1. Hysteresis	00.50 pH
o1. Filter time	0 s	L1. Delay	0010 s
o1. 22mA signal	OFF	L2. Contact function	Hi
o1. Hold behavior	Last	L2. Contact response	N/C
o1. Fix current	021.0 mA	L2. Switching point	14.00 pH
o2. Unit °C / °F	°C	L2. Hysteresis	00.50 pH
o2. Temp probe	Pt 100	L2. Delay	0010 s
o2. 0/4...20mA	4-20 mA	Ct. Setpoint	07.00 pH
o2. Current start	000.0 °C	Ct. Neutral zone	01.00 pH
o2. Current end	100.0 °C	Ct. P action	0100 %
o2. Filter time	0 s	Ct. I action	0000 s
o2. 22mA signal	OFF	Ct. D action	0000 s
o2. Hold behavior	Last	Ct. PLC/PFC controller	PLC
o2. Fix current	021.0 mA	Ct. Pulse length	0010 s
tc. TC measurement	Auto	Ct. Pulse frequency	0060 /min
tc. Measuring temp	025.0 °C	Ct. Hold behavior	Last
tc. TC calibration	Auto	Pb. EasyCLN/Rinse	rinse
tc. Calibration temp	025.0 °C	Pb. Rinsing interval	000.0 h
tc. TC medium	00.00 %/K	Pb. Rinse duration	0060 s
CA. Cal solution	-01-BUF	Pb. Contact type	N/C
CA. Cal interval	0000 h	Pb. Cleaning interval	000.0 h
AL. Sensocheck	OFF	Pb. Calibration interval	000.0 h
AL. Alarm delay	0010 s	Pb. Lock interval	Off
AL. LED Hold	off		

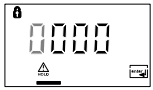
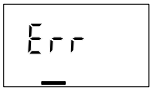
Parameter set – user settings

Code. Parameter	Setting	
o1. pH/ORP unit	_____	_____
o1. Electrode type	_____	_____
o1. 0/4-20 mA	_____	_____
o1. Current start	_____	_____
o1. Current end	_____	_____
o1. Filter time	_____	_____
o1. 22mA signal	_____	_____
o1. Hold behavior	_____	_____
o1. Fix current	_____	_____
o2. Unit °C / °F	_____	_____
o2. Temp probe	_____	_____
o2. 0/4...20mA	_____	_____
o2. Current start	_____	_____
o2. Current end	_____	_____
o2. Filter time	_____	_____
o2. 22mA signal	_____	_____
o2. Hold behavior	_____	_____
o2. Fix current	_____	_____
tc. TC measurement	_____	_____
tc. Measuring temp	_____	_____
tc. TC calibration	_____	_____
tc. TC medium	_____	_____
CA. Cal solution	_____	_____
CA. Cal interval	_____	_____
AL. Sensocheck	_____	_____
AL. Alarm delay	_____	_____
AL. LED Hold	_____	_____

Code. Parameter	Setting	
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	_____	_____
Pb. Rinsing interval	_____	_____
Pb. Rinse duration	_____	_____
Pb. Contact type	_____	_____
Pb. Cleaning interval	_____	_____
Pb. Calibration interval	_____	_____
Pb. Lock interval	_____	_____

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**, then **enter**.)
Hold During calibration the Transmitter remains in the Hold mode.	 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. Red LED flashes when "HOLD ON" has been set.
Input errors		The calibration parameters are checked 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).

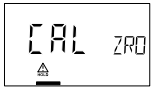
pH calibration
Calibration is used to adapt the device to the individual electrode characteristics, namely asymmetry potential and slope. Calibration can be performed with Calimatic automatic buffer recognition, with manual buffer input, by entering premeasured electrode data, or by sampling the product.
When using ISFET electrodes, you must adjust the zero point first. Then you can conduct either a one or a two-point calibration.

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.
- 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.

When using ISFET electrodes or electrodes with differing nominal zero the nominal zero point must be adjusted each time a new electrode is connected. This is important if you want to obtain reliable Sensoface messages.
The Sensoface messages issued during all further calibrations are based on this basic calibration.

Zero adjustment (ISFET)

Allows use of electrodes with differing nominal zero (pH only)

Display	Action	Remark
	Press **cal** key, enter code 1001 Select with ► key, edit number with ▲ key, proceed with **enter**	The Transmitter is in the Hold mode. If an invalid code is entered, the device returns to measuring mode.
	Ready for calibration The“CAL” and “enter” icons are flashing.	Display (3 s)
	Immerse electrode in a pH 7.00 buffer. Enter the temperature-corrected pH value in the range 6.50 to 7.50 using the arrow keys (see buffer table). Confirm with **enter**.	If the zero offset of the electrode is too large (> ± 200 mV), the CAL ERR error message is generated. In that case the electrode cannot be calibrated.
	Stability check: The measured mV value is displayed. The “hourglass” icon is flashing.	Note: Stability check can be stopped (by pressing **cal**). However, this reduces calibration accuracy.

Display	Action	Remark
	At the end of the adjustment procedure the zero offset [mV] (based on 25 °C) of the electrode is displayed. Proceed with **enter**.	This is not the final calibration value! Asymmetry potential and slope must be determined with a complete 2-point calibration (cal 1100) (see following pages).
	Security prompt. Display of pH value (alternately with Hold) and temperature, "enter" flashes, Sensoface is active. Place electrode in process. Press **enter** to end the zero point adjustment.	After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

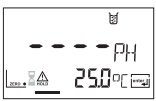
Information on zero adjustment

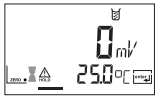
After having adjusted the nominal zero point, be sure to calibrate the electrode following one of the procedures as described on the next pages:

- Automatic calibration with Calimatic
- Manual calibration
- Data entry of premeasured electrodes

Automatic calibration with Calimatic (BUF -xx-) Temperature detection automatic or manual

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.

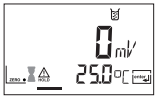
Display	Action	Remark
	Press **cal** key, enter code 1100. Select with ► key, edit number with ▲ key, proceed with **enter**	If an invalid code is entered, the Transmitter returns to measuring mode.
	Remove the electrode and temperature probe, clean them and immerse them in the first buffer solution (in any order). When "Manual temp detection" has been configured, enter value in the secondary display using the arrow keys. Start with **enter**.	Transmitter in Hold mode, measured value frozen. Sensoface inactive.
	Buffer recognition 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: The measured mV value is displayed.	To abort stability check: Press **cal**. (accuracy reduced)
	Calibration with the first buffer is terminated. Remove the electrode and temp probe from the first buffer solution and rinse them thoroughly.	
	• One-point calibration: End with **cal**. Slope [%] and asymmetry potential [mV] of the electrode are displayed. Proceed with **enter**.	For one-point calibration only: 
	• Two-point calibration: Immerse electrode and temperature probe in the second buffer solution. 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. Repeat calibration: **cal**, End calibration: **enter**.	Slope and asymmetry potential of electrode (related to 25 °C) are displayed.
	pH value and Hold are displayed alternately. Sensoface active, “enter” flashes. End with **enter**. Hold is deactivated after 20 s.	Security prompt.

Manual calibration
Temperature detection automatic or manual

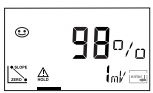
For calibration with manual buffer specification, you must enter the pH value of the buffer solution used in the Transmitter for the proper temperature. This presetting enables calibration with any desired buffer solution. The MAN calibration mode and the type of temperature detection are selected in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

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 and temperature probe, clean them and immerse them in the first buffer solution (in any order). When "Manual temp detection" has been configured, enter value in the secondary display using the arrow keys. Start with **enter**.	Transmitter in Hold mode, measured value frozen. Sensoface inactive.
	Enter the pH value of your buffer solution for the proper temperature. 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.

Display	Action	Remark
	Stability check: The measured mV value is displayed.	To abort stability check: Press **cal**. (accuracy reduced)
	Calibration with the first buffer is terminated. Remove the electrode and temp probe from the first buffer solution and rinse them thoroughly.	
	• One-point calibration: End with **cal**. Slope [%] and asymmetry potential [mV] of the electrode are displayed. Proceed with **enter**.	For one-point calibration only: 
	• Two-point calibration: Immerse electrode and temperature probe in the second buffer solution. Enter the pH value of the second buffer solution. 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. Repeat calibration: **cal**, End calibration: **enter**.	Slope and asymmetry potential of electrode (related to 25 °C) are displayed.
	pH value and Hold are displayed alternately. Sensoface active, "enter" flashes. End with **enter**. Hold is deactivated after 20 s.	Security prompt.

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 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 Start with **enter**.	Transmitter in Hold mode, measured value frozen. Sensoface inactive.
	Enter asymmetry potential [mV]. Select with ►, edit number with ▲, proceed with **enter**	
	Enter slope [%]. Select with ►, edit number with ▲, proceed with **enter**	
	The Transmitter displays the new slope and asymmetry potential (at 25 °C). Proceed with **enter**.	
	pH value and Hold are displayed alternately. Sensoface active, "enter" flashes. End with **enter**. 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

Product calibration

Calibration by sampling

During product calibration the electrode remains in the process. The measurement process is only interrupted briefly.

Procedure: During sampling the currently measured value is stored in the Transmitter. The Transmitter immediately returns to measuring mode. The calibration mode indicator flashes and reminds you that calibration has not been terminated.

The sample is measured in the lab or directly on the site using a portable meter. To ensure an exact calibration, the sample temperature should correspond to the measured process temperature. The sample value is then entered in the Transmitter. From the difference between the stored measured value and entered sample value, the Transmitter calculates the new asymmetry potential (one-point calibration).

If the sample is invalid, you can take over the value stored during sampling. In that case the old calibration values are stored. Afterwards, you can start a new product calibration.

Display	Action	Remark
	Product calibration, step 1: Press **cal** key, enter code 1105 (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. Proceed with **enter**	Now the sample can be measured in the lab.

Display	Action	Remark
	Measuring mode: 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: When the sample value has been determined, call up the product calibration once more (**cal**, code 1105).	Display (approx. 3 sec)
	Enter lab value. The new asymmetry potential is calculated.	
	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"; Sensoface active, "enter" flashes. End with **enter**.	After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

ORP calibration

ORP calibration standardizes the electrode potential to the reference system used. The electrode potential is determined using a redox buffer solution. The desired value for the reference electrode is entered in the Transmitter for the proper temperature.
ORP calibration mode is automatically preset when ORP measurement is configured.

$mV_{ORP} = mV_{meas} + \Delta mV$

mV_{ORP} = displayed ORP
mV_{meas} = direct electrode potential
ΔmV = delta value, calculated during calibration

Temperature dependence of commonly used reference systems

Temperature [°C]	Ag/AgCl/KCl 1 mol/l [ΔmV]	Ag/AgCl/KCl 3 mol/l [ΔmV]	Thalamid [ΔmV]	Mercury sulfate [ΔmV]
0	249	224	-559	672
10	244	217	-564	664
20	240	211	-569	655
25	236	207	-571	651
30	233	203	-574	647
40	227	196	-580	639
50	221	188	-585	631
60	214	180	-592	623
70	207	172	-598	613
80	200	163	-605	603

Display	Action	Remark
	Activate calibration (Press **cal**). Enter mode 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 and temperature probe, clean them and immerse them in the redox buffer.	Display (approx. 3 sec) The Transmitter is in Hold mode.
	Enter desired value for redox buffer. (Secondary display: Electrode potential displayed for approx. 6 s.) Select with ► key, edit number with ▲ key, proceed with **enter.**	After approx. 6 sec the secondary display shows the measured temperature.
	Display of electrode data (delta value) Proceed with **enter**. Rinse electrode and temperature probe and reinstall them.	"Zero" and "enter" icons are flashing, Sensoface is active.
	The measured ORP value [mV] is shown in the main display alternately with "Hold", Sensoface active, "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.

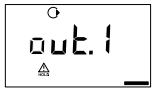
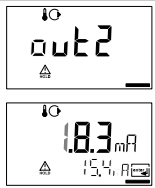
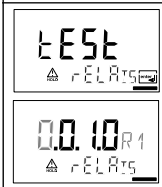
Measurement

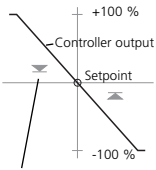
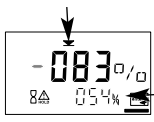
Display	Remark
	In the measuring mode the main display shows the configured process variable (pH or ORP [mV]), the secondary display shows the temperature. During calibration you can return to measuring mode by pressing the **cal**, during configuration by pressing **conf**. (Waiting time for meas. value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

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

Diagnostics functions

These functions are used for testing the connected peripherals.

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

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

Controller functions

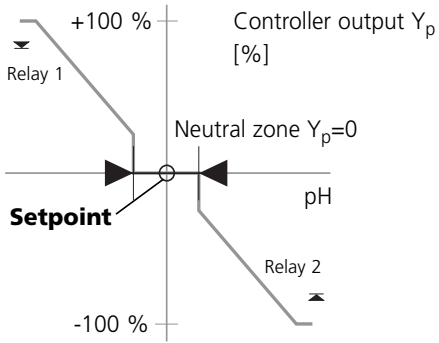
PID controller

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

$Y_P = \frac{\text{Setpoint - Meas. value}}{\text{Constant}} * K_C$

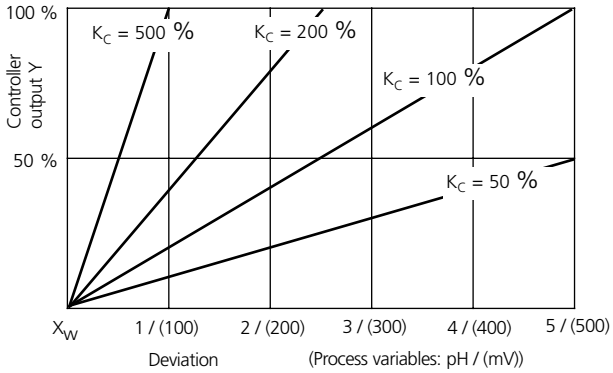
with:

Y_P	Proportional action
T_R	Reset time [s]
T_D	Rate time [s]
K_C	Controller gain [%]
Constant	5 (for pH)
	500 mV (for ORP)

Neutral zone (Y=0)

Tolerated deviation from setpoint.
The setting "1pH", for example, permits a deviation of ± 0.5 pH from the desired value without activating the controller.

Proportional action (Gradient K_C [%])



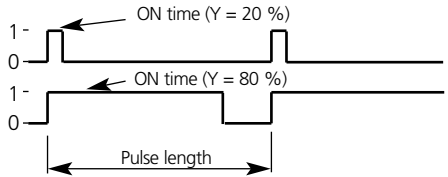
Controller functions

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.

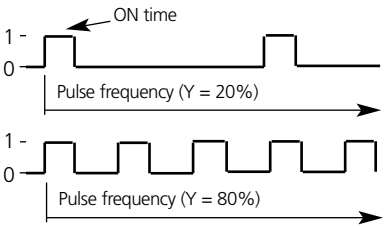
Output signal (switching contact)of pulse length controller



Pulse frequency controller (PFC)

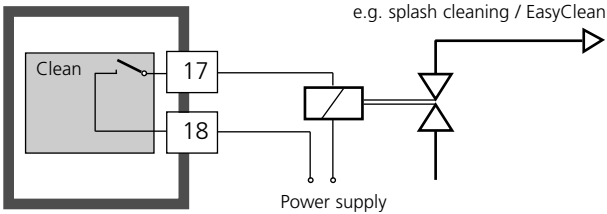
The pulse frequency controller is used to operate a frequency-controlled actuator. It varies the frequency with which the contacts are switched on. The maximum pulse frequency [pulses/min] can be defined. It depends on the actuator.
The contact ON time is constant. It is automatically calculated from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

Output signal (switching contact) of pulse frequency controller



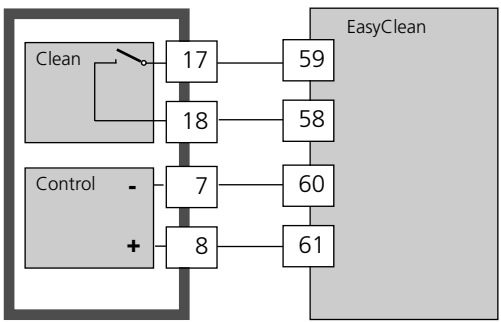
Connecting a rinsing system

The "Clean" contact can be used to connect a simple splash cleaning system. Rinse duration and rinsing interval are defined during configuration (Pg 66).



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 67).
Also see EasyClean Manual.



Error messages (Error Codes)

Error	Display	Problem Possible causes	Alarm contact	Red LED	Out 1 (22 mA)	Out 2 (22 mA)
ERR 01	Measured value flashes	**pH electrode** • Electrode defective • Too little electrolyte in electrode • Electrode not connected • Break in electrode cable • Incorrect electrode connected • Measured pH value < -2 or > 16 • Measured ORP value < -1999 mV or > 1999 mV	x	x	x	
ERR 02	Measured value flashes	**Redox electrode** • Electrode defective • Electrode not connected • Break in electrode cable • Incorrect electrode connected • Electrode potential < -1500 mV • Electrode potential > 1500 mV	x	x	x	
ERR 98	"Conf" flashes	**System error** Configuration or calibration data defective; completely reconfigure and recalibrate the device. Memory error in device program	x	x	x	x
ERR 99	"FAIL" flashes	**Factory settings** EEPROM or RAM defective 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 (flash-ing)	Problem Possible causes	Alarm contact	Red LED	Out 1 (22 mA)	Out 2 (22 mA)
ERR 03		**Temperature probe** Open or short circuit Temperature range exceeded	x	x	x	x
ERR 11		**Current output 1** Current below 0 (3.8) mA	x	x	x	
ERR 12		**Current output 1** Current above 20.5 mA	x	x	x	
ERR 13		**Current output 1** Current span too small / too large	x	x	x	
ERR 21	 	**Current output 2** Current below 0 (3.8) mA	x	x		x
ERR 22		**Current output 2** Current above 20.5 mA	x	x		x
ERR 23		**Current output 2** Current span too small / too large	x	x		x
ERR 41 **ERR 42**		**Rinsing probe**: Communication Calibration error	x	x	x	x
ERR 33 **ERR 34**		**Sensocheck**: Glass electrode Reference electrode	x	x	x	Sensoface active
		• Zero error, Sensoface active, see Pg 100				
		• Slope error, Sensoface active, see Pg 100				
		• Response time exceeded, Sensoface active, see Pg 100				
		• Cal interval expired, Sensoface active, see Pg 100				

Error messages (during calibration)

Symbol flashes:	Problem Possible causes
	**Asymmetry potential out of range (±60 mV)** • Electrode worn out • Buffer solution contaminated • Buffer does not belong to configured buffer set • Temperature probe not immersed in buffer solution (for automatic temp compensation) • Wrong buffer temperature selected (for manual temperature specification) • Nominal electrode zero point ≠ pH 7
	**Electrode slope out of range (80 – 103 %)** • Electrode worn out • Buffer solution contaminated • Buffer does not belong to configured buffer set • Temperature probe not immersed in buffer solution (for automatic temp compensation) • Wrong buffer temperature set (for manual temperature specification) • Electrode used has different nominal slope
	**Problems during recognition of the buffer solution** • Same or similar buffer solution was used for both calibration steps • Buffer solution used does not belong to buffer set currently configured in the device

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

Operating states

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 (cal) 0000	■	■	■	■	■	■		20 s
Error Info (conf) 0000	■	■	■	■	■	■		20 s
Calibration (cal) 1100	■	■	■				▨	
Temp adjustment (cal) 1015	■	■	■				▨	

Explanation:

■ active

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

▨ LED flashes during HOLD (configurable)

Operating state	Out 1	Out 2	Rel.1/2 Controller	Rel.1/2 Limit value	Cleaning contact	Alarm contact	LED	Time out
Product calibration Step 1 (**cal**) 1105 Step 2 (**cal**) 1105	■ ■	■ ■	■ ■	■	■	■	▨	
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	■	■	■				▨	

Sensoface

(Sensocheck must have been activated during configuration.)

The 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. 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. The calibration interval has been exceeded.
	Electrode defective	Check the electrode and its connections (also see error messages Err 33 and Err 34, Page 95).

Appendix

Product line and accessories

Devices	Order No.
pH Transmitter 2100 e	52 121 102

Mounting accessories

Pipe-mount kit	52 120 741
Panel-mount kit	52 120 740
Protective hood	52 120 739

Sensors

Mettler-Toledo GmbH, Process Analytics offers a wide range of pH and ORP electrodes and ISFET sensors for the following fields of applications:

- Chemical process industry
- Pharmaceutical industry
- Food and beverage industry
- Water/waste-water

For more information concerning our sensors and housings program, please refer to http://www.mtpro.com.

Specifications

pH/mV input Input for pH or ORP electrodes or ISFET sensors

Measurement range		-1500 to +1500 mV
Display range	pH value	-2.00 to 16.00
	ORP	-1999 to +1999 mV
Glass electrode input[1)]		
Input resistance		> 0.5 x 10^{12} Ohms
Input current		< 2 x 10^{-12} A
Reference electrode input[1)]		
Input resistance		> 1 x 10^{10} Ohms
Input current		< 1 x 10^{-10} A
Meas. error[1,2,3)]		
pH value		< 0,02
mV value		< 1 mV

Electrode standardization pH [*)] pH calibration

Operating modes

BUF		
Buffer sets	Calibration with automatic buffer recognition	
	Calimatic:	
	-01-	Mettler-Toledo 2.00/4.01/7.00/9.21
	-02-	Merck/Riedel de Haen 2.00/4.00/7.00/9.00/12.00
	-03-	Ciba (94) 2.06/4.00/7.00/10.00
	-04-	NIST technical 1.68/4.00/7.00/10.01/12.46
	-05-	NIST standard 1.680/4.008/6.865/9.184
	-06-	HACH 4.00/7.00/10.18
	-07-	WTW technical buffers 2.00/4.01/7.00/10.00
MAN	Calibration with manual entry of individual buffer values	
DAT	Data entry of premeasured electrodes	

Zero point adjustment	±200 mV
Max. calibration range	Asymmetry potential: ±60 mV Slope: 80 to 103 % (47.5 to 61 mV/pH)
Sensor standardization ORP *)	ORP calibration
Max. calibration range	-700 to +700 ΔmV
Cal timer	0000 to 9999 h
Sensocheck	Automatic monitoring of glass and reference electrode (can be disabled)
Sensoface	Provides information on the electrode condition. Evaluation of zero/slope, response, calibration interval, Sensocheck
Temperature input *)	Pt100 / Pt1000 / NTC 30 kOhms / NTC 8.55 kOhms 2-wire connection, adjustable
Measurement range	Pt 100/Pt 1000: -20.0 to +200.0 °C (-4 to +392 °F) NTC 30 kOhms - 20.0 to +150.0 °C (-4 to +302 °F) NTC 8.55 kOhms -10.0 to +130.0 °C (+14 to +266 °F)
Adjustment range	10 K
Resolution	0.1 °C / 1 °F
Meas. error [1,2,3)]	< 0.5 K (< 1 K for Pt100; <1K for NTC >100°C)
Temp compensation of process medium	Linear –19.99 to +19.99 %/K (reference temp 25 °C)

Specifications

HOLD input	Galv. separated (OPTO coupler)
Function	Switches device to HOLD mode
Switching voltage	0 to 2 V (AC/DC) inactive 10 to 30 V (AC/DC) active
CONTROL input	Galv. separated (OPTO coupler)
Function	Control input for automatic cleaning/ calibration system
Switching voltage	0 to 2 V (AC/DC) inactive 10 to 30 V (AC/DC) active
Output 1	0/4 to 20 mA, max. 10 V, floating (galv. connected to output 2)
Measured variable *)	pH or mV value
Overrange*)	22 mA in the case of error messages
Output filter*)	Low-pass, filter time constant 0 to 120 s
Meas. error 1)	< 0.3 % current value + 0.05 mA
Start/end of scale	As desired within range for pH or mV
Adm. span	pH 2.00 to 18.00 / 200 to 3000 mV
Output 2	0/4 to 20 mA, max. 10 V, floating (galv. connected to output 1)
Process variable	Temperature
Overrange *)	22 mA in the case of temp error messages
Output filter *)	Low-pass, filter time constant 0 to 120 s
Meas. error 1)	< 0.3 % current value + 0.05 mA
Start/end of scale *)	20 to 200 °C / -4 to 392 °F
Adm. span	20 to 220 K (36 to 396 °F)
Power output	for operating an ISFET adapter +3 V (V_0 = 2.9 to 3.1 V / R_i = 360 Ω –3 V (V_0 = -4.8 to –3.,7 V / R_i = 360 Ω
Alarm contact	Relay contact, floating
Contact ratings	AC< 250 V / < 3 A / < 750 VA DC< 30 V / < 3 A / < 90 W
Contact response	N/C (fail-safe type)
Alarm delay	0000 to 0600 s

Limit values	Output via relay contacts R1, R2 Contacts R1, R2 floating, but inter-connected
Contact ratings	AC< 250 V / < 3 A / < 750 VA DC< 30 V / < 3 A / < 90 W
Contact response *)	N/C or N/O
Delay *)	0000 to 9999 s
Switching points *)	As desired within range
Hysteresis *)	00.00 to 05.00 pH units / 0000 to 0500 mV
PID process controller	Output via relay contacts R1, R2 (see limit values) (Relay R1 base valve, relay R2 acid valve)
Setpoint specification *)	pH -02.00 to 16.00 / -1500 to +1500 mV
Neutral zone *)	pH 00.00 to 05.00 / 0000 to 0500 mV
Proportional action *)	Controller gain K_C: 0010 ... 9999 %
Integral action *)	Reset time T_R: 0000 ... 9999 s (0000 s = no integral action)
Derivative action *)	Rate time T_D: 0000 ... 9999 s (0000 s = no derivative action)
Controller type *)	Pulse length controller or pulse frequency controller
Pulse period *)	0001 to 0600 s, min. ON time 0.5 s (pulse length controller)
Max. pulse frequency *)	0001 to 0180 min-1 (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 to 999.9 h (000.0 h = cleaning function switched off)
Cleaning time *)	0000 to 1999 s
Calibration interval *)	000.0 to 999.9 h
Cleaning interval *)	000.0 to 999.9 h

Specifications

Display	LC display, 7-segment with icons
Main display	Character height 17 mm, unit symbols 10 mm
Secondary display	Character height 10 mm, unit symbols 7 mm
Sensoface	3 status indicators (friendly, neutral, sad Smiley)
Mode indicators	5 status bars: "meas", "cal", "alarm", "cleaning", "config" 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 specifiable for output 1 and 2 (00.00 to 22.00mA)
Manual controller	Controller output entered directly (start of control process)
Device self-test	Automatic memory test (RAM, FLASH, EEPROM)
Display test	Display of all segments
Last Error	Display of last error occurred
Sensor monitor	Display of direct, uncorrected sensor signal (electrode)
Relay test	Manual control of the four switching contacts
Parameter sets *)	Two selectable parameter sets for different applications
Data retention	Parameters and calibration data > 10 years (EEPROM)

Protection against electrical shock	Protective separation of all extra-low-voltage circuits against mains by double insulation as per EN 61010-1
Power supply	24 (-15%) to 230 V AC/DC (+10%); approx. 5 VA, 2.5 W AC: 45 to 65 Hz; Overvoltage category II, Class II

Nominal operating conditions

Ambient temperature	-20 to +55 °C
Transport/Storage temp	-20 to +70 °C
Relative humidity	10 to 95 % not condensing
Power supply	24 (-15%) to 230 V AC/DC (+10%)
Frequency for AC	45 to 65 Hz

EMC	EN 61326
Emitted interference	Class B (residential environment) Class A for mains supply > 60 V DC
Immunity to interference	Industrial environment

Explosion protection

FM:	NI Class I Div 2 Group A, B, C & D, T4 Ta = 55 °C; Type 2 NI Class I Zone 2 Group IIC, T4 Ta = 55°C; Type 2
CSA:	Class I Div 2 Groups A, B, C and D, T4 Ex nA IIC T4

Enclosure	Molded enclosure made of PBT (polybutylene terephtalate)
Color	Bluish gray RAL 7031
Assembly	• Wall mounting • Pipe mounting: dia 40 to 60 mm, □ 30 to 45 mm • Panel mounting, cutout to DIN 43 700 Sealed against panel
Dimensions	H 144 mm, B 144 mm, T 105 mm
Ingress protection	IP 65 / NEMA 4X
Cable glands	3 breakthroughs for cable glands M20x1.5 2 breakthroughs for NPT 1/2 " or 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

CSA INTERNATIONAL

Certificate of Compliance

Certificate: 220331

Project: 1430364 **Date Issued:** May 14, 2003

Issued to: **Mettler-Toledo GmbH**
Im Hackacker 15
Urdorf, 8902
SWITZERLAND
Attention: Mr. Alfred Peer

The products listed below are eligible to bear the CSA Mark shown

Issued by: Pocholo Laforteza

Authorized by: Nick Alfano
Operations Manager

PRODUCTS

Class 2258 02 PROCESS CONTROL EQUIPMENT - For Hazardous Locations

Class I, Division 2, Groups A, B, C and D
Ex nA IIC T4

2100e pH Transmitter, 5100e CO2 Transmitter, 4100e O2 Transmitter, 7100e Cond Transmitter, 7100e Cond Ind Transmitter and 4100ppb Oxy (trace elements) Transmitter, conduit connected, rated Input 24-230V ac/dc -15%/+10%, 45 to 65 Hz, 6VA; four sets of relay contacts 250V ac, 3.0 amps or 120Vdc, 3.0 amps, milliamp outputs rated 0 to 20 mA (with 130Vac/dc isolation), and other signal circuits all SELV including sensor connection which provides non-incendive connections to one of the following sensor type: InPro 3200, 4250, 6800, 6900, CO_2, 7000, 7100 and 7200 using maximum 3.2 metres of cable. (Refer to control drawing 194.130-240). Operating ambient: -20 to 55°C, installation category II, pollution degree 2. Type 2 enclosure. Temperature Code T4.

DQD 507WD 2002/04/30

Warnings and notes to ensure safe operation

Warning: Do not disconnect equipment unless power has been switched off.
Warning: Clean only with antistatic moistened cloth.
Warning: Substitution of components may impair suitability for hazardous locations.

- The equipment shall be installed and protected from mechanical impact and ultraviolet (UV) sources.
- Clean only with a moistened antistatic cloth as potential electrostatic hazard may exist. Service equipment only with conductive clothing, footwear and personal grounding devices to prevent electrostatic accumulation.
- Internal grounding provisions shall be provided for field wiring. Bonding between conduit shall be provided during installation, and all exposed non-current carrying metallic parts shall be bonded and grounded.
- Installation in a Class I, Division 2 or Class I, Zone 2 hazardous location shall be in accordance with the Canadian Electrical Code (CEC Part 1) Section 18 Division 2 wiring methods.
- The equipment shall have a switch or circuit breaker in the building installation (that is in close proximity to the equipment) that is marked as the disconnect switch.
- The enclosure Type 2 is only for indoor use.
- The mains supply voltage fluctuations should not exceed -15/+10 percent of the nominal supply voltage.
- Do not use the equipment in a manner not specified in this documentation.
- **Caution:** Use supply wires suitable for 30 °C above ambient and rated at least 250 V.
- **Caution:** Use signal wires suitable for at least 250 V.

SPECIAL INSTRUCTIONS FOR FIELD REPRESENTATIVES
None

Hazardous Location

Class I Divison 2, Groups A, B, C, D T4
Ex nA IIC T4 CSA 02.1342049X

Enclosure Type 2, Tamb = - 20 °C to + 55 °C

Installation category II, pollution degree 2

pH/ORP measuring circuit or
CO_2 measuring circuit
(Terminals KL. 1, 2, 3, KL. C)
maximum values: V_{oc} = 10 V C_a = 20 µF
I_{sc} = 12 mA L_a = 1 H
P_o = 15 mW

DF supply circuit
(Terminals KL. 3, 4, 5)
maximum values: V_{oc} = 10 V C_a = 20 µF
I_{sc} = 14 mA L_a = 1 H
P_o = 35 mW

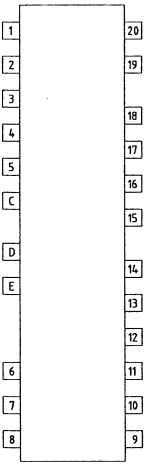
or DO measuring circuit or
DO measuring circuit (trace elements)
(Terminals KL. 1, 2, 3, 4, 5, KL. C)
maximum values: V_{oc} = 10 V C_a = 20 µF
I_{sc} = 17 mA L_a = 1 H
P_o = 22 mW

or Cond measuring circuit
(Terminals KL. 1, 2, 3, 4, 5)
maximum values: V_{oc} = 10 V C_a = 20 µF
I_{sc} = 112 mA L_a = 8 mH
P_o = 140 mW

or Condl measuring circuit
(Terminals KL. 1, 2, 3, 4, 5)
maximum values: V_{oc} = 7.1 V C_a = 100 µF
I_{sc} = 72 mA L_a = 20 mH
P = 128 mW

Temp measuring circuit
(Terminals KL. D, KL. E)
maximum values: V_{oc} = 5 V C_a = 1000 µF
I_{sc} = 10 mA L_a = 1 H
P_o = 13 mW

OK inputs HOLD, CONTROL
(Terminals KL. 6, 7 and 8, 7)
maximum values: V_{max} = 30 V C_i = 0
I_{max} = no limitation L_i = 0



TERMINALS 1, 2, 3, 4, 5, C, D, E:
NON-INCENDIVE FIELD WIRING CONNECTIONS FOR CLASS I, DIVISION 2, GROUPS A, B, C, D

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISON 2, GROUPS A, B, C, D
OR NON-HAZARDOUS LOCATIONS ONLY

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISON 2

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMEMT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS

AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

WARNING - CLEAN ONLY WITH A MOISTENED ANTISTATIC CLOTH AS POTENTIAL ELECTROSTATIC HAZARD MAY EXIST. SERVICE EQUIPMENT ONLY WITH CONDUCTIVE CLOTHING, FOOTWEAR AND PERSONAL GROUNDING DEVICES TO PREVENT ELECTROSTATIC ACCUMULATION.

WARNING - INTERNAL GROUNDING PROVISIONS SHALL BE PROVIDED FOR FIELD WIRING. BONDING BETWEEN CONDUIT SHALL BE PROVIDED DURING INSTALLATION, AND ALL EXPOSED NON-CURRENT CARRYING METALLIC PARTS SHALL BE BONDED AND GROUNDED.

THE EQUIPMENT SHALL BE INSTALLED AND PROTECTED FROM MECHANICAL IMPACT AND ULTRAVIOLET (UV) SOURCES.

Transmitter 2100 e, 4100 e, 4100 ppb, 5100 e, 7100 e

pH 2100 e	one pH/ORP input with DF supply circuit
CO_2 5100 e	one CO_2 input
O_2 4100 e	one DO input
O_2 4100 ppb	one DO input (measurement of trace elements)
Cond 7100 e	one Conductivity input for 2-/4-electrode sensors
Cond Ind 7100 e	one Conductivity input for electrodeless conductivity sensors

Power supply circuit
(Terminals Kl. 19, 20)
24 to 230 V AC/DC -15% / +10 %
45 to 65 Hz

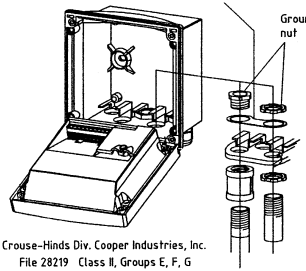
Switching circuits
ALARM and CLEAN
(Terminals KL. 15, 16 and 17, 18)
maximum values:
AC: < 250 V / < 3 A / <750 VA / resistive load
DC: < 30 V / < 3 A / < 90 W / resistive load

Switching circuits
REL. 1 and REL. 2
(Terminals KL. 12, 13 and 14, 13)
maximum values:
AC: < 250 V / < 3 A / <750 VA / resistive load
DC: < 30 V / < 3 A / < 90 W / resistive load

Output circuits
OUT 1 and OUT 2
(Terminals KL. 9, 10 and 11, 10)
maximum values:
V_{oc} = 10 V C_a = 10 µF
I_{sc} = 22 mA L_a = 100 mH
P_o = 220 mW

Conduit mounting:

Place washer between enclosure and nut



Crouse-Hinds Div. Cooper Industries, Inc.
File 28219 Class II, Groups E, F, G
HUB BASIC SCRU-TITE: ST-1, STA-1
GROUND HUB: SSTG-1, STG-1, STAG-1
GROUND NUT: STGN-1, STAGN-1
FILE 13046 Class I, Zone 1, Ex e II; IP 66
GROUND HUB BASIC SCRU-TITE: STGK-1, SSTGK-1

Appleton
FILE 208042 Class II, Groups E, F, G
HUBG-50D, HUBL-50D

Thomas & Betts Corporation
FILE 23086 Class I, Div 2
Hub: 370AL, 370
Grounding Bushing: 3870

Installation in a Class I, Division 2 or Class I, Zone 2 hazardous locations shall be in accordance with the Canadian Electrical Code C22.1 Section 18 Division 2 wiring methods.

Version: METTLER TOLEDO

Verteiler: FUL (Zx)				Zul. Abweichungen für Maße ohne Toleranzangabe ISO 2768 - m		Oberfläche	Maßstab Blatt 1/2
							Halbzeug
					Datum	Name	Benennung
				Bearb.	07.03.03	dam	control drawing CSA
				Gepr.(KONS	10.3.3		Transmitter 2100, 4100, 5100, 7100
				Freigabe(FGL)			
				Schutzvermerk nach DIN 34 beachten			Zeichnungsnummer 194.130-240
Nr.	AE	Datum	Bearbeiter	FGL KONS			Ungültig ab: / Ersetzt durch:

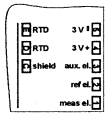
pH sensor group InPro 3xxx

- InPro3200

pH sensor group InPro 4xxx

- InPro4250/120/Pt1000

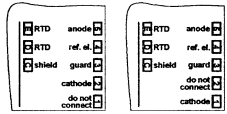
terminal assignment



O_2 sensor group InPro 6xxx

- InPro6900/12
- InPro6910/12
- InPro6800/12
- InPro6800/25

terminal assignment



CO_2 sensor group InPro 5xxx

- CO_2-sensor

terminal assignment

Cable: VP6-HT/XM, VP6-ST/XM

	A	B	C	D	E	F	Shield
Cable type X Koax+4L / measuring system	Core/ transparent	Shield/ red	grey	blue	white	green	yellow/ green
pH + BE + Temp	pH	BE	(T3)		T1	T2	
ORP + BE + Temp	ORP	BE	(T3)		T1	T2	
pH + BE + Temp + ORP/HE	pH	BE	(T3)	HE/ORP	T1	T2	
pH + BE + Temp (CO_2-sensor)	pH	BE	(T3)		T1	T2	Shaft
OX (2P) + Temp (InPro6100/6800)	Kathode	Anode			T1	T2	Shaft
OX (2P) + Guard +Temp (InPro6900)	Kathode	Anode	Guard		T1	T2	Shaft

Legende:
- -pH: pH-Lead-off
- -BE: reference electrode
- -HE: solution ground, auxiliary electrode
- -ORP: Redox electrode
- -Kathode: cathode of O_2-sensors
- -Anode: anode of O_2-sensors
- -Guard: guard-electrode of O_2-sensors
- -T1: temperature device
- -T2: temperarure device (zero)
- -T3: temperature device (compensation lead)

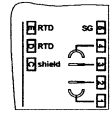
Cond sensor group InPro 70xx-VP

- InPro7000-VP
- InPro7005-VP
- InPro7001/120-VP
- InPro7001/225-VP
- InPro7002/1.5"TC-VP
- InPro7002/2"TC-VP

Cond sensor group InPro 71xx-VP

- InPro7108-VP/CPVC
- InPro7108-VP/PEEK
- InPro7108-VP/PEEK/HA-C22
- InPro7108-25/40-VP
- InPro7108-25/40/HA-C22-VP
- InPro7108-26/65-VP
- InPro7108-25/65/HA-C22-VP
- InPro7108/1.5"TC-VP
- InPro7108/2"TC-VP

terminal assignment

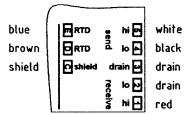


Wire color Patch cord	VP connector pin (on sensor)	Transmitter Cond 7100 e
bare	G	unused
blue	D	3
black	E	4
red	C	D
green	F	E
white	H	2
clear	B	C
white/blue	A	1

Condl sensor group InPro 72xx

- InPro7200
- InPro7201
- InPro7202

terminal assignment



Version: METTLER TOLEDO

Verteiler: FGL (Zx)						Zul. Abweichungen für Maße ohne Toleranzangabe ISO 2768 - m	Oberfläche	Maßstab	Blatt 2/2
								Halbzeug	
							Datum	Name	Benennung: control drawing CSA Transmitter 2100, 4100, 5100, 7100
						Bearb.	07.03.03	dam	
						Gepr.(KON)	19.3.3		
						Freigabe(FGL)			
						Schutzvermerk nach DIN 34 beachten			Zeichnungsnummer: 194.130-240
Nr.	AE	Datum	Bearbeiter	FGL	KON				Ungültig ab: / Ersetzt durch:

Buffer tables

-01- Mettler-Toledo technical buffers

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

-02- Merck Titrisols, Riedel Fixanals

°C	pH				
0	2.01	4.05	7.13	9.24	12.58
5	2.01	4.04	7.07	9.16	12.41
10	2.01	4.02	7.05	9.11	12.26
15	2.00	4.01	7.02	9.05	12.10
20	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
25	2.00	4.01	6.98	8.95	11.88
30	2.00	4.01	6.98	8.91	11.72
35	2.00	4.01	6.96	8.88	11.67
40	2.00	4.01	6.95	8.85	11.54
45	2.00	4.01	6.95	8.82	11.44
50	2.00	4.00	6.95	8.79	11.33
55	2.00	4.00	6.95	8.76	11.19
60	2.00	4.00	6.96	8.73	11.04
65	2.00	4.00	6.96	8.72	10.97
70	2.01	4.00	6.96	8.70	10.90
75	2.01	4.00	6.96	8.68	10.80
80	2.01	4.00	6.97	8.66	10.70
85	2.01	4.00	6.98	8.65	10.59
90	2.01	4.00	7.00	8.64	10.48
95	2.01	4.00	7.02	8.64	10.37

Buffer tables

-03- Ciba (94) buffers
Nominal values: 2.06, 4.00, 7.00, 10.00

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

* Extrapolated

-04- Technical buffers to NIST

°C	pH				
0	1.67	4.00	7.11$_5$	10.32	13.42
5	1.67	4.00	7.08$_5$	10.25	13.21
10	1.67	4.00	7.06	10.18	13.01
15	1.67	4.00	7.04	10.12	12.80
20	1.67$_5$	4.00	7.01$_5$	10.06	12.64
25	**1.68**	**4.00$_5$**	**7.00**	**10.01**	**12.46**
30	1.68	4.01$_5$	6.98$_5$	9.97	12.30
35	1.69	4.02$_5$	6.98	9.93	12.13
40	1.69	4.03	6.97$_5$	9.89	11.99
45	1.70	4.04$_5$	6.97$_5$	9.86	11.84
50	1.70$_5$	4.06	6.97	9.83	11.71
55	1.71$_5$	4.07$_5$	6.97	9.83 *	11.57
60	1.72	4.08$_5$	6.97	9.83 *	11.45
65	1.73	4.10	6.98	9.83 *	11.45 *
70	1.74	4.13	6.99	9.83 *	11.45 *
75	1.75	4.14	7.01	9.83 *	11.45 *
80	1.76$_5$	4.16	7.03	9.83 *	11.45 *
85	1.78	4.18	7.05	9.83 *	11.45 *
90	1.79	4.21	7.08	9.83 *	11.45 *
95	1.80$_5$	4.23	7.11	9.83 *	11.45 *

* Extrapolated

Buffer tables

-05- NIST standard buffers
NIST standard (DIN 19266 : 2000-01)

°C	pH			
0				
5	1.668	4.004	6.950	9.392
10	1.670	4.001	6.922	9.331
15	1.672	4.001	6.900	9.277
20	1.676	4.003	6.880	9.228
25	**1.680**	**4.008**	**6.865**	**9.184**
30	1,685	4.015	6.853	9.144
37	1,694	4.028	6.841	9.095
40	1.697	4.036	6.837	9.076
45	1.704	4.049	6.834	9.046
50	1.712	4.064	6.833	9.018
55	1.715	4.075	6.834	9.985
60	1.723	4.091	6.836	8.962
70	1.743	4.126	6.845	8.921
80	1.766	4.164	6.859	8.885
90	1.792	4.205	6.877	8.850
95	1.806	4.227	6.886	8.833

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

-06- HACH buffers
Nominal value: 4.00, 7.00, 10.18

°C	pH		
0	4.00	7.14	10.30
5	4.00	7.10	10.23
10	4.00	7.04	10.11
15	4.00	7.04	10.11
20	4.00	7.02	10.05
25	4.01	7.00	10.00
30	4.01	6.99	9.96
35	4.02	6.98	9.92
40	4.03	6.98	9.88
45	4.05	6.98	9.85
50	4.06	6.98	9.82
55	4.07	6.98	9.79
60	4.09	6.99	9.76
65	4.09 *	6.99 *	9.76 *
70	4.09 *	6.99 *	9.76 *
75	4.09 *	6.99 *	9.76 *
80	4.09 *	6.99 *	9.76 *
85	4.09 *	6.99 *	9.76 *
90	4.09 *	6.99 *	9.76 *
95	4.09 *	6.99 *	9.76 *

* Values complemented

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

Buffer tables

-07- WTW buffers

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

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 Calimatic. The buffer set must be selected prior to the first calibration.
Buffer solution	Solution with an exactly defined pH value for calibrating a pH meter.
Calibration	Adjustment of the pH meter 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. Before the first calibration, the buffer set used must be activated once. 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.

Glossary

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.
ISFET	ISFET combination pH electrodes consist of an ISFET measuring electrode, a reference electrode, and a temperature probe. Please refer to ISFET manual for additional information.
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

Zero point adjustment Basic adjustment of the ISFET electrode to ensure reliable Sensoface information.

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