Mettler Toledo pH 2100/2H Transmitter



\$195.00

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Instruction manual pH Transmitter 2100 e/2(X)H



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 <u>cleaned</u> 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".







Mettler-Toledo GmbH, Process Analytics, Industrie Nord, CH-8902 Urdorf, Tel. +41 (01) 736 22 11 Fax +41 (01) 736 26 36 Subject to technical changes. Mettler-Toledo GmbH, 09/03. Printed in Germany.

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pH Transmitter 2100 e/2(X)H

Safety information

Be sure to read and observe the following instructions!

The device has been manufactured using state of the art tecnology and it complies with 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.

Safety precautions for installation

- Be sure to observe the stipulations of EN 60079-10 / EN 60079-14 during installation.
- The **Transmitter pH 2100 e/2H** is approved for measurements in FM Class I Div 2.
- The **Transmitter pH 2100 e/2XH** is approved for operation in the following locations: ATEX, FM Zone 1 with measurement in Zone 0, and FM Class I Div 1.

Connection to power supply units

• **pH 2100 e/2H**: Before connecting this device to a supply unit, make sure that its output voltage cannot exceed 30 V DC.

Do not use alternating current or mains power supply!

• **pH 2100 e/2XH**: This device may only be connected to an explosion-proof power supply unit (for input ratings refer to annex of EC-Type-Examination Certificate).

Before commissioning it must be made sure that the connections to other equipment such as power supply unit and cables are intrinsically safe.

Connecting terminals:

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Suitable for single wires/flexible leads up to 2.5 mm² (AWG 14).

Note for cleaning in the hazardous location

Within the hazardous location only clean the Transmitter with a moistened cloth to prevent electrostatic charging.

Intended use

The pH Transmitter pH 2100 e/2(X)H 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.

- The **Transmitter pH 2100 e/2H** is approved for measurements in FM Class I Div 2.
- The **Transmitter pH 2100 e/2XH** is approved for operation in the following locations: ATEX, FM Zone 1 with measurement in Zone 0, and FM Class I Div 1.

Trademarks

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

InPro[®] is a registered trademark of Mettler-Toledo. HART[®] is a registered trademark of the HART Communications Foundation (HCF).

EC Declaration of Conformity



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Conformity with FDA 21 CFR Part 11

In their directive "Title 21 Code of Federal Regulations, 21 CFR Part 11, Electronic Records; Electronic Signatures" the US American health agency FDA (Food and Drug Administration) regulates the production and processing of electronic documents for pharmaceutical development and production. This results in requirements for measuring devices used for corresponding applications. The following features ensure that the measuring devices of the pH Transmitter Series 2100 e/2(X)H meet the demands of FDA 21 CFR Part 11:

Electronic Signature

Access to the device functions is regulated and limited by individually adjustable codes – "Passcodes" (for Passcode Editor see Page 58, overview of factory settings on back of manual). This prevents unauthorized modification of device settings or manipulation of the measurement results. Appropriate use of these passcodes makes them suitable as electronic signature.

Audit Trail

Every (manual) change of device settings can be automatically documented. For that purpose, each change is marked by a "Configuration Change Flag", which can be interrogated and documented via HART communication. Then the changed device settings/parameters can also be retrieved and documented via HART communication.

EC-Type-Examination Certificate

	TÜV		
	CERT		
	Translation		
(1)	EC-TYPE EXAMINATION CERTIFICATE		
(2)	Equipment or Protective System intended for use in potentially explosive atmospheros - Directive 94/9/EC		
(3)	EC-Type Examination Certificate Number		
	TÜV 99 ATEX 1447		
(4)	Equipment or Transmitter type 2100/2X* Protective System		
(5) (6) (7)	Marufacturer: Mettler Toledo GmbH Address: CH-9902 Urdorf, Im Hackacker 15 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.		
(8)	The TÜV Hannover/Sachsen-Anhalt e.V., TÜV Certification Body N° 0032 in accordance with Article 9 of the Council Directive 94/9/EC of March 23, 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.		
	The examination and test results are recorded in confidential report N° 99/PX12991.		
(9)	Compliance with the Essential Health and Safety Requirements has been assured by compliance with:		
	EN 50 014:1997 EN 50 020:1994		
(10)	If the sign "X" is placed after the certification number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.		
(11)	This EC-TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment or protective system.		
(12)	The marking of the equipment or protective system shall include the following:		
	(ii) G EEx ib [ia] IIC T6		
TÜV H TÜV C Am TÜ D-3051	anover/ashear-Anhat 4.V. Hannover, 1999-06-23 Bry Zavrtharvorgsstelle B Hannover		
Y	brushi		
Head Certif	Ication Body		
APCERTNO	10 11:15 This sentitude may unit be reproduced where any phenage, activative inclusion. Excerpts or clanges shall be aclosed by the TOY terrorientSacham-Anata k.V. page 1/3		

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pH Transmitter 2100 e/2(X)H

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(13)	SCHEDULE NORD
(14	EC-TYPE EXAMINATION CERTIFICATE N° TÜV 99 ATEX 1447
(15)	Description of equipment or protective system
	The transmitter type 2100/2X* is used for the recognition and processing of electrochemical quantities.
	The maximum permissible ambient temperature is 55°C.
	Electrical data
	Current loopin type of protection "Intrinsic Safety" EEx to IIC (terminals 10, 11) only for the connection to a certified intrinsically safe circuit with the following maximum values: U, = 30 V I, = 100 mA P, = 0.8 W effective internal capacitance C _i = 20 nF effective internal inductance L _i =0.2 mH
	$ \begin{array}{llllllllllllllllllllllllllllllllllll$
	$ \begin{array}{c} \max_{x}, \operatorname{permissible external capacitance} & C_{s}=3 J,F\\ \max_{x}, \operatorname{permissible external inductance} & L_{s}=200 \text{mH} \end{array} \\ \hline \\ \mbox{Temperature measuring loopin type of protection "Intrinsic Safety" EEx is IIC (terminals 7, 8) & Maximum values: \\ & Maximum values: \\ & U_{0}=5 V\\ & U_{0}=3 \text{mA} \\ & P_{0}=4 \text{mW} \\ & R_{s}=1900 \Omega \\ & Characteristic: linear effective internal capacitance is negligibly small. \\ & The offective internal capacitance (C_{s}=200 \text{mS}) \\ & The offective internal capacitance (C_{s}=200 \text{m} \\ & The offective internal capacitance (C_{s}=-250 \text{m} \\ & The offective internal capacitance (C_{s}=-250 \text{m} \\ & The offective internal capacitance (C_{s}=-210 \text{mS}) \\ & The offective internal capacitance (C_{s}=-210 \text{mS}) \\ & The offective internal capacitance (C_{s}=-210 \text{m} \\ & The offective internal capacitance (C_$
BA (2 11 36 1.000.000	max, permissible external inductance $L_0 = 100 \mu$ max, permissible external inductance $L_0 = 1 H$
	page 2/3

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	Schedule EC-type examination certificate N° TÜV 99 ATEX 1447
	EP for the connection to the equipotential bonding system (Terminal 9)
	The current loop is safely separated from the measuring loops up to a voltage of 60 V. The pH-measuring loop and the temperature measuring loop are galvanically connected.
(16)	Test documents are listed in the test report No. 99/PX12991.
(17)	Special condition for safe use
(18)	none. Essantial Health and Safety Requirements
(10)	no additional ones
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501 BE 11 20	
N. N	page 3/3

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pH Transmitter 2100 e/2(X)H

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1. Supplement to EC-Type-Examination Certificate

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	TUV NORD
	Translation
	1. SUPPLEMENT to
EC-TYP	E EXAMINATION CERTIFICATE No. TÜV 99 ATEX 1447
Equipment:	transmitter type 2100/2X*
Manufacturer:	Mettler Toledo GmbH
Address:	CH-8902 Urdorf
	Im Hackacker 15
In the future, the t listed in the test rep The changes refer	ransmitter type 2100/2X* may also be operated according to the test documents port. to the electrical data of the transmitter.
Electrical data	
(Terminals 10, 11 o	m type of protection "Intrinsic Safety / EEx ia IIC only for connection to a certified intrinsically safe dircuit maximum values: U _i = 30 V I _i = 100 mA P _i = 0,0 mA P _i = 0,0 mA P _i = 0,0 mA Effective internal docutance C _i = 20 nF effective internal inductance L _i = 0,2 mH
Supply/ISFET-circt (Terminals 17, 18,	it In type of protection "Intrinsic Safety" EEx la IIC maximum values: U = 10 V A L = 10 VA L = 14 MA R = 712 Ω characteristic line: linear effective informal inductance is negligibly small. max. permissible external capacitance C ₁ = 25 pF The effective internal inductance is negligibly small. max. permissible external inductance C ₂ = 3 μ F max. permissible external inductance C ₃ = 150 mH
EP (Terminal 9 or 16)	for connection to the equipotential bonding system
The current loop Supply/ISFET-circu loop and the supply	is safely galvanically separated from the measuring loops and from the it up to a voltage of 60 V. The pH-measuring loop, the temperature measuring //ISFET-circuit are galvanically connected.

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		TIN NOOD
		IGANORD
	1. Supplement to EC-Type Examination Certifi	icate No. TÜV 99 ATEX 1447
	The transmitter type 2100/2X* incl. of this 1. supplement EN 50 014:1997 +A1+A2 EN 50 020:2002	nt also meets the requirements of
	All other details remain unchanged for this 1. supplement	ent.
	(16) The test documents are listed in the test report N	° 05 YEX 551993.
	(17) Special conditions for safe use none	
	(18) Essential Health and Safety Requirements no additional ones	
	TÜV NORD CERT GmbH & Co. KG Am TÜV 1 D-30519 Hannover Tal: 446 911 984 700	Hannover, 2005-05-23
	Fax: +46 511 986-1590	
	Certification Body	
0000		
1010		

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pH Transmitter 2100 e/2(X)H



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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 piece)
- 2 Washer (1 piece), for conduit mounting: 7 Place washer between enclosure and 8 nut 9
- 3 Cable ties (3 pieces)

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- 4 Hinge pin (1 piece), insertable from either side
- 5 Enclosure screws (4 pieces)
- Fig.: Assembling the enclosure

- 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

pH Transmitter 2100 e/2(X)H

Mounting plan



Fig.: Mounting plan



- 1 Cable gland (3 pieces)
- 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)

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

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Fig.: Protective hood for wall and pipe mounting

pH Transmitter 2100 e/2(X)H



- 1 Screws (4 pieces)
- 2 Gasket (1 piece)
- 3 Panel
- 4 Span pieces (4 pieces)
- 5 Threaded sleeves (4 pieces)

Panel cutout 138 x 138 mm (DIN 43700)

Fig.: Panel-mount kit

Installation and connection

Information on installation

- 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.
- All parameters must be set by a system administrator prior to commissioning.

Connection to power supply units

- **2100** e/2H: Before connecting this device to a supply unit, make sure that its output voltage cannot exceed 30 V DC. Do not use alternating current or mains power supply!
- **2100 e/2XH**: This device may only be connected to an explosion-proof power supply unit (for input ratings refer to annex of EC-Type-Examination Certificate).

Terminals: suitable for single wires/flexible leads up to 2.5 $\rm mm^2$ (AWG 14).

Warning!

FM

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Additional safety precautions have to be taken for applications in hazardous locations to CSA! (See Pg 101)

Division 2 wiring

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.

Control Drawing: Refer to page 98.

pH Transmitter 2100 e/2(X)H

Terminal assignments



Fig.: Terminal assignments of pH Transmitter 2100 e/2H



Fig.: Terminal assignments of pH Transmitter 2100 e/2XH





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- **3** Pulling out the terminals using a screwdriver (also see **7**)
- 4 Cable laying in the Transmitter
- **5** Connecting lines for loop current
- **6** Cover for electrode and temperature probe terminals
- 7 Area for placing the screwdriver to pull out the terminals
- 8 Connection of handheld terminal

Fig.: Information on installation, rear side of Transmitter

pH Transmitter 2100 e/2(X)H

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Wiring examples pH

Example 1:

- pH measurement with monitoring of glass electrode
- VP connection



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pH Transmitter 2100 e/2(X)H

Example 2:

- pH measurement with monitoring of glass and reference electrode
- VP connection



Wiring examples pH

Example 3:

• pH measurement with monitoring of glass electrode



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Example 4:

• pH measurement with monitoring of glass and reference electrode



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Wiring examples pH

Example 5:

 pH measurement with ISFET sensor (For details see ISFET/Preamp manual)



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Wiring example ORP

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Example 6:

 ORP measurement without monitoring of reference electrode



User interface and display

User interface



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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

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

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cel 🔪 🗲 enter	Cal Info, display of asymmetry potential and slope
conf , Penter	Error Info: Display of last error message
► + ▲	Start GainCheck device self-test

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Safety functions

Sensocheck, Sensoface sensor monitoring

Sensocheck continuously monitors the sensor and lines. Sensocheck can be switched off (Configuration, Pg 57).



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 electrode.

GainCheck device self test

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

Start GainCheck device self-test:

► + ▲

Automatic device self-test

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

Safety functions

Hold mode

Display: 🛕

The Hold mode is a safety state during configuration and calibration. The loop current is frozen (Last) or set to a fixed value (Fix).

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.

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Outputs

Loop current

The loop current is controlled by the process variable selected in the configuration.

The current beginning and end can be set to represent any desired value.

To check connected peripherals (e.g. limit switches, controllers), the loop current can be manually specified (see Pg. 76).

HART communication

The pH Transmitter 2100 e/2(X)H can be remote-controlled via HART communication. It can be configured using a handheld terminal or from the control room. Measured values, messages and device identification can be downloaded at any time. This allows easy integration also in fully automatic process cycles.

A list of the HART commands can be found in the "pH Transmitter 2100 e/2(X)H Transmitter-Specific Command Specification": www.mtpro.com/transmitters.

Alarm

The alarm delay is configurable. Error messages can also be signaled by a 22 mA loop current (see Configuration, Pg 57).

The alarm LED on the front panel can be configured as follows:HOLD off:Alarm: LED flashingHOLD on:Alarm: LED on. HOLD: LED flashing.
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Passcodes

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The passcodes allow fast access to the functions

Calibration

Key+passcode		Description	
cal 🔪	0000	Cal Info Display of zero and slope	75
cal 🖊	1001	Zero point adjustment (ISFET) Adjusting zero point (ISFET sensor only)	62
cal 🔪	1100	Slope calibration Adjusting the slope (sensor)	64
	1105	Product calibration Adjusting the asymmetry potential (zero)	70
cal 🔪	1015	Temp probe adjustment	74

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Configuration

Key+passcode		Description	
conf	0000	Error Info Display last error and erase	75
conf	1200	Configuration	43
conf	2222	Sensor monitor Display uncorrected electrode potential	75
conf	5555	Current source Specify output current	76

Passcode editor

Key+passcode		Description	Page
conf	1989	Administrator passcode Changing the passcodes	58

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Configuration

In the Configuration mode you set the device parameters.



Menu structure of configuration

The configuration steps are assigned to different menu groups:

- Current output (code: o1.)
- Temperature compensation (code: tc.)
- Calibration mode (code: CA.)
- Alarm settings (code: AL.)

With the arrow keys you can jump between the individual menu groups. Each menu group contains menu items for setting the parameters.



Example: "o1." is displayed with all menu items of the "Current output" menu group.

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

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Code	Menu	Selection / Default
out1	Current output	(Factory setting bold print)
o1.UnIT	Select measured variable	pH/ORP
o1.EL	Select electrode type	(GLAS EL / FEt EL)
o1.4mA	Enter current start (4 mA)	- 2.00 16.00 PH (00.00 PH) - 1999 1999 mV (0000 mV)
o1.20mA	Enter current end (20 mA)	- 2.00 16.00 PH (14.00 PH) - 1999 1999 mV (0014 mV)
o1.FtME	Time constant of output filter	0000 0120 SEC (0000 SEC)
o1.FAIL	22 mA signal in the case of error	ON / OFF
o1.HoLD	Signal behavior during HOLD	Last / Fix
o1.FIX	Enter fixed value	000.0 022.0 mA (021.0 mA)
tc	Temperature compensation	
tc.UnIT	Select temperature unit	° C / °F
tc.rTD	Select temperature probe	Pt100/Pt1000/NTC30/NTC8.55
tc.MEAS	Temp detection during meas	Auto/man (man: -20.0 200 °C) (025.0 °C) (man: -004 0392 °F) (0025 °F)
tc.CAL	Temp detection during cal	Auto/man (man: -20.0 200 °C) (025.0 °C) (man: -004 0392 °F) (0025 °F)
tc.LIN	Enter TC process medium	-19.00 19.99 %/K (00.00 %/K)
CAL	Calibration mode	
CA.SOL	Select calibration mode	BUF / MAN / DAT (-01-BUF)
CA.tiME	Enter cal timer interval	0000 9999 h (0000 h)
ALrt	Alarm settings	
AL.SnSO	Select Sensocheck	ON / OFF (OFF)
AL.dIY	Enter alarm delay	0000 0600 SEC (0010 SEC)
AL.LED	LED in HOLD mode	ON / OFF (OFF)
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pH Transmitter 2100 e/2(X)H

Individual settings

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Code	Parameter	Setting
o1.UnIT	Unit pH/ORP	
o1.EL	Electrode type	
o1.4mA	Current start	
o1.20mA	Current end	
o1.FtME	Filter time	
o1.FAIL	22mA signal	<u> </u>
o1.HoLD	Hold behavior	<u> </u>
o1.FIX	Fix current	
tc.UnIT	Unit °C / °F	
tc.rTD	Temp probe	
tc.MEAS	Measuring temp	
tc.CAL	Calibration temp	
tc.LIN	TC process medium	
CA.SOL	Calibration solution	
CA.tiME	Calibration interval	
AL.SnSO	Sensocheck	
AL.dLY	Alarm delay	
AL.LED	LED Hold	

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Configuration Current output



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- 1. Press conf key.
- 2. Enter passcode 1200.
- Select Current output menu group using arrow keys. All items of this menu group are indicated by the code "o1."
- Press enter to select menu, edit with arrow keys (see Pg 43). Confirm (and proceed) with enter.
- 5. End: Press conf, then enter.





pH Transmitter 2100 e/2(X)H

Measured variable, electrode type

- 1

Code	Display	Action	Choices
o1.		Select configuration (Press conf .)	
	After correct input a welcome text (CONF) is displayed for approx. 3 s	Enter passcode "1200" (Select position using arrow key ► and edit number using ▲ key. When the display reads "1200", press enter to confirm.)	
	A HOLD	The Transmitter is in HOLD mode (HOLD icon is on, red LED flashes when "HOLD ON" has been set).	
	C ORP A of United	Select measured variable pH/ORP Select with arrow key ► Proceed with enter	pH/ORP
		Only with pH selected: Select electrode type: • Glass electrode • ISFET electrode Select with ▶ arrow key Proceed with enter	Glass (FEt EL)
	FEL ▲ of. EL		

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

Configuration Current output



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- 1. Press conf key.
- 2. Enter passcode 1200.
- Select Current output menu group using arrow keys. All items of this menu group are indicated by the code "o1."
- 4. Press **enter** to select menu, edit with arrow keys (see Pg 45). Confirm (and proceed) with **enter**.
- 5. End: Press conf, then enter.





pH Transmitter 2100 e/2(X)H

Current start. Current end.

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Code	Display	Action	Choices
01.	о ДОООРн ≜ ₀≀. Ч.н <u>е</u>	Current start Enter lower end of scale, depend- ing on measured variable selected (pH or ORP) Select with ► key, edit number with ► key, proceed with enter	pH -2 16 (-1999 mV +1999 mV)
	о Ч.О.О РН ♠ о! 20, в <u></u>	Current end Enter upper end of scale, depend- ing on measured variable selected (pH or ORP) Select with > key, edit number with > key, proceed with enter	pH -2 16 (-1999 mV +1999 mV)

Assignment of measured values: Current start and current end



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Configuration Current output



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- 1. Press conf key.
- 2. Enter passcode 1200.
- Select Current output menu group using arrow keys. All items of this menu group are indicated by the code "o1."
- 4. Press **enter** to select menu, edit with arrow keys (see Pg 47). Confirm (and proceed) with **enter**.
- 5. End: Press conf, then enter.





pH Transmitter 2100 e/2(X)H

Time constant of output filter

Code	Display	Action	Choices
01.		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 s 0 - 120 s

Time constant of output filter

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

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

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

Note:

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



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Configuration Current output



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- 1. Press conf key.
- 2. Enter passcode 1200.
- Select Current output menu group using arrow keys. All items of this menu group are indicated by the code "o1."
- 4. Press **enter** to select menu, edit with arrow keys (see Pg 49). Confirm (and proceed) with **enter**.
- 5. End: Press conf, then enter.





pH Transmitter 2100 e/2(X)H

Output current during Error and HOLD

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Code	Display	Action	Choices
01.		22 mA signal for error message Select with ► arrow key Proceed with enter	OFF (ON)
	● LAST A of Koling	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 > arrow key Proceed with enter	LAST (FIX)
		Only with FIX selected: Enter current which is to flow at the output during HOLD Select position with → arrow key and edit number with → key. Proceed with enter	21.0 mA (00.0 22.0 mA

Output signal during HOLD:



Configuration Temperature compensation



- 1. Press conf key.
- 2. Enter passcode 1200.
- Select Temperature compensation menu group using arrow keys. All items of this menu group are indicated by the code "tc."
- Press enter to select menu, edit with arrow keys (see Pg 51). Confirm (and proceed) with enter.
- 5. End: Press conf, then enter.

Temperature compensation:



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pH Transmitter 2100 e/2(X)H

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Temperature unit and probe

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Code	Display	Action	Choices
tc.	teijorie	Specify temperature unit Select with ► arrow key Proceed with enter	° C (°F)
		Select temperature probe Select with ▶ arrow key Proceed with enter	Pt 100 (PT1000, NTC30, NTC8,55)

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Configuration **Temperature compensation**



- 1. Press conf key.
- 2. Enter passcode 1200.
- 3. Select Temperature compensation menu group using arrow keys. All items of this menu group are indicated by the code "tc."
- 4. Press enter to select menu, edit with arrow keys (see Pg 53). Confirm (and proceed) with enter.
- 5. End: Press conf, then enter.

Select temperature probe TC during measurement TC during calibration Enter TC process medium



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Temp detection for meas/cal, TC process medium

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Code	Display	Action	Choices
tc.	ו און א נכאצראים	Select temp detection during measurement (Auto/MAN) AUTO: Temp detection with temperature probe MAN: Manual temperature input Select with > key, proceed with enter	AUT (MAN)
	1250 ∙c ≜≊tañErs⊒	Only with manual temp detection selected (MAN) Enter temperature. Select position with ➤ arrow key and edit number with ➤ key. Proceed with enter	25 °C (xxx.x °C)
	AUT ▲ Ec. En <u>r</u>	Select temp detection during cali- bration (Auto/MAN) Select with ► key, proceed with enter	AUT (MAN)
	Arta Ing	Only with manual temp detection selected (MAN) Enter temperature. Select position with ➤ arrow key and edit number with ➤ key. Proceed with enter	25 °C (xxx.x °C)
	∎ 10000%/k 42tc. L'N⊡	For pH measurement only: Enter temperature compensation of process medium. Select position with ► arrow key and edit number with ► key. Proceed with enter	00.00 %/K (xx.xx %/K)

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Configuration Calibration mode

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pH Transmitter 2100 e/2(X)H

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Buffer sets. Calibration mode. Calibration timer.

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Code	Display	Action	Choices
CA.	■ -] -]] ▲ C.R. Sci	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 MAN: Calibration with manual buffer entry DAT: Entry of asymmetry potential and slope of premeasured elec- trodes. Select with ▶ key, proceed with enter	-01-BUF (-01-BUF/- 02-BUF/ -03-BUF/ -04-BUF/ -05-BUF/ -06-BUF/ -07-BUF/ MAN/ DAT)
		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 9999 h)

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Configuration Alarm settings



- 1. Press **conf** key.
- 2. Enter passcode 1200.
- Select Alarm settings menu group using arrow keys. All items of this menu group are indicated by the code "AL."
- 4. Press **enter** to select menu, edit with arrow keys (see Pg 57). Confirm (and proceed) with **enter**.
- 5. End: Press conf, then enter.



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pH Transmitter 2100 e/2(X)H

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Sensocheck. Alarm delay. LED.

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Code	Display	Action			Choices
AL.		Select Sensoche (continuous moi reference electro Select with • ke enter	ck nitoring of ode) ey, procee	f glass and ed with	ON / OFF
		Alarm delay Acts on LED inc signal. Select with \rightarrow k with \rightarrow key, pro	lication ar ey, edit r oceed wit	nd 22 mA number h enter	0010 s (xxxx s)
		LED in Hold mod Select with > ke enter	de ey, procee	d with	ON / OFF
		LED state:			
		Parameter setting	Alarm	HOLD	
		ON	on	flashes	
		OFF	flashes	off	

Passcodes according to FDA 21 CFR Part 11

Access to the device functions can be protected with adjustable passcodes if required. If such a protection is not required, you should use the preset passcodes.

To call up passcode editor:

Press conf key and enter Administrator passcode (1989).

Display	Action	Remark
	 Press conf key. Enter Administrator passcode (1989): Welcome text is displayed 	This text is displayed for approx. 3 s
	"Cal Info" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 0000
8 (]]]] (:AL 0-(A <u>m</u>	"Zero point adjustment" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 1001
	"Calibration" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 1100
	"Product calibration" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 1105
	"Temp probe adjustment" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 1015

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pH Transmitter 2100 e/2(X)H

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Display	Action	Remark
	"Error Info" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 0000
	"Configuration" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 1200
● □ □□□ □□□□ 5n5ni <u>m</u>	"Sensor monitor" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 2222
	"Current source" Edit: Arrow keys Proceed: enter Cancel: conf	Default setting: 5555
● (989:56 580:5 <u>∞</u>	"Administrator passcode" Edit: Arrow keys Proceed: enter Cancel: conf	Caution! If you have lost the Administrator pass- code, the Passcode Editor cannot be called up! Please consult our technical support!
	Cancel new administrator passcode Proceed: enter Cancel: conf	Default setting: 1989
6 (989:85 5800 ₪	Take over new administra- tor passcode Proceed: enter Cancel: conf	

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Calibration

Calibration adjusts the Transmitter to the electrode.



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 sensors, 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 times of the electrode and temperature probe are 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 sensors or electrodes with a zero

point other than pH 7 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 point adjustment (ISFET)

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

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Display	Action	Remark
	Press cal key, enter passcode 1001 Select with ▶ key, edit number with ▲ key, proceed with enter	Transmitter is in the Hold mode. If an invalid passcode is entered, Transmitter returns to measuring mode.
	Ready for calibration "CAL" and "enter" are flash- ing.	Display (3 s)
רום מיווי איז איז איז איז איז איז איז איז איז אי	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 (> \pm 200 mV), the CAL ERR error message is gener- ated. In that case the electrode cannot be calibrated.
	Stability check: The measured mV value is dis- played. The "hourglass" as well as "Zero" and "Beaker" icons are flashing.	Note: Stability check can be stopped (by pressing cal). However, this reduces calibration accuracy.

pH Transmitter 2100 e/2(X)H

Display	Action	Remark
	At the end of the adjustment procedure the zero offset [mV] (based on 25 °C) of the elec- trode is displayed. The "Zero" and "enter" icons are flashing. Proceed with enter	This is no final value! Zero and slope must be determined with a complete 2-point calibration (cal 1100) (see following pages).
202 PH	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 calibration.	After end of calibra- tion, the outputs remain in Hold mode for approx. 20 sec.

Information on zero point adjustment

After having adjusted the zero offset, 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 passcode 1100 Select with > key, edit number with > key, proceed with enter	If an invalid passcode is entered, 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 tem- perature 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 tem- perature probe remain in the first buffer solution.	The response time of the electrode and temperature probe is consider- ably reduced if the electrode is first moved about in the
ТОО РН <u>А</u> 2500 с год	Buffer recognition terminated, the nominal buffer value is dis- played.	buffer solution and then held still.
64	pH Transmi	tter 2100 e/2(X)H

pH Transmitter 2100 e/2(X)H

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Display	Action	Remark
1 	Stability check: The measured mV value is dis- played.	To abort stability check: Press cal . (accuracy reduced)
	Calibration with the first buffer is terminated. Remove the elec- trode 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 sec- ond buffer solution. Start with enter .	The calibration process runs again as for the first buffer.
98 ¤,₀ ▲ 1 ₀/⊡	Retract electrode and temp probe out of second buffer, rinse off, re-install. Repeat calibration: cal , End calibration: enter .	Slope and asymme- try potential of electrode (related to 25 °C) are displayed.
Т.О.2 РН 26.7т	pH value and Hold are dis- played alternately. "enter" flashes, Sensoface is active. Proceed with enter . Hold is deactivated after 20 s.	Security prompt.
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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 passcode 1100 Select with ▶ key, edit number with ▲ key, proceed with enter .	If an invalid passcode is entered, 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 tem- perature value in the secondary display using the arrow keys. Start with enter .	Transmitter in Hold mode, measured value frozen. Sensoface inactive.
— <u>— 250</u> °г—	Enter the pH value of your buffer solution for the proper temperature. While the "hour- glass" icon flashes, the elec- trode and temperature probe remain in the first buffer solu- tion.	The response time of the electrode and temperature probe is consider- ably reduced if the electrode is first moved about in the buffer solution and then held still.

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pH Transmitter 2100 e/2(X)H

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Display	Action	Remark
1 	Stability check: The measured mV value is dis- played.	To abort stability check: Press cal . (accuracy reduced)
	Calibration with the first buffer is terminated. Remove the elec- trode 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 asymme- try potential of electrode (related to 25 °C) are displayed.
1.0 2 PH 84 25.70	pH value and Hold are dis- played alternately. "enter" flashes, Sensoface is active. Proceed with enter . Hold is deactivated after 20 s.	Security prompt.
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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 passcode 1100 Select with ► key, edit number with ▲ key, proceed with enter .	If an invalid passcode is entered, 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 ▶ key, edit number with ▲ key, proceed with enter .	
	Enter slope [%]. Select with key, edit number with ▲ key, proceed with enter .	
	The Transmitter displays the new slope and asymmetry potential (at 25 °C). Proceed with enter .	
7.02 PH ™ 25.7℃	pH value and Hold are dis- played alternately. "enter" flashes, Sensoface is active. Proceed with enter . Hold is deactivated after 20 s.	Security prompt.

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pH Transmitter 2100 e/2(X)H

Convert 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

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Converting asymmetry potential in electrode zero point:

ZERO Electrode zero point $ZERO = 7 - \frac{V_{AS} [mV]}{S [mV / pH]} \begin{vmatrix} ZERO & Electrode Zero point \\ V_{AS} & Asymmetry potential \\ S & Slope \end{vmatrix}$

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 measured 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 1st step: Press cal key, enter passcode 1105 (Press ▶ key to select position, enter number using ▲ key, confirm with enter)	If an invalid passcode is entered, the Transmitter returns to measuring mode.
3.90 Рн Stort 📾	Take sample and store value. Proceed with enter	Now the sample can be measured in the lab.
70	nH Transmi	tter 2100 e/2(X)H

pH Transmitter 2100 e/2(X)H

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Display	Action	Remark
9.90Рн 28.3«с	Measuring mode: From the flashing CAL mode indicator you see that sample calibration has not been termi- nated.	While the sample value is deter- mined, the Transmitter is in measuring mode.
	Product calibration 2nd step: 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 asym- metry potential is calculated.	
	Display of slope and new asymmetry potential (related to 25 °C). End calibration with enter .	New calibration: Press cal .
Э.90 рн 283лгш	The measured value is shown in the main display alternately with "Hold"; "enter" flashes, Sensoface is active. End with enter .	After end of calibra- tion, the outputs remain in Hold mode for approx. 20 sec.

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ORP calibration

ORP calibration mode is automatically preset when ORP measurement is configured. The potential of a redox electrode is calibrated using a redox (ORP) buffer solution. In the course of that, the difference between the measured potential and the potential of the calibration solution is determined according to the following equation. During measurement the Transmitter adds this difference to the measured potential.

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

 $\begin{array}{ll} {\sf mV}_{{\sf ORP}} &= {\sf displayed \ {\sf ORP}} \\ {\sf mV}_{{\sf meas}} &= {\sf direct \ electrode \ potential} \\ {\Delta {\sf mV}} &= {\sf delta \ value, \ determined \ during} \\ {\sf calibration} \end{array}$

The electrode potential can also be related to another reference system – e.g. the standard hydrogen electrode. In that case the temperature-corrected potential (see table) of the reference electrode used must be entered during calibration. During measurement, this value is then added to the ORP measured.

Please make sure that measurement and calibration temperature are the same, since the temperature behavior of the reference electrode is not automatically taken into account.

Temperature [°C]	Ag/AgCl/KCl 1 mol/l [ΔmV]	Ag/AgCl/KCl 3 mol/l [ΔmV]	Thalamid [∆mV]	Mercury sulfate [∆mV]
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

Temperature dependence of commonly used reference systems

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pH Transmitter 2100 e/2(X)H

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Display	Action	Remark
	Activate calibration (Press cal). Enter passcode 1100. Select with ▶ key, edit number with ▲ key, proceed with enter .	If an invalid passcode is entered, the Transmitter returns to measuring mode.
	Remove the electrode and tem- perature probe, clean them and immerse them in the redox buffer.	Display (approx. 3 sec) The Transmitter is in the 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 dis- play shows the measured tempera- ture.
	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.
● 220m/ 239rt⊡	The measured ORP value [mV] is shown in the main display alternately with "Hold", "enter" flashes, Sensoface is active. End with enter .	After end of calibra- tion, the outputs remain in Hold mode for approx. 20 sec.

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Temp probe adjustment

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Display	Action	Remark	
	Activate calibration (Press cal , Enter passcode 1015.) Select with → key, edit number with → key, proceed with enter .	Wrong settings change the measure- ment properties! If an invalid passcode is entered, the Transmitter returns to measuring mode.	
	Measure the temperature of the process medium using an exter- nal thermometer	Transmitter is in the 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.	ter measured temperature ue. lect with ▶ key, it number with ▲ key, oceed with enter . Default: Value of secondary display. Default: Value of secondary display.	

Measurement

■ In the measuring mode the main display shows the configured process variable (pH or ORP [mV]) and the temperature	
Smiley only visible with Sensocheck activated Science Control of the control of t	ne de ess- ox.

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pH Transmitter 2100 e/2(X)H

Diagnostics functions

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METTLER TOLEDO

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Display	Remark
1 12 PR 125.0	Display of output current Press enter while in measuring mode. The main display shows the measured value, the secondary display the output current. After 5 sec the Transmitter returns to measuring mode.
Smiley only with Sensocheck activated	Display of calibration data (Cal Info) Press cal while in measuring mode and enter passcode 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 enter).
C	Display of electrode potential (Sensor monitor) Press conf while in measuring mode and enter passcode 2222. The (uncompensated) electrode potential is shown in the main display, the measuring temperature in the sec- ondary display. Press enter to return to measurement.
Smiley only with Sensocheck activated	Display of last error message (Error info) Press conf while in measuring mode and enter passcode 0000. The last error message is dis- played for approx. 20 sec. After that the message will be deleted. (immediate return to measurement at pressing enter).

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Diagnostics functions

These functions are used for testing the connected peripherals.

Display	Action / Remarks
	 Specify output current Press conf, enter passcode 5555 The output current indicated in the main display can be modified. 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).

Cleaning

To remove dust, dirt and spots, the external surfaces of the device may be wiped with a damp, lint-free cloth. A mild household cleaner may also be used if necessary.

Operating states

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METTLER TOLEDO

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Operating state	Out 1	LED	Time out
Measurement			
Cal Info (cal) 0000			20 s
Error Info (conf) 0000			20 s
Calibration (cal) 1100			
Temp adjustment (cal) 1015			
Product cal 1 (cal) 1105			
Product cal 2 (cal) 1105			
Configuration (conf) 1200			20 min
Sensor monitor (conf) 2222			20 min
Current source 1 (conf) 5555			20 min
Explanation:	ac	tive	

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as configured (Last/Fix or Last/Off)

LED flashes during HOLD (configurable)

Error messages (error codes)

Error	Display	Problem Possible causes	Red LED and out 1 (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 	х
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	х
ERR 98	"Conf" flashes	System error Configuration or calibration data defective. Completely reconfigure and recalibrate the device. Memory error in device program	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

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pH Transmitter 2100 e/2(X)H

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Errors	Symbol (flashes)	Problem Possible causes	Red LED and out 1 (22 mA)
ERR 03	ł	Temperature probe Open or short circuit Temperature range exceeded	х
ERR 11		Current output Current below 3.8 mA	х
ERR 12		Current output Current above 20.5 mA	x
ERR 13		Current output Current span too small / too large	x
ERR 33 ERR 34	s	Sensocheck: Glass electrode Reference electrode	х
	Zero •	• Zero error, Sensoface active, see Pg 82	
	Zero Slope	Slope error, Sensoface active, see Pg 82	
	Ŀ	Response time exceeded, Sensoface active, see Pg 82	
	E	Calibration interval expired, Sensoface active, see Pg 82	

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Calibration error messages

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Symbol flashes:	Problem Possible causes
1] _m v	 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 temperature compensation) Wrong buffer temperature set (for manual temperature specification) Nominal electrode zero point ≠ pH 7
٦6 ₀,₀ ⊠	 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 temperature 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 unit
80	ی pH Transmitter 2100 e/2(X)H

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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
ERL ERR	 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

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Sensoface

(Sensocheck must have been activated during configuration.)

The little smiley in the display (Sensoface) alerts to 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 red LED is lighted, the output current is set to 22 mA (when configured correspondingly). Sensocheck can be switched off during configuration (then Sensoface is also disabled). Exception: After a calibration a 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 an electrode defect.

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Display	Problem	Status	5
Slope Zero	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.
ĕ	Cal timer	:	Over 80 % of the calibration interval has already past.
		::	The calibration interval has been exceeded.
Ł	Electrode defective		Check the electrode and its connections (also see error messages Err 33 and Err 34, see Pg 79).

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Appendix

METTLER TOLEDO

Product line and accessories

Devices	Order No.
pH Transmitter 2100 e/2H	52 120 724
pH Transmitter 2100 e/2XH	52 120 758
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

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pH/mV input	Input for pH or ORP electrodes or ISFET sensors				
Meas. range Display range	-1500 +1 pH value ORP	1500 mV -2.00 16.00 -1999 +1999 mV			
Glass electrode input " Input resistance Input current Reference electrode in Input resistance Input current	> 0.5 x 10 ¹² < 2 x 10 ⁻¹² A put ¹⁾ > 1 x 10 ¹⁰ C < 1 x 10 ⁻¹⁰ A	• 0.5 x 10 ¹² Ohms : 2 x 10 ¹² A ut ¹⁰ • 1 x 10 ¹⁰ Ohms : 1 x 10 ¹⁰ A			
Measurement error ^{1,2,3)} pH value mV value	< 0.02 < 1 mV	TC: 0.002 pH/K TC: 0.1mV/K			
Sensor standardization pH * ¹ Operating modes BUF Buffer sets		pH calibration Calibration with Calimatic automatic buffer			
		recognition : -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) 2.06/4.00/7.00/1 -04- NIST technical 1.68/4.00/7.00/1 -05- NIST standard			
		-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 Prd	Data entry of preme Product calibration	asured electrodes		

pH Transmitter 2100 e/2(X)H

Zero point adjustment Max. calibration range Slope:	±200 mV Asymmetry potential: ±60 mV 80 103 % (47,5 61 mV/pH)		
Sensor standardization ORP " Max. calibration range	ORP calibration -700 +700 ΔmV		
Cal timer	0000 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 time, calibration interval, Sensocheck		
Sensor monitor	Direct display of measured values from sensor for validation (resistance / temperature)		
Temperature input *)	Pt100/Pt1000/NTC 30 kOhm/NTC 8,55 kOhm		
Measurement range	Pt 100/Pt 1000: NTC 30 kOhms NTC 8.55 kOhms	- 20,0 +200.0 °C (-4 + 392 °F) - 20,0 +150.0 °C (-4 +302 °F) - 10,0 +130.0 °C (-4 +266 °F)	
Adjustment range Resolution Measurement error ^{1,2,3)}	10 K 0.1 ℃ / 1 ℉ <0.5 K (<1 K for Pt	100; <1 K for NTC >100°C)	
Temp compensation of process medium	Linear –19.99 +19.99 %/K (reference temp 25 °C)		

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Specifications

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Loop current Supply voltage	4 20 mA floating 12 30 V
Characteristic Overrange ^{*)} Output filter ^{*)}	pH, OKP Linear 22 mA in the case of error messages Low-pass (PT1 filter), filter time constant 0 120 s
Meas. error ¹⁾ Start/end of scale	< 0.3 % current value + 0.05 mA As desired within range for pH or mV
Admissible span Current source function	pH 2.00 18.00 / 200 3000 mV 3.8 mA 22.00 mA
HART communication	Digital communication by FSK modulation of loop current, reading of device identification, measured values, status and messages, reading and writing of parameters, start of product calibration, signaling of configuration changes according to FDA 21 CFR Part 11
Power output	For operating an ISFET adapter +3 V / 0.5 mA -3 V / 0.5 mA
Display Main display Secondary display Sensoface	LC display, 7-segment with icons Character height 17 mm, unit symbols 10 mm Character height 10 mm, unit symbols 7 mm 3 status indicators (friendly, neutral, sad Smiley)
Status indication	5 mode indicators "meas", "cal", "alarm", "cleaning", "config" 18 further icons for configuration and messages
Alarm indication	 Keg LED in case of alarm or HOLD, user defined 5 keys: [cal] [conf] [▶] [▲] [enter]

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Service functions

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Current source	Loop current specifiable 3.8 22.00 mA
Device self-test	Automatic memory test (RAM, FLASH, EEPROM)
Display test	Display of all segments
Last Error	Display of last error
Sensor monitor	Display of direct, uncorrected sensor signal (resistance / temperature)
Passcodes	Modifiable according to FDA 21 CFR Part 11 "Electronic Signatures"
Data retention	Parameters and calibration data $>$ 10 years (EEPROM)

EMC

Emitted interference:

EN 61326 Class B (residential area) Class A for mains > 60 V DC Industry

Immunity to interference:

Explosion protection

2100 e/2XH:	ATEX:	TÜV 99 ATEX 1447
		II 2 (1) G EEx ib [ia] IIC T6
	FM:	FMRC J.I. 300580
		IS/I/1/ ABCD/T4
		NI/I/2/ABCD/T4
	CSA	CSA 1662790
		CI I, Div 1, Gr ABC & D T4; Ex ib [ia] IIC T4
		CI I, Div 2, Gr ABC & D, T4; Ex nAL[L] IIC T4
2100 e/2H:	FM	FM 300580
		NI/I/2/ABCD/T4

Nominal operating conditions

Ambient temperature	-20 +55 °C
Transport/Storage temp	-20 +70 °C
Relative humidity	10 80 % not condensing
Supply voltage	12 30 V

Specifications

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Enclosure	Molded enclosure made of PBT
Color Assembly	Wall mounting Pipe mounting:
	dia 40 60 mm, ☐ 30 45 mm • Panel mounting, cutout to DIN 43 700 Sealed against panel
Dimensions	H 144 mm, W 144 mm, D 105 mm
Ingress protection	IP 65/NEMA 4X (USA, Canada: indoor use only)
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
 2) Drug count

3) Plus sensor error

Buffer tables

-01- Mettler-Toledo technical buffers

°C	рН			
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

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Buffer tables

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-02- Merck Titrisols, Riedel Fixanals

°C	рН				
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

pH Transmitter 2100 e/2(X)H

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

°C	рН			
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

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Buffer tables

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-04- Technical buffers to NIST

°C	рН				
0	1.67	4.00	7.115	10.32	13.42
5	1.67	4.00	7.085	10.25	13.21
10	1.67	4.00	7.06	10.18	13.01
15	1.67	4.00	7.04	10.12	12.80
20	1.675	4.00	7.015	10.06	12.64
25	1.68	4.005	7.00	10.01	12.46
30	1.68	4.015	6.985	9.97	12.30
35	1.69	4.025	6.98	9.93	12.13
40	1.69	4.03	6.975	9.89	11.99
45	1.70	4.045	6.975	9.86	11.84
50	1.705	4.06	6.97	9.83	11.71
55	1.715	4.075	6.97	9.83 *	11.57
60	1.72	4.085	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	1.765	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	1.805	4.23	7.11	9.83 *	11.45 *

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* Extrapolated

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pH Transmitter 2100 e/2(X)H

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

°C	рН			
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.

Buffer tables

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

°C	рН			
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.

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pH Transmitter 2100 e/2(X)H

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-07- WTW buffers

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°C	рН				
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		

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FM Control Drawing



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pH Transmitter 2100 e/2(X)H



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Explosion protection

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		CSA	(DINTERNATIONAL			
С	ertific	ate	of Co	omp	liance	2
Certificate:	1662790			Master Contr	act: 220331	
Project:	1662790			Date Issued:	May 18, 2005	
Issued to:	Mettler-Toledo Gm Im Hackacker 15 Urdorf, 8902 SWITZERLAND	ьн				
	Attention: Mr. M	lichael Haas				
The	products listed l	below are	eligible to b	ear the CS	A Mark show	n
PRODUCTS	SP	Ø	Issu Aut	horized by: K	Atkins Atkins ek Alfano perations Manager	
CLASS 2258	DA - PROCESS CONT	POL FOURM	ENT: Intrinsiaall	h. Cofe Fasia	For Honorland Land	
Class I. Divisi	on L Grouns A. B. C.a	nd D	EINT - ISUIIISICAI	iy Sale Linity -	FO: Hazardous Local	licitis
Ex ib [ia] IIC	and oroups it. b. e.u					
Transmitters M devices provid connected per Temperature 5	Aodels 2100/2XH, 7100 les intrinsically safe ou control drawings 194.1 5°°C, Temperature Cod	0/2XH and Mo puts to simple 20-170, 194.22 e T4.	dels 4100/2XH, in apparatus, ph, con 20-190 and 194.32	nput rated 30V. nductivity and 20-190, 194.40	, 4-20 mA, intrinsical oxygen probes when 1-120. Maximum Am	ly safe ibient
For all models	the input entity parame	eters are:				
Terminals 10, 11 or 14,1;	Ui, Vmax 5 30V	li, Imax 100mA	Pi, Pmax 0.8W	Ci 32.4nF	Li 0.24mH	
Output entity p	barameters are:					
2100/2XH						
QD 507 Rev. 2003-01-	31					

pH Transmitter 2100 e/2(X)H

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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.

OBSERVE THE SPECIFICATIONS OF THE CONTROL DRAWING!

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CSA Control Drawing



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pH Transmitter 2100 e/2(X)H



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Glossary

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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 cali- bration. 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.

pH Transmitter 2100 e /2(X)H

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Combination electrode	Combination of glass and reference elec- trode 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 each electrode and changes with age and wear.
Electrode zero point	See asymmetry potential
GainCheck	Device self-test which runs automatically in the background at fixed intervals. The memory and measured-value transmission are checked. You can also start the GainCheck manually. Then a display test is also conducted and the software version displayed.
ISFET sensor	ISFET sensors consist of an ISFET measuring electrode, a reference electrode, and a tem- perature probe. For additional information, please refer to ISFET manual.

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Glossary

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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.
Passcode	User-defined four-digit number to select certain modes.
pH electrode system	A pH electrode system consists of a glass and a reference electrode. If they are com- bined 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 con- dition. The zero point, slope, and response time are evaluated. In addition, the Sensocheck information is indicated.

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Slope	See Electrode slope
Two-point calibration	Calibration with which the electrode asym- metry 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 InPro3300 ISFET sensor to ensure reliable Sensoface information.

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pH Transmitter 2100 e/2(X)H

METTLER TOLEDO

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pH Transmitter 2100 e/2(X)H

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