DOC026.53.00794

si792 P
si792x P
si792x P-FF
si792x P-PA

pH/ORP
2-Wire Transmitters

USER MANUAL

07/2013, Edition 7

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Section 1 Specifications

Specifications are subject to change without notice.

Transmitter	
Composition	PBT (polybutylene terephthalate)
Display	LCD
Fittings	3 knockouts for M20 x 1.5 strain reliefs
	2 knockouts for ½ inch NPT or rigid metallic conduit
Power requirements—si792 P and si792x P, (4–20 mA/HART)	14–30 VDC (30 VDC maximum)
Power requirements—FF and Profibus PA	FISCO bus supply: 9 to 17.5 VDC Linear barrier: 9 to 24 VDC
Loop current—si792 P and si792x P, (4–20 mA/HART)	4–20 mA floating; 3.80–22.00 mA specifiable
Current consumption—FF and Profibus PA	< 13.2 mA
Maximum current in case of fault (FDE)—FF and Profibus PA	< 17.6 mA
Measurement error[2]	<0.3% of current value + 0.05 mA

Specifications

Certification (may not apply to all sensors. Refer to the control drawing or listing for certification information for the sensor that is used) ***Note:*** *Hach differential pH/ORP sensors are not ATEX certified.*	si792 P 4–20 mA/HART transmitter: **US:** **si792 P** **FM listed for:** Class I, Division 2 **si792x P; si792x P-FF; si792x P-PA** **FM listed for:** Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, Class III, Division 1 Class I, Zone 0, AEx ia, Group IIC T4 **Enclosure:** Type 2
	Canada: **si792 P CSA certified to:** Class I, Division 2 **si792x P CSA certified and si792x P-FF; si792x P-PA cFMus certified to:** Class I, Division 1, Groups A, B, C, D Class I, Division 2, Groups A, B, C, D Sensor: Class I, Zone 0, Group IIC Transmitter: Class I, Zone 1, Group IIC **Enclosure:** Type 2
	EU: **si792x P;** **ATEX Certification:** II 2 (1) G Ex ib [ia Ga] IIC T6 Gb **si792x P-FF; si792x P-PA** **ATEX Certification:** II 2 (1) G Ex ia IIC T4 Ga **CE Marked to:** EMC Directive 2004/108/EC ATEX Directive 94/9/EC **Enclosure:** IP65
Power output for pHD sensor adapter	+3 V/0.5 MA –6 V/0.5 mA (5.0 to 5.2 V, maximum 640 µA)
Output averaging time constant (HART)	0–120 seconds
Output span allowed	pH: 2.00 to 18.00; mV: 200 to 3000

Storage temperature	–20 to 70 °C (–4 to 158 °F)
Operating temperature	–20 to 55 °C (–4 to 131 °F)
Weight	Approximately 1 kg
Data retention	Parameters and calibration data >10 years (EEPROM)
Passcodes	Modifiable according to FDA 21 CFR Part 11 “Electronic Signatures” (HART only)
Sensocheck	Sensocheck automatic monitoring of glass and reference electrode (can be disabled). Delay: 30 seconds.
Sensor monitor	Direct display of measured values from sensor for validation (electrode potential/temperature)
Communications	
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.
Foundation Fieldbus (FF_H1)	Bus-powered device with constant current consumption. Cyclic and acyclic data exchange. 1 resource block, 1 transducer block, 3 analog input function blocks (switchable: pH, ORP, temperature, R_{glass}, R_{ref}, slope, asymmetry potential)
	Execution time: 50 ms
	Certified to ITK 4.6
	Physical interface: to IEC 1158-2
	Address range: 017 to 246

Specifications

Profibus-PA (DPV1)	Bus-powered device with constant current consumption. Cyclic and acyclic data exchange. Physical block, 2 analog input function blocks, 2 discrete input blocks, logbook block, alarm block.
	PNO directive: PROFIBUS-PA, Profile for Process Control Devices, Version 3.0
	Physical interface: MBP-IS (Manchester Bus Powered–Intrinsically Safe) to IEC 1158-2 (DIN-EN 61158-2)
	Connection: via segment coupler to SPC, PC, PCS
	Address range: 1 to 126
Temperature input	
Probe	Pt100/PT1000/NTC 300 Ω (selectable), 2-wire connection
Range, Pt100/Pt1000	si792 P; si792x P; si792x P-FF: –20.0 to 200.0 °C (–4 to 392 °F)
	si792x P-PA: –20.0 to 150.0 °C (–4 to 302 °F)
Range, NTC 300 Ω	–20.0 to 110.0 °C (–4 to 230 °F)
Resolution	0.1 °C; 0.1 °F
Measurement error[1,2]	<0.5 K (<1 K for Pt100; <1 K for NTC >100 °C)
Temperature compensation of sample	Linear –19.99 to 19.99%/K (25 °C reference temperature)
pH/ORP inputs	
pH/ORP	Input for Combination or Differential pH/ORP Sensors
Glass/reference electrode input	IEC 746 Part 1, at nominal operating conditions
Input resistance—glass electrode	>0.5 x 10^{12} Ω

Input resistance—reference electrode	>1 x 10^{10} Ω
Input current—glass electrode	<2 x 10^{-12} A
Input current—reference electrode	<1 x 10^{-10} A
Measurement range	–1500 to 1500 mV
Measurement error—pH[1,2]	<0.02 pH units plus sensor error; TC: 0.002 pH/K
Measurement error—mV[1,2]	<1 mV plus sensor error; TC: 0.1 mV/K
Display range—pH	–2.00 to 16.00 pH units
Display range—ORP	–1999 to 1999 mV
pH sensor calibration	
Offset range	± 60 mV
Slope range	85 to 103% (47.5 to 61 mV/pH unit)
Calibration timer	0 to 9999 hours
ORP sensor calibration (si792 P, si792x P and si792x P-FF only)	
Calibration range	–700 to 700 mV
Calibration timer	0 to 9999 hours

[1] (± 1 count plus sensor error)
[2] IEC 746 Part 1, at nominal operating conditions

Specifications

Section 2 General information

2.1 Safety information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.

General information

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol, when noted on the product, identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol, when noted on the product, identifies the presence of a strong corrosive or other hazardous substance and a risk of chemical harm. Only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol, when noted on the product, indicated the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.
	This symbol, when noted on the product, identifies the presence of a noxious substance and a risk of chemical harm. Only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.

2.2 General product information

2.2.1 Product overview

The si792 P series transmitters are used for pH/ORP and temperature measurement in industry, environment, food processing and sewage treatment. This manual describes the installation, operation and maintenance for standard and EU models of the si792 P series transmitters.

The molded transmitter enclosure can be attached to a panel, wall, post or pipe railing. The optional hood (see **Accessories on page 87**) provides protection against direct weather exposure and mechanical damage.

Three communication protocols are available for the si792 transmitter:

- 4–20 mA/HART—Models si792(x) P, includes the si792 P and si792x P models
- Foundation Fieldbus—si792x P-FF
- Profibus PA—si792x P-PA

This user manual includes instructions for all three protocols.

Important Note: *An 'x' in the model number is an indication of an instriniscally safe (IS) instrument.*

2.2.2 FDA 21 CFR part 11 Compliance (HART only)

In the 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. The features described in **section 2.2.2.1** and **section 2.2.2.2** make the transmitter compliant with the requirements of FDA 21 CFR Part 11.

2.2.2.1 Electronic signatures for si792 P series transmitters

Device functions are protected by passcode access, which prevents unauthorized modification of device settings or manipulation of measurement results. Passcodes may be used as electronic signatures. Passcodes can be edited with the passcode editor (**Appendix B on page 97**).

2.2.2.2 Audit trail for si792 P series transmitters

The si792 series can automatically track all changes to the device settings. Each change is tagged with a Configuration Change flag, which is documented using HART communication. Altered device settings or parameters can be retrieved from the transmitter using HART communication.

2.3 Product models

The si792 P series instruments are programmed at the factory with default settings for specific sensors and probes. The default settings, chosen to accommodate regional safety standards, can be changed by the user.

See **Parts and accessories on page 87** for a list of instrument models.

Section 3 Installation

DANGER
Explosion hazard. The installation and commissioning of this equipment must only be carried out by trained personnel.

DANGER
Explosion hazard. Never connect items to the transmitter that are not specified on the control drawing. Do not connect or disconnect any equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER
Explosion hazard. The safety of the transmitter may be impaired if any of the following conditions have occurred:

- ***visible damage***
- ***storage above 70 °C for prolonged periods***
- ***exposure to severe transport stresses***
- ***previous installation***
- ***failure to operate properly***

If any of these conditions have occurred, return the device to the manufacturer for recertification.

DANGER
Explosion hazard. pHD sensors (PDxxx and RDxxx) must have a serial number greater than 0712431582 to be used in CID1 hazardous locations. Check the serial number of the pHD sensor before wiring the sensor to si792x P, si792x P-FF or si792x P-PA instruments.

The si792 and si792x transmitters differ in hazard classification. The si792 transmitter is designed for non-hazardous or Class I, Division 2, Groups A, B, C, D hazardous locations. The si792x transmitter is designed for Class I, Division 1, Groups A, B, C, D hazardous locations. Refer to the control drawing or listing applicable to the site location.

For outdoor installation, use of a protective hood or sunshield is recommended (**section 11.2 on page 87**).

Installation of the si792x in an outdoor hazardous location per FM or CSA control drawings requires a suitable enclosure and must follow NEC guidelines. Refer to NEMA 250 to determine enclosure needs.

3.1 Hazardous location control drawings

Before installation, review the applicable Hazardous Location Control Drawings or ATEX EC-type Examination Certificates included with the instrument and on the provided documentation CD. Follow all regulations specified for the installation location.

Refer to the documentation CD for manuals provided in other languages.

3.2 Unpacking the transmitter

Check the shipment for transport damage and make sure all components have been shipped complete. The package includes:

- Display module
- Back enclosure
- Bag of hardware and fasteners
- Test report and user manual

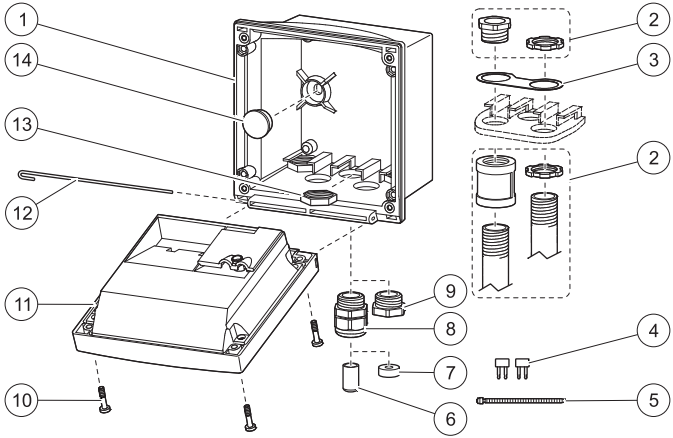

Figure 1 Instrument Components

1 Back enclosure	**8** Strain relief (3x)
2 Optional conduit hardware	**9** Filler plug (3x)
3 Conduit washer	**10** Enclosure screw (4x)
4 Jumper (2x)	**11** Display module
5 Cable tie (3x)	**12** Hinge pin
6 Sealing insert	**13** Hex nuts (5x)
7 Rubber reducer	**14** Sealing plug (2x)

3.3 Mechanical installation

3.3.1 Transmitter assembly

Refer to **Figure 1** and the following instructions to assemble the transmitter.

1. Insert the strain relief fittings in the holes of the back enclosure and secure with the hex nuts (**Figure 2**).
2. Insert the conduit hardware or plugs in the back enclosure and secure with the hex nuts.
3. Attach the display module to the back enclosure using the hinge pin.

3.3.2 Mounting

Refer to the following sections to mount the transmitter on a wall, panel or pipe.

3.3.2.1 Wall mount

1. Use a punch to open the two wall-mount holes in the back enclosure (**Figure 2**).
2. Drill holes in the wall suitable for the user-supplied mounting bolts.
3. Attach the back enclosure to the wall using two customer-supplied bolts.
4. Insert the clear plastic plugs into the mounting holes.

3.3.2.2 Panel or pipe mount (optional)

Refer to **Figure 2** and the instructions supplied with the panel and pipe mounting kits (see **Accessories on page 87**).

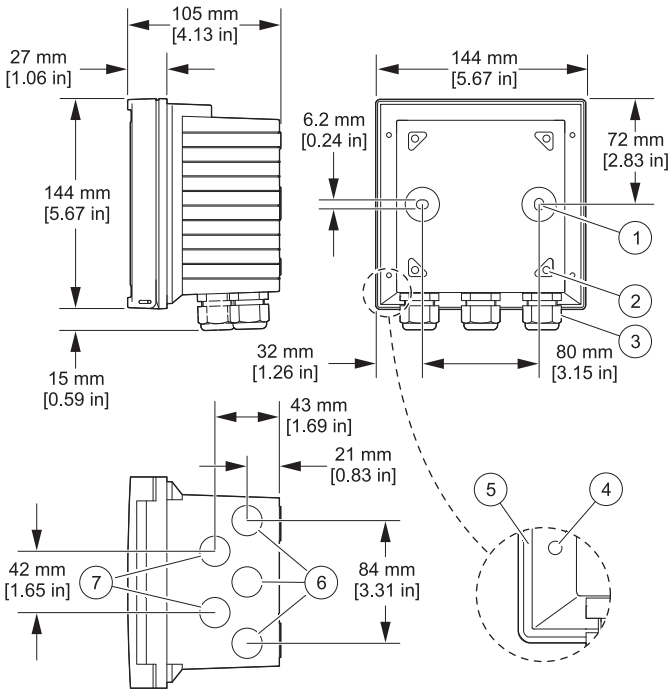

Figure 2 Wall attachment dimensions

1 Breakout for wall mounting (2x)	**5** Groove for panel mount gasket
2 Hole for pipe mounting (4x)	**6** Strain relief opening (3x)
3 Strain relief (3x)	**7** Strain relief or ½ inch conduit opening (2x) Ø 21.5 mm [0.85 in]
4 Breakout for panel mounting	

3.4 Wiring Safety Information

When making any wiring connections to the instrument, the following warnings and notes must be adhered to, as well as any warnings and notes found throughout the individual installation sections. For more safety information refer to **section 2.1 on page 11**.

DANGER
Always disconnect power to the instrument when making any electrical connections.

Electrostatic Discharge (ESD) Considerations
To minimize hazards and ESD risks, maintenance procedures not requiring power to the analyzer should be performed with power removed.

Delicate internal electronic components can be damaged by static electricity, resulting in degraded instrument performance or eventual failure.

The manufacturer recommends taking the following steps to prevent ESD damage to the instrument:

- Before touching any electronic components (such as printed circuit cards and the components on them) discharge static electricity from the body by touching an earth-grounded metal surface such as the chassis of an instrument or a metal conduit or pipe.
- To reduce static build-up, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
    - To discharge static electricity from the body and keep it discharged, wear a wrist strap connected by a wire to earth ground.
    - Handle all static-sensitive components in a static-safe area. If possible, use anti-static floor pads and work bench pads.

3.5 Electrical installation

DANGER
Explosion hazard. Do not connect any components that are not specified for the device. Always refer to the Hazardous Location Control Drawing.

Prerequisites:

- Review the applicable control drawing or EC-type Examination certificate.
- Review the electrical code regulations
- Review the regulations for electrical installations in hazardous locations (e.g. EN 60079-10/EN 60079-14; 97/9/EC directive; NEC; CEC; Profibus Technical Guidelines)
- Remove power or confirm non-hazardous status before making any connections
- Confirm that the intrinsic safety of the device is maintained when connected to other equipment such as a power supply unit.

3.5.1 Wire preparation

To remove the terminal blocks from the transmitter for sensor wiring:

1. Insert a flat screwdriver between the terminal block and the transmitter body.
2. Use the screwdriver as a lever to lift the terminal block off the connectors (see **Figure 3 on page 22**).

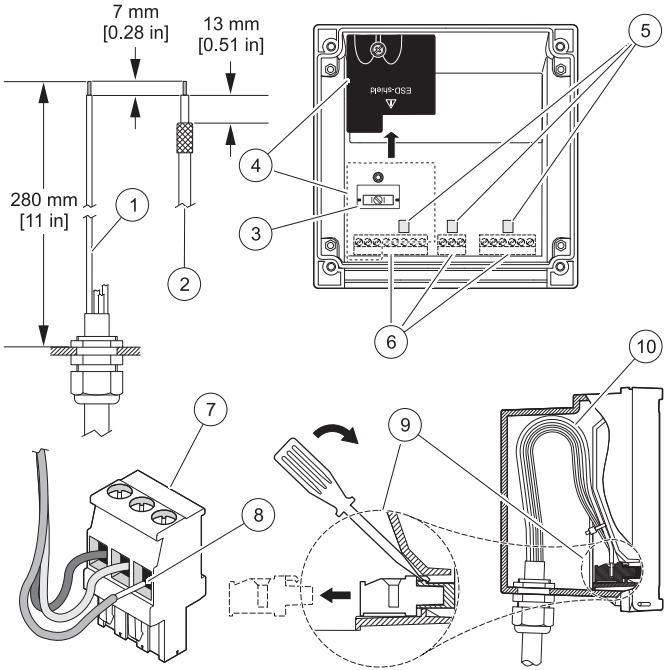

Figure 3 Wire preparation and insertion

1 Stripping lengths for cables	**6** Terminals (vary by model number)
2 Stripping lengths for coaxial cables	**7** Typical terminal
3 Cable shield connection ***Note:*** *Do not connect to earth ground.*	**8** Seat insulation against connector
4 ESD shield removed	**9** Removing terminal with screwdriver
5 Areas for screwdriver to pry terminal	**10** Cable loop position in housing

3.5.2 Power and communication connections

DANGER
Explosion hazard. The AC power source for the power supply unit cannot exceed 250 VAC. Do not connect the transmitter directly to an AC power source.

DANGER
Explosion hazard. The output voltage of the power supply unit cannot exceed 30 VDC. The si792x transmitter must be connected to an appropriately certified explosion-proof power supply unit. Refer to "associated apparatus" in the control drawing or to the EC-Type Examination Certificate for input ratings.

Prerequisites

- Trained personnel only must install or commission the equipment.
- Follow the instructions in this user manual and the applicable local and national codes.
- Observe the technical specifications and input ratings during installation.
- Disconnect all power sources during wiring and installation.
- Use single wires/flexible leads up to 2.5 mm (AWG 14) for connection to terminals.
- Do not damage the wire when stripping the insulation.
- All parameters must be set by a system administrator (Authority Having Jurisdiction) before commissioning.

3.5.2.1 si792 P and si792x P (4–20 mA/HART) wiring

DANGER
Explosion hazard. Never connect items to the transmitter that are not specified on the control drawing.

Use **Figure 4** and **Table 1** to connect the power supply to the si792 P and si792x P (4–20 mA/HART)..

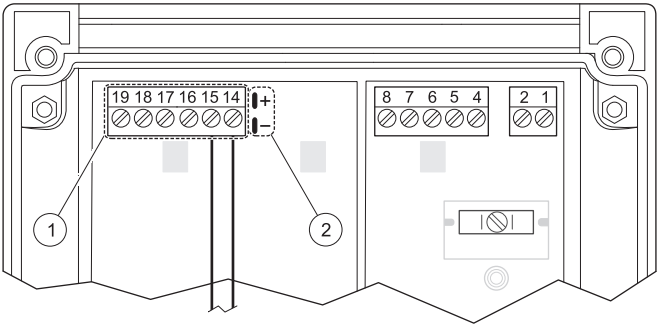

Figure 4 si792(x) P wiring

1 Wiring terminals—see **Table 1**	**2** HART connection (see warnings in **section 3.6 on page 29**)

Table 1 Terminal assignments—si792(x) P

Terminal No.	Assignment
14	4–20 mA output (–)
15	4–20 mA output (+)

3.5.2.2 si792x P-FF and si792x P-PA wiring

Use **Figure 5** and **Table 2** to connect power and communication to the si792x P-FF (Foundation Fieldbus) or si792x P-PA (Profibus).

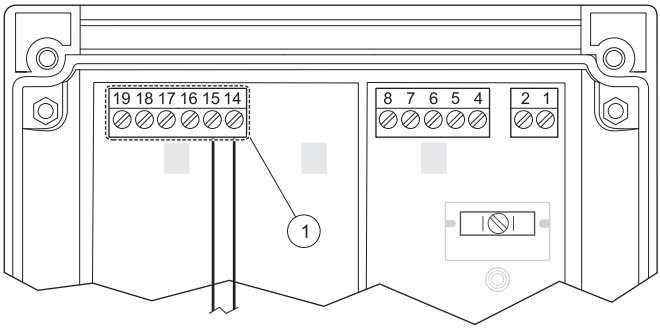

Figure 5 si792x P-FF and si792x P-PA wiring

1 Wiring terminals—see **Table 2**

Table 2 Terminal assignments—si792x P-FF and si792x P-PA

Terminal No.	Assignment
14	Connection from FF or Profibus PA (–)
15	Connection from FF or Profibus PA (+)

3.5.3 Sensor wire connection

Important Note: *Do not connect earth ground to the shield connector in the transmitter. Connect the cable shields to the shield connector.*

Refer to the following sections to connect the transmitter to a sensor:

- Hach combination pH/ORP sensors—**section 3.5.3.1 on page 26**
- pH/ORP solution ground sensors—**section 3.5.3.2 on page 27**
- pH/ORP differential sensors—**section 3.5.3.3 on page 28**

3.5.3.1 Hach combination pH/ORP sensors wiring

1. Install the jumpers shown in **Figure 6**.
2. Use **Table 3** to wire the sensor to the transmitter.

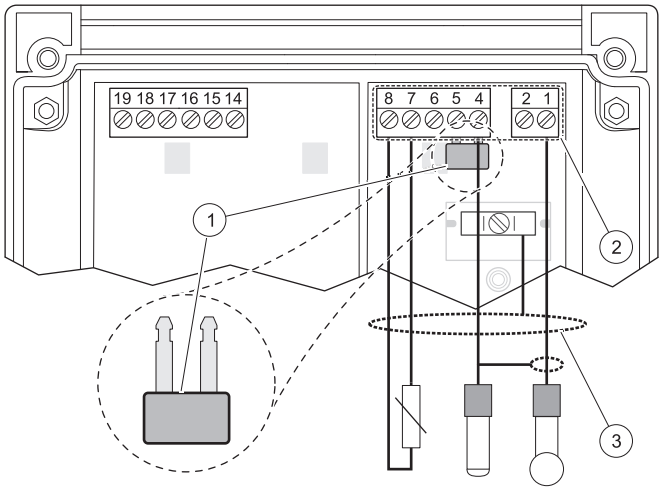

Figure 6 Wiring for Hach combination pH/ORP sensors

1 Jumper between terminal 4 and 5	***3*** Cable shield connection
2 Wiring terminals—see **Table 3**	***Note:*** *Do not connect to earth ground.*

Table 3 Terminal assignments—pH/ORP sensors

Terminal No.	Assignment	Hach PC and RC series color	SixPlug (former SMEK) connection
1	Measure electrode	coaxial cable center wire	coaxial cable center wire
4	Reference electrode	braided coaxial shield	braided coaxial shield

Table 3 Terminal assignments—pH/ORP sensors (Continued)

7	RTD (resistive temp device)	red	green
8	RTD (resistive temp device)	white	white

3.5.3.2 pH/ORP sensors with solution ground wiring

Use **Figure 7** and **Table 4** to wire the sensor to the transmitter.

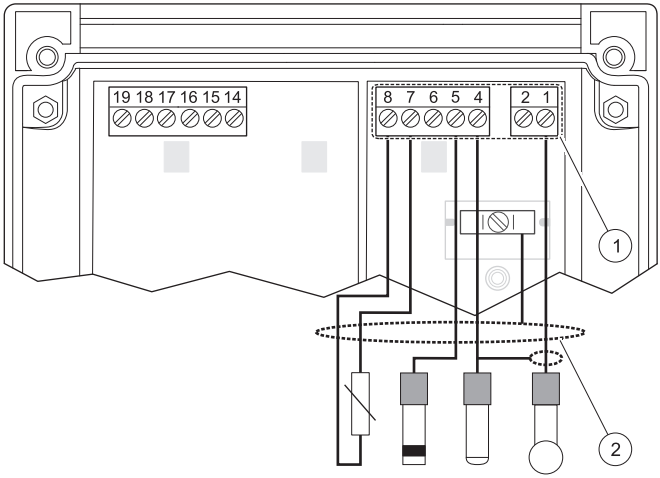

Figure 7 Wiring for pH/ORP sensors with solution ground

1 Wiring terminals—see **Table 4**	**2** Cable shield connection ***Note:*** *Do not connect to earth ground.*

Table 4 Terminal assignments—sensors with solution ground

Terminal No.	Assignment
1	Measure electrode
4	Reference electrode
5	Solution ground
7	RTD (resistive temperature device)
8	RTD (resistive temperature device)

3.5.3.3 Differential pH/ORP sensor wiring

Use **Figure 8** and **Table 5 on page 29** to wire the sensor to the transmitter. The pHD sensor has 7 wires (2 shield wires). The LCP sensor has 6 wires (1 shield wire).

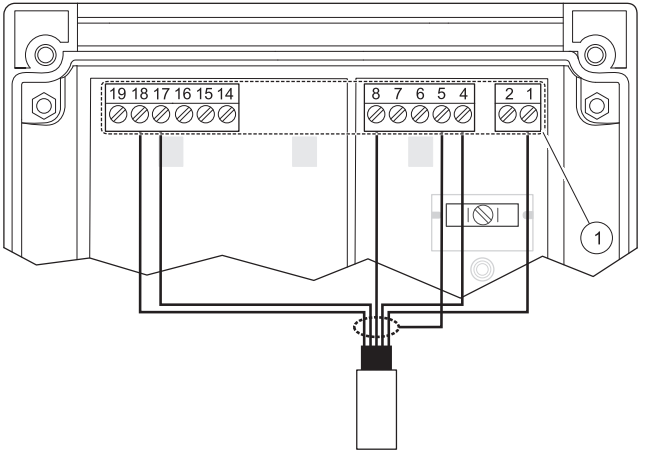

Figure 8 Wiring for differential pH/ORP sensors (PDXXX/RDXXX)

1 Wiring terminals—see **Table 5 on page 29**

Table 5 Terminal assignments—differential sensors

Terminal No.	Assignment	Hach wire color
1	Measure electrode (pHD is Reference)	red
4	Reference electrode (pHD is Measure)	green
5	Cable shield connections (2 shield wires for Hach pHD, 1 shield wire for Hach LCP) ***Note:*** *Do not connect to earth ground.*	shield
8	RTD (resistive temperature device)	yellow
17	–6 V	white
18	GND	black

3.6 HART communication connection

DANGER
Explosion hazard. Never connect items to the transmitter that are not specified on the control drawing. Do not connect or disconnect any equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER
The si792x transmitter must be used with an explosion-proof HART communication device. Refer to the appropriate control drawing for the location of the HART (Rosemount) device.

Refer to **Figure 4 on page 24** for the connector location.

Section 4 Interface and navigation

The si792 transmitter user interface contains a display, indicators and keys for navigation and menu selection.

4.1 si792(x) P (4–20 mA/HART) interface

Use the arrow and enter keys to scroll through the menu and change settings. Use the indicators to identify which mode the transmitter is in. Refer to **Figure 9** to identify the keys and indicators of the si792(x) P.

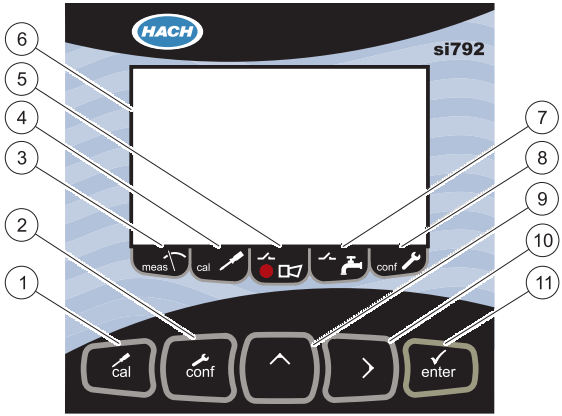

Figure 9 User interface—si792(x) P

1 Calibration key	**7** Wash mode indicator (not available)
2 Configure key	**8** Configuration mode indicator
3 Measure mode indicator	**9** Up arrow key
4 Calibration mode indicator	**10** Right arrow key
5 Alarm indicator	**11** Enter key
6 Display	

4.2 si792x P-FF and si792x P-PA interface

Refer to **Figure 10** to identify the keys and indicators of the si792x P-FF and si792x P-PA.

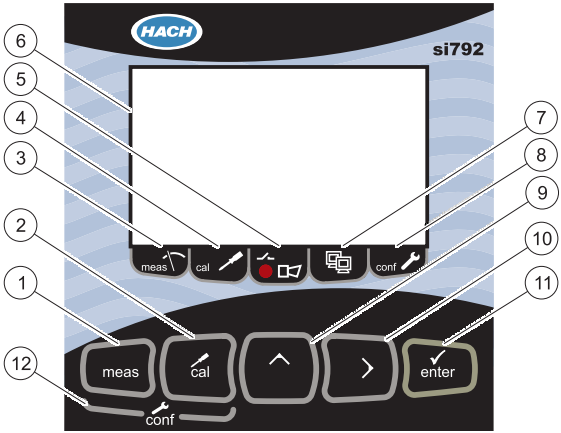

Figure 10 User interface—si792x P-FF and si792x P-PA

1 Measure key	**7** Communication indicator
2 Calibration key	**8** Configuration mode indicator
3 Measure mode indicator	**9** Up arrow key
4 Calibration mode indicator	**10** Right arrow key
5 Alarm indicator	**11** Enter key
6 Display	**12** Configuration mode

4.3 Display

Figure 11 identifies all of the possible icons and symbols that may be seen in the si792 transmitter display.

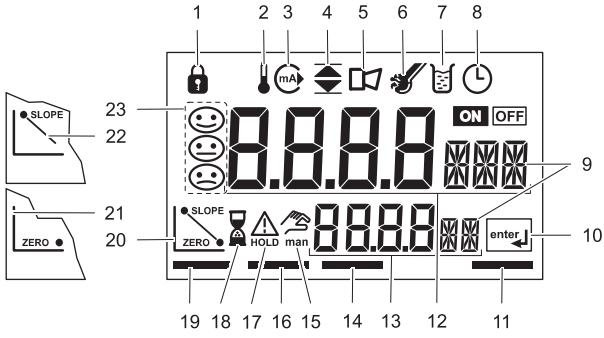

Figure 11 Display

1 Passcode	**13** Secondary display
2 Temperature	**14** Alarm mode
3 4–20 mA/HART output	**15** Manual temperature on
4 Limit values (FF and Profibus PA)	**16** Calibration mode
5 Alarm	**17** Hold mode active
6 Sensocheck—probe error	**18** Hourglass (waiting indication)
7 Calibration active	**19** Measure mode active
8 Calibration interval	**20** Calibration complete
9 Parameter display	**21** Calibration—zero or first point
10 Enter prompt	**22** Calibration—second point
11 Configuration mode	**23** Sensofaces
12 Main display	

Section 5 Operation—4–20 mA/HART

The following section describes how to operate the si792(x) P (4–20 mA/HART) transmitters.

5.1 Measure mode

In the measure mode the display shows the pH or ORP value and the temperature. The status bar is shown above the measure mode indicator.

- To return to the measure mode from the configure menu, press **CONF** and then **ENTER**.
- To return to the measure mode from the calibration menu, press **CAL** and then **ENTER**.

Note: *The waiting time for the stabilization of the measured value is approximately 20 seconds.*

5.2 Configuration

Use the configuration mode to specify the sensor, range and other parameters for the system as shown in **Table 6**.

1. Press **CONF** and enter **1200** to enter the configuration mode.
2. Use the arrow and enter keys to change the settings. All settings and options are shown in **section 5.2.1**, **section 5.2.2**, **section 5.2.3** and **section 5.2.4**.

Table 6 Configuration menu

Code	Setting	Passcode
o1	4–20 mA current output	1200
tc	Temperature compensation	
CAL	Calibration setup	
AL.	Alarm settings	

To exit the configuration mode at any time, press **CONF** and then **ENTER**. The output current will be held for 20 seconds and the measured value will be displayed.

Note: *During configuration the transmitter remains in the Hold mode for safety reasons. The loop current is held at the value specified in the o1.HoLD menu option. The Sensoface icon is inactive. The configuration mode indicator is displayed (**Figure 11 on page 33**).*

5.2.1 Output configuration

An overview of the 4–20 mA output setup menu is shown in **Table 7**.

Table 7 Output setup menu—out.1MNU

Select the parameter			
o1.UniT	pH (default)	o1.EL (electrode)	Glass (default for EU version)
			ISFET
			pHD (default for standard version; for pHD and LCP sensors)
	ORP		
Specify the value for the 4 mA signal (section 5.2.1.1)			
o1.4mA	Enter the pH value (–2.00 to 16.00 pH; default: 0 pH)		
	Enter the ORP value (–1999 to 1999 mV; default: 0 mV)		
Specify the value for the 20 mA signal (section 5.2.1.1)			
o1.20mA	Enter the pH value (–2.00 to 16.00 pH; default: 14 pH)		
	Enter the ORP value (–1999 to 1999 mV; default: 14 mV)		
Set time averaging filter for reducing noise (section 5.2.1.2)			
o1.Ftme	Enter the time in seconds (0 to 120 seconds; default: 0 seconds)		
Send a 22 mA signal during errors (section 5.2.1.3)			
o1.FAil	On		
	Off (default)		
Specify the value to output during HOLD periods (section 5.2.1.4)			
o1.HoLD	LAST measured value (default)		
	FIXed	Enter the fixed value to output in mA (3.8 to 22 mA; default: 21 mA)	

Press **ENTER** to access a menu item. Use the **ARROW KEYS** to edit values. Press **ENTER** to save the settings. If a value is outside of the acceptable range, “Err” will be displayed and the value will not be accepted. To exit the menu and return to the measurement mode, press **CONF** and then **ENTER**.

Example: Set the 4 mA current output signal to 3 pH.

1. Press **CONF**, enter passcode: 1200, **ENTER**. The display will show Conf and then **out.1MNU**.
2. Press **ENTER** to access the output setup menu. The display will show **o1.UniT**.
3. Press **ENTER**, **ENTER** to show the 4 mA submenu. The display will show **o1.4mA**.
4. Use the **UP ARROW** and **RIGHT ARROW** to edit the value to 03.00 pH. Press **ENTER** to save the value. The display will show **o1.20mA**.
5. Press **CONF** and then **ENTER** to exit the configuration menu.

5.2.1.1 Output range

The upper and lower end of the pH or ORP measurement range should correspond to the 4 mA and 20 mA signals. For example, to set a range of 3–12 pH, set the 4 mA signal to correspond to a pH value of 3 and the 20 mA signal to correspond to a pH value of 12.

5.2.1.2 Time averaging filter

An averaging filter is available to reduce noise in the output signal. The filter averages readings over a specified time interval. The time interval can be set from 0 to 120 seconds (default: 0 seconds).

When set to 0 seconds, there is no signal averaging for noise reduction. When set to 120 seconds, the current output value will be correspond to the process signal averaged over the last 120 seconds. Increase the time interval to reduce the noise in the output signal.

Note: *The filter acts on the output signal but not on the displayed value.*

5.2.1.3 Output signal during errors

When an error condition occurs, a 22 mA output signal can be sent as a notification (default: off).

5.2.1.4 Output signal during HOLD

The output signal during hold periods can be maintained at the last measured value (**Figure 12**) or fixed at a specified value (**Figure 13**). The allowable range for the fixed value is 3.4 to 22 mA.

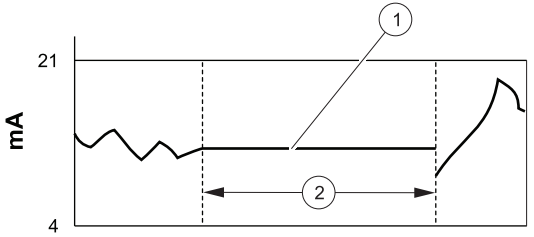

Figure 12 Output signal during HOLD—last value

1 Output signal during HOLD	**2** HOLD mode time span

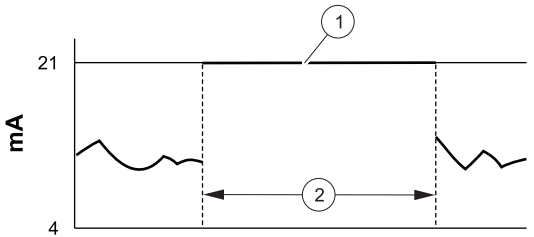

Figure 13 Output signal during HOLD—fixed value

1 Output signal during HOLD	**2** HOLD mode time span

5.2.2 Temperature compensation configuration

An overview of the temperature compensation setup menu is shown in **Table 8**.

Table 8 Temperature compensation setup menu—tc MNU

Select temperature unit		
tc.UnIT	°C (default)	
	°F	
Select temperature probe		
tc.rTD	Pt100	
	Pt1000 (default for EU version)	
	NTC300 (default for standard version with pHD and LCP sensors)	
Temperature detection during measurement		
tc.MEAS	Auto (default)	
	Manual	Enter the temperature (–20 to 200 °C; default: 25 °C)
		Enter the temperature (–4.0 to 392 °F; default: 25 °F)
Temperature detection during calibration		
tc.CAL	Auto (default)	
	Manual	Enter the temperature (–20 to 200 °C; default: 25 °C)
		Enter the temperature (–4 to 392 °F; default: 25 °F)
pH only temperature compensation of process medium		
tc.LIN	Enter compensation (–19.99 to 19.99%/K; default: 0%/K)	

Press **ENTER** to access a menu item. Use the **ARROW KEYS** to edit values. Press **ENTER** to save the settings. If a value is outside of the acceptable range, “Err” will be displayed and the value will not be accepted. To exit the menu and return to the measurement mode, press **CONF** and then **ENTER**.

5.2.3 Calibration mode configuration

An overview of the calibration setup menu is shown in **Table 9**. Refer to **Appendix A on page 89** for buffer tables.

Table 9 Calibration mode setup menu—CAL mnu

Select pH buffer set		
CA.SOL	–01–BUF	Knick/Mettler-Toledo
	–02–BUF	Merck Titrisols, Riedel Fixanals
	–03–BUF	Ciba (94)
	–04–BUF	NIST technical buffers
	–05–BUF	NIST standard buffers
	–06–BUF (default)	HACH buffers
	–07–BUF	WTW technical buffers
	–08–BUF	Hamilton Duracal
	MAN (manual entry, for buffers not listed in this table)	
	DAT—Entry of offset and slope of premeasured electrodes	
Enter calibration timer interval		
CA.tiME	Enter the time interval for calibration (0 to 9999 hours; default: 0 h to disable timer)	

5.2.4 Alarm settings configuration

An overview of the alarm setup menu is shown in **Table 10**.

Table 10 Output setup menu for alarm settings

Select Sensocheck		
AL.SnSO	CHECK ON	Continuous Sensocheck evaluation of probe function
	CHECK OFF (default)	
Enter alarm delay		
AL.dLY	0010 sec (default)	Range: 0000–0600 sec
LED in Hold mode		
AL.LED	HOLD ON	LED blinks during hold
	HOLD OFF	LED off during hold

Section 6 Operation—Foundation Fieldbus

The following section describes how to operate the si792x Fieldbus transmitter. The transmitter can be operated as follows:

- Direct interface with the transmitter (**section 6.1**)
- Foundation Fieldbus communication (**section 6.2 on page 44**)

6.1 Configuration

Use the configuration mode to specify the sensor, range and other parameters for the system.

6.1.1 Configuration steps

Complete the following steps to configure the si792 transmitter.

1. Press **MEAS** + **CAL** and enter **1200** to enter the configuration mode.
2. Use the arrow and enter keys to change the settings. All settings and options are shown in **section 6.1.2**.

To exit the configuration mode at any time, press **MEAS** + **CAL** and then **ENTER**. The Hold mode will be active for 20 seconds and then the measured value will be displayed.

Note: *During configuration the transmitter remains in the Hold mode for safety reasons. The Sensoface icon is inactive. The configuration mode indicator is displayed (**Figure 10 on page 32**).*

6.1.2 Configuration menu

Select the process variable		
In.UnIT	pH (default) Range: –2.00–16.00 pH	
	ORP Range: –1500 mV–1000 mV	
Select electrode type		
In.SnSR	Glass (default for EU version)	
	ISFET	
	pHD (default for standard version, with pHD and LCP sensors)	
Select temperature unit		
tc.UnIT	°C (default)	
	°F	
Select temperature sensor		
tc.rTD	PT100	
	PT1000 (default for EU version)	
	300 NTC (default for standard version, with pHD and LCP sensors)	
Select temperature during measurement		
tc.MEAS	Auto (default)	
	Manual	°C (default: 25 °C) Range: –20–150 °C
		°F Range: –004–0392 °F
Select temperature during calibration		
tc.CAL	Auto (default)	
	Manual	°C (default: 25 °C) Range: –20–100 °C
		°F Range: –004–0392 °F
Select TC process medium		
tc.LIN	–19.9–19.99 %/K (default: 00.00 %/K)	

6.1.2 Configuration menu (continued)

Select calibration mode / solution		
CA.SOL	-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 (default)	HACH buffers
	-07-BUF	WTW technical buffers
	-08-BUF	Hamilton
	MAN (manual entry, for buffers not listed in this table)	
CA.timE	CAL timer interval	0000–9999 h (default: 0000 h)
Select Sensocheck		
AL.SnSO	CHECK ON	Continuous Sensocheck evaluation of sensor function
	CHECK OFF (default)	
LED in Hold mode		
AL.LED	HOLD ON	LED blinks during hold
	HOLD OFF (default)	LED off during hold
Enter Fieldbus address (optional)[1]		
FF.ADR	0017–0031 BUS (default: 0026 BUS)	

[1]Use only when there is no bus connection. The transmitter will restart and set all parameters to default values. Individual settings must be entered once more.

6.2 Foundation Fieldbus communication

Use the Foundation Fieldbus specification to set up and configure the si792 transmitter. The communication parameters are listed in the following sections. The sensor can be calibrated as described in **section 6.2.4 on page 62**.

6.2.1 Standard resource block (RB)

The standard resource block describes the transmitter characteristics (manufacturer, device name, operating status, global status). The resource block must be in automatic mode for any of the other blocks to operate. The bus parameters for the standard resource block (RB) are shown in **Table 11**.

Table 11 Bus parameters—resource block (RB)

Parameter	Description	Default	R/W
ST_REV	Static revision	0	R
TAG_DESC	TAG description		R/W
STRATEGY	Strategy	0	R/W
ALERT_KEY	Alert key	0	R/W
MODE_BLK	Target	OOS (out of service)	R/W
	Actual	—	
	Permitted	OOS, Auto	
	Normal	Auto	
BLOCK_ERR	Block error		R
RS_STATE	Resource state	1	R
TEST_RW	Test		R/W
DD_RESOURCE	DD resource		R
MANUFAC_ID	Manufacturer ID	0x001D6D for Hach	R
DEV_TYPE	Device type	0x0064	R
DEV_REV	Device revision	1	R
DD_REV	DD revision	1	R

Table 11 Bus parameters—resource block (RB) (continued)

Parameter	Description	Default	R/W
GRANT_DENY	Grant	0	R/W
	Deny	0	R/W
HARD_TYPES	Hardware type	1	R
RESTART	Restart		R/W
FEATURES	Feature supported	Reports/ Soft W Lock	R
FEATURES	Feature selected	Reports/ Soft W Lock	R/W
CYCLE_TYPE	Cycle type	Scheduled/ Block Execution	R
CYCLES_SEL	Cycle selected	Scheduled/ Block Execution	R/W
MIN_CYCLE_T	Min cycle time	1600 1/32 ms (50ms)	R
MEMORY_SIZE	Memory size		R
NV_CYCLE_T	Non-volatile cycle time		R
FREE_SPACE	Free space		R
FREE_TIME	Free time		R
SHED_RCAS			R/W
SHED_ROUT			R/W
FAULT_STATE	Fault state		R
SET_FSTATE	Set fault state	1	R/W
CLR_FSTATE	Clear fault state	1	R/W
MAX_NOTIFY	Max notifications	20	R
LIM_NOTIFY	Limit of notification	8	R/W
CONFIRM_TIME	Confirmation time	640000 1/32 ms	R/W
WRITE_LOCK	Write locking	1 (Unlocked)	R/W
UPDATE_EVT	Unacknowledged	0	R/W
	Update state	0	R
	Time stamp	0	R
	Static revision	0	R
	Relative index	0	R/W

Table 11 Bus parameters—resource block (RB) (continued)

Parameter	Description	Default	R/W
BLOCK_ALM	Unacknowledged		R/W
	Alarm state		R
	Time stamp		R
	Sub-code		R
	Value		R
ALARM_SUM	Current		R
	Unacknowledged		R
	Unreported		R
	Disabled		R/W
ACK_OPTION	Automatic acknowledge option	0 (Disabled)	R/W
WRITE_PRI	Write priority	0	R/W
WRITE_ALM	Unacknowledged		R/W
	Alarm state		R
	Time stamp		R
	Sub-code		R
	Value		R
ITK_VER	ITK_version	4	R
DEVICE_LOCK	Locks the device for local access. 1 byte Data type = uns8 Range: 0 (Unlocked) 1 (Locked)	0 (Unlocked)	R/W

6.2.2 Standard analog input block (AI)

Three Analog Input Function Blocks provide for cyclic transmission of measured values (currently measured value with status, alarm limits, freely selectable process parameter).

6.2.2.1 Operating modes

Use the MODE_BLK parameter to set the following operating modes:

- OOS—out of service. If not write-protected, access to all parameters is allowed.
- MAN—manual
- Auto—online, normal state

6.2.2.2 Set the parameter and units

Use CHANNEL to set the measured parameter and units (**Table 12**). The corresponding measurement unit is selected in the UNITS subparameter of XD_SCALE (**Table 13 on page 49**).

Table 12 Measurement parameters and units

Channel	Parameter	Unit
1	pH	pH
2	ORP	mV
3	Temperature	°C
		°F
4	Glass impedance	MΩ
5	Ref. impedance	kΩ
6	Slope	%
7	Asymmetry potential	mV

6.2.2.3 Data processing

Use the L_TYPE parameter to apply a linearization function to the data.

- Direct—data is sent directly from the TB to the AI without processing. The units for the XD_SCALE and OUT_SCALE parameters must be identical.
- Indirect—data from the TB is linearly scaled from the input scale (XD_SCALE) to the output scale (OUT_SCALE).
- Indirect square root—data is rescaled from the input scale (XD_SCALE) and recalculated using a root function. Then the value is linearly scaled to the output scale (OUT_SCALE).

6.2.2.4 Alarms

The AI block can generate block alarms and limit alarms. Use the ACK_OPTION parameter to specify if an alarm must be acknowledged. When the measured value status is “bad”, the AI block BLOCK_ERR parameter indicates an Input Failure.

- **Block alarms**—a block error will be reported via the BLOCK_ERR parameter (simulate active, input failure, block configuration error, out of service (OOS)). The BLOCK_ALM parameter sends the alarm status to the control system.
- **Limit alarms**—the measured value OUT falls outside of the limit values (HI_HI_LIM, HI_LIM, LO_LIM, LO_LO_LIM).

If an alarm occurs, evaluate the following bus parameters:

- OUT parameter (currently measured value) in the AI block
- LAST_ERROR parameter in the transducer block
- SENSOFACE_STATUS parameter in the transducer block

6.2.2.5 Bus parameters for the analog input block

The bus parameters for the analog input function block (AI) are shown in **Table 13**.

Table 13 Bus parameters/analog input blocks (AI)

Parameter	Description	Default	R/W
ST_REV	Static Revision	0	R
TAG_DESC	TAG Description		R/W
STRATEGY	Strategy	0	R/W
ALERT_KEY	Alert Key	0	R/W
MODE_BLK	Target	OOS	R/W
	Actual	—	
	Permitted	OOS, Auto	
	Normal	Auto	
BLOCK_ERR	Block Error		R
PV	Process Value		R
	Status		R
OUT	Measured Value		R
	Status		R
SIMULATE	Simulate Status		R/W
	Simulate Value		R/W
	Transducer Status		R
	Transducer Value		R
	Simulate Enable / Disable		R/W
XD_SCALE	High Range	100	R/W
	Low Range	0	R/W
	Units Index	0	R/W
	Decimal Point	0	R/W
OUT_SCALE	High Range	100	R/W
	Low Range	0	R/W
	Units Index	0	R/W
	Decimal Point	0	R/W

Table 13 Bus parameters/analog input blocks (AI) (continued)

Parameter	Description	Default	R/W
GRANT_DENY	Grant	0	R/W
	Deny	0	R/W
IO_OPTS	IO Block Options	0	R/W
STATUS_OPTS	Status Options		
CHANNEL	Channel	1	R/W
L_TYPE	Linearization Type	0	R/W
LOW_CUT	Low Cut Off	0	R/W
PV_TIME	Filter Time	0	R/W
FIELD_VAL	Percent Value		R
	Status		R
UPDATE_EVT	Unacknowledged	0	R/W
	Update State	0	R
	Time Stamp	0	R
	Static Revision	0	R
	Relative Index	0	R
BLOCK_ALM	Unacknowledged	0	R/W
	Alarm State	0	R
	Time Stamp	0	R
	Sub-code	0	R
ALARM_SUM	Current	0	R
	Unacknowledged	0	R
	Unreported	0	R
	Disabled	0	R/W
ACK_OPTION	Automatic Acknowledge Option	0	R/W
AIARM_HYS	Alarm Hysteresis	0.50%	R/W
HI_HI_PRI	High High Priority	0	R/W
HI_HI_LIM	High High Limit	INF	R/W
HI_PRI	High Priority	0	R/W
HI_LIM	High Limit	INF	R/W
LO_PRI	Low Priority	0	R/W

Table 13 Bus parameters/analog input blocks (AI) (continued)

Parameter	Description	Default	R/W
LO_LIM	Low Limit	–INF	R/W
LO_LO_PRI	Low Low Priority	0	R/W
LO_LO_LIM	Low Low Limit	–INF	R/W
HI_HI_ALM	Unacknowledged	0	R/W
	Alarm State	0	R
	Time Stamp	0	R
	Sub-code	0	R
	Value	0	R
HI_ALM	Unacknowledged	0	R/W
	Alarm State	0	R
	Time Stamp	0	R
	Sub-code	0	R
	Value	0	R
LO_ALM	Unacknowledged	0	R/W
	Alarm State	0	R
	Time Stamp	0	R
	Sub-code	0	R
	Value	0	R
LO_LO_ALM	Unacknowledged	0	R/W
	Alarm State	0	R
	Time Stamp	0	R
	Sub-code	0	R
	Value	0	R

6.2.2.6 Cyclic measured value status

The cyclic measured value status is shown in **Table 14**.

Table 14 Cyclic measured value status

Priority	Quality	Sub-status	Bin-coding (no limit bits)	Hex-coding
Low	Good	Good Non-Specific	10 00 00 00	0 x 80
		Good Active Advisory Alarm	10 00 10 xx	0 x 88
		Good Active Critical Alarm	10 00 11 xx	0 x 8C
	Uncertain	Uncertain Non-Specific	01 00 00 xx	0 x 40
		Last Usable Value (LUV)	01 00 01 xx	0 x 44
		Substitute-Set	01 00 10 xx	0 x 48
		Initial Value	01 00 11 xx	0 x 4C
		Sensor Conversion Not Accurate	01 01 00 xx	0 x 50
		Engineering Unit Violation	01 01 01 xx	0 x 54
		Sub-Normal	01 01 10 xx	0 x 58
	Bad	Non-Specific	00 00 00 xx	0 x 00
		Sensor Failure	00 01 00 xx	0 x 10
		Device Value	00 00 11 xx	0 x 0C
High		Out of Service	00 01 11 xx	0 x 1C

6.2.2.7 Measured value limits—limit bits

The respective status bit is set when a condition occurs (**Table 15**). The status bit is reset when the condition no longer exists.

Table 15 Limit bit description

Bin coding of limit bits	Description
00	OK
01	Low-limited
10	High-limited
11	Constant

6.2.3 Transducer block

The transducer block provides for acyclic data transmission. Calibration, configuration, and maintenance commands coming from the control station are processed in the Transducer Block. The bus parameters for the transducer block (TB) are shown in **Table 16** (default values are in bold type).

Table 16 Transducer block bus parameters

Parameter	Description	R/W	Bytes	Data type	Range
ST_REV	The revision of the static data associated with the function block. Used by the host to determine when to re-read the static data.	R	2		The revision value is incremented every time a static parameter in the block is changed.
TAG-DESC	The user description of the intended application of the block.	R/W	32		**Default: Text**
STRATEGY	The strategy field can be used to identify a grouping of blocks. Can be used for any purpose by the user.	R/W	2		**Default: 0**
ALERT_KEY	Identification number that may be used by the host system to sort alarms and other device information.	R/W	1		**Default: 0**

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
MODE_BLK	Allows the user to set the Target, Permitted, and Normal device mode. Displays the Actual mode. Target Actual Permitted Normal	R/W R R/W R/W	1 1 1 1		Available modes: Automatic, Out Of Service (OOS), Manual
BLOCK_ERR	Reflects the error status associated with the hardware or software of the block. It is a bit string so multiple errors may be shown.	R	2		
UPDATE_EVENT	Unacknowledged Update State Time Stamp Static Rev Relative Index	R	1 1 8 2 2		**Default: 0**
BLOCK_ALM	Unacknowledged Alarm State Time Stamp Subcode Value	R	1 1 8 2 1		**Default: 0**

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
TRANSDUCER_ DIRECTORY	Directory that specifies the number and the starting indices of the transducers in the transducer block.	R	4		
TRANSDUCER_TYPE	Identifies the transducer type.	R	2		**Default: 65535 = other**
XD_ERROR	A transducer block sub-code. XD_ERROR contains the highest priority alarm that has been activated in the TB_DETAILED_STATUS parameter.	R	1		**Default: 0**
COLLECTION_ DIRECTORY	A directory that specifies the number, starting indices, and DD item of IDs of the data collection in each transducer within a transducer block. Used by the host for efficient transfer of information.	R	36		
Output					
PRIMARY_VALUE_TYPE	pH/ORP	R/W	2	uns16	**0 = pH** 1 = ORP
PRIMARY_VALUE	Shows the pH value and status Value Status	R	4 1	DS-65	

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
PRIMARY_VALUE_RANGE	Shows the range of the pv High Range Low Range Unit Index Decimal Point	R	 4 4 2 1	DS-68	–2–16 **16pH** **-2pH** **1422 (pH)** **2**
SENSOR_TYPE_PH	Glass, ISFET, pHD	R/W	2	uns 16	0 = Glass 1 = ISFET 2 = pHD
SENSOR_MV	Sensor output in mV	R	2	float	
SECONDARY_VALUE_1	Process ORP value and status Value Status	R	 4 1	DS-68	–1500–1000mV
SECONDARY_VALUE_ UNIT_1		R	2	uns 16	**Default: 1243 = mV**
ISO_POTENTIAL	Isopotential pH value	R	4	float	**Default: 7 pH**
SECONDARY_VALUE_2	Process temperature value and status Value Status	R	 4 1	DS-65	–20–200 °C

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
Temperature					
SECONDARY_VALUE_UNIT_2	Degree C or degree F. Changes the unit of temperature being displayed and transmitted.	R/W	2	uns16	**1001 = °C** 1002 = °F
TEMP_SENSOR_COMP	Indicates manual or automatic temperature compensation. Turns automatic pH sensor temp. compensation on and off.	R/W	1	uns8	**0 = Automatic** 1 = Manual
TEMP_SENSOR_MAN_VALUE	Temperature value used in manual temp. compensation mode. The constant temp. value used to calculate pH in the manual temp. compensation mode	R/W	4	float	–20–200 °C
TEMP_SENSOR_CALIB	Indicates manual or automatic mode of temperature measurement for calibration.	R/W	1	uns8	**0 = Automatic** 1 = Manual
TEMP_SENSOR_CALIB_MAN_VALUE	Temperature value used in manual temp. compensation for calibration.	R/W	4	float	–20–200 °C
TEMP_SENSOR_TYPE	Type of temperature sensor. The value entered must correspond to the temp. element in the pH sensor being used.	R/W	2	uns16	128 = Pt100 200 = Pt1000[1] 1000 = NTC300[2] 1001 = NTC8.55

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
TEMPERATURE_COEFF	Rate of change of solution pH with temp, used for solution pH temp. compensation. CAL_MAN_PH_POINT_1 Entering a value augments the temp. compensation to correct for changes in the actual solution pH with temp. This value should correspond to the known temperature characteristics of the process solution.	R/W	4	float	–19.99–19.99 **Default:** Typically **0.00**, unless solution pH temperature compensation is being used.
TEMP_WIRE_IMPEDANCE	Sets the wire impedance of the temp. sensor. Typically 0 unless the wire of the sensor gets too long.	R/W	4	float	0–1000Ω **Default: 0Ω**
TEMP_SENSOR_CAL	Desired temperature reading, used for temperature measurement calibration. The temp. value entered for a single point temp. standardization.	R/W	4	float	–10–10K
Calibration					
CAL_MAN_PH_POINT_1	pH of buffer solution used in a manual buffer calibration.	R/W	4	float	–2–16pH

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
CAL_MAN_PH_POINT_2	pH of buffer solution used in a manual buffer calibration.	R/W	4	uns8	–2–16pH
CAL_SLOPE_PH	The slope of the pH electrode in %	R/W	4	float	80–103% **Default:** Theoretical value is **100% = 59.16mV/pH**, but the actual value is determined by a 2 point buffer calibration.
CAL_ZERO_PH	The zero offset resulting from a buffer calibration or a standardization	R/W	4	float	–60–60mV **Default:** Theoretical value is **0.00 mV**, but actual value will depend upon the characteristics of the pH sensor field –60–60mV.
CAL_OFFSET_ISFET	Sets the offset of the ISFET.	R/W	4	float	–200–200mV
CAL_ZERO_ORP	The zero offset resulting from a buffer calibration.	R/W	4	float	–700–700mV
CALIBRATION_TIMER	Sets the calibration timer (time in which the device should be calibrated).	R/W	4	float	0–9999h **Default: 0000 h = disable**

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
CALIBRATION_MODE	Sets the calibration mode.	R/W	1	uns8	**0 = BUF** 1 = MAN 2 = DAT
CALIBRATION_MODE_ BUFFER	Sets the buffer set for CALIBRATION_MODE.= BUF	R/W	1	uns8	1 = - 01 - BUF 2 = - 02 - BUF 3 = - 03 - BUF 4 = - 04 - BUF 5 = - 05 - BUF **6 = - 06 - BUF** 7 = - 07 - BUF 8 = - 08 - BUF
CAL_SAMPLE_PRD_PH	Starts the 1st part of pH-product calibration.	R/W	1	uns8	**0 = Nop** 1 = Sample
CAL_SAMPLE_PRD_PH_ STORED_VAL	Shows the stored value of the first step of pH-product calibration	R	4	float	–2–16pH
CAL_PRODUCT_PH	Sets the value for the 2nd part of pH-product calibration.	R/W	4	float	–2–16pH
CAL_SAMPLE_PRD_ORP	Starts the 1st part of ORP-product calibration.	R/W	1	uns8	**0 = Nop** 1 = Sample
CAL_SAMPLE_PRD_ORP_ STORED_VAL	Shows the stored value of the first step of ORP-product calibration.	R	4	float	–1500–1000mV

Table 16 Transducer block bus parameters (continued)

Parameter	Description	R/W	Bytes	Data type	Range
CAL_PRODUCT_ORP	Sets the value for the 2nd part of ORPproduct calibration.	R/W	4	float	–1500–1000mV **Default: ORP**
Alert					
SENSOCHECK	Enables or disables Sensocheck.	R/W	1	uns8	**0 = Off** 1 = On
ALARM_LED_MODE	Sets the LED to HOLD mode.	R/W	1	uns8	**0 = Off** 1 = On
LAST_ERROR	Shows the last error.	R	2	uns16	0...100 **Default: 0 = None**
SENSOFACE_STATUS	Shows the current status of the Sensoface.	R	1	uns8	**0 = Good** 2 = Bad
Identification and local parameter setting					
SW_REV_LEVEL	Software revision number	R	2	uns8	
HW_REV_LEVEL	Hardware revision number	R	1	uns8	

[1]Default for EU version
[2]Default for standard version

6.2.4 Calibration via Foundation Fieldbus

The transmitter can be calibrated via Foundation Fieldbus using the comparison or grab sample method.

pH

1. Make sure the system is configured for pH (PRIMARY_VALUE_TYPE = pH).
2. Collect a grab sample and set CAL_SAMPLE_PRD_PH to sample. The pH value of the sample is stored. After writing, the parameter is automatically reset to NOP (no operation).
3. Read the parameter CAL_SAMPLE_PRD_PH_STORED_VAL. It contains the stored value.
4. Measure the grab sample and write the lab value in CAL_PRODUCT_PH. The device is now calibrated. CAL_SAMPLE_PRD_PH_STORED_VAL is reset to zero.

Note: *Calibration values can also be entered directly in the CAL_SLOPE_PH and CAL_ZERO_PH parameters.*

ORP

1. Make sure the system is configured for ORP (PRIMARY_VALUE_TYPE = ORP).
2. Collect a grab sample and set CAL_SAMPLE_PRD_ORP to sample. The ORP value of the sample is stored. After writing, the parameter is automatically reset to NOP (no operation).
3. Read the parameter CAL_SAMPLE_PRD_ORP_STORED_VAL. It contains the stored value.
4. Measure the grab sample and write the lab value in CAL_PRODUCT_ORP. The device is now calibrated. CAL_SAMPLE_PRD_ORP_STORED_VAL is reset to zero.

Section 7 Operation—Profibus PA

The following section describes how to operate the si792x P-PA transmitter. The transmitter can be operated as follows:

- Direct interface with the transmitter (**section 7.1**)
- Profibus PA communication (**section 7.2 on page 65**)

Note: *Calibration must be completed by direct interface with the transmitter.*

7.1 Configuration

Use the configuration mode to specify the sensor, range and other parameters for the system.

7.1.1 Configuration steps

1. Press **MEAS** + **CAL** and enter **1200** to enter the configuration mode.
2. Use the arrow and enter keys to change the settings. All settings and options are shown in **section 7.1.2**.

To exit the configuration mode at any time, press **MEAS** + **CAL** and then **ENTER**. The Hold mode will be active for 20 seconds and then the measured value will be displayed.

Note: *During configuration the transmitter remains in the Hold mode for safety reasons. The Sensoface icon is inactive. The configuration mode indicator is displayed (**Figure 11 on page 33**).*

7.1.2 Configuration menu

Select process variable pH/mV		
	pH (default) Range: 0.00–14.00	A change of the process variable requires a complete configuration
	mV Range: –1500–1500	
Select the temperature unit		
Auto	Auto °C (default)	The measurement and calibration are automatically recorded when the temperature sensor is connected
	Auto °F	
man	man °C	Manual input during measurement and calibration
	man °F	
manAuto	°C Auto man	Recorded automatically during measurement Manual input during calibration
	°F Auto man	
Select the temperature sensor (auto)		
	PT100 PT1000 (default for EU version) 300 NTC (default for standard version with pHD and LCP sensors)	
	BUS EXT	External temperature during measurement (°C) Manual input during calibration (°C)
Enter temperature of sensor (man)		
	xxx.x °C (default: 025.0 °C)	
	xxx.x °F	
Select Sensocheck		
	CHECK ON	Continuous Sensocheck evaluation of sensor function
	CHECK OFF (default)	

7.1.2 Configuration menu (continued)

Select the calibration mode			
	-01-BUF	Knick /Mettler Toledo	Calibration mode: Automatic with Calimatic
	-02-BUF	Merck Titrisols, Riedel Fixanals	
	-03-BUF	Ciba (94)	
	-04-BUF	NIST technical buffers	
	-05-BUF	NIST standard buffers	
	-06-BUF (default)	HACH buffers	
	-07-BUF	WTW technical buffers	
	-08-BUF	Hamilton	
	DAT		Direct entry of zero and slope of premeasured electrodes
	MAN		Calibration with manual buffer entry
Enter cal timer interval			
	0000–9999 h (default: 0000 h (Off))		
Enter Profibus address			
Edit	0001–0126 (default: 0126)		Make sure that the transmitter is not communicating via Profibus

7.2 Profibus communication

Profibus uses a master/slave data exchange technique. The master (typically a PLC) generates queries to individual slaves. The slaves, in turn, reply back with a response to the master. A Profibus message contains the information required to send a query or request, including the slave address, function code, data, and a checksum. See **Table 17 on page 66** for Profibus communication parameters.

Table 17 PROFIBUS communication

Cause	No. of binary message	Analog input status	Physical Block (PB) Global status	Text of binary message (default)	Logbook (default)
Factory settings defective	1	0000 11xx	Failure	ERR SYSTEM	Yes
Configuration data defective, Gaincheck	2	0000 11xx	Failure	ERR PARAMETERS	Yes
Memory error (RAM, ROM, EPROM)	3	0000 11xx	Failure	ERR MEMORY	Yes
pH range violation (pH electrode)	4	0100 0111 0100 1111	Failure	ERR PH VALUE	Yes
mV range violation (redox electrode)	5	0100 0111 0100 1111	Failure	ERR MV VALUE	Yes
Temp range violation Temperature probe	6	0100 0111 0100 1111	Failure	ERR TEMP VALUE	Yes
Sensocheck Glass electrode	7	0100 0111 0100 1111	Failure	CHK GLASS EL.	Yes
Sensocheck Reference electrode	8	0100 0111 0100 1111	Failure	CHK REF. EL.	Yes
Zero point/Slope	9	0101 00xx	Maintenance req.	CHK ZERO/SLOPE	Yes
Electrode response time	10	0101 00xx	Maintenance req.	CHK EL. RESPONSE	Yes

Table 17 PROFIBUS communication (continued)

Cause	No. of binary message	Analog input status	Physical Block (PB) Global status	Text of binary message (default)	Logbook (default)
Calibration timer Cal prompt	11	0101 00xx	Maintenance req.	CAL REQUIRED	
Calibration	12	0100 0111 0100 1111	Function check	CAL RUNNING	
Configuration	13	0100 0111 0100 1111	Function check	CONF RUNNING	
HOLD (Device state = Maintenance)	14	0100 0111 0100 1111	Function check	HOLD	X
HI_HI_LIM FB analysis mV/mV	15	1000 1110	Limit 1 Bit 1	HI_HI_LIMIT PH HI_HI_LIMIT MV	
HI_LIM FB analysis mV/mV	16	1000 1010	Limit 1 Bit 2	HI_LIMIT PH HI_LIMIT MV	
LO_LIM FB analysis mV/mV	17	1000 1001	Limit 1 Bit 3	LO_LIMIT PH LO_LIMIT MV	
LO_LO_LIM FB analysis mV/mV	18	1000 1101	Limit 1 Bit 4	LO_LO_LIMIT PH LO_LO_LIMIT MV	

Table 17 PROFIBUS communication (continued)

Cause	No. of binary message	Analog input status	Physical Block (PB) Global status	Text of binary message (default)	Logbook (default)
HI_HI_LIM FB temperature	19	1000 1110	Limit 2 Bit 1	HI_HI_LIMIT TEMP	
HI_LIM FB temperature	20	1000 1010	Limit 2 Bit 2	HI_LIMIT TEMP	
LO_LIM FB temperature	21	1000 1001	Limit 2 Bit 3	LO_LIMIT TEMP	
LO_LO_LIM FB temperature	22	1000 1101	Limit 2 Bit 4	LO_LO_LIMIT TEMP	
Logbook empty	23	Function check		EMPTY LOGBOOK	

Section 8 Calibration

8.1 Calibration

The transmitter is adjusted to the probe through the calibration. The available calibration methods are shown in **Table 18**.

Table 18 Calibration methods and passcodes

Method	Passcode
pH or ORP calibration by method specified in configuration menu (**Table 9 on page 40**)	1100
Adjustment of temperature probe	1015
Cal info	0000
pH or ORP calibration by comparison	1105 (not available with si792x P-PA)
Zero pH adjustment (for ISFET type probes only)	1001 (not available with si792x P-PA)

During calibration the transmitter remains in the Hold mode for safety reasons. The loop current is frozen at the value specified in the o1.HoLD menu option. The Sensoface icon is inactive. The calibration mode indicator is displayed (**Figure 11 on page 33**).

To exit the calibration mode at any time, press **CAL** and then **ENTER**. The output current will be held for 20 seconds and the measured value will be displayed.

8.1.1 pH calibration

The pH probe can be calibrated by automatic buffer recognition, by manual buffer entry or by comparison to an alternate measurement method. A one-point or two-point calibration is accepted when buffer solutions are used. If calibration data is available for the probe, the slope and offset can be entered.

ISFET probes or probes with an offset or isopotential other than pH 7 require an offset adjustment before calibration.

Calibration

Note: *Calibrations must be performed by trained personnel. Incorrectly set parameters may result in errors in sample measurements.*

Note: *To reduce the response time of the probes, briefly stir the buffer solution with the probe and then hold it still.*

8.1.1.1 Calibration with automatic buffer recognition

The buffer solutions selected in the configure menu (**section 5.2.3 on page 40**) must be used during calibration for accurate results. Other buffer solutions, even those with the same nominal pH values, may show a different temperature dependence and result in measurement errors.

Complete the following steps to calibrate the pH probe:

1. Press **CAL**, enter passcode: 1100, **ENTER**. The display will show CAL1.
2. Remove the pH and temperature probes from the process. Clean the probes and immerse in the first buffer solution (any order). Briefly stir the solution with the probes.
3. Press **ENTER**. Automatic recognition of the buffer solution will begin. The display will first show the hourglass and no buffer value, then the recognized buffer value followed by the measured millivolt value. When the measurement is complete, the display will show CAL2.
4. When CAL2 is displayed, remove the probes from the first buffer solution and rinse thoroughly.
5. Complete a one-point calibration or start a two-point calibration:
   - **One-point calibration**: press **CAL** to end the calibration. The slope (%) and offset (mV) of the probe (based on 25 °C) will be displayed.
   - **Two-point calibration**: immerse the probes in the second buffer solution. Press **ENTER**. The buffer detection will repeat as for the

first buffer solution. When complete, the slope (%) and offset (mV) of the probe (based on 25 °C) will be displayed.

6. Press **ENTER**, **ENTER** to return to the measurement mode. The HOLD mode will remain active for 20 seconds.
7. Remove the probes from the buffer, rinse and return to the process.

8.1.1.2 Calibration with manual buffer entry

For calibration with manual buffer specification, the pH value of the buffer solution at the proper temperature must be entered. This calibration allows for calibration with any buffer solution.

Be sure that manual calibration is selected in the configure, cal menu (**section 5.2.3 on page 40**).

1. Press **CAL**, enter passcode: 1100, **ENTER**. The display will show CAL1.
2. Remove the pH and temperature probes from the process. Clean the probes and immerse in the first buffer solution (any order). Briefly stir the solution with the probes.
3. Press **ENTER**. Use the **UP ARROW** and **RIGHT ARROW** to edit the displayed pH value to match the pH of the buffer solution at the selected temperature.
4. Press **ENTER**. Measurement of the buffer solution will begin. When measurement is complete, the display will show CAL2.
5. Complete a one-point calibration or start a two-point calibration:
   - **One-point calibration**: press **CAL** to end the calibration. The slope (%) and offset (mV) of the probe (based on 25 °C) will be displayed.
   - **Two-point calibration**: immerse the probes in the second buffer solution. Press **ENTER**. Edit the displayed pH value to match the second buffer solution and press **ENTER**. Measurement of the

buffer solution will begin. When complete, the slope (%) and offset (mV) of the probe (based on 25 °C) will be displayed.

6. Press **ENTER**, **ENTER** to return to the measurement mode. The HOLD mode will remain active for 20 seconds.
7. Remove the probes from the buffer, rinse and return to the process.

8.1.1.3 Enter calibration data from calibrated probes

If the slope and offset of a probe have been determined from a prior calibration, these values can be entered into the transmitter.

Be sure that DAT is selected in the configure, cal menu (**section 5.2.3 on page 40**).

1. Press **CAL**, enter passcode: 1100, **ENTER**. The display will show CAL and then a screen for offset (mV) entry.
2. Enter the offset mV value of the probe. Press **ENTER**. The value of the slope (%) will be displayed.
3. Enter the slope value of the probe in percent (%). **Table 19** shows the slope in percent vs. mV/pH unit for reference. Press **ENTER**. The slope (%) and offset (mV) of the probe will be displayed.
4. Press **ENTER**, **ENTER** to return to the measurement mode. The HOLD mode will remain active for 20 seconds.

Table 19 Slope in % vs. mV/pH unit

Slope (%)	Slope (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

Table 19 Slope in % vs. mV/pH unit (Continued)

Slope (%)	Slope (mV/pH)
94	55.6
96	56.8
98	58.0
100	59.2
102	60.4

8.1.1.4 Calibration by comparison— si792 (x) P (HART) and si792x P-FF only

The probe can be calibrated by entering the sample value from measurement in an instrument such as a laboratory or portable meter (one-point calibration). The probe does not need to be removed from the process during calibration. The sample temperature should correspond to the measured process temperature for accurate results.

1. Press **CAL**, enter passcode: **1105**, **ENTER**. The display will briefly show CAL PRD and then StorE.
2. Collect a grab sample for measurement in the lab. Press **ENTER** to store the sample value in the transmitter.

   The cal mode indicator will flash to indicate that calibration is not complete. The transmitter will continue to measure and display the current sample values.
3. Measure the grab sample with a laboratory or portable meter.
4. Press **CAL**, enter passcode: **1105**, **ENTER** to access the product calibration once more. The display will briefly show CAL PRD and then CALC.
5. Edit the displayed value to match the value measured by the laboratory or portable meter and press **ENTER**. The slope and offset will be shown.

6. Press **ENTER** to end the calibration. The display will show the measured value alternating with Hold.
7. Press **ENTER** to return to the measuring mode. The outputs will remain in the hold mode for approximately 20 seconds.

Note: *For comparison calibration via Foundation Fieldbus, see* *section 8.1.1.4 on page 73**.*

8.1.1.5 Zero adjustment for ISFET probes—For si792(x) P (HART) and si792x P-FF only

The nominal zero point must be adjusted each time a new ISFET or probe with an offset or isopotential other than pH 7 is connected. If not adjusted, the Sensoface messages will not be accurate. Complete the following steps to adjust the zero point.

1. Press **CAL**, enter passcode: 1001, **ENTER**. The display will show CAL ZRO and then the pH value for the zero point.
2. Place the pH probe in a pH 7.00 buffer solution. Briefly stir the solution with the probe.
3. Enter the temperature-corrected pH value of the buffer solution. The value must be between 6.50 and 7.50 pH. Press **ENTER** to save the value.
4. The transmitter will measure the mV reading of the probe. The hourglass will flash. When complete, the mV value of the zero offset of the probe will be displayed. Press **ENTER**.
5. Press **ENTER** to end the zero adjustment.

After adjusting the zero offset, be sure to calibrate the probe by following one of the available procedures:

- Automatic buffer recognition
- Manual buffer entry
- Product comparison method
- Data entry

8.1.2 ORP calibration

The ORP probe is calibrated using an ORP (redox) standard solution. The probe can also be calibrated by product comparison (**section 8.1.1.4 on page 73**).

During calibration, the difference between the measured potential and the specified potential of the calibration standard is determined. In the measurement mode, this difference is added to the measured potential to obtain the displayed potential (equation **(1)**).

(1) $mV_{ORP} = mV_{meas} + \Delta mV$

where:
mV_{ORP} = displayed ORP
mV_{meas} = direct probe potential
ΔmV = delta value, determined during calibration

The probe potential can also be related to another reference system such as the standard hydrogen probe. In this case the temperature-corrected potential (**Table 20**) of the reference probe used must be entered during calibration. During measurement, this value is then added to the measured potential.

Table 20 Temperature-corrected potential of commonly used reference systems

Temperature (°C)	Ag/AgCl/KCl 1 mol/L (Δ mV)	Ag/AgCl/KCl 3 mol/L (Δ mV)	Thalamid (Δ mV)	Mercuric sulfate (Δ 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

Table 20 Temperature-corrected potential of commonly used reference systems (Continued)

Temperature (°C)	Ag/AgCl/KCl 1 mol/L (Δ mV)	Ag/AgCl/KCl 3 mol/L (Δ mV)	Thalamid (Δ mV)	Mercuric sulfate (Δ mV)
70	207	172	–598	613
80	200	163	–605	603

Be sure that ORP is selected in the Configure, Output menu (**section 5.2.1 on page 36**).

Be sure that the measurement and calibration temperature are the same. The temperature behavior of the reference probe is not automatically taken into account.

Complete the following steps to calibrate the ORP probe:

1. Press **CAL**, enter passcode: 1100, **ENTER**. The display will show the mV screen to be edited.
2. Remove the ORP and temperature probes from the process. Clean the probes and immerse in the redox standard. Briefly stir the solution with the probes.
3. Enter the millivolt value of the redox standard solution.
4. Press **ENTER**. The display will show the delta mV value.
5. Press **ENTER**. The display will show the measured mV value alternating with Hold.
6. Press **ENTER** to return to the measurement mode.
7. Remove the probes from the solution, rinse and return to the process. The HOLD mode will remain active for 20 seconds.

8.2 Temperature probe adjustment

Calibration of the temperature probe is advisable, especially for the Pt100 temperature probe.

1. Press **CAL**, enter passcode: 1015, **ENTER**. CAL TMP will be displayed for 3 seconds. The process temperature will be shown.
2. Measure the process temperature with an external thermometer.
3. Use the **UP ARROW** and **RIGHT ARROW** to enter the value of the temperature from the external thermometer.
4. Press **ENTER** to save the value.
5. The transmitter remains in HoLD mode. Press **ENTER** again.

   The transmitter remains in HoLD mode for approximately 20 seconds after calibration and returns to the measurement mode.

Note: *Repeat input of the process temperature value when "Err" is displayed.*

Calibration

Section 9 Maintenance

DANGER

Explosion hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER

Electrostatic hazard. Follow the instructions in section on page 20 before conducting any maintenance tasks.

9.1 Cleaning the instrument

Use only a moistened antistatic, lint-free cloth to remove dust, dirt and spots from the external surfaces of the transmitter. Use a mild household cleaner if necessary.

9.2 Sensor maintenance

Refer to the user manual supplied with each sensor for specific cleaning requirements.

Section 10 Troubleshooting

10.1 Sensoface

The Sensoface feature is active whenever Sensocheck is active. This feature monitors the electrode for defects in the sensor or cable, and indicates the maintenance status of the sensor (**Table 21**).

Table 21 Sensoface description

Sensoface	Description
	The probe is functioning properly.
	The offset and slope of the probe are acceptable, but will require replacement soon.
	The offset and slope of the probe have reached values which no longer ensure proper calibration or the pH probe is defective due to a broken glass pH bulb. Replace the electrode.

10.2 Sensocheck

The Sensocheck feature monitors the sensor electrodes and wires for open circuits. **Table 22** shows the probe types that Sensocheck monitors. When problems are detected, the error message “Err 33” is displayed, along with an icon corresponding to the type of problem.

Sensocheck can be switched off in the configuration menu.

Note: *For confirmation a Sensoface is displayed after calibration.*

Note: *Set Sensocheck to off when a fast response time is required.*

Table 22 Sensocheck and electrode types

	Electrode type	Measure probe	Reference probe
Sensocheck on	pH/ORP	On	On
	pHD[1]	Off	Off

1 Not available in EU

10.3 Error codes

Table 23 describes the error codes.

Table 23 Error codes

Code	Description	Corrective action
ERR 01	pH value flashes; measured pH value is <–2 or >16 or measured potential is <–1500 or >1500 mV.	Make sure that the correct probe is connected to the transmitter.
		Make sure that the probe has sufficient electrolyte.
		Make sure that the probe is in solution.
		Replace probe and cable.
ERR 02	ORP value flashes; measured ORP value is <–1900 or >1900 mV	Make sure that the correct probe is connected to the transmitter.
		Make sure that the probe is in solution.
		Replace probe and cable.
ERR 03	Temperature probe icon flashes; open or short circuit; temperature range exceeded	Check the temperature sensor wiring.
		Make sure that the correct temperature sensor selection in the configuration menu. (NTC300 for pHD and LCP sensors)
		Measure resistance of the temperature sensor in the probe. For pHD and LCP sensors, resistance between the black and yellow wires should be 250–350 ohms.
ERR 11	Current output icon flashes; current is below 3.8 mA	Check the loop power supply voltage to the transmitter.
ERR 12	Current output icon flashes; current is above 20.5 mA	Make sure of the current output selection (Table 7 on page 36).

Table 23 Error codes (Continued)

Code	Description	Corrective action
ERR 13	Current output icon flashes; reading range value set too large or too small	Check the range settings (**Table 7 on page 36**)
ERR 33	Sensocheck icon flashes; error with glass pH probe	First calibrate the transmitter. If error repeats check the following steps.
		Make sure of the configuration settings.
		Clean connection terminals and probe cap.
		Replace probe and cable.
ERR 34	Sensocheck icon flashes; error with reference electrode	Clean connection terminals and probe cap.
		Replace probe and cable.
		Jumper between terminal 4 and 5 is missing (combination sensors only)
ERR 98	CONF flashes; configuration or calibration data is defective. Memory error in the program.	Return to the factory for repair and calibration.
ERR 99	FAIL flashes; EEPROM or RAM defective	Return to the factory for repair and calibration.

10.4 Calibration errors

Table 24 describes the calibration error messages.

Table 24 Calibration error messages

Display	Description	Corrective action
Zero error icon	Offset potential of pH probe in pH 7 buffer is out of range (± 60 mV)	Make sure that the buffer used matches the buffer specified in configuration.
		Replace the buffer solution.
		Make sure that the pH probe has a offset potential of approximately 0 mV in a pH 7 buffer solution; if not adjust the zero (page 74).
		Make sure that the temperature probe is immersed in buffer solution (for automatic temperature compensation).
		Make sure of the temperature specification in configuration.
		Replace the probe.
Slope error icon	Slope of pH probe is out of range (80–103%)	Make sure that the buffer used matches the buffer specified in configuration.
		Replace the buffer solution.
		Make sure that the temperature probe is immersed in buffer solution (for automatic temperature compensation).
		Make sure of the temperature specification in configuration.
		Replace the probe.

Table 24 Calibration error messages (Continued)

Display	Description	Corrective action
CAL ERR with calibration error icon	Buffer recognition problem; mV value not correct for specified buffer or mV values are similar for 2 buffers.	Make sure that the buffer(s) used match the buffer(s) specified in configuration.
		For manual calibration, make sure that the correct buffer is used as specified.
		Replace the buffer solution(s).
		Make sure of the temperature specification in configuration.
		Make sure that the correct probe is connected to the transmitter.
		Clean the probe.
		Replace the probe.
CAL ERR with calibration timer icon	Calibration canceled due to large drift in mV reading.	Make sure that the buffer(s) used match the buffer(s) specified in configuration.
		Replace the buffer solution(s).
		Make sure that the temperature of the buffer solution does not change during measurement.
		Make sure that the cable is sufficiently shielded from strong electric fields.
		Make sure that the probe has electrolyte.
		Clean the probe.
		Replace the probe.

10.5 Diagnostic functions

Table 25 lists the diagnostic functions.

Table 25 Diagnostic functions

Function	Description
View the output current	From the measuring mode, press **ENTER**. The output current will show in the main display for five seconds, then return to measuring mode.
View calibration data	From the measuring mode, press **CAL** and enter passcode ‘0000’. The slope will show in the main display and the zero current will show in the secondary display. After 20 seconds, the transmitter will return to the measuring mode, or press **ENTER** to return immediately to the measuring mode.
View the last error message	From the measuring mode, press **CONF** and enter passcode ‘0000’. The last error message will show for 20 seconds, or press **ENTER** to return immediately to the measuring mode. After viewing the error, the message will be deleted.
View the uncorrected probe potential (sensor monitor)	From the measuring mode, press **CONF** and enter passcode ‘2222’. The measured (uncorrected) potential will show in the main display. Press **ENTER** to return to the measurement mode.
Specify output current	From the measuring mode, press **CONF** and enter passcode ‘5555’. The measured current will show in the secondary display. The output current in the main display can be modified. To change the output current: **1.** Select the current value with the **RIGHT ARROW** key. **2.** Edit the number using the **UP ARROW** key. **3.** Press **ENTER** to confirm. The entered value will show in the secondary display. The transmitter will remain in Hold mode. **4.** To exit Hold mode, press **CONF**, then **ENTER** to return to measuring mode.

Section 11 Parts and accessories

11.1 si792 P series versions

Description	Catalog number
si792(x) P standard versions[1]	
si792 P, pH/ORP, CID2	LXV500.99.70012
si792x P, pH/ORP, CID1; ATEX Zone 1	LXV500.99.70112
si792x P-PA, pH/ORP, CID1; ATEX Zone 1	LXV500.99.76112
si792x P-FF, pH/ORP, CID1; ATEX Zone 1	LXV500.99.77112
si792(x) P EU versions[2]	
si792 P, pH/ORP, CID2	LXV500.99.70002
si792x P, pH/ORP, CID1; ATEX Zone 1	LXV500.99.70102
si792x P-PA, pH/ORP, CID1; ATEX Zone 1	LXV500.99.76102
si792x P-FF, pH/ORP, CID1; ATEX Zone 1	LXV500.99.77102

[1] Standard models are not available in the EU. Standard models contain default settings for Hach pHD and LCP sensors. Default settings can be changed by the user.

[2] Available in the EU only. EU models contain default settings for pH/ORP combination electrodes with PT1000. Default settings can be changed by the user.

11.2 Accessories

Description	Catalog number
Panel-Mount Installation Kit, si792	LZY484
Pipe-Mount Installation Kit, si792	LZY483
Protective Hood, si792	LZY485
si792 P pH/ORP Manual, English	DOC026.53.00794
si792 Series Complete Documentation on CD	DOC086.98.00794

Parts and accessories

Appendix A Buffer tables

Refer to the following tables for pH values of specific buffer sets at varying temperatures.

- 01 Knick/Mettler-Toledo (**Table 26**)
- 02 Merck, Riedel (**Table 27**)
- 03 Ciba (94) buffers (**Table 28**)
- 04 NIST technical (**Table 29**)
- 05 NIST standard (**Table 30**)
- 06 Hach buffers (**Table 31**)
- 07 WTW buffers (**Table 32**)
- 08 Hamilton Duracal (**Table 33**)

Table 26 Knick/Mettler-Toledo technical buffers

°C	pH 2	pH 4	pH 7	pH 9
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

Buffer tables

Table 27 Merck Titrisols, Riedel Fixanals

°C	pH 2	pH 4	pH 7	pH 9	pH 12
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

Table 28 Ciba (94) buffers

°C	pH 2	pH 4	pH 7	pH 10
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[1]	4.10[1]	6.92[1]	9.61[1]
70	2.07	4.11	6.92	9.57
75	2.04[1]	4.13[1]	6.92[1]	9.54[1]
80	2.02	4.15	6.93	9.52
85	2.03[1]	4.17[1]	6.95[1]	9.47[1]
90	2.04	4.20	6.97	9.43
95	2.05[1]	4.22[1]	6.99[1]	9.38[1]

[1]Extrapolated values

Buffer tables

Table 29 NIST technical buffers

°C	pH 2	pH 4	pH 7	pH 10	pH 12
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	12.8
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	12.3
35	1.69	4.025	6.98	9.93	12.13
40	1.69	4.03	6.975	9.89	11.99
45	1.7	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[1]	11.57
60	1.72	4.085	6.97	9.83[1]	11.45
65	1.73	4.1	6.98	9.83[1]	11.45[1]
70	1.74	4.13	6.99	9.83[1]	11.45[1]
75	1.75	4.14	7.01	9.83[1]	11.45[1]
80	1.765	4.16	7.03	9.83[1]	11.45[1]
85	1.78	4.18	7.05	9.83[1]	11.45[1]
90	1.79	4.21	7.08	9.83[1]	11.45[1]
95	1.805	4.23	7.11	9.83[1]	11.45[1]

[1]Extrapolated values

Table 30 NIST standard buffers

°C	pH 2	pH 4	pH 7	pH 9
0	1.666	4.010	6.984	9.464
5	1.668	4.004	6.951	9.395
10	1.670	4.000	6.923	9.332
15	1.672	3.999	6.900	9.276
20	1.675	4.001	6.881	9.225
25	1.679	4.006	6.865	9.180
30	1.683	4.012	6.853	9.139
35	1.688	4.021	6.844	9.102
40	1.694	4.031	6.838	9.068
45	1.700	4.043	6.834	9.038
50	1.707	4.057	6.833	9.011
55	1.715	4.071	6.834	8.985
60	1.723	4.087	6.836	8.962
65	1.733	4.109	6.841	8.942
70	1.743	4.126	6.845	8.921
75	1.755	4.145	6.852	8.903
80	1.766	4.164	6.859	8.885
85	1.779	4.185	6.868	8.868
90	1.792	4.205	6.877	8.850
95	1.806	4.227	6.886	8.833

Buffer tables

Table 31 Hach buffers

°C	pH 4	pH 7	pH 10
0	4.00	7.14	10.3
5	4.00	7.1	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[1]	6.99[1]	9.76[1]
70	4.09[1]	6.99[1]	9.76[1]
75	4.09[1]	6.99[1]	9.76[1]
80	4.09[1]	6.99[1]	9.76[1]
85	4.09[1]	6.99[1]	9.76[1]
90	4.09[1]	6.99[1]	9.76[1]
95	4.09[1]	6.99[1]	9.76[1]

[1]Extrapolated values

Table 32 WTW buffers

°C	pH 2	pH 4	pH 7	pH 10
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	40	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	4.1	6.98	
65	1.99	4.13	6.99	
70	2	4.16	7	
75	2	4.19	7.02	
80	2	4.22	7.04	
85	2	4.26	7.06	
90	2	4.3	7.09	
95	2	4.35	7.12	

Buffer tables

Table 33 Hamilton Duracal buffers

°C	pH 4	pH 7	pH 10
0	4.01[1]	7.12[1]	10.19[1]
5	4.01	7.09	10.19
10	4.00	7.06	10.15
15	4.00	7.04	10.11
20	4.00	7.02	10.06
25	4.01	7.00	10.01
30	4.01	6.99	9.97
35	4.02	6.98	9.92
40	4.03	6.97	9.86
45	4.04	6.97	9.83
50	4.06	6.97	9.79
55	4.08[1]	6.98[1]	9.77[1]
60	4.1[1]	6.98[1]	9.75[1]
65	4.13[1]	6.99[1]	9.74[1]
70	4.16[1]	7.00[1]	9.73[1]
75	4.19[1]	7.02[1]	9.73[1]
80	4.22[1]	7.04[1]	9.73[1]
85	4.26[1]	7.06[1]	9.74[1]
90	4.3[1]	7.09[1]	9.75[1]
95	4.35[1]	7.09[1]	9.75[1]

[1]Extrapolated values

Values above 50 °C are not traceable to NIST.

Appendix B Passcode editor

For applications requiring compliance to FDA 21 CFR Part 11, certain device functions must be protected with passcodes. Passcodes can be changed in the passcode editor. If passcode protection is not required, use the preset passcodes (**Table 34**).

To activate the passcode editor:

1. Press **CONF**.
2. Enter **1989**, the administrator passcode. The initial screen will show for approximately 3 seconds, then proceed to the next function.
3. Use the **ARROW** keys to change the passcode.
4. Press **ENTER** to proceed to the next function. Press **CONF** to exit the passcode editor. Refer to **Table 34** for default passcodes.

Table 34 Default passcode settings

Display	Function		Default setting
Cal INFO	Calibration information		0000
CAL 0-CAL	Calibration zero		1001 (not for si792x P-PA)
CAL CAL	Calibration		1100
CAL PROD	Product calibration		1105 (not for si792x P-PA)
CAL RTD	Temperature probe adjustment		1015
CFG ERR	Error information		0000
CFG CONF	Configuration		1200
CFG SNSR MO	Sensor monitor		2222
CFG OUT	Current source		5555
CFG SPCL ST	Administrator passcode. Use **ARROW** keys to select NO or YES		1989
NO SPCL ST	Do not change administrator passcode	Press **ENTER** to return to the default passcode	
		Press **CONF** to exit the editor	

Table 34 Default passcode settings (Continued)

Display	Function		Default setting
YES SPCL ST	Change administrator passcode	Press **ENTER** to accept the new passcode	
		Press **CONF** to exit the editor	

Important Note: *The passcode editor cannot be accessed without the administrator passcode. Record changes in a secure location. It is not possible to override this system if the passwords are lost. The unit must be exchanged. Contact technical support for assistance.*

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