M420 pH

Instruction Manual

www.mt.com/pro

75560

METTLER TOLEDO

Warranty

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

Subject to change without notice.

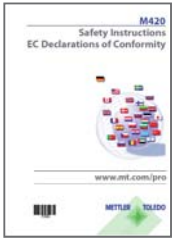
Return of Products Under Warranty
Please contact our Service Team before returning a defective device. Ship the cleaned device to the address you have been given.
If the device has been in contact with process fluids, it must be decontaminated/disinfected before shipment. In that case, please attach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

Disposal
Please observe the applicable local or national regulations concerning the disposal of "waste electrical and electronic equipment".

CD-ROM

Complete documentation:

- Instruction manuals
- Safety instructions
- Short instructions



Safety Information

In official EU languages and others.

- FM / CSA
- EC Declarations of Conformity

Short Instructions

In German, English, French, Russian, Spanish, Portuguese, Japanese, Chinese.
Download: www.mt.com/pro

- Installation and commissioning
- Operation
- Menu structure
- Calibration
- Error messages and recommended actions

Specific Test Report

Contents

Contents

Intended Use

The M420 pH is used for pH/mV, ORP, and temperature measurement in industry, environment, food processing, and sewage treatment.
The sturdy molded enclosure can be fixed into a control panel or mounted on a wall or at a post. The protective hood, which is available as accessory, provides additional protection against direct weather exposure and mechanical damage.
The device has been designed for application with commercially available sensors with a nominal zero point at pH 7, ISFET sensors, or ISM® sensors.
Plain-text messages in a large, backlit display allow intuitive operation. The "Sensocheck" automatic monitoring of glass and reference electrode and the "Sensoface" function for clear indication of the sensor condition provide excellent diagnostics. The internal logbook can handle up to 100 entries – up to 200 with AuditTrail (TAN).
The device provides two parameter sets which can be switched manually or via a control input for different process adaptations or different process conditions (e.g. beer and CIP).
Password protection for granting access rights during operation can be configured.
Two floating, digital control inputs ("Hold" and "Control") are available for external control.
The device provides two current outputs (for transmission of measured value and temperature, for example).

Approvals for Measurement in Hazardous Locations:

M420 pH: General Safety, approved for operation in hazardous locations Zone 2 (FM* and CSA*, Class I Div 2)

M420 pH X: Approved for operation in hazardous locations Zone 1/0 (ATEX; FM* and CSA*, Class I Div 1) as well as Zone 2 (FM* and CSA*, Class I Div 2).

* FM and CSA approvals pending

Safety Information

Safety information –
Be sure to read and observe the following instructions!
The device has been manufactured using state of the art technology 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.

See also separate document:
- "Safety Instructions"
  (EC Declaration of Conformity, FM*, CSA*, ATEX (if applicable) Certificates)

⚠ CAUTION!

Commissioning must only be performed by trained personnel authorized by the operating company! 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 must be performed. This test must be carried out at the manufacturer's factory.

Please note:
Before commissioning it must be proved that the device may be connected with other equipment.

* FM and CSA approvals pending

Information for Installation in Hazardous Locations (M420 pH X)

- Be sure to observe the stipulations of EN 60079-10 / EN 60079-14 or the corresponding local regulations during installation and commissioning. See also separate "Safety Instructions" document.

Approvals for Application in Hazardous Locations:

M420 pH X

- acc. to ATEX in Zone 0, 1, 2
- acc. to FM* and CSA* in Class I Div 1, 2 / Zone 0, 1, 2

M420 pH

- acc. to FM* and CSA* in Class I Div 2

Terminals:

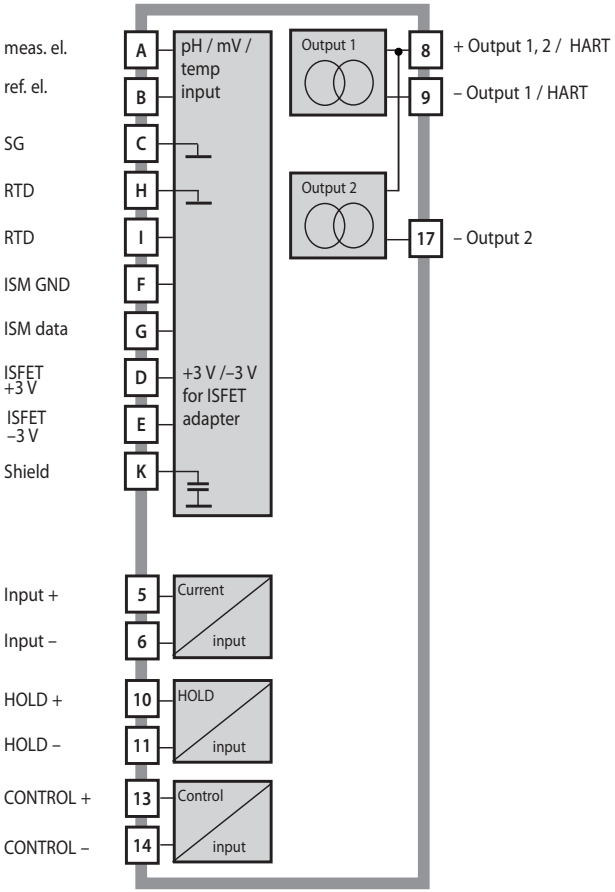
Screw terminal, suitable for single wires / flexible leads up to 2.5 mm^2 (AWG 14).
Recommended torque for the terminal screws: 0.5 ... 0.6 Nm.

Registered Trademarks

The following names are registered trademarks. For practical reasons they are shown without trademark symbol in this manual.
ISM® is a registered trademark of Mettler-Toledo AG
InPro® is a registered trademark of Mettler-Toledo AG
HART® is a registered trademark of the HART Communication Foundation.

* FM and CSA approvals pending

Overview of M420 pH



Package Contents

Check the shipment for transport damage and completeness!

The package should contain:

- Front unit, rear unit, bag containing small parts
- Specific test report
- Documentation (cf Pg 3)
- CD-ROM

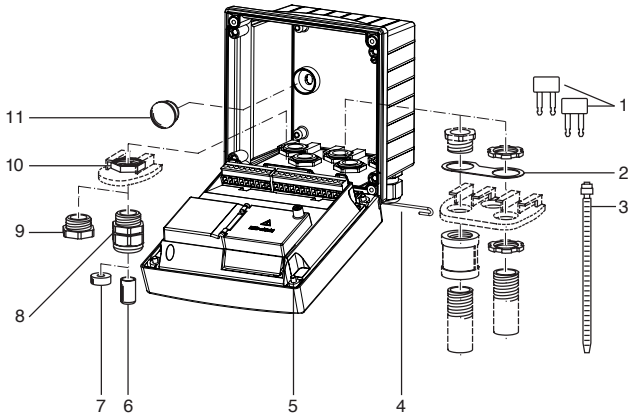
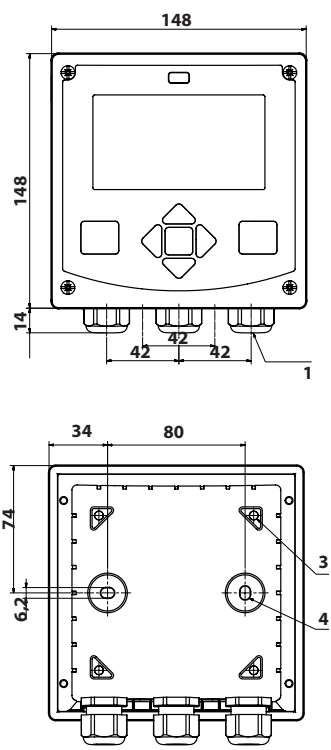


Fig.: Assembling the enclosure

1) Jumper (3 x)
2) Washer (1 x), for conduit mounting: Place washer between enclosure and nut
3) Cable tie (3 x)
4) Hinge pin (1 x), insertable from either side
5) Enclosure screw (4 x)
6) Sealing insert (1 x)
7) Rubber reducer (1 x)
8) Cable gland (3 x)
9) Filler plug (3 x)
10) Hexagon nut (5 x)
11) Sealing plug (2 x), for sealing in case of wall mounting

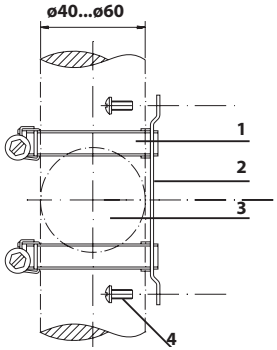
Mounting Plan, Dimensions



1) Cable gland (3 x)
2) Knockouts for cable gland or ½" conduit, 21.5 mm dia. (2 knockouts) Conduits not included!
3) Knockout for pipe mounting (4 x)
4) Knockout for wall mounting (2 x)

Fig.: Mounting plan (All dimensions in mm!)

Pipe Mounting, Protective Hood



1) Hose clamp with worm gear drive to DIN 3017 (2 x)
2) Pipe-mount plate (1 x)
3) For vertical or horizontal posts or pipes
4) Self-tapping screw (4 x)

Fig.: Pipe-mount kit (521202741) – All dimensions in mm!

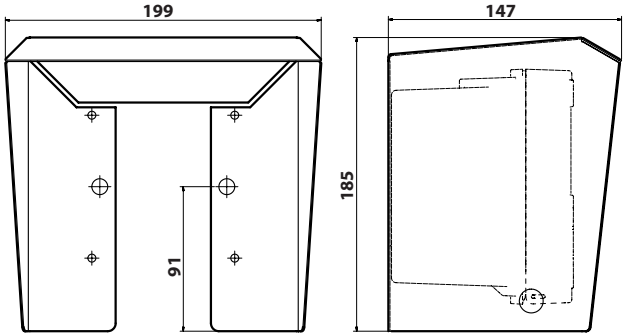
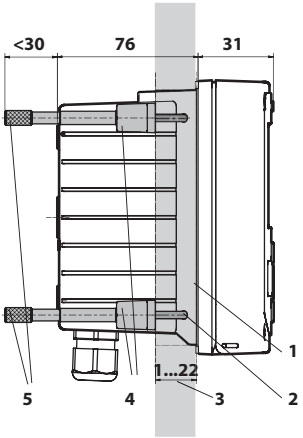


Fig.: Protective hood for wall and pipe mounting (52121470) – All dimensions in mm!

Panel Mounting



1) Circumferential sealing (1 x)
2) Screw (4 x)
3) Position of control panel
4) Span piece (4 x)
5) Threaded sleeve (4 x)

Cutout
138 x 138 mm (DIN 43700)

Fig.: Panel-mount kit (52121471) – All dimensions in mm!

Installation Instructions

- Installation of the device must 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 during installation!
- Be sure not to notch the conductor when stripping the insulation!
- The supplied current must be galvanically isolated. If not, connect an isolator module.
- All parameters must be set by a system administrator prior to commissioning!

Terminals:

suitable for single wires / flexible leads up to 2.5 mm^2 (AWG 14)

Additional safety precautions have to be taken for operation in hazardous locations ATEX Zone 0, 1, 2 and FM*, CSA* Cl. I Div 1, 2 / Zone 0, 1, 2!
(See separate "Safety Instructions" document.)

* FM and CSA approvals pending

Rating Plates / Terminal Assignments

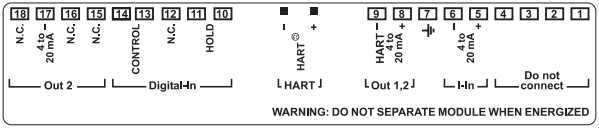


Fig.: Terminal assignments of M420

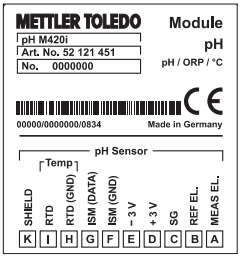


Fig.: M420 pH sensor input terminal assignments

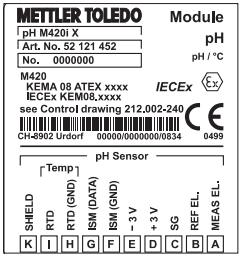


Fig.: M420 pH X sensor input terminal assignments

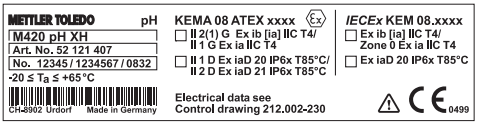
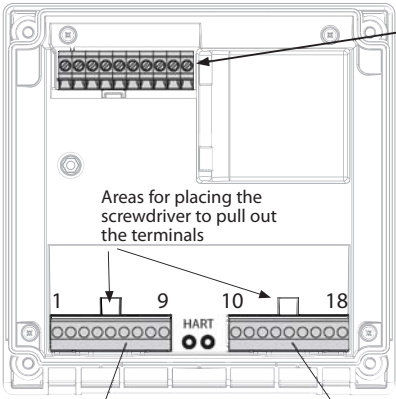


Fig.: M420 pH XH rating plate (outside at bottom of front)

Fig.: M420 pH H rating plate (outside at bottom of front)

Wiring of M420 pH



Sensor connection pH input	
A	meas. el.
B	ref. el.
C	SG
D	+3 V
E	–3 V
F	ISM GND
G	ISM data
H	RTD (GND)
I	RTD
K	Shield

Terminal row 1	
1	Do not connect
2	Do not connect
3	Do not connect
4	Do not connect
5	+ input
6	– input
7	PA (equip. bonding)
8	+out 1,2/HART
9	– out 1/HART

Terminal row 2	
10	hold
11	hold
12	n.c.
13	contr
14	contr
15	n.c.
16	n.c.
17	– out 2
18	n.c.

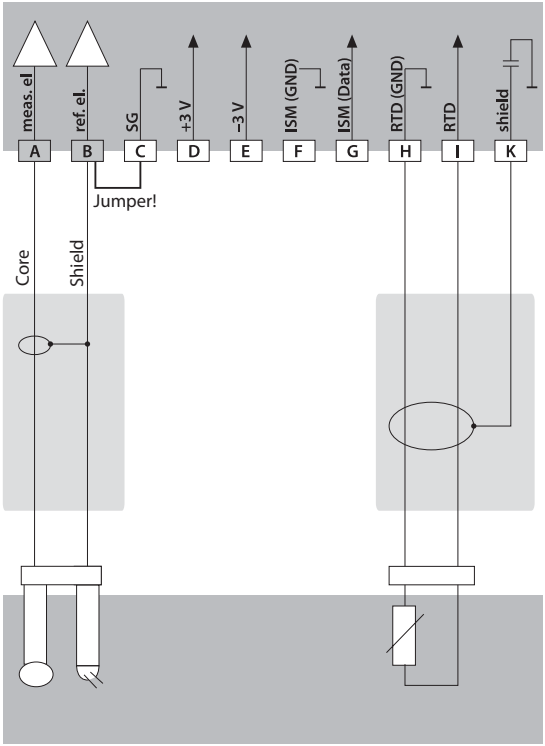
In addition:
2 HART pins (between terminal row 1 and 2

Fig.: Terminals, device opened, back of front unit

Example 1:

Measuring task: pH, temperature, glass impedance

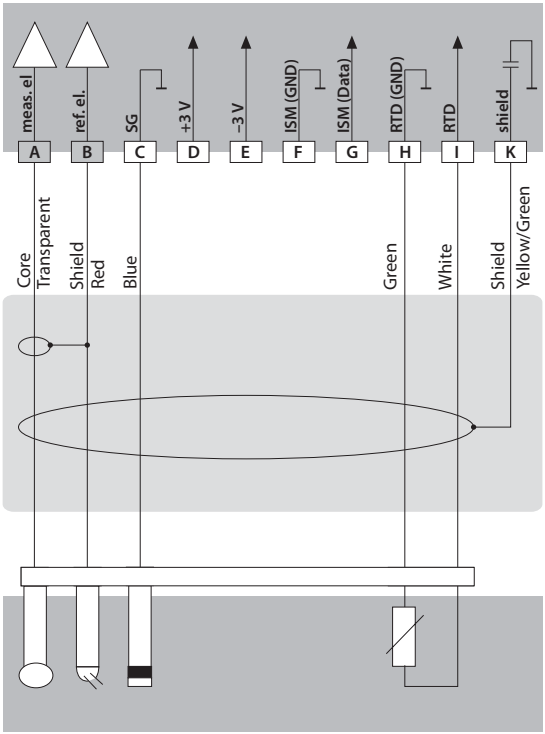
Sensors (example): HA 405-DXK-S8 (Mettler-Toledo)



Example 2:

Measuring task: pH/ORP, temp, glass impedance, ref. impedance

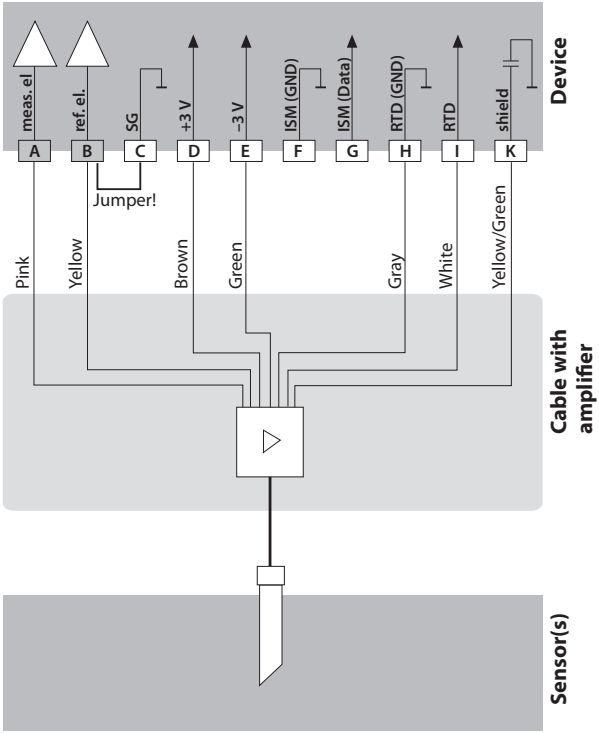
Sensors (example): InPro 4260 (Mettler-Toledo)



Example 3:

Measuring task: pH, temp (safe areas only)

Sensors (example): InPro 3300 ISFET (Mettler-Toledo)



Example 4:

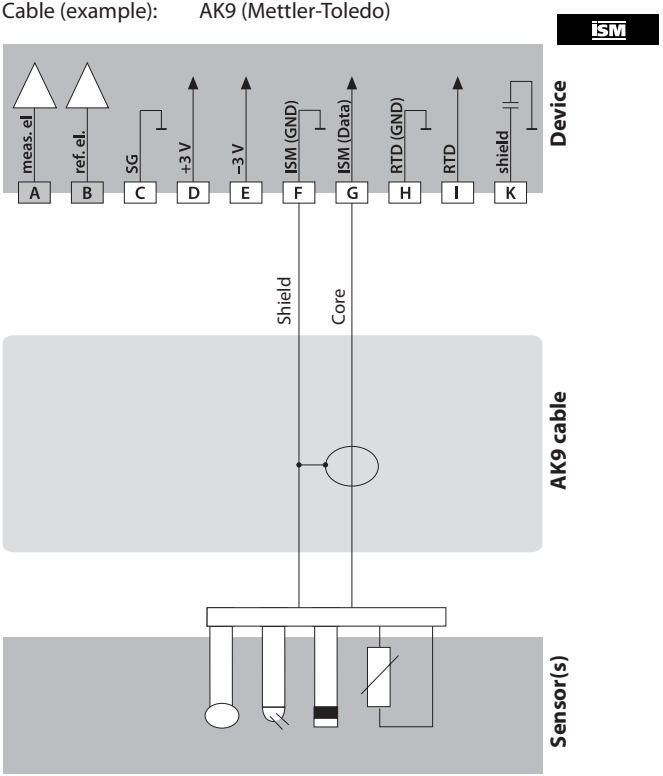
Caution!

Do not connect an additional analog sensor!

Measuring task: pH/ORP, temp, glass impedance, ref. impedance

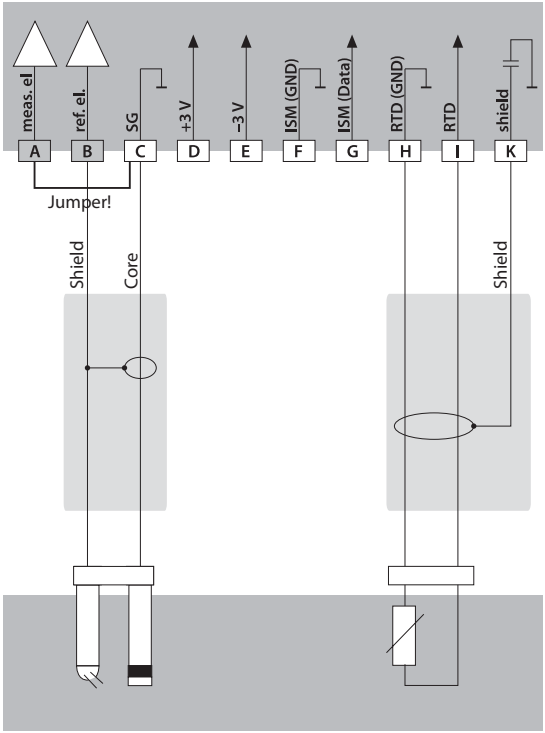
Sensors (example): ISM® digital InPro 4260i (Mettler-Toledo)

Cable (example): AK9 (Mettler-Toledo)

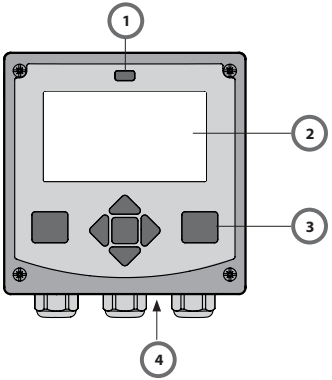


Example 5:

Measuring task: ORP, temp, glass impedance, ref. impedance

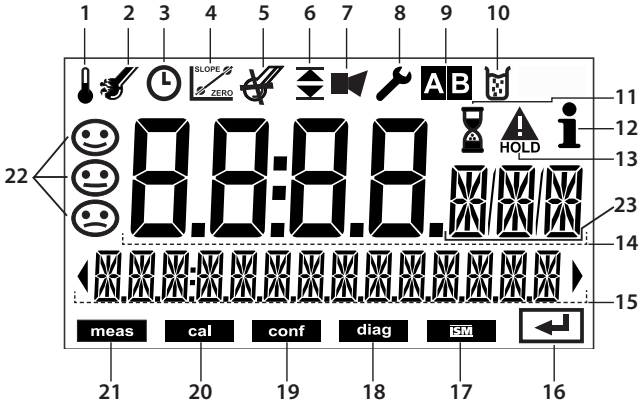


User Interface, Keypad



1 IrDA transmitter/receiver
2 Display
3 Keypad
4 Rating plate (bottom)

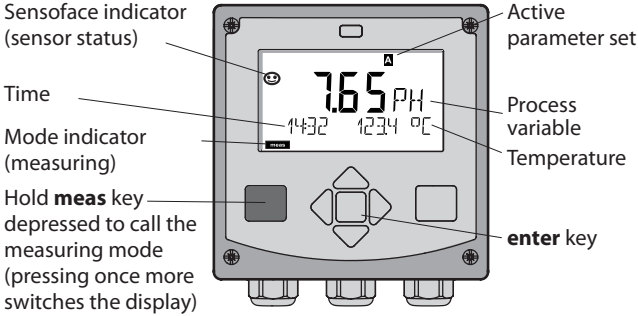
Key	Function
meas	• Return to last menu level • Directly to measuring mode (press > 2 s)
info	• Retrieve information • Show error messages
enter	• Configuration: Confirm entries, next configuration step • Calibration: Continue program flow • Measuring mode: Display output current
Arrow keys up / down	• Measuring mode: Call menu • Menu: Increase/decrease a numeral • Menu: Select
Arrow keys left / right	• Measuring mode: Call menu • Menu: Previous/next menu group • Number entry: Move between digits



1 Temperature
2 Sensocheck
3 Interval/response time
4 Sensor data
5 Digital sensor devaluated
6 Limit values
7 Alarm
8 Service
9 Parameter sets A/B
10 Calibration
11 Waiting time running
12 Info available
13 HOLD mode active
14 Main display
15 Secondary display
16 Proceed with enter
17 Digital sensor
18 Diagnostics
19 Configuration mode
20 Calibration mode
21 Measuring mode
22 Sensoface
23 Measurement symbol

Measuring Mode

After the operating voltage has been connected, the device automatically goes to "Measuring" mode. To call the measuring mode from another operating mode (e.g. Diagnostics, Service):
Hold **meas** key depressed (> 2 s).



In measuring mode the display indicates:
- Measured value and time (24/12 h AM/PM) as well as temperature in °C or °F (formats selected during configuration)

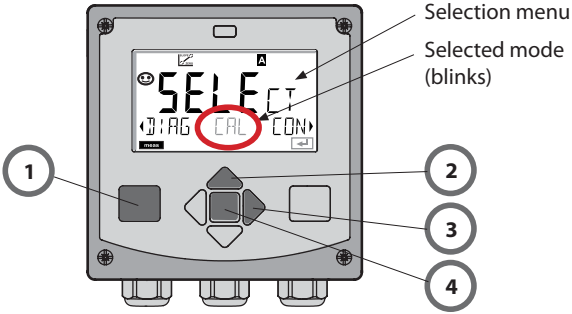
By pressing the **meas** key in measuring mode you can view the following displays (for approx. 60 sec):
- Measured value and selection of parameter set A/B (if set to "Manual")
- Measured value and tag (point of measurement designation – entered during configuration)
- Time and date

Pressing the **enter** key shows the output currents. They are displayed as long as **enter** is held depressed, then the measured-value display will return after 3 sec.

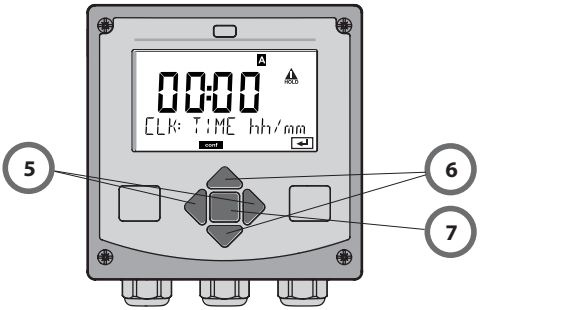
The device must be configured for the respective measurement task!

Selecting the Mode / Entering Values

To select the operating mode:
1) Hold **meas** key depressed (> 2 s) (measuring mode)
2) Press any arrow key: the selection menu appears
3) Select operating mode using left / right arrow key
4) Press **enter** to confirm the selected mode



To enter a value:
5) Select numeral: left / right arrow key
6) Change numeral: up / down arrow key
7) Confirm entry with **enter**



Operating Modes

Diagnostics
Display of calibration data, display of sensor data, performing a device self-test, viewing the logbook entries, display of hardware/software versions of the individual components. The logbook can store 100 events (00...99). They can be displayed directly on the device. The logbook can be extended to 200 entries using a TAN (Option).

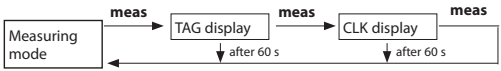
HOLD
Manual activation of HOLD mode, e.g. for replacing a digital sensor. The signal outputs adopt a defined state.

Calibration
Every sensor has typical characteristic values, which change in the course of the operating time. Calibration is required to supply a correct measured value. The device checks which value the sensor delivers when measuring in a known solution. When there is a deviation, the device can be "adjusted". In that case, the device displays the "actual" value and internally corrects the measurement error of the sensor. Calibration must be repeated at regular intervals. The time between the calibration cycles depends on the load on the sensor. During calibration the device is in HOLD mode.
During calibration the analyzer remains in the HOLD mode until it is stopped by the operator.

Configuration
The analyzer must be configured for the respective measurement task. In the "Configuration" mode you select the connected sensor, the measurement range to be transmitted, and the conditions for warning and alarm messages. During configuration the device is in HOLD mode.
Configuration mode is automatically exited 20 minutes after the last keystroke. The device returns to measuring mode.

Service
Maintenance functions (monitor, current source), IrDA operation, passcode assignment, reset to factory settings, enabling of options (TAN).

Menu Structure of Modes and Functions



Pressing any arrow key opens the selection menu.
Select the menu group using the left/right arrow keys.
Press **enter** to open a menu. Press **meas** to return.

DIAG	CALDATA	Display of calibration data
	SENSOR	Display of sensor data
	SELFTEST	Self test: RAM, ROM, EEPROM, module
	LOGBUCH	100 events with date and time
	MONITOR	Display of measured values (mV_pH, mV_ORP, RTD, resistances of glass electrode, reference electrode)
	VERSION	Display of software version, model designation, serial number
HOLD		Manual activation of HOLD mode, e.g. for sensor replacement. The signal outputs behave as configured (e.g. last measured value, 21 mA)
CAL	CAL_PH	pH adjustment (as configured)
	CAL_ORP	ORP adjustment
	P_CAL	Product calibration
	ISFET-ZERO	Zero adjustment (for ISFET only)
	CAL_RTD	Adjustment of temperature probe
CONF	PARSET A	Configuring parameter set A
	PARSET B	Configuring parameter set B
SERVICE (Access via code, factory setting: 5555)	MONITOR	Display of measured values for verification
	OUT1	Current source, output 1
	OUT2	Current source, output 2
	IRDA	Activating the IrDA interface
	CODES	Specifying access codes for operating modes
	DEFAULT	Reset to factory setting
	OPTION	Enabling an option via TAN

HOLD Mode

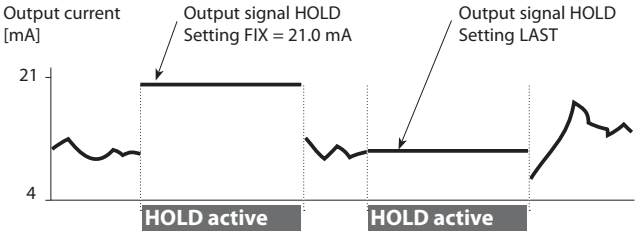
The HOLD mode is a safety state during configuration and calibration. Output current is frozen (Last) or set to a fixed value (Fix).

HOLD mode, display icon: 

Output Signal Response

- **Last:** The output current is frozen at its last value. Recommended for short configuration procedures. The process should not change decisively during configuration. Changes are not noticed with this setting!
- **Fix:** The output current is set to a value that is noticeably different from the process value to signal the control system that the device is being worked at.

Output Signal During HOLD:

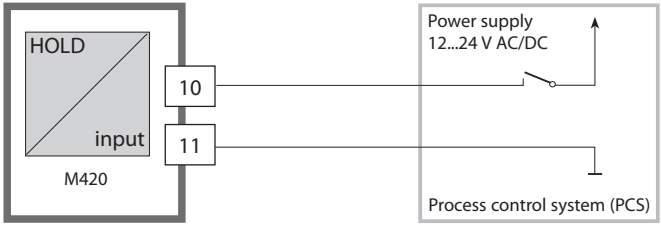


Terminating the HOLD Mode

The HOLD mode is ended by switching to measuring mode (hold **meas** key depressed). The display reads "Good Bye", after that, the HOLD mode is exited.

When the calibration mode is exited, a confirmation prompt ensures that the installation is ready for operation (e.g.: sensor reinstalled, located in process).

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



HOLD inactive	0...2 V AC/DC
HOLD active	10...30 V AC/DC

Manual Activation of HOLD
The HOLD can be activated manually from the HOLD menu.
This allows checking or replacing a sensor, for example, without provoking unintended reactions of outputs or contacts.
Press **meas** key to return to selection menu.

Alarm

When an error has occurred, **Err xx** is displayed immediately.
Only after expiry of a user-defined delay time will the alarm be registered and entered in the logbook.
During an alarm the display blinks.

Error messages can also be signaled by a 22 mA output current (see Configuration).
2 sec after the failure event is corrected, the alarm status will be deleted.

Configuration

Menu Structure of Configuration

The device provides 2 parameter sets "A" and "B". By switching between the parameter sets you can adapt the device to different measurement situations, for example.
Parameter set "B" only permits setting of process-related parameters.
The configuration steps are assigned to different menu groups.
Using ◂ and ▸, you can jump between the individual menu groups.
Each menu group contains menu items for setting the parameters.
Pressing **enter** opens a menu item.
The values are edited using ▴ and ▾.
Pressing **enter** confirms/stores the settings.
Return to measurement: Press **meas**.

Select menu group	Menu group	Code	Display	Select menu item
	Sensor selection	SNS:		enter
		Menu item 1		enter
		⋮		enter
		Menu item ...		enter
▸	Current output 1	OT1:		
▸	Current output 2	OT2:		
▸	Compensation	COR:		
▸	Alarm mode	ALA:		◂
▸	Setting the clock	CLK:		◂
▸	Tag number	TAG:		

Parameter Set A/B: Configurable Menu Groups

(Some parameters are identical in A and B. They are configured in parameter set A only.)

Menu group	Parameter set A	Parameter set B
SENSOR	Sensor selection	---
OUT1	Current output 1	Current output 1
OUT2	Current output 2	Current output 2
CORRECTION	Compensation	Compensation
ALARM	Alarm mode	Alarm mode
PARSET	Parameter set selection	---
CLOCK	Setting the clock	---
TAG	Tag number	---

Parameter Set A/B
Manual selection

Display	Action	Remark
	To switch between parameter sets: Press **meas**	Manual selection of parameter sets must have been preset in CONFIG mode. Default setting is a fixed parameter set A. Wrong settings change the measurement properties!
	PARSET blinks in the lower line. Select parameter set using ◂ and ▸ keys	
	Select PARSET A / PARSET B	
	Confirm with **enter** Cancel with **meas**	

Configuration			Choices	Default
Sensor (SENSOR)				
SNS:			STANDARD ISFET ISM	STANDARD
	RTD TYPE		100 PT 1000 PT 30 NTC	100 PT
	TEMP UNIT		°C / °F	°C
	TEMP MEAS		AUTO MAN EXT (only if enabled via TAN)	AUTO
		MAN	–20...200 °C (–4...392 °F)	025.0 °C (077.0 °F)
	TEMP CAL		AUTO MAN EXT (only if enabled via TAN)	AUTO
		MAN	–20...200 °C (–4...392 °F)	025.0 °C (077.0 °F)
	CAL MODE		AUTO MAN DAT	AUTO
		AUTO BUFFER SET	-00-...-09- Please note: Pressing **info** displays nominal buffer values and manufacturers	-00-

Configuration				Choices	Default
Sensor (SENSOR)					
SNS:	CAL TIMER			OFF FIX ADAPT	OFF
	ON	CAL-CYCLE		0...9999 h	0168 h
	ISM*	CIP COUNT		ON/OFF	OFF
		ON	CIP CYCLES	0...9999 CYC	0000 CYC
		SIP COUNT		ON/OFF	OFF
		ON	SIP CYCLES	0...9999 CYC	0000 CYC
Output 1 (OUT1)					
OT1:	CHANNEL			PH/ORP/TMP	PH
	PH	BEGIN		–2.00...16 PH	00.00 PH
		END		–2.00...16 PH	14.00 PH
	ORP	BEGIN		–1999...1999 mV	
		END		–1999...1999 mV	
	TMP °C	BEGIN		–20...300 °C	
		END		–20...300 °C	
	TMP °F	BEGIN		–4...572 °F	
		END		–4...572 °F	
	FILTERTIME			0...120 SEC	0000 SEC
	22mA-FAIL			ON/OFF	OFF
	HOLD MODE			LAST/FIX	LAST
	FIX	HOLD-FIX		4...22 mA	021.0 mA

*) For ISM® sensors only

Configuration				Choices	Default
Output 2 (OUT2)					
OT2:	CHANNEL			PH/ORP/TMP	TMP
	... other steps like output 1				
Temperature compensation (CORRECTION)					
COR:	TC LIQUID			–19.99...19.99%/K	00.00%/K
	TEMP EXT*			ON/OFF	OFF
	ON	I-INPUT		0...20 mA/ 4...20 mA	4...20 mA
		°C	BEGIN 4 mA	–20...200 °C	000.0 °C
			END 20 mA	–20...200 °C	100.0 °C
		°F	BEGIN 4 mA	–4...392 °F	032.0 °F
			END 20 mA	–4...392 °F	212.0 °F
Alarm (ALARM)					
ALA:	DELAYTIME			0...600 SEC	0010 SEC
	SENSOCHECK			ON/OFF	OFF
Parameter set (PARSET)					
PAR:	Select fixed parameter set (A) or switch between A/B via control input or manually in measuring mode			PARSET FIX / CNTR INPUT / MANUAL	PARSET FIX (parameter set A fixed)
Real-time clock (CLOCK)					
CLK:	FORMAT			24 h / 12 h	
	24 h	TIME hh/mm		00..24:00...59	00:00
	12 h	TIME hh/mm		00...12 AM/ PM:00...59	00.00
	DAY/MONTH			01...31/01...12	31.12.
	YEAR			2000...2099	2006
Tag number (TAG)					
TAG:	(Input in text line)				XXXXXXXXXX

*) is only displayed if enabled and SENSOR TEMP EXT has been selected.

Configuration (Original for Copy)

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

Please note:
Fill in your configuration data on the following pages or use them as original for copy.

Parameter	Parameter set A	Parameter set B
SNS: Sensor type		--- *)
SNS: RTD type		---
SNS: Temperature unit		---
SNS: Temp measurement		---
SNS: Manual meas. temp		---
SNS: Calibration temp		---
SNS: Manual cal temp		---
SNS: Calibration mode		---
SNS: Calibration timer		---
SNS: Calibration cycle		---
SNS: CIP counter		---
SNS: CIP cycles		---
SNS: SIP counter		---
SNS: SIP cycles		---
OT1: Process variable		
OT1: Current start		
OT1: Current end		

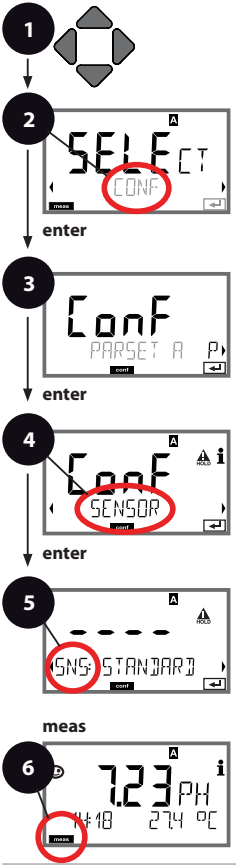
*) These parameters cannot be adjusted in parameter set B, the values are the same as in parameter set A.

Parameter	Parameter set A	Parameter set B
OT1: Filter time		
OT1: 22 mA error current		
OT1: HOLD mode		
OT1: HOLD-FIX current		
OT2: Process variable		
OT2: Current start		
OT2: Current end		
OT2: Filter time		
OT2: 22 mA error current		
OT2: HOLD mode		
OT2: HOLD-FIX current		
COR: Temp coefficient		
COR: Ext. temp input		
COR: Current range		
COR: Current start		
COR: Current end		
ALA: Alarm on/off		
ALA: Delay		
ALA: Sensocheck on/off		
PAR: Parameter set selection		---*)
CLK: Time format		---
CLK: Time hh/mm		---
CLK: Day/month		---
CLK: Year		---
TAG: Tag number		---

*) These parameters cannot be adjusted in parameter set B, the values are the same as in parameter set A.

Sensor

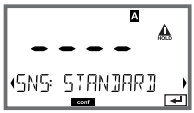
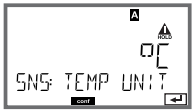
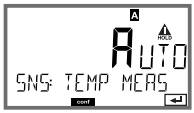
Select: sensor type, temperature probe, temperature unit, temp detection during measurement



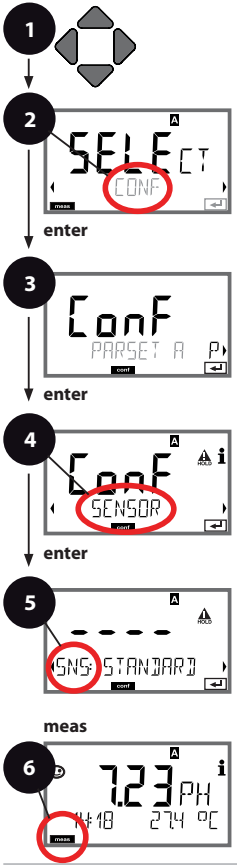
1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "SNS:" code.
Press **enter** to select menu, edit with arrow keys (see next page). Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

5

Select sensor type	enter
Select type of temp probe	
Temperature unit	
Temp detection during measurement	
(Man. temperature)	
Temp detection during calibration	
(Man. temperature)	
Calibration mode	
(AUTO: Buffer set)	
Calibration timer	
Calibration cycle	
Cleaning cycle counter	
Cleaning cycles	
Sterilization cycle counter	
Sterilization cycles	

Menu item	Action	Choices
Select sensor type 	Select sensor type using ▲ ▼ keys. Confirm with **enter**	**STANDARD** ISFET ISM
Select type of temp probe 	(not for ISM) Select type of temperature probe using ▲ ▼ keys. Confirm with **enter**	**100 PT** 1000 PT 30 NTC
Temperature unit 	Select °C or °F using ▲ ▼ keys. Confirm with **enter**	**°C** / °F
Temp detection during measurement 	Select mode using ▲ ▼: AUTO: Measured by sensor MAN: Direct input of temperature, no measurement (see next step) EXT: Temperature specified via current input – only if enabled (TAN) Confirm with **enter**	**AUTO** MAN EXT
(Manual temp) 	Modify digit using ▲ ▼, select next digit using ◀ ▶ keys. Confirm with **enter**	–20...200 °C (–4...+392 °F)

Sensor
Select: temp detection during calibration, calibration mode



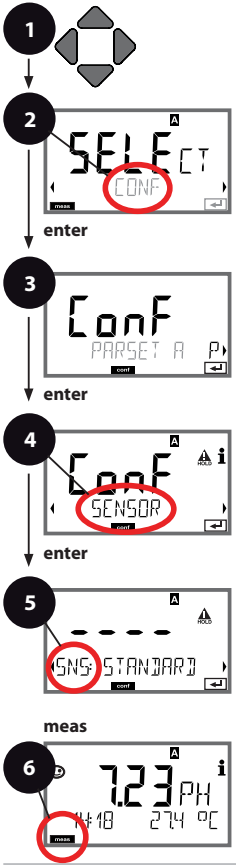
1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "SNS:" code.
Press **enter** to select menu, edit with arrow keys (see next page). Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

5

Select sensor type	enter
Select type of temp probe	
Temperature unit	
Temp detection during measurement	
(Man. temperature)	
Temp detection during calibration	
(Man. temperature)	
Calibration mode	
(AUTO: Buffer set)	
Calibration timer	
Calibration cycle	
Cleaning cycle counter	
Cleaning cycles	
Sterilization cycle counter	
Sterilization cycles	

Menu item	Action	Choices
Temp detection during calibration 	Select mode using ▲ ▼: AUTO: Measured by sensor MAN: Direct input of temperature, no measurement (see next step) EXT: Temperature specified via current input – only if enabled (TAN) Confirm with **enter**	**AUTO** MAN EXT
(Manual temp) 	Modify digit using ▲ ▼, select next digit using ◀ ▶ keys. Confirm with **enter**	–20...200 °C (-4...+392 °F)
Calibration Mode 	Select CALMODE using ▲ ▼ keys: AUTO: Calibration with Calimatic buffer set recognition MAN: Manual input of buffer solutions. DAT: Input of adjustment data of premeasured sensors Confirm with **enter**	**AUTO** MAN DAT
(AUTO: Buffer set) 	Select buffer set using ▲ ▼ keys (see buffer tables for nominal values). Confirm with **enter**	-00-...-09- Pressing the **info** key displays the manufacturer and nominal values in the lower line.

Sensor
Adjust: calibration timer, calibration cycle



1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "SNS:" code.
Press **enter** to select menu, edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

5

Select sensor type	enter
Select type of temp probe	
Temperature unit	
Temp detection during measurement	
(Man. temperature)	
Temp detection during calibration	
(Man. temperature)	
Calibration mode	
(AUTO: Buffer set)	
Calibration timer	
Calibration cycle	
Cleaning cycle counter	
Cleaning cycles	
Sterilization cycle counter	
Sterilization cycles	

Menu item	Action	Choices
Calibration timer 	Adjust CALTIMER using ▲ ▼ keys: OFF: No timer ADAPT: Maximum cal cycle (adjust in the next step) FIX: Fixed cal cycle (adjust in the next step) Confirm with **enter**	**OFF**/ADAPT/FIX With ADAPT, the calibration cycle is automatically reduced depending on the sensor load (high temperatures and pH values) and for digital sensors also depending on the sensor wear
Calibration cycle 	Only with FIX/ADAPT: Modify digit using ▲ ▼, select next digit using ◀ ▶ keys. Confirm with **enter**	0...9999 h

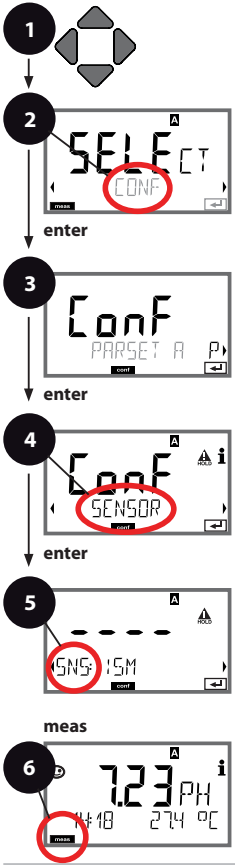
Note for the calibration timer:
When Sensocheck has been activated in the Configuration > Alarm menu, the expiration of the calibration interval is indicated by Sensoface:

Display	Status
+	Over 80% of the calibration interval has already past.
+	The calibration interval has been exceeded.

The calibration timer settings apply to both parameter sets A and B.

The time remaining until the next due calibration can be seen in the diagnostics menu (see Diagnostics chapter).

Sensor
Adjust: CIP cleaning cycles, SIP sterilization cycles



1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "SNS:" code.
Press **enter** to select menu, edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

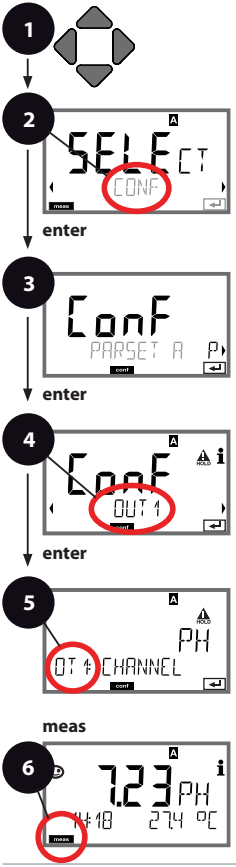
5

Select sensor type	enter
Select type of temp probe	
Temperature unit	
Temp detection during measurement	
(Man. temperature)	
Temp detection during calibration	
(Man. temperature)	
Calibration mode	
(AUTO: Buffer set)	
Calibration timer	
Calibration cycle	
Cleaning cycle counter	
Cleaning cycles	
Sterilization cycle counter	
Sterilization cycles	

Menu item	Action	Choices
CIP / SIP The following adjustments are possible for ISM® sensors :		
Cleaning cycle counter 	Select ON or OFF using ▲ ▼ keys. Confirm with **enter**	ON/**OFF**
Cleaning cycles 	Only with CIP COUNT ON: Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	0...9999 CYC (**0000 CYC**)
Sterilization cycle counter 	Select ON or OFF using ▲ ▼ keys. Confirm with **enter**	ON/**OFF**
Sterilization cycles 	Only with CIP COUNT ON: Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	0...9999 CYC (**0000 CYC**)

The cleaning and sterilization cycles are counted to measure the load on the sensor.
Suitable for biochemical applications (process temp approx. 0...50 °C, CIP temperature > 70 °C, SIP temperature > 115 °C).

Current Output 1
Process variable, current start, current end



1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "OT1:" code.
Press **enter** to select menu, edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

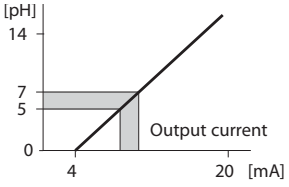
5

Process variable	enter
Current start	
Current end	
Time constant of output filter	
Output current during error message	
Output current during HOLD	
Output current for HOLD FIX	

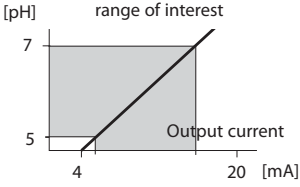
Menu item	Action	Choices
Process variable 	Select using ▲ ▼ keys: PH: pH value ORP: Redox potential TMP: Temperature Confirm with **enter**	**PH**/ORP/TMP
Current start 	Modify digit using ▲ ▼, select next digit using ◀ ▶ keys. Confirm with **enter**	–2...16 pH (PH) –1999...1999 mV (ORP) –20...300 °C / –4...572 °F (TMP)
Current end 	Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	–2...16 pH (PH) –1999...1999 mV (ORP) –20...300 °C / –4...572 °F (TMP)

Assignment of Measured Values: Current Start and Current End

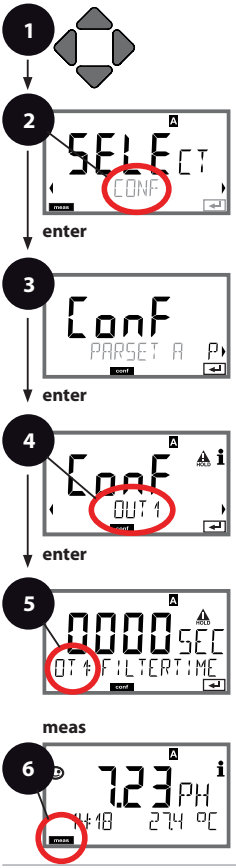
Example 1: Range pH 0...14



Example 2: Range pH 5...7
Advantage: Higher resolution in range of interest



Current Output 1
Adjust time constant of output filter



1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "OT1:" code.
Press **enter** to select menu, edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

5

Current range	enter
Process variable	
Current start	
Current end	
Time constant of output filter	
Output current during error message	
Output current during HOLD	
Output current for HOLD FIX	

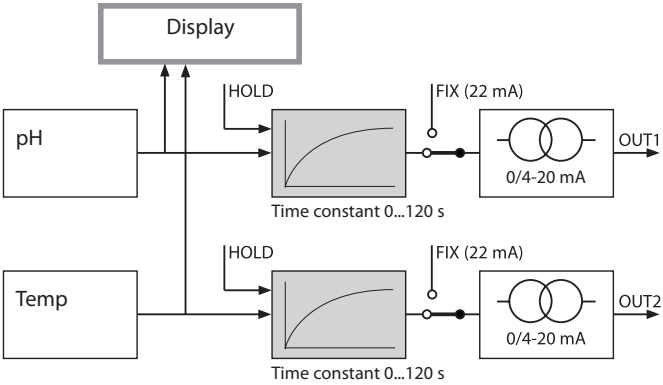
Menu item	Action	Choices
Time constant of output filter 	Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	0...120 SEC (**0000 SEC**)

Time Constant of Output Filter

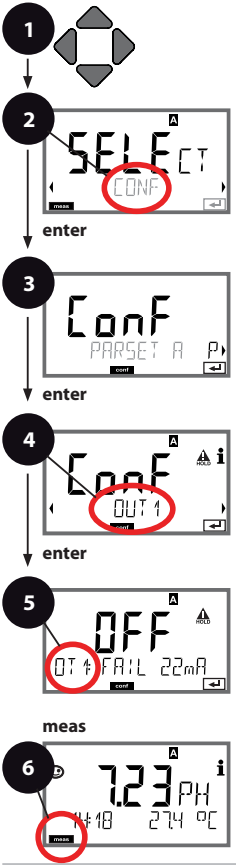
To smoothen the current output, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is at 63 % after the time constant has been reached. The time constant can be set from 0 to 120 sec. If the time constant is set to 0 sec, the current output directly follows the input.

Please note:

The filter only acts on the current output, not on the display!
During HOLD the filter is not applied. This prevents a jump at the output.



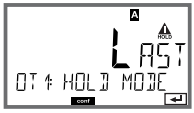
Current Output 1
Output current during Error and HOLD



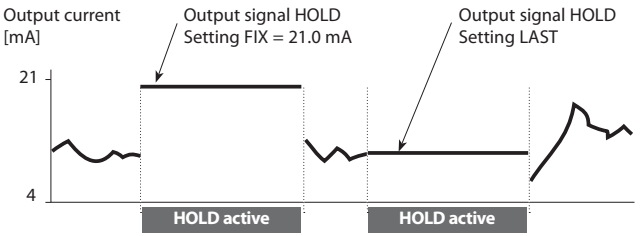
1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "OT1:" code.
Press **enter** to select menu, edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

5

Current range	enter
Process variable	
Current start	
Current end	
Time constant of output filter	
Output current during error message	
Output current during HOLD	
Output current for HOLD FIX	

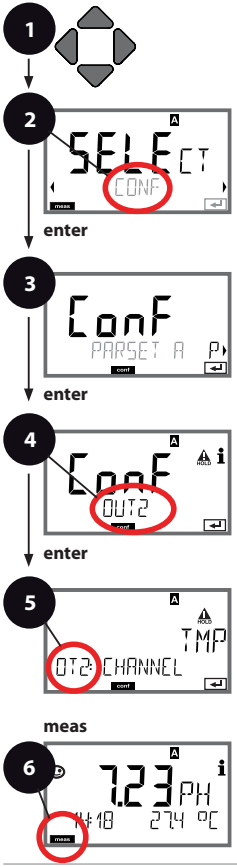
Menu item	Action	Choices
Output current during error message 	Select ON or OFF using ▲ ▼ keys. Confirm with **enter**	ON/**OFF**
Output current during HOLD 	LAST: During HOLD the last measured value is maintained at the output. FIX: During HOLD a value (to be entered) is maintained at the output. Select using ▲ ▼ Confirm with **enter**	**LAST**/FIX
Output current for HOLD FIX 	Only with FIX selected: Enter current which is to flow at the output during HOLD Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	00.00...22.00 mA (**21.00 mA**)

Output Signal During HOLD:



Current Output 2

Output current range, current start, current end



1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **OUT2** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "OT2:" code.
Press **enter** to select menu, edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

5

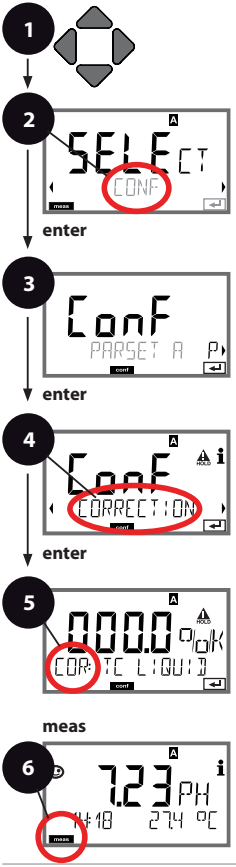
Process variable	enter
Current start	
Current end	
Time constant of output filter	
Output current during error message	
Output current during HOLD	
Output current for HOLD FIX	

Menu item	Action	Choices
Process variable 	Select using ▲ ▼ keys: PH: pH value ORP: Redox potential TMP: Temperature Confirm with **enter**	PH/ORP/**TMP**
. . .		

All the following adjustments are made as for current output 1 (see Pg 48)!

Temperature Compensation

TC process medium, current input for temp measurement

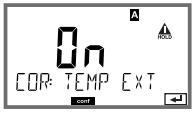


1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **CORRECTION** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "COR:" code.
Press **enter** to select menu, edit with arrow keys (see next page). Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

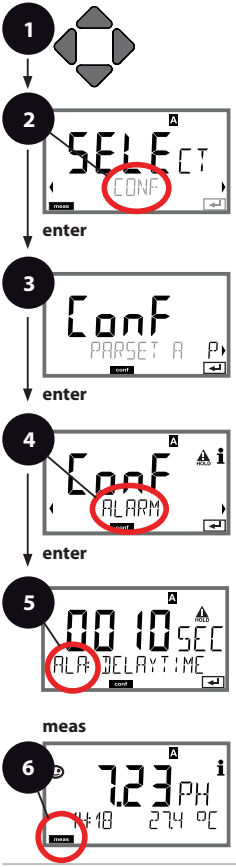
5

Temperature compensation, process medium
Current input for ext. temperature measurement
Current range
Current start
Current end

enter

Menu item	Action	Choices
Temp compensation, process medium 	For pH measurement only: Enter temperature compensation of the process medium. Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	–19.99...+19.99 %/K
Current input for ext. temperature measurement 	Only if enabled via TAN and selected during configuration (SENSOR). Select ON or OFF using ▲ ▼ keys. Confirm with **enter**	**ON**/OFF
Current range 	Select desired range using ▲ ▼ keys. Confirm with **enter**	**4-20 mA** / 0-20 mA
Current start 	Modify digit using ▲ ▼, select next digit using ◀ ▶ keys. Confirm with **enter**	Input range: –20...200 °C / –4...392 °F
Current end 	Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	Input range: –20...200 °C / –4...392 °F

Alarm
Alarm delay, Sensocheck



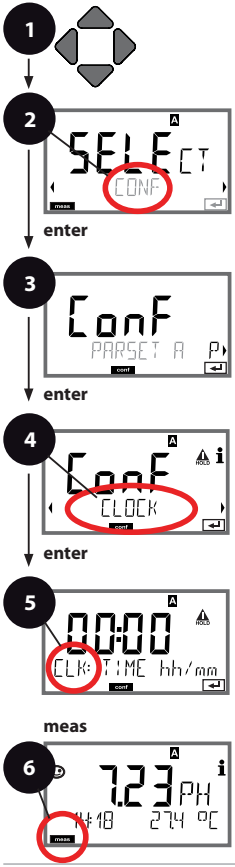
1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set using ◂ ▸ keys, press **enter**.
4 Select **ALARM** menu using ◂ ▸ keys, press **enter**.
5 All items of this menu group are indicated by the "ALA:" code.
Press **enter** to select menu, edit with arrow keys (see next page). Confirm (and proceed) with **enter**.
6 End: Press **meas** key until the [meas] mode indicator is displayed.

Menu item	Action	Choices
Alarm delay 	Only with Alarm ON selected: Enter value using ▲ ▼ ◀ ▶ keys. Confirm with **enter**	0...600 SEC (**010 SEC**)
Sensocheck 	Select Sensocheck (continuous monitoring of glass and reference electrode) Select ON or OFF using ▲ ▼ keys. Confirm with **enter**. (At the same time, Sensoface is activated. With OFF, Sensoface is also switched off.)	ON/**OFF**

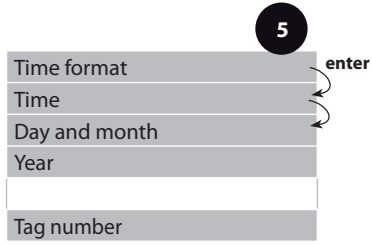
Error messages can be signaled by a 22 mA output current (see Error Messages and Configuration of Output 1/Output 2).

The alarm delay time delays the 22 mA signal (if configured).

Time and Date
Tag Number



1 Press any arrow key.
2 Select **CONF** using ◂ ▸ keys, press **enter**.
3 Select parameter set A using ◂ ▸ keys, press **enter**.
4 Press **enter**.
5 Select **CLOCK** or **TAG** using ◂ ▸ keys, press **enter**.
6 All items of this menu group are indicated by the "CLK:" or "TAG" code.
Press **enter** to select menu,
edit with arrow keys (see next page).
Confirm (and proceed) with **enter**.
7 End: Press **meas** key until the [meas] mode indicator is displayed.



Time and Date

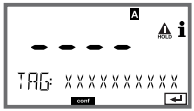
Control of the calibration and cleaning cycles is based on the time and date of the integrated real-time clock.
In measuring mode the time is shown in the lower display.
When using digital sensors, the calibration data is written in the sensor head.
In addition, the logbook entries (cf Diagnostics) are provided with a time stamp.

Please note:
There is no automatic switchover from winter to summer time!
Be sure to manually adjust the time!

Tag Number (" TAG")

You can enter a designation for the point of measurement (tag number) in the lower display line. Up to 32 digits are possible.
Pressing **meas** (repeatedly) in the measuring mode indicates the tag number.
Being part of the device configuration, the "TAG" can be read out via IrDA.
A standardized tag number helps, for example, to correctly re-install a device after repair.

5

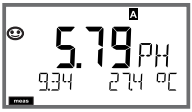
Menu item	Action	Choices
Tag number 	Select character using ▲ ▼ keys, select next digit using ◀ ▶ keys. Confirm with **enter**	A...Z, 0...9, – + < > ? / @ The first 10 characters are seen in the display without scrolling.

Operation

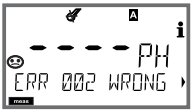
M420 can be operated with ISM® sensors.
The following display examples refer to an M420 pH transmitter and a pH ISM® sensor (slight variations for other combinations).

The sensor type is selected during **configuration**, the selected type is indicated by a display icon:

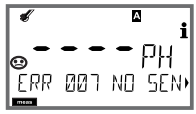
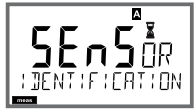
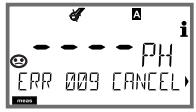
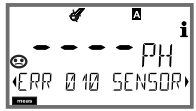
The device only switches to measuring mode when the connected sensor corresponds to the type configured (Sensoface is happy):



Otherwise, an error message is released. The **info** icon is displayed. You can display the error text in the bottom line using the ◂ ▸ keys. Sensoface is sad (see table of error messages and Sensoface in the Appendix):

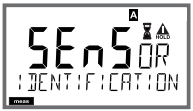


Connecting a Digital Sensor

Step	Action/Display	Remark
Connect sensor		Before a digital sensor is connected, the error message "No sensor" is displayed.
Wait until the sensor data are displayed.		The hourglass in the display blinks.
(Sensor devaluated) Replace sensor		When this error message appears, the sensor cannot be used any more. Sensoface is sad.
(Sensor defective) Replace sensor		When this error message appears, the sensor cannot be used. Sensoface is sad.
Check sensor data	 View sensor information using ◀ ▶ keys, confirm with **enter**.	The ISM icon is displayed. Sensoface is happy.
Go to measuring mode	Press **meas**, **info**, or **enter**	After 60 sec the device automatically returns to measuring mode (timeout).

Sensor Replacement

An ISM® sensor should only be replaced during HOLD mode to prevent unintended reactions of the outputs or contacts. When you first want to calibrate the new sensor, it can also be replaced in calibration mode.

Step	Action/Display	Remark
Select HOLD mode	Press any key to call the selection menu, select HOLD using the ◂ ▸ keys, confirm with **enter.**	Now the device is in HOLD mode. The HOLD mode can also be activated externally via the HOLD input. During HOLD the output current is frozen at its last value or set to a fixed value.
Disconnect and remove old sensor		
Install and connect new sensor.		Temporary messages which are activated during the replacement are indicated but not output to the alarm contact and not entered in the logbook.
Wait until the sensor data are displayed.		

Step	Action/Display	Remark
Check sensor data	 View sensor information using ◂ ▸ keys, confirm with **enter**.	You can view the sensor manufacturer and type, serial number, and last calibration date.
Check measured values		
Exit HOLD	Hit **meas** key: Return to selection menu. Hold **meas** key depressed: Device switches to measuring mode	The sensor replacement is entered in the extended logbook.

Calibrating a Digital Sensor

After calibration of a digital sensor the calibration and statistics data are written into the sensor. During this time the display indicates "STORING DATA". This process takes approx. 5 to 10 sec.
Do not remove the sensor during this process!

Calibration

Please note:

- All calibration procedures must be performed by trained personnel. Incorrectly set parameters may go unnoticed, but change the measuring properties.

- The response time of the sensor and temperature probe is considerably reduced when the sensor is first moved about in the buffer solution and then held still.

- The device 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 response. This leads to measurement errors.

When using ISFET sensors or sensors with a zero point other than pH 7, the nominal zero point must be adjusted each time a new sensor 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.

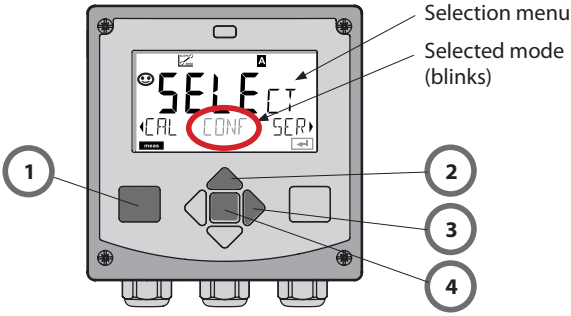
Selecting a Calibration Mode

Calibration is used to adapt the device to the individual sensor characteristics, namely asymmetry potential and slope.
Access to calibration can be protected with a passcode (SERVICE menu).
First, you open the calibration menu and select the calibration mode:

CAL_PH	Depending on configuation setting:	
	AUTO	Automatic buffer recognition (Calimatic)
	MAN	Manual buffer input
	DAT	Input of premeasured electrode data
CAL_ORP	ORP calibration	
P_CAL	Product calibration (calibration with sampling)	
ISFET-ZERO	Zero adjustment. Required for ISFET sensors, subsequently you can conduct either a one or a two-point calibration.	
CAL_RTD	Temperature probe adjustment	

To preset CAL_PH (CONF menu / configuration):

1) Hold **meas** key depressed (> 2 s) (measuring mode)
2) Press any arrow key: the selection menu appears
3) Select CONF mode using left / right arrow key
4) Select "SENSOR" – "CALMODE": AUTO, MAN, or DAT.
   Press **enter** to confirm



Zero Adjustment (ISFET)

This adjustment allows the use of ISFET sensors with differing nominal zero (pH only). The function is available when Sensor selection = ISFET has been set during configuration. Zero adjustment is disabled for any other sensors.
The adjustment is made using a zero buffer (pH 7.00). Permitted range for buffer value: pH 6.5 ... 7.5. Temperature-corrected input. Maximum zero offset: ± 200 mV.

Display	Action	Remark
	Select Calibration. Proceed with **enter**.	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Immerse sensor 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 sensor is too large (> ± 200 mV), a CAL ERR error message is generated. In that case the sensor cannot be calibrated.
	Stability check. The measured value [mV] is displayed. The "hourglass" icon is blinking.	Please note: Stability check can be stopped (by pressing **enter**). However, this reduces calibration accuracy.

Display	Action	Remark
	At the end of the adjustment procedure the zero offset [mV] of the sensor is displayed (based on 25 °C). Sensoface is active. Proceed with **enter**	This is not the final calibration value of the sensor! Asymmetry potential and slope must be determined with a complete 2-point calibration.
	Use the arrow keys to select: • Repeat (repeat calibration) or • Measuring. Confirm with **enter.**	
	Place sensor in process. End zero calibration with **enter**.	After end of calibration, the outputs remain in HOLD mode for a short time.

Note for Zero Adjustment
After having adjusted the zero offset, be sure to calibrate the sensor following one of the procedures as described on the next pages.

Automatic Calibration (Calimatic)

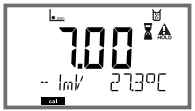
The AUTO calibration mode and the type of temperature detection are selected during **configuration**. Make sure that the buffer solutions used correspond to the configured buffer set. Other buffer solutions, even those with the same nominal values, may demonstrate a different temperature response. This leads to measurement errors.

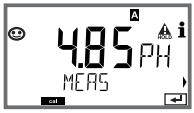
Display	Action	Remark
	Select Calibration. Proceed with **enter**.	
	Ready for calibration. Hourglass blinks. Select calibration method: CAL_PH Proceed with **enter**	Display (3 sec) Now the device is in HOLD mode.
	Remove the sensor and temperature probe, clean them, and immerse them in the first buffer solution (in any order). Start with **enter**	When manual input of temperature has been configured, the temp value in the display blinks and can be edited using the arrow keys.
	Buffer recognition. While the "hourglass" icon is blinking, the sensor and temperature probe remain in the first buffer solution.	The response time of the sensor and temperature probe is considerably reduced when the sensor is first moved about in the buffer solution and then held still.
	Buffer recognition terminated, the nominal buffer value is displayed.	

Display	Action	Remark
 	Stability check. The buffer value, measured voltage [mV], and temperature are displayed, "CAL2" and "enter" are blinking. Calibration with the first buffer is terminated. Remove the sensor and temp probe from the first buffer solution and rinse them thoroughly. **Use the arrow keys to select:** • END (1-point cal) • CAL2 (2-point cal) • REPEAT Proceed with **enter**	Please note: Stability check can be stopped after 10 sec (by pressing **enter**). However, this reduces calibration accuracy. Display for 1-point cal:  Sensoface is active. End with **enter**
	2-point calibration: Immerse sensor and temperature probe in the second buffer solution. Start with **enter**	The calibration process runs as for the first buffer.
	Retract sensor and temp probe out of second buffer, rinse off, re-install. Proceed with **enter**	The slope and asymmetry potential of the sensor (based on 25 °C) are displayed.
	**Use the arrow keys to select:** • MEAS (end) • REPEAT Proceed with **enter** End: HOLD is deactivated with delay.	When 2-point cal is ended: 

Manual Calibration with Buffer Entry

The MAN calibration mode and the type of temperature detection are selected during **configuration**. For calibration with manual buffer specification, you must enter the pH value of the buffer solution used in the device for the proper temperature. Any desired buffer solution can be used for calibration.

Display	Action	Remark
	Select Calibration. Proceed with **enter**.	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Remove the sensor and temperature probe, clean them, and immerse them in the first buffer solution. Start with **enter**	When manual input of temperature has been configured, the temp value in the display blinks and can be edited using the arrow keys.
 	Enter the pH value of your buffer solution for the proper temperature. While the "hourglass" icon is blinking, the sensor and temperature probe remain in the buffer solution.	The response time of the sensor and temperature probe is considerably reduced when the sensor is first moved about in the buffer solution and then held still.

Display	Action	Remark
	Stability check. The measured value [mV] is displayed, "END" and enter blink. Calibration with the first buffer is terminated. Remove the sensor and temp probe from the first buffer solution and rinse them thoroughly. **Use the arrow keys to select:** • END (1-point cal) • CAL2 (2-point cal) • REPEAT Proceed with **enter**	Please note: Stability check can be stopped after 10 sec (by pressing **enter**). However, this reduces calibration accuracy. Display for 1-point cal:  Sensoface is active. End with **enter**
	2-point calibration: Immerse sensor and temperature probe in the second buffer solution. Enter pH value. Start with **enter**	The calibration process runs as for the first buffer.
	Rinse sensor and temperature probe and reinstall them. Proceed with **enter**	Display of slope and new asymmetry potential (based on 25 °C).
	**Use the arrow keys to select:** • MEAS (end) • REPEAT Proceed with **enter** End: HOLD is deactivated with delay.	When 2-point cal is ended: 

Data Entry of Premeasured Sensors

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

Display	Action	Remark
	Select Calibration. Proceed with **enter**.	
	"Data Input" Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Enter asymmetry potential [mV]. Proceed with **enter**	
	Enter slope [%].	
	The device displays the new slope and asymmetry potential (at 25 °C). Sensoface is active.	
	**Use the arrow keys to select:** • MEAS (end) • REPEAT Proceed with **enter**	End: HOLD is deactivated with delay.

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

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

Converting asymmetry potential to sensor zero point

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

ZERO = Sensor zero point

V_{AS} = Asymmetry potential

S = Slope

Product Calibration (pH)

Calibration by sampling (one-point calibration).
During product calibration the sensor remains in the process.
The measurement process is only interrupted briefly.

Procedure:

1) 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.
   During sampling the device saves the currently measured value and then returns to measuring mode. The "calibration" mode indicator blinks.
2) In the second step you enter the measured sample value in the device. From the difference between the stored measured value and entered sample value, the device calculates the new asymmetry potential.

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
	Select product calibration: P_CAL. Proceed with **enter**	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Take sample and save value. Proceed with **enter**	Now the sample can be measured.

Display	Action	Remark
	The device returns to measuring mode.	From the blinking CAL mode indicator you see that product calibration has not been terminated.
	Product calibration step 2	Display (3 sec) Now the device is in HOLD mode.
	The stored value is displayed (blinking) and can be overwritten with the measured sample value. Proceed with **enter**	
	Display of new asymmetry potential (based on 25°C). Sensoface is active. To end calibration: Select MEAS, then **enter**	Repeat calibration: Select REPEAT, then **enter**
End of calibration	After end of calibration, the outputs remain in HOLD mode for a short time.	

ORP (Redox) Calibration

The potential of a redox sensor 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 this difference is added to the measured potential.

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

mV_{ORP} = displayed ORP

mV_{meas} = direct sensor potential

ΔmV = delta value, determined during calibration

The sensor 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.

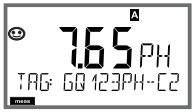
Temperature Dependence of Commonly Used Reference Systems Measured Against SHE

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

Display	Action	Remark
	Select ORP calibration, proceed with **enter**	
	Remove the sensor and temperature probe, clean them, and immerse them in the redox buffer.	Display (3 sec) Now the device is in HOLD mode.
	Enter setpoint value for redox buffer. Proceed with **enter**	
	The ORP delta value is displayed (based on 25°C). Sensoface is active. Proceed with **enter**	
	To repeat calibration: Select REPEAT. To end calibration: Select MEAS, then press **enter**	After end of calibration, the outputs remain in HOLD mode for a short time.

Temp Probe Adjustment

Display	Action	Remark
	Select temp adjustment. Proceed with **enter**	Wrong settings change the measurement properties!
	Measure the temperature of the process medium using an external thermometer.	Display (3 sec) Now the device is in HOLD mode.
	Enter the measured temperature value. Maximum difference: 10 K. Proceed with **enter**	Display of actual temperature (uncompensated) in the lower display.
	The corrected temperature value is displayed. Sensoface is active. To end calibration: Select MEAS, then **enter** To repeat calibration: Select REPEAT, then **enter**	
	After calibration is ended, the device will switch to measuring mode.	After end of calibration, the outputs remain in HOLD mode for a short time.

Display	Remark
 or AM/PM and °F: 	From the configuration or calibration menus, you can switch the device to measuring mode by pressing the **meas** key. In the measuring mode the main display shows the configured process variable (pH, ORP [mV], or temperature), the secondary display shows the time and the second configured process variable (pH, ORP [mV], or temperature). The [meas] mode indicator lights and the active parameter set (A/B) is indicated.
By pressing the **enter** key you can briefly display the output currents. By pressing the **meas** key you can step through the following displays. When no key has been pressed for 60 sec, the device returns to the standard display.	
  	1) Selecting the parameter set (if set to "manual" in the configuration). Select the desired parameter set using the ◂ ▸ arrow keys (PARSET A or PARSET B blinks in the lower display line). Confirm with **enter**. Further displays (each with **meas**). 2) Display of tag number ("TAG") 3) Display of time and date

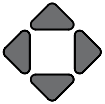
Diagnostics

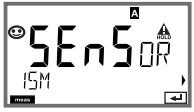
In the Diagnostics mode you can access the following menus without interrupting the measurement:

CALDATA	Viewing the calibration data
SENSOR	Viewing the sensor data
SELFTEST	Starting a device self-test
LOGBOOK	Viewing the logbook entries
MONITOR	Displaying currently measured values
VERSION	Displaying device type, software version, serial number

Access to diagnostics can be protected with a passcode (SERVICE menu).

Please note:
HOLD is not active during Diagnostics mode!

Action	Key	Remark
Activate diagnostics		Press any arrow key to call the selection menu. Select DIAG using ◂ ▸ keys, confirm with **enter**
Select diagnostics option		Use ◂ ▸ keys to select from: CALDATA SENSOR SELFTEST LOGBOOK MONITOR VERSION See next pages for further proceeding.
End	**meas**	End with **meas**.

Display	Menu item
    	**Display of calibration data** Select CALDATA using ◂ ▸, confirm with **enter**. Use the ◂ ▸ keys to select the desired parameter from the bottom line of the display (LAST_CAL ISFET-ZERO ZERO SLOPE NEXT_CAL). The selected parameter is shown in the main display. Press **meas** to return to measurement.
 	**Display of sensor data:** For analog sensors, the type is displayed (STANDARD / ISFET), for digital sensors, the manufacturer, type, serial number, and last calibration date. In each case Sensoface is active. Display data using ◂ ▸ keys, return with **enter** or **meas**.

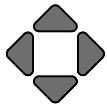
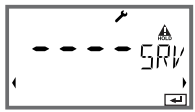
Display	Menu item
	**Device self-test** (To abort, you can press **meas**.) 1) **Display test**: Display of all segments. Proceed with **enter**
	2) **RAM test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Proceed with **enter**
	3) **EEPROM test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Proceed with **enter**
	4) **FLASH test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Proceed with **enter**
	5) **Module test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Press **enter** or **meas** to return to measuring mode.

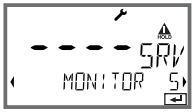
Display	Menu item
  	**Display of logbook entries** Select LOGBOOK using ◀ ▶, confirm with **enter**. With the ▲ ▼ keys, you can scroll backwards and forwards through the logbook (entries -00-...-99-), -00- being the last entry. If the display is set to date/time, you can search for a particular date using the ▲ ▼ keys. Press ◀ ▶ to view the corresponding message text. If the display is set to the message text, you can search for a particular message using the ▲ ▼ keys. Press ◀ ▶ to display the date and time. Press **meas** to return to measurement.
	**Extended logbook / Audit Trail (via TAN)** With the ▲ ▼ keys, you can scroll backwards and forwards through the extended logbook (entries -000-...-199-), -000- being the last entry. **Display: CFR** Audit Trail also records function activations (CAL CONFIG SERVICE), some Sensoface messages (cal timer, wear), and opening of the enclosure.

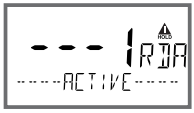
Display	Menu item
	**Display of currently measured values (sensor monitor)** Select MONITOR using ◀ ▶, confirm with enter. Use the ◀ ▶ keys to select the desired parameter from the bottom line of the display: mV_PH mV_ORP RTD R_GLASS R_REF I-INPUT (for digital sensors also: OPERATION TIME SENSOR WEAR LIFETIME CIP SIP AUTOCLAVE). The selected parameter is shown in the main display. Press meas to return to measurement.
Display examples:	
	Display mV_pH (for validation, sensor can be immersed in a calibration solution, for example, or the device is checked by using a simulator)
	Display of remaining lifetime (for digital sensors only) The "Dynamic Lifetime Indicator", DLI, calculates the expected remaining sensor lifetime based on the sensor load.
	Display of sensor operating time (for digital sensors only)
	**Version** Display of **device type, software/hardware version**, and **serial number** for all device components. Use the ▲ ▼ keys to switch between software and hardware version. Press **enter** to proceed to next device component.

The Service mode allows
- displaying the currently measured values with the sensor monitor
- performing a device sef-test
- testing the two current outputs
- activating and communicating via the IrDA interface
- assigning and editing passcodes
- resetting the device to factory settings
- enabling options via TAN.

Please note:
HOLD is active during Service mode!

Action	Key/Display	Remark
Activate Service		Press any arrow key to call the selection menu. Select SERVICE using ◂ ▸ keys, confirm with **enter**
Passcode		Enter passcode "5555" for service mode using the ▲ ▼ ◂ ▸ keys. Confirm with **enter.**
Display		In service mode the following icons are displayed: • [diag] mode indicator • HOLD triangle • Service (wrench)
End	**meas**	End with **meas**.

Menu item	Remark
 Display example: 	**Display of currently measured values (sensor monitor) with HOLD mode activated:** Select MONITOR using ◂ ▸, confirm with **enter**. Select variable in the bottom text line using ◂ ▸. The selected parameter is shown in the main display. As the device is in HOLD mode, you can perform validations using simulators without influencing the signal outputs. Press **meas** to return to the service menu. Return to measurement: Press **meas** once more.
	**Specify current at outputs 1 and 2:** Select OUT1 or OUT2 using the ◂ ▸ keys, confirm with **enter**. Enter a valid current value for the respective output using ▴ ▾ ◂ ▸ keys. Confirm with **enter**. For checking purposes, the actual output current is shown in the bottom right corner of the display. End with **enter** or **meas**.

Menu item	Remark
	**IrDA communication:** Select IRDA using ◂ ▸, confirm with **enter**.
HOLD 	When IrDA communication is active, the device remains in the HOLD mode for reasons of safety. Further operation is performed via IrDA. End communication with **meas**. **Exception: Firmware update (must not be interrupted!)**
	**Assigning passcodes:** In the "SERVICE - CODES" menu you can assign passcodes to DIAG, HOLD, CAL, CONF, and SERVICE modes (Service preset to 5555). **When you have lost the Service passcode**, you have to request an "Ambulance TAN" from the manufacturer specifying the serial number of your device. To enter the "Ambulance TAN", call the Service function and enter passcode 7321. After correct input of the ambulance TAN the device signals "PASS" for 4 sec and resets the Service passcode to 5555.
	**Reset to factory settings:** In the "SERVICE - DEFAULT" menu you can reset the device to factory settings. Not affected: calibration data
	**Release of options:** Options come with a "transaction number" (TAN). This TAN must be entered and confirmed with **enter** to release the option.

Operating States

Operating status	OUT 1	OUT 2	Time out
Measuring			-
DIAG			60 s
CAL			No
CONF			20 min
SERVICE			20 min
SERVICE OUT 1			20 min
SERVICE OUT 2			20 min
HOLD			No

Explanation:

as configured (Last/Fix or Last/Off)

active

manual

Product Line and Accessories

M420

Designation		Article Number
M420 pH H		52121405
M420 pH H OUT2	with 2nd current output	52121406
M420 pH XH		52121407
M420 pH XH OUT2	with 2nd current output	52121408
M420 O2 H		52121415
M420 O2 H OUT2	with 2nd current output	52121416
M420 O2 XH		52121417
M420 O2 XH OUT2	with 2nd current output	52121418
M420 Cond H		52121425
M420 Cond H OUT2	with 2nd current output	52121426
M420 Cond XH		52121427
M420 Cond XH OUT2	with 2nd current output	52121428
M420 Cond Ind H		52121435
M420 Cond Ind H OUT2	with 2nd current output	52121436
M420 Cond Ind XH		52121437
M420 Cond Ind XH OUT2	with 2nd current output	52121438

TAN options		
Logbook	SW-420-002	52121466
Extended logbook (Audit Trail)	SW-420-003	52121467
Trace oxygen measurement	SW-420-004	52121468
Current input + 2 digital inputs	SW-420-005	52121469

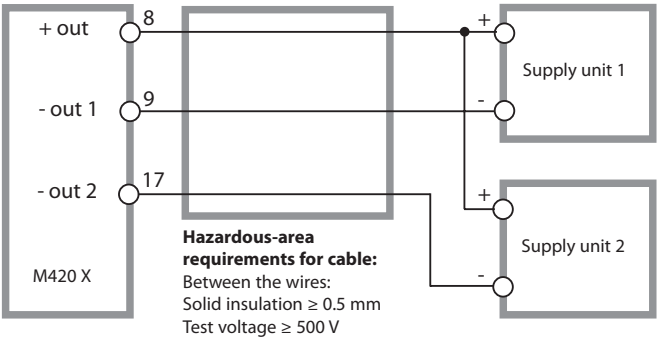
Mounting accessories	
Pipe-mount kit	52120741
Protective hood	52121470
Panel-mount kit	52121471

M420: Supply Units and Connection

Recommended Power Supply Units:	**Order No.:**
Repeater power supply, IS, 24 V AC/DC, output 0/4...20 mA	52120688 WG 20 A2 Power Supply
Repeater power supply, IS, 90...253 V AC, output 4...20 mA	52121689 WG 21 A7 Power Supply
Repeater power supply, IS, 90...253 V AC, HART, output 4...20 mA	52120704 WG 21 A7 Opt. 470
Repeater power supply, IS, 24 V AC/DC, output 4...20 mA	52129772 WG 21 A7 Opt. 336
Repeater power supply, IS, 24 V AC/DC, HART, output 4...20 mA	52120774 WG 21 A7 Opt. 336, 470

Option 336: 24 V AC/DC power supply
Option 470: for transmission of HART protocol

Connection to Supply Units



pH/mV input	Input for pH or ORP sensors or ISFET		
	Input	Glass electrode or ISFET	
	Input	Reference electrode	
	Input	ORP electrode (e.g. platinum) or auxiliary electrode for impedance measurement	
Measuring range (MR)	-1500 ... +1500 mV		
Display range	pH value	-2.00 ... 16.00	
	ORP	-1999 ... +1999 mV	
Glass electrode input[4]	Input resistance	> 1 x 10^{12} Ω	
	Input current	< 1 x 10^{-12} A [2]	
	Impedance range	0.5 ... 1000 MΩ (± 20%)	
Reference electrode input[4]	Input resistance	> 1 x 10^{10} Ω	
	Input current	< 1 x 10^{-10} A [2]	
	Impedance range	0.5 ... 200 kΩ (± 20%)	
Meas. error[1,2,3]	pH value	< 0.02	TC: 0.002 pH/K
(Display)	mV value	< 1 mV	TC: 0.1 mV/K
pH sensor standardization *	pH calibration		
Operating modes	BUF	Calibration with Calimatic automatic buffer recognition	
	MAN	Manual calibration with input of individual buffer values	
	DAT	Data entry of pre-measured electrodes	
	Product calibration		
Calimatic buffer sets *	-01- Mettler-Toledo	2.00/4.01/7.00/9.21	
	-02- Merck/Riedel de Haen	2.00/4.00/7.00/9.00/12.00	
	-03- Ciba (94)	2.06/4.00/7.00/10.00	
	-04- NIST technical	1.68/4.00/7.00/10.01/12.46	
	-05- NIST standard	1.679/4.006/6.865/9.180	
	-06- HACH	4.00/7.00/10.01	
	-07- WTW techn. buffers	2.00/4.01/7.00/10.00	
	-08- Hamilton	4.01/7.00/10.01	
	-09- Reagecon	2.00/4.00/7.00/9.00/12.00	

Specifications

Zero adjustment	± 200 mV (for ISFET)	
Max. calibration range	Asymmetry potential	±60 mV
	Slope	80 ... 103 % (47.5 ... 61 mV/pH)
	(possibly restricting notes from Sensoface)	
ORP sensor standardization*	ORP calibration (zero adjustment)	
Max. calibration range	-700 ... +700 ΔmV	
Adaptive cal timer* (Pat. DE 101 41 408)	Interval 0000 ... 9999 h	
Sensocheck	Automatic monitoring of glass and reference electrode, can be disabled	
Delay	Approx. 30 s	
Sensoface	Provides information on the sensor condition, evaluation of zero/slope, response time, calibration interval, wear, Sensocheck, can be switched off	
Temperature input	Pt100 / Pt1000 / NTC 30 kΩ *	
	2-wire connection, adjustable	
Measuring range	Pt 100/Pt 1000	-20.0 ... +200.0 °C / -4 ... +392 °F
	NTC 30 kΩ	-20.0 ... +150.0 °C / -4 ... +302 °F
Adjustment range	10 K	
Resolution	0.1 °C / 1 °F	
Meas. error[1,2,3)]	< 0.5 K (< 1K for Pt100; < 1K for NTC > 100 °C)	
Temperature compensation of process medium	Linear -19.99 ... +19,99 %/K	
	Reference temp 25 °C	
ISM input	"One wire" interface for operation with ISM (digital sensors)	
	(6 V / Ri= approx. 1.2 kΩ)	
I input	Current input 0/4 ... 20 mA / 50 Ω for external temperature signal	
Start/end of scale	Configurable within the measurement range for °C (°F)	
Characteristic	Linear	
Measurement error [1.3)]	< 1% current value + 0.1 mA	

HOLD input	Galvanically separated (OPTO coupler)	
Function	Switches device to HOLD mode	
Switching voltage	0 ... 2 V (AC/DC)	Inactive
	10 ... 30 V (AC/DC)	HOLD active
CONTROL input	Galvanically separated (OPTO coupler)	
Function	Selecting parameter set A/B	
Switching voltage	0 ... 2 V (AC/DC)	Parameter set A
	10 ... 30 V (AC/DC)	Parameter set B
Output 1	Current loop 4 ... 20 mA, floating, protected against inverse polarity HART communication	
Supply voltage	14 ... 30 V	
Process variable*	pH, ORP, or temperature	
Characteristic	Linear	
Overrange *	22 mA in the case of error messages	
Output filter *	PT_1 filter, time constant 0 ... 120 s	
Measurement error [1)]	< 0.25 % current value + 0.025 mA	
Start/end of scale *	Configurable within the measurement ranges for pH, mV, °C, °F	
Permissible span	pH 2.00 ... 18.00 / 200 ... 3000 mV / 20 ... 320 K / 36 ... 576 °F	
Output 2	Current loop 4 ... 20 mA, floating, protected against inverse polarity	
Supply voltage	14 ... 30 V	
Process variable*	pH, ORP, or temperature	
Characteristic	Linear	
Overrange *	22 mA in the case of error messages	
Output filter *	PT_1 filter, time constant 0 ... 120 s	
Measurement error [1)]	< 0.25 % current value + 0.05 mA	
Start/end of scale *	Configurable within the measurement ranges for pH, mV, °C, °F	
Permissible span	pH 2.00 ... 18.00 / 200 ... 3000 mV / 20 ... 320 K / 36 ... 576 °F	

Power output	for operating an ISFET adapter
	+3 V / 0,5 mA
	–3 V / 0.5 mA
Real-time clock	Different time and date formats selectable
Power reserve	> 5 days
Display	LC display, 7-segment with icons
Main display	Character height approx. 22 mm, unit symbols approx. 14 mm
Secondary display	Character height approx. 10 mm
Text line	14 characters, 14 segments
Sensoface	3 status indicators (friendly, neutral, sad face)
Mode indicators	meas, cal, conf, diag
	Further icons for configuration and messages
Alarm indication	Alarm icon, display blinks
Keypad	Keys: meas, info, 4 cursor keys, enter
HART communication	Digital communication by FSK modulation of output current 1
	Device identification, measured values, status and messages, parameter setting, calibration, records
IrDA interface	Infrared interface for service purposes
FDA 21 CFR Part 11	Access control by editable passcodes
	Logbook entry and flag via HART in the case of configuration changes
	Message and logbook entry when enclosure is opened
Diagnostics Functions	
Calibration data	Calibration date, zero, slope, response time
Device self-test	Displaytest, automatic memory test (RAM, FLASH, EEPROM), module test
Logbook	100 events with date and time
Extended logbook (TAN)	AuditTrail: 200 events with date and time

Service functions		
Sensor monitor	Display of direct sensor signals (mV/temperature/resistance ...)	
Current source	Current specifiable for output 1 and 2 (00.00 ... 22.00 mA)	
IrDA	Activating the IrDA function	
Passcodes	Assigning passcodes for menu access	
Factory setting	Resetting all parameters to factory setting Exception: Calibration data	
TAN	Enabling optionally available additional functions	
Data retention	Parameters, calibration data, logbook > 10 years (EEPROM)	
EMC	EN 61326-1 (General Requirements)	
Emitted interference	Class B (residential area)	
Immunity to interference	Industry EN 61326-2-3 (Particular Requirements for Transmitters)	
Explosion protection M420 pH X (see "Safety Instructions": "Explosion Protection")	USA: Canada: IECEx KEMA 08.009 KEMA 08 ATEX 0144	FM / CSA Cl 1 Div 2 (pending) CSA Cl I Div 2 (pending)
Nominal operating conditions		
Ambient temperature	–20 ... +65 °C	
Transport/Storage temperature	–20 ... +70 °C	
Relative humidity	10 ... 95% not condensing	
Supply voltage	14 ... 30 V	
Enclosure	Molded enclosure made of PBT/PC, glass reinforced	
Fastening	Wall, pipe/post, or panel mounting	
Color	Gray, RAL 7001	
Ingress protection	IP 67	
Flammability	UL 94 V-0	
Dimensions	148 mm x 148 mm	

Specifications

Control panel cutout	138 mm x 138 mm to DIN 43 700
Weight	1.2 kg (1.6 kg incl. accessories and packaging)
Cable glands	3 knockouts for M20 x 1.5 cable glands 2 knockouts for NPT ½" or rigid metallic conduit
Connections	Terminals, conductor cross section max. 2.5 mm^2

* User-defined

1) Acc. to EN 60746-1, at nominal operating conditions

2) ± 1 count

3) Plus sensor error

4) At room temperature

-01- Mettler-Toledo technical buffers

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

-02- Merck Titrisols, Riedel-de-Haen Fixanals

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

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

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

* extrapolated

-04- NIST technical buffers

°C	pH				
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*

* Values complemented

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

°C	pH			
0				
5	1.668	4.004	6.950	9.392
10	1.670	4.001	6.922	9.331
15	1.672	4.001	6.900	9.277
20	1.676	4.003	6.880	9.228
25	**1.680**	**4.008**	**6.865**	**9.184**
30	1.685	4.015	6.853	9.144
37	1.694	4.028	6.841	9.095
40	1.697	4.036	6.837	9.076
45	1.704	4.049	6.834	9.046
50	1.712	4.064	6.833	9.018
55	1.715	4.075	6.834	9.985
60	1.723	4.091	6.836	8.962
70	1.743	4.126	6.845	8.921
80	1.766	4.164	6.859	8.885
90	1.792	4.205	6.877	8.850
95	1.806	4.227	6.886	8.833

Please note:
The actual pH values of the individual batches of the reference materials are documented in a certificate of an accredited laboratory.
This certificate is supplied with the respective buffers. 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 only provides examples of pH(PS) values for orientation.

-06- HACH buffers
Nominal values: 4.01 7.000 10.01 (± 0.02 at 25 °C)

°C	pH		
0	4.00	7.118	10.30
5	4.00	7.087	10.23
10	4.00	7.059	10.17
15	4.00	7.036	10.11
20	4.00	7.016	10.05
25	4.01	7.000	10.01
30	4.01	6.987	9.96
35	4.02	6.977	9.92
40	4.03	6.970	9.88
45	4.05	6.965	9.85
50	4.06	6.964	9.82
55	4.07	6.965	9.79
60	4.09	6.968	9.76
65	4.10*	6.98*	9.71*
70	4.12*	7.00*	9.66*
75	4.14*	7.02*	9.63*
80	4.16*	7.04*	9.59*
85	4.18*	7.06*	9.56*
90	4.21*	7.09*	9.52*
95	4.24*	7.12*	9.48*

* Values complemented

-07- WTW technical buffers

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

-08- Hamilton Duracal buffers

°C	pH		
0	4.01	7.12	10.23
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	4.05	6.97	9.79
55	4.06	6.98	9.75
60	4.08	6.98	9.72
65	4.10*	6.99*	9.69*
70	4.12*	7.00*	9.66*
75	4.14*	7.02*	9.59*
80	4.16*	7.04*	9.59*
85	4.18*	7.06*	9.56*
90	4.21*	7.09*	9.52*
95	4.24*	7.12*	9.48*

* Values complemented

-09- Reagecon buffers

°C	pH				
0°C	*2.01	*4.01	*7.07	*9.18	*12.54
5°C	*2.01	*4.01	*7.07	*9.18	*12.54
10°C	2.01	4.00	7.07	9.18	12.54
15°C	2.01	4.00	7.04	9.12	12.36
20°C	2.01	4.00	7.02	9.06	12.17
25°C	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
30°C	1.99	4.01	6.99	8.95	11.81
35°C	2.00	4.02	6.98	8.90	11.63
40°C	2.01	4.03	6.97	8.86	11.47
45°C	2.01	4.04	6.97	8.83	11.39
50°C	2.00	4.05	6.96	8.79	11.30
55°C	2.00	4.07	6.96	8.77	11.13
60°C	2.00	4.08	6.96	8.74	10.95
65°C	*2.00	*4.10	*6.99	*8.70	*10.95
70°C	*2.00	*4.12	*7.00	*8.67	*10.95
75°C	*2.00	*4.14	*7.02	*8.64	*10.95
80°C	*2.00	*4.16	*7.04	*8.62	*10.95
85°C	*2.00	*4.18	*7.06	*8.60	*10.95
90°C	*2.00	*4.21	*7.09	*8.58	*10.95
95°C	*2.00	*4.24	*7.12	*8.56	*10.95

* Values complemented

Error Handling

Alarm Condition:

- The  alarm icon is displayed
- The complete measured-value display blinks
- "**ERR xxx**" is displayed in the lower menu line

Press the [**info**] key to view a short error text:

- The error text appears in the lower menu line
- The main display reads "**InFo**".

Parameter Errors:

Configuration data such as current range, limit values, etc are checked during the input.
If they are out of range,

- "**ERR xxx**" is displayed for 3 sec,
- the respective maximum or minimum value is shown,
- input must be repeated

If a faulty parameter arrives through the interface (IrDA, HART),

- an error message will be displayed: "**ERR 100...199**"
- the faulty parameter can be localized by pressing the [**info**] key

Calibration Errors:

If errors occur during calibration, e.g. by using a wrong buffer,

- an error message will be displayed for 4 sec
- calibration will be restarted

Sensoface:

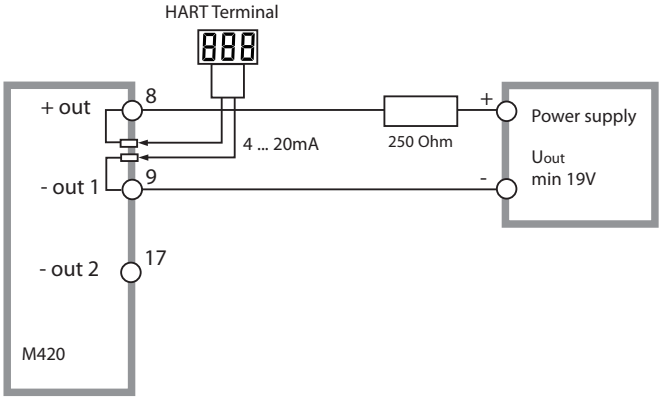
If the Sensoface becomes sad

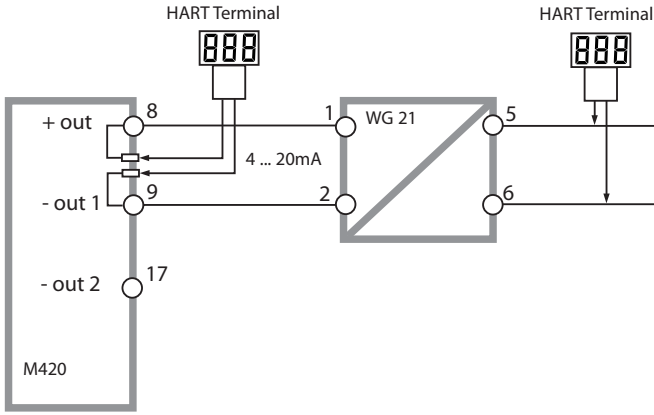
- the cause can be seen by pressing the [**info**] key
- the calibration data can be seen in the Diagnostics menu

Error	**Info text** (is displayed in case of fault when the Info key is pressed)	**Problem** **Possible causes**
ERR 99	DEVICE FAILURE	**Error in factory settings** EEPROM or RAM defective This error message only occurs in the case of a total defect. The device must be repaired and recalibrated at the factory.
ERR 98	CONFIGURATION ERROR	**Error in configuration or calibration data** Configuration or calibration data defective Reset device to factory settings (SERVICE/DEFAULT), then calibrate
ERR 97	NO MODULE INSTALLED	**No module** Please have the module replaced in the factory.
ERR 96	WRONG MODULE	**Wrong module** Please have the module replaced in the factory.
ERR 95	SYSTEM ERROR	**System error** Restart required. If error still persists, send in the device for repair.
ERR 01	NO SENSOR	**pH sensor *** Sensor defective Sensor not connected Break in sensor cable
ERR 02	WRONG SENSOR	**Wrong sensor ***
ERR 03	CANCELED SENSOR	**Sensor devaluated ***

Error	**Info text** (is displayed in case of fault when the Info key is pressed)	**Problem Possible causes**
ERR 04	SENSOR FAILURE	**Failure in sensor ***
ERR 05	CAL DATA	**Error in cal data ***
ERR 10	ORP RANGE	**ORP display range violation** < -1999 mV or > 1999 mV
ERR 11	PH RANGE	**pH display range violation** < -2 or > 16
ERR 12	MV RANGE	**mV range**
ERR 13	TEMPERATURE RANGE	**Temperature range violation**
ERR 15	SENSOCHECK GLASS-EL	**Sensocheck glass**
ERR 16	SENSOCHECK REF-EL	**Sensocheck ref.**
ERR 60	OUTPUT LOAD	**Load error**
ERR 61	OUTPUT 1 TOO LOW	**Output current 1** < 3.8 mA
ERR 62	OUTPUT 1 TOO HIGH	**Output current 1** > 20.5 mA
ERR 63	OUTPUT 2 TOO LOW	**Output current 2** < 3.8 mA
ERR 64	OUTPUT 2 TOO HIGH	**Output current 2** > 20.5 mA
ERR 69	TEMP. OUTSIDE TABLE	**Temperature** value outside table
ERR 100 ...255	VOID PARAMETER	**Invalid parameter**

*) ISM® sensors


HART Terminal
+ out
8
4 ... 20mA
250 Ohm
+
Power supply
Uout
min 19V
- out 1
9
-
- out 2
17
M420


HART Terminal
HART Terminal
+ out
8
1
WG 21
5
4 ... 20mA
- out 1
9
2
6
- out 2
17
M420

Sensoface

(Sensocheck must have been activated during configuration.)

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

Sensocheck
Continuously monitors the sensor and its wiring.
Critical values make the Sensoface "sad" and the corresponding icon blinks:

The Sensocheck message is also output as error message Err 15 (glass electrode) or Err 16 (reference electrode). The alarm contact is active, output current 1 is set to 22 mA (when configured correspondingly). Sensocheck can be switched off during configuration (then Sensoface is also disabled).
Exception:
After a calibration a smiley is always displayed for confirmation.

Please 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 the sensor defect.

Display	Problem	Status	
	Asymmetry potential and slope	😐	Asymmetry potential (zero) and slope of the sensor are still okay. The sensor should be replaced soon.
		☹	Asymmetry potential and slope of the sensor have reached values which no longer ensure proper calibration. Replace sensor.
	Calibration timer	😐	Over 80% of the calibration interval has already past.
		☹	The calibration interval has been exceeded.
	Sensor defect	☹	Check the sensor and its connections (see also Error Messages Err 15 and Err 16).
	Response time	😐	Sensor response time has increased. The sensor should be replaced soon. To achieve an improvement, clean the sensor and soak it in buffer.
		☹	Sensor response time significantly increased (> 72 s, calibration aborted after 120 s) Replace sensor.

Display	Problem	Status	
	Sensor wear (for digital sensors only)		High temperatures and pH values have caused a wear of over 80%. The sensor should be replaced soon.
			Wear is at 100%. Replace sensor.

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 M420 Series meet the demands of FDA 21 CFR Part 11:

Electronic Signature – Passcodes

Access to the device functions is regulated and limited by individually adjustable codes – "Passcodes" (see SERVICE). 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. Each change is tagged with a "Configuration Change Flag", which can be interrogated and documented using HART communication. Altered device settings or parameters can also be retrieved and documented using HART communication.

Extended logbook

Audit Trail also records function activations (CAL, CONFIG, SERVICE), some Sensoface messages (cal timer, wear), and opening of the enclosure.

Glossary

Asymmetry potential	The voltage which a pH sensor provides at a pH of 7. The asymmetry potential is different for each sensor and changes with age and wear.
Buffer set	Contains selected buffer solutions which can be used for automatic calibration (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 sensor characteristics. The asymmetry potential and slope are adjusted. Either a one- or two-point calibration can be carried out. 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.

CIP	Cleaning In Place – CIP cycles are used for cleaning the process-wetted parts in the process. They are performed for biotech applications, for example. Depending on the application, one or more chemicals are used at temperatures above 70 °C. This extremely stresses the sensors. Digital sensors can release a message after preset number of CIP cycles. This allows replacing the sensor in time.
Combination electrode	Combination of glass and reference electrode in one body.
dsm	Digital sensor
GainCheck	Device self-test which runs automatically in the background at fixed intervals. The memory and measured-value transfer are checked. You can also start GainCheck manually in the diagnostics menu. In that case, also a display test will be performed.
ISFET adapter	Adapter between ISFET sensor and transmitter. Here, the signal of the pH-sensitive FET is converted to voltage corresponding to the signal of a glass electrode. This voltage is led to the pH input of the device and is processed further as usual. The adapter is directly supplied from the device.

ISM®	Intelligent Sensor Management – ISM® sensors have an "electronic datasheet" which allows the storage of additional operating parameters such as calibration date and settings directly in the sensor.
One-point calibration	Calibration with which only the asymmetry potential (zero point) is taken into account. The previous slope value is maintained. Only one buffer solution is required for a one-point calibration.
Passcode	User-defined four-digit number to select certain operating modes.
pH sensor	A pH sensor consists of a glass and a reference electrode. If they are combined in one body, they are referred to as combination electrode. When the sensor has an additional platinum electrode, the oxidation-reduction potential (ORP) can be measured simultaneously with the pH.
Response time	Time from the start of a calibration step to the stabilization of the sensor 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 sensor condition. The zero point, slope, and response time are evaluated. In addition, the Sensocheck information is indicated.
SIP	Sterilization In Place – CIP cycles are used for sterilizing the process-wetted parts in the process. They are performed for biotech applications, for example. Depending on the application, one or more chemicals are used at temperatures above 115 °C. This extremely stresses the sensors. Digital sensors can release a message after preset number of SIP cycles. This allows replacing the sensor in time.
Slope	Is indicated in % of the theoretical slope (59.2 mV/pH at 25 °C). The sensor slope is different for each sensor and changes with age and wear.
TAN	Transaction number for releasing an additional function.
Two-point calibration	Calibration with which the asymmetry potential (zero point) and slope are determined. Two buffer solutions are required for two-point calibration.
Zero adjustment	Basic adjustment of the ISFET sensor to ensure reliable Sensoface information.
Zero point	See asymmetry potential

EC Declarations of Conformity

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Process Analytics

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EC Declaration of conformity
EG-Konformitätserklärung
EC Déclaration de Conformité

CE

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Switzerland Schweiz Suisse

declare under our sole responsibility that the product,
erklären in alleiniger Verantwortung, dass dieses Produkt,
déclarons sous notre seule responsabilité que le produit,

Description / Beschreibung / Description: **M420 Series / Serie / Série**

to which this declaration relates is in conformity with the following standard(s) or other normative document(s).
auf welches sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder Richtlinie(n) übereinstimmt.
auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou au(x) document(s) normatif(s).

EMC Directive / EMV-Richtlinie / CEM Directive	2004/108/EC / 2004/108/EG / 2004/108/CE
Low-voltage directive / Niederspannungs-Richtlinie / Directive basse tension	2006/95/EC / 2006/95/EG / 2006/95/CE
Standard / Norm / Norme	DIN EN 61010-1 / VDE 0411 Teil 1 : 2002-08 DIN EN 61326-1 / VDE 0843 Teil 20-1 : 2006-10 DIN EN 61326-2-3 / VDE 0843 Teil 20-2-3 : 2007-05

Mettler-Toledo AG, Process Analytics

Waldemar Rauch
General Manager PO Urdorf

Thomas Hösli
Head of Operation and R&D

Place and Date of Issue / Ausstellungsort und Datum / Lieu et date d'émission: Urdorf, 07.08.2008

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METTLER TOLEDO

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EC Declaration of conformity
EG-Konformitätserklärung
EC Déclaration de Conformité

CE 0499

We / Wir / Nous: **Mettler-Toledo AG, Process Analytics**
Im Hackacker 15
8902 Urdorf
Switzerland Schweiz Suisse

declare under our sole responsibility that the product,
erklären in alleiniger Verantwortung, dass dieses Produkt,
déclarons sous notre seule responsabilité que le produit,

Description / Beschreibung / Description: **M420 X Series / Serie / Série**

to which this declaration relates is in conformity with the following directive(s) and standard(s).
auf welches sich diese Erklärung bezieht, mit den/der folgenden Norm(en) oder Richtlinie(n) übereinstimmt.
à ce que cette déclaration rapporte est conforme aux directive(s) et aux norme(s) suivantes.

ATEX Directive / ATEX Richtlinie / ATEX Directive	**94/9/EC / 94/9/EG / 94/9/CE**	**EC-Type Examination Certificate / EG-Baumeisterprüfbescheinigung / Attestation d'Examen CE de Type: KEMA 08 ATEX 0144, KEMA Quality B.V. NL-6812 Arnheim, ExNB-No. 0344**
EMC Directive / EMV-Richtlinie / CEM Directive	**2004/108/EC / 2004/108/EG / 2004/108/CE**	
Low-voltage directive / Niederspannungs-Richtlinie / Directive basse tension	**2006/95/EC / 2006/95/EG / 2006/95/CE**	
Standard / Norm / Norme	**EN 60079-0 :2006** **EN 60079-11 :2007** **EN 60079-26 :2007** **EN 61241-0 :2006** **EN 61241-11 :2006**	**DIN EN 61010-1 / VDE 0411 Teil 1 : 2002-08** **DIN EN 61326-1 / VDE 0843 Teil 20-1 : 2006-10** **DIN EN 61326-2-3 / VDE 0843 Teil 20-2-3 : 2007-05**

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Place and Date of issue / Ausstellungsort und Datum / Lieu et date d'émission: Urdorf, 09.09.2008

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METTLER TOLEDO

M420 X Control Drawing

Hazardous classified Area

2-Wire Transmitter M420...X...
(intrinsically safe apparatus)

IECEx IECEx KEM 08.xxxx
Ex ib [ia] IIC T4 or Zone 0 Ex ia IIC T4 or
Ex iaD 20 IP6x T85 °C

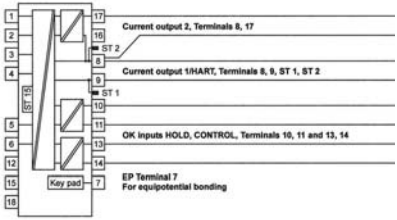
ATEX KEMA 08 ATEX xxxx
II 2(1) G Ex ib [ia] IIC T4 or II 1 G Ex ia IIC T4 or
II 1 D Ex iaD 20 IP6x T85 °C or II 2 D Ex iaD 21 IP6x T85 °C

InduCon interface
Terminals 1, 2, 3, 4

Module interface
ST 15

Current input
Terminals 5, 6

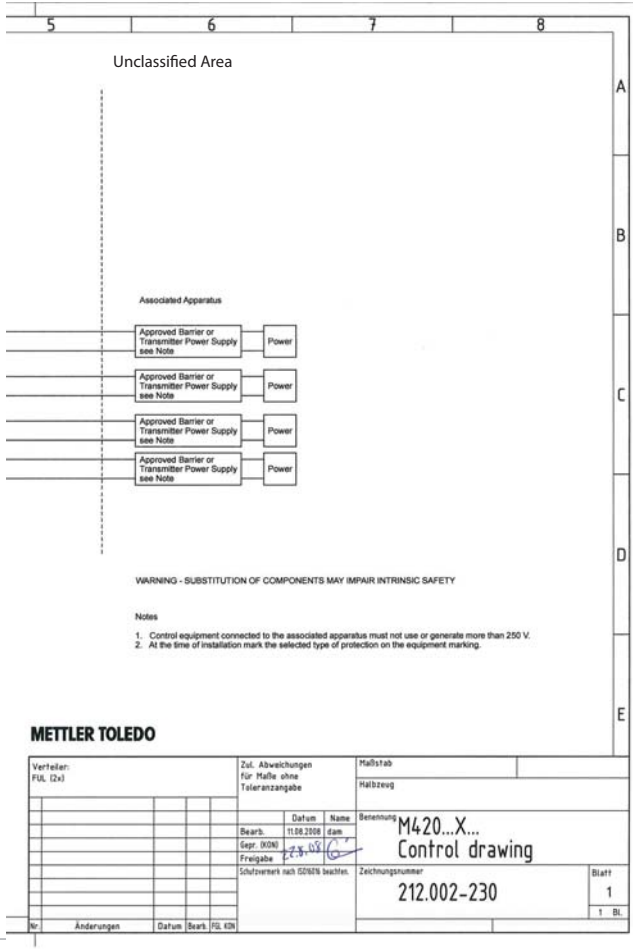
Terminals 12, 15, 16, 18
not connected



	In type of protection intrinsic safety Ex ia IIC only for connection to intrinsically safe circuits, with the following maximum values									
	Ui, Vmax (V)	Ii, Imax (mA)	Pi, Pmax (mW)	Ci (nF)	Li (µH)					
Current output 1 / HART (Terminals 8, 9, ST1, ST2)	30	100	800	5.3	2.5					
Current output 2 (Terminals 8, 17)	30	100	800	5.3	2.5					
Current input (Terminals 5, 6)	30	100	800	12	0					
OK input HOLD (Terminals 10, 11)	30	100	1000	0	0					
OK input CONTROL (Terminals 13, 14)	30	100	1000	0	0					
	In type of protection intrinsic safety, with the following maximum values									
				Ex ia IIC		Ex ia IIB		Ex ia IIA		
	Uo, Voc (V)	Io, Isc (mA)	Po (mW)	Co, Ca (µF)	Lo, La (mH)	Co, Ca (µF)	Lo, La (mH)	Co, Ca (µF)	Lo, La (mH)	
InduCon interface (Terminals 1, 2, 3, 4)	5	124	155	83.2	2	1000	8.5	1000	16	Linear charac
Module interface	only for connection to a measuring module ** M420* X, belonging to M420...X... system									
EP (Terminal 7)	For equipotential bonding									

Simultaneous connection of a measuring module ** M420* X and an InduCon measuring system is not permitted.

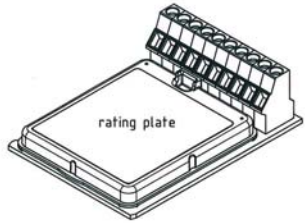
Safe galvanic isolation up to 60 V


5
6
7
8
A
B
C
D
E
Unclassified Area
Associated Apparatus
Approved Barrier or Transmitter Power Supply see Note
Power
Approved Barrier or Transmitter Power Supply see Note
Power
Approved Barrier or Transmitter Power Supply see Note
Power
Approved Barrier or Transmitter Power Supply see Note
Power
WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY
Notes
1. Control equipment connected to the associated apparatus must not use or generate more than 250 V.
2. At the time of installation mark the selected type of protection on the equipment marking.
METTLER TOLEDO
Verteiler:
FUL (2x)
Zul. Abweichungen für Maße ohne Toleranzangabe
Maßstab
Halbzeug
Datum
Name
Bearb.
11.08.2008
dam
Gepr. (KON)
Freigabe
Schutzvermerk nach ISO16016 beachten.
Benennung
M420...X...
Control drawing
Zeichnungsnummer
212.002-230
Blatt
1
1 Bl.
Nr.
Änderungen
Datum
Bearb.
FGL KON

Hazardous Classified Area
Measuring Module pH M420i X
belonging to
M420...X...
control drawing 212.002-230

Module interface	In type of protection intrinsic safety Ex ia IIC, only for connection to M420...X...									
	In type of protection intrinsic safety, with the following maximum values									
				Ex ia IIC		Ex ia IIB		Ex ia IIA		
	Uo, Voc (V)	Io, Isc (mA)	Po (mW)	Co, Ca (nF)	Lo, La (mH)	Co, Ca (µF)	Lo, La (mH)	Co, Ca (µF)	Lo, La (mH)	
pH Measuring Loop (Terminals A, B, C, K)	15	19.9	49.8	553	90	3.52	320	13.9	610	Linear characteri
Temperature Measuring Loop (Terminals H, I)	10	18.3	45.7	2.87 µF	95	19.8	350	99	630	Linear characteri
pH/Temperature Measuring Loop (Terminals A, B, C, H, I, K)	15	38.2	95.5	432	23	3.4	90	13.8	180	Linear characteri
ISM Measuring Loop (Terminals F, G)	15	10.6	26.8	580	300	3.55	1000	14	1000	Linear characteri
pH/Temperature/Supply Measuring Loop (Terminals A, B, C, D, E, H, I, K)	15	93.8	200	379	4	3.35	19	13.8	40	Linear characteri

The measuring circuits are galvanically connected



WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

Notes

1. The Intrinsically Safe Equipment connecting to A, B, C, D, E, F, G, H, I, K must be IECEx or ATEX Approved or be a simple Apparatus.
2. Simple Apparatus is defined as a device that does not generates more than 1.5 V, 0.1 A, 25 mW.

METTLER TOLEDO

Verteiler: FUL (2x)			Zul. Abweichungen für Maße ohne Toleranzangabe		Maßstab
					Halbzeug
				Datum / Name	Benennung: Module pH M420i X Control drawing
			Bearb.	11.08.2008 dam	
			Gepr. (KON)		
			Freigabe	28.08.08	
			Schutzvermerk nach ISO16016 beachten.		Zeichnungsnummer: 212.002-240
					Blatt 1 / 1 Bl.
Nr.	Änderungen	Datum / Bearb. / FGL KON			

Index

D

Passcodes

In the SERVICE – CODES menu you can assign passcodes to protect the access to certain functions.

Operating mode	Passcode
Service (SERVICE)	**5555**
Diagnostics (DIAG)	
HOLD mode	
Calibration (CAL)	
Configuration (CONF)	

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Subject to technical changes.

FM and CSA approvals pending