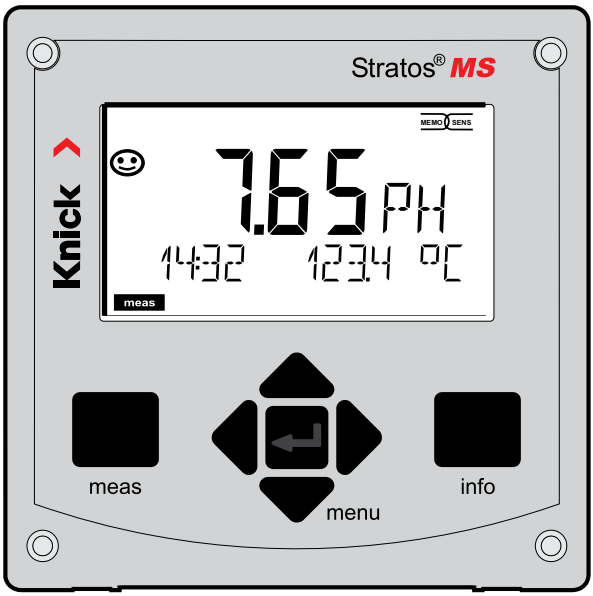
Knick

User Manual

Stratos MS A405

pH Measurement



Read before installation.
Keep for future use.

www.knick.de

Supplemental Directives

Read this document and retain it for future reference. Before assembling, installing, operating, or maintaining the product, ensure that you fully understand the instructions and risks. Observe all safety instructions. Failure to follow the instructions in this document may result in serious injury and/or property damage.
This document is subject to change without notice.
These supplemental directives explain how safety information is laid out in this document and what content it covers.

Safety Chapter

This document's Safety chapter is designed to give the reader a basic understanding of safety. It illustrates general hazards and gives strategies on how to avoid them.

Safety Guide

The external Safety Guide is designed to give the reader a basic understanding of safety. It illustrates general hazards and suggests strategies on how to avoid them.

Warnings

This document uses the following warnings to indicate hazardous situations:

Symbol	Category	Meaning	Remark
⚠	WARNING	Designates a situation that can lead to death or serious (irreversible) injury.	The warnings contain information on how to avoid the hazard.
⚠	CAUTION	Designates a situation that can lead to slight or moderate (reversible) injury.	
None	NOTICE	Designates a situation that can lead to property or environmental damage.	

Additional Safety Information

Stratos Safety Guide

Table of Contents

Table of Contents

Safety Guide

In official EU languages and others

Quickstart Guides

Installation and first steps:

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

Test Report 2.2 According to EN 10204

Electronic Documentation

www.knick-international.com:
Manuals + software

Safety

Always Read and Observe the Safety Instructions!
The device is constructed in accordance with the latest technology and generally accepted safety rules and regulations.
Under certain circumstances, however, usage may pose risks to users or cause damage to the device.

Commissioning must be carried out by specialist personnel authorized by the operating company. If safe operation is not possible, the device must not be switched on or, if it is already on, must be switched off properly and secured against unintended operation.
Reasons to assume safe operation is not possible:

- the device shows visible damage
- failure to perform the intended function
- prolonged storage at temperature of below -30 °C/-22 °F or above 70 °C/158 °F
- severe transport stresses

Before recommissioning the device, a professional routine test must be performed. This test should be carried out by the manufacturer at its factory.

Mains Connection
The device does not have a power switch. An appropriately arranged and accessible disconnecting device for the transmitter must be present in the system installation. The disconnecting device must disconnect all non-grounded, current-carrying wires. The disconnecting device must be labeled in a way that enables the associated transmitter to be identified. The power line may carry dangerous touch voltages. Touch protection must be ensured by proper installation.

Personnel Requirements
Customer shall ensure that any personnel using or otherwise interacting with the product is adequately trained and has been properly instructed.
The operating company shall comply and cause its personnel to comply with all applicable laws, regulations, codes, ordinances and relevant industry qualification standards related to product. Failure to comply with the foregoing shall constitute a violation of operating company's obligations concerning the product, including but not limited to an unintended use as described in this document.

Intended Use

Stratos MS is a 4-wire analyzer for use with Memosens sensors. Current is provided through a universal power supply 80 ... 230 V AC, 45 ... 65 Hz / 24 ... 60 V DC.
The analyzer provides two 0 (4) .... 20 mA current outputs for transmission of measured value and temperature, for example.
Two floating relay contacts are available for free configuration.

You can select one of the following measuring functions:

- pH
- ORP
- Dissolved oxygen
- Conductivity measurement (conductive/inductive)

The defined rated operating conditions must be observed when using this product. They can be found in the Specifications chapter of this User Manual; see page 87.

Function Check Mode (HOLD Function)

After activating configuration, calibration, or service, Stratos MS enters function check mode (HOLD).
The current outputs respond in accordance with the configuration.
Operations must not be carried out while Stratos Pro is in function check (HOLD) mode, as the system may behave unexpectedly and put users at risk.

Introduction

Enclosure and mounting possibilities

- The sturdy molded enclosure is rated IP66/IP67 / TYPE 4X Outdoor.
  Material of front unit: PBT, rear unit: PC.
  Dimensions: H 148 mm, W 148 mm, D 117 mm.
  It is provided with knockouts to allow:
- panel mounting (138 mm x 138 mm cutout to DIN 43700)
- wall mounting (with sealing plugs to seal the enclosure)
- post/pipe mounting (dia. 40 … 60 mm, ☐ 30 … 45 mm)

Protective hood (accessory)

The protective hood provides additional protection against direct weather exposure and mechanical damage (available as accessory).

Connection of sensors, cable glands

For connecting the cables, the enclosure provides

- 3 knockouts for cable glands M20x1.5
- 2 knockouts for NPT 1/2" or rigid metallic conduit

For quasi-stationary installations with Memosens sensors, we recommend using the M12 socket accessory (ZU0822) instead of a cable gland – which allows simple replacement of the sensor cable without opening the device.

Memosens sensors and connecting cables

Please visit our website for more information on our product range: **www.knick.de.**

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

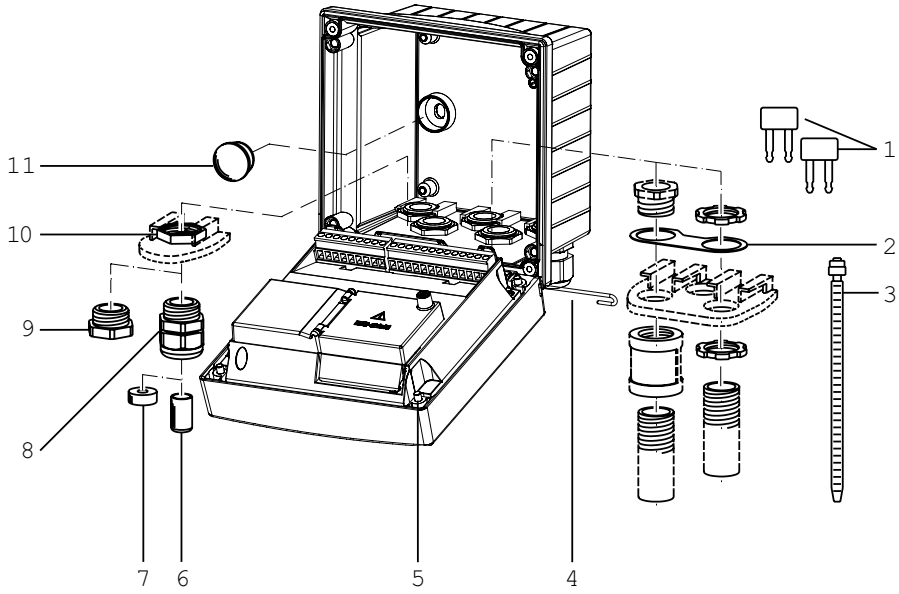
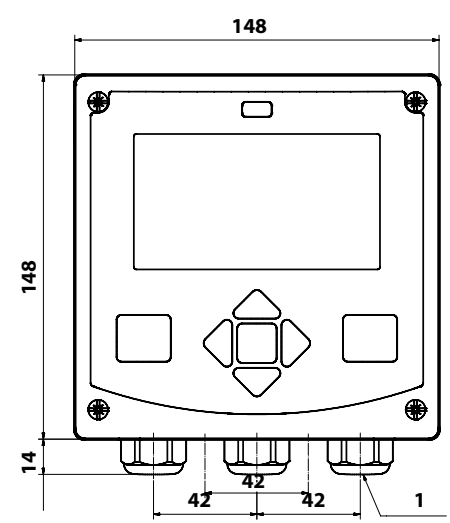
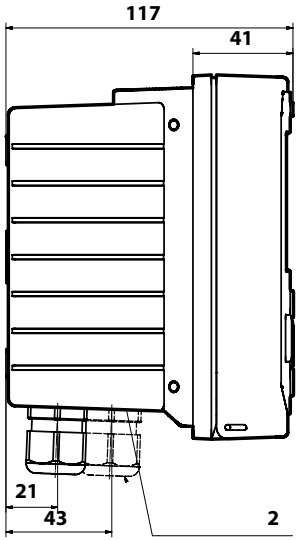


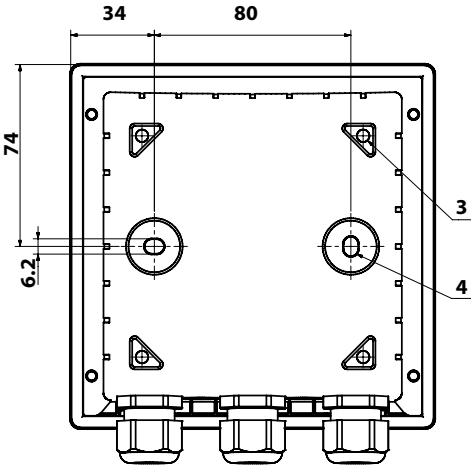
Fig.: Assembling the enclosure

1) Insertable jumper (3x)
2) Plate (1x), for conduit mounting: Plate between housing and nut
3) Cable tie (3x)
4) Hinge pin (1x), insertable from either side
5) Enclosure screw, captive (4x)
6) Blanking plug (2x)
7) Reduction sealing insert (1x)
8) Cable gland (3x)
9) Blanking cap (2x)
10) Hex nut (5x)
11) Plastic sealing plug (2x), for sealing in case of wall mounting

Mounting Plan, Dimensions







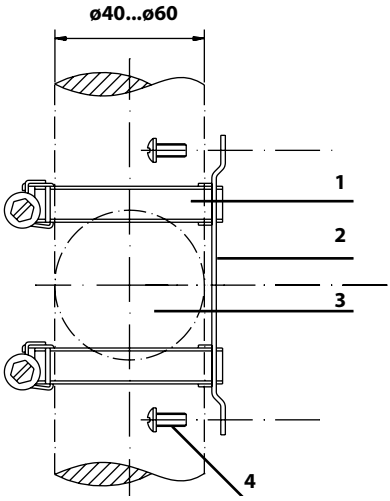
1) Cable gland (3x)
2) Knockouts for cable gland or ½" conduit, dia. 21.5 mm (2 knockouts).
   Conduit couplings not included!
3) Knockout for pipe mounting (4x)
4) Knockout for wall mounting (2x)

Mounting Accessories

Pipe-mount kit, accessory ZU0274
Protective hood for wall and pipe mounting, accessory ZU0737
Panel-mount kit, accessory ZU0738

All dimensions in mm

Pipe Mounting, Protective Hood



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

Fig.: Pipe-mount kit, accessory ZU0274

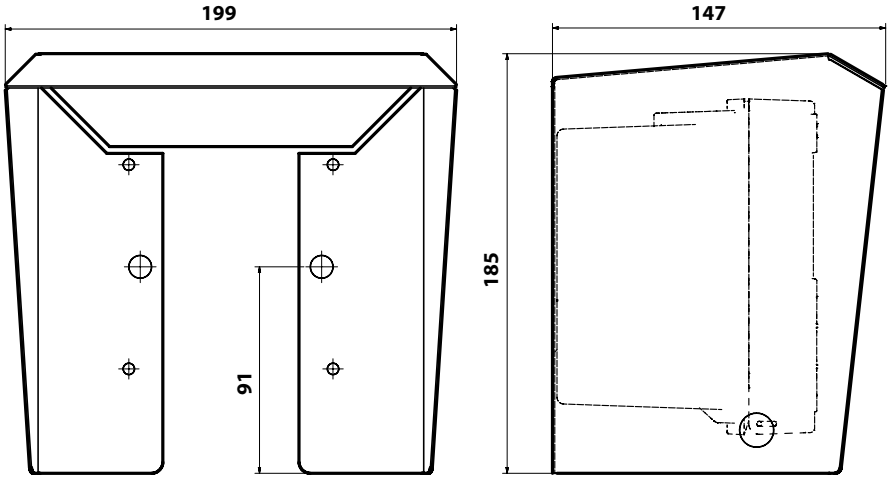
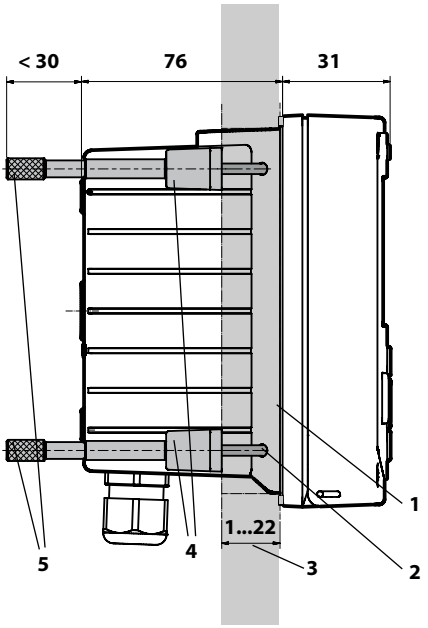


Fig.: Protective hood for wall and pipe mounting, accessory ZU0737

All dimensions in mm

Panel Mounting



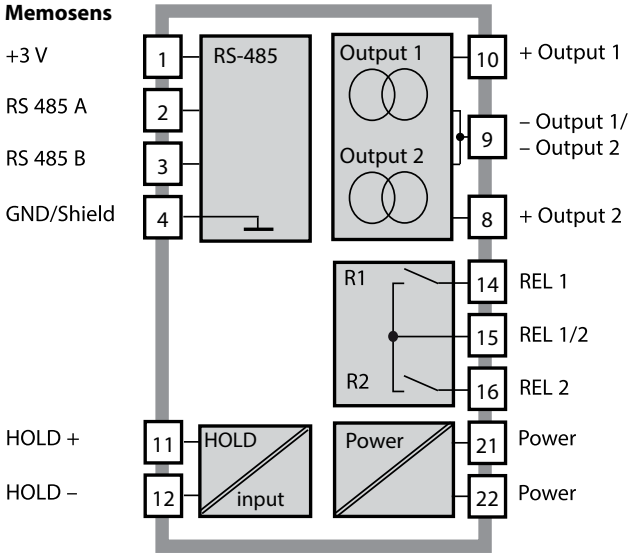
1) Circumferential sealing (1 x)
2) Screw (4 x)
3) Position of control panel
4) Span piece (4 x)
5) Threaded sleeve (4 x)

Cutout
138 x 138 mm (DIN 43700)

Fig.: Panel-mount kit, accessory ZU0738

All dimensions in mm

System Overview



Terminal Assignments, Rating Plates

The terminals are suitable for single or stranded wires up to 2.5 mm² (AWG 14).

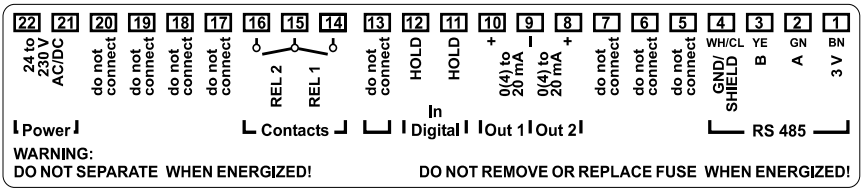


Fig.: Terminal assignments of Stratos MS

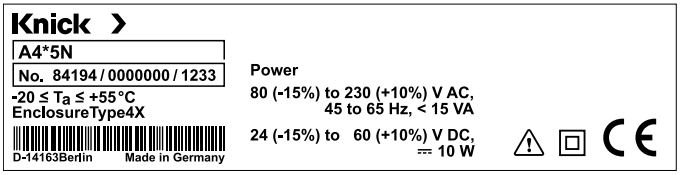
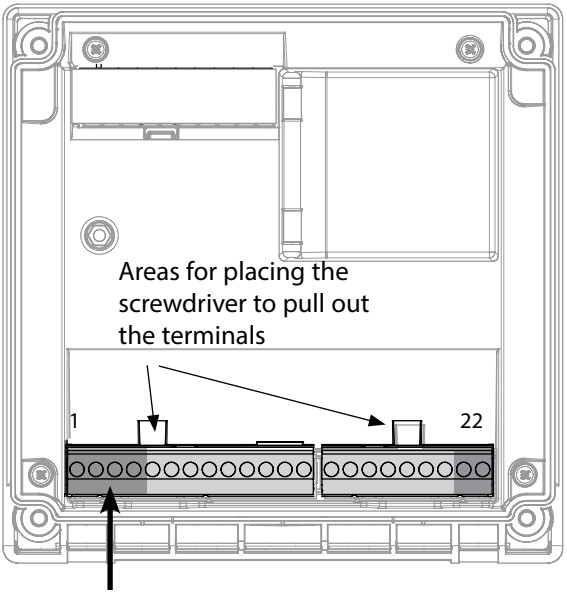


Fig.: Stratos MS rating plate at outside bottom of front (illustrative example)

Power Supply

Connect the power supply for Stratos MS to terminals 21 and 22
(80 ... 230 V AC, 45 ... 65 Hz / 24 ... 60 V DC)



Connection of Memosens sensor		
1	Brown	+3 V
2	Green	RS 485 A
3	Yellow	RS 485 B
4	White/Transp.	GND/shield

Figure:
Terminals, device opened,
back of front unit

Terminal assignments		
Memosens connection		
1 (BN)	+3 V	Brown
2 (GN)	RS 485 A	Green
3 (YE)	RS 485 B	Yellow
4 (WH/CL)	GND/ shield	White / Transp.
5	do not connect	
6	do not connect	
7	do not connect	
Current outputs OUT1, OUT2		
8	+ Out 2	
9	– Out 1 / Out 2	
10	+ Out 1	
11	HOLD	
12	HOLD	
13	do not connect	
Relay contacts REL1, REL2		
14	REL 1	
15	REL 1/2	
16	REL 2	
17	do not connect	
18	do not connect	
19	do not connect	
20	do not connect	
Power supply		
21	power	
22	power	

Start-Up

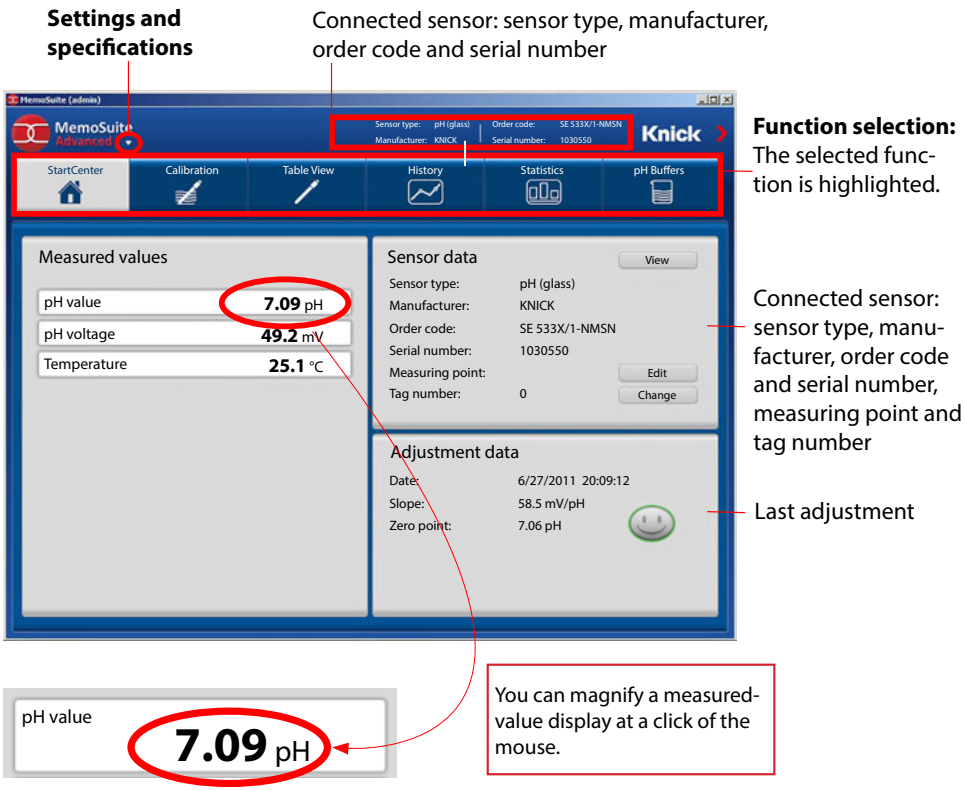
When a Memosens sensor is connected, the appropriate measuring function (device type) is automatically loaded.

Changing the Measuring Function

In the "Service" menu you can select another measuring function at any time.

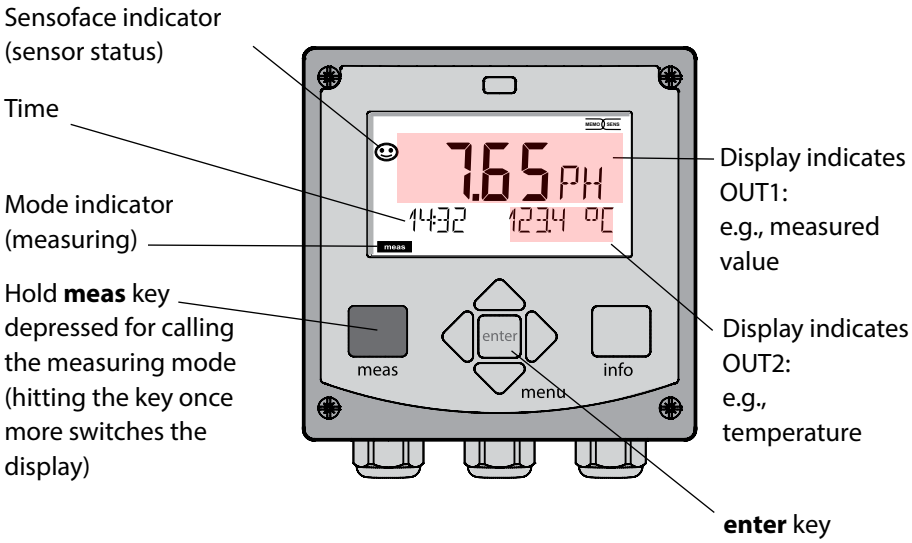
Calibration and Maintenance in the Lab

The "MemoSuite" software allows calibrating Memosens sensors under reproducible conditions at a PC in the lab. The sensor parameters are registered in a database. Documenting and archiving meet the demands of FDA CFR 21 Part 11. Detailed reports can be output as csv export for Excel. MemoSuite is available as accessory and comes in the versions "Basic" and "Advanced": www.knick.de.



Measuring Mode

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



Depending on the configuration, you can set various displays as standard display for the measuring mode (see page 20).

Note: By pressing the **meas** key in measuring mode you can view the displays for approx. 60 sec.

You must configure the analyzer for the respective measurement task, see page 28.

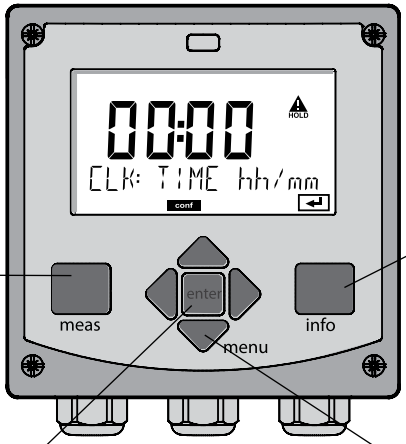
The Keys and Their Functions

Up / Down arrows

- Menu: Increase/decrease a numeral
- Menu: Selection

Left / Right arrows

- Menu: Previous/next menu group
- Number entry: Move between digits



meas

- Return to last menu level
- Directly to measuring mode (press > 2 s)
- Measuring mode: other display (temporarily for approx. 60 s)

info

- Retrieve information
- Show error messages

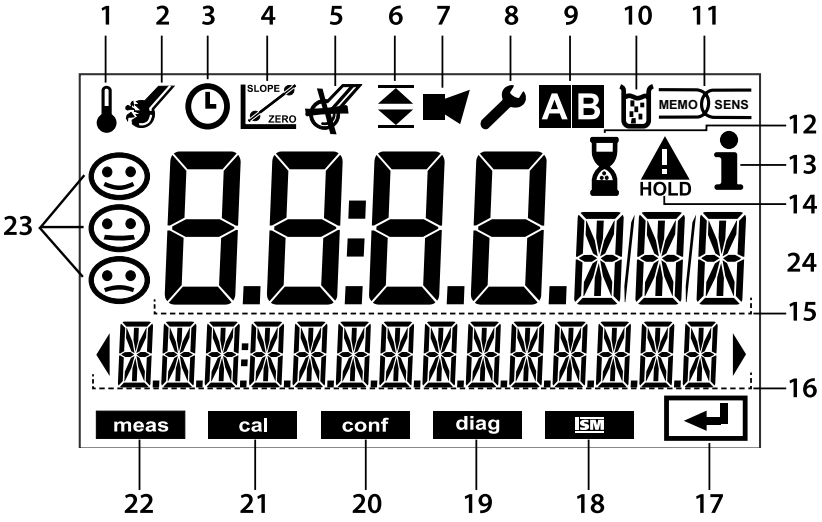
enter

- Configuration: Confirm entries, next configuration step
- Calibration: Continue program flow

menu

- Measuring mode: Call menu

The Display

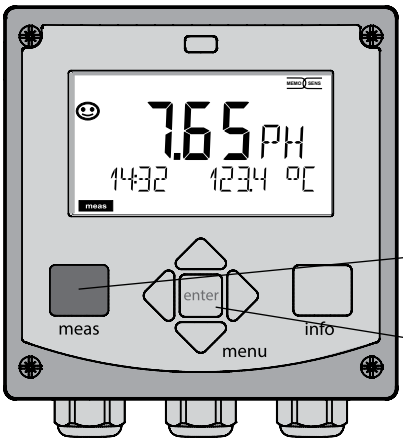


1 Temperature
2 Sensocheck
3 Interval/response time
4 Sensor data
5 Wear
6 Limit message:
Limit 1 ▼ or Limit 2 ▲
7 Alarm
8 Service
9 Not used
10 Calibration
11 Memosens sensor
12 Waiting time running
13 Info available
14 HOLD mode active
15 Primary process value
16 Secondary display
17 Proceed using enter
18 Not used
19 Diagnostics
20 Configuration mode
21 Calibration mode
22 Measuring mode
23 Sensoface
24 Unit symbols

Signal Colors (Display Backlighting)

Red	Alarm (in case of fault: display values blink)
Red blinking	Input error: illegal value or wrong passcode

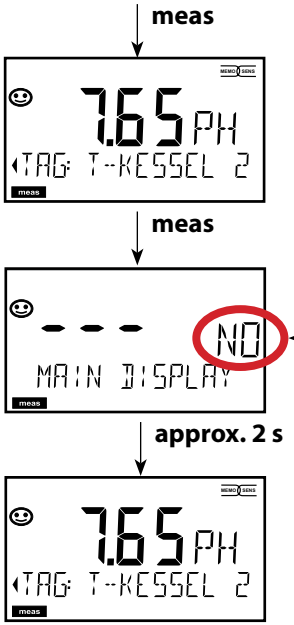
Display in Measuring Mode



The MAIN DISPLAY is the display which is shown in measuring mode. To call the measuring mode from any other mode, hold the **meas** key depressed for at least 2 sec.

meas key

enter key



By pressing **meas** briefly you can step through further displays such as primary value or tag number (TAG).
After 60 sec they switch back to the main display.

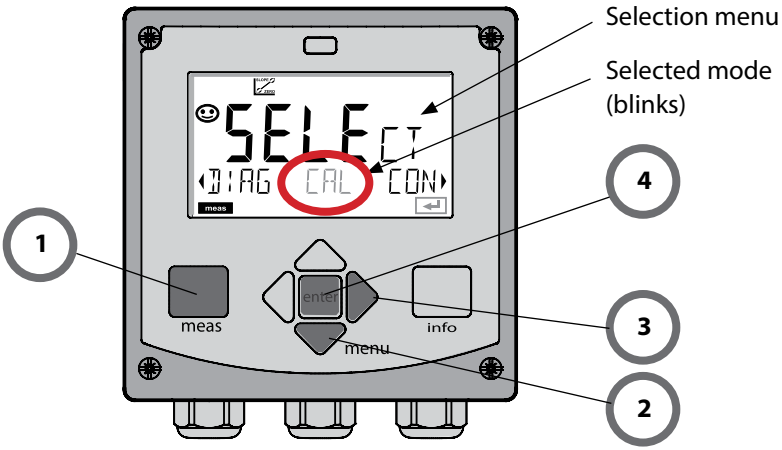
Press **enter** to select a display as MAIN DISPLAY (displayed permanently in measuring mode).

The secondary display shows "MAIN DISPLAY – NO".

Use the **UP** / **DOWN** arrows to select "MAIN DISPLAY – YES" and confirm by pressing **enter**.
This display is now shown in measuring mode.

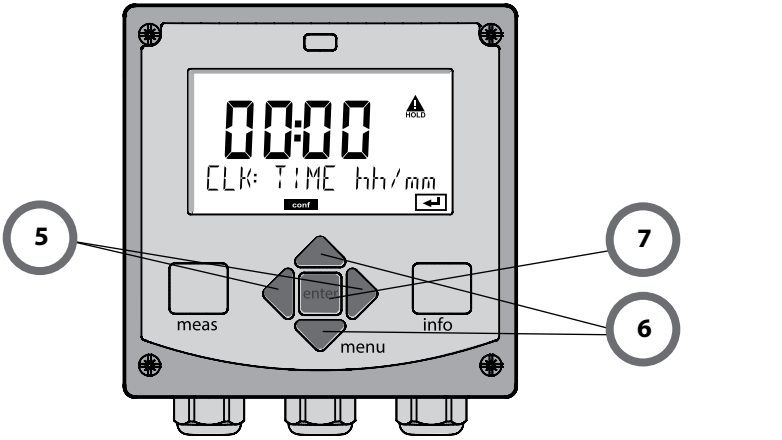
To select the operating mode:

1) Hold **meas** key depressed (> 2 s) (measuring mode)
2) Press **menu** 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
6) Change numeral: up / down arrow
7) Confirm entry by pressing **enter**



Operating Modes

Diagnostics
Display of calibration data, display of sensor data, sensor monitor, 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.

HOLD
Manual activation of HOLD mode, e.g., for replacing a sensor.
The signal outputs adopt a defined state. HOLD can also be activated via the external input (see next page).

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 device remains in the HOLD mode until it is stopped by the operator.

Configuration
You must configure the analyzer for the respective measurement task. In the "Configuration" mode you select the connected sensor, the measuring 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.

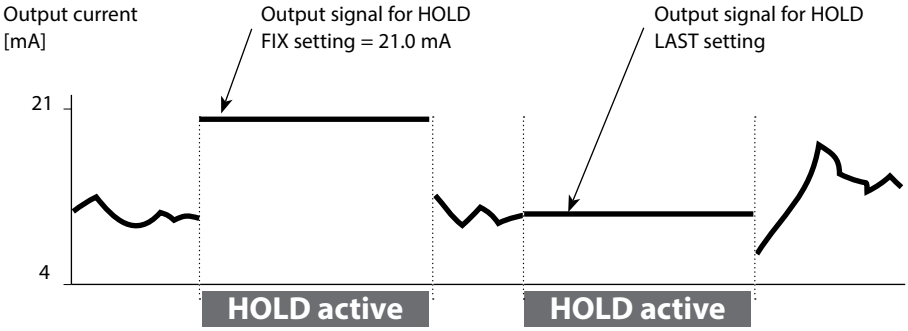
Service
Maintenance functions (current source, relay test), assigning passcodes, selecting the device type (pH/oxy/conductivity), resetting to factory settings.

The HOLD mode is a safety state during configuration and calibration.
Output current is frozen (LAST) or set to a fixed value (FIX).
Alarm and limit contacts are disabled.
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

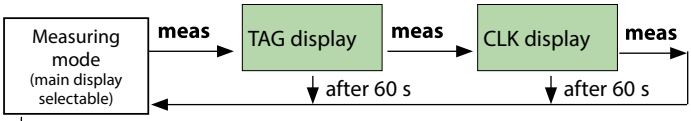
The HOLD mode is exited by switching to measuring mode (hold **meas** key depressed). The display reads "Good Bye". After that, the HOLD mode is exited. When the calibration mode is exited, a confirmation prompt ensures that the installation is ready for operation (e.g.: sensor reinstalled, located in 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

Operating Modes / Functions



Pressing the **menu** key (down arrow) opens the selection menu.
Select the menu group using the left/right arrow keys.
Pressing **enter** opens a menu item. Press **meas** to return.

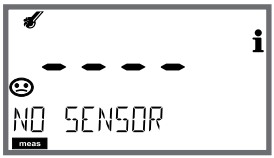
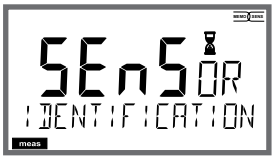
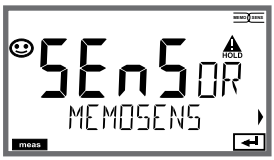
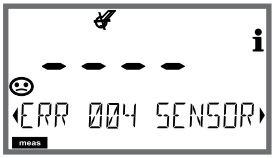
DIAG	CALDATA	Display of calibration data
	SENSOR	Display of sensor data
	SELFTEST	Self test: RAM, ROM, EEPROM, module
	LOGBOOK	100 events with date and time
	MONITOR	Display of direct sensor values
	VERSION	Display of software version, model designation, serial no.
HOLD		Manual activation of HOLD mode, e.g., for sensor replacement. The signal outputs behave as configured (e.g., last measured value, 21 mA)
CAL	pH	pH adjustment / ORP adjustment / product calibration
	Oxy	Adjustment (WTR/AIR) / zero adjustment / product cal.
	COND(I)	Adjustment with solution / factor input / product cal.
	CAL_RTD	Adjustment of temperature probe
CONF	CONF	Configuration See “Overview of Configuration” on next page.
SERVICE (Access via code, factory setting: 5555)	MONITOR	Display of measured values for validation (simulators)
	OUT1	Current source, output 1
	OUT2	Current source, output 2
	RELAIS	Relay test
	CODES	Specifying access codes for operating modes
	DEVICE TYPE	Selecting the device type
	DEFAULT	Reset to factory setting

Menu Structure of Configuration

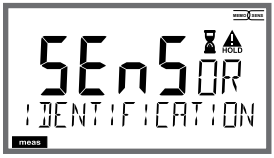
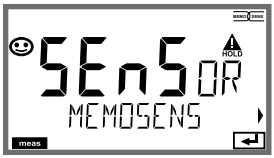
The configuration steps are assigned to different menu groups.
Using the left/right arrow keys, you can jump between the individual menu groups.
Each menu group contains menu items for setting the parameters.
Pressing **enter** opens a menu item. Use the arrow keys to edit a value.
Press **enter** to confirm/save the settings.
Return to measurement: Hold **meas** key depressed (> 2 s).

Select menu group	Menu group	Code	Display	Select menu item
	Sensor settings	SNS:		enter
		Menu item 1		enter
		⋮		
		Menu item ...		enter
	Current Output 1	OT1:		enter
	Current Output 2	OT2:		
	Compensation	COR:		
	Alarm mode	ALA:		
	Relay outputs (LIMIT / ALARM / WASH)	REL:		
	Setting the clock	CLK:		
	Tag number	TAG:		

Connecting a Memosens Sensor

Step	Action/Display	Remark
Connect sensor		When no Memosens sensor is connected, the error message "NO SENSOR" is displayed.
Wait until the sensor data are displayed.		The hourglass in the display blinks.
Check sensor data	 View sensor information using ◀ ▶ keys, confirm using **enter**.	Sensoface is friendly when the sensor data are okay.
Go to measuring mode	Press **meas**, **info** or **enter**	After 60 sec the device automatically returns to measuring mode (timeout).
Possible error message		
Sensor defective. Replace sensor		When this error message appears, the sensor cannot be used. Sensoface is sad.

Replacing a Sensor

Step	Action/Display	Remark
Select HOLD mode A sensor should only be replaced during HOLD mode to prevent unintended reactions of the outputs or contacts.	Press **menu** key to call the selection menu, select HOLD using the ◀ ▶ keys, press **enter** to confirm.	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.		
Check sensor data	 View sensor information using ◀ ▶ keys, confirm using **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 the selection menu. Hold **meas** key depressed: Device switches to measuring mode.	

Configuration

CAUTION! Incorrect parameter settings or adjustments can result in incorrect outputs. Stratos MS must therefore be commissioned by a system specialist, all its parameters must be set, and it must be fully adjusted. For detailed information on parameter setting and adjustment, see the user manual

Configuration: Overview

Configuration (default in bold print)			
Sensor			**pH**
SNS	TEMP UNIT		**°C** / °F
	CALMODE		**AUTO** / MAN / DAT
	AUTO	BUFFER SET	-01- MT **-02- KNC** ... -U1- USR ("info" shows nominal buffer values)
	CALTIMER		**OFF** / ON
	ON	CAL-CYCLE	0 ... 9999 h (**168 h**)
	CHECK TAG		**OFF** / ON
	CHECK GROUP		**OFF** / ON

Current output 1			pH
OT1	RANGE		**4 ... 20 mA** / 0 ... 20 mA
	CHANNEL		**PH** / ORP / TEMP
	PH	BEGIN (0)4 mA	**00.00 pH /** –2.00 ... 16.00 pH
		END 20 mA	**14.00 pH /** –2.00 ... 16.00 pH
	rH	BEGIN (0)4 mA	**000.0 rH** / 000.0 ... 200.0 rH
		END 20 mA	**200.0 rH** / 000.0 ... 200.0 rH
	ORP (Memosens ORP sensor)	BEGIN (0)4 mA	**–1000 mV /** –1999 ... 1999 mV
		END 20 mA	**1000 mV /** –1999 ... 1999 mV
	TMP °C	BEGIN (0)4 mA	**000.0 °C /** –20 ... 300 °C
		END 20 mA	**100.0 °C /** –20 ... 300 °C
	TMP °F	BEGIN (0)4 mA	**032.0 °F /** –4 ... 572 °F
		END 20 mA	**212.0 °F /** –4 ... 572 °F
	FILTERTIME		0000 SEC / 0 ... 120 SEC
	FAIL 22 mA		**OFF** / ON
	FACE 22mA		**OFF** / ON
	HOLD MODE		LAST / FIX
	FIX	HOLD_FIX	**021.0 mA** / 0 ... 22 mA
Current output 2			**Default setting CHANNEL: TMP (other settings like OT1)**

Correction			pH
COR	TC SELECT		**OFF** / LIN / PURE WTR
	LIN	TC LIQUID	**00.00 %/K /** –19.99 ... 19.99 %/K

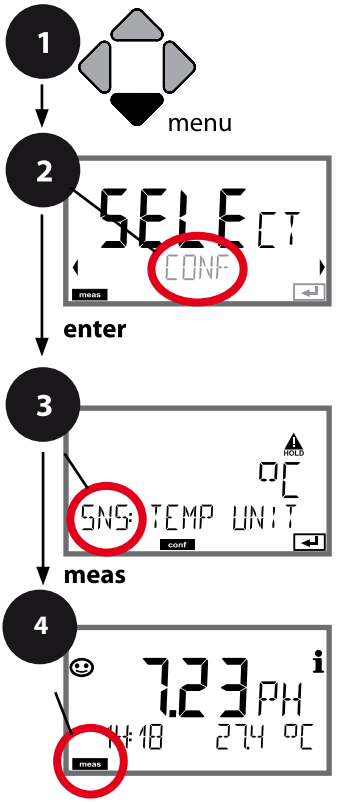
Configuration (default in bold print)		
Alarm		**pH**
ALA	DELAYTIME	0 ... 600 s (**0010 SEC**)
	SENSOCHECK	ON / **OFF**
Relay 1		
RL1	**LIMIT** ALARM WASH	The following submenu depends on the selected setting.
LM1	CHANNEL	**PH** / ORP / TMP
	FUNCTION	**Lo LEVL** / Hi LEVL
	CONTACT	**N/O** / N/C
	LEVEL	**00.00 pH** –2.00 ... 16.00 pH (–1999 ... 1999 mV) (–20 ... 200 °C)
	HYSTERESIS	**00.50 pH** 0.00 ... 10.00 pH / 0 ... 2000 mV / 0 ... 100 °C (0 ... 180 °F)
	DELAYTIME	**0010 SEC** 0000 ... 9999 s
AL1	TRIGGER	FAIL / FACE
	CONTACT	**N/O** / N/C
WS1	CYCLE TIME	**000.0 h** 0.0 ... 999.9 h
	DURATION	**0060 SEC** 0 ... 1999 s
	RELAX TIME	**0030 SEC** / 0000 ... 1999 s
	CONTACT	**N/O** / N/C
Relay 2 Default LIMIT / FUNCTION: Hi LEVL (other settings like Relay 1)		

Time/date			
CLK	FORMAT	**24 h** / 12 h	
	24 h	hh:mm	
	12 h	hh:mm (AM / PM)	00 ... 12:59 AM / 1 ... 11:59 PM
	DAY / MONTH	dd.mm	
	YEAR	2000 ... 2099	
Measuring points (TAG / GROUP)			
TAG	The entries are made in the text line.		A...Z, 0...9, – + < > ? / @
GROUP	The entries are made in the text line.		0000...9999 (**0000**)

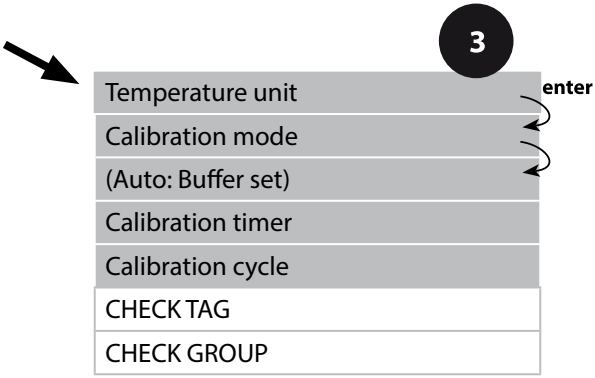
Configuring the Sensor

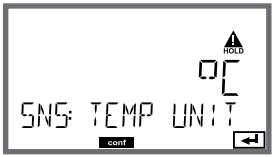
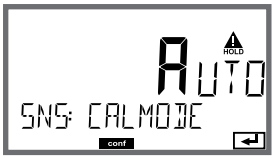
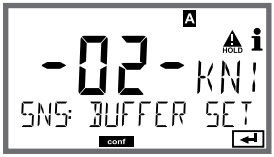
Device Type: pH

The device type is automatically selected upon first start-up. In the SERVICE menu you can change the device type. Afterwards, you must select the corresponding calibration mode in the CONF menu.



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



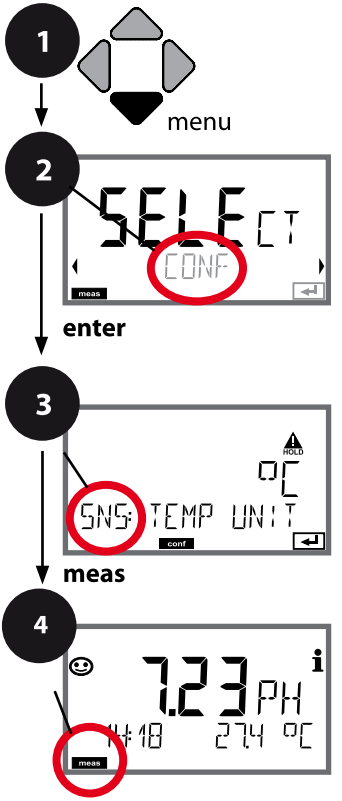
Menu item	Action	Choices
Temperature unit 	Select °C or °F using ▲ ▼ keys. Press **enter** to confirm.	**°C** / °F
Calibration mode 	Select CALMODE using ▲ ▼ keys: AUTO: Calibration with Calimatic buffer set recognition MAN: Manual input of buffer solutions DAT: Input of adjustment data of premeasured sensors Press **enter** to confirm.	**AUTO** MAN DAT
(AUTO: Buffer set) 	Select buffer set using ▲ ▼ keys (see buffer tables for nominal values) Press **enter** to confirm.	-01-...-13-, -U1- USR (see Appendix) Pressing the **info** key displays the manufacturer and nominal values in the lower line.
Calibration timer 	Adjust CALTIMER using ▲ ▼: OFF: No timer ON: Fixed cal cycle (adjust in the next step) Press **enter** to confirm.	**OFF** / ON (ON: 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:

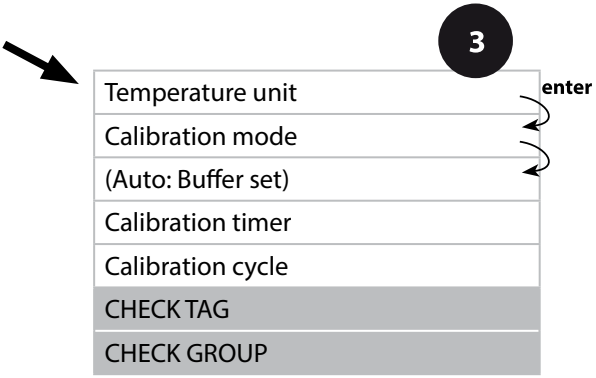
+	Over 80 % of the calibration interval has already passed.
+	The calibration interval has been exceeded.

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

Sensor Verification (TAG, GROUP)



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



Menu item	Action	Choices
TAG 	Select ON or OFF using ▲ ▼ keys. Press **enter** to confirm. When switched on, the entry for "TAG" in the Memosens sensor is compared to the entry in the analyzer. If the entries differ, a message will be generated.	ON/**OFF**
GROUP 	Select ON or OFF using ▲ ▼ keys. Press **enter** to confirm. Function as described above	ON/**OFF**

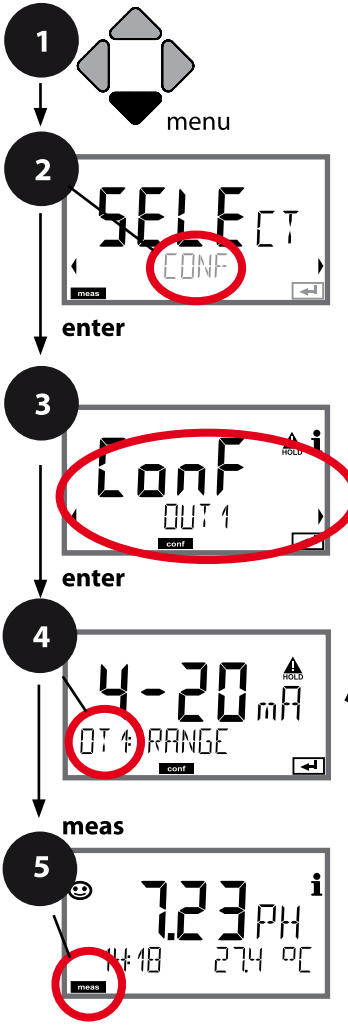
Sensor Verification (TAG, GROUP)

When Memosens sensors are calibrated in the lab, it is often useful and sometimes even mandatory that these sensors will be operated again at the same measuring points or at a defined group of measuring points. To ensure this, you can save the respective measuring point (TAG) or group of measuring points (GROUP) in the sensor. TAG and GROUP can be specified by the calibration tool or automatically entered by the transmitter. When connecting an MS sensor to the transmitter, it can be checked if the sensor contains the correct TAG or belongs to the correct GROUP. If not, a message will be generated and Sensoface gets "sad". The "sad" Sensoface icon can also be signaled by a 22 mA error current. Sensor verification can be switched on in the Configuration in two steps as TAG and GROUP if required.
When no measuring point or group of measuring points is saved in the sensor, e.g., when using a new sensor, Stratos enters its own TAG and GROUP. When sensor verification is switched off, Stratos always enters its own measuring point and group. A possibly existing TAG/GROUP will be overwritten.

Configuring the Current Output

Output Current: Range, Current Start/End

(Example: current output 1)

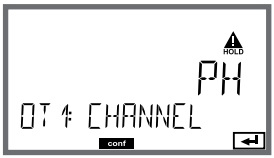


1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **OUT1** menu using ◂ ▸ keys,
press **enter**.
4 All items of this menu group are indicated by the "OT1:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.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

4

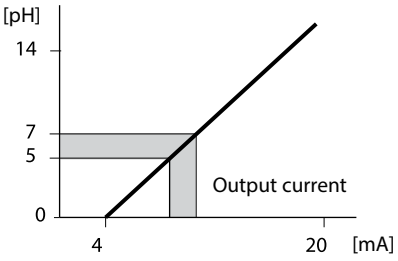
Current range
Process variable
Current start
Current end
Time averaging filter
Output current during error message
Output current for Sensoface message
Output current during HOLD
Output current for HOLD FIX

enter

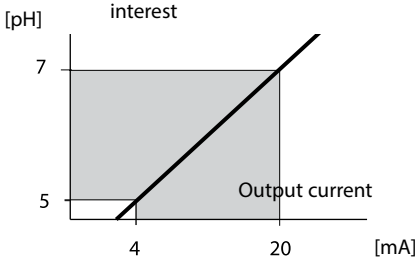
Menu item	Action	Choices
Current range 	Select 4-20 mA or 0-20 mA range using ▲ ▼ keys. Press **enter** to confirm.	**4-20 mA** / 0-20 mA
Process variable 	**Example: current output 1, device type pH** Select using ▲ ▼ keys: PH: pH value ORP: ORP value TMP: Temperature Press **enter** to confirm.	**PH**/ORP/TMP
Current start 	Modify digit using ▲ ▼ keys, select next digit using ◀ ▶ keys. Press **enter** to confirm.	–2.00 ... 16.00 pH (PH) –1999 ... 1999 mV (ORP) –20 ... 300 °C / –4 ... 572 °F (TMP)
Current end 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	–2.00 ... 16.00 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

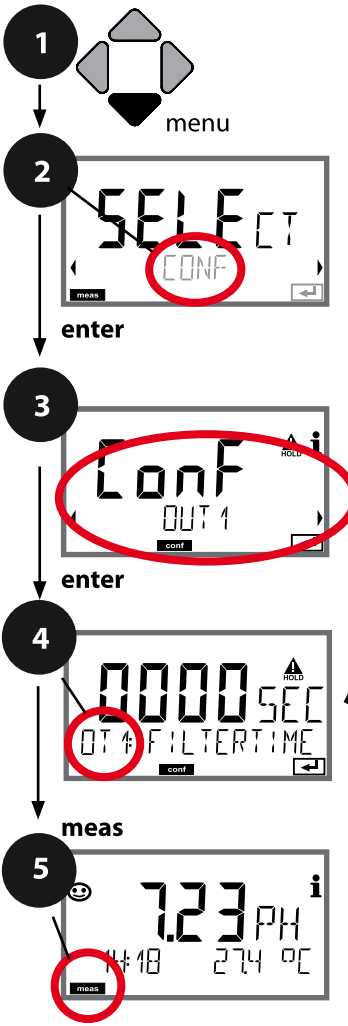


Example 2: Range pH 5...7
Advantage: Higher resolution in range of interest



Output Current: Time Averaging Filter

(Example: current output 1)

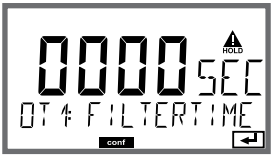


1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **OUT1** menu using ◂ ▸ keys,
press **enter**.
4 All items of this menu group are indicated by the "OT1:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.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

4

Current range
Process variable
Current start
Current end
Time averaging filter
Output current during error message
Output current for Sensoface message
Output current during HOLD
Output current for HOLD FIX

enter

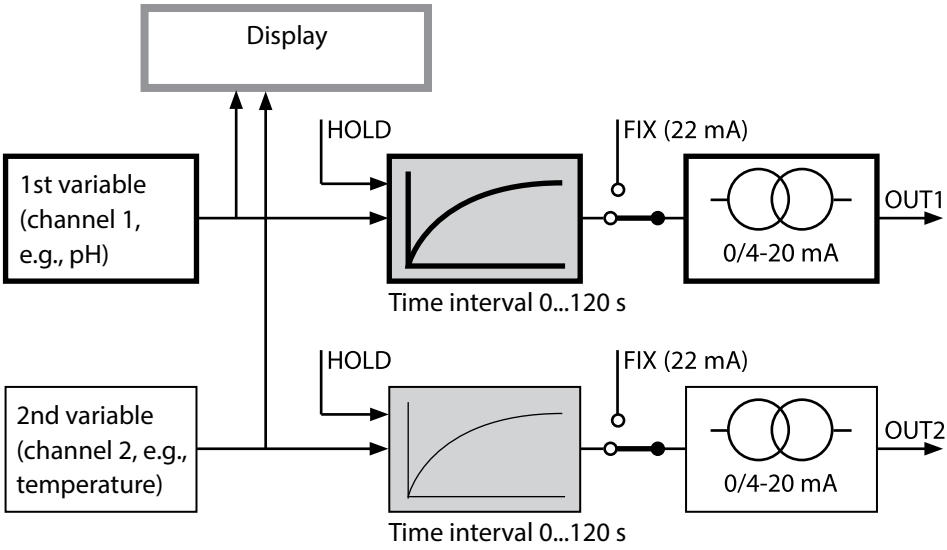
Menu item	Action	Choices
Time averaging filter 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...120 SEC **(0000 SEC)**

Time averaging 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 interval has been reached. The time interval can be set from 0 to 120 sec. If the time interval is set to 0 sec, the current output directly follows the input.

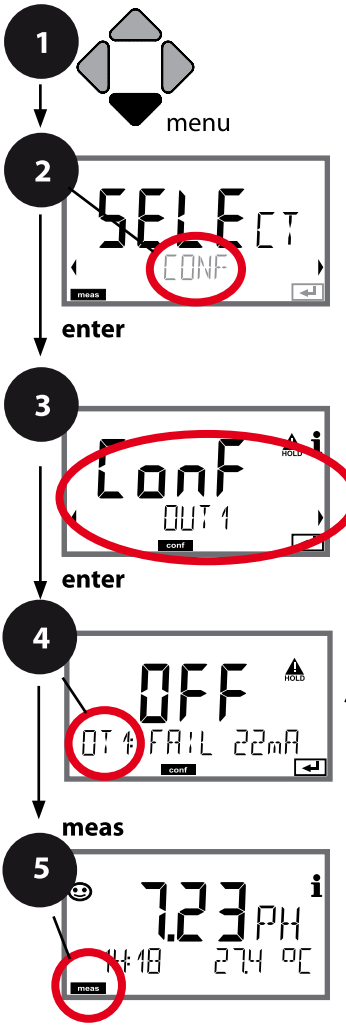
Note:

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



Output Current: Error and HOLD

(Example: current output 1)

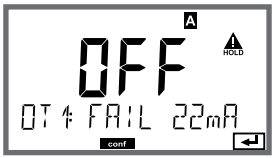


1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **OUT1** menu using ◂ ▸ keys,
press **enter**.
4 All items of this menu group are indicated by the "OT1:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.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

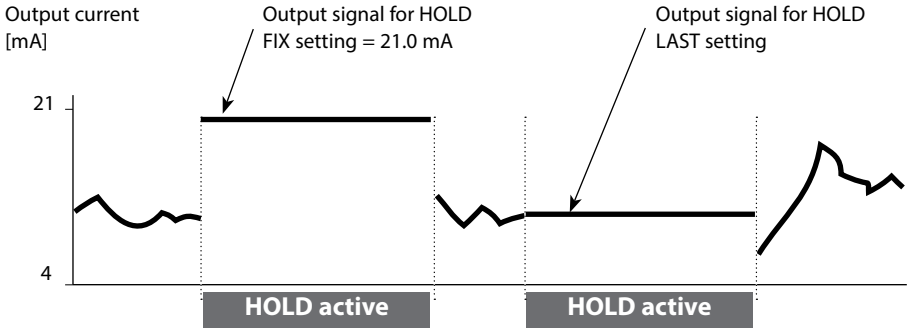
4

Current range
Process variable
Current start
Current end
Time averaging filter
Output current during error message
Output current for Sensoface message
Output current during HOLD
Output current for HOLD FIX

enter

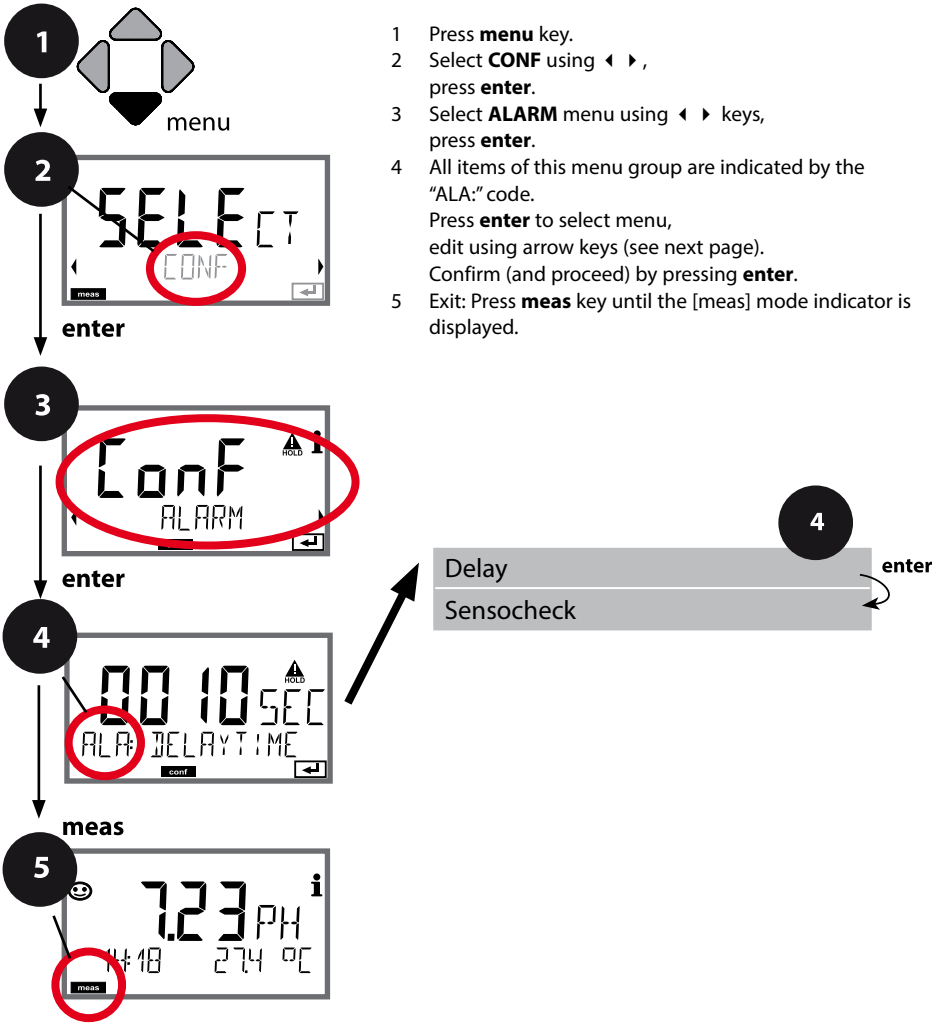
Menu item	Action	Choices
Output current during error message 	The output current can be set to 22 mA in the case of error messages or error messages. Select ON or OFF using ▲ ▼ keys. Confirm by pressing **enter**	**OFF** / ON
Output current during Sensoface messages **OT1: FACE 22 mA**	The output current can be set to 22 mA in the case of Sensoface messages. Select ON or OFF using ▲ ▼ keys. Confirm by pressing **enter**	**OFF** / ON
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 ▲ ▼ Press **enter** to confirm.	**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. Press **enter** to confirm.	00.00...22.00 mA (**21.00 mA**)

Output signal during HOLD:

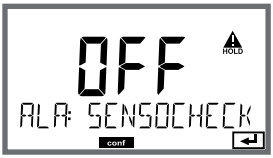


Configuring the Alarm

Alarm Delay, Sensocheck



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

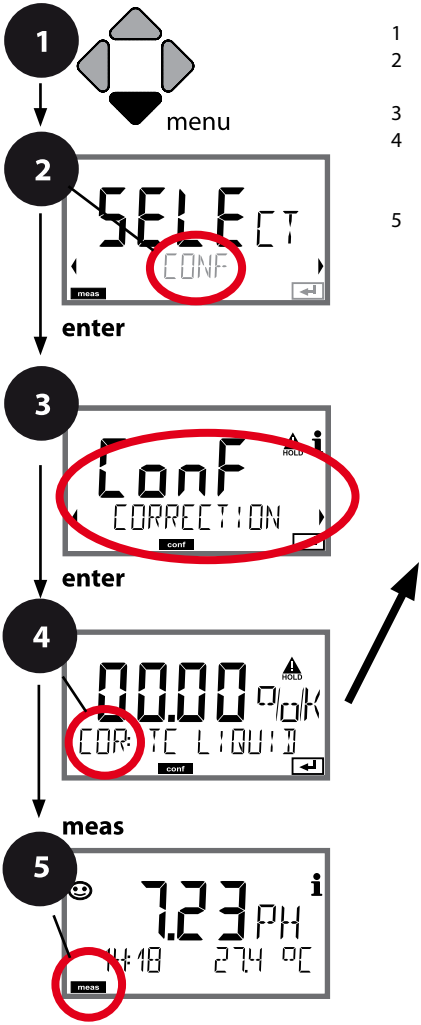
Menu item	Action	Choices
Alarm delay 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...600 SEC **(0010 SEC)**
Sensocheck 	Select Sensocheck (continuous monitoring of glass and reference electrode). Select ON or OFF using ▲ ▼ keys. Press **enter** to confirm. (At the same time, Sensoface is activated. With OFF, Sensoface is also switched off.)	ON / **OFF**

The alarm delay time delays the color change of the display backlighting to red, the 22 mA signal (if configured), and the alarm contact switching.

Error messages can be signaled by a 22 mA output current. In addition, a relay contact (RELAY1 / RELAY2) can be configured as alarm contact.

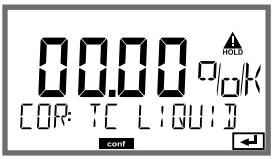
Temperature Compensation

Temperature Compensation of Process Medium (pH)



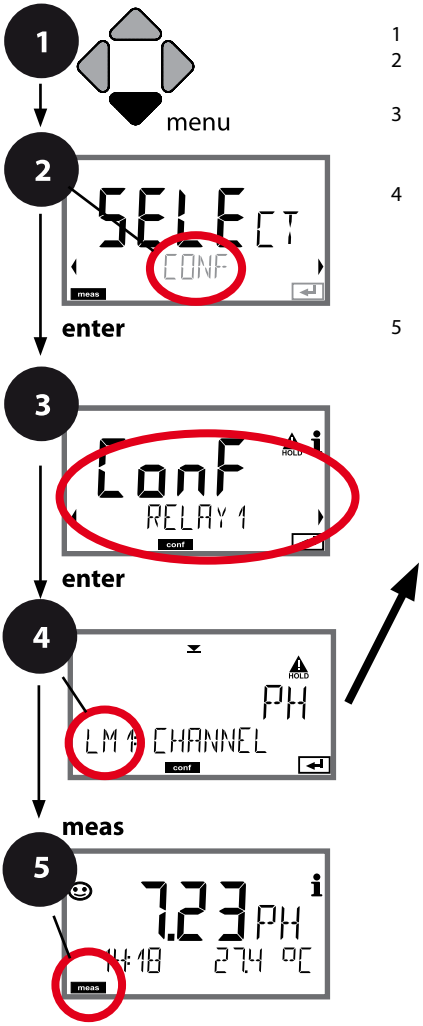
1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **CORRECTION** menu using ◂ ▸ keys, press **enter**.
4 All items of this menu group are indicated by the "**COR**:" code.
Confirm (and proceed) by pressing **enter**.
5 Exit: Press **meas** key until the [meas] mode indicator is displayed.

4
Temp compensation of process medium (linear)

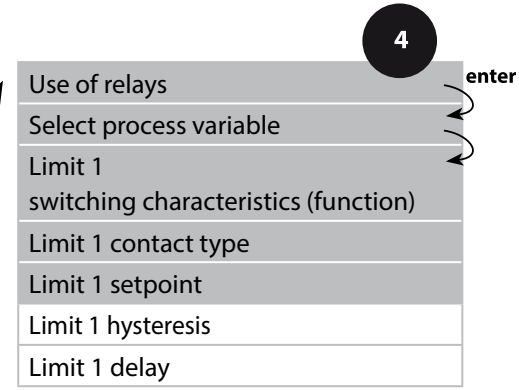
Menu item	Action	Choices
Temperature compensation of process medium 	For pH measurement only: Select temperature compensation of the process medium. Linear: LIN Select using ◂ ▸, press **enter** to confirm.	**OFF** / LIN
Temperature compensation, linear 	Enter the linear temperature compensation of the process medium. Enter value using ▲ ▼ ◂ ▸ keys Press **enter** to confirm.	-19.99...+19.99 %/K

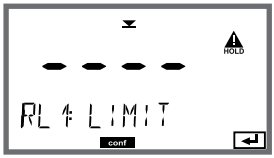
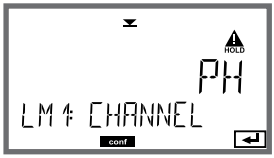
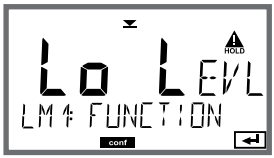
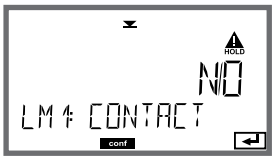
Configuring the Relay Contacts

Relay Contacts: Function Assignment, Limit Values



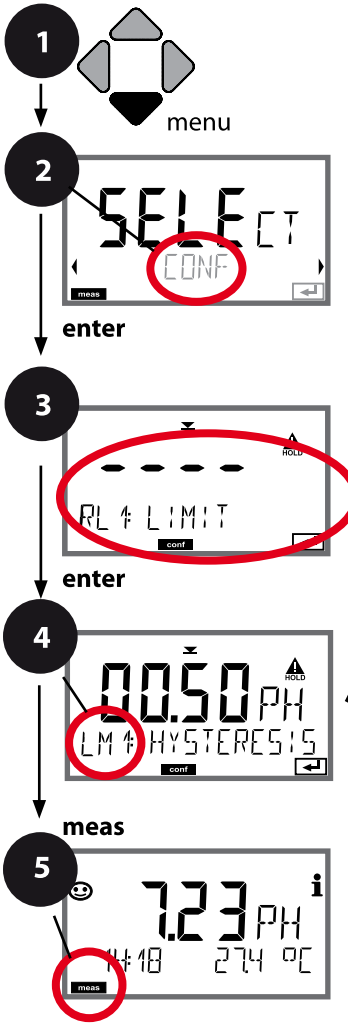
1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **RELAY1** menu using ◂ ▸ keys,
press **enter**.
Specify relay contact function: **LIMIT**.
4 All items of this menu group are indicated by the "**LM1**:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.
5 Exit: Press **meas** key until the [meas] mode indicator is displayed.



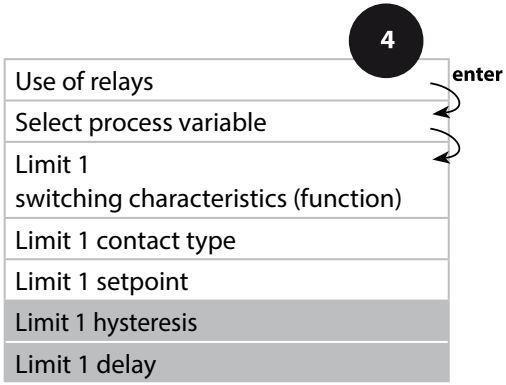
Menu item	Action	Choices
Use of relays 	Select in the text line using ▲ ▼ keys: • Limit function (LIMITS) • Error message (ALARM) • Rinse contact (WASH) Press **enter** to confirm.	**LIMIT /** ALARM / WASH **Note:** The following submenu depends on the selected setting.
Select process variable 	Select desired process variable using ▲ ▼ keys. Press **enter** to confirm.	**PH**/ORP/TMP
Limit 1 function 	Select desired function using arrow keys. LoLevel: active if value falls below setpoint LoLevel: active if value exceeds setpoint Press **enter** to confirm.	**Lo LEVL** / Hi LEVL Limit 1 icon: ▼
Limit 1 contact response 	N/O: normally open contact N/C: normally closed contact Select using ▲ ▼ keys. Press **enter** to confirm.	**N/O** / N/C
Limit 1 setpoint 	Enter setpoint using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	-2.00 ... 16.00 pH (00.00 pH) –1999 ... 1999 mV / –20 ... 200 °C

Relay Contacts: Limit Function, Hysteresis

(Example: relay 1)



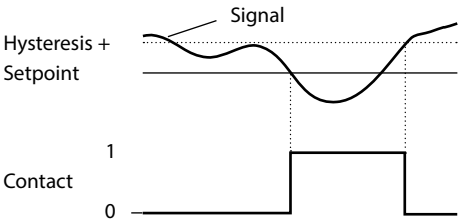
1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **RELAY1** menu using ◂ ▸ keys,
press **enter**.
Specify relay contact function: **LIMIT**.
4 All items of this menu group are indicated by the "**LM1**:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.
5 Exit: Press **meas** key until the [meas] mode indicator is displayed.



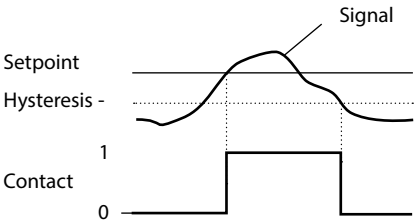
Menu item	Action	Choices
Limit 1 hysteresis 	Select hysteresis using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0 ... 10.00 pH **(00.50 pH)**
Limit 1 delay 	The contact is activated with delay (deactivated without delay) Adjust delay using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0 ... 9999 SEC (**0010 SEC**)

Application of hysteresis:

Limit Lo

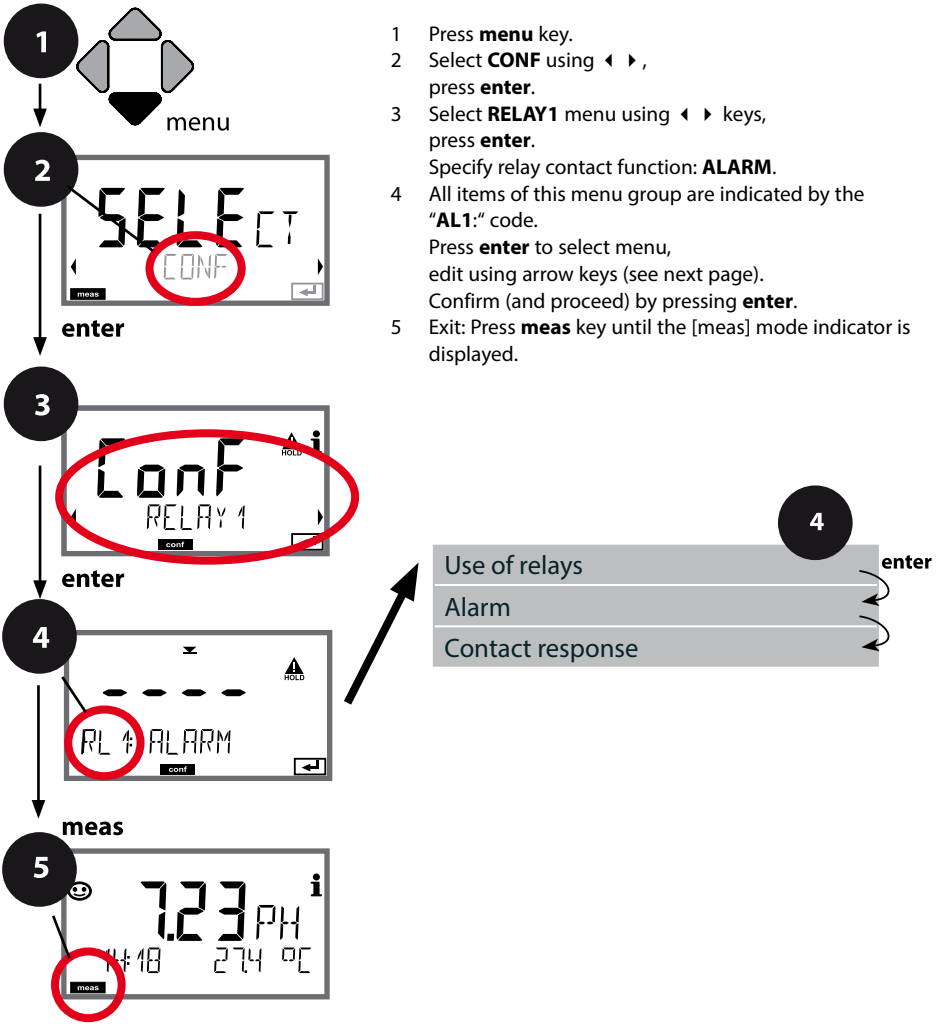


Limit Hi

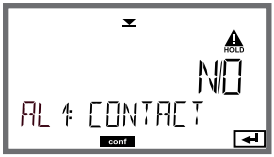


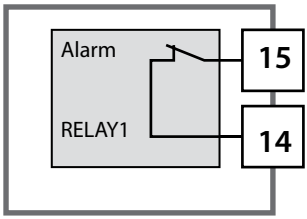
Relay Contacts: Alarm

(Example: relay 1)



1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **RELAY1** menu using ◂ ▸ keys,
press **enter**.
Specify relay contact function: **ALARM**.
4 All items of this menu group are indicated by the "**AL1**:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.
5 Exit: Press **meas** key until the [meas] mode indicator is displayed.

Menu item	Action	Choices
Alarm 	Select error messages (FAIL) or Sensoface messages (FACE) as trigger signal using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	**FAIL** / FACE
Contact response 	N/O: normally open contact N/C: normally closed contact Select using ▲ ▼ keys. Press **enter** to confirm.	**N/O** / N/C

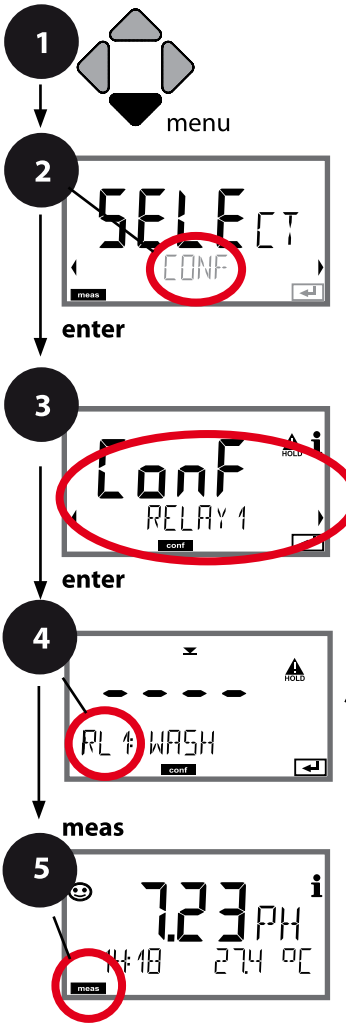


Alarm contact

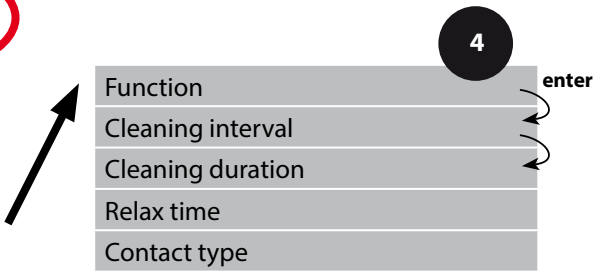
A relay contact (RELAY1 / RELAY2) can be configured as alarm contact.

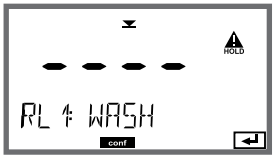
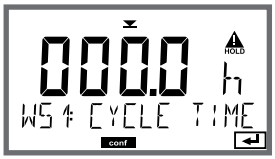
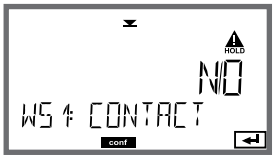
Relay Contacts: Controlling a Rinsing Probe

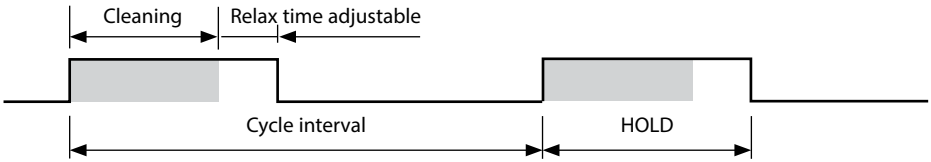
(Example: relay 1)



1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **RELAY1** menu using ◂ ▸ keys,
press **enter**.
Specify relay contact function: **WASH**.
4 All items of this menu group are indicated by the "**WS1**:" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.
5 Exit: Press **meas** key until the [meas] mode indicator is displayed.

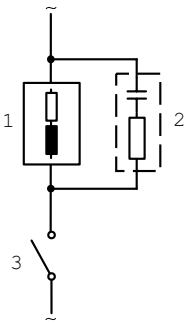


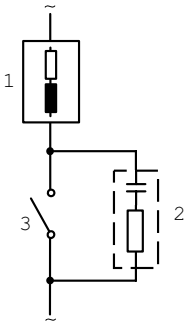
Menu item	Action	Choices
Use of relays 	Select in the text line using ▲ ▼ keys: • Limit function (LIMITS) • Error message (ALARM) • Rinse contact (WASH) Press **enter** to confirm.	LIMIT / ALARM / **WASH** **Note:** The following submenu depends on the selected setting.
Cleaning interval 	Adjust value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0.0...999.9 h (**000.0 h**)
Cleaning duration 	Adjust value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm. **Without figure:** Relax time	0...9999 SEC (**0060 SEC**) Relax time: 0000...1999 SEC **(0030 SEC)**
Contact type 	N/O: normally open contact N/C: normally closed contact Select using ▲ ▼ keys. Press **enter** to confirm.	**N/O** / N/C



Protective Wiring of Relay Contacts

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

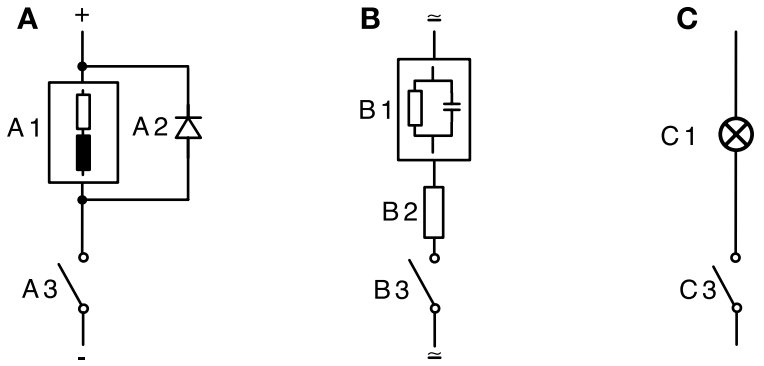




Typical AC applications with inductive load

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

Typical Protective Wiring Measures



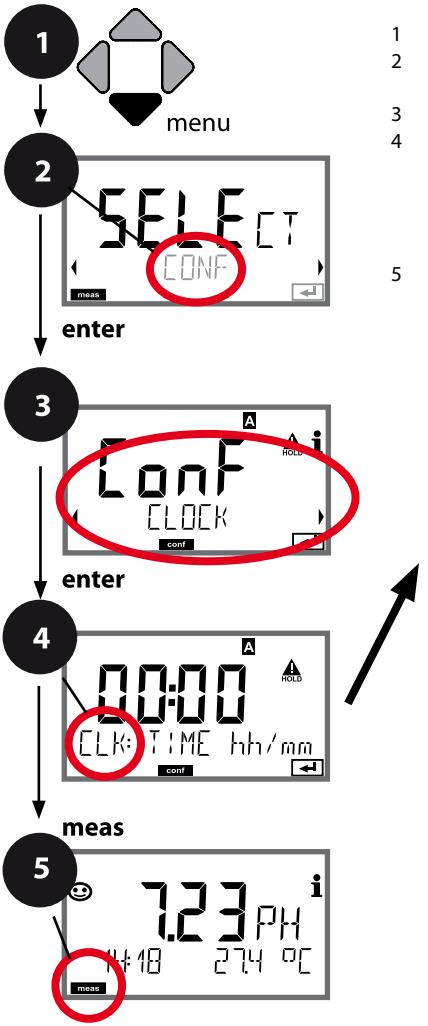
A: DC application with inductive load
B: AC/DC applications with capacitive load
C: Connection of incandescent lamps

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

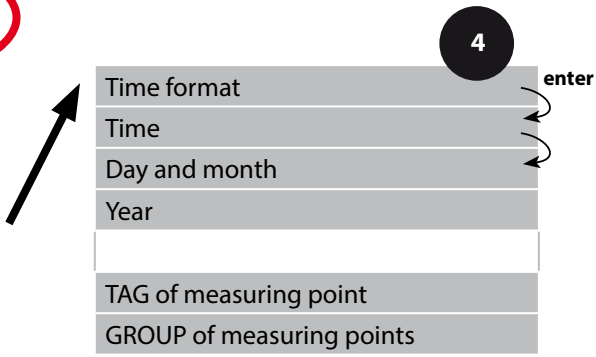
NOTICE! Make sure that the maximum ratings of the relay contacts are not exceeded even during switching, see page 89.

Configuring the Time/Date

Time and Date, Measuring Point



1 Press **menu** key.
2 Select **CONF** using ◂ ▸,
press **enter**.
3 Select **CLOCK** or **TAG** using ◂ ▸ keys, press **enter**.
4 All items of this menu group are indicated by the "CLK:" or "TAG" code.
Press **enter** to select menu,
edit using arrow keys (see next page).
Confirm (and proceed) by pressing **enter**.
5 Exit: 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.

Note:

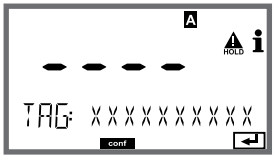
There is no automatic switchover from winter to summer time!

Be sure to manually adjust the time!

Sensor Verification (TAG, GROUP)

When Memosens sensors are calibrated in the lab, it is often useful and sometimes even mandatory that these sensors will be operated again at the same measuring points or at a defined group of measuring points. To ensure this, you can save the respective measuring point (TAG) or group of measuring points (GROUP) in the sensor. TAG and GROUP can be specified by the calibration tool or automatically entered by the transmitter. When connecting an MS sensor to the transmitter, it can be checked if the sensor contains the correct TAG or belongs to the correct GROUP. If not, a message will be generated and Sensoface gets "sad". The "sad" Sensoface icon can also be signaled by a 22 mA error current. Sensor verification can be switched on in the Configuration in two steps as TAG and GROUP if required.

When no measuring point or group of measuring points is saved in the sensor, e.g., when using a new sensor, Stratos enters its own TAG and GROUP. When sensor verification is switched off, Stratos always enters its own measuring point and group. A possibly existing TAG/GROUP will be overwritten.

Menu item	Action	Choices
TAG of measuring point 	In the lower display line you can enter a designation for the measuring point (TAG) and for a group of measuring points (GROUP) if applicable. Up to 32 digits are possible. By pressing **meas** (repeatedly) in the measuring mode you can view the tag number. Select character using ▲ ▼ keys, select next digit using ◀ ▶ keys. Press **enter** to confirm.	A...Z, 0...9, – + < > ? / @ The first 10 characters are seen in the display without scrolling.
GROUP of measuring points	Select number using ▲ ▼ keys, select next digit using ◀ ▶ keys. Confirm by pressing **enter**	0000 ... 9999 **(0000)**

Calibration

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.

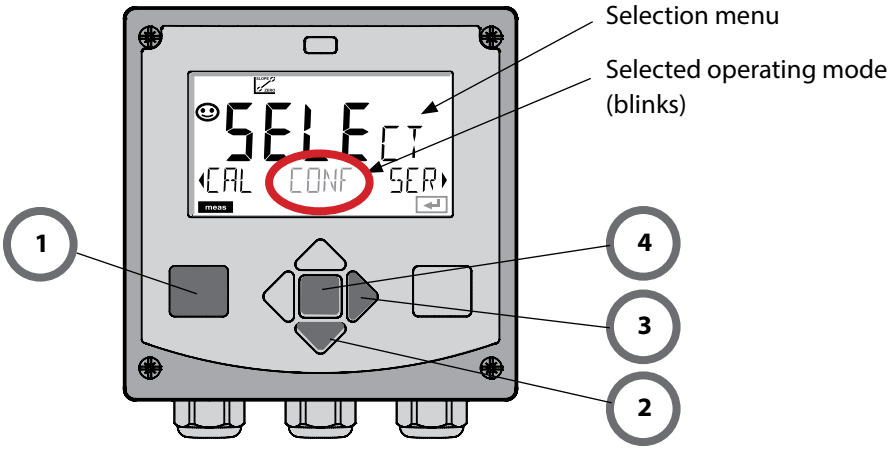
- The device can only operate properly when the buffer solutions used correspond to the configured set. Other buffer solutions, even those with the same nominal values, may demonstrate a different temperature response.
  This leads to measurement errors.

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)	
CAL_RTD	Temperature probe adjustment	

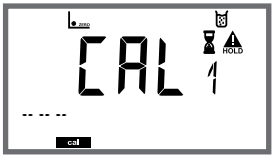
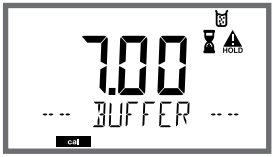
To preset CAL_PH (CONF menu / configuration):

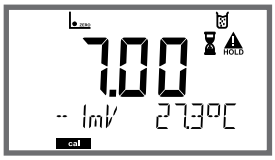
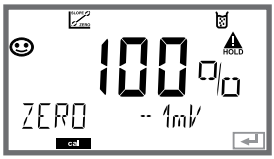
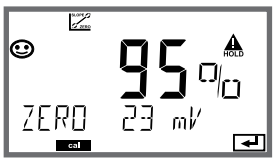
1) Hold **meas** key depressed (> 2 s) (measuring mode)
2) Press **menu** key: the selection menu appears
3) Select CONF mode using left / right arrow key
4) Select "SENSOR" – "CALMODE": AUTO, MAN, or DAT.
   Press **enter** to confirm.



Automatic Calibration

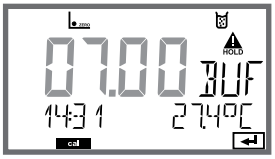
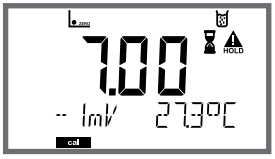
The AUTO calibration mode must have been preset during **configuration**.
Make sure that the buffer solutions used correspond to the configured buffer set.
Other buffer solutions, even those with the same nominal values, may demonstrate a different temperature response. This leads to measurement errors.

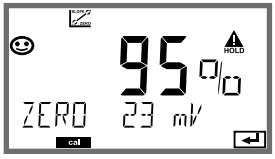
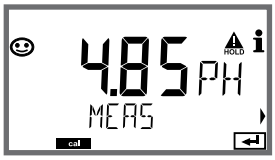
Display	Action	Remark
	Select Calibration. Press **enter** to proceed.	
	Ready for calibration. Hourglass blinks. Select calibration method: CAL_PH Press **enter** to proceed.	Display (3 sec) Now the device is in HOLD mode.
	Remove the sensor, clean it, and immerse it in the first buffer solution (it does not matter which solution is taken first). Press **enter** to start.	
 	Buffer recognition. While the "hourglass" icon is blinking, the sensor remains in the first buffer solution. Buffer recognition terminated, the nominal buffer value is displayed, then zero point and temperature.	To reduce the sensor response time, first move it about in the buffer solution and then hold it still.

Display	Action	Remark
 	Stability check. The measured value [mV] is displayed, "CAL2" and "enter" are blinking. Calibration with the first buffer is terminated. Remove the sensor from the first buffer solution and rinse it thoroughly. **Use the arrow keys to select:** • END (1-point cal) • CAL2 (2-point cal) • REPEAT Press **enter** to proceed.	**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. Exit by pressing **enter**
	2-point calibration: Immerse sensor in second buffer solution. Press **enter** to start.	The calibration process runs as for the first buffer.
	Retract sensor out of second buffer, rinse off, re-install. Press **enter** to proceed.	The slope and asymmetry potential of the sensor (based on 25 °C) are displayed.
	**Use the arrow keys to select:** • MEAS (exit) • REPEAT Press **enter** to proceed. Exit: HOLD is deactivated with delay.	When 2-point cal is exited: 

Manual Calibration

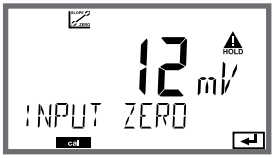
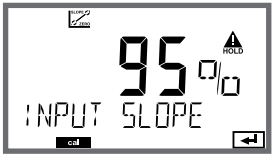
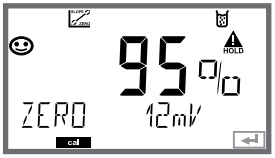
The MAN calibration mode and the type of temperature detection are selected during **configuration**. For calibration with manual buffer specification, you must enter the pH value of the buffer solution used in the device for the proper temperature. Any desired buffer solution can be used for calibration.

Display	Action	Remark
	Select Calibration. Press **enter** to proceed.	
	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. Press **enter** to start.	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
	At the end of the stability check, the value will be saved and the asymmetry potential will be displayed. 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 Press **enter** to proceed.	**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. Exit by pressing **enter**
	2-point calibration: Immerse sensor and temperature probe in the second buffer solution. Enter pH value. Press **enter** to start.	The calibration process runs as for the first buffer.
	Rinse sensor and temperature probe and reinstall them. Press **enter** to proceed.	Display of slope and asymmetry potential of the sensor (based on 25 °C).
	**Use the arrow keys to select:** • MEAS (exit) • REPEAT Press **enter** to proceed. Exit: HOLD is deactivated with delay.	When 2-point cal is exited: 

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

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

%	mV
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

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

ZERO = Sensor zero

V_{AS} = Asymmetry potential

S = Slope

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 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

Calculating the rH (reference system: Ag/AgCl/KCl 3 mol/l)

$$rH = 2\,(((ORP + E_{REF})/E_N) + pH)$$

ORP	oxidation-reduction potential measured between the platinum electrode and the reference electrode
E_{REF}	temperature-dependent potential of the reference electrode measured relative to SHE (standard hydrogen electrode)
E_N	Nernst potential (temperature dependent)
pH	currently measured pH value

Display	Action	Remark
	Select ORP calibration. Press **enter** to proceed.	
	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. Press **enter** to proceed.	
	The ORP delta value is displayed (based on 25 °C). Sensoface is active. Press **enter** to proceed.	
	To repeat calibration: Select REPEAT. To exit calibration: Select MEAS, then **enter**	After end of calibration, the outputs remain in HOLD mode for a short time.

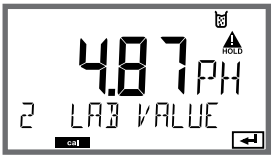
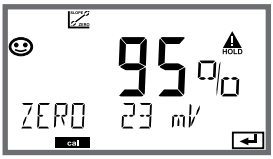
Product Calibration

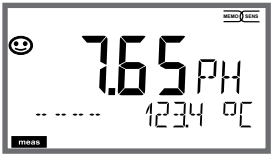
Calibration by Sampling (One-Point Calibration).
During product calibration the sensor remains in the process.
The measurement process is only interrupted briefly.
Procedure:

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 must 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 Press **enter** to proceed.	If you have protected the calibration with a passcode (in the Service menu), the device will return to measuring mode when an invalid code is entered.
	Ready for calibration. Hourglass blinks. Press **enter** to proceed.	Display (3 sec)
	Take sample and save value. Press **enter** to proceed.	Now the sample can be measured in the lab.

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: When the sample value has been determined, open the product calibration once more (P_CAL).	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. Press **enter** to proceed.	
	Display of new asymmetry potential (based on 25 °C). Sensoface is active. To exit calibration: Select MEAS, then **enter**	To repeat calibration: Select REPEAT, then **enter**
End of calibration	After end of calibration, the outputs remain in HOLD mode for a short time.	

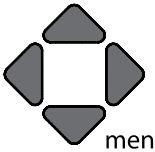
Display	Remark
 or AM/PM and °F:  	From the configuration or calibration menus, you can switch the device to measuring mode by pressing the **meas** key. In the measuring mode the upper display line shows the configured process variable (pH, ORP [mV] or temperature), the lower display line shows the time and the second configured process variable (pH, ORP [mV] or temperature). The [meas] mode indicator lights. **Note:** • After prolonged power outage (> 5 days), the time display is replaced by dashes and cannot be used for processing. In that case, enter the correct time.
By pressing the **meas** key you can step through the different displays. When no key has been pressed for 60 sec, the device returns to the standard display, see "Display in Measuring Mode" on page 20.	
	Further displays (each by pressing **meas**). 1) Display of tag number ("TAG") 2) Display of time and date (without figure)

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

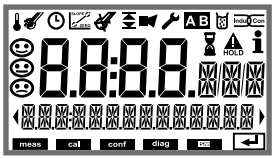
CALDATA	Viewing the calibration data
SENSOR	Viewing the sensor data
SELFTEST	Starting a device self-test
LOGBOOK	Viewing the logbook entries
MONITOR	Displaying currently measured values
VERSION	Displaying device type, software version, serial number

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

Note:
HOLD is not active during Diagnostics mode!

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

Display	Menu item
	**Displaying the calibration data** Select CALDATA using ◂ ▸, confirm by pressing **enter**. Use the ◂ ▸ keys to select from the bottom line of the display (LAST_CAL ZERO SLOPE NEXT_CAL). The selected parameter is shown in the upper display line.
	
	
	
	Press **meas** to return to measurement.
	**Displaying the sensor data** Manufacturer, type, serial number and last calibration date. In each case Sensoface is active. Display data using ◂ ▸ keys, return by pressing **enter** or **meas**.

Display	Menu item
	**Device self-test** (To abort, you can press **meas**.) 1 **Display test**: Display of all segments with changing background colors (white/green/red). Proceed by pressing **enter**
	2 **RAM test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Proceed by pressing **enter**
	3 **EEPROM test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Proceed by pressing **enter**
	4 **FLASH test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Proceed by pressing **enter**

Display	Menu item
	**Displaying the logbook entries** Select LOGBOOK using ◂ ▸, press **enter** to confirm. 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.

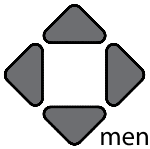
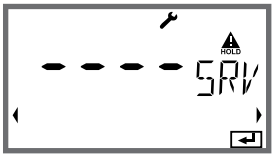
Display	Menu item
	**Displaying the currently measured values (sensor monitor)** Select MONITOR using ◂ ▸, press **enter** to confirm. Use the ◂ ▸ keys to select the desired parameter from the bottom line of the display. The selected parameter is shown in the upper display line. Press **meas** to return to measurement.
Display examples: 	Display of 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 sensor operating time
	**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.

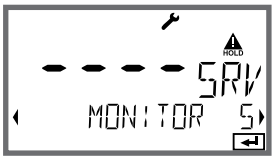
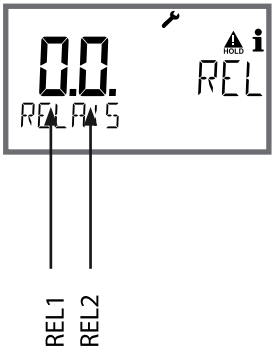
Service

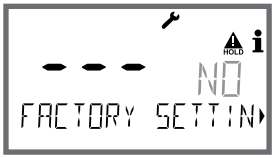
In the Service mode you can access the following menus:

MONITOR	Displaying currently measured values
OUT1	Testing current output 1
OUT2	Testing current output 2
RELAIS	Testing the relay function
CODES	Assigning and editing passcodes
DEVICE TYPE	Selecting the device type (pH, Oxy, Cond)
DEFAULT	Resetting the device to factory settings

Note:
HOLD is active during Service mode!

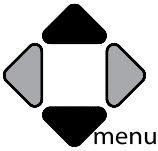
Action	Key/Display	Remark
Activate Service		Press **menu** key to call the selection menu. Select SERVICE using ◂ ▸ keys, press **enter** to confirm.
Passcode		Enter passcode "5555" for service mode using the ▲ ▼ ◂ ▸ keys. Press **enter** to confirm.
Display		In service mode the following icons are displayed: • HOLD triangle • Service (wrench)
Exit	**meas**	Exit by pressing **meas**.

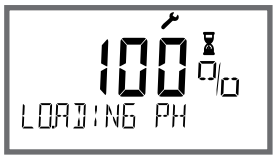
Menu item	Remark
	**Displaying currently measured values (sensor monitor) with HOLD mode activated:** Select MONITOR using ◂ ▸, press **enter** to confirm. Select the process variable in the bottom text line using ◂ ▸. The selected parameter is shown in the upper display line. As the device is in HOLD mode, you can perform validations using simulators without influencing the signal outputs. Hold **meas** depressed for longer than 2 sec to return to Service menu. Press **meas** once more to return to measurement.
	**Specifying the current for outputs 1 and 2:** Select OUT1 or OUT2 using the ◂ ▸ keys, press **enter** to confirm. Enter a valid current value for the respective output using ▲ ▼ ◂ ▸ keys. Confirm by pressing **enter**. For checking purposes, the actual output current is shown in the bottom right corner of the display. Exit by pressing **enter** or **meas**.
	**Relay test (manual test of contacts):** Select RELAIS using ◂ ▸, press **enter** to confirm. Now the status of the relays is "frozen". The 2 digits of the main display represent the respective states (from left to right: REL1, REL2). The selected digit blinks. Select one of the relays using the ◂ ▸ keys, close (1) or open (0) using the ▲ ▼ keys. Exit by pressing **enter**. The relays will be re-set corresponding to the measured value. Press **meas** to return to measurement.

Menu item	Remark
	**Setting the 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 and hardware version 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. **NOTICE!** After a reset to factory setting the device must be reconfigured completely, including the sensor parameters!

Power Disruption while Loading the Process Variable

In very rare cases it seems that the analyzer cannot be operated because it remains in "Firmware Update" mode – indicated by the --FIRMW UPDATE-- message.
This occurs when the power is disrupted while the process variable is loaded.
Follow the instructions below to fix the error.

Action	Key/Display	Remark
Device start		If the power supply is disrupted while the process variable is loaded (e.g., during initial start-up or when changing the process variable), the following can occur:
Reconnecting the power supply		After the power supply has been reconnected, the analyzer starts and then remains in --FIRMW UPDATE-- mode. If this occurs, disconnect the power supply.
Restoring the factory settings		Press the ▲ ▼ keys simultaneously and hold them depressed while the analyzer is reconnected to the power supply.
Device start		Release the keys when the display shows LOADING BASE. The analyzer will restart with the BASE software when 100 % is reached.

Action	Key/Display	Remark
Searching for the process variable		Then the analyzer searches for a measuring module or Memosens sensor.
Loading the process variable, automatic		When a module or a sensor has been found, the loading progress is shown in percentages.
Loading the process variable, manual		If neither module nor sensor are found, the display shows DEVICE TYPE. The selected process variable blinks. You can modify it using the ▲ ▼ keys. Press **enter** to load the process variable displayed.
Loading ...		Make sure that the power supply is not interrupted before the **process variable is fully loaded (100%)**.

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; completely reconfigure and recalibrate the device.
ERR 95	SYSTEM ERROR	**System error** Restart required. If error still persists, send in the device for repair.
ERR 01	NO SENSOR	**Sensor error** Device type not assigned Defective sensor Sensor not connected Break in sensor cable
ERR 02	WRONG SENSOR	**Wrong sensor** Replace the sensor.
ERR 04	SENSOR FAILURE	**Failure in sensor** Replace the sensor.
ERR 05	CAL DATA	**Error in cal data**
ERR 10	ORP RANGE	**Display range exceeded** ORP: < -1999 mV or > 1999 mV
ERR 11	RANGE	**Display range exceeded**
ERR 12	MV RANGE	**mV range exceeded**
ERR 13	TEMPERATURE RANGE	**Temperature range exceeded** Connect the sensor, check the sensor cable and replace if necessary, check the sensor connection, adjust the parameter settings.
ERR 14	rH RANGE	**rH range exceeded**
ERR 15	SENSOCHECK GLASS-EL	**Glass Sensocheck (pH)**

Error	Info text (is displayed in case of fault when the Info key is pressed)	Problem Possible causes
ERR 60	OUTPUT LOAD	**Load error** Check the current loop, deactivate unused current outputs.
ERR 61	OUTPUT 1 TOO LOW	**Output current 1** < 0 (3.8) mA
ERR 62	OUTPUT 1 TOO HIGH	**Output current 1** > 20.5 mA
ERR 63	OUTPUT 2 TOO LOW	**Output current 2** < 0 (3.8) mA
ERR 64	OUTPUT 2 TOO HIGH	**Output current 2** > 20.5 mA

Sensoface messages:

Calibration timer expired:	OUT OF CAL TIME CALIBRATE OR CHANGE SENSOR
Sensor zero/slope:	SENSOR ZERO/SLOPE CALIBRATE OR CHANGE SENSOR
ISFET sensor offset:	SENSOR ISFET-ZERO CALIBRATE OR CHANGE SENSOR
Sensor response:	SENSOR DRIFT CALIBRATE OR CHANGE SENSOR
Sensor TAG does not correspond to device entry.	WRONG SENSOR TAG
Sensor GROUP does not correspond to device entry.	WRONG SENSOR GROUP xxxx

Sensocheck, Sensoface Sensor Monitoring

Sensocheck continuously monitors the sensor and its wiring.
The three Sensoface indicators provide information on required maintenance of the sensor. Additional icons refer to the error cause.
Pressing the **info** key shows an information text.

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

Sensoface message
The Sensocheck message is also output as error message Err 15.
The alarm contact is active, the display backlighting turns red,
output current OUT is set to 22 mA (when configured correspondingly).
All other Sensoface message can be output via a contact
(relay contacts, alarm --> "FACE").

Disabling Sensocheck and Sensoface

Sensocheck can be switched off in the configuration menu (then Sensoface is also disabled).
Exception:
After a calibration, a smiley is always displayed for confirmation.

Decommissioning

Disposal

Local codes and regulations must be observed when disposing of the product.

Returns

If required, send the product in a clean condition and securely packed to your local contact. See www.knick.de.

Operating status	OUT 1	OUT 2	REL1/2	Time out
Measure				-
DIAG				60 s
CAL				No
CONF				20 min
SERVICE				20 min
SERVICE OUT 1				20 min
SERVICE OUT 2				20 min
SERVICE RELAY				20 min
Cleaning function				No
HOLD				No

Explanation:

as configured (Last/Fix or Last/Off)

active

manual

Product Range

Devices	Order No.
Stratos MS A405N	A405N
Mounting accessories	
Pipe-mount kit	ZU0274
Panel-mount kit	ZU0738
Protective hood	ZU0737
M12 socket for sensor connection with Memosens cable / M12 connector	ZU0860

Up-to-date information:
www.knick.de
Phone: +49 30 80191-0
Email: info@knick.de

pH input	Memosens (terminals 1 … 4)	
Data In/Out	Asynchronous interface, RS-485, 9600/19200 Bd	
Power supply	Terminal 1: +3.08 V/10 mA, Ri < 1 ohm, short-circuit-proof	
Display range	pH value	-2.00 ... 16.00
(depending on sensor)	ORP	-1999 ... 1999 mV
	Temperature	-20.0 ... +200.0 °C (-4 ... +392 °F)
	rH	0.0 ... 42.0 rH
pH sensor standardization *	pH calibration	
Operating modes	AUTO	Calibration with Calimatic automatic buffer recognition
	MAN	Manual calibration with entry of individual buffer values
	DAT	Data entry of premeasured sensors
	Product calibration	
Calimatic buffer sets *	-01- Mettler-Toledo	2.00/4.01/7.00/9.21
	-02- Knick CaliMat	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	4.01/7.00/10.01
	-07- WTW techn. buffers	2.00/4.01/7.00/10.00
	-08- Hamilton	4.01/7.00/10.01/12.00
	-09- Reagecon	2.00/4.00/7.00/9.00/12.00
	-10- DIN 19267	1.09/4.65/6.79/9.23/12.75
	-11- Hamilton A	2.00/4.01/7.00/9.00/11.00
	-12- Hamilton B	2.00/4.01/6.00/9.00/11.00
	-13- Kraft	2.00/4.00/7.00/9.00/11.00
	-U1-	Specifiable buffer set with 2 buffer solutions
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	
Calibration timer	Interval 0000 ... 9999 h (Patent DE 101 41 408)	
Sensocheck	Automatic monitoring of glass electrode	
Delay	Approx. 30 s	
Sensoface	Provides information on the sensor condition (can be switched off) Evaluation of zero/slope, calibration interval, Sensocheck	
TC of process medium	Linear -19.99 ... +19.99 %/K, ultrapure water	
Reference temperature	25 °C	

*) user-defined

HOLD input	Galvanically separated (optocoupler)
Function	Switches device to HOLD mode
Switching voltage	0 ... 2 V AC/DC HOLD inactive 10 ... 30 V AC/DC HOLD active
Output 1	0/4 ... 20 mA, max. 10 V, floating (terminals 8 / 9, galvanically connected to output 2)
Overrange *	22 mA in the case of error messages
Characteristic	Linear
Output filter *	PT_1 filter, time constant 0 ... 120 s
Measurement error [1)]	< 0.25% current value + 0.025 mA
Output 2	0/4 ... 20 mA, max. 10 V, floating (terminals 9 / 10, galvanically connected to output 1)
Overrange *	22 mA in the case of error messages
Characteristic	Linear
Output filter *	PT_1 filter, time constant 0 ... 120 s
Measurement error [1)]	< 0.25% current value + 0.025 mA

*) user-defined
1) at normal operating conditions

Relays 1 / 2	Two relay contacts, floating (terminals 14 / 15 / 16)	
Contact ratings	AC < 250 V / < 3 A / < 750 VA DC < 30 V / < 3 A / < 90 W	
Usage	Limit value Alarm Wash	
Limit value	Function	Min or Max
	Setpoint	As desired within range
	Contact response	N/C or N/O
	Hysteresis	User-defined
	Response delay	0000 ... 9999 s
Alarm	Trigger	Failure or Sensoface
	Contact response	N/C or N/O
Wash	Cycle time	0.1 ... 999.9 h
	ON time	0 ... 1999 s
	Contact response	N/C or N/O
Real-time clock	Different time and date formats selectable	
Power reserve	> 5 days	
Display	LC display, 7-segment with icons, colored backlighting	
Primary 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	Display blinks, red backlighting	
Keypad	Keys: meas, info, 4 cursor keys, enter	
Diagnostics		
Calibration data	Calibration date, zero, slope	
Device self-test	Automatic memory test (RAM, FLASH, EEPROM)	
Display test	Display of all segments	
Logbook	100 events with date and time	

Service functions	
Current source	Current specifiable for output 1 and 2 (00.00 ... 22.00 mA)
Sensor monitor	Display of direct sensor signals (mV/temperature/operating time)
Relay test	Manual control of relay contacts
Device type	Selecting the measuring function
Data retention	Parameters, calibration data, logbook > 10 years (EEPROM)
Electrical safety	Protection against electric shock by protective separation of all extra-low-voltage circuits against mains according to EN 61010-1
EMC	EN 61326-1
Emitted interference	Class A (industrial applications) [1)]
Immunity to interference	Industrial applications
RoHS conformity	according to EC directive 2011/65/EU
Power supply	80 V (-15%) … 230 (+10%) V AC ; approx. 15 VA ; 45 … 65 Hz 24 V (-15%) … 60 (+10%) V DC ; 10 W Overvoltage category II, protection class II
Nominal operating conditions	
Climatic class	3K5 according to EN 60721-3-3
Location class	C1 according to EN 60654-1
Ambient temperature	–20 … 65 °C / –4 … 149 °F
Relative humidity	10 … 95 %
Transport and storage	
Transport/Storage temperature	–30 … 70 °C / –22 … 158 °F
Enclosure	Molded enclosure made of PBT/PC, glass fiber reinforced
Mounting	Wall, pipe/post or panel mounting
Color	Gray, RAL 7001
Ingress protection	IP66/IP67/TYPE 4X outdoor (with pressure compensation) when the device is closed
Flammability	UL 94 V-0 for external parts
Dimensions	H 148 mm, W 148 mm, D 117 mm
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	5 knockouts for M20 x 1.5 cable glands 2 of 5 knockouts for NPT ½" or rigid metallic conduit
Terminals	
Screw terminals	for single or stranded wires 0.2 … 2.5 mm^2
Tightening torque	0.5 … 0.6 Nm

[1)] This equipment is not designed for domestic use, and is unable to guarantee adequate protection of the radio reception in such environments.

-01- Mettler-Toledo
(corresponds to former "Knick technical buffers")
Nominal values in bold.

°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- Knick CaliMat
(Merck Titrisols, Riedel-de-Haen Fixanals)
Nominal values in bold.

°C	pH				
0	2.01	4.05	7.09	9.24	12.58
5	2.01	4.04	7.07	9.16	12.39
10	2.01	4.02	7.04	9.11	12.26
15	2.00	4.01	7.02	9.05	12.13
20	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
25	2.00	4.01	6.99	8.95	11.87
30	2.00	4.01	6.98	8.91	11.75
35	2.00	4.01	6.96	8.88	11.64
40	2.00	4.01	6.96	8.85	11.53
50	2.00	4.01	6.96	8.79	11.31
60	2.00	4.00	6.96	8.73	11.09
70	2.00	4.00	6.96	8.70	10.88
80	2.00	4.00	6.98	8.66	10.68
90	2.00	4.00	7.00	8.64	10.48

-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
Nominal values in bold.

°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 (DIN 19266 : 2015-05)
Nominal values in bold.

°C	pH				
0	1.666	4.000	6.984	9.464	
5	1.668	3.998	6.951	9.395	13.207
10	1.670	3.997	6.923	9.332	13.003
15	1.672	3.998	6.900	9.276	12.810
20	1.675	4.000	6.881	9.225	12.627
25	**1.679**	**4.005**	**6.865**	**9.180**	**12.454**
30	1.683	4.011	6.853	9.139	12.289
35	1.688	4.018	6.844	9.102	12.133
37		4.022	6.841	9.088	
38	1.691				12.043
40	1.694	4.027	6.838	9.068	11.984
45					11.841
50	1.707	4.050	6.833	9.011	11.705
55	1.715	4.075	6.834	8.985	11.574
60	1.723	4.091	6.836	8.962	11.449
70	1.743	4.126	6.845	8.921	
80	1.766	4.164	6.859	8.885	
90	1.792	4.205	6.877	8.850	
95	1.806	4.227	6.886	8.833	

Note: The 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 in bold.

°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**	**7.00**	**10.00**
30	4.01	6.987	9.96
35	4.02	6.977	9.92
40	4.03	6.97	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

-07- WTW technical buffers
Nominal values in bold.

°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
Nominal values in bold.

°C	pH				
0	1.99	4.01	7.12	10.23	12.58
5	1.99	4.01	7.09	10.19	12.46
10	2.00	4.00	7.06	10.15	12.34
15	2.00	4.00	7.04	10.11	12.23
20	2.00	4.00	7.02	10.06	12.11
25	**2.00**	**4.01**	**7.00**	**10.01**	**12.00**
30	1.99	4.01	6.99	9.97	11.90
35	1.98	4.02	6.98	9.92	11.80
40	1.98	4.03	6.97	9.86	11.70
45	1.97	4.04	6.97	9.83	11.60
50	1.97	4.05	6.97	9.79	11.51
55	1.98	4.06	6.98	9.75	11.42
60	1.98	4.08	6.98	9.72	11.33
65	1.98	4.10*	6.99*	9.69*	11.24
70	1.99	4.12*	7.00*	9.66*	11.15
75	1.99	4.14*	7.02*	9.63*	11.06
80	2.00	4.16*	7.04*	9.59*	10.98
85	2.00	4.18*	7.06*	9.56*	10.90
90	2.00	4.21*	7.09*	9.52*	10.82
95	2.00	4.24*	7.12*	9.48*	10.74

* Values complemented

-09- Reagecon buffers
Nominal values in bold.

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

* Values complemented

-10- DIN 19267 buffers
Nominal values in bold.

pH	**°C**				
0	1.08	4.67	6.89	9.48	13.95*
5	1.08	4.67	6.87	9.43	13.63*
10	1.09	4.66	6.84	9.37	13.37
15	1.09	4.66	6.82	9.32	13.16
20	1.09	4.65	6.80	9.27	12.96
25	**1.09**	**4.65**	**6.79**	**9.23**	**12.75**
30	1.10	4.65	6.78	9.18	12.61
35	1.10	4.65	6.77	9.13	12.45
40	1.10	4.66	6.76	9.09	12.29
45	1.10	4.67	6.76	9.04	12.09
50	1.11	4.68	6.76	9.00	11.89
55	1.11	4.69	6.76	8.96	11.79
60	1.11	4.70	6.76	8.92	11.69
65	1.11	4.71	6.76	8.90	11.56
70	1.11	4.72	6.76	8.88	11.43
75	1.11	4.73	6.77	8.86	11.31
80	1.12	4.75	6.78	8.85	11.19
85	1.12	4.77	6.79	8.83	11.09
90	1.13	4.79	6.80	8.82	10.99
95	1.13*	4.82*	6.81*	8.81*	10.89*

* extrapolated

-11- Hamilton A
Nominal values in bold.

pH	**°C**				
0	1.99	4.01	7.12	9.31	11.42
5	1.99	4.01	7.09	9.24	11.33
10	2.00	4.00	7.06	9.17	11.25
15	2.00	4.00	7.04	9.11	11.16
20	2.00	4.00	7.02	9.05	11.07
25	**2.00**	**4.01**	**7.00**	**9.00**	**11.00**
30	1.99	4.01	6.99	8.95	10.93
35	1.98	4.02	6.98	8.90	10.86
40	1.98	4.03	6.97	8.85	10.80
45	1.97	4.04	6.97	8.82	10.73
50	1.97	4.05	6.97	8.78	10.67
55	1.98	4.06	6.98	8.75	10.61
60	1.98	4.08	6.98	8.72	10.55
65	1.98	4.10	6.99	8.70	10.49
70	1.99	4.12	7.00	8.67	10.43
75	1.99	4.14	7.02	8.64	10.38
80	2.00	4.16	7.04	8.62	10.33
85	2.00	4.18	7.06	8.60	10.28
90	2.00	4.21	7.09	8.58	10.23
95	2.00	4.24	7.12	8.56	10.18

-12- Hamilton B
Nominal values in bold.

pH	**°C**				
0	1.99	4.01	6.03	9.31	11.42
5	1.99	4.01	6.02	9.24	11.33
10	2.00	4.00	6.01	9.17	11.25
15	2.00	4.00	6.00	9.11	11.16
20	2.00	4.00	6.00	9.05	11.07
25	**2.00**	**4.01**	**6.00**	**9.00**	**11.00**
30	1.99	4.01	6.00	8.95	10.93
35	1.98	4.02	6.00	8.90	10.86
40	1.98	4.03	6.01	8.85	10.80
45	1.97	4.04	6.02	8.82	10.73
50	1.97	4.05	6.04	8.78	10.67
55	1.98	4.06	6.06	8.75	10.61
60	1.98	4.08	6.09	8.72	10.55
65	1.98	4.10	6.11	8.70	10.49
70	1.99	4.12	6.13	8.67	10.43
75	1.99	4.14	6.15	8.64	10.38
80	2.00	4.16	6.18	8.62	10.33
85	2.00	4.18	6.21	8.60	10.28
90	2.00	4.21	6.24	8.58	10.23
95	2.00	4.24	6.27	8.56	10.18

-13- Kraft
Nominal values in bold.

pH	**°C**				
0	2.01	4.05	7.13	9.24	11.47*
5	2.01	4.04	7.07	9.16	11.47
10	2.01	4.02	7.05	9.11	11.31
15	2.00	4.01	7.02	9.05	11.15
20	**2.00**	**4.00**	**7.00**	**9.00**	**11.00**
25	2.00	4.01	6.98	8.95	10.85
30	2.00	4.01	6.98	8.91	10.71
35	2.00	4.01	6.96	8.88	10.57
40	2.00	4.01	6.95	8.85	10.44
45	2.00	4.01	6.95	8.82	10.31
50	2.00	4.00	6.95	8.79	10.18
55	2.00	4.00	6.95	8.76	10.18*
60	2.00	4.00	6.96	8.73	10.18*
65	2.00	4.00	6.96	8.72	10.18*
70	2.01	4.00	6.96	8.70	10.18*
75	2.01	4.00	6.96	8.68	10.18*
80	2.01	4.00	6.97	8.66	10.18*
85	2.01	4.00	6.98	8.65	10.18*
90	2.01	4.00	7.00	8.64	10.18*
95	2.01	4.00	7.02	8.64	10.18*

* Values complemented

-U1- Specifiable Buffer Set

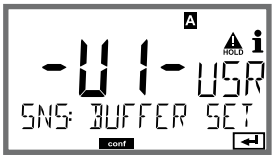
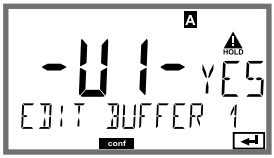
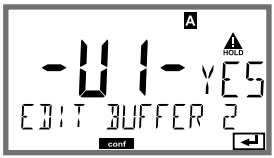
You can specify a buffer set with 2 buffer solutions in the temperature range of 0 ... 95 °C, step width: 5 °C.
To do so, select buffer set -U1- in the configuration menu.
As delivered, the Ingold technical buffer solutions pH 4.01 / 7.00 are stored as buffer set and can be edited.

Conditions for the specifiable buffer set:

- All values must lie in the range pH 0 ... 14
- Maximum difference between two adjacent pH values (5 °C step width) of the same buffer solution: pH 0.25
- The values of buffer solution 1 must be lower than those of buffer solution 2:
  The difference between values for identical temperatures must be greater than 2 pH units.

Faulty entries are indicated in measuring mode by the "FAIL BUFFERSET -U1-" message.

The 25 °C value is always used for buffer display during calibration.

Step	Action/Display	Remark
Select buffer set -U1- (CONFIG / SNS menu)		
Select buffer solution 1 for editing	 Select "YES" using up/ down key.	You are prompted for confirmation to prevent accidental changes of the settings.
Editing the values of buffer solution 1	 Edit using arrow keys, press **enter** to confirm and proceed to next temperature value. 	Enter the values for the first buffer solution in 5°C steps. The difference to the next value must not exceed 0.25 pH unit.
Select buffer solution 2 for editing		The difference between buffer solutions for identical temperatures must be greater than 2 pH units.

Buffer Set U1:
Fill in your configuration data or use the table as original for copy.

Temperature (°C)	Buffer 1	Buffer 2
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		
95		

D

P

Q

R

S

Knick
Elektronische Messgeräte
GmbH & Co. KG

Headquarters
Beuckestraße 22 • 14163 Berlin
Germany
Phone: +49 30 80191-0
Fax: +49 30 80191-200
info@knick.de
www.knick.de

Local Contacts
www.knick-international.com

Translation of the original instructions

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The latest documents are available for download on our website under the corresponding product description.

100137 TA-212.100-pH-KNEN03