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pH- and Redox-Converter UNICON-pH

pH- and ORP measurement with standard electrodes

Headmounting

Features

- Measuring range programmable
  pH value pH-1.00 ... +15.00, ORP -1500 ... +1500mV,
  temperature compensated,
- Monitoring of impedance,
  glass- and reference electrode
  and calibration cycle as well
- Measuring range for pH/ORP
  switchable by external signal
- Temperature measurement programmable
  for Pt100 or Pt1000 sensor
- Output 4 ... 20mA, 2-wire loop powered
  for temperature measurement
- 2 alarm outputs, voltage free
- Isolation between output/
  range-switch input/electrode
- Simulation mode (manual operation)
  for pH, ORP and temperature

Fieldmounting

Note:
Electrodes and fittings must be ordered separately

General information

The Converter UNICON-pH is used among other things in the food technology, in chemistry, in pharmaceutical industry and in the sewage technology. Depending upon structural conditions can be selected between field mounting (electrode and converter are mounted seperately) and head mounting (electrode and converter form one unit). The UNICON-pH operates with all common pH- and ORP-electrodes.

Short information

Programming	Parameters are programmed via front side membrane keypad.
Alarm output	Switching performance is programmable as minimum or maximum function. The state of the alarm outputs is shown in the LCD-display.
Electrode monitoring	One alarm output is selectable for impedance protection of the glass-and reference electrode against broken glass and break of wire.
Measuring range/ measuring pH/ORP switching	A second measuring range for pH or ORP can be selected by switching by an external control signal. It is also possible to change from pH to ORP measurement and reverse.

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Content

Technical data

Power supply

Supply voltage	:	14 ... 30 V DC, 2-wire, loop powered
Operating temperature	:	0 ... 50 °C (32 ... 122 °F)
Isolation	:	pH - and ORP output/temperature output/alarm output 1/ alarm output 2/range switch input
Test voltage	:	500 V DC

pH / ORP

Output signal	:	4 ... 20 mA
Burden	:	RA [Ω] ≤ $\frac{\text{Supply voltage -14 V}}{\text{0.02 A}}$
Measuring range	:	programmable in range pH-1.00 ... +15.00 or -1500 ... +1500 mV
Input resistance	:	> 10^{12} Ω
Input current	:	< 10^{-12} A
Electrode zero point	:	pH = 7.00 (ΔpH = ± 2.0)
Slope	:	30 ... 80 mV / pH
Offset ORP	:	± 200 mV
Error	:	± 0.2 % of the range or ± 2Digit
Temperature coefficient	:	<100 ppm/°C
Measuring derate	:	approx. 2/sec.
Type of calibration	:	- manual input of buffer value, 1- or 2-point calibration - automatic buffer identification of the buffer solution: -WTW; technical buffer with the nominal values 4.01/7.00 in range 0 ... 95 °C/10.00 in range 0 ... 50 °C -Schott; technical buffer with the nominal values 4.00/7.00/10.00 in range 0 ... 40 °C -Ingold; (Mettler Toledo) technical buffer with nominal values 4.01/7.00/9.21 in range 0 ... 95 °C -buffer acc. to DIN 19266 with nominal values 4.01/6.87/9.18 in range 0 ... 95 °C - data entering of the value for zero point and slope - ORP offset

Temperature

Output signal	:	4 ... 20 mA
Burden	:	RA [Ω] ≤ $\frac{\text{Supply voltage -14 V}}{\text{0.02 A}}$

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Temperature sensor RTD	:	Pt100 or Pt1000
Unit	:	programmable °C; °F
Measuring range	:	programmable -40.0 ... +160.0 °C (-40.0 ... +320.0 °F)
Min./max. span	:	25.0 °C (45.0 °F)/200 °C (360.0 °F)
Accuracy	:	± 0.1% ± 1 Digit
Temperature coefficient	:	< 50 ppm/°C
Linearization error	:	± 0.1 %
Glass impedance	:	0 ... 1 GΩ (temperature compensated)
- Measuring range	:	0,001 ... 2 GΩ (not compensated)
- Accuracy	:	±20 %
Reference impedance	:	0 ... 100 kΩ (not compensated)
- Accuracy	:	±20 %
Monitoring of the calibration interval	:	1 ... 1000 days

Alarm output

Transistor output	:	14 ... 30 V DC, max. 60 mA, short circuit protection
Voltage drop	:	< 2 V

Range switch

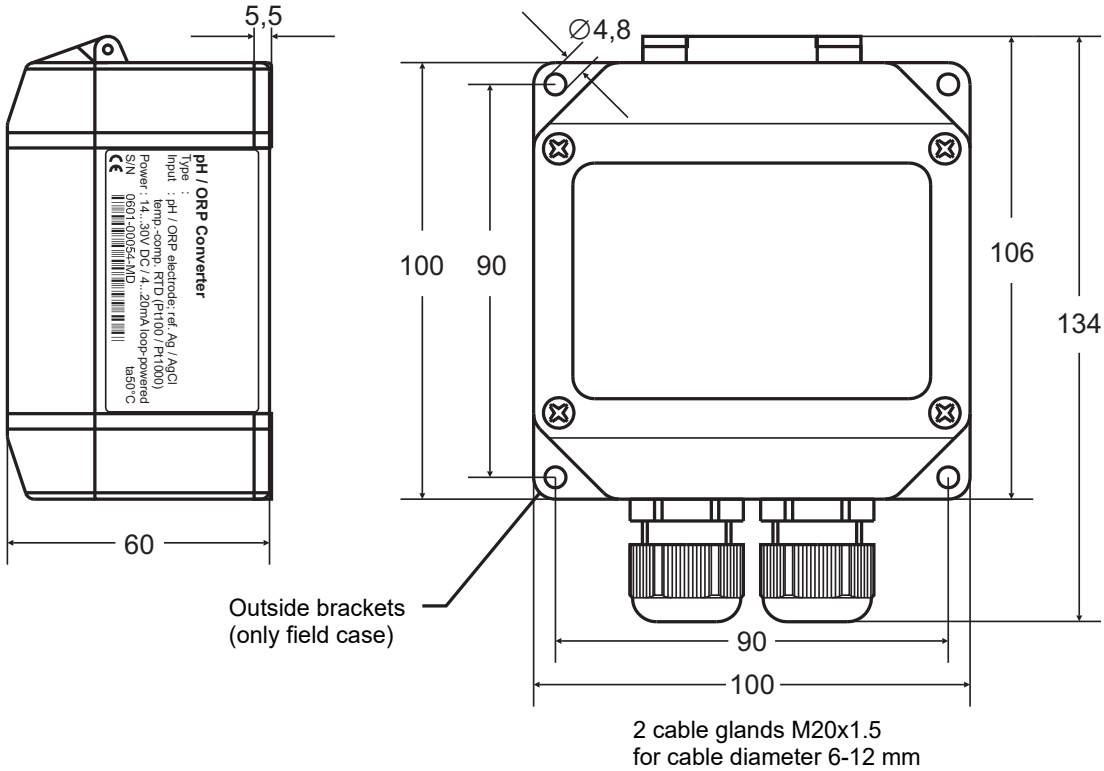
Input resistance	:	>10 KΩ
Range 1 active	:	U = 0 ... 3 V DC
Range 2 active	:	U = 12 ... 30 V DC

Display	:	LCD-dot matrix, character height 3.8 mm 2 lines, 16 characters each

Case

Model	:	head mounting/field mounting, protection IP65
Material	:	Polyamide with fibreglass PA6-GF 15/15
Weight	:	0.36 kg
Connection	:	Screw terminal with pressure plate, 2.5 mm² fine wire, 4 mm² single wire
Front keypad	:	Polyester

Dimensions



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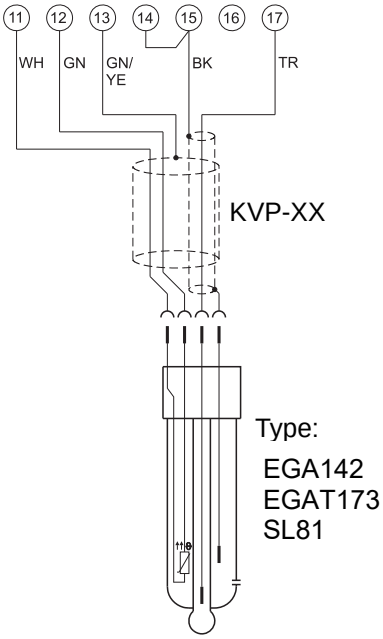
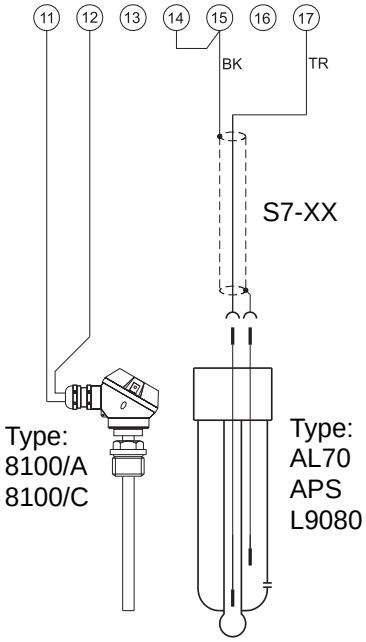
Connection diagrams/terminals

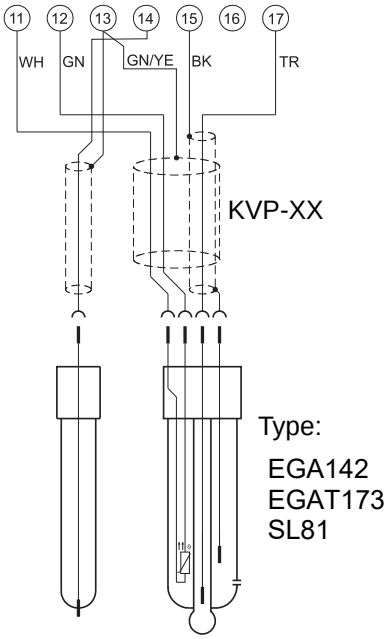
1. pH-combination electrode
with integr. temperature sensor



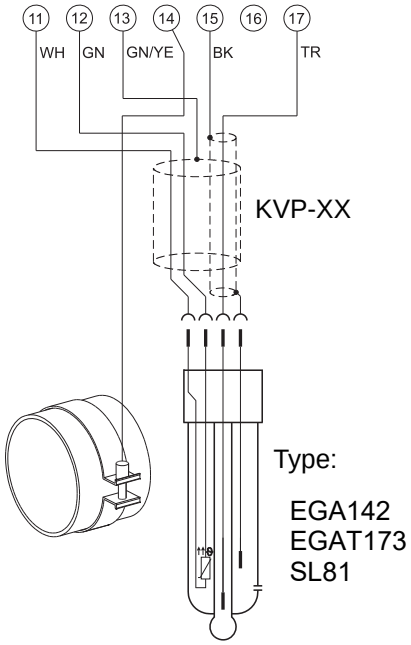
2. pH-combination electrode
with ext. temperature sensor



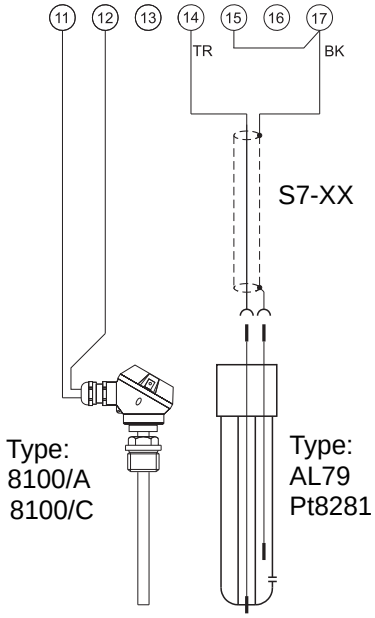
3. pH-combination electrode
with ORP-electrode



4. pH-combination electrode with integr.
temperature sensor and ext. liquid ground



5. ORP-combination electrode
with ext. temperature sensor



Terminal description see next page

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Picture 1 and 2

Terminal	Measuring input	KVP-XX*	S7-XX*
11	Temperature sensor Pt100/Pt1000	white (WH)	
12	Temperature sensor Pt100/Pt1000	green (GN)	
13	Shield	green/yellow (GN/YE)	
14	ORP-electrode/ liquid ground	link to terminal 15	
15	Reference electrode	black (BK)	black (BK)
16	not used		
17	Glass electrode	transparent (TR)	transparent (TR)

Picture 3 and 4

Terminal	Measuring input	KVP-XX*
11	Temperature sensor Pt100/Pt1000	white (WH)
12	Temperature sensor Pt100/Pt1000	green (GN)
13	Shield	green/yellow (GN/YE)
14	ORP-electrode/ liquid ground	
15	Reference electrode	black (BK)
16	not used	
17	Glass electrode	transparent (TR)

Picture 5

Terminal	Measuring input	S7-XX*
11	Temperature sensor Pt100/Pt1000	
12	Temperature sensor Pt100/Pt1000	
13	Shield	
14	ORP-electrode/ liquid ground	transparent (TR)
15	Reference electrode	link to terminal 17
16	not used	
17	Glass electrode	black (BK)

* -XX = cable length [m]

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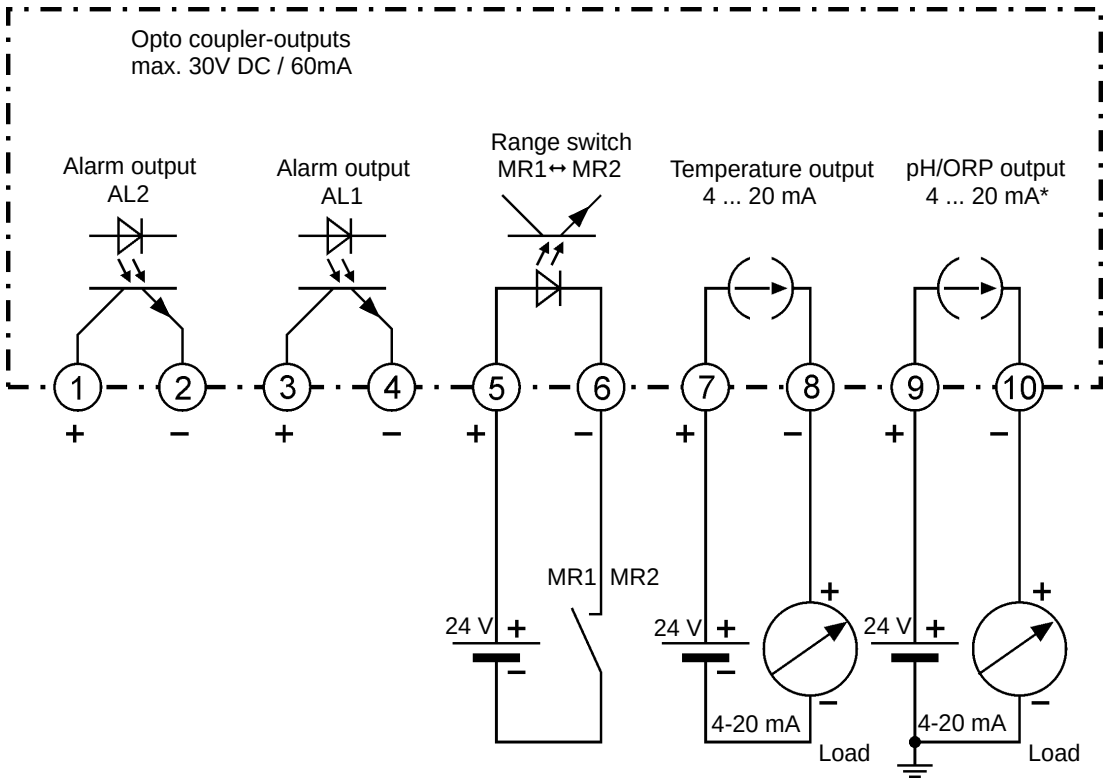
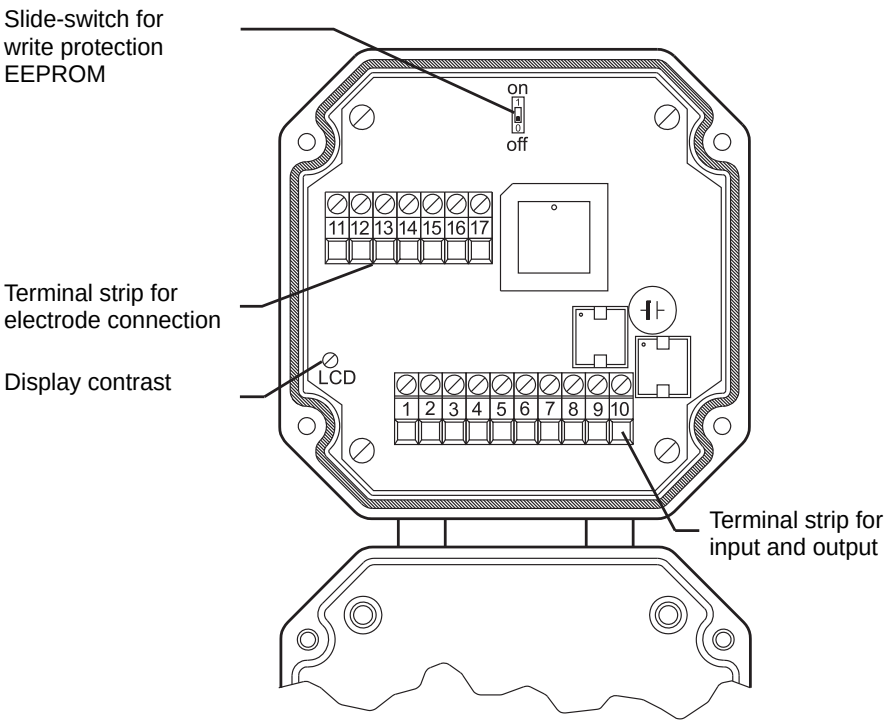
Connection diagram / terminals



* For supplying the converter use terminals (9) and (10) as shown. If the converter is used for monitoring only, terminals (9) and (10) must be connected directly to supply voltage.

Legend (cover plate)



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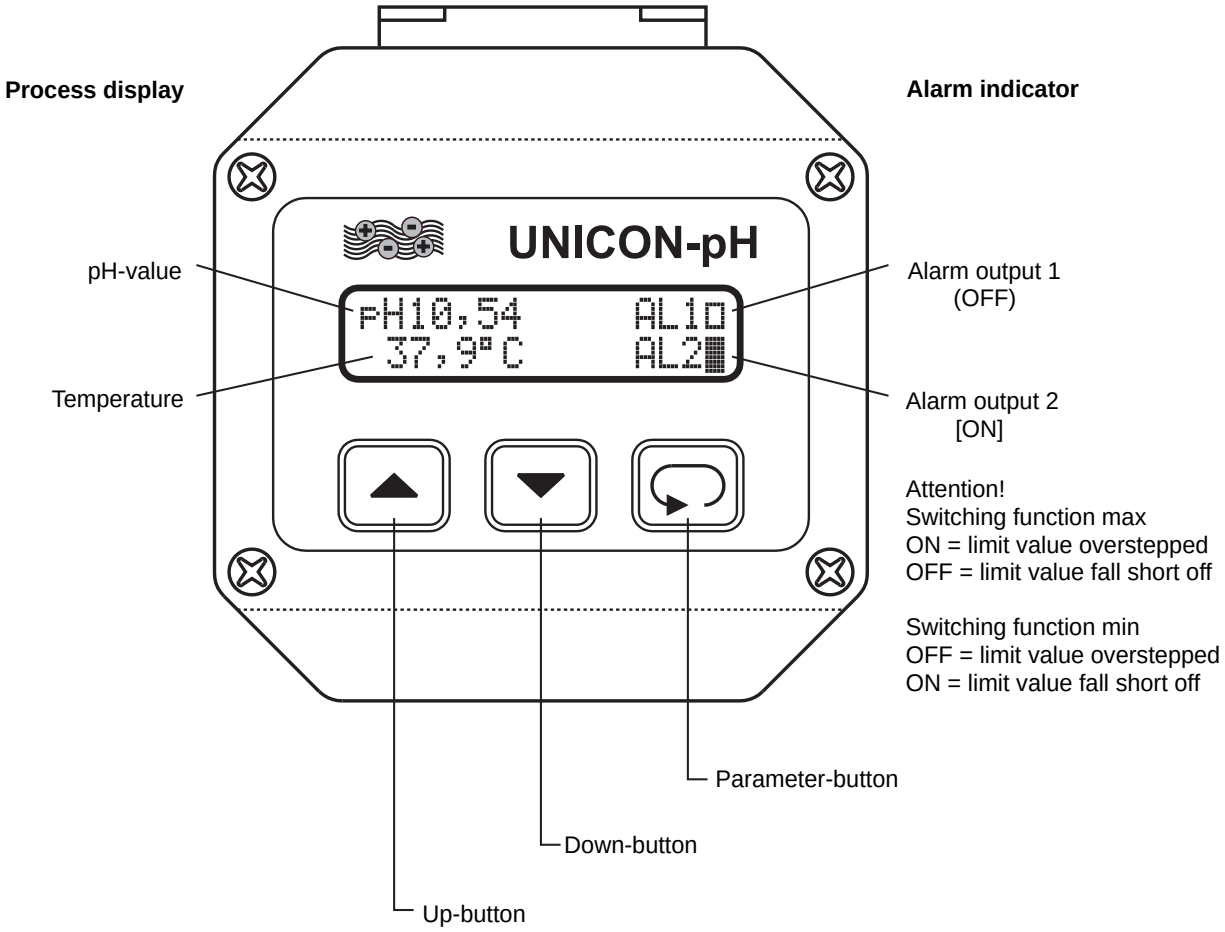
Controls and display



Description

After switching on the supply voltage, the converter initializes itself. The display shows messages about the device type and software version. After the initializing procedure the converter displays the process values in the working level.

Operating of the device is arranged in 2 levels. The requested parameter can be called by the button . Selection within a parameters or entering data, use buttons and . Parameters are stored zero voltage safe in the EEPROM.

The configuration level is called up by pressing the button . Now all parameters defining the function of the converter can be programmed.

After finishing the configuration or if longer than 120 seconds no button was pushed, the program returns to the working level. Leaving the configuration level is possible at any time by pushing the button for 2 seconds.

Installation note!
Before the device can be used, it must be configurated for the intended use**.**

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Notes about calibration.

In practice the characteristic curves of pH electrodes deviate from the ideal line. For precise measurement it is necessary to calibrate the UNICON-pH on the used pH-electrode when setting in operation and afterwards in regular time intervals. Standardised pH buffer solutions can be used to check measuring points of the connected pH-electrode.
Maximum operating values for correct measurement: Zeropoint 6.0 ... 8.0 pH; slope 53.0 ... 59.2 mV/pH.

Single point calibration:
The pH-electrode is calibrated with one pH buffer solution only. The program moves the characteristic curve parallel through the calibration point (see diagram A).
- practicable if the pH value of the process solution is close to the pH value of the buffer solution, no high precision is required and the temperature does not fluctuate heavily.

Two point calibration:
The pH-electrode is calibrated with 2 buffer solutions. The exact characteristic curve is determined. The program calculates the deviation from the ideal characteristic curve (see diagram B).
- This calibration is recommended if the pH value or the temperature of the process solution fluctuates heavily and high precision is required.

Diagram A

Single point-calibration
with buffer pH7.00

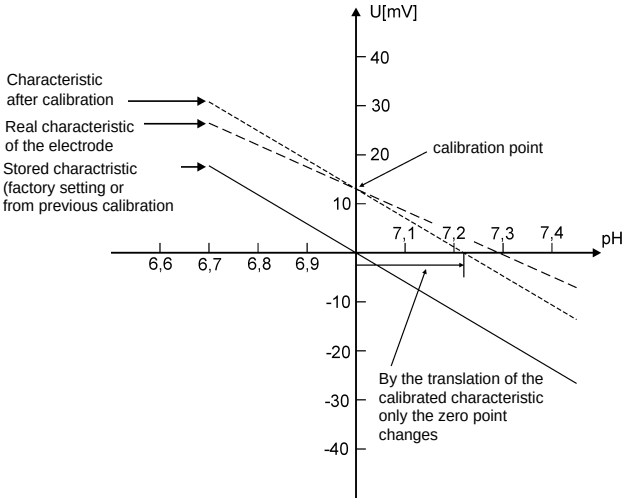
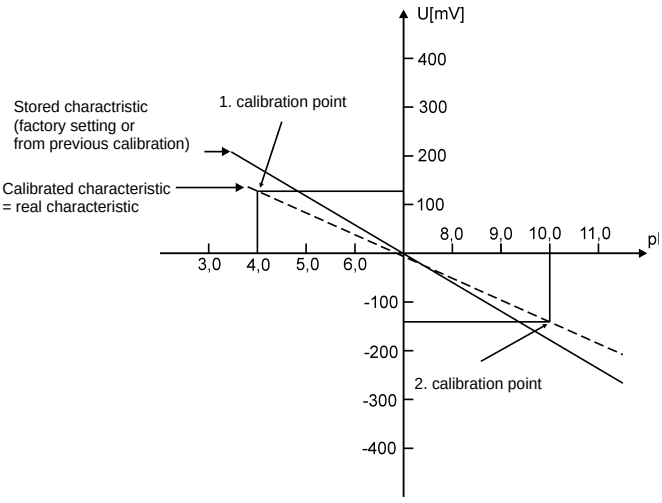


Diagram B

Two point-calibration
with buffer pH4.01 and pH10.00



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Calibration modes of the UNICON-pH

1.) Automatic calibration (parameter 3 = Auto)
Using one of the standardised pH buffer solutions sets listed in the technical data (page 2) the UNICON-pH automatically calculates the parameters of the connected pH electrode. The automatic calibration can be accomplished only with sensors with integrated temperature sensor. Parameter 51 must be set to Pt100 or Pt1000

In this calibration mode also with aged pH electrodes the used buffer will be recognized, if their zero-point may not have shifted no more than ±1.0pH. For example, if a buffer with 4pH is used, the measured value may be in the range of 3.0 up to 5.0pH. The buffer is not recognized surely, if the measured value falls below this or exceeds this values and the automatic calibration will be stopped.
Thus the electrode did not become useless but the large deviation points to a strong aging. A manual calibration is still possible in most cases.

2.) Manual calibration (parameter 3 = Manual)
For manual calibration it is possible to choose a buffer from the standardised buffer solution sets or to enter the buffer value manually.
Manual calibration is recommend also, if the automatic calibration is not possible. In contrast to the automatic calibration during the manual calibration the buffers are not reconized automatically. Through this restriction of the maximum deviation to ±pH1,0 is dropped. If the measurement differs more than ±pH3,0 the electrode must be replaced.

3.) Data input (parameter 3 = Data)
The parameters zero and slope of the attaced electrode are known and entered directly.

Required solutions:
- Buffer solutions according to the desired method of calibration.
- Tap water for rinsing the electrode.

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Programming

Notes to representation

Error messages

Parameter only appears at appropriate model (see order code)

Parameter-button for parameter selection or storing of the values

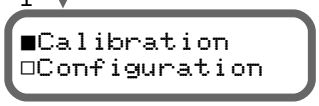
Up- and Down-buttons for selection or entering values in the parameter level

Note! During the configuration only those parameters will be displayed, which are not excluded by other parameter settings or if they are available in the device.

Calibration/configuration

Process value for pH- or ORP- and temperature-values
Alarm output indication (only if activated)
□ = OFF and ■ = ON.
If collective alarm SAL is activated, the display toggles between error massage and process value.

1



Calibration : the connected electrode shall be calibrated.
Configuration : the converter shall be configured.

Configuration

continue page 17
parameter 39

Calibration

2

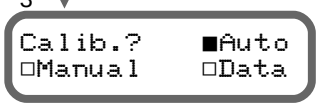
This parameter only appears for model 2,
if MR1 = pH und MR2 = ORP.

pH calibration

ORP calibration

continue page 16
parameter 35/36

3



Selection of the calibration mode
Auto : automatic buffer detection.
Manual : manual input of the buffer values.
Data : input of zero-point and slope.

⚠ The manual calibration is recommended for older electrodes.

Auto

continue page 11
parameter 4

Manual

continue page 13
parameter 15

Data

continue page 16
parameter 33

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Automatic calibration

⚠ Only for electrodes with integrated temperature sensor

4

Select buffer set
WTW ▼

Buffer set	nominal pH-values of the buffers
WTW	4.01/7.00 at 0...95 °C/10.00 at 0...50 °C
Schott	4.00/7.00/10.00 at 0 ... 40 °C
Ingold (Mettler Toledo)	4.01/7.00/9.21 at 0 ... 95 °C
DIN19266	4.01/6.87/9.18 at 0 ... 95 °C

5

Dip pH electrode
into 1.buffer

Rinse the electrode in tap water and immerse in the 1. buffer solution.
Start the calibration with button ↻.

6

1.buffer temp.
23.6°C /

Temperature measuring of the 1. pH-buffer solution.
A rotating bar indicates the measuring process. If the bar stops , the measured value is taken over and the calibration procedure will be continue with the next parameter.
It is possible to stop the measurement during the measuring process, with button ↻ at any time and the current value will be stored.

Temp.not const.
□next ■back

next ► Parameter 7
back ► Parameter 6

7

Nom. val. pH7.06
23.6°C 10s

Measuring of the 1. buffer
As soon as the measured value is constant, this is taken over as first calibration parameter.
The calibration procedure continues with parameter 8.

pH-measurement not const. ⟷ *4s* ⟷ Use manual calibration

No constant value within 3min.

pH-electrode Difference>pH1.0 ⟷ *4s* ⟷ Use manual calibration

Difference of current value to buffer > pH1.0

Buffer temp. to low

Buffer temperature out of range.

⚠ The measured values are not talken over

back to parameter 1 page 10

8

Buffer pH7.00
Difference pH 0.1

The nominal value of the identified buffers and the difference to the actual value will be displayed.

9

2.buffer calib.?
■YES □NO

YES : 2-point-calibration.
A 2. buffer solution has to be measured.
NO : 1-point-calibration.
The calibration procedure is finished

YES

continue page 12
parameter 10

NO

continue page 12
parameter 14

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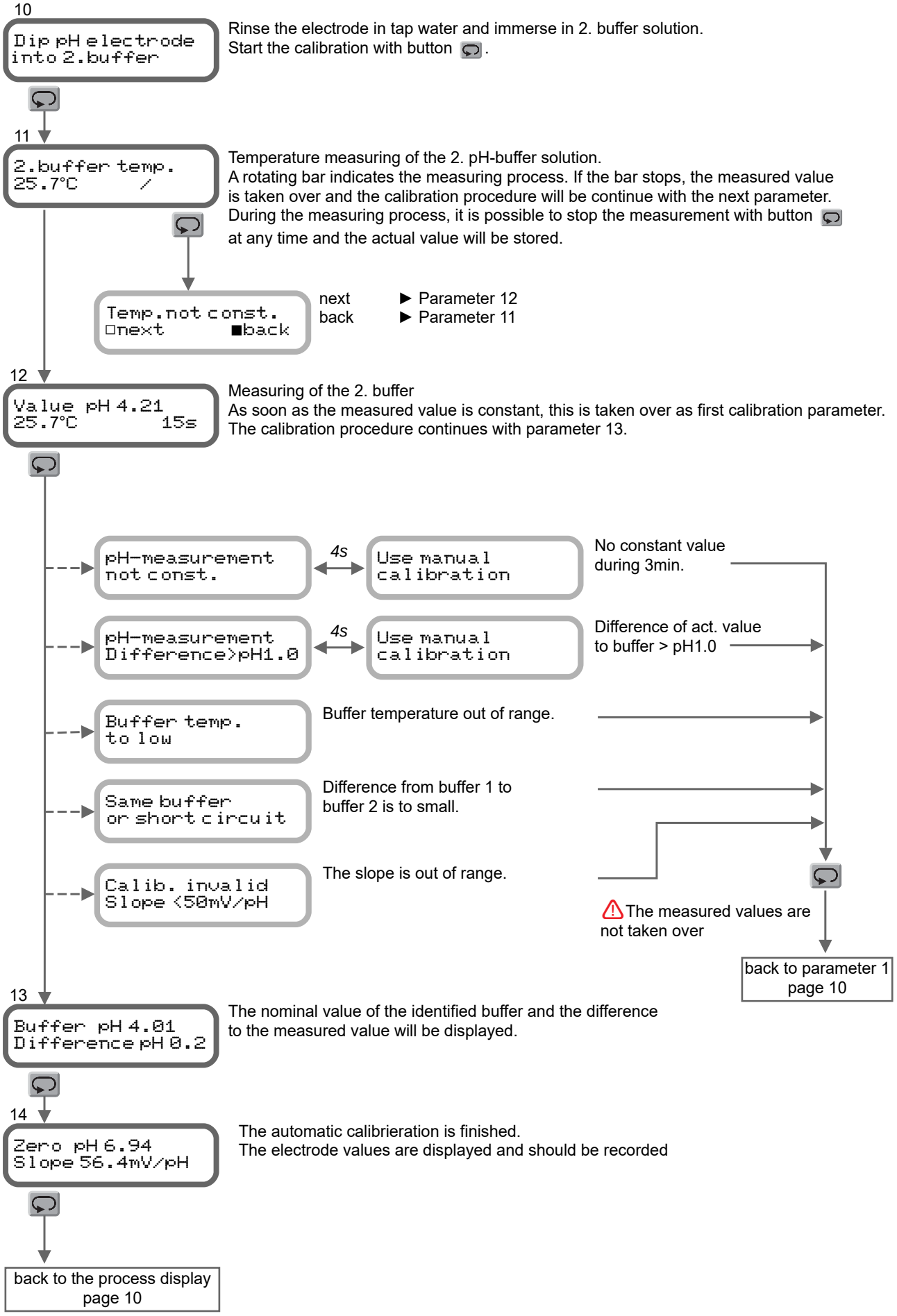

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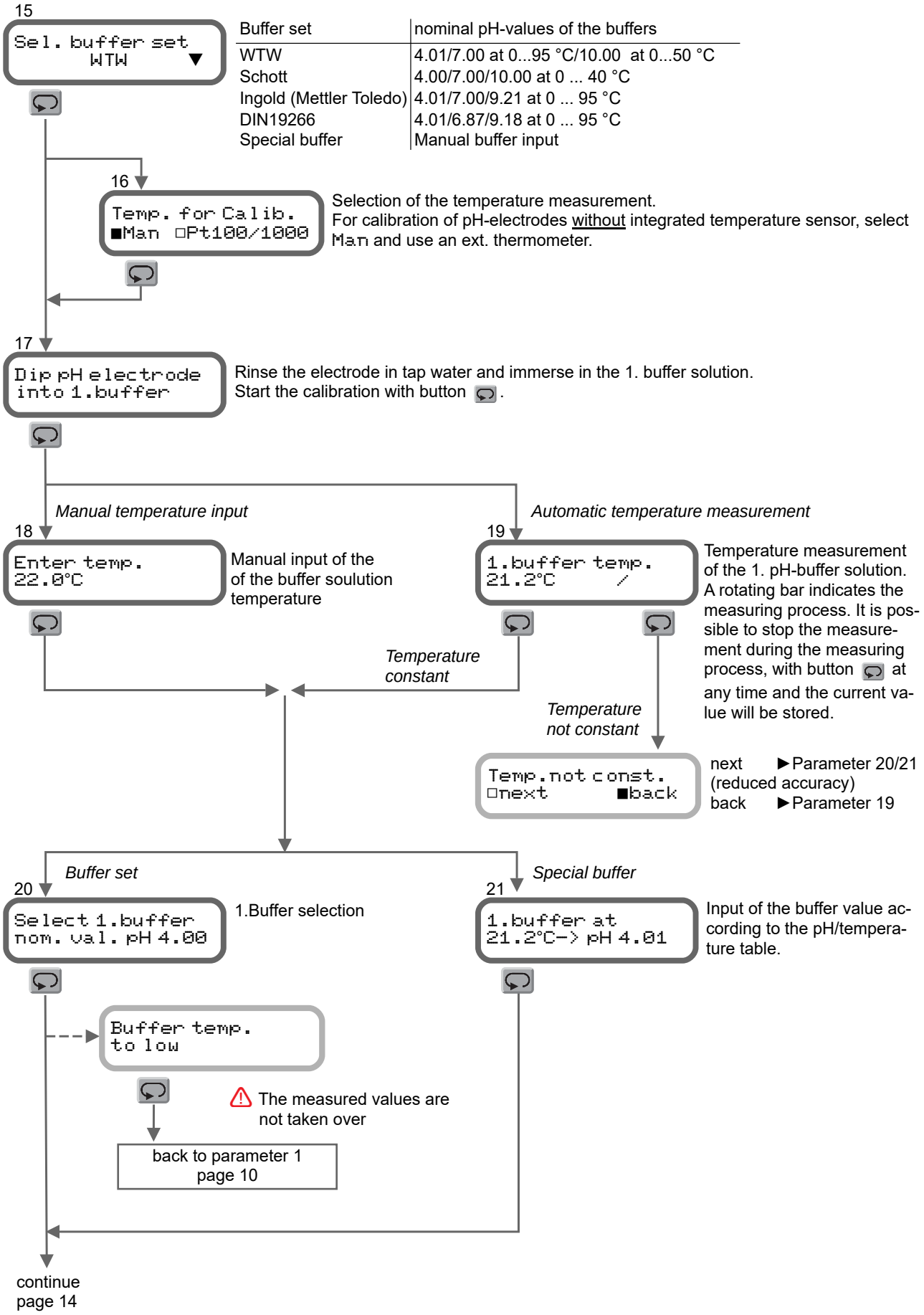
Manual calibration



Buffer set	nominal pH-values of the buffers
WTW	4.01/7.00 at 0...95 °C/10.00 at 0...50 °C
Schott	4.00/7.00/10.00 at 0 ... 40 °C
Ingold (Mettler Toledo)	4.01/7.00/9.21 at 0 ... 95 °C
DIN19266	4.01/6.87/9.18 at 0 ... 95 °C
Special buffer	Manual buffer input

Selection of the temperature measurement.
For calibration of pH-electrodes without integrated temperature sensor, select Man and use an ext. thermometer.

Rinse the electrode in tap water and immerse in the 1. buffer solution.
Start the calibration with button .

Manual input of the of the buffer soulution temperature

Temperature measurement of the 1. pH-buffer solution. A rotating bar indicates the measuring process. It is possible to stop the measurement during the measuring process, with button at any time and the current value will be stored.

next ▶Parameter 20/21 (reduced accuracy)
back ▶Parameter 19

1.Buffer selection

Input of the buffer value according to the pH/temperature table.

⚠ The measured values are not taken over

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22

Value pH 2.76
21.2°C 11s

Measuring of the 1. buffer
The next parameter will be selected if the measuring value is constant. During the measuring process, it is possible to stop the measurement with button at any time and the current value will be stored. The calibration accuracy is reduced.

Value not const.
□next ■back

next ► parameter 23
back ► parameter 22

pH-electrode
out of operation

Deviation of zero-point >pH3.0.
The electrode must be replaced.

back to parameter 1
page 10

23

Buffer pH 4.01
Difference pH-1.2

4s

Measurement
may be faulty

The calculated buffer and the difference to the measured value are displayed.
The message " measurement may be faulty " appears, if the deviation >pH2.0.

Abort calib.?
□YES ■NO

If the difference exceeds >pH2.0, the calibration can be stopped.
Parameter zero-point and slope are not changed.
YES : continue page 10, process display
NO : continue parameter 24

24

2.buffer calib.
■YES □NO

YES : 2-point-calibration.
A 2. buffer solution has to be measured.
NO : 1-point-calibration.
The calibration procedure is finished

YES

NO

continue page 15
parameter 32

25

Dip pH electrode
into 2.buffer

Rinse the electrode in tap water and immerse in the 2. buffer solution.
Start the calibration with button .

Manual temperature input

Automatic temperature measurement

26

Enter temp.
22.0°C

Manual temperature input of the buffer solution.

27

2.buffer temp.
22.7°C /

Temperature measuring of the 2. pH-buffer solution.
A rotating bar indicates the measuring process. It is possible to stop the measurement during the measuring process, with button at any time and the current value will be stored.

continue
page 15

Temp.not const.
□next ■back

next ► parameter 28/29
(reduced accuracy)
back ► parameter 27

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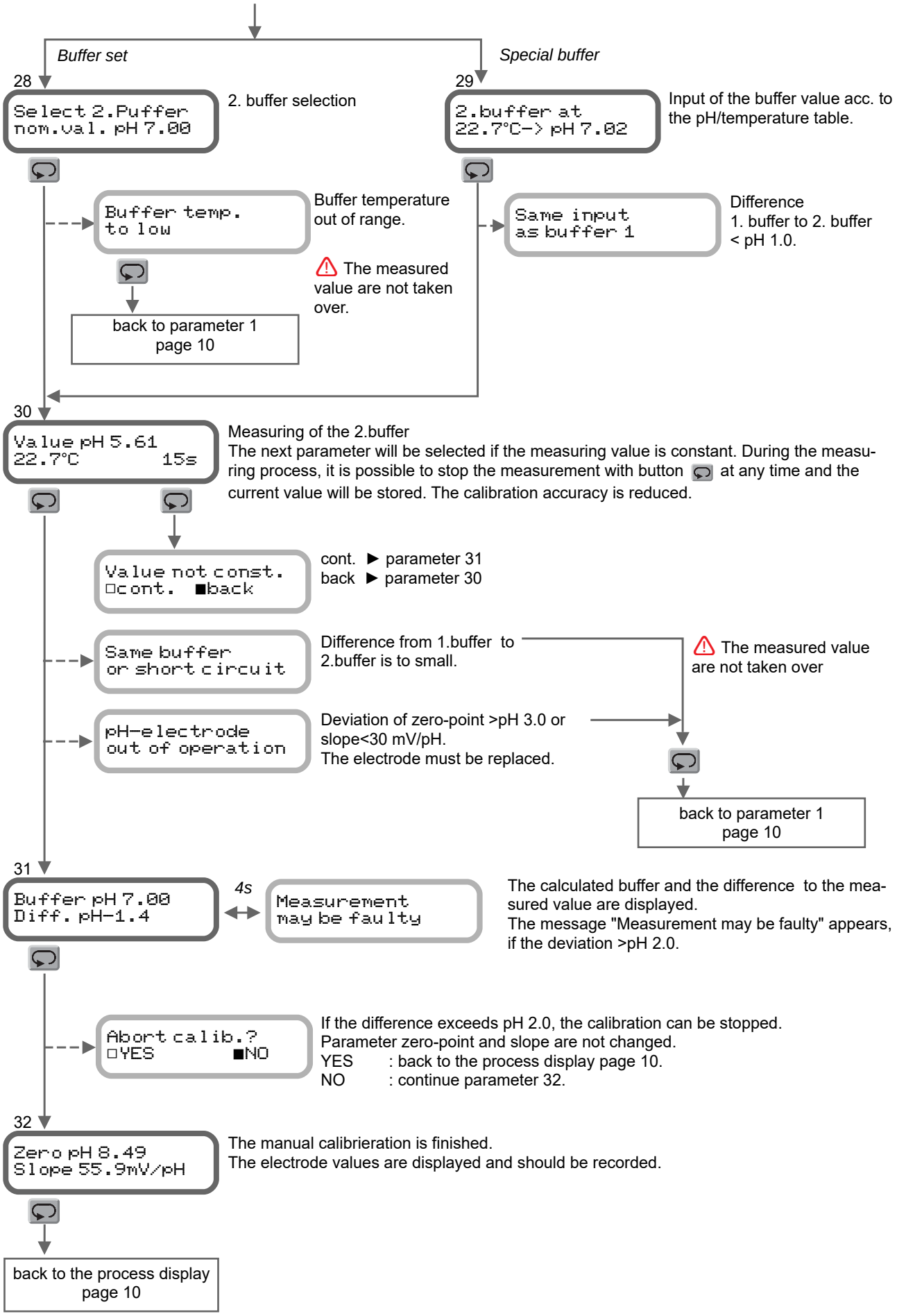
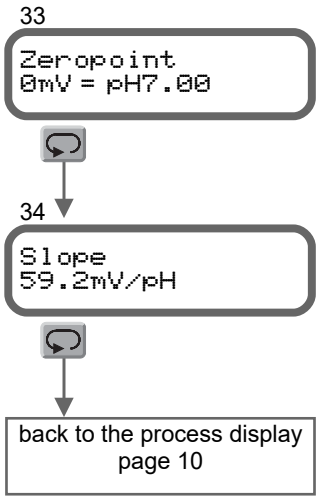


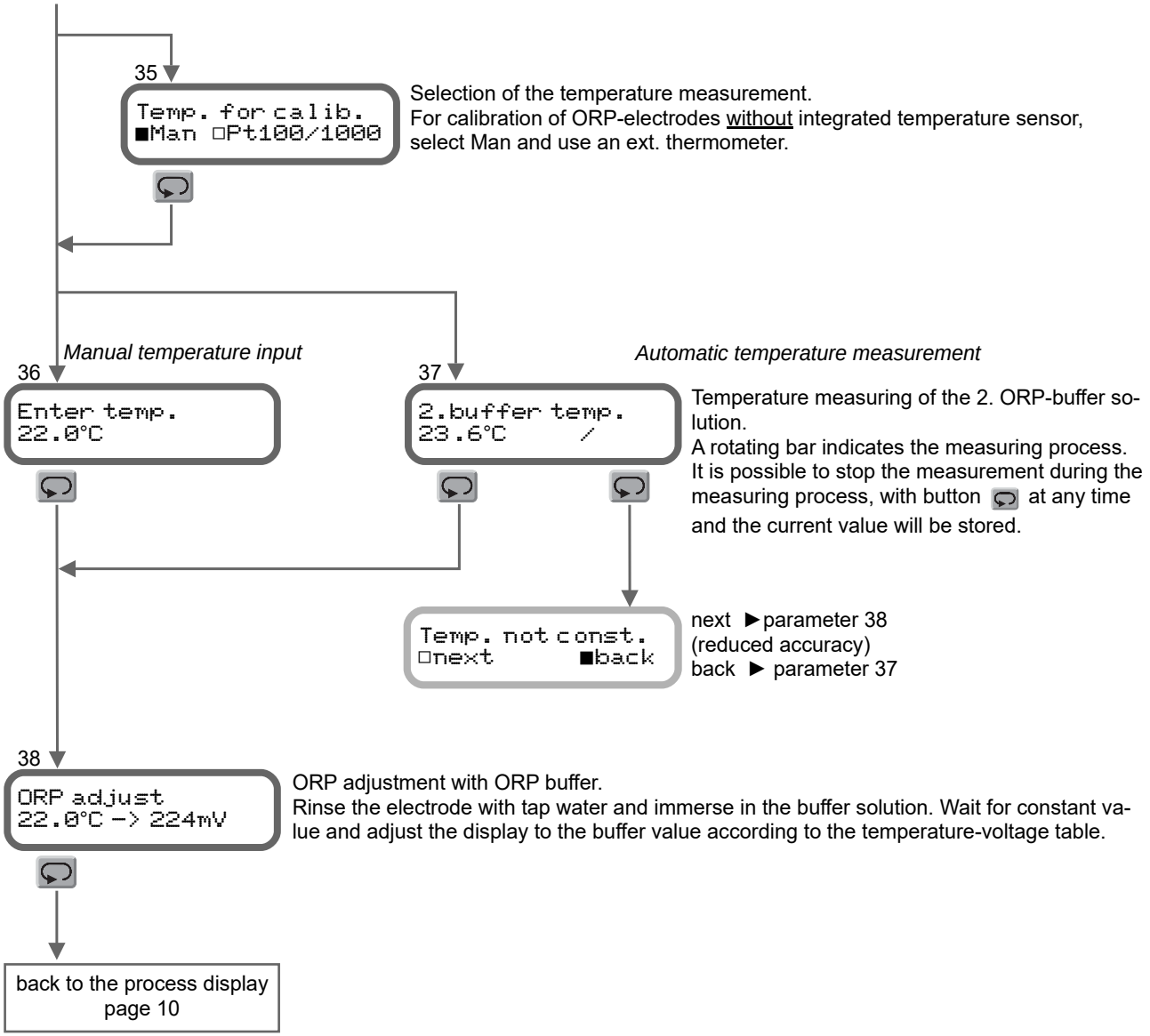
Data calibration



Input of the known zero point of the pH electrode related on 25 °C
(pH-value of the electrode at 0 mV).
Setting possible from 4.00 ... 10.00 pH

Input of the known slope of the pH electrode.
Setting possible from 30.0 ... 80.0 mV.

ORP calibration



Selection of the temperature measurement.
For calibration of ORP-electrodes without integrated temperature sensor, select Man and use an ext. thermometer.

Temperature measuring of the 2. ORP-buffer solution.
A rotating bar indicates the measuring process.
It is possible to stop the measurement during the measuring process, with button at any time and the current value will be stored.

next ►parameter 38
(reduced accuracy)
back ► parameter 37

ORP adjustment with ORP buffer.
Rinse the electrode with tap water and immerse in the buffer solution. Wait for constant value and adjust the display to the buffer value according to the temperature-voltage table.

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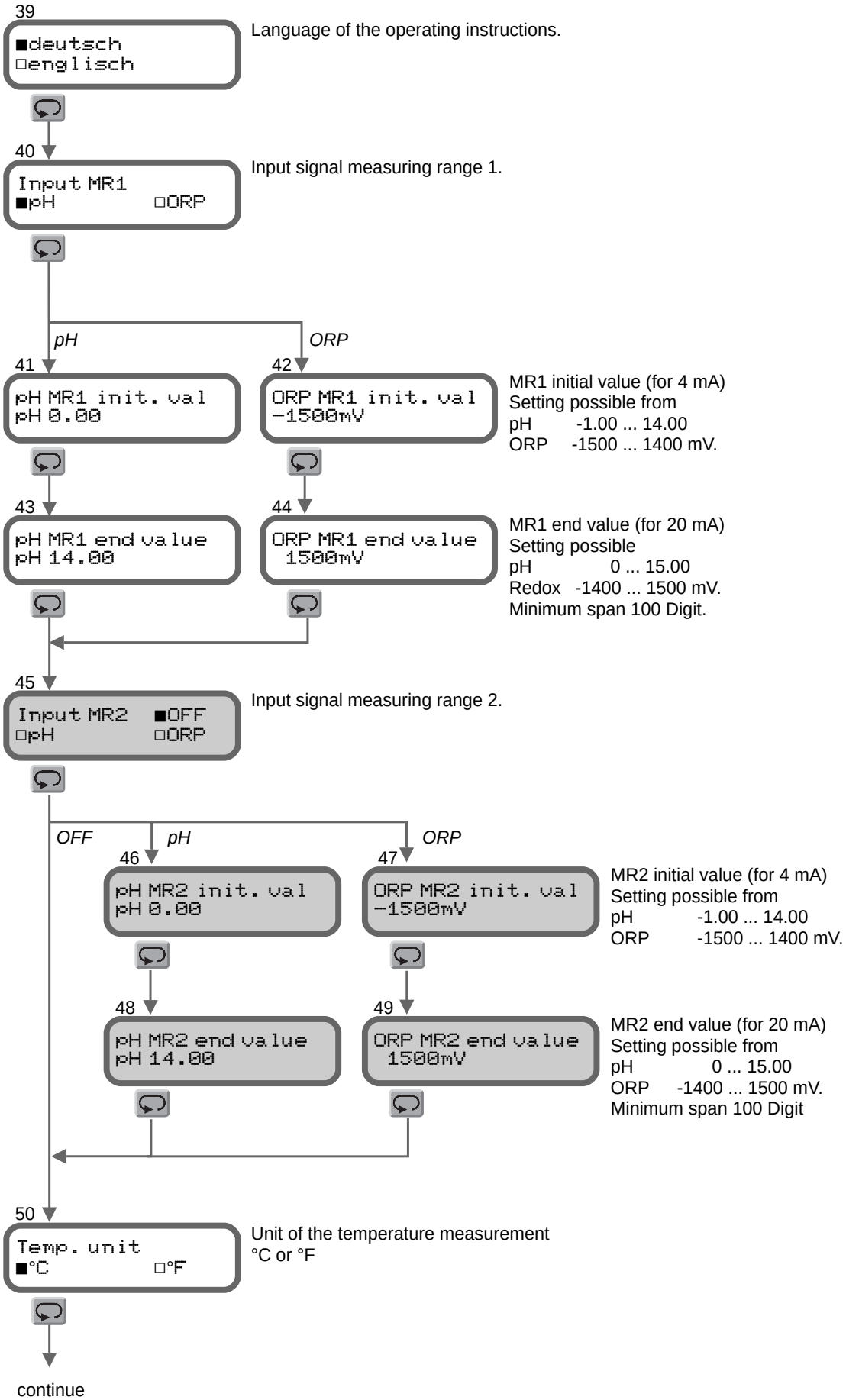
Configuration



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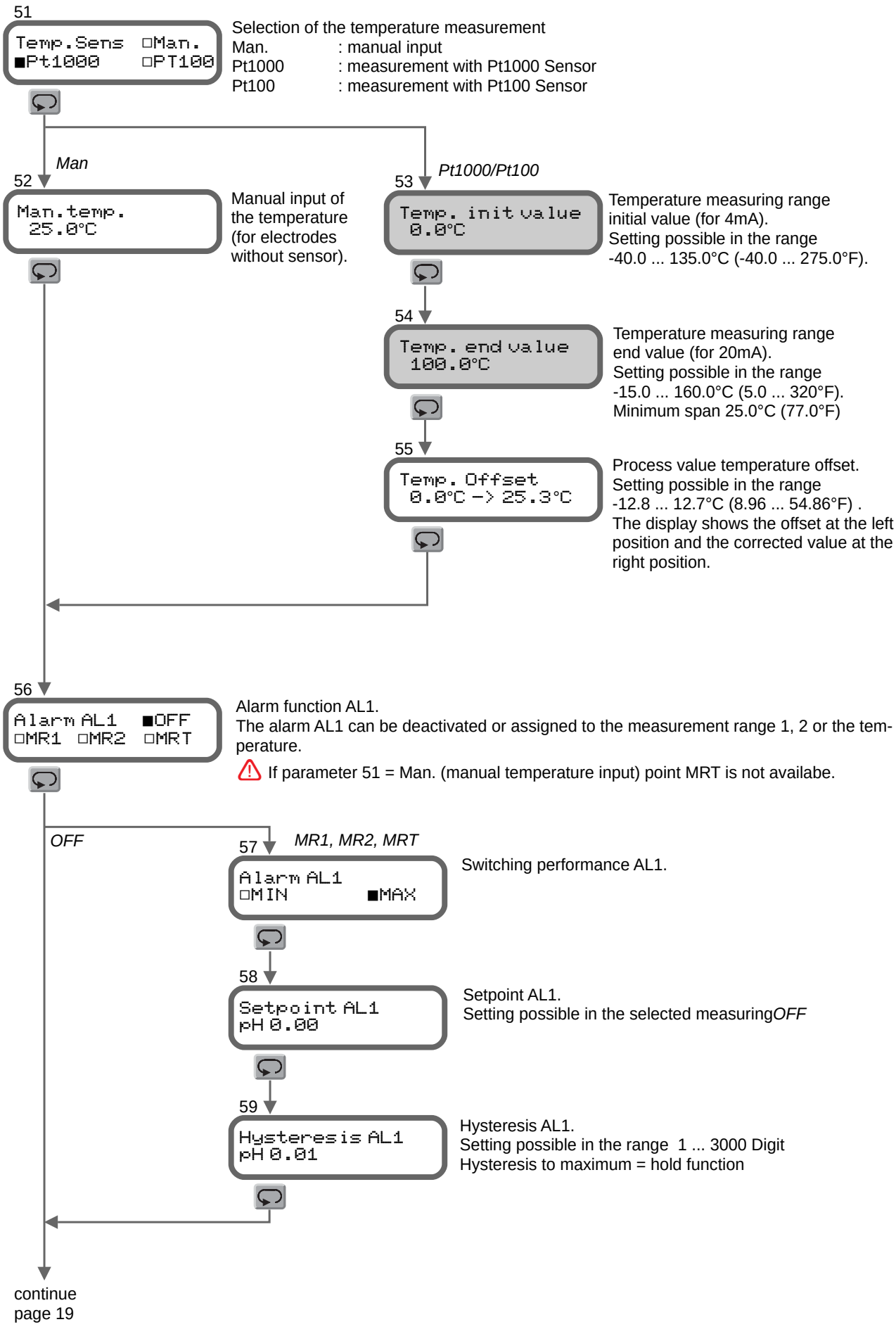

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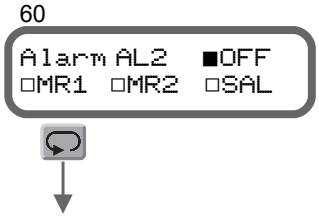
60



Alarm function AL2.
The alarm AL2 can be deactivated or assigned to the measurement range 1 or 2 or to collective alarm (SAL).

⚠ Settings for switching performance, setpoint and hysteresis of the alarm outputs are identical for AL1 and AL2 if MR1 or MR2 is selected.

Collective alarm

If an error occurs the depending alarm-message is displayed in the process display.

61

Monitoring of the maximum glass impedance (for example break of wire).

62

Setpoint of the maximum glass impedance.
The currently measured impedance of the glass electrode is displayed in the first line.
The second line displays the setpoint (MAX Point)
Setting possible in the range 1...1000 MΩ

63

Monitoring of the minimum glass impedance (for example shorted line or break of glass).

64

Setpoint of the minimum glass impedance.
The currently measured impedance of the glass electrode is displayed in the first line. The second line displays the setpoint (MIN Point)
Setting possible in the range 1...1000 MΩ. It is recommended to program a 1/5 of the measured impedance

65

Monitoring of the maximum reference impedance
(only possible with connected liquid ground).
Monitoring of dirty diaphragm.

66

Setpoint of the maximum reference impedance.
The currently measured impedance of the glass electrode is displayed in the first line. The second line displays the setpoint (Max Point)
Setting possible in the range 0.1...100.0 kΩ. It is recommended to program 5-times the value of the measured impedance.

67

Monitoring of the calibration interval.
Setting possible from OFF, 1 ... 1000 days.
Left area shows calibration interval.
Right area shows the remaining days of the interval.

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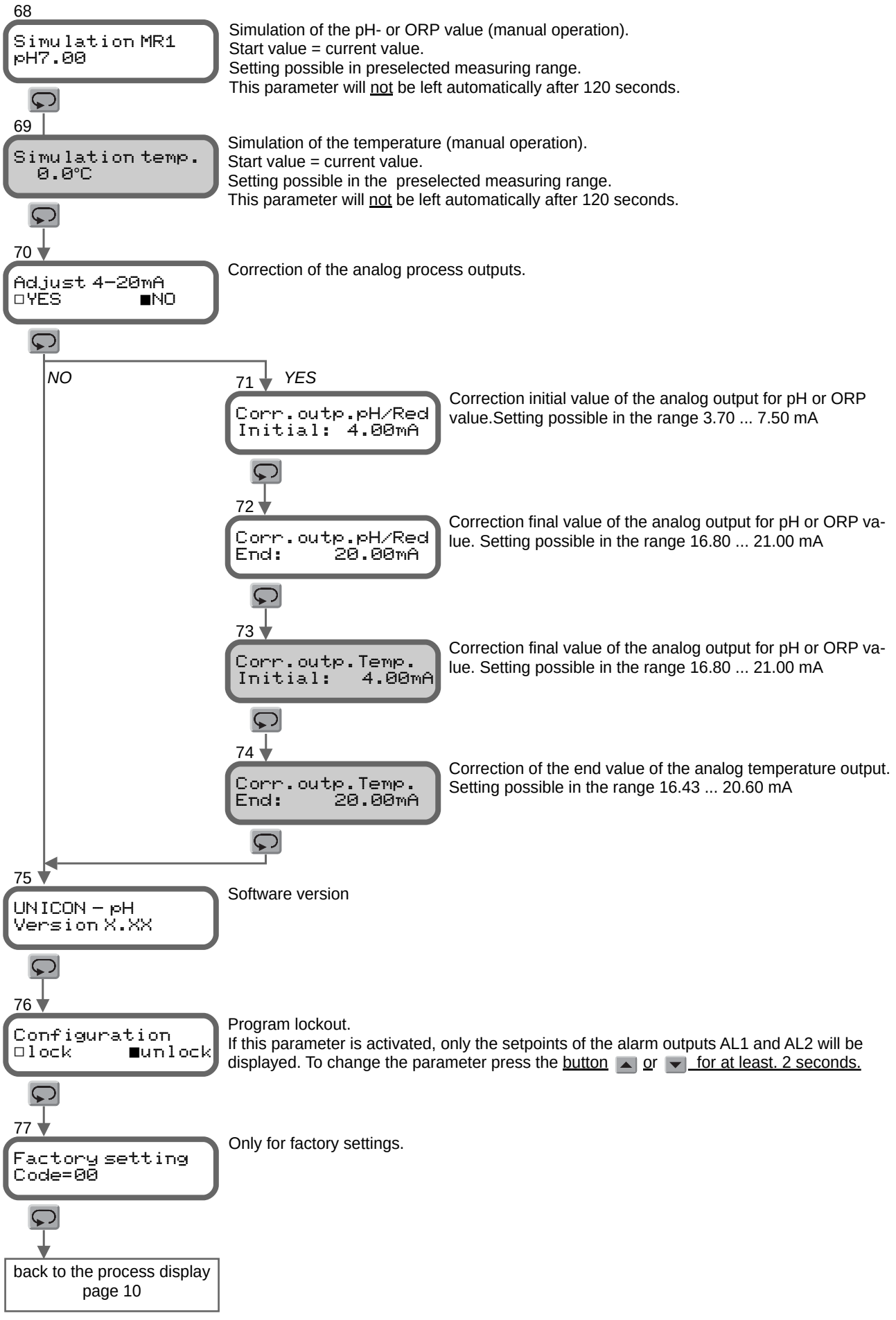

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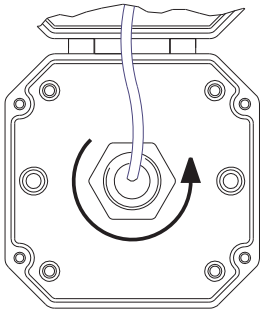
Error messages

Error! Factory check necessary	Memory error. Factory check is necessary
Write protect !!	A changed parameter setting cannot be stored, because the write protection is activated by intern slide switch in position 1. Set the switch to position 0 and modify settings again.
Transm.error RAM<->EEPROM	An error has occurred in the data transfer from the controller to the EEPROM, or the data in the EEPROM are damaged .
after 2 seconds Transm.error for Init RAM	With the button a new initialisation of the EEPROM can be triggered. The factory and calibration settings get lost. The converter works with a reduced precision and should be new calibrated in the factory. All programmed values get lost.
Reset UNICON – pH Version X.XX	The converter triggers an internal reset. An attempt is made to read data from the EEPROM.

Mounting notes

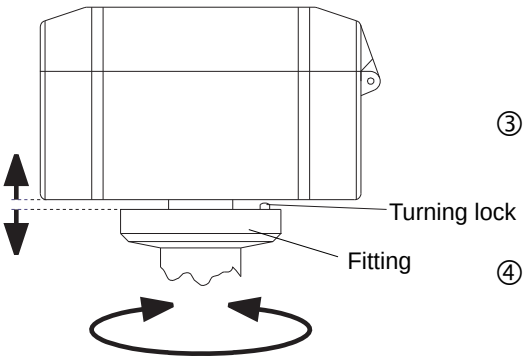
Basically its recommended that there is no air between the active area of the electrode and the measuring solution.
While installing a system with UNICON-pH head mounting, it may be necessary to turn converter and fitting against each other for easy operation and better reading of the display. These assembly variations are possible in steps of 30°.

In order to turn the case against the fitting position, please proceed as follows:



① Open the converter by releasing the 4 cover screws..

② Unscrew the nut of the connection converter and fitting



③ Separate the converter from fitting and place it in the desired Position. Please make sure that the turning lock will click in none of the holes

④ Tighten the nut of the connection converter and fitting.

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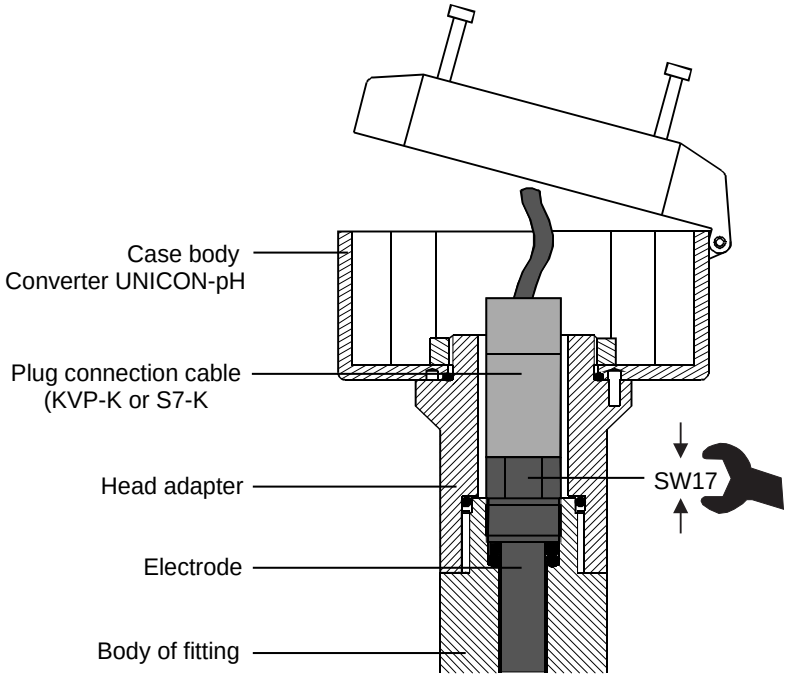
Replacement of electrodes in fittings for head mounting.

pH- and ORP electrodes have a limited life. For replacement operate as follows:

① Open the converter by releasing the 4 cover screws.
② Disconnect connection cable (KVP-K or S7-K) from the terminals11-17 on the circuit board.
③ Unscrew the body of the fitting and head-adapter.
④ Remove the screwed plug of the connection cable from the electrode.
⑤ Unscrew the electrode out of the fitting with a spanner (SW17).



Operating Instruction for pH/ORP- electrodes

Delivery and shipping	The electrodes are supplied with a protection cap filled with a 3-mole KCl-storage solution. This cap prevents a draining of the electrode.
Storage	The electrodes should be stored within the temperature range -5...+30 °C. Otherwise they can be damaged irreparably, by temperatures under -5 °C. In order to avoid a draining of the electrodes, these should be stored with the associated protective cap. With longer storage time, the level of liquid of the cap is to be examined. A storage time longer than 1 year is not recommendable.
Refreshing	Dried electrodes normally can be regenerated, but they will never achieve the original conditions. Therefor the electrode must be stored in a 3-mole KCl-solution for 24 hours. If the electrode should bring thereafter still no satisfying values, a heating up to 60-80° in a water bath can cleanse a possibly blocked up diaphragm. The electrodes with liquid reference must to be filled up.

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Preparing for Measurement

During adjustment of the cable length, the black insulating of the coax lead must be removed.
pH-electrodes have a high internal resistance. Humidity at the connection plug must be avoided (danger; creeping current). Don't touch the contacts of the plug while removing the plug protection cap. Transition resistance lead to an erroneous measurement.
Take off the Protection cap and rinse off possible salt incrustations. Electrodes with liquid electrolyte for the reference electrode must be possibly refilled. Electrodes with gel filling may not be opened, protecting covers may not be shifted. If there are some bubbles at the front measuring area, they are removable by shaking the electrode (like a fibre thermometer).

Calibration

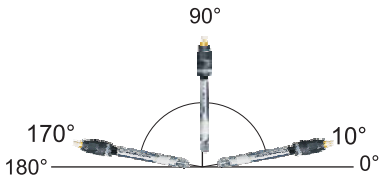
In practice the characteristic curves of the pH electrode deviate from the ideal line. For precise measurement it is necessary to calibrate the pH-electrode during commissioning and after regular time intervals.
It is common to calibrate the electrode with a 2-point-calibration for zero-point and the slope.
The value of the buffer-solution should be nearly at the measuring value of the process. For higher precision it is recommended to heat the solution to the process temperature. Alkaline buffer change theire value while picking up CO2 from the air. Acid buffer are ideal because they have a higher stability. For the best result it´s recommend to calibrate with buffer-solution pH4.00 and pH7.00. The buffer solutions should be used only once.
Before dipping the electrode into the buffer solution, it must be rinsed with water and dabbed with clean fleece cloth. Each pollution of the buffer solution can change their value, and worsen the accuracy of the calibration.

Mounting

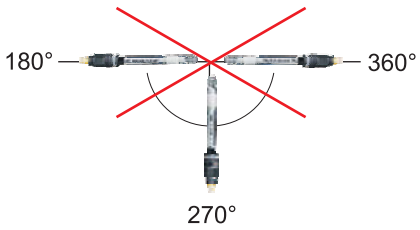
It is very important to mount the electrode immediately before starting up the system, to protect the electrode against drainage.
For the mounting it necessary to use a 17mm ring- or mouth spanner. Other tools will damage the glass protection sheath.

Mounting pos.

The mounting direction should be in range 10° and 170° from the vertical position



YES



NO

Cleaning and maintenance

Dirty electrodes supply incorrect results of measurement. Therefore they should be cleaned in regular intervals. In order not to damage the electrodes, the glass diaphragm should not be scratched or scouring agents treated.
- rough contamination are dabbed with a fleece cloth.
- oily and greasy contamination are eliminated with household cleaner (no scrubbing means).
- calcifying are solved by diluted hydrochloric acid.
- Protein contamination are solved with hydrochloric acid and pepsin mixture.
- contamination of sulfide can be separated in a mixture from hydrochloric acid and thiourea.

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Ordering code

UNICON-pH - [1.] - [2.] - [3.] - [4.] - [ ]

1. Model

1 Output 4 ...20 mA, 2-wire loop powered
for pH- und ORP,
2 transistor alarm outputs,
supply voltage 14 ... 30 V DC,

2 as 1, but additional
2. measuring range for pH and ORP,
output temperature 4 ... 20 mA, 2-wire loop powered,
monitoring impedance of the glass and
reference electrode and the calibration interval as well.

2. Mounting

01 Head mounting
Assembly of the UNICON-pH directly on the fitting of the electrode
Connection of the electrode with a separate connection cable
KVP-K / S7-K(see separate data sheet)

02 Field mounting
Note: Inline fittings, combination electrodes and connection cable must be ordered separately (see separate data sheet)

3. Reference system

3 all systems with electrode zero point pH 7.00
e.g. silver/silver chloride (Ag/AgCl)

4. Temperature measurement

13 Pt1000/Pt100 Sensor via software selectable

Further information about pH- and ORP-measuring systems

-combination pH- and ORP electrodes
-Pt1000 temperature sensor
-in-line fittings
-accessories for conductivity and pH/ORP measurement

please contact us.