Kobold ACM-1

Transmitter/controller for conductivity, TDS, resistance, temperature and standard signals

Operating instructions

WARNING:

A sudden malfunction of the instrument, or one of the sensors connected to it, could potentially result in dangerous overdosing! Suitable preventive measures must be in place to prevent this from happening.

Note:

Please read these Operating Instructions before placing the instrument in operation. Keep the manual in a place which is accessible to all users at all times.

Resetting the brightness of the LC display:

If the brightness setting has been adjusted so that the display text is no longer legible, the basic setting can be restored as follows:

✱ Switch off the supply voltage.

✱ Switch on the supply voltage and immediately press and hold the [▼] and [▲] keys simultaneously.

Operator language selection:

✱ Press the [EXIT] key for longer than 3 seconds.

✱ Select the appropriate language with the [▼] and [▲] keys.

✱ Briefly press the [PGM] key.

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1 Typographical conventions

1.1 Warning signs

Danger

This symbol is used when there may be **danger to personnel** if the instructions are ignored or not followed correctly!

Caution

This symbol is used when there may be **damage to equipment or data** if the instructions are ignored or not followed correctly!

1.2 Reference signs

Note

This symbol is used to draw your **special attention** to a remark.

abc[1]

Footnote

Footnotes are remarks that **refer to specific points** in the text. Footnotes consist of two parts:

A marker in the text and the footnote text.

The markers in the text are arranged as consecutive superscript numbers.

✱

Instruction

This symbol indicates the description of an **action to be performed**.

The individual steps are marked by this asterisk.

Example:

✱ Briefly press the [▲] key.

2 Description

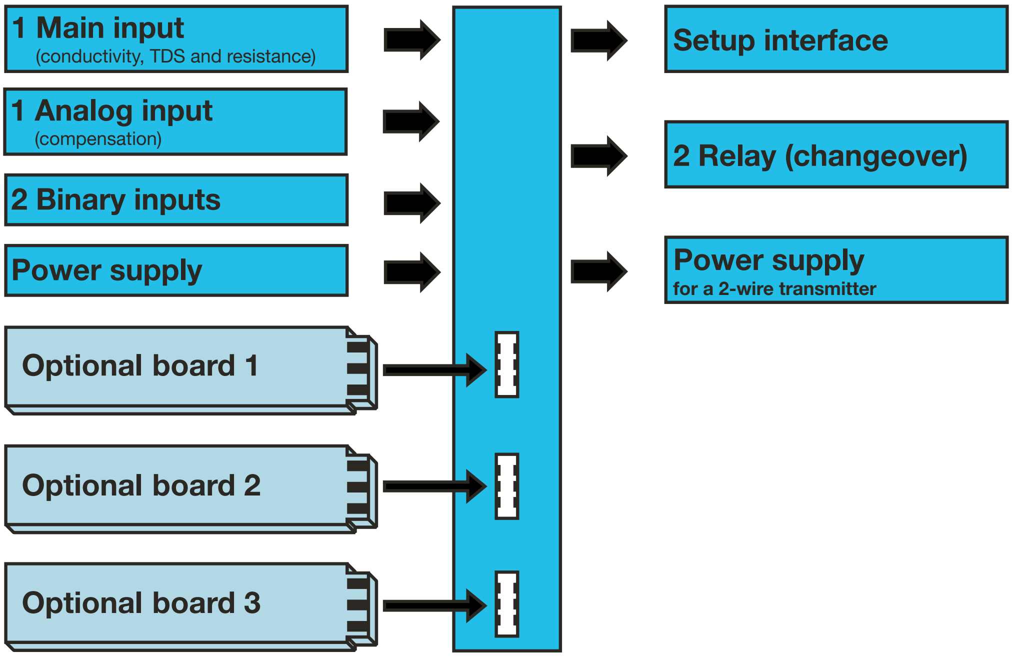
Inputs/outputs

In addition to the main input (conductivity, TDS, resistance) and the secondary input (temperature compensation), the basic instrument alone has two binary inputs, two relays, one power supply for external sensors and a setup interface.

Input signals can be shown as numbers or as a bar graph on the graphic display. Parameters are displayed in plain text for easily comprehensible and reliable operation.

Optional

Three further slots can be fitted with extensive additional configurable inputs and outputs and interfaces.



Application

The instrument is suitable, for example, for displaying, measuring and controlling:

- Conductivity, TDS and resistance.
- Free chlorine, chlorine dioxide, ozone, hydrogen peroxide and peracetic acid, in combination with suitable sensors.
- (Hydrostatic) liquid levels with 2-wire transmitters (level probes)
- Flow rate in conjunction with transmitters
- Two temperature measuring points.
- Most sensors and transmitters that output standard signals (0 - 10 V or 0(4) - 20 mA).

Because temperature measurement is integrated, temperature compensation takes place quickly and precisely, which is particularly important for many analytical measurements.

Special features

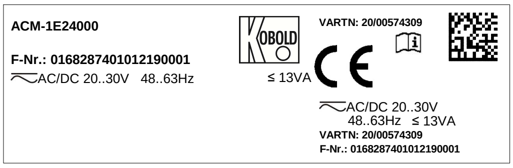
- Display: mS/cm, µS/cm, MOhm x cm, mg/l, pH, mV, etc. Special settings are also possible with the setup program
- Configurable display text (operator level)
- A choice of display visualizations: large numbers, bar graph or tendency

(trend) display
- Four limit controllers
- Integrated calibration routines: with 1, 2 and 3 points
- Math and logic module (optional)
- Calibration logbook
- Three optional slots
- Selectable languages: English, German, French, etc.
- Setup program provides: convenient programming, system documentation
- RS422/485 interface (optional)
- Profibus-DP interface (optional)

3 Instrument identification

3.1 Nameplate

on the transmitter



The date of manufacture is encoded in the "F No." (serial number):
1122 means year of manufacture 2011 / calendar week 22

3.2 Type designation

Order Details (Example: **ACM-1 E 1 0 0 0 Y**)

Model	Version	Housing	Power supply	Option 1 (Optional board)	Option 2 (Optional board)	Option 3 (Optional board)	Special
ACM Evaluation electronics conductivity/ specific resistance/ TDS	**1** = Compact-Line (new) Input: 1x conductivity/ specific resistance/TDS 1x temperature/ standard signal, 2x binary input sensor supply: 2-wire transmitter, 2 relays	**E** = for panel mounting **F** = Field housing **S** = Field housing with wall mounting bracket **R** = Field housing with pipe mounting bracket	**1** = 110...240 V_{AC} -15%/+10%, 48...63 Hz **2** = 20...30 $V_{AC/DC}$, 48...63 Hz	**4** = analogue output 0(4)-20 mA, 0(2)-10V **(Standard)** **0** = without **1** = universal input (Pt100, Pt1000, resistance, current, voltage) **2** = 1 relay (changeover contact) **3** = 2 relays < (NO with common pin) **4** = analogue output 0(4)-20 mA, 0(2)-10V **5** = 2 Photo-Mos relay switch (0.2A) **6** = 1 semiconductor relay TRIAC (1A) **7** = 1 power supply 4.85V (e. g. for ISFET sensor) **8** = 1 power supply 12V_{DC} (e. g. for inductive proximity switch)	**0** = without **1** = universal input (Pt100, Pt1000, resistance, current, voltage) **2** = 1 relay (changeover contact) **4** = analogue output 0(4)-20 mA, 0(2)-10V **5** = 2 Photo-Mos relay switch (0.2 A) **6** = 1 semiconductor relay TRIAC (1A) **7** = 1 power supply 4.85V (e. g. for ISFET sensor) **8** = 1 power supply 12 V_{DC} (e. g. for inductive proximity switch)	**0** = without **1** = universal input (Pt100, Pt1000, resistance, current, voltage) **2** = 1 relay (changeover contact) **3** = 2 Relais (NO with common pin) **4** = analogue output 0(4)-20 mA, 0(2)-10 V **5** = 2 Photo-Mos relay switch (0.2 A) **6** = 1 semiconductor relay TRIAC (1A) **7** = 1 power supply 4.85 V (e. g. for ISFET sensor) **8** = 1 power supply 12 V_{DC} (e. g. for inductive proximity switch) **S** = Interface RS 422/485 **D** = Data logger with interface RS 485[1)] **P** = Interface Profibus DP	**0** = without (factory set) **Y** = adjusted according to customer specification

[1)] The readout of data is only possible with the PC setup software! Note: All languages are available on the device side and can be changes by the customer at any time. The factory default setting of a language (except for "German") entail additional costs.

3.3 Accessories (included in delivery)

4 x fastening elements, complete[1]
3 x CON plug-in link[1]
3 x jumper wire[2]
1 x seal for panel[1]
1 x fastening elements, complete[2]
- 1 x DIN rail fastening left
- 1 x DIN rail fastening right
- 3 x wall mount
- 3 x fastening screw

1 For basic type extension 01 only (in the panel enclosure)
2 For basic type extension 05 only (in the surface-mounted enclosure)

3.4 Accessories (optional)

Type	Sales No.
Holder for C rail	ACM-Halt
PC setup software	ACM-Soft
PC interface cable including USB/TTL converter and two adapters (USB connecting cable)	ACM-Int

Optional board	Code	Sales No.
Analog input (universal)	1	APM-1000001
Relay (1 x changeover)	2	APM-1000002
Relay (2 x NO)	3	APM-1000003
Analog output	4	APM-1000004
Two MosFET semiconductor switches	5	APM-1000005
Semiconductor relay 1 A	6	APM-1000006
Supply voltage output +/- 5 V DC (e.g. for ISFET)	7	APM-1000007
Supply voltage output 12 V DC (e.g. for inductive proximity switch)	8	APM-1000008
Interface - RS422/485	10	APM-100000S
Datalogger with RS485 interface	11	APM-100000D
Profibus-DP interface	12	APM-100000P

4.1 General

Mounting location

Find a location that ensures easy accessibility for the later calibration.

The fastening must be secure and must ensure low vibration for the instrument.

Avoid direct sunlight!

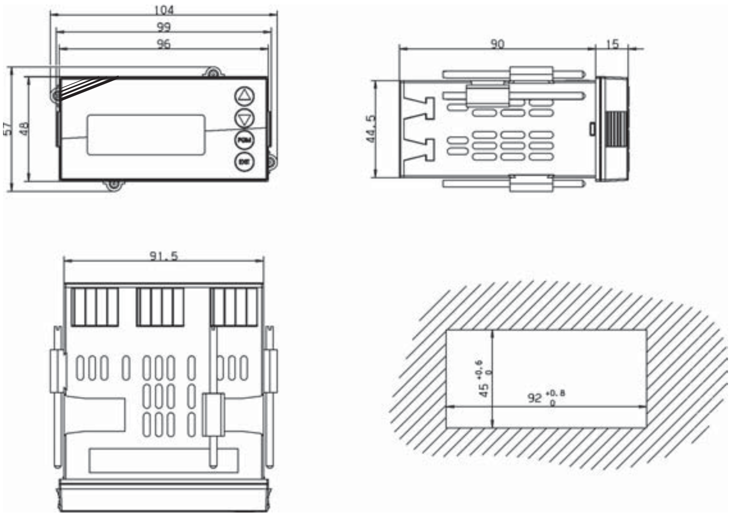
Permissible ambient temperature at the installation location: -10 - 55°C with max. 95% rel. humidity, no condensation.

Installation position

The instrument can be mounted in any position.

4.2 Dimensions

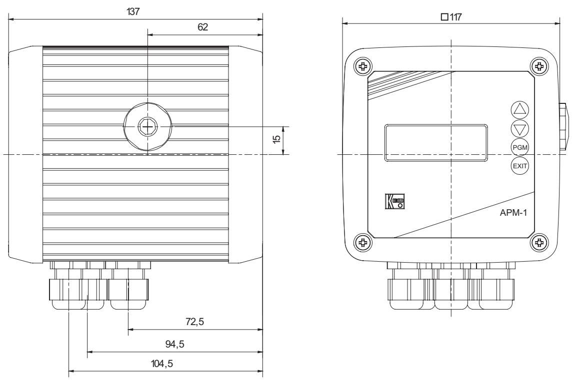
4.2.1 Panel mounting



Close mounting

Minimum spacing of panel cutouts	Horizontal	Vertical
Without setup connector:	30 mm	11 mm
With setup connector (see arrow):	65 mm	11 mm

4.2.2 Field housing



5 Installation

5.1 Installation instructions

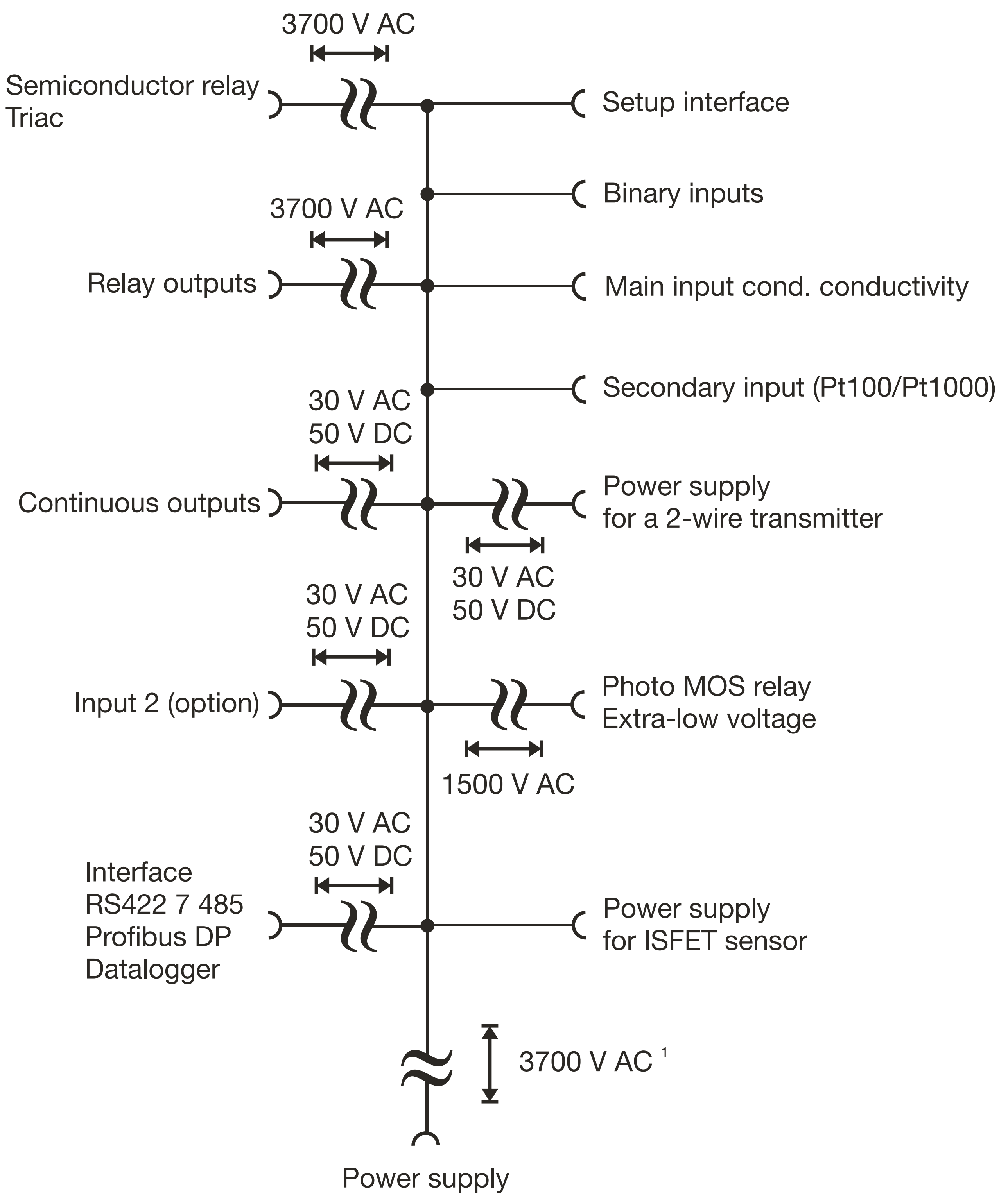
The electrical connection must only be performed by qualified personnel!

- ❑ The choice of cable, the installation and the electrical connection must conform to the requirements of VDE 0100 “Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V” and the relevant local regulations
- ❑ If contact with live parts is possible when working on the device, it must be completely disconnected from the electrical supply.
- ❑ The load circuits must be fused for the maximum load currents in each case to prevent the relay contacts from becoming welded in the event of a short circuit.
- ❑ Electromagnetic compatibility meets the requirements of EN 61326.
- ❑ Lay the input, output, and supply lines so they are physically separated from each other and are not parallel.
- ❑ Use twisted and shielded probe cables. If possible, do not lay these cables close to components or cables through which current is flowing. Ground the shielding at one end.
- ❑ The probe cables must have an uninterrupted run (do not route them via terminal blocks or similar arrangements).
- ❑ No other consumers can be connected to the power terminals of the instrument.
- ❑ The instrument is not suitable for installation in areas with an explosion hazard.
- ❑ Apart from faulty installation, incorrect settings on the instrument may also affect the proper functioning of the subsequent process or lead to damage. You should therefore always provide safety equipment that is independent of the instrument and it should only be possible for qualified personnel to make settings.

Mounting information for conductor cross-sections and ferrules

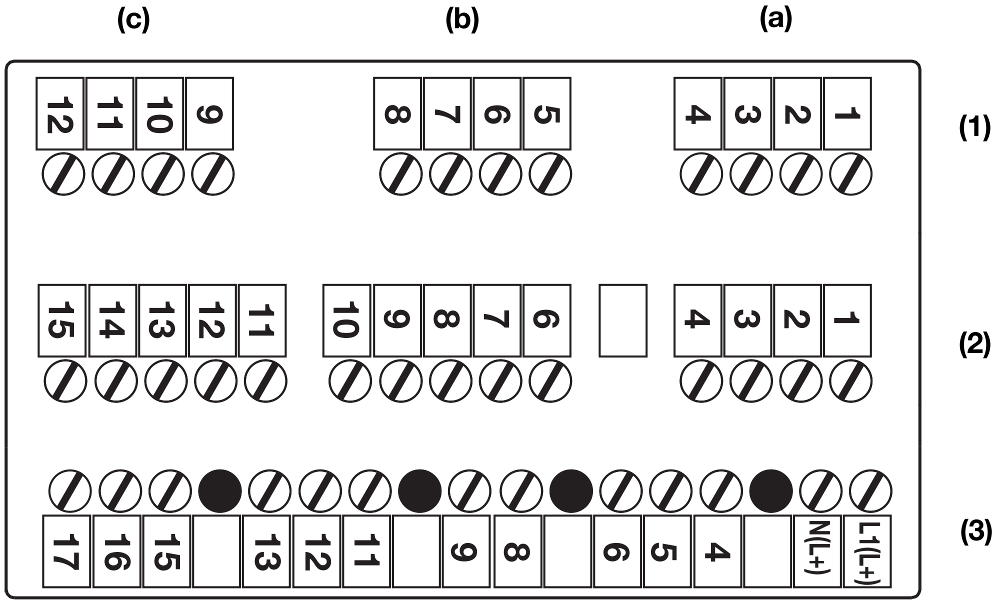
Ferrule	Conductor cross-section		Minimum length of ferrule or stripping
	Minimum	Maximum	
Without ferrule	0.34 mm^2.	2.5 mm^2.	10 mm (stripping)
Without collar	0.25 mm	2.5 mm^2.	10 mm
With collar up to 1.5 mm^2	0.25 mm^2.	1.5 mm^2.	10 mm
Twin, with collar	0.25 mm^2.	1.5 mm^2.	12 mm

5.2 Electrical isolation



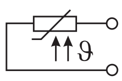
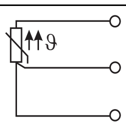
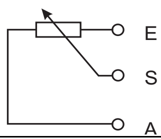
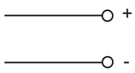
5.3 Connection

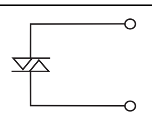
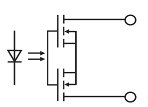
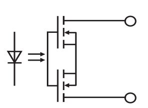
5.3.1 Terminal assignment



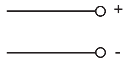
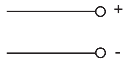
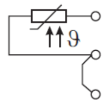
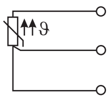
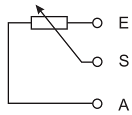
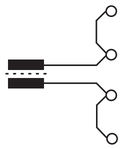
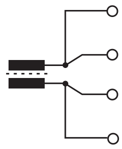
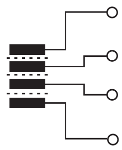
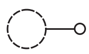
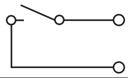
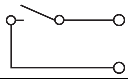
(1)	Row 1	**(a)**	Option 1	**(b)**	Option 2	**(c)**	Option 3
(2)	Row 2	Main input board (conductivity / resistance / temperature / standard signal)					
(3)	Row 3	PSU board (power supply / 2x relays)					

5.3.2 Optional board (row 1, slot a, b or c)

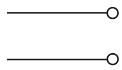
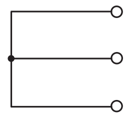
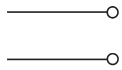
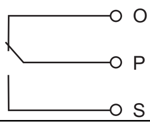
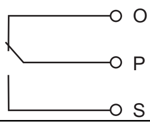
Function	Symbol	Terminal for slot (a)	Terminal for slot (b)	Terminal for slot (c)
Analog input				
Temperature sensor in a two-wire circuit Pt100 or Pt1000		2 4	6 8	10 12
Temperature sensor in a three-wire circuit Pt100 or Pt1000		2 3 4	6 7 8	10 11 12
Resistance transmitter		2 3 4	6 7 8	10 11 12
Electrical current		3 4	7 8	11 12

Function	Symbol	Terminal for slot (a)	Terminal for slot (b)	Terminal for slot (c)
Voltage 0(2) - 10 V	+ -	1 2	5 6	9 10
Voltage 0 - 1 V	+ -	2 3	6 7	10 11
Continuous output				
Current or voltage	+ -	2 3	6 7	10 11
Modbus interface				
RS422	RxD+ RxD- TxD+ TxD-	1 2 3 4	5 6 7 8	9 10 11 12
RS485	RxD/TxD+ RxD/TxD-	3 4	7 8	11 12
Profibus interface				
	VP(+5V) RxD/TxD-P(B) RxD/TxD-N(A) DGND	1 2 3 4	5 6 7 8	9 10 11 12
Datalogger interface				
RS485	RxD/TxD+ RxD/TxD-	2 3	6 7	10 11
Relay (1x changeover)				
	O P S	K3 1 2 3	K4 5 6 7	K5 9 10 11
Relay (2x NO, common pin)				
	S P S	K3 1 2 K6 3		K5 9 10 K8 11
Triac (1 A)				
		K3 2 3	K4 6 7	K5 10 11
Photo MOS relay (0.2 A)				
		K3 1 2	K4 5 6	K5 9 10
		K6 3 4	K7 7 8	K8 11 12

5.3.3 Main board (row 2)

Function	Symbol	Terminal
Standard signal input for electrical current 0(4) - 20 mA		3 4
Standard signal input for voltage 0(2) - 10 V or 10 - 0(2) V		1 4
Temperature sensor in a two-wire circuit Pt100 or Pt1000		2 3 4
Temperature sensor in a three-wire circuit Pt100 or Pt1000		2 3 4
Resistance transmitter		4 3 2
Conductivity cell		
Conductivity cell (2-electrode system) Terminals 6+7 and 8+9 can be bridged on the instrument; 2-wire cable routing up to the head of the conductivity cell. For concentric cells, terminal 6 must be connected with the outer electrode.		6 7 8 9
Conductivity cell (2-electrode system) Wiring for highest accuracy; 4-wire cable routing to the head of the conductivity cell. For concentric cells, terminal 6 must be connected with the outer electrode.		6 7 8 9
Conductivity cell (4-electrode system) 6 - Outer electrode 1 7 - Inner electrode 1 8 - Inner electrode 2 9 - Outer electrode 2		6 7 8 9
Shield connection		
Conductivity cell		10 GND
Binary inputs		
Binary input 1		12+ 14
Binary input 2		13+ 14

5.3.4 PSU board (row 3)

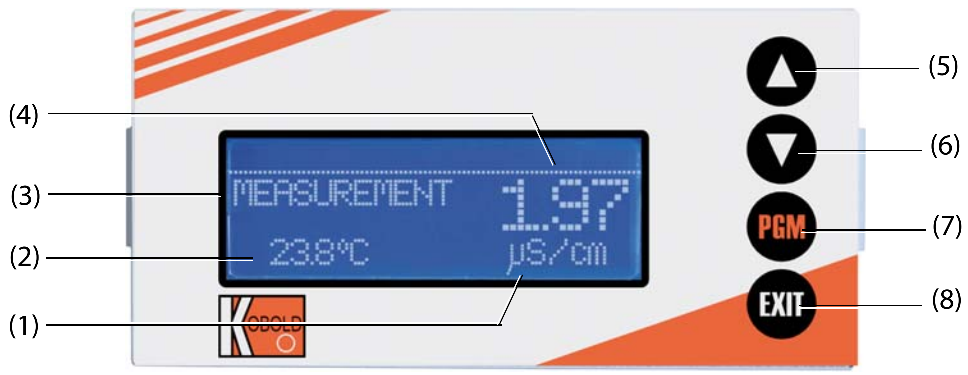
Function	Symbol	Terminal
Power supply for ACM-1		
Power supply: AC 110 - 240 V Power supply: AC/DC 20 - 30 V		1 L1 (L+) 2 N (L-)
n.c.		4 5 6
Supply voltage for external 2-wire transmitter		
24 V DC (-15 / +20%)		8 L+ 9 L–
Relay 1		
Switching output K1 (floating)		11 12 13
Relay 2		
Switching output K2 (floating)		15 16 17

6 Operation

Operation via the instrument keypad is described below.

Instrument operation via th e optional set-up program, See section 12 "Setup program", page 80.

6.1 Controls



(1) Measurement unit

(2) Temperature

(3) Operating mode

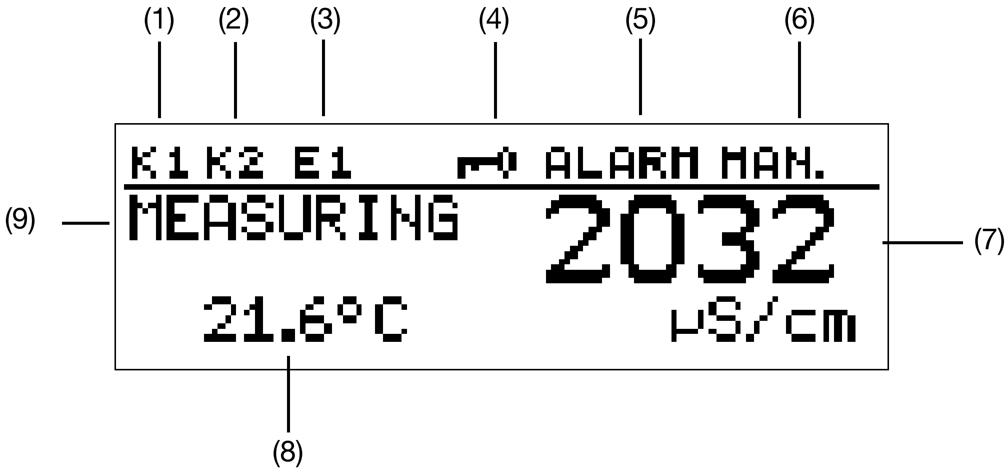
(4) Measured value

(5)	▲ key	Increase numerical value / Forward selection
(6)	▼ key	Decrease numerical value / Forward selection
(7)	PGM key	Change level / Forward selection / Confirm selection
(8)	EXIT key	Cancel entry / Exit level

6.2 Display

6.2.1 Measuring mode (normal display)

Example



(1) Binary output (relay) K1 is active
(2) Binary output (relay) K2 is active
(3) Binary input is active
(4) Keypad is locked
(5) Instrument status
ALARM (flashing): Broken sensor or overrange, etc.
AL R1: Controller monitoring alarm from controller channel 1
AL R2: Controller monitoring alarm from controller channel 2
CALIB: Calibration mode active
CALIB (flashing): Calibration timer elapsed
(6) Output mode
MAN.: Manual mode and/or simulation mode active
HOLD: Hold mode active
(7) Top display
Measured value and unit of the variable set by parameter "Top display"
(8) Bottom display
Measured value and unit of the variable set by parameter "Bottom display"
(9) Operating mode
MEASURING: Standard measuring mode is active

To return to Measuring mode (MEASURING):
Press the EXIT key or wait for a "timeout".

6.3 Principle of operation

6.3.1 Operation in levels

				See page
Measurement mode				
	Normal display			25
	Min/max values of the main input			27
	Min/max values of the optional inputs			28
	Output display			28
	Current values of the main input			28
	Current values of the optional inputs			29
	Current values of the math channels			29
	States of the binary inputs and outputs			29
	Manual mode overview			30
	Hardware information			30
	Instrument information			31
	User data			81
	Calibration (depending on the basic setting)			47, 53
	Manual mode / simulation			35
	Hold mode			38
Main menu				
	User level			31
		Conductivity input		106
		Temperature input		107
		Optional inputs		107
			Analog input 1, 2, 3	
		Binary inputs		109
			Binary input 1, 2	
		Controllers		109
			Controller 1	
			Parameter set 1, 2	
			Configuration	
			Controller 2	
			Parameter set 1, 2	
			Configuration	
			Controller special functions	111
		Limit value control		111
			Limit value 1, 2, 3	
		Binary outputs		112
			Binary output 1, 2, 3, ... 8	
		Analog outputs		113
			Analog output 1, 2, 3	
		Interface		114
		Wash timer		115
		Datalogger		115

- Display 115
- Administrator level (password) 32
  - Parameter level 32
    - Parameters as above for "User level"
  - Release level 32
    - Parameters as above for "User level"
  - Basic setting 32
  - Calibration level 35
    - Main input (depending on the basic setting)
      - Temperature coefficient, linear
      - Relative cell constant
    - Optional input 1, 2, 3
      - Temperature coefficient, linear
      - Temperature coefficient, curve
      - Relative cell constant
      - Zero point
      - Limit point
      - 2-point
  - Calibration release 35
    - Main input (depending on the basic setting)
      - Temperature coefficient, linear
      - Temperature coefficient, curve
      - Relative cell constant
      - Zero point
      - Limit point
      - 2-point
      - 3-point
      - K factor
    - Optional input 1, 2, 3
      - Temperature coefficient, linear
      - Temperature coefficient, curve
      - Relative cell constant
      - Zero point
      - Limit point
      - 2-point
      - 3-point
  - Delete min/max values 35
    - Main input
    - Optional input 1, 2, 3
  - Delete logbook 35
    - Main input
    - Optional input 1, 2, 3
  - Delete daily batch 35
  - Delete total batch 35

Calibration level			47
	Main input		
		Temperature coefficient, linear	
		Temperature coefficient, curve	
	Optional input 1, 2, 3		107
		Temperature coefficient, linear	
		Temperature coefficient, curve	
		Relative cell constant	
		Zero point	
		Limit point	
		2-point	
Calibration logbook			73
	Main input		
	Optional input 1, 2, 3		
Instrument information			31

6.4 Measuring mode

Different display types can be configured, See "Display of measured values STANDARD" page 94.

To return to Measuring mode:
press the EXIT key or wait for a "timeout".

Measurements with "out of range" are ignored.

The min./max. value memory can be reset:
Administrator level / Delete min/max.

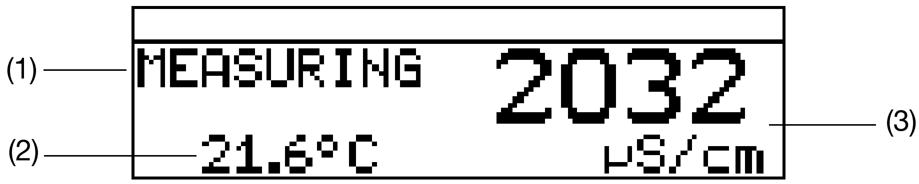
When the basic setting is changed, the min and max values are deleted.

6.4.1 Normal display

Visualization

The following are displayed in Measuring mode:

- Analog input signal
- Unit (for example pH)
- Temperature of the sample medium

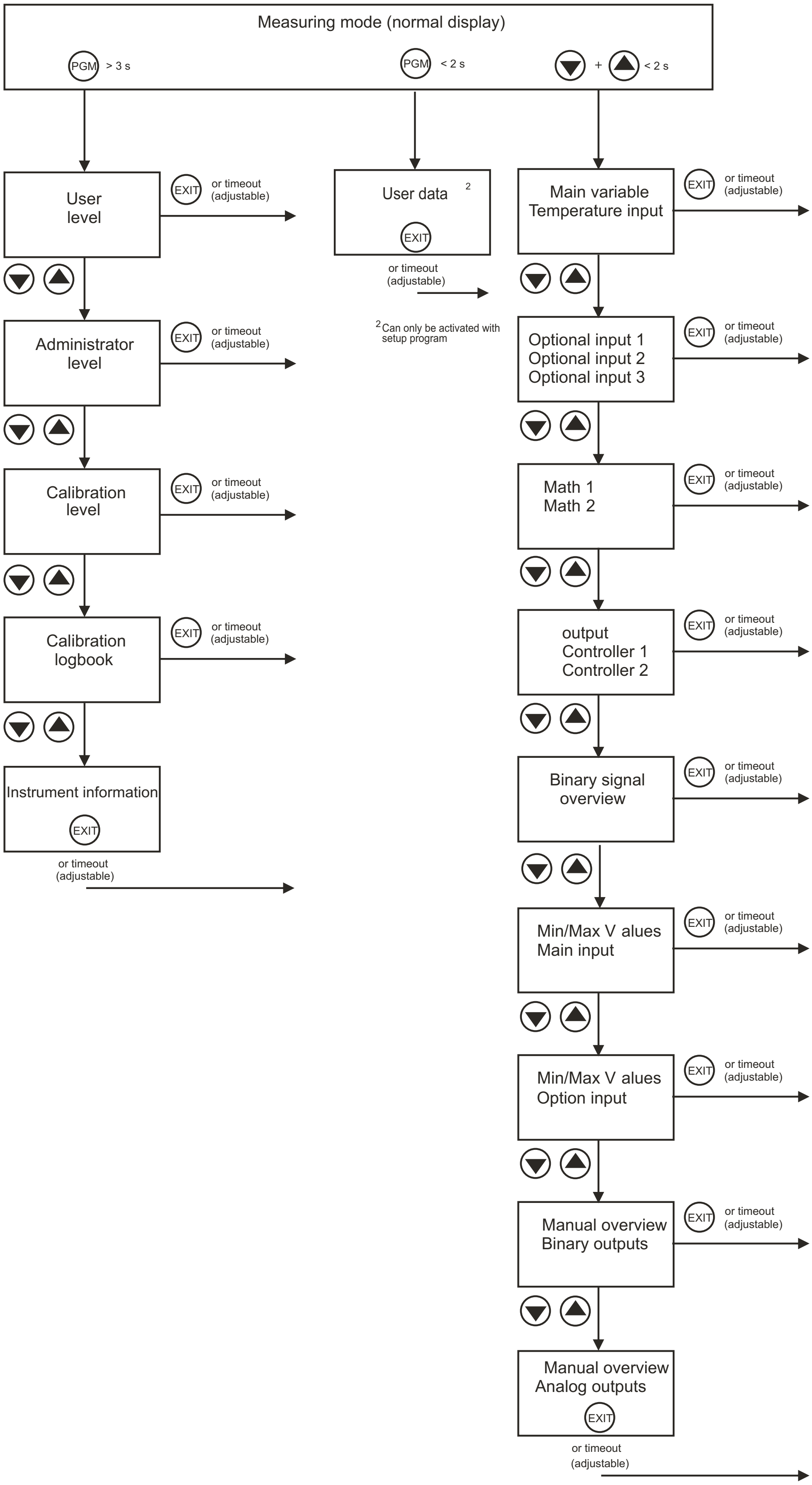


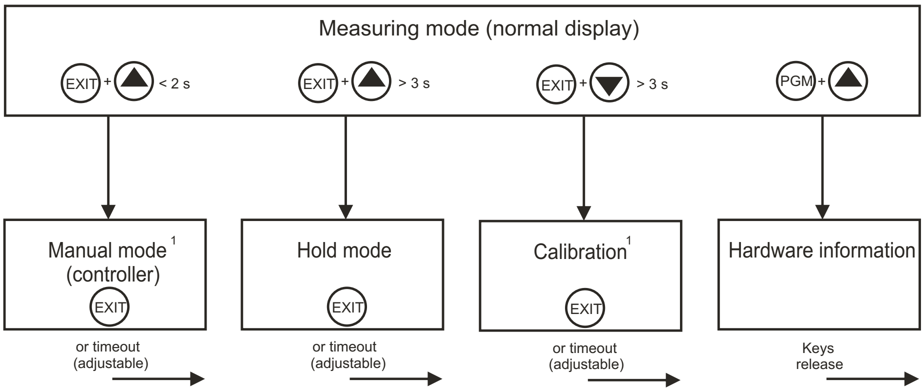
(1) MEASURING -> Measuring mode

(2) 21.6°C -> Temperature of the sample medium

(3) 2032 µS/cm -> the measured value calculated from the standard signal at the input

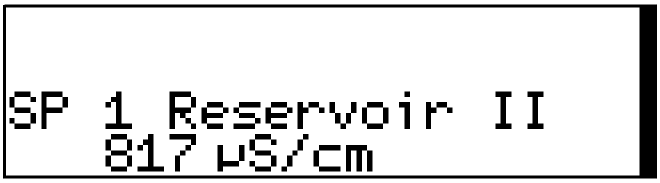
6.5 Input/output information





[1] Only if released

6.5.1 User data



Up to 8 parameters that are frequently changed by the user can be combined in the user level under "User data" (via setup program only).

Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the PGM key.

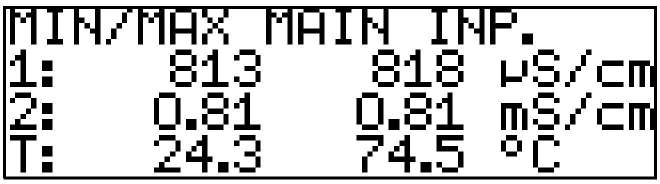
✱ Select the required "quick setting" with the ▲ and ▼ keys.

Editing

✱ Briefly press the PGM key.

✱ Edit the setting with the ▲ and ▼ keys.

6.5.2 Min/max values of the main input



Activating the display

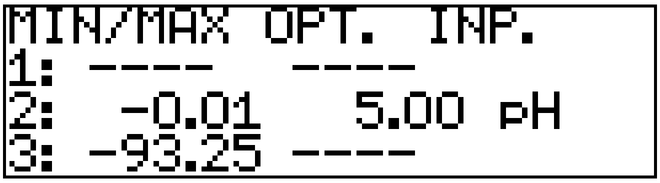
The instrument is in Measuring mode (normal display)

✱ Briefly press the ▲ or ▼ key (several times if necessary).
Minimum and maximum values of the main value "1:" (mS/cm, µS/cm,

MOhm x cm, mV, %, ppm) and the temperature "T:" are displayed.

The extreme values of the main measurement variable and the temperature are **not** mutually assigned (e.g. not 813 µS/cm at 24.3°C).

6.5.3 Min/max values of the optional inputs

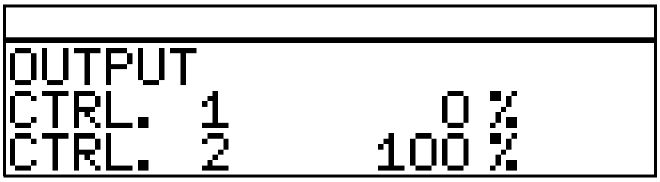


Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the ▲ or ▼ key (several times if necessary).
Minimum and maximum values of the optional inputs (1, 2 and 3) are displayed

6.5.4 Output level

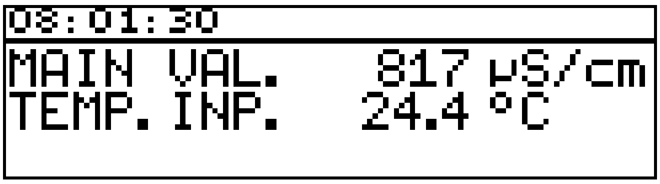


Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the ▲ or ▼ key (several times if necessary).
The current output levels of the controller outputs.

6.5.5 Current values of the main entries



Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the or ▼ key (several times if necessary).
The current values of the main output are displayed.

6.5.6 Curgent values of the optional entries

```
OPT. IN 1      0
OPT. IN 2      0
OPT. IN 3      0
```

Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the ▲ or ▼ key (several times if necessary).
The current values of the optional inputs (1, 2 and 3) are displayed

6.5.7 Current values of the math channels

```
MATHS 1    8888
MATHS 2    8888
```

Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the ▲ or ▼ key (several times if necessary).
The current values of the main output are displayed.

6.5.8 States of the binary inputs and outputs

```
OVERVIEW BIN.SIG.
E1 ○ E2 ○
K1 ⊙ K2 ○ K3 ○ K4 ○
K5 ○ K6 ○ K7 ○ K8 ○
```

Activating the display

The instrument is in Measuring mode (normal display)

✱ Briefly press the ▲ or ▼ key (several times if necessary.
The states of binary inputs E1 and E2 and of relays K1 through K8 are displayed. In the example shown here, relay K1 is active.

6.5.9 Manual mode overview

Analog outputs (optional boards)

In this example, analog outputs 2 and 3 are working normally.

```
MANUAL OVERVIEW
ANALOG INPUT 1   MAN.
ANALOG INPUT 2   ----
ANALOG INPUT 3   ----
```

Switching outputs (PSU board and optional boards)

In this example relay output 2 is in Manual mode.

```
MANUAL OVERVIEW
BINARY OUPUTS
K1 o K2 ◉ K3 o K4 o
K5 o K6 o K7 o K8 o
```

The instrument is in "normal display" mode

✱ Briefly press the [▲] or [▼] key (several times if necessary).

Manual mode can only be displayed if at least one output is in Manual mode. For example Administrator level / Parameter level / Binary outputs / Binary output 1 / Manual mode "Active" or "Simulation".

To return to Measuring mode:
press the [EXIT] key or wait for a "timeout".

6.5.10 Hardware info

These displays are required for phone support.

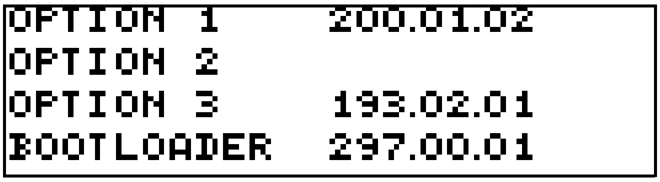
The instrument is in Measuring mode (normal display)

✱ Press and hold the [PGM] and [▲] keys.

```
MAIN CPU     268.01.01-34

MAIN INPUT   269.01.01-04
```

Alternating display



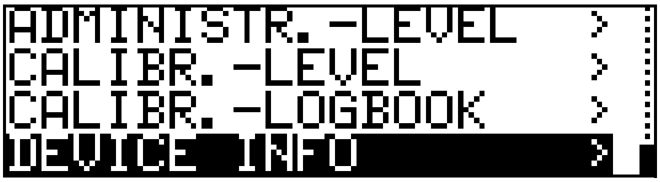
6.5.11 Device info

These displays provide an overview of fitted hardware options and the settings of inputs (helpful for troubleshooting, etc.).

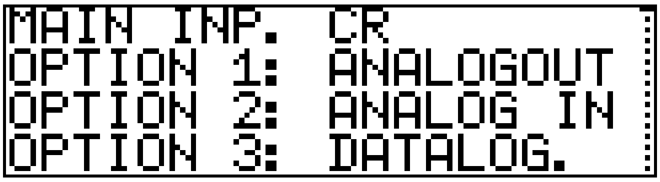
✱ Press the [PGM] key for longer than 3 seconds.

✱ Briefly press the [▲] or [▼] key (several times if necessary).

✱ Select Device info



✱ Press the [PGM] keys.



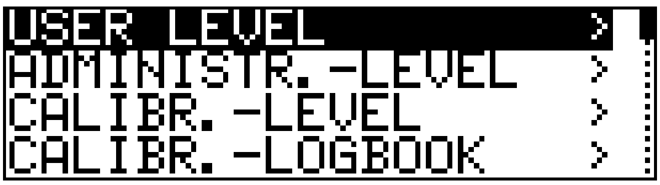
✱ Briefly press the [▲] or [▼] key (several times if necessary).
For further information about the inputs, press the [▲] or [▼] keys.

6.6 User level

All the parameters that the Administrator (See section 6.7 "Administrator level", page 32) has released can be edited at this level. All the other parameters (marked by a key 🔑) are read only.

✱ Press the [PGM] key for longer than 2 seconds.

✱ Select "USER LEVEL".



All possible parameters are accessed below. Depending on the configuration of a specific instrument, some of these parameters may not appear.

6.6.1 Parameters of the User level

See section 16.2 "Parameters of the User level", page 106.

6.7 Administrator level

- All the parameters can be edited at this level.
- At this level, it is also possible to define which parameters can be edited by a "normal" user (operator) and which calibrations can be performed.

To get to the Administrator level, proceed as follows:

✱ Press the [PGM] key for longer than 2 seconds.

✱ Use the [▼] or [▲] keys to select "ADMINISTR.-LEVEL".

✱ Use the [▼] and [▲] keys to enter the password 300 (factory setting).

✱ Confirm the [PGM] key.

6.7.1 Parameter level

The settings that can be made here are the same as those at the User level, See "User level" page 31. As the operator (user) has administrator rights here, the parameters that are locked in the User level can now also be modified.

6.7.2 Release level

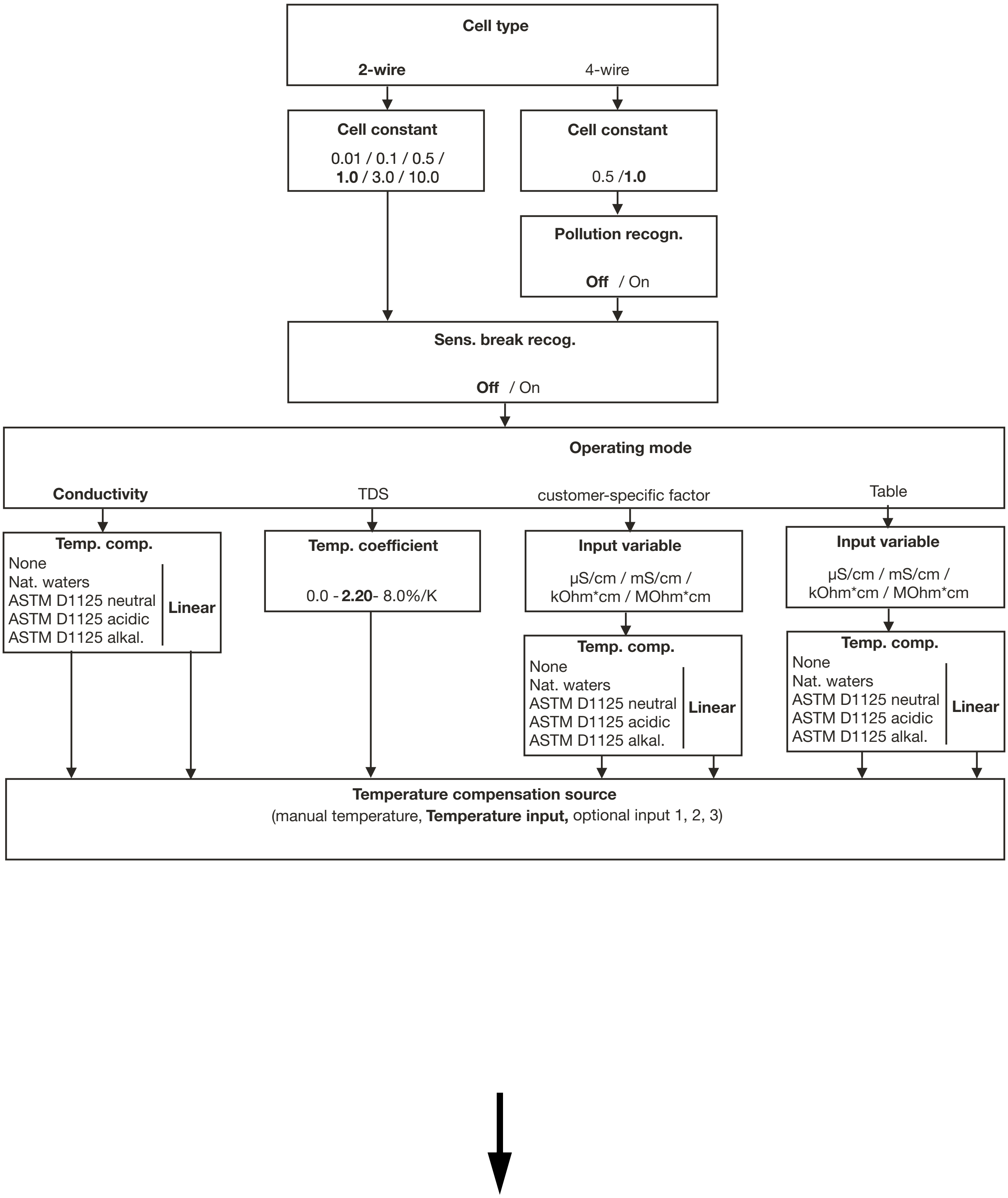
All parameters can be released (modification possible) or locked (no modification possible) for editing at the User level.

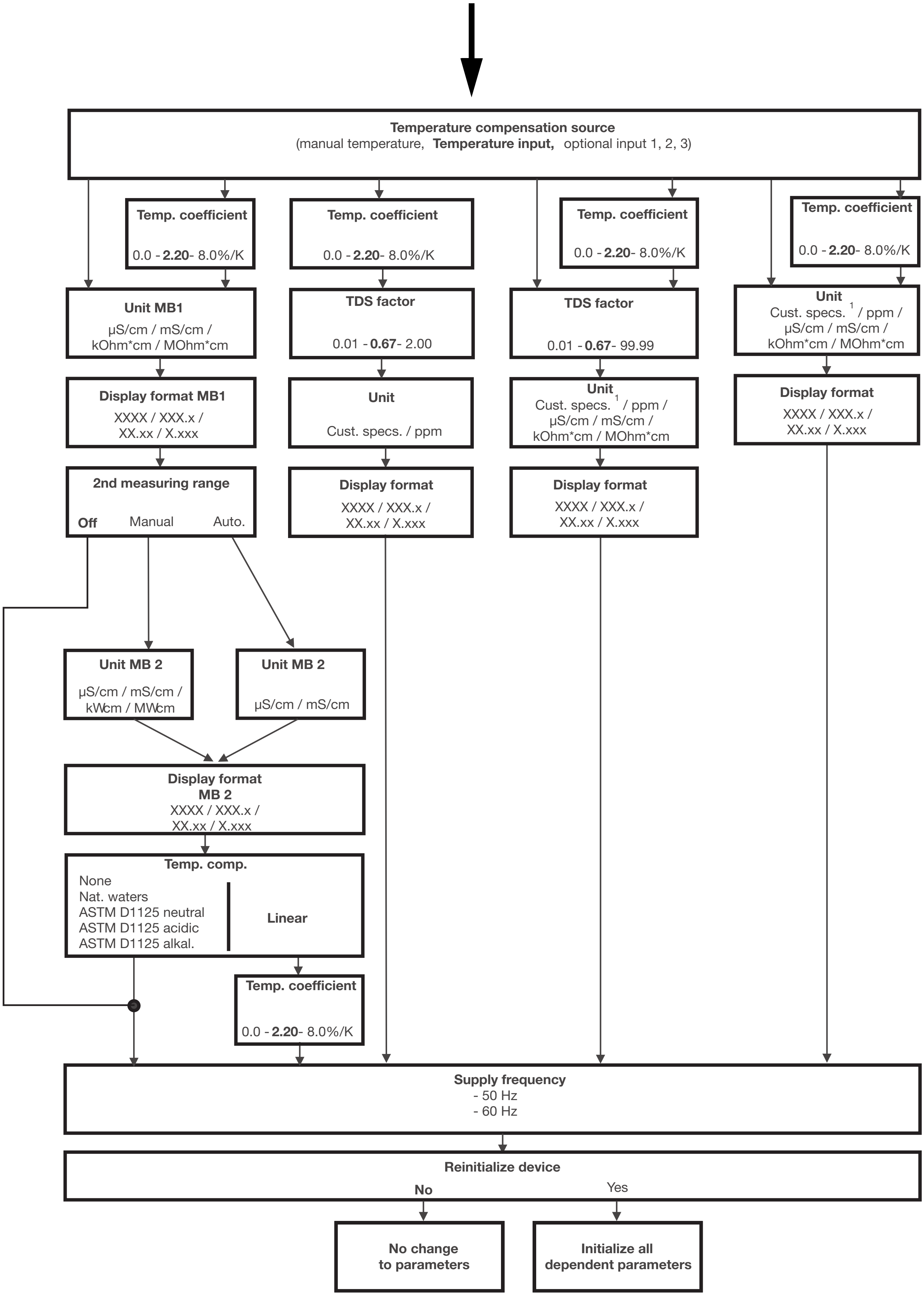
6.7.3 Basic setting

The ACM-1 has a basic setting wizard, to make it easier for the
user to configure the extensive setting options of the instrument and to avoid configuration conflicts.
The basic settings are reached via ADMINISTR.-LEVEL / PASSWORD / BASIC SETTING.

All the important settings are systematically polled here. At the end, once a request for conformation has been acknowledged, the instrument is initialized with the new settings. Dependent parameters are checked and adjusted.

Basic setting wizard




Temperature compensation source
(manual temperature, Temperature input, optional input 1, 2, 3)
Temp. coefficient
0.0 - 2.20- 8.0%/K
Unit MB1
µS/cm / mS/cm / kOhm*cm / MOhm*cm
Display format MB1
XXXX / XXX.x / XX.xx / X.xxx
2nd measuring range
Off
Manual
Auto.
Unit MB 2
µS/cm / mS/cm / kWcm / MWcm
Unit MB 2
µS/cm / mS/cm
Display format MB 2
XXXX / XXX.x / XX.xx / X.xxx
Temp. comp.
None
Nat. waters
ASTM D1125 neutral
ASTM D1125 acidic
ASTM D1125 alkal.
Linear
Temp. coefficient
0.0 - 2.20- 8.0%/K
TDS factor
0.01 - 0.67- 2.00
Unit
Cust. specs. / ppm
Display format
XXXX / XXX.x / XX.xx / X.xxx
Temp. coefficient
0.0 - 2.20- 8.0%/K
TDS factor
0.01 - 0.67- 99.99
Unit
Cust. specs. 1 / ppm / µS/cm / mS/cm / kOhm*cm / MOhm*cm
Display format
XXXX / XXX.x / XX.xx / X.xxx
Temp. coefficient
0.0 - 2.20- 8.0%/K
Unit
Cust. specs. 1 / ppm / µS/cm / mS/cm / kOhm*cm / MOhm*cm
Display format
XXXX / XXX.x / XX.xx / X.xxx
Supply frequency
- 50 Hz
- 60 Hz
Reinitialize device
No
Yes
No change to parameters
Initialize all dependent parameters

6.7.4 Calibration level

Depending on which operating mode has been configured (in the Basic setting menu), one or more of the following calibration options will be available:

- Cell constant
- Temperature coefficient

6.7.5 Calibration release

Which calibration procedure may be performed directly and which may not can be configured here, See section 8.2.2 "Ways to start the calibration", page 48.

6.7.6 Delete min/max values

If required, the values can be deleted once a request for confirmation has been acknowledged.

See "Min/max values of the main input" page 27 or
See "Min/max values of the optional inputs" page 28.

6.7.7 Delete logbook

The last five calibration processes for each input are archived in the calibration logbook. If a "Datalogger" optional board is fitted, the date and time are also archived.
If necessary the logbook can be deleted after a confirmation prompt.

6.7.8 Delete daily batch

If required, the counter can be deleted once a request for confirmation has been acknowledged.

6.7.9 Delete total batch

If required, the counter can be deleted once a request for confirmation has been acknowledged.

6.8 MANUAL mode / Simulation mode

These functions can be used to set the switching outputs and analog outputs of the instrument manually to a defined state. This facilitates dry startup, troubleshooting and customer service, etc. ▲

Simulation mode accesses the analog outputs and binary outputs **directly**. When simulation mode has been selected, MANUAL mode is **not** possible!

In MANUAL mode the settings for "higher order controllers" are taken into consideration.

6.8.1 MANUAL mode only via "higher order" controller functions

Select Manual mode

In the factory setting of the instrument the MANUAL mode parameter is locked and can **only be activated by the administrator**!
This parameter must first be released for other users, See "Release level" page 32.

✱ Set ADMINISTR.-LEVEL / PARAMETER LEVEL / CONTROLLER / CTRL.SPEC. FUNCT. / MANUAL MODE "Locked, **Coding** or **Switching**.

Locked = No Manual mode, control is via device.

Coding = The outputs are active as long as the [▼] or [▲] key is pressed.

Switching = the outputs are active if the [▼] or [▲] key is pressed. If the corresponding key is pressed again, the output becomes inactive again.

Activate Manual mode

The instrument is in Display mode

✱ Press the [EXIT] and [▲] keys for less than 2 seconds.
The word MANUAL appears in the status line of the display.

If the [EXIT] keys (alone) are pressed for longer than 3 seconds, the instrument switches to language selection.

If the [EXIT] and [▲] keys are pressed for longer than 3 seconds, the instrument goes into HOLD mode.

Then the outputs of the instrument respond according to the default settings.

To exit HOLD mode, press the [EXIT] and [▲] keys for longer than 3 seconds.

Control is not longer via the instrument. The output level of the controllers is 0%.

Controller 1 is activated by the [▲] key. In this case the output level of controller 1 is 100%.

Controller 2 is activated by the [▼] key. In this case the output level of controller 2 is 100%.

Deactivation

✱ Press the [EXIT] key.

Control is once again through the outputs of the instrument.
The word MANUAL appears in the status line of the display.

6.8.2 Simulation of binary outputs

Activate simulation

In the factory setting of the instrument the MANUAL mode parameter is set to "No simulation" and can **only be activated by the administrator**!
This parameter must first be released for other users, See "Release level" page 32.

If a higher order switching function has been assigned to an output, Simulation mode is not possible for that output.

* Set ADMINISTR. LEVEL / PARAMETER LEVEL / BINARY OUTPUTS / BINARY OUTPUT1(....8) "Manual mode no simulation, **Inactive** or **Active"**.

No simulation = No Manual mode, control is via device.

Inactive = Relay K1 or K2 is de-energized;the word MANUAL appears in the status line of the display

Active = Relay K1 or K2 is energized;the word MANUAL appears in the status line of the display

Deactivate Manual mode

No simulation = No Manual mode, control is via device.

When the instrument is in display mode, the word MANUAL disappears from the status line of the display.

6.8.3 Simulation of analog outputs via MANUAL mode

Release and activation

* Select activation of simulation of the actual value output: ADMINISTR.-LEVEL / PARAMETER LEVEL / ANALOG OUTPUTS / ANALOG OUTPUT 1 (2, 3) / SIMULATION / ON.

With "On" the output takes on the value of the "Simulation value" parameter.

When the instrument is in display mode, the word MANUAL appears in the status line of the display.

Deactivation

* ADMINISTR.-LEVEL / PARAMETER LEVEL / ANALOG OUTPUTS / ANALOG OUTPUT 1 (2, 3) / SIMULATION / OFF.

The corresponding output of the instrument works again.

When the instrument is in display mode, the word MANUAL disappears from the status line of the display.

6.9 HOLD mode

In HOLD status the outputs take on the states programmed in the relevant parameter (controller channel, switching output or analog output).

This function can be used to "freeze" switching outputs and the analog outputs of the instrument. This means the current status of the output will be retained even when the measured value changes. Control is not via the instrument.

If MANUAL mode is activated while HOLD mode is activated, MANUAL mode takes precedence and MANUAL then appears in the status line of the display! MANUAL mode can be terminated by pressing the EXIT key.
If HOLD mode is still activated (by the binary input or by keyboard), the instrument then returns to HOLD mode!

HOLD mode can be activated by pressing the key or by the binary input.

Activation by pressing key

✱ Press and hold the EXIT and ▲ keys longer than 3 seconds.
Then the outputs of the instrument respond according to the default settings.
The word HOLD appears in the status line of the display.

If the EXIT and ▲ keys are pressed for less than 3 seconds, the instrument goes into Manual mode.

Then the outputs of the instrument respond according to the default settings.

Pressing a key to deactivate HOLD mode

✱ Press the EXIT and ▲ keys for longer than 3 seconds.

If the EXIT and ▲ keys are pressed for less than 3 seconds, the instrument goes into Manual mode.

Then the outputs of the instrument respond according to the default settings.

Control is through the outputs of the instrument again. The word MANUAL disappears from the status line of the display.

7 Commissioning

7.1 Getting started

Some suggestions follow for configuring the instrument reliably in little time.

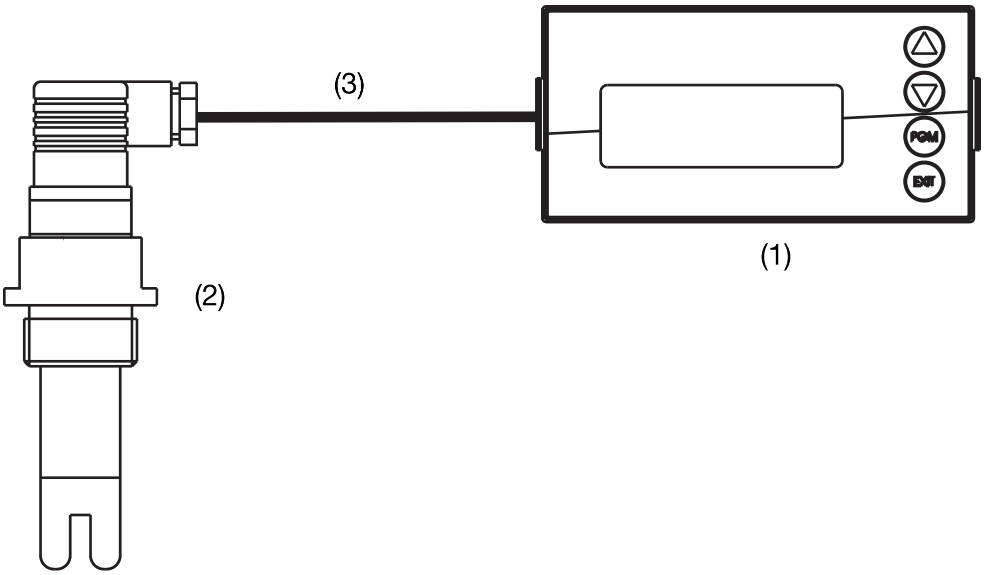
- Mount the instrument, See section 4 "Mounting", page 13.
- Install the instrument, See section 5 "Installation", page 14 ff.
- Call up Administrator level (ADMINISTR. LEVEL).
- Enter password 0300 (factory setting).
- Call up PARAMETER LEVEL / DISPLAY / OPERAT. TIMEOUT.
- Set OPERAT. TIMEOUT to 0 minutes (no timeout).
- Leave the Display level with "EXIT"
- Leave the Parameter level with "EXIT"
- Select BASIC SETTING and work through all the menu items, See section 6.7.3 "Basic setting", page 32.
- Answer "YES" to the "Reinitialize device" query
- Configure the required additional parameters.
- Calibrate the instrument to the conductivity cell and sample medium, See section 8 "Calibrating a conductivity cell", page 47 or
  See section 9 "Calibrating a sensor with a standard signal", page 53.

7.2 Setting examples

7.2.1 Conductivity measurement, temperature compensated

Measurement of drinking water.

Layout



(1) Transmitter/controller type ACM-1
(2) Conductivity cell on the main board
(3) Conductivity cable

Electrical connection

See section 5 "Installation", page 14.

Task

Measurement range:	0 - 1.00 mS/cm
Cell constant K:	1.0 1/cm
Output signal:	4 - 20 mA
Temperature measurement	Pt100
Limit monitoring:	Limit function
Limit value 1:	0.80 mS/cm

7 Commissioning

Basic setting

Start the basic settingsSee section 6.7.3 "Basic setting", page 32
Diagrammatic overview, See section "Basic setting wizard", page 33.

Cell type	2-wire
Cell constant	1.0
Broken sensor detection	Off
Operating mode	Conductivity
Temperature compensation	Linear
Temperature compensation source	Temperature input
Temperature coefficient	2.20 (factory setting)
Unit	mS/cm
Display format	XX.xx
2nd measuring range	Off
Supply frequency	50 Hz
Reinitialize device	Yes

Temperature input

Administrator level / Password / Parameter level / Temperature input

Temperature sensor	Pt100

Analog output

Administrator level / Password / Parameter level / Analog outputs / Analog output 1

Signal source	Main variable
Signal type	4 - 20 mA
Start of scaling	0.00 mS/cm
End of scaling	1.00 mS/cm

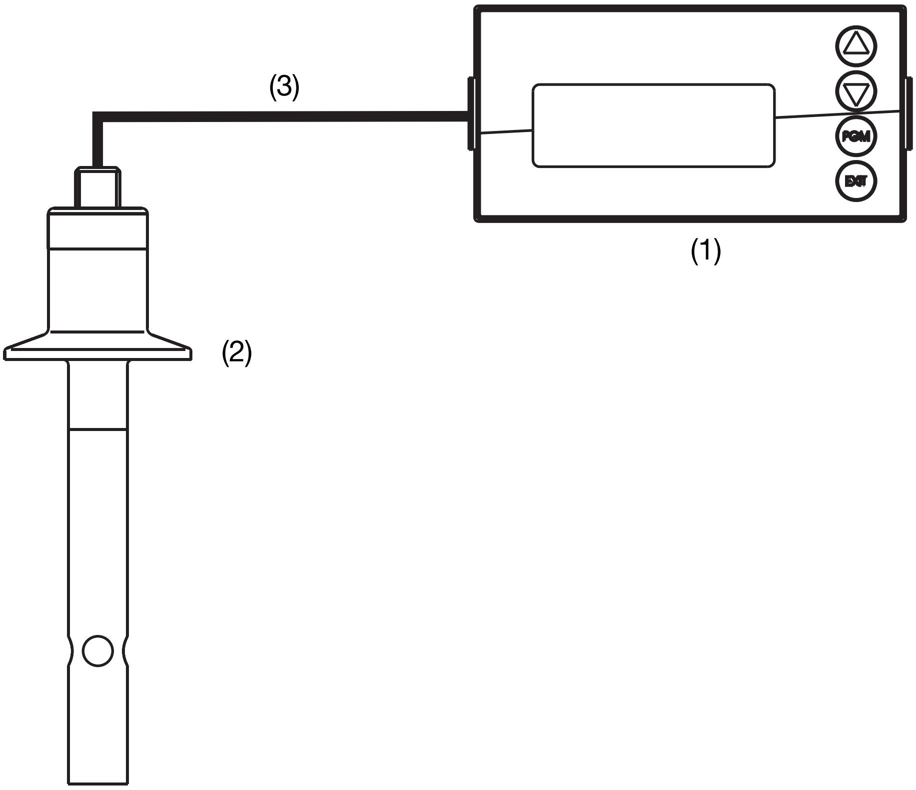
Controller settings

See section 11.6.3 "Controller with limit value function", page 79.

7.2.2 Measurement of ultra-pure water with 2-electrode measuring cell

USP limit monitoring.

Layout



(1) Transmitter/controller type ACM-1
(2) Conductivity cell on the main board
(3) Conductivity cable

Electrical connection

See section 5 "Installation", page 14.

Task

Measurement range:	0 - 2.00 µS/cm
Cell constant K:	0.01 1/cm
Output signal:	4 - 20 mA
Temperature measurement	Pt100
Limit monitoring:	Limit value function
Limit value 1:	USP

7 Commissioning

Basic setting

Start the basic settingsSee section 6.7.3 "Basic setting", page 32
Diagrammatic overview, See section "Basic setting wizard", page 33.

Cell type	2-wire
Cell constant	0.01
Broken sensor detection	Off
Operating mode	Conductivity
Temperature compensation	None
Temperature compensation source	Temperature input
Unit	µS/cm
Display format	X.xxx
2nd measuring range	Off
Supply frequency	50 Hz
Reinitialize device	Yes

Temperature input

Administrator level / Password / Parameter level / Temperature input

Temperature sensor	Pt100

Analog output

Administrator level / Password / Parameter level / Analog outputs / Analog output 1

Signal source	Main variable
Signal type	4 - 20 mA
Start of scaling	0.00 µS/cm
End of scaling	2.00 µS/cm

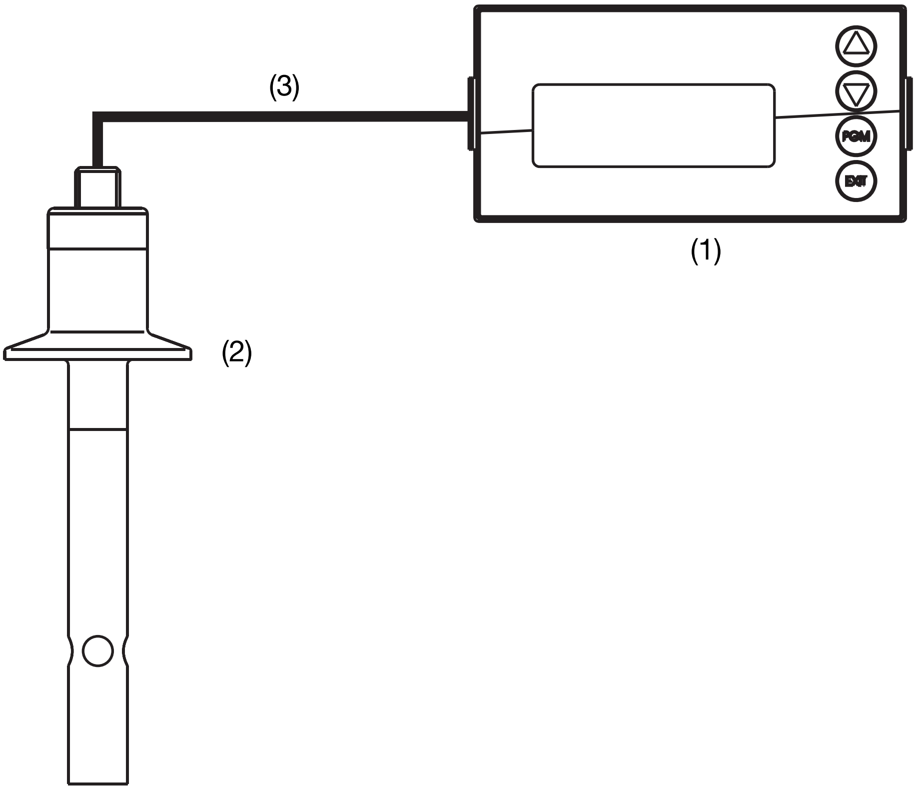
Controller settings

See section 11.6.2 "Limit monitoring to USP", page 78.

7.2.3 Measurement of ultra-pure water with 2-electrode measuring cell

Display in MOhm x cm.

Layout



(1) Transmitter/controller type ACM-1
(2) Conductivity cell on the main board
(3) Conductivity cable

Electrical connection

See section 5 "Installation", page 14.

Task

Measurement range:	0 - 20.00 MOhm x cm
Cell constant K:	0.01 1/cm
Output signal:	4 - 20 mA
Temperature measurement	Pt100
Limit monitoring:	Limit value function
Limit value 1:	10.00 MOhm x cm

7 Commissioning

Basic setting

Start the basic settingsSee section 6.7.3 "Basic setting", page 32
Diagrammatic overview, See section "Basic setting wizard", page 33.

Cell type	2-wire
Cell constant	0.01
Broken sensor detection	Off
Operating mode	Conductivity
Temperature compensation	None
Temperature compensation source	Temperature input
Unit	MOhm x cm
Display format	XX.xx
2nd measuring range	Off
Supply frequency	50 Hz
Reinitialize device	Yes

Temperature input

Administrator level / Password / Parameter level / Temperature input

Temperature sensor	Pt100

Analog output

Administrator level / Password / Parameter level / Analog outputs / Analog output 1

Signal source	Main variable
Signal type	4 - 20 mA
Start of scaling	0.00 MOhm x cm
End of scaling	20.00 MOhm x cm

Controller settings

See section 11.6.1 "Simple limit monitoring", page 78.

8.1 Notes

During calibration, relays and analog output signals adopt their configured states!

When is calibration required?

- The temperature coefficient of the sample medium must be determined once.
- The cell constant must be calibrated at regular intervals (depending on the sample medium and requirements).

Every successfully completed calibration is documented in the calibration logbook, See section 10 "Calibration logbook", page 73.

8.2 General information

The electrical properties of all sensors vary slightly from instance to instance and also change during operation (due to deposits or wear, etc.). This changes the output signal of the sensor.

8.2.1 Requirements

- The instrument must be supplied with voltage, See section 5 "Installation", page 14 ff.
- A conductivity cell must be connected to the transmitter.

For a configuration example See section 7.2.1 "Conductivity measurement, temperature compensated", page 41.

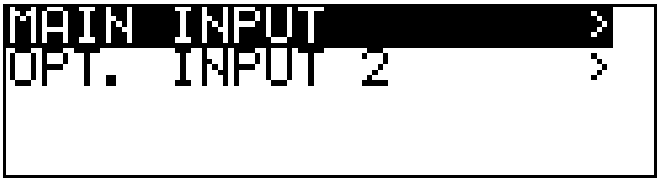
A conductivity cell be

- connected directly to the main input or
- connected to the "Analog input (universal)" optional board via a transmitter.

- "Conductivity" must be configured as operating mode in the basic setting.
- The instrument is in Measuring mode.

8.2.2 Ways to start the calibration

Select the input to which the conductivity cell is connected.



If Calibration level is not released

- Press the [PGM] key for longer than 3 seconds / ADMINISTR.-LEVEL / PASSWORD / CALIBR.-LEVEL / MAIN INPUT or ANALOG INPUT.

If Calibration level is released

- Press the [PGM] and [▼] keys simultaneously / MAIN INPUT or ANALOG INPUT.

If Calibration level is released

- Press the [PGM] key for longer than 3 seconds / CALIBR.-LEVEL / MAIN INPUT or ANALOG INPUT.

8.2.3 Calibration options

The instrument provides two calibration options for adjusting the ACM-1 to the measuring point:

Calibration of the temperature coefficient

See section 8.4 "Calibrating the relative cell constant", page 51.

Calibration of the cell constant

See "Calibrating the relative cell constant" page 51.

8.3 Calibration of the temperature coefficient of the sample medium

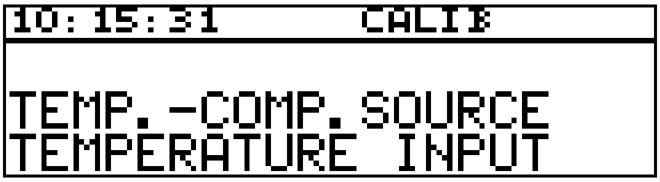
✱ Make preparations, See section 8.2 "General information", page 47.

✱ Start calibration, See section 8.2.2 "Ways to start the calibration", page 48.

✱ Select "TEMP.COEFF. LIN.".

Now the source of temperature acquisition can be selected (manually, or using the temperature input of the PSU board, or the temperature input via the optional board). This source will be active for the duration of the calibration.

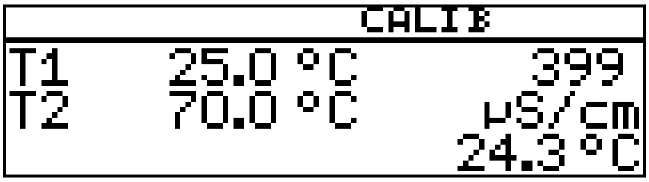
An example follows: automatic temperature acquisition using the temperature sensor integrated into the conductivity cell.



The current sensor temperature appears in the display (+ flashing) (1).

✱ Enter the required working temperature and confirm your entry with the PGM key.

The working temperature must be at least 5°C above or below the reference temperature (25.0°C).



The conductivity (399 µS/cm) at the current temperature (24.3°C) now appears on the right of the LC display.
The temperatures T1 (25°C) and T2 (70.0°C) that have yet to be triggered are shown on the left.

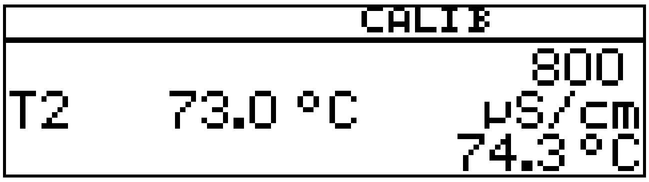
✱ Heat the sample medium until the working temperature is reached.

During calibration, the rate of temperature change in the measurement solution must not exceed 10°C/min.

8 Calibrating a conductivity cell

Calibration is also possible in the cooling process (with a falling temperature). It starts above the working temperature and ends below the working temperature.

As soon as the temperature of the sample medium exceeds T1 (25°C), this is hidden on the display. The uncompensated conductivity at the current temperature is displayed on the right.

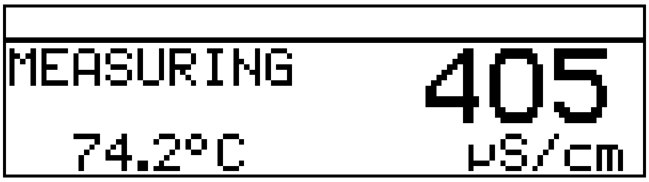


If the temperature of the medium exceeded T2 (73.0°C), the instrument determines the temperature coefficient.

The LC display now shows the determined temperature coefficient as %/K.

✱ Use the PGM key to accept the temperature coefficient or the EXIT key to reject it.

The transmitter is in "measuring mode" and displays the compensated conductivity of the solution.



The currently measured conductivity can be coerced manually by pressing the PGM key. This may be useful if the reference or working temperature cannot be reached precisely.
However, the calibration result incorporates a certain amount of inaccuracy!

8.4 Calibrating the relative cell constant

✱ Make preparations, See section 8.2 "General information", page 47.

✱ Start calibration, See section 8.2.2 "Ways to start the calibration", page 48.

✱ Select the relative cell constant.

✱ Immerse the conductivity cell in a reference solution with a known conductivity.

The measurement solution must maintain a constant temperature during calibration! The conductivity cell must be kept at a distance of at least 20 mm from the container wall during the calibration and must not be moved!

The current measurement value and the temperature are displayed.

✱ When the measurement value is steady, press the PGM key; the conductivity measurement flashes in the display.

✱ Set the value to the actual conductivity.

✱ Press the PGM key. The relative cell constant determined by the instrument is displayed (as a %).

✱ Use the PGM key to accept the value or the EXIT key to reject it.

✱ The current measurement value and the temperature are displayed.

8.4.1 Entering the cell constant manually

If the exact cell constant is known (for example a measuring cell with the ASTM test report), the value can be entered directly.

ADMINISTR.-LEVEL / PARAMETER LEVEL / INPUT CONDUCT. /REL. CELL CONST.

8.4.2 Cell constants

Two-electrode systems

Cell constant [1/cm]	Setting range of the relative cell constant	Resulting usable range [1/cm]
0.01	20 - 500%	0.002 - 0.05
0.1		0.02 - 0.5
1.0		0.2 - 5
3.0		0.6 - 15
10.0		2.0 - 50

Four-electrode systems

Cell constant [1/cm]	Setting range of the relative cell constant	Resulting usable range [1/cm]
0.5	20 - 150%	0.1 - 0.75
1.0		0.2 - 1.5

9 Calibrating a sensor with a standard signal

9.1 General information

During calibration, relays and analog output signals adopt their configured states!

Sensors with a standard signal output can only be connected to an "Analog input (universal)" optional board!

The sensors connected to the instrument should be cleaned and the instrument itself calibrated, at regular intervals (subject to the sample medium).

Every successfully completed calibration is documented in the calibration logbook, See section 10 "Calibration logbook", page 73.

9.1.1 Operating modes

The operating mode selection depends on which sensor (transmitter) is connected.

Linear operating mode

For example sensor for free chlorine, redox, pressure, liquid level or humidity

pH operating mode

For example pH sensor

Conductivity operating mode

For example sensor for conductivity, concentration

Customer specs.

For sensors with non-linear characteristics.
Up to xx interpolation points can be defined in an instrument table.
This allows for an excellent approximation of a non-linear characteristic.

Chlorine, pH and temperature-compensated

Combination of chlorine sensor and pH sensor and temperature sensor.
The measured value for chlorine often depends to a great extent on the pH value of the solution.
The chlorine measurement is compensated depending on the pH value in this operating mode. The pH measurement is temperature-compensated

9.1.2 Calibration options

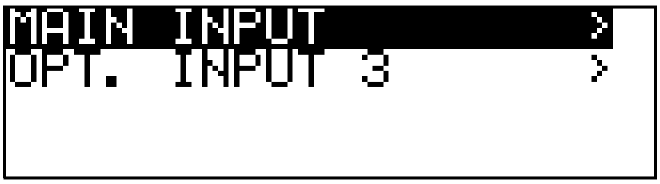
Different calibration options are available depending on the operating mode.

Operating mode	Calibration options					Page
	1-point	2-point	Limit point	Rel. cell const.	Temp.coeffic.	
Linear	X	X	X	-	-	55
pH	X	X	-	-	-	59
Conductivity	-	-	-	X	X	63
Concentration	-	-	-	X		69
Customer specs.	Due to the table with interpolation points, no calibration is required					
Chlorine, pH-compensated	-	-	X	-	-	71

- With **one-point (offset) calibration**, the zero point of the sensor is calibrated.
- With **two-point calibration**, the zero point and slope of the sensor are calibrated. This is the recommended calibration for most sensors.
- With **one-point final value calibration**, the slope of the sensor is calibrated. This is the recommended calibration for chlorine sensors, for example.
- **Calibration of relative cell constant**
  With conductivity measuring cells only.
- **Calibration of the temperature coefficient**
  With conductivity measuring cells only.

9.1.3 Ways to start the calibration

Select the input to which the sensor is connected.



If Calibration level is not released

- Press the PGM key for longer than 3 seconds / ADMINISTR.-LEVEL / PASSWORD / CALIBR.-LEVEL / OPTION INPUT.

If Calibration level is released

- Press the PGM and ▼ keys simultaneously / OPTION INPUT.

If Calibration level is released

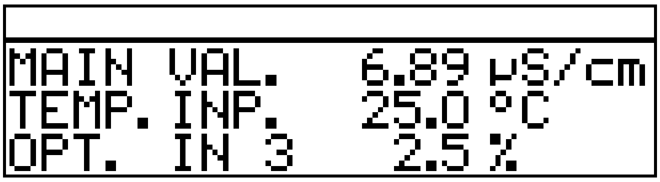
- Press the PGM key for longer than 3 seconds / CALIBR.-LEVEL / OPTION INPUT.

9.2 Linear operating mode

9.2.1 1-point calibration

This example is based on a liquid level measurement (as a %).
The input signal is provided by a pressure transmitter.

- The transmitter is in "Measuring mode".

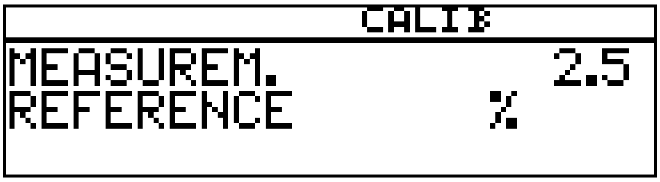


✱ Now bring the system to a defined state (e.g. when measuring liquid level, empty the container).

✱ Start the calibration, See "Ways to start the calibration" page 54.

✱ Select the zero point calibration with the [PGM] key.

✱ Wait until the display value has stabilized; then press [PGM] to continue.



Set the displayed value to the required value (usually 0%) with the [▼] and [▲] keys; then press [PGM] to continue.

The zero point determined by the instrument is displayed.

Use the [PGM] key to accept the value or
the [EXIT] key to reject it.

The instrument returns to Measuring mode.

```
MAIN VAL.   6.89 µS/cm
TEMP. INP.  25.0 °C
OPT.  IN 3   0.0 %
```

Calibration is complete

After rinsing, the sensor can again be used to take measurements.

9.2.2 Two-point calibration

The values determined during calibration (zero point and slope) work out as follows:

$$\text{Display} = \frac{\text{Input value}}{\text{Slope}} + \text{Zero point}$$

This example is based on a liquid level measurement. The input signal is provided by a pressure transmitter.

- The transmitter is in "Measuring mode".

```
MAIN VAL.   6.89 µS/cm
TEMP. INP.  25.0 °C
OPT.  IN 3   2.5 %
```

✱ Now bring the system to a defined state (e.g. when measuring liquid level, empty the container).

✱ Start the calibration, See "Ways to start the calibration" page 54.

✱ Select the 2-point calibration with the PGM key.

```
ZERO POINT       >
LIMIT POINT      >
2-POINT          >
```

✱ Wait until the display value has stabilized; then press PGM to continue.

```
            CALIB
MEASUREM.          2.5
REF.  1          %
```

✱ Set the displayed value to the required value (usually 0) with the [▼] and [▲] keys; then press [PGM] to continue.

```
            CALIB
INPUT              0.0
REF.  1          %
```

✱ Now bring the system to a second defined state (e.g. when measuring liquid level, container full).
Wait until the display value has stabilized; then press [PGM] to continue

```
            CALIB
MEASUREM.         94.9
REF.  2          %
```

✱ Set the displayed value to "Maximum" (usually 100%) with the [▼] and [▲] keys; then press [PGM] to continue.

```
            CALIB
INPUT            100.0
REF.  2          %
```

The zero point and slope determined by the instrument are displayed.

✱ Use the [PGM] key to accept the calibrated values or reject them with the [EXIT] key.

```
            CALIB
ZERO POINT  -2.7%
SLOPE      108.2%
```

✱ The instrument returns to Measuring mode.

```
MAIN VAL.   6.89 µS/cm
TEMP.INP.   25.0 °C
OPT.  IN 3 100.0 %
```

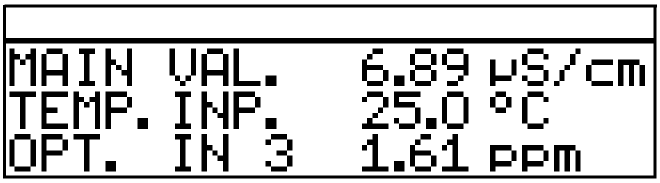
Calibration is complete

After rinsing, the sensor can again be used to take measurements.

9.2.3 Calibration limit point

This example is based on a measurement of free chlorine. The input signal is provided by a corresponding transmitter.

- The transmitter is in "Measuring mode".

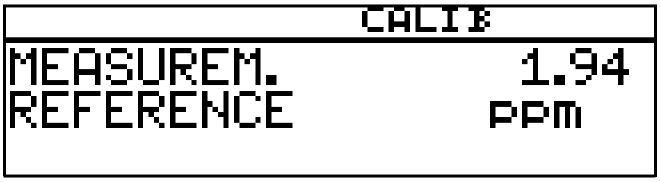


✱ The process must now be brought to the state that is as relevant as possible to the final value (e.g. when measuring chlorine, the required concentration).

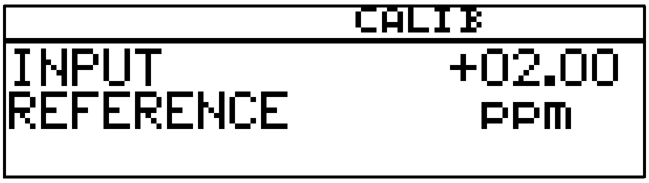
✱ Start the calibration, See "Ways to start the calibration" page 54.

✱ Select the limit point calibration with the PGM key.

✱ Wait until the display value has stabilized; then press PGM to continue.



Set the displayed value to the measured reference value with the ▼ or ▲ keys; then press PGM to continue.



The slope determined by the instrument is displayed.

✱ Use the PGM key to accept the value or the EXIT key to reject it.

```
                CALIB
SLOPE            97.5%
```

✱ The instrument returns to Measuring mode.

```
MAIN VAL.    6.89 µS/cm
TEMP. INP.   25.0 °C
OPT.  IN 3   1.61 ppm
```

Calibration is complete

After rinsing, the sensor can again be used to take measurements.

9.3 pH operating mode

9.3.1 Zero point (1-point) calibration

This example is based on a glass combination electrode with a connected two-wire transmitter.

- The transmitter is in "Measuring mode".

```
10:42:08
MAIN VAL.    6.89 µS/cm
TEMP. INP.   5.00 pH
OPT.  IN 3   24.4 °C
```

✱ Perform calibration as follows.

Zero point (1-point) calibration

✱ Make preparations, See section 8.2 "General information", page 47 .

✱ Start calibration, See section 8.2.2 "Ways to start the calibration", page 48.

✱ Select zero point calibration.

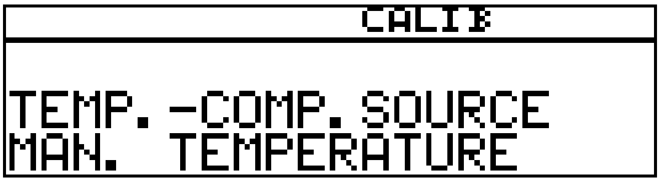
```
ZERO POINT          >
2-POINT             >
3-POINT             >
```

✱ Immerse the combination electrode in a buffer solution with a known pH value.

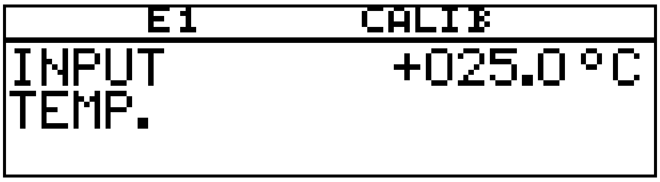
✱ Start the zero point calibration with the PGM key.

Now the source of temperature acquisition can be selected (manually, or using the temperature input of the PSU board, or the temperature input via the optional board). This source will be active for the duration of the calibration.

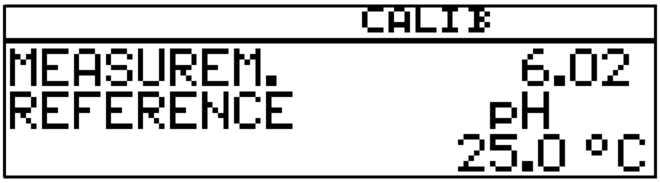
An example follows: manual temperature entry.



✱ To enter the temperature manually, use the ▼ and ▲ keys to set the calibration solution temperature and confirm your entry with the PGM key.



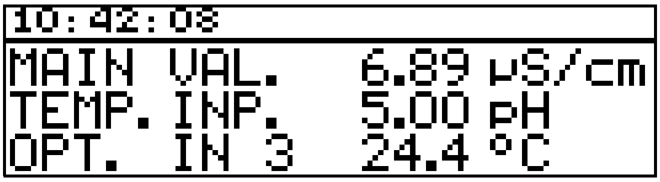
✱ Wait until the display value has stabilized; then press PGM to continue.



✱ Set the displayed value to the buffer solution value with the ▼ or ▲ keys; then press PGM to continue.

✱ Use the PGM key to accept the zero point or the EXIT key to reject it.

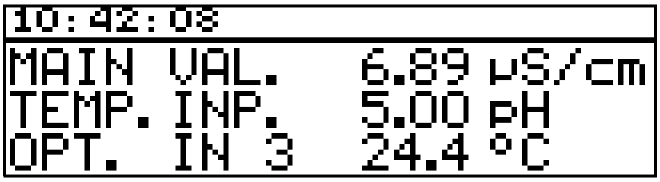
The instrument returns to Measuring mode.



9.3.2 2-point calibration

This example is based on a glass combination electrode with a connected two-wire transmitter.

- The transmitter is in "Measuring mode".



✱ Perform calibration as follows:

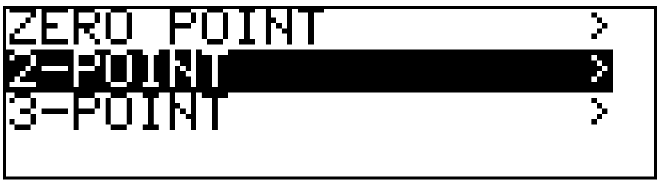
2-point calibration

The buffer solutions (reference solutions) used for calibration must differ by at least 2 pH!
During the calibration, the temperature of the two buffer solutions must be identical and remain constant!

✱ Make preparations, See section 8.2 "General information", page 47 .

✱ Start calibration, See section 8.2.2 "Ways to start the calibration", page 48.

✱ Select 2-point calibration.



✱ Immerse the combination electrode in the first buffer solution with the known pH value.

✱ Start the two-point calibration with the PGM key.

Now the source of temperature acquisition can be selected (manually, or using the temperature input of the PSU board, or the temperature input via the optional board). This source will be active for the duration of the calibration.

An example follows: manual temperature entry.

```
            CALIB
TEMP.-COMP.SOURCE
MAN.  TEMPERATURE
```

* To enter the temperature manually, use the [▼] and [▲] keys to set the calibration solution temperature and confirm your entry with the [PGM] key.

```
    E1      CALIB
INPUT      +025.0°C
TEMP.
```

* Wait until the display value has stabilized; then press [PGM] to continue.

```
            CALIB
MEASUREM.       7.06
REF.  1         pH
              25.0 °C
```

* Set the displayed value to the value of the first buffer solution with the [▼] and [▲] keys; then press [PGM] to continue.

```
            CALIB
INPUT         +07.03
REF.  1         pH
```

* Rinse and dry the pH combination electrode.
* Immerse the pH combination electrode in the second buffer solution.
* Wait until the display value has stabilized; then press [PGM] to continue.

```
            CALIB
MEASUREM.       4.03
REF.  2         pH
              25.0 °C
```

* Set the displayed value to the second buffer solution value with the [▼] or

▲ keys; then press PGM to continue.

```
                     CALIB
INPUT                +04.01
REF.  2               pH
```

The zero point and slope determined by the instrument are displayed.

✱ Use the PGM key to accept the calibrated values or reject them with the EXIT key.

```
                     CALIB
ZERO POINT   7.03pH
SLOPE        99.4%
```

The instrument returns to Measuring mode.

```
10:42:08
MAIN VAL.    6.89 µS/cm
TEMP. INP.   5.00 pH
OPT.  IN 3   24.4 °C
```

9.4 Conductivity operating mode

9.4.1 Calibration of the relative cell constant

This example is based on a conductivity cell with a connected two-wire transmitter.

- The transmitter is in "Measuring mode".

```
MAIN VAL.    6.89 µS/cm
TEMP. INP.   25.0 °C
OPT.  IN 3    109 µS/cm
```

✱ Immerse the conductivity cell in a reference solution with a known conductivity.

✱ Start the calibration, See "Ways to start the calibration" page 54.

✱ Select REL. CELL CONST.

✱ Press the PGM key.

```
TEMP.COEFF. LIN.   >
REL. CELL CONST.   >
```

✱ When the measured value is stable, press the PGM key

.

```
                CALIB
MEASUREM.        1950
REFERENCE       µS/cm
```

✱ The measured conductivity value flashes on the display.

```
                CALIB
INPUT          +02000
REFERENCE       µS/cm
```

✱ Use the ▼ or ▲ keys to set the value to the actual conductivity.

✱ Press the PGM key;
the relative cell constant determined by the instrument is displayed (as a %).

```
                CALIB
CELL CONST    102.6 %
```

✱ Use the PGM key to accept the temperature coefficient or the EXIT key to reject it.

```
MAIN VAL.   6.89 µS/cm
TEMP.INP.   25.0 °C
OPT. IN 3   2001 µS/cm
```

The current measurement value and the temperature are displayed.

Calibration is complete

After rinsing, the sensor can again be used to take measurements.

9.4.2 Calibration of the temperature coefficient

Linear temperature coefficient

This example is based on a conductivity cell with a connected two-wire transmitter.

- The transmitter is in "Measuring mode".

```
MAIN VAL.    6.89 µS/cm
TEMP. INP.   25.0 °C
OPT.  IN 3    109 µS/cm
```

✱ Immerse the conductivity cell in the sample medium.

Start the calibration, See "Ways to start the calibration" page 54.

✱ Select "LINEAR TEMP. COEF.".

```
TEMP.COEFF. LIN.     >
REL.  CELL  CONST.   >
```

The current sensor temperature flashes in the display (1).

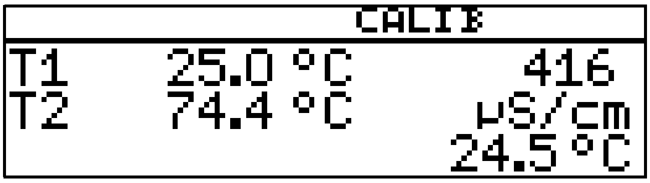
```
                CALIB
INPUT              024.4 °C   (1)
WORK-TEMP.
 <  20.0 °C     >  30.0 °C
```

The working temperature must be at least 5°C above or below the reference temperature (25.0°C).

✱ Enter the required working temperature and confirm your entry.
The LC display now shows the selected working temperature (flashing) (2).

```
                CALIB
INPUT             +075.0 °C   (2)
WORK-TEMP.
 <  20.0 °C     >  30.0 °C
```

✱ Press the [PGM] key.



The conductivity (399 µS/cm) at the current temperature (24.3°C) now appears on the right of the LC display.
The temperatures T1 (25°C) and T2 (70.0°C) that have yet to be triggered are shown on the left.

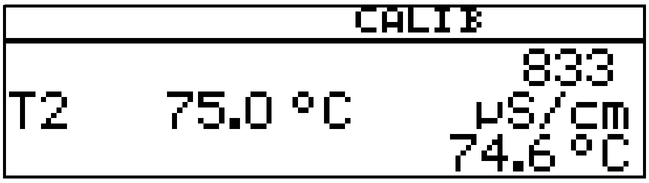
✱ Press the [PGM] key.

✱ Heat the sample medium until the working temperature is reached.

During calibration, the rate of temperature change in the measurement solution must not exceed 10°C/min.

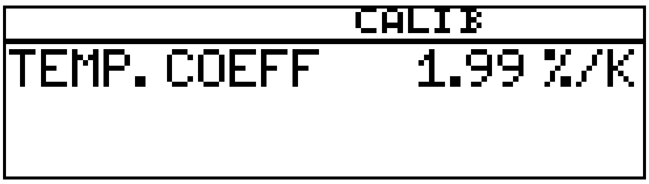
Calibration is also possible in the cooling process (with a falling temperature). It starts above the working temperature and ends below the working temperature.

As soon as the temperature of the sample medium exceeds T1 (25°C), this is hidden on the display. The uncompensated conductivity at the current temperature is displayed on the right.

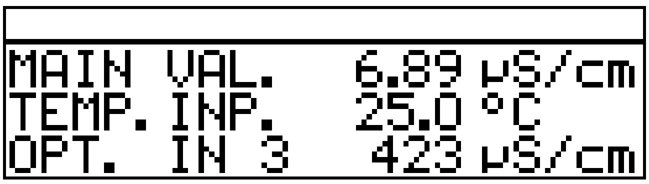


If the temperature of the medium exceeded T2 (73.0°C), the instrument determines the temperature coefficient.

The LC display now shows the determined temperature coefficient as %/K.



✱ Use the [PGM] key to accept the temperature coefficient or the [EXIT] key to reject it.



The transmitter is in "Measuring mode" and displays the compensated conductivity of the solution.

Calibration is complete

After rinsing, the sensor can again be used to take measurements.

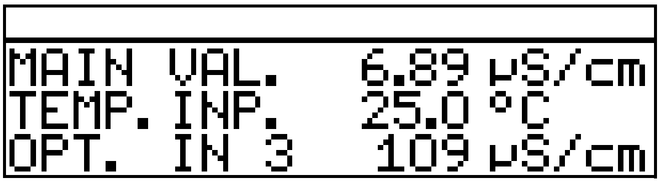
With non-linear temperature coefficient (TEMP. COEFF. CURVE)

This example is based on a conductivity cell with a connected two-wire transmitter.

The non-linear temperature coefficient can **only** be calibrated with a rising temperature!
The start temperature **must be below** the configured reference temperature (usually 25°C)!

The "TEMP.COEFF. CURVE" menu item is only displayed if a temperature sensor is connected and "TEMP.COEFF. CURVE" is configured as the type of temperature compensation.

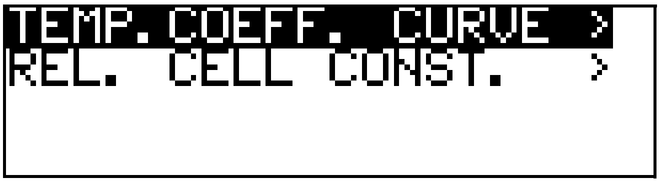
- The transmitter is in "Measuring mode".



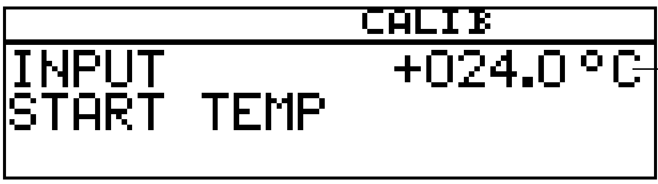
✱ Immerse the conductivity cell in the sample medium.

Start the calibration, See "Ways to start the calibration" page 54.

✱ Select "TEMP. COEFF. CURVE " and press the PGM key.

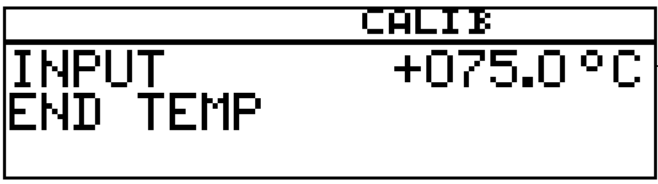


✱ Enter the required start temperature (1) for the temp. coef. curve.



(1)

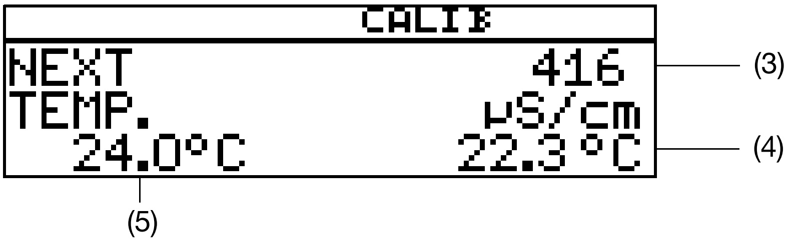
✱ Enter the required end temperature (2) for the temp. coef. curve.



(2)

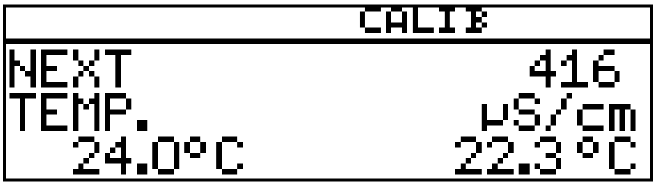
9 Calibrating a sensor with a standard signal

✱ Heat the sample medium continuously
(3) the current uncompensated conductivity
(4) the current temperature of the sample medium
(5) the first target temperature



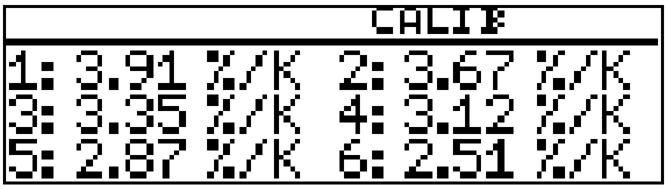
During calibration, the rate of temperature change in the measurement solution must not exceed 10°C/min.

During the calibration process, the instrument displays values for the following five temperature interpolation points.



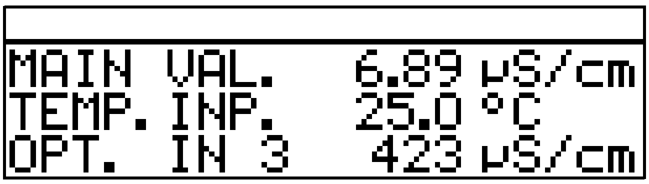
The end temperature has been reached

Use the [PGM] key to accept the temperature coefficients or the [EXIT] key to reject the calibration result.



The LC display now shows the determined temperature coefficients as %/K.

✱ Use the [PGM] key to accept the temperature coefficients or the [EXIT] key to reject the values.



The transmitter is in "Measuring mode" and displays the compensated conductivity of the solution.

Calibration is complete

After rinsing, the sensor can again be used to take measurements.

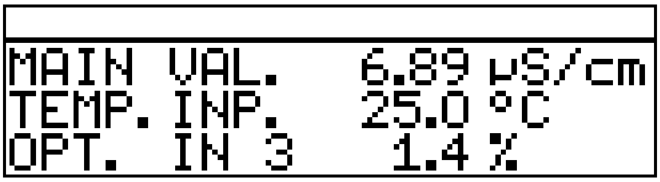
9.5 Concentration operating mode

9.5.1 Calibration of the relative cell constant

This example is based on a conductivity cell with a connected two-wire transmitter.

The conductivity of a caustic solution is converted into a concentration value [%] by the instrument.

- The transmitter is in "Measuring mode".



✱ Immerse the conductivity cell in a sample medium with a known conductivity.

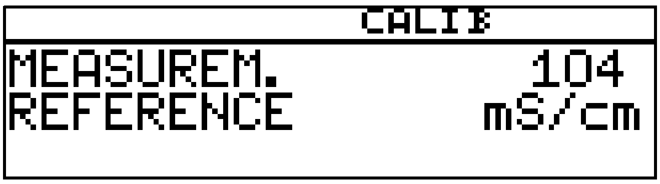
✱ Start the calibration, See "Ways to start the calibration" page 54.

✱ Press the [PGM] key.

The measured conductivity value is displayed.

✱ Wait until the measurement value has stabilized.

✱ Press the [PGM] key.



✱ Use the [▼] and [▲] keys to set the value to the actual conductivity.

✱ Press the [PGM] key; the relative cell constant determined by the instrument is displayed (as a %).

```
                   CALIB
CELL CONST     103.3 %

```

✱ Use the [PGM] key to accept the relative cell constant or the [EXIT] key to reject the values.

```

MAIN VAL.   6.89 µS/cm
TEMP.INP.   25.0 °C
OPT.  IN 3   1.4 %
```

The transmitter is in "Measuring mode" and displays the compensated conductivity of the solution.

Calibration is complete

After rinsing, the sensor can again be used to take measurements.

9.6 Chlorine measurement operating mode, pH-compensated

9.6.1 Final value calibration

The pH signal and temperature signal are supplied via the main input, the chlorine signal (standard signal) via the optional input.

- The transmitter is in "Measuring mode".

```
MAIN VAL.    7.00 pH
TEMP. INP.   24.2 °C
OPT.  IN 3   1.04 ppm
```

Calibrate pH sensor

✱ Perform calibration, See "pH operating mode" page 59.

Calibrate chlorine sensor

✱ The process must now be brought to the state that is as relevant as possible to the final value (e.g. when measuring chlorine, the required concentration).

✱ Start the calibration, See "Ways to start the calibration" page 54.

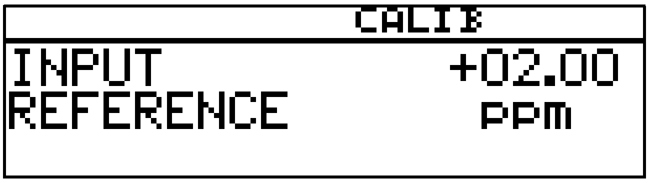
✱ Select the limit point calibration with the [PGM] key.

```
LIMIT POINT        >
```

✱ Wait until the display value has stabilized; then press [PGM] to continue.

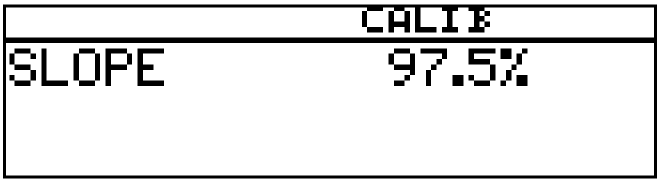
```
              CALIB
MEASUREM.         1.94
REFERENCE         ppm
```

Set the displayed value to the measured reference value with the [▼] or [▲] keys; then press [PGM] to continue.

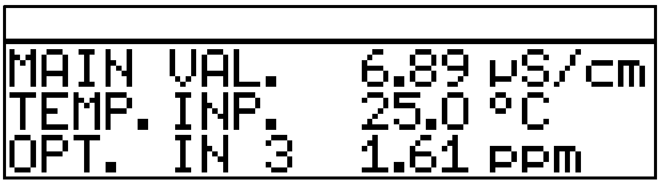


The slope determined by the instrument is displayed.

✱ Use the PGM key to accept the value or the EXIT key to reject it.



The instrument returns to Measuring mode.



Calibration is complete

After rinsing, the sensor can again be used to take measurements.

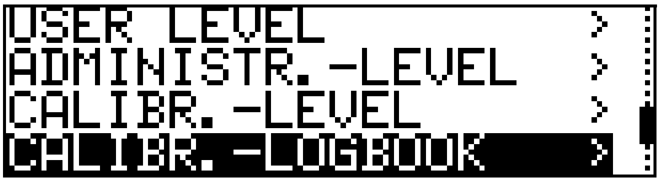
10.1 General information

The characteristic data for the last 5 successful calibration processed are documented in the calibration logbook.

Calling up

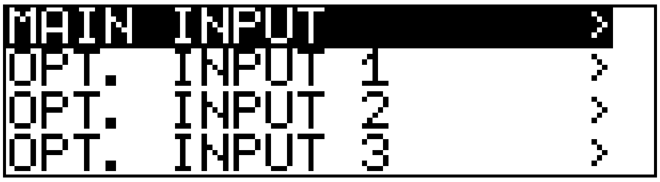
The instrument is in Measuring mode.

✱ Press the PGM key for longer than 3 seconds.



Select input

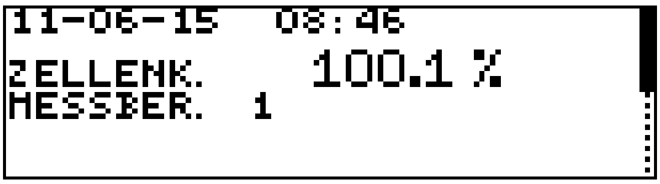
Briefly press the PGM key.



Most recent successful calibration

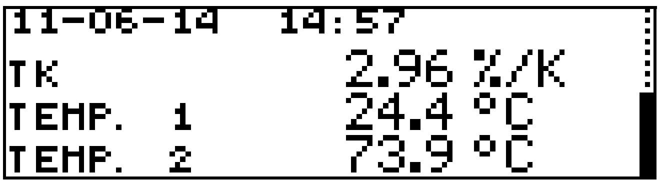
The "time stamp" in the following screen printouts (top left, for example 11-06-06 12:02) only appears if optional slot 3 is fitted with the "Datalogger with interface RS485"!

✱ Briefly press the ▼ key.



Next most recent successful calibration

✱ Briefly press the ▼ key.



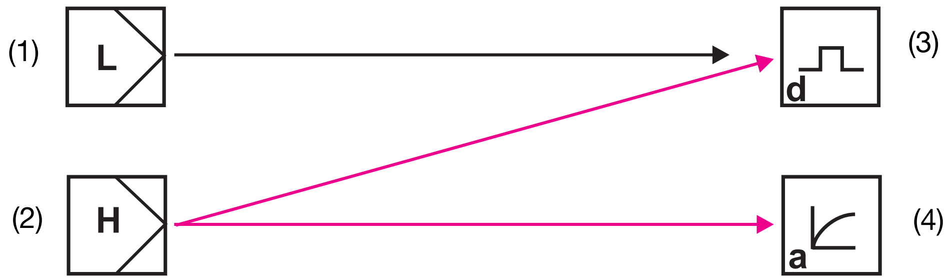
11 Controller

11.1 General information

Apart from faulty installation, incorrect settings on the instrument may also affect the proper functioning of the subsequent process or lead to damage. You should therefore always provide safety equipment that is independent of the instrument and it should only be possible for qualified personnel to make settings.

11.2 Controller functions

"Software" control functions are assigned to "Hardware" outputs for this instrument.



1 Software controller for "simple" switching functions (e.g. alarm control)

2 Software controller for "higher order" switching functions (e.g. PID controller)

3 "Switching" hardware output (e.g. relay)

3 "Continuous" hardware output (analog output)

11.2.1 Simple switching functions

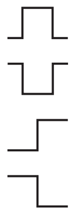
Up to four switching functions can be set (limit value 1, 2, 3, 4) ADMINISTR.-LEVEL / PARAMETER LEVEL / LIMIT VALUE CONTR. / LIMIT VALUE x.

11.2.2 Higher order switching functions (PID)

Higher order switching functions are configured at the parameter level via the parameters of "Controller 1 or 2".

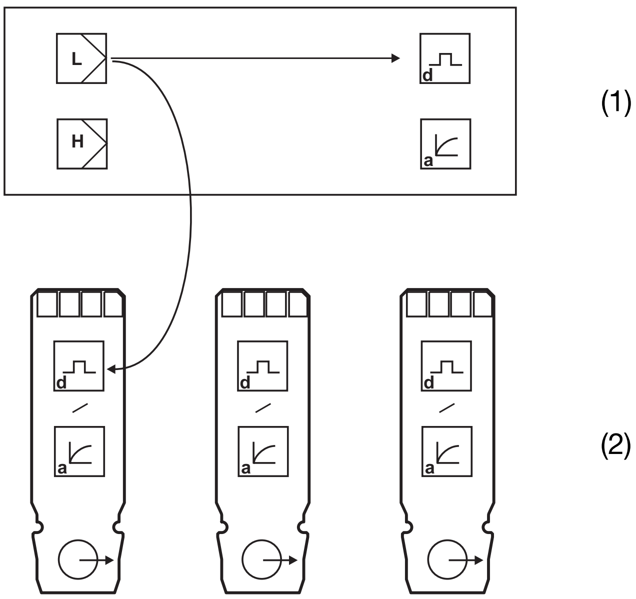
ADMINISTR.-LEVEL / PARAMETER LEVEL / CONTROLLER / CONTROLLER 1(2) / CONFIGURATION / CONTROLLER TYPE / e.g. PULSE LENGTHS

11.2.3 Typical operator level parameters

Binary outputs Signal source	**Explanation**
No signal	No switching function desired
Limit control 1 to 4	"Simple" switching functions
Alarm function (AF1) Alarm function (AF2) Alarm function (AF7) Alarm function (AF8)	
Controller 1(2)	"Higher order" switching functions
Limit value Pulse width Pulse frequency Steady Modulating	

11.3 Software controllers and outputs

Simple controller functions

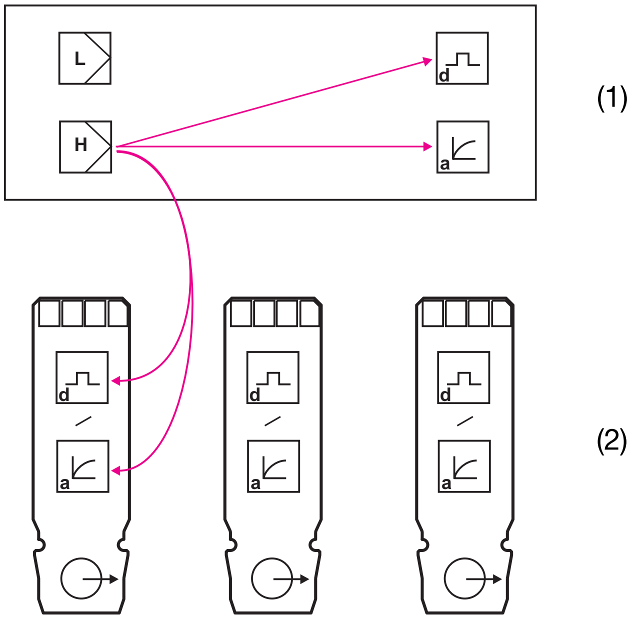


1 Main board
2 Optional board
L Simple controller
H Higher order controller
d Digital output
a Analog output

If "Simple controller functions" have been configured, only the digital outputs can be controlled!

The operator must configure which of the digital outputs will be controlled - the main board or optional board 1, 2 or 3

Higher order controller functions



1 Main board
2 Optional board
L Simple controller
H Higher order controller
d Digital output
a Analog output

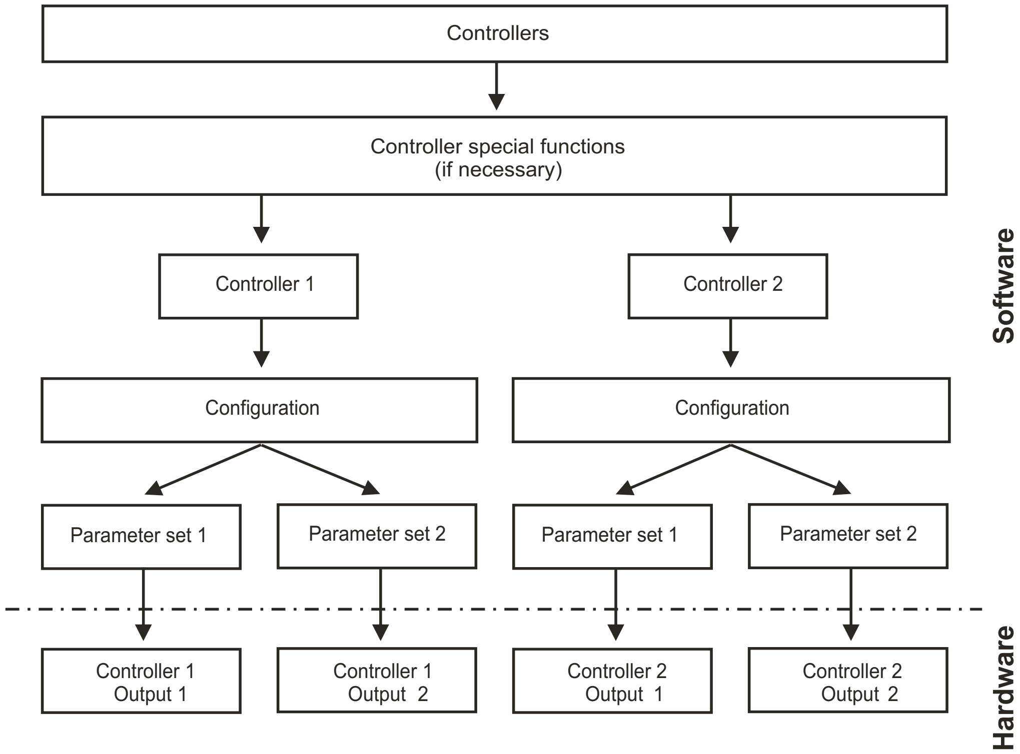
If "higher order controller functions" have been configured, both the digital outputs and the analog outputs can be controlled.

The operator must configure which of the outputs will be controlled - the main board or optional board 1, 2 or 3

Additional explanations, See section 16.1 "Glossary", page 94.

11.4 Configuration of higher order controllers

11.4.1 Structure



11.5 Parameter sets

Different process steps may require different controller settings. The instrument offers the option of creating two parameter sets and then switching between them by means of a binary input.

Defining a parameter set

ADMINISTR.-LEVEL / PARAMETER LEVEL / CONTROLLER / 1(2) / PARAMETER SET 1(2)
See "Controller" page 109.

Configuring parameter set switchover

ADMINISTR.-LEVEL / PARAMETER LEVEL / BINARY INPUTS / BINARY INPUT 1(2) / PARAMET. SWITCHOVER

See "Binary inputs" page 109.

11.6 Sample configurations

11.6.1 Simple limit monitoring

Configuration

Limit monitoring

Limit value 1

Signal source:	Main value
Switching function:	Alarm function (AF8)
Switching point:	10.00 Mom x cm
Hysteresis:	0.50 Mom x cm

Configuration of binary output, e.g. relay)

Binary outputs

Binary output 1

Signal source:	Limit monitoring 1
At calibration:	Standard operation
Error:	Inactive
HOLD mode:	Frozen
Turn-on delay:	0 seconds
Turn-off delay:	0 seconds
Wiper time:	0 seconds
Manual mode:	No simulation

11.6.2 Limit monitoring to USP

Configuration

Limit monitoring

Limit value 1

Signal source:	Main value
Switching function:	USP
Switching point:	derived automatically from table, See "Excerpt from USP <645>" page 101
Hysteresis	0.50 µS/cm

Configuration of binary output, e.g. relay)

Binary outputs

Binary output 1

Signal source:	Limit monitoring 1
At calibration:	Standard operation

Error:	Inactive
HOLD mode:	Frozen
Turn-on delay:	0 seconds
Turn-off delay:	0 seconds
Wiper time:	0 seconds
Manual mode:	No simulation

11.6.3 Controller with limit value function

Configuration of software controllers

Controller 1

Configuration

Controller type:	Pulse value
Controller actual value:	Main variable
Stroke retransmission:	No signal
Additive disturbance:	No signal
Multiplicative disturbance:	No signal
Min./max. contact:	Max. contact
Inactive/active contact:	Active contact
HOLD mode	0 %
HOLD output:	0 %
Error:	0 %
Alarm control:	Off

Parameter set 1

Min. setpoint:	As required
Max. setpoint:	As required
Setpoint:	0.80 mS/cm
Hysteresis:	As required
On-delay:	As required
Delayed release:	As required
Alarm delay:	As required

Configuration of binary output, e.g. relay)

Binary outputs

Binary output 1

Signal source:	Controller 1 output 1

[1] This parameter only appears if "Separate controllers" has been configured in special controller functions.

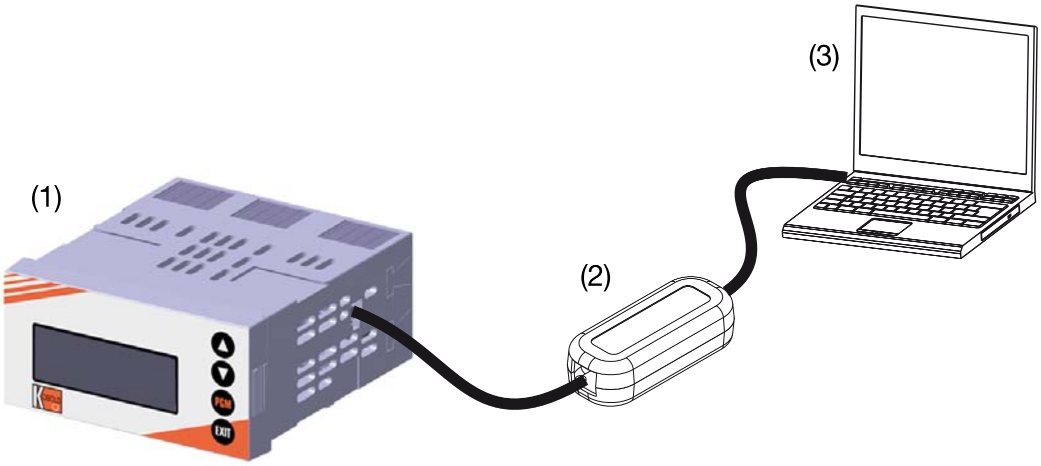
12.1 Configurable parameters

Both the setup program (ACM-Soft) and the PC interface cable with USB/ TTL converter (ACM-Int) are available as options and provide a convenient way to adapt the transmitter to meet requirements:

- Setting the measuring range.
- Setting the behavior of outputs wh en the measuring range is exceeded.
- Setting the functions of switching outputs K1 to K8.
- Setting the functions of the binary inputs.
- Setting a customized characteristic
- etc.

Data can only be transferred from or to the transmitter if it is supplied with voltage, See section 5 "Installation", page 14ff.

Connection

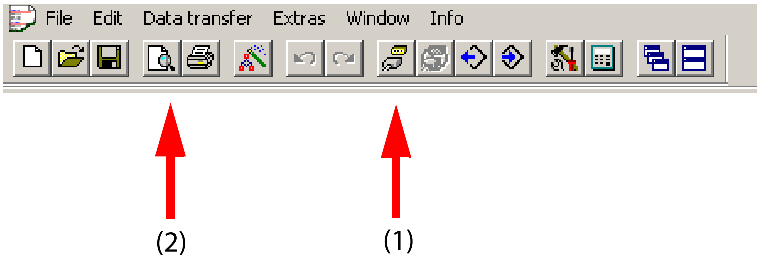


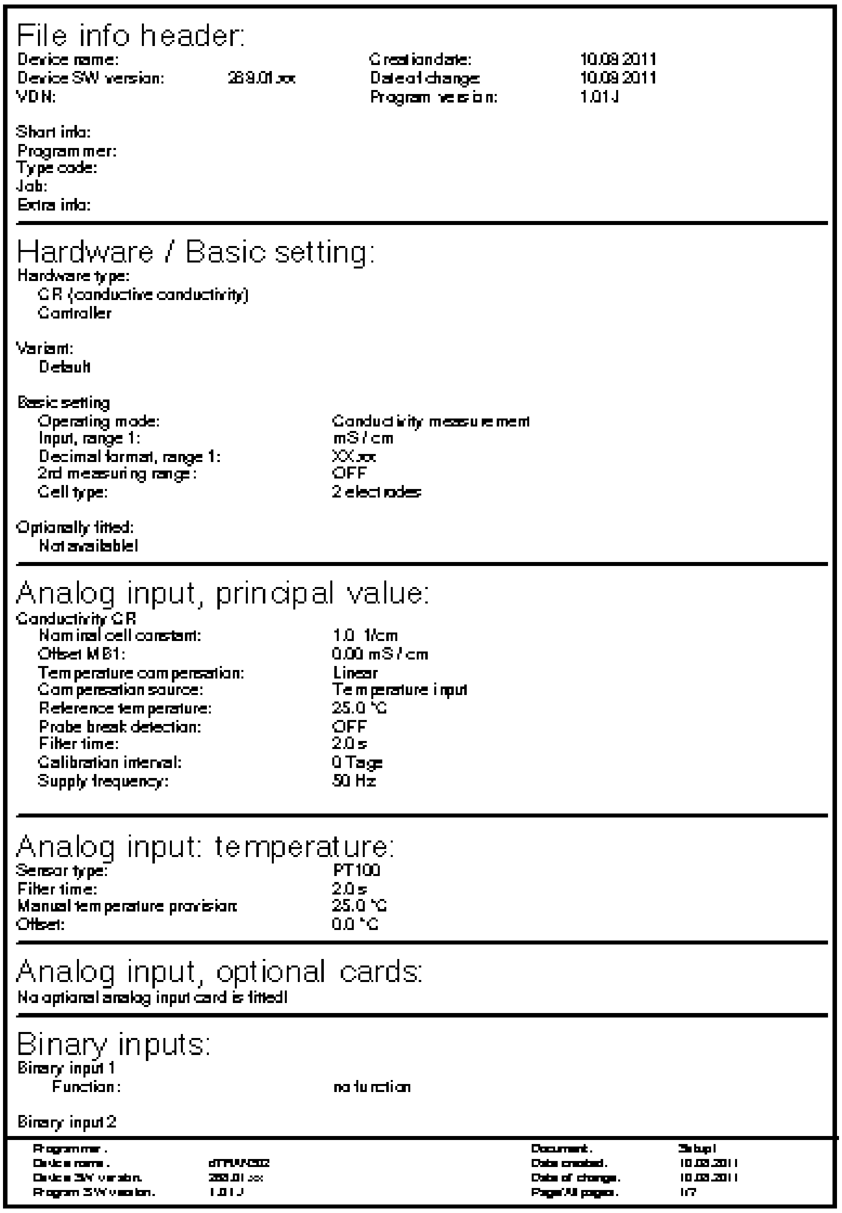
(1) ACM-1
(2) PC interface cable with USB/TTL converter, □
Sales no.: ACM-Int
(3) PC or notebook

12.2 Documenting the instrument configuration

- ✱ Start the setup program
- ✱ Establish the connection to the instrument (1).

Read the instrument configuration (2).





File info header:

Device name: — Creation date: 10.09.2011
Device SW version: 289.01.xx — Date of change: 10.09.2011
VDN: — Program version: 1.01J

Short info:
Programmer:
Type code:
Job:
Extra info:

Hardware / Basic setting:

Hardware type:
CR (conductive conductivity)
Controller

Variant:
Default

Basic setting

Operating mode:	Conductivity measurement
Input, range 1:	mS / cm
Decimal format, range 1:	XX.xx
2nd measuring range:	OFF
Cell type:	2 electrodes

Optionally fitted:
Not available!

Analog input, principal value:

Conductivity CR

Nominal cell constant:	1.0 1/cm
Offset MB1:	0.00 mS / cm
Temperature compensation:	Linear
Compensation source:	Temperature input
Reference temperature:	25.0 °C
Probe break detection:	OFF
Filter time:	2.0 s
Calibration interval:	0 Tage
Supply frequency:	50 Hz

Analog input: temperature:

Sensor type:	PT100
Filter time:	2.0 s
Manual temperature provision:	25.0 °C
Offset:	0.0 °C

Analog input, optional cards:

No optional analog input card is fitted!

Binary inputs:

Binary input 1
Function: no function

Binary input 2

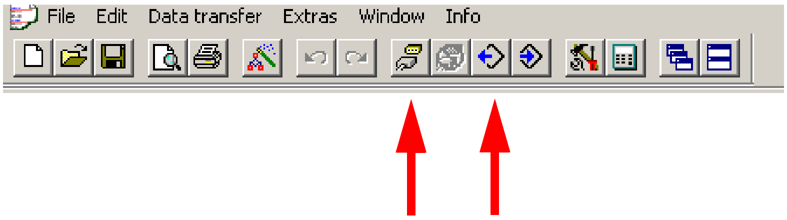
Programmer:		Document:	Setup1
Device name:	dTRANS02	Date created:	10.09.2011
Device SW version:	289.01.xx	Date of change:	10.09.2011
Program SW version:	1.01J	Page/All pages:	1/7

12.3 Special features for "Datalogger"

✱ Start the setup program

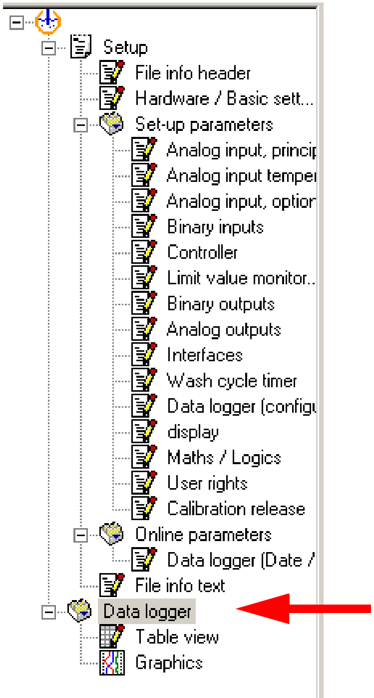
✱ Establish the connection to the instrument (1).

✱ Read the instrument configuration (2).

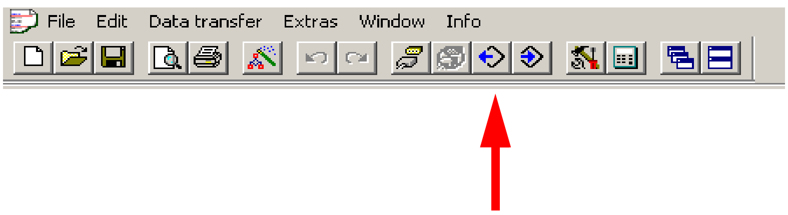


(1) (2)

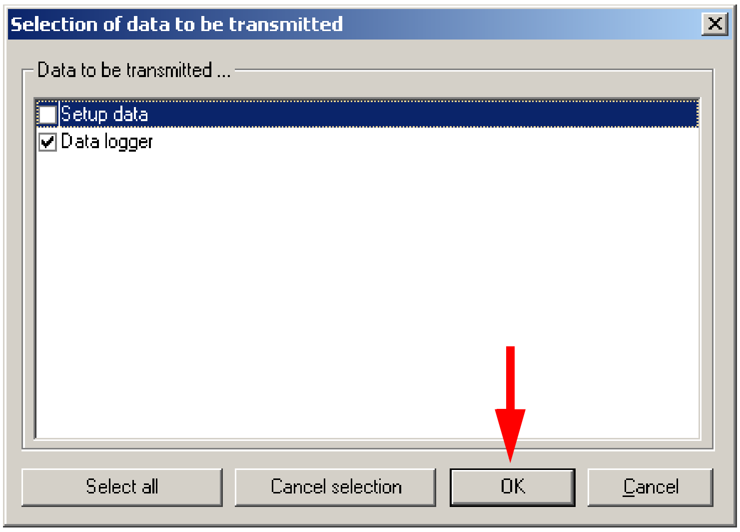
✱ Read data from datalogger (for example table view)
- Mark datalogger icon (3)
- Read values from the instrument (4)



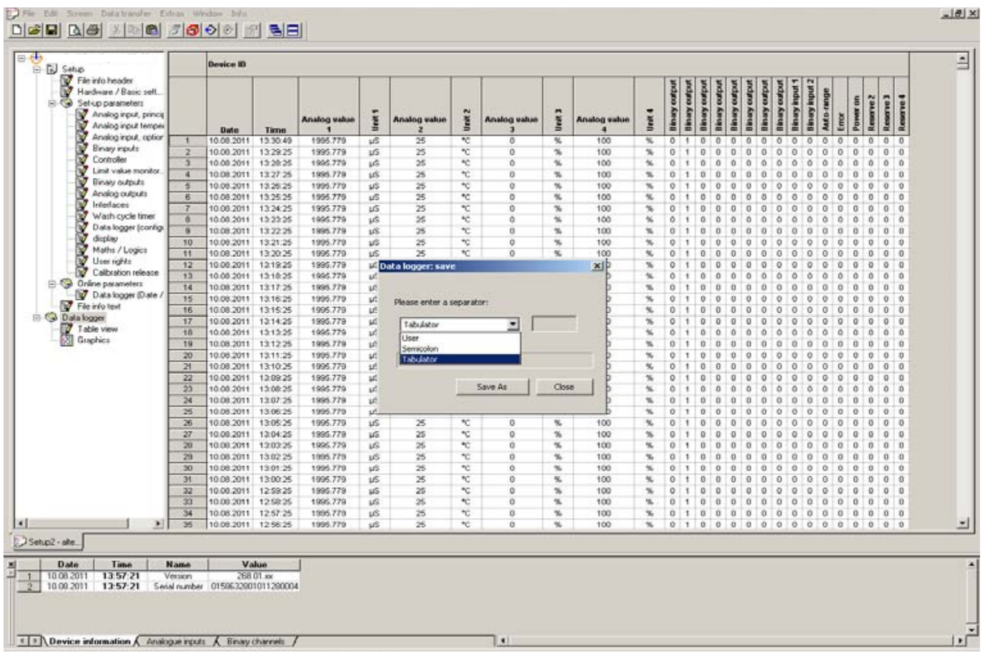
(3)



(4)



✱ Export data (for processing in an external program).



13 Eliminating faults and malfunctions

Problem	Possible cause	Action
No measurement display or current output	There is no supply voltage	Check the power supply
Measurement display 0000 or current output 4 mA	Sensor not immersed in medium; level in container too low	Top up the container
	Flow-through fitting is blocked	Clean the flow-through fitting
	Sensor faulty	Replace the sensor
Incorrect or fluctuating measurement display	Sensor faulty	Replace the sensor
	Sensor positioning incorrect	Choose another installation location
	Air bubbles	Optimize assembly
MAIN VALUE INPUT OVERRANGE	Measurement overrange	Choose a suitable measuring range
MAIN VALUE INPUT UNDERRANGE	Measurement underrange	
ALARM MEASURING 8888 27.4°C pH	Main input: Measurement range "out of range"	
MAIN INPUT COMPENS. RANGE	Compensation range has been left	
TEMPERATURE INPUT OVERRANGE	Measurement overrange	Choose a suitable measuring range
TEMPERATURE INPUT UNDERRANGE	Measurement underrange	
ALARM MEASURING 8888 8888 °C pH	Temperature input: Measurement range "out of range"	
OPTION INPUT 1. COMPENS. RANGE	Compensation range has been left	Choose a suitable measuring range
OPTION INPUT 1. OUT OF RANGE	Temperature input: Measurement range "out of range"	
ELECTRODE CONTAMINATED	Coating	Clean electrodes. Replace conductivity cell.

DEPENDENT PARAME- TERS ADJUSTED	Configuration change	OK
DATALOGGER IS DELETED	Configuration change	OK
LEVEL LOCKED	Inhibit via binary contact	Check configuration and unlock if necessary
PARAMETER LOCKED	Do not release	If appropriate release in the release level
WRONG PASSWORD		Test
KEYPAD LOCKED	Inhibit via binary contact	Check configuration and unlock if necessary
CONFIGURATION RE-ESTABLISHED	Cancel in basic setting	OK
ERROR PROFIBUS		Check hardware
UNZULÄSSIGE HARDWARE-BESTÜCKUNG		Check fitting, adjust if necessary
ERROR TIMER TIME RE-ADJUSTMENT	Instrument had no power supply for a very long time	Establish power supply Set the datalogger time

14 Technical data

Inputs (main board)

Main input	Measuring range/control range	Accuracy	Effect of temperature
µS/cm	0.000 - 9.999 00.00 - 99.99 000.0 - 999.9 0000 - 9999	≤ 0.6% of range + 0.3 µS x cell constant (K)	0.2%/10K
mS/cm	0.000 - 9.999 00.00 - 99.99 000.0 - 999.9 0000 - 9999	≤ 0.6% of range + 0.3 µS x cell constant (K)	0.2%/10K
kΩ x cm	0.000 - 9.999 00.00 - 99.99 000.0 - 999.9 0000 - 9999	≤ 0.6% of range + 0.3 µS x cell constant (K)	0.2%/10K
MΩ x cm	0.000 - 9.999 00.00 - 99.99 000.0 - 999.9 0000 - 9999	≤ 0.6% of range + 0.3 µS x cell constant (K)	0.2%/10K
Secondary input			
Temperature Pt100/1000	-50 - 250°C[1]	≤ 0.25% of range	0.2%/10K
Temperature NTC/PTC	0.1 - 30 kΩ Entry via table with 20 value pairs	≤ 1.5% of range	0.2%/10K
Standard signal	0(4) - 20 mA or 0 - 10 V	0.25% of range	0.2%/10K
Resistance transmitter	Minimum: 100 Ω Maximum: 3 kΩ	+/- 5 Ω	0.1%/10K

[1] Selectable in °F.

Resistance thermometer inputs (optional board)

Designation	Connection type	Measuring range	Measuring accuracy		Effect of ambient temperature
			3-wire/4-wire	2-wire	
Pt100 DIN EN 60751 (factory-set)	2-wire/3-wire 4-wire	-200 - +850°C	≤ 0.05%	≤ 0.4%	50 ppm/K
Pt1000 DIN EN 60751 (factory-set)	2-wire/3-wire 4-wire	-200 - +850°C	≤ 0.1%	≤ 0.2%	50 ppm/K
Sensor lead resistance	Maximum 30 Ω per line with three- and four-wire circuit				
Measurement current	approx. 250 µA				
Lead compensation	Not required for three- and four-wire circuit. With a 2-wire circuit, lead resistance can be compensated in the software by correcting the process value.				

Standard signals inputs (optional board)

Designation	Measuring range	Measuring accuracy	Ambient temperature effect
Voltage	0(2) - 10 V	≤ 0.05%	100 ppm/K
Electrical current	0 - 1 V Input resistance R_E > 100 kΩ	≤ 0.05%	100 ppm/K
Resistance transmitter	Minimum: 100 Ω Maximum: 4 kΩ	+/- 4 Ω	100 ppm/K

Temperature compensation

Type of compensation	**Range**1
Linear 0 - 8%/K	-10 - 160°C
ASTM D1125 - 95 (ultra-pure water)	0 - 100°C
Natural waters (ISO 7888)	0 - 36°C
Reference temperature	
Adjustable from 15 - 30°C; preset to 25°C (default)	

[1] Note the sensor operating temperature range!

Measuring circuit monitoring

Inputs		Underrange/ overrange	Short circuit	Broken lead
Conductivity		Yes	Depends on measuring range	Depends on measuring range
Temperature		Yes	Yes	Yes
Voltage	2 - 10 V 2 - 10 V	Yes Yes	Yes No	Yes No
Current	4 - 20 mA 0 - 20 mA	Yes Yes	Yes No	Yes No
Resistance transmitter		No	No	Yes

Two-electrode systems

Cell constant [1/cm]	Setting range of the relative cell constant	Resulting usable range [1/cm]
0.01	20 0 500%	0.002 - 0.05
0.1		0.02 - 0.5
1.0		0.2 - 5
3.0		0.6 - 15
10.0		2.0 - 50

Four-electrode systems

Cell constant [1/cm]	Setting range of the relative cell constant	Resulting usable range [1/cm]
0.5	20 - 150%	0.1 - 0.75
1.0		0.2 - 1.5

Binary input

Activation	Floating contact is open: function is not active Floating contact is closed: function is active
Function	Key lock, manual mode, HOLD, HOLD inverse, alarm suppression, freeze measured value, level lock, reset partial quantity, reset total quantity, parameter set switchover

Controller

Controller type	Limit comparators, limit controllers, pulse length controllers, pulse frequency controllers, modulating controllers, continuous controllers
Controller structure	P / PI / PD / PID

Outputs

Relay (changeover) - Contact rating - Contact service life	PSU board	5 A at 240 VAC resistive load 350,000 operations at nominal load/750,000 operations at 1 A
Supply voltage for 2-wire transmitter	PSU board	Electrically isolated, non-controlled DC 17 V at 20 mA, open-circuit voltage approx. DC 25 V
Power supply for inductive proximity switch	Optional board	DC 12 V; 10 mA
Relay (changeover) - Contact rating - Contact service life	Optional board	8 A at AC 240 V resistive load 100,000 operations at nominal load/350,000 operations at 3A
Relay SPST (normally open) - Contact rating - Contact service life	Optional board	3A at 240VAC resistive load 350,000 operations at nominal load/900,000 operations at 1A

14 Technical data

Semiconductor relay - Contact rating - Protective circuit	Optional board	 1 A at 240 V Varistor
Semiconductor switch (photo MOS)	Optional board	U ≤ 50 V AC/DC I ≤ 200 mA
Voltage - Output signals - Load resistance - Accuracy	Optional board	 0 - 10 V / 2 - 10 V R_{load} ≥ 500 Ω ≤ 0.5%
Electrical current - Output signals - Load resistance - Accuracy	Optional board	 0 - 20 mA / 4 - 20 mA R_{load} ≤ 500 Ω ≤ 0.5%

Display

Type	LC graphic display, blue with background lighting, 122 x 32 pixels

Electrical data

Supply voltage (switch-mode PSU)	AC 110 - 240 V -15/+10%; 48 - 63 Hz or AC/DC 20-30 V; 48 - 63 Hz
Electrical safety	to DIN EN 61010, Part 1 overvoltage category II, pollution degree 2
Power consumption	Max. 13 VA
Data backup	EEPROM
Electrical connection	On the back via screw terminals, conductor cross-section up to max. 2.5 mm^2
Electromagnetic Compatibility (EMC) - Interference emission - Immunity to interference	DIN EN 61326-1 Class A to industrial requirements

Enclosure

Enclosure type	Plastic enclosure for panel mounting to DIN IEC 61554, Aluminium field housing, orange
Depth behind panel	90 mm (panel mounting), 137 mm (field housing)
Ambient temperature Storage temperature	-5...+55°C (panel mounting), -5...+50°C (field housing) -30...+70°C
Climatic rating	Rel. humidity ≤90% annual mean, no condensation
Operating position	Horizontal
Protection	to DIN EN 60529, front IP65, rear IP20
Weight (fully fitted)	about 380 g (panel mounting), about 1480 g (field housing)

Interface

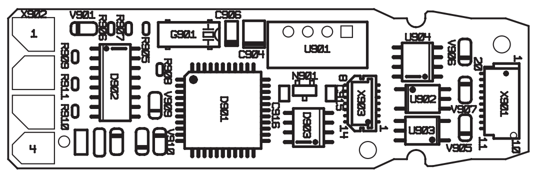
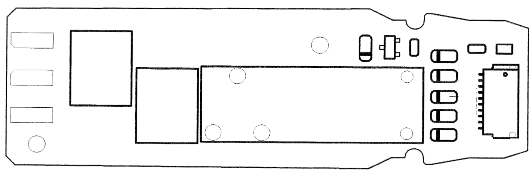
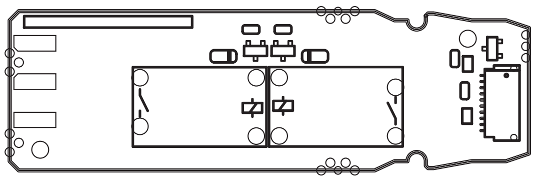
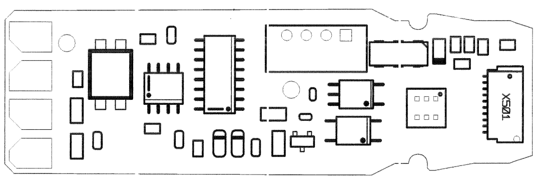
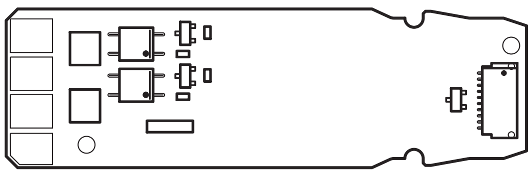
Modbus	
Interface type	RS422/RS485
Protocol	Modbus, Modbus Integer
Baud rate	9600. 19200, 38400
Device address	0 - 255
Max. number of nodes	32
PROFIBUS-DP	
Device address	0 - 255

Caution:
The instrument **must** be de-energized on the input and output sides!
Optional boards must only be retrofitted by qualified specialists.

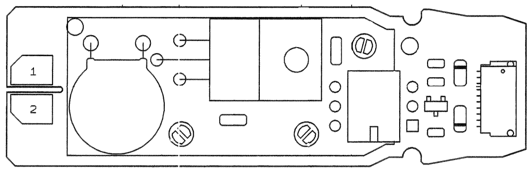
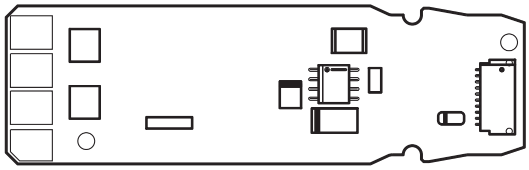
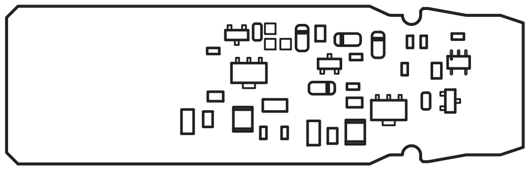
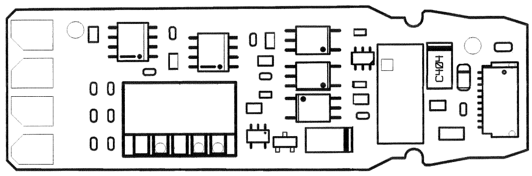
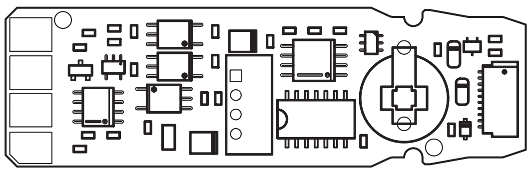
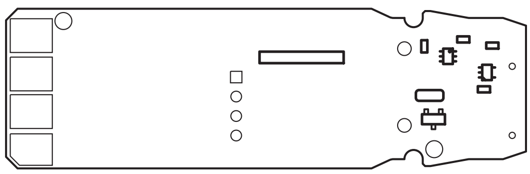
ESD:
Optional boards can be damaged be electrostatic discharge. You must therefore prevent electrostatic charges from accumulating during installation and removal. Optional boards should be retrofitted at a grounded workstation.

15.1 Identifying an optional board

The packaging of the optional board is identified by a sales number.

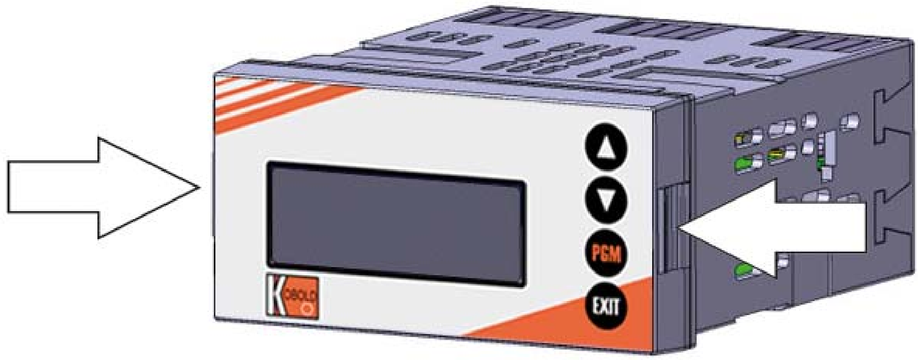
Optional board	Code	Sales No.	Board view
Analog input (universal)	1	APM-100001	
Relay (1 x changeover)	2	APM-100002	
Relay (2 x NO) This board must **only** be inserted in optional slot 1 or 3!	3	APM-100003	
Analog output	4	APM-100004	
Two MosFET semiconductor switch	5	APM-100005	

15 Retrofitting optional boards

Optional board	Code	Sales No.	Board view
Semiconductor relay 1 A	6	APM-100006	
Supply voltage output +/- 5 V DC (e.g. for ISFET)	7	APM-100007	
Supply voltage output 12 V DC (e.g. for inductive proximity switch)	8	APM-100008	
Interface - RS422/485 This board must **only** be inserted in optional slot 3!	10	APM-10000S	
Datalogger with interface RS422/485 and real-time clock This board must **only** be inserted in optional slot 3!	11	APM-10000D	
Profibus-DP interface This board must **only** be inserted in optional slot 3!	12	APM-10000P	

Note:
The optional boards detected by the instrument are displayed in "Device information" (See section 6.5.11 "Device info", page 31).

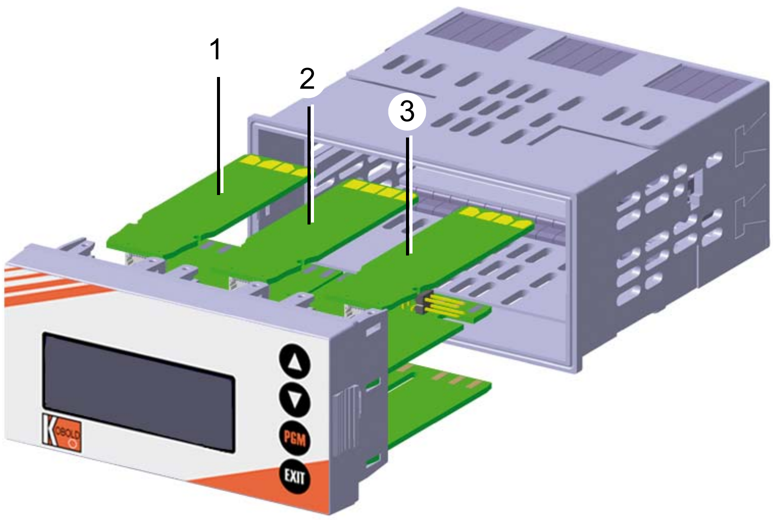
15.2 Removing a plug-in module



(1) Squeeze the front panel together by the left and right sides and remove the plug-in module.

15.3 Inserting a plug-in module

Caution:
No "3" relays (2 x SPST/normally open) may be inserted in slot 2!



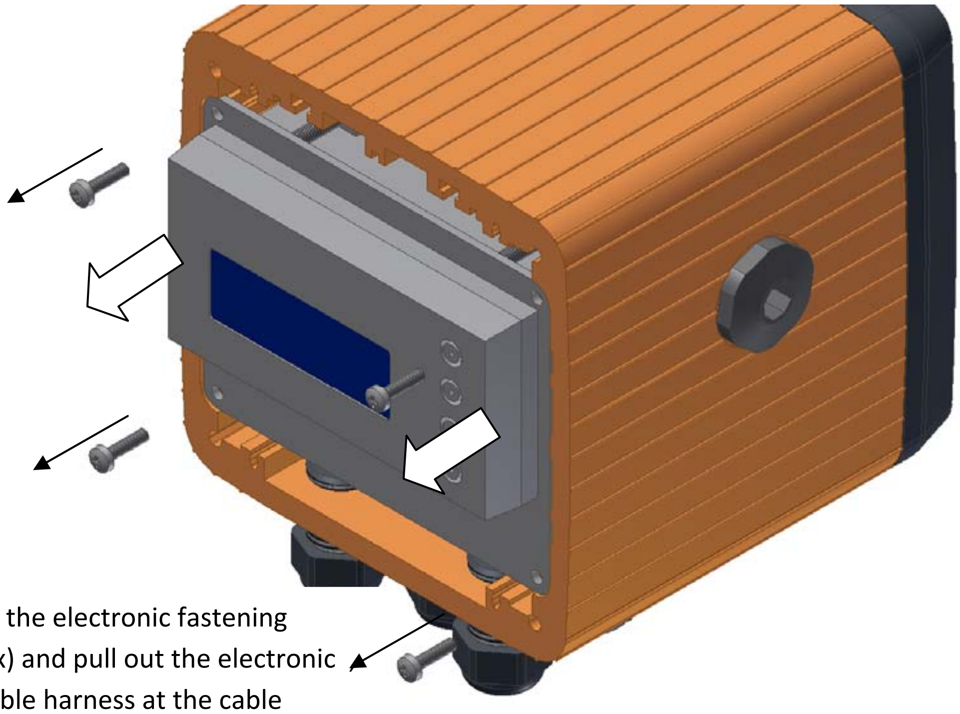
(1) Slot 1 for optional board
(2) Slot 2 for optional board
(3) Slot 3 for optional board

(1) Push the optional board into the slot until it locks in place.

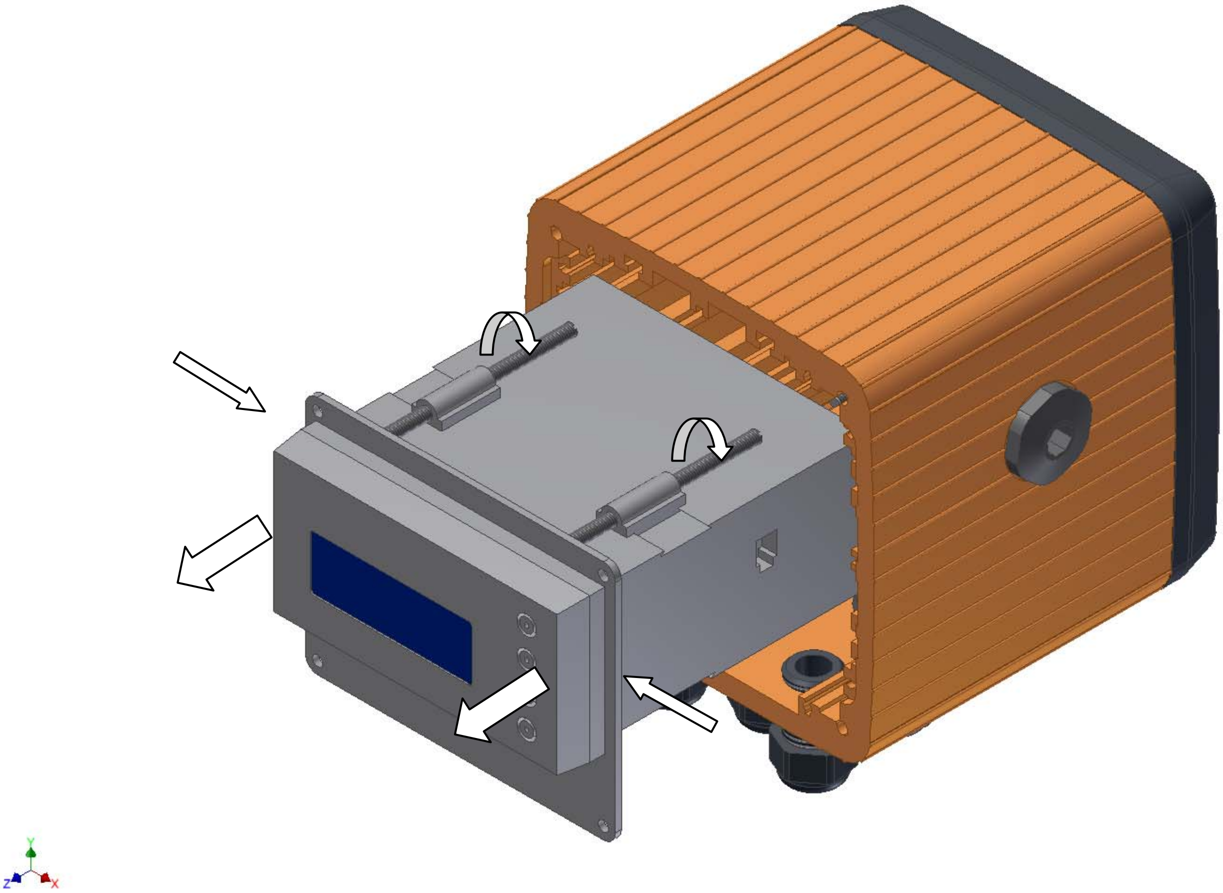
(2) Push the device plug-in into the enclosure until it locks in place.

15 Retrofitting optional boards

1. Screw out the front cover and remove the front cover
2. Take care of the gasket



3. Screw out the electronic fastening screws (4x) and pull out the electronic Loosen cable harness at the cable glands, if needed



4. Loosen the clamp screws (4x), push back the front plate and press together the latching surface of electronic module from left and right. Pull out the electronic insert from the electronic housing.

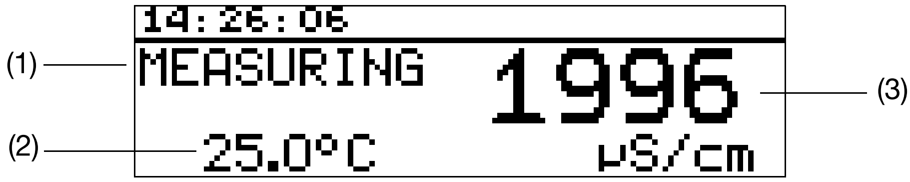
5. The optional boards can now be installed in the electronic. The assembly takes place in reverse order. While mounting the front cover on the housing profile, care should be taken to correctly position the gasket in the groove.

16 Appendix

16.1 Glossary

Display of measured values STANDARD

The measurement value, measurement variable and temperature of the measuring material are shown in standard display.



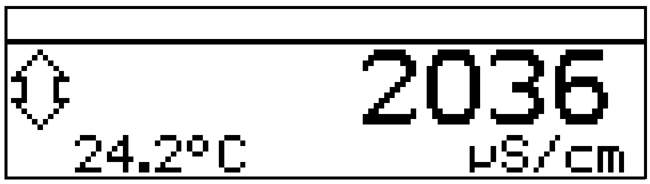
(1) Operating mode

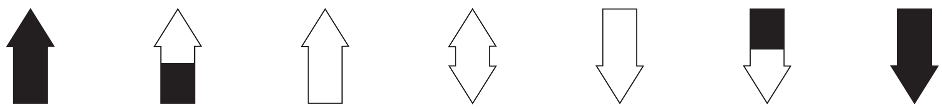
(2) Display bottom (temperature input)

(3) Display top (analog input measurement value)

Display of measured values TENDENCY

The operator can quickly see the direction in which the measurement is changing.



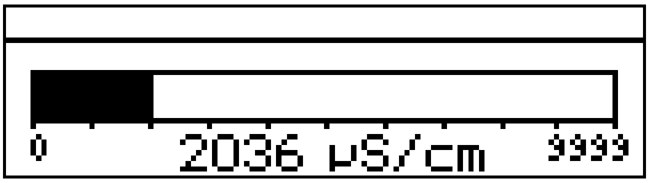


Rising			Steady	Falling		
Greatly	Moderately	Slightly		Slightly	Moderately	Greatly

The measurement tendency (trend) is calculated over the last 10 measurement values.
So with a sampling interval of 500 ms, the last 5 seconds are considered.

Display of measured values BARGRAPH

- Values of the main inputs, input options or math channels (signal source) can be represented as a variable bar (a bar graph).



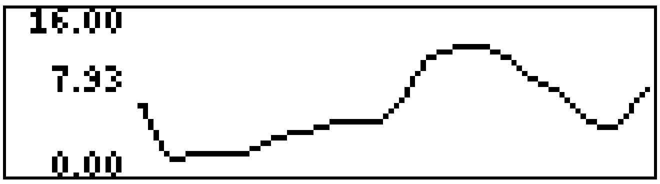
Scaling the bar

- ✱ Activate "BARGRAPH" as the display of measured values.
- ✱ Select "SCALE START" with [▼].
- ✱ Confirm the selection with [PGM].
- ✱ Use [▼] and [▲] to enter the lower limit of the range to be displayed.
- ✱ Confirm the selection with [PGM].
- ✱ Select "SCALE END" with [▼].
- ✱ Use [▼] or [▲] to enter the upper limit of the range to be displayed.
- ✱ Confirm the selection with [PGM].

To return to Measuring mode:
Press the [EXIT] key repeatedly or wait for a "timeout".

Display of measured values TREND CHART

Values of the main inputs, input options or math channels (signal source) can be represented as a graph.
The current values appear to the right on the screen.



Scaling the display

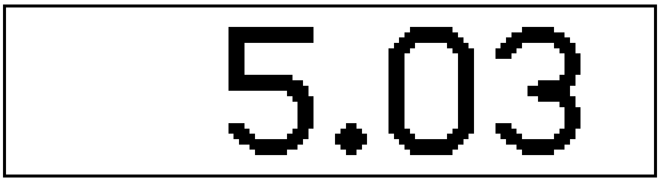
- ✱ Activate "TREND CHART" as the display of measured values.
- ✱ Select "SCALE START" with [▼].
- ✱ Confirm the selection with [PGM].
- ✱ Use [▼] and [▲] to enter the lower limit of the range to be displayed.

- ✱ Confirm the selection with [PGM].
- ✱ Select "SCALE END" with [▼].
- ✱ Use [▼] or [▲] to enter the upper limit of the range to be displayed.
- ✱ Confirm the selection with [PGM].

To return to Measuring mode:
Press the [EXIT] key repeatedly or wait for a "timeout".

Display of measured values LARGE DISPLAY

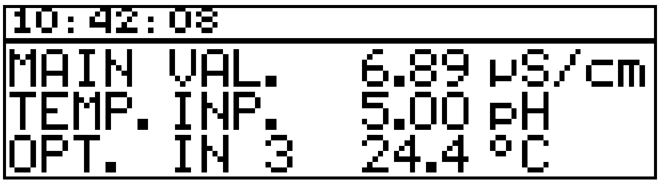
Values of the main inputs, input options or math channels (signal source) can be displayed in large format.



Display of measured values 3 MEAS. VALUES

Three values of the main inputs, input options or math channels (signal source) can be displayed simultaneously.

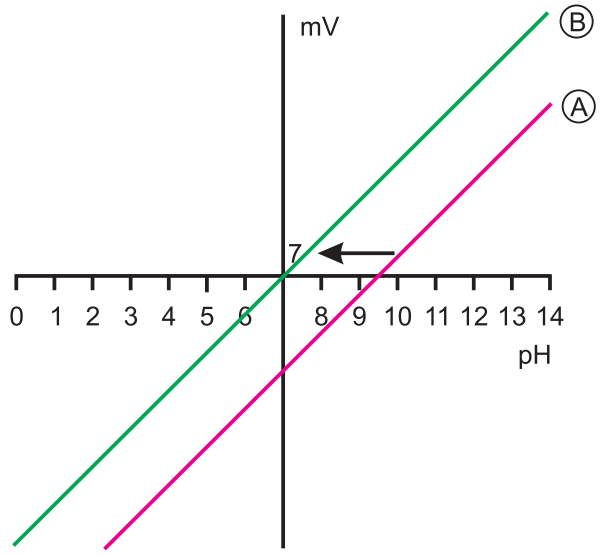
The position of the value to be displayed can be set to "Top", "Center" or "Bottom".



Relative cell constant

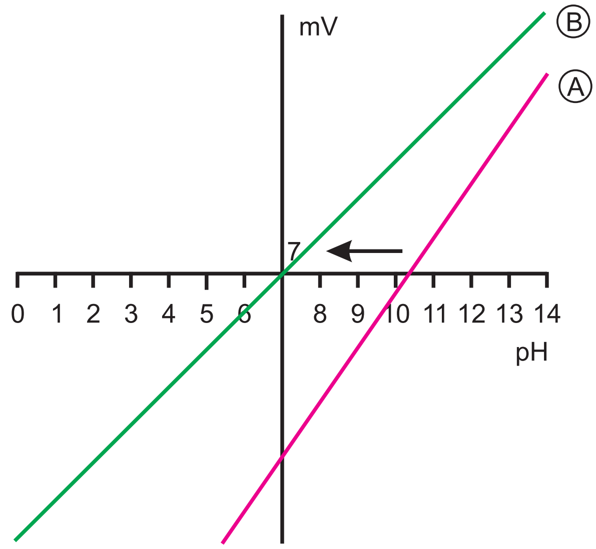
Mechanical or chemical effects can change the electrical properties of a conductivity cell. This will result in a measurement error. This deviation (and thus the measurement error as well) can be compensated for by adjusting the relative cell constant in the transmitter. The relative cell constant defines the deviation of the actual cell constant of the measuring cell from its nominal value.

Zero point (1-point) calibration



- With one-point offset calibration, the zero point of the pH combination electrode is calculated, See section 8.4 "Calibrating the relative cell constant", page 51.
  Recommended only for special applications, such as ultra-pure water.

2-point calibration



- With two-point calibration, the zero point and slope of the combination electrode are calibrated.
  This is the recommended calibration for most sensors.

Temperature compensation (conductivity or resistance)

The conductivity of a measurement solution is temperature-dependent (the conductivity of a solution rises as the temperature increases). The dependency of conductivity and temperature describes the **temperature coefficient** of the measurement solution. As conductivity is not always measured for the reference temperature, automatic temperature compensation is integrated in this instrument. The transmitter uses the temperature coefficient to calculate the conductivity that would exist for a reference temperature from the current conductivity and the current temperature. This is then displayed. This process is called temperature compensation. Modern transmitters offer different ways to perform this temperature compensation.

- Linear compensation (constant temperature coefficient).
  This type of compensation can be applied to many kinds of normal water, with acceptable accuracy. The temperature coefficient used is then approx. 2.2%/°C
- Natural water (EN27888 or ISO 7888).
  In this case, so-called non-linear temperature compensation is used. According to the standard cited above, the relevant type of compensation can be applied to natural groundwater, spring water and surface water.
  The definition range for the water temperature is as follows:
  0°C ≤ T < 36°C
  Conductivity of the water is compensated in the range from 0°C to 36°C.
- ASTM1125-95.
  This type of temperature compensation is used in measurements of ultra-pure water. The highly non-linear nature of the temperature dependency for neutral, acidic and alkaline impurities is taken into consideration in accordance with the standard.
  The definition range for the water temperature is as follows:
  0°C < T < 100°C.
  Conductivity of the water is compensated in the range from 0°C to 100°C.

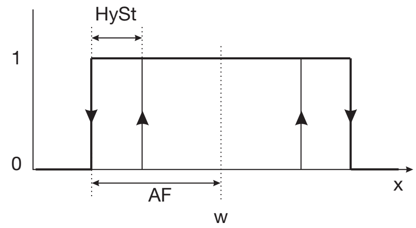
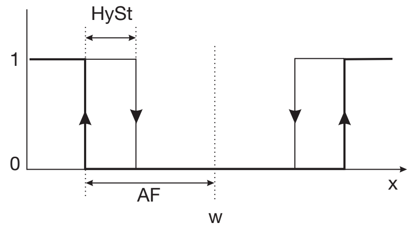
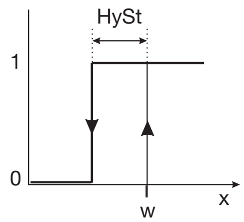
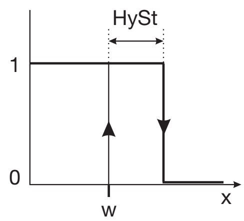
Temperature compensation (pH or ammonia)

The pH value of a measurement solution depends on the temperature. Since the pH value is not always measured at the reference temperature, the instrument is able to perform a temperature compensation.

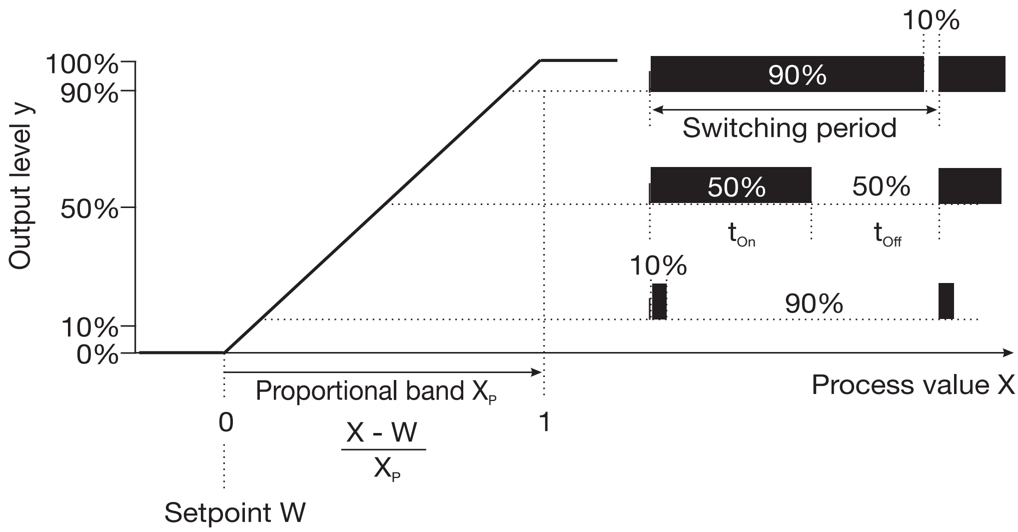
The sensor signal for the ammonia measurement is temperature-dependent. The instrument can perform temperature compensation.

The redox potential of a measurement solution is **not** temperature-dependent! Temperature compensation is not required.

Limit value (alarm) function of the binary outputs

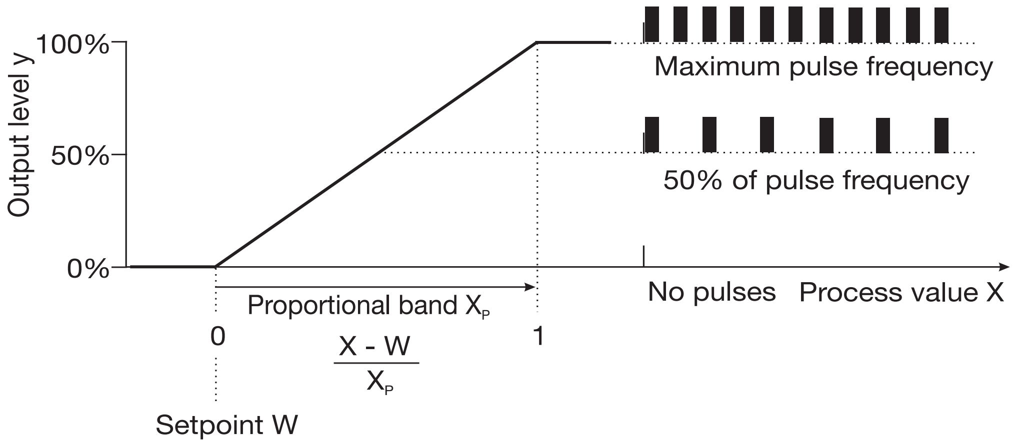
	AF1	
	AF2	
	AF7	
	AF8	

Pulse length controller (output active with x > w and P control structure)



If actual value x exceeds setpoint W, the P controller will control in proportion to the control deviation. When the proportional range is exceeded, the controller operates with an output level of 100% (100% clock ratio).

Pulse frequency controller (output active with x > w and P control structure)



If actual value x exceeds setpoint W, the P controller will control in proportion to the control deviation. When the proportional range is exceeded, the controller operates with an output level of 100% (maximum switching frequency).

Special controller functions: Separate controllers

This function is normally deactivated (factory setting or select "No").

In the deactivated state, the software prevents the two controller outputs from being able to work "against each other". So, for example, it is not possible to dose acid and lye at the same time.

If the controllers are separate ("Yes" selection), each controller can be freely configured.

Switch-off of the I-component

This function is normally deactivated (factory setting or select "No").

In the deactivated state, the controller works in accordance with general controller theory.

When I-component switch-off is activated ("Yes" selection), the part of the output level that can be traced back to the I-component is set to zero when the setpoint is reached.

This can be useful with mutual neutralization (acid and lye dosing both possible) in one treatment tank.

Calibration timer

The calibration timer indicates (on request) a required routine calibration. The calibration timer is activated by entering the number of days that must expire before there is a scheduled re-calibration (specified by the system or the operator).

Wash timer

The wash timer can be used to implement automated sensor cleaning. To do this, the function is assigned to a switching output.

The cycle time (cleaning interval) can be adjusted in the range from 0.0 to 240.0 hours.

A cycle time of "0.0" means the wash timer is deactivated.

The wash time (cleaning duration) is adjustable from 1 to 1800 seconds.

During the wash time the controller goes into the HOLD state, which is maintained for 10 seconds after completion of the wash time. A sensor calibration within the cycle time restarts the wash timer.

USP contact (for ultra-pure water)

The USP contact makes it possible to monitor the quality of ultra-pure water according to the requirements of USP <645>. USP <645> contains a table that assigns a limit value for conductivity depending on the temperature. If the conductivity stays below this limit value, the ultra-pure water meets the requirements of USP <645>.

If the conductivity of the water is greater than what is specified in the USP table for a given temperature, the USP contact switches the instrument.

Limit values are defined in levels. For example, a value of 5°C is used at 8°C.

Note:

During monitoring, temperature compensation must be turned off (temperature coefficient = 0)!
To do this, select Administrator Level / Basic Setting / Temperature Compensation / None.

Excerpt from USP <645>

Temperature °C	Max. conductivity µS/cm (uncompensated)	Temperature °C	Max. conductivity µS/cm (uncompensated)
0	0.6	55	2.1
5	0.8	60	2.2
10	0.9	65	2.4
15	1.0	70	2.5
20	1.1	75	2.7
25	1.3	80	2.7
30	1.4	85	2.7
35	1.5	90	2.7
40	1.7	95	2.9
45	1.8	100	3.1
50	1.9		

If the conductivity is exceeded at the relevant temperature, the configured contact switches.

USP warning alarm

The USP warning alarm switches before the water quality reaches the set limit value.
This parameter (0 - 100) is used to set the distance as a percentage (relative to the active limit value) to be maintained from the USP limit.

Ultra-pure water per Ph. Eur.

The limit comparators of the instrument switch, depending on the corresponding configuration, according to the limit valued of the European Pharmacopeia (Ph. Eur.) for purified water.

Temperature °C	Max. conductivity µS/cm
0	0.6
10	0.9
15	1.0
20	1.1
25	1.3
30	1.4
35	1.5
40	1.7
45	1.8
50	1.9

Ph. Eur. warning alarm

The Ph. Eur. warning alarm switches before the water quality reaches the set limit value.
This parameter (0 - 100) is used to set the distance as a percentage (relative to the active limit value) to be maintained from the USP limit.

TDS

Display/control with the unit ppm.

The specific TDS factor can also be entered in this mode.

TDS (**T**otal **D**issolved **S**olids, also commonly referred to in Germany as filtrate dry residue (Filtrattrockenrückstand).
This value is important in areas such as groundwater analysis and power plants.
The value is also used in evaluating drinking water quality (for example in the USA, Arab and Asian countries).
Various organizations have published limit values on this topic.

- WHO (**W**orld **H**ealth **O**rganization) <1000 mg/l
- USEPA (**U**nited **S**tates **E**nvironmental **P**rotection **A**gency) <500 mg/l

Standardized determination is performed gravimetrically, i.e.:

- Filter sample
- Evaporate filtrate
- Weigh residue

A conductivity measurement is used for the online measurement. A single time is sufficient to determine the conversion factor. It corresponds to the ratio of the conductivity value of the water to the value of the gravimetrically determined filtrate dry residue (TDS). The factor moves within the range from 0.55 to 1.0. A typical value for drinking water is about 0.67.

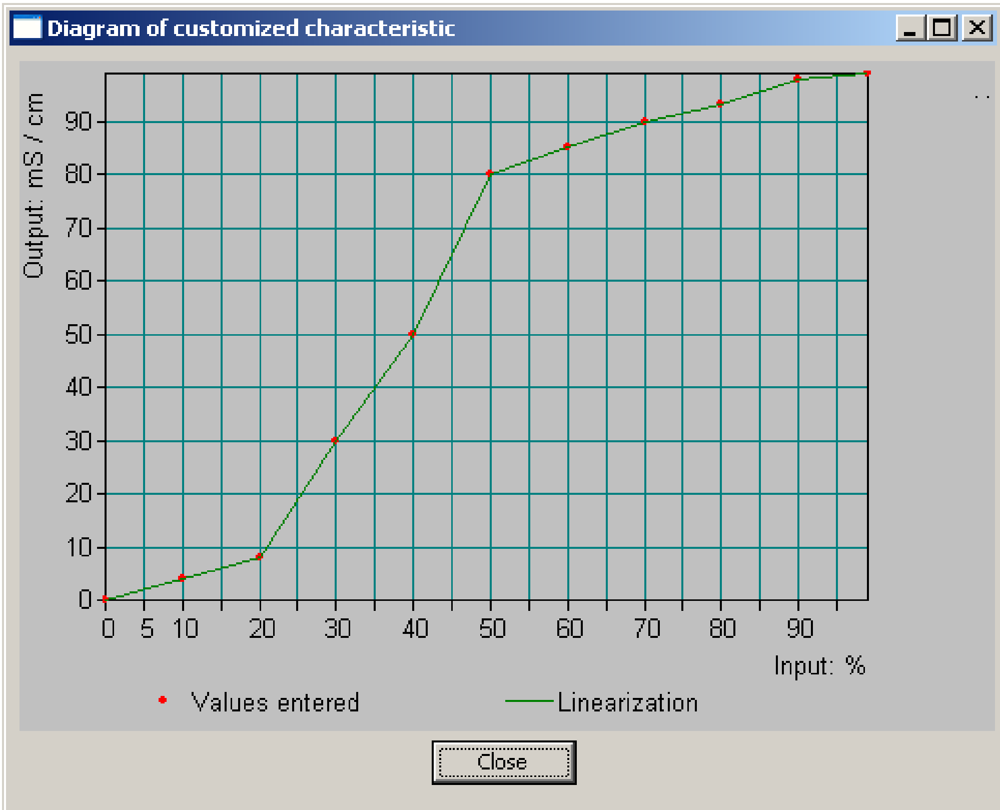
With modern instruments, this factor can be entered individually to achieve the most accurate measurement possible.

Customer specs. table

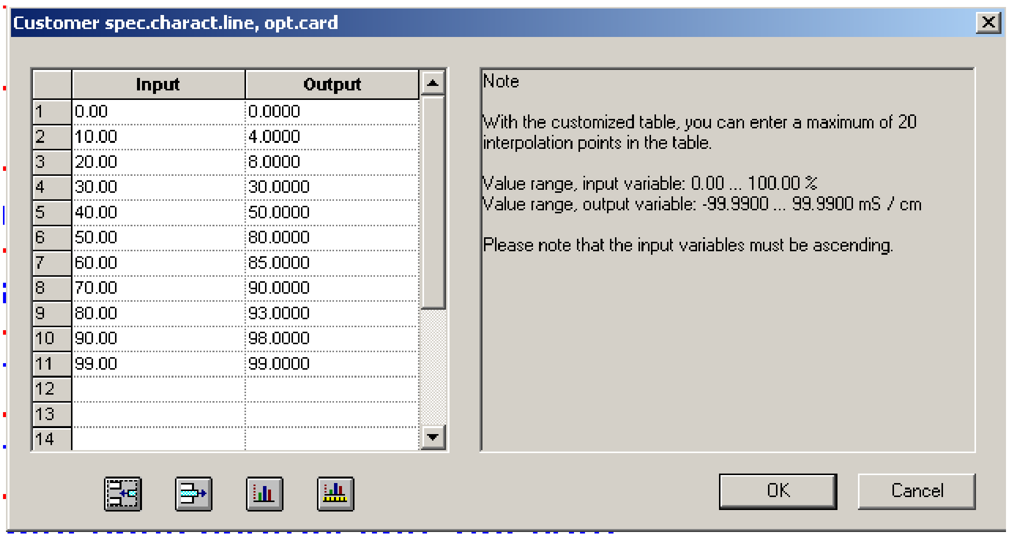
In this mode, the input value can be displayed based on a table (max. 20 value pairs). This function is used to display and linearize non-linear input variables. Values can only be entered in the table using the optional setup program.

Cust. specs. characteristic

In this mode, the instrument can model a monotonically increasing input variable to any output value.



The optional setup program is used to enter the requisite value table.


Customer spec.charact.line, opt.card

	Input	Output
1	0.00	0.0000
2	10.00	4.0000
3	20.00	8.0000
4	30.00	30.0000
5	40.00	50.0000
6	50.00	80.0000
7	60.00	85.0000
8	70.00	90.0000
9	80.00	93.0000
10	90.00	98.0000
11	99.00	99.0000
12		
13		
14		

Note

With the customized table, you can enter a maximum of 20 interpolation points in the table.

Value range, input variable: 0.00 ... 100.00 %
Value range, output variable: -99.9900 ... 99.9900 mS / cm

Please note that the input variables must be ascending.

OK Cancel

Min./max. value memory

This storage records the minimum and maximum input quantities that have occurred. This information can be used, for example, to assess whether the design of the connected sensor is suitable for the values that actually occur.

The max./min. value memory can be reset,
See section 6.7.6 "Delete min/max values", page 35:

Datalogger

Recording duration = about 10 hours with a storage interval of 1 second

Recording duration = about 150 days with a storage interval of 300 seconds

Range switchover

In some processes it is advantageous to have two measurement ranges available, for example in rinsing and regeneration processes.

Normally in these processes a low conductivity must be recorded. In the case of rinsing / regeneration, however, the conductivity is significantly higher, which would result in measurement overrange (error). This situation is not only unsatisfactory, it could also be dangerous.

When range switchover is activated, the parameter set is switched as well!

When range switchover is activated, two copies of the following parameters are present:

- Relative cell constant
- Offset
- Temperature compensation
- Temperature coefficient

- Autorange
  The Autorange function can be used to define two measurement ranges between which the instrument switches in a defined manner.
- Manual
  Switching is initiated in this function mode by a binary input.

Autorange is only configurable for units mS/cm and µS/cm.

Measurement range 1 must be smaller than measurement range 2.

Control only occurs in measurement range 1.

The actual value output in measurement range 2 is scaled to the full display scope.

Switching from measurement range 1 to measurement range 2 occurs when display range 1 is exceeded. The display jumps back when the actual value falls below 90% of display range 1.

A binary output can indicate switching from one measurement range to the other.

Parameter set switchover

In some processes (different process steps) is is advantageous to have two complete parameter sets available.

Define the parameter sets See section 11.5 "Parameter sets", page 77.

The predefined parameter sets are activated by a binary input.

Deposit detection

Deposit detection can be activated for four-electrode cells.

It may happen during normal operation that a coating forms on the electrodes. Because of this, the conductivity that is displayed is lower than the actual conductivity. When the "Deposit detection" function is activated, cell maintenance is required.

16.2 Parameters of the User level

When there are numerous instrument parameters to configure, it is advisable to make a note in the table below of all the parameters to be changed and to work through these parameters in the given order.

The following list shows the maximum number of parameters that can be modified.

Some of these parameters will not be visible (and therefore not editable) for your particular instrument, depending on the configuration.

Parameter	Selection / value range **Factory setting**	New setting
Conductivity input		
Cell constant	0.01 / 0.1 / 0.5 / **1.0** / 3.0 / 10.0	
Relative cell constant and Relative cell constant MB 2	20.0 - **100.0** - 500.0	
Offset and offset MB 2	-20.00 - **0.00** - 20.00% of the display range	
Temperature compensation and temperature compensation MB 2	None **Linear** Natural waters ASTM 1125 neutral ASTM 1125 acidic ASTM 1125 alkaline	
Temperature compensation source	**Temperature input** Option input 1 Option input 2 Option input 3 Manual temperature input	
Temperature coefficient and temperature coefficient MB 2	0.00 - **2.20** - 8.00%/K	
Reference temperature	15.0 - **25.0** - 35.0°C	
Pollution recognition	**Off** On	
Broken sensor detection	**Off** On	
Filter time constant	0.0 - **2.0** - 25.0 seconds	
Calibration interval	**0** - 99 days (0 = timer not active)	

Parameter	Selection / value range **Factory setting**	New setting
Differential measurement	**Off** Main input - (minus) Option input 1 Main input - (minus) Option input 2 Main input - (minus) Option input 3 Option input 1 - (minus) Main input Option input 2 - (minus) Main input Option input 3 - (minus) Main input	
Supply frequency	**50 Hz** 60 Hz	
Temperature input		
Temperature sensor	No sensor **Pt 100** Pt 1000 Cust. specs. 0 - 20 mA 4 - 20 mA 0 - 10 V 2 - 10 V Resistance transmitter	
Unit	**°C/°F** % Without unit Cust. specs.	
Scaling start	-100.0 - **0.0** - 499.9°C	
Scaling end	-99.9 - **100.0** - 500.0°C	
Filter time constant	0.0 - **2.0** - 25.0 seconds	
Manual temperature	-99.9 - **25.0** - +99.9°C	
Offset	-99.9 - **0.0** - +99.9°C	
Optional inputs		
Analog inputs 1 to 3		
Operating mode	**Off** Linear Temperature pH measurement Conductivity Concentration Cust. specs. Stroke feedback Chlorine, pH-compensated	
Signal type	**0 - 20 mA** 4 - 20 mA 0 - 10 V 2 - 10 V 0 - 1 V Pt100 Pt1000 Cust. specs.	

16 Appendix

Parameter	Selection / value range **Factory setting**	New setting
Connection type	**2-wire** 3-wire 4-wire	
Display format	XXXX XXX.x **XX.xx** X.xxx	
Unit	µS/cm mS/cm kΩ∗cm MΩ∗cm None Cust. specs. mV **pH** % ppm mg/l	
Scaling start	**-9999** - +9998	
Scaling end	-9998 - +**9999**	
Temperature compensation source	**Temperature input** Option input 1 Option input 2 Option input 3 Manual temperature	
pH compensation source	**Main input** Option input 1 Option input 2 Option input 3	
Temperature compensation	None **Linear** TC graph Natural waters ASTM D1125 neutral ASTM D1125 acidic ASTM D1125 alkaline NaOH 0 - 12% NaOH 25 - 50% HNO_3 0 - 25% HNO_3 36 - 82% H_2SO_4 0 - 28% H_2SO_4 36 - 85% H_2SO_4 92 - 99% HCl 0 - 18% HCl 22 - 44%	
Reference temperature	15.0 - **25.0** - 30.0°C	
Filter time constant	0.0 - **2.0** - 25.0 seconds	
Relative cell constant	20.0 - **100.0** - 500.0 1/cm	
Temperature coefficient	0.00 - **2.20** - 8.00 1/cm	

Parameter	Selection / value range **Factory setting**	New setting
Zero point	-9999 - **0** - +9999	
Slope	-999.9 - **100.0** - +999.9%	
Binary inputs		
Binary input 1 or 2		
Function	No function Manual mode Hold mode Hold mode inverse Alarm stop Freeze measured value Key lock Lock levels Flow rate measurement Reset day counter Reset total counter Range switchover	
Controller		
Controller 1 or 2 Parameter set 1 or 2		
Min. setpoint	**0** - 9999	
Max. setpoint	0 - **9999**	
Setpoint	**0** - 9999	
Setpoint 2	**0** - 9999	
Proportional range	**0** - 9999	
Reset time	**0.00** - 9999 s	
Derivative time	**0.00** - 9999 s	
Period time	2.00 - **60.0** - 999.9 s	
Hysteresis	0 - **200** - 9999	
On-delay	**0.00** - 999.5 s	
Delayed release	**0.00** - 999.5 s	
Output limit	**0** - 100%	
Min. turn-on time	0.20 - **0.50** - 99.50 s	
Actuator time	10 - **60** - 3000 s	
Max. pulse frequency	1 - **60** - 80 1/s	
Alarm tolerance	0.00 - **1.00** - 16.00	
Alarm delay	**0.00** - 9999 s	
Configuration		
Controller type	**Off** Limit value Pulse lengths Pulse frequency Continuous Modulating	

Parameter	Selection / value range **Factory setting**	New setting
Controller actual value	**Main value** Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2 Differential signal	
Stroke retransmission	No signal **Main value** Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2	
Additive disturbance	No signal **Main value** Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2	

[1] Delayed release is automatically deactivated when wiper times are greater than 0 seconds.

Parameter	Selection / value range **Factory setting**	New setting
Multiplicative disturbance	No signal **Main value** Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2	
Min/max contact	**Min contact** Max contact	
Make/break contact	Make contact **Break contact**	
Hold mode	**0%** 100% Frozen Hold output	
Hold reg. ratio	**0 -** 100%	
Error	**0%** 100% Frozen Hold output	
Alarm control	**Off** On	
Controller special functions		
I-switch-off	**Inactive** (the controller is working normally) Active (special behavior)	
Separate controllers	**No** Yes	
Manual mode	**Locked** Coding Switching	
Limit value control		
Limit values 1 to 4		

Parameter	Selection / value range **Factory setting**	New setting
Signal source	**No signal** Main value Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2 Differential signal Flow rate Partial quantity Total quantity Output controller 1 Output controller 2 Setpoint 1 controller 1 Setpoint 2 controller 1 Setpoint 1 controller 2 Setpoint 2 controller 2	
Switching function	Alarm function (AF1) Alarm function (AF2) Alarm function (AF7) Alarm function (AF8)	
Switching point	**0** - 9999	
Hysteresis	**0** - 9999	
Binary outputs		
Binary outputs 1 to 8		

Parameter	Selection / value range **Factory setting**	New setting
Signal source	**No signal** Limit value control 1 Limit value control 2 Limit value control 3 Limit value control 4 Controller 1 output 1 Controller 1 output 2 Controller 2 output 1 Controller 2 output 2 Controller alarm 1 Controller alarm 2 Controller alarm Sensor warnings Sensor error Warnings and errors Calibration timer Wash timer Logic 1 Logic 2 Autorange	
At calibration	**Standard operation** Inactive Active Frozen	
Error	**Inactive** Active Frozen	
Hold mode	**Inactive** Active Frozen Standard operation	
Switch-on delay	**0.0** - 3600 s	
Switch-off delay	**0.0** - 3600 s	
Pulse time[1]	**0.0** - 3600 s	
Manual mode	**No simulation** Inactive Active	
Analog outputs		
Analog outputs 1 to 3		

Parameter	Selection / value range **Factory setting**	New setting
Signal source	No signal **Main value** Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2 Differential signal Flow rate Partial quantity Total quantity Output controller 1 Output controller 2 Setpoint 1 controller 1 Setpoint 2 controller 1 Setpoint 1 controller 2 Setpoint 2 controller 2	
Signal type	**0 - 20 mA** 4 - 20 mA 20 - 0 mA 20 - 4 mA 0 - 10 V 10 - 0 V	
Scaling start	**0** - 9999	
Scaling end	0 - **9999**	
At calibration	**Moving** Frozen Safe value	
In case of error (output signal, of the controller in case of error)	**0/4 mA / 0 V** 20 mA / 10 V Frozen Safety value	
Hold mode (output signal, of the controller in Hold mode)	**Frozen** Safety value Standard mode 0/4 mA / 0 V 20 mA / 10 V	
Safety value	**0.0** - 20.0 mA	
Simulation	**Off** On	
Simulation value	Off **0.0** - 20.0 mA	
Interface		
Modbus address	**1** - 254	

Parameter	Selection / value range **Factory setting**	New setting
Baud rate	**9600** 19200 38400	
Parity	**None** Even Odd	
Stop bits	**1** 2	
Profibus address	**0** - 99	
EEPROM marking	**Off** On	
Wash timer		
Cycle time	**0.0** - 240.0 hours (0.0 = Wash contact is not active	
Wash time	1 - **60** - 1800 seconds	
Datalogger		
Storage interval	1 - **60** - 300 seconds	
Channels 1 to 4	No signal **Main value** (standard for channel 1) Not comp. Main value **Temperature** (standard for channel 2) Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2 Differential signal Flow rate Partial quantity Total quantity **Output controller 1** (standard for channel 3) **Output controller 2** (standard for channel 4) Setpoint 1 controller 1 Setpoint 2 controller 1 Setpoint 1 controller 2 Setpoint 2 controller 2	
Date year	**20**xx	
Date month	**1** - 12	
Date day	**1** - 31	
Time hour	**0** - 24	
Time minute	**0** - 59	
Time second	**0** - 59	
Display		

Parameter	Selection / value range **Factory setting**	New setting
Lighting	**On** With operation	
Display of measured value	Standard Tendency Bargraph Trend chart Large display 3 measured values Time	
Display Top / Center / Bottom	No signal **Main value** (standard for "Top") Not comp. Main value **Temperature**(standard for "Center" and "Bottom") Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2 Differential signal Flow rate Partial quantity Total quantity Output controller 1 Output controller 2 Setpoint 1 controller 1 Setpoint 2 controller 1 Setpoint 1 controller 2 Setpoint 2 controller 2	
Operating timeout	0 - **1** - 10 minutes (0 = operating timeout is turned off)	
Scaling start	**0** - 9999	
Scaling end	0 - **9999**	

Parameter	Selection / value range **Factory setting**	New setting
Signal source	**Main value** Not comp. Main value Temperature Option input 1 Option input 1 not compensated Option input 2 Option input 2 not compensated Option input 3 Option input 3 not compensated Math 1 Math 2 Differential signal Flow rate Partial quantity Total quantity	
Temperature unit	**°C** °F	
LCD inverse	**Off** On	
Contrast	0 - **10** - 20	

17 EU Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Transmitter/controller for conductivity, TDS, resistance, temperature and standard signals Model: ACM-1

to which this declaration relates is in conformity with the standards noted below:

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

Also the following EU guidelines are fulfilled:

2014/30/EU EMC Directive
2014/35/EU Low Voltage Directive
2011/65/EU **RoHS**

Hofheim, 20. Dec. 2016

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