BA 194C/07/en/07.02
No. 51500268
Software version 2.50 or later

Liquisys M
CPM 223 / 253
Transmitter for pH and Redox

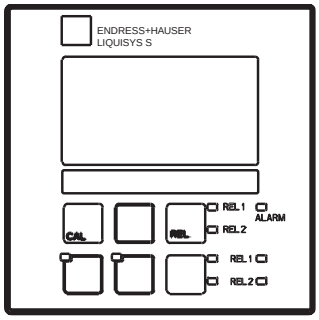


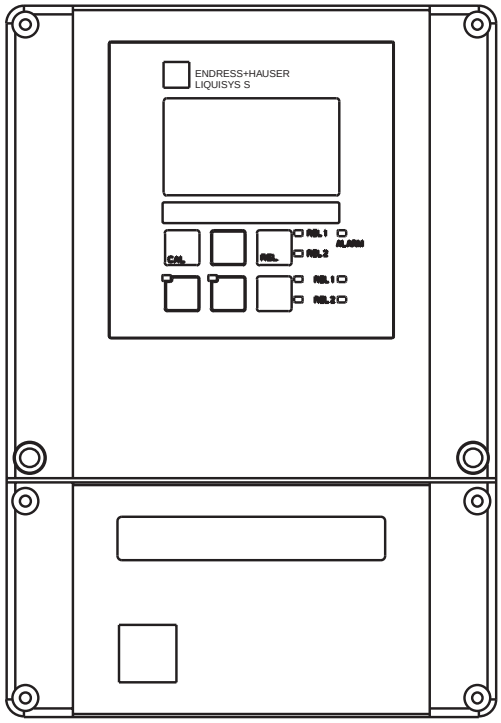






Operating Instructions





slp 8.0 deen 220802

Quality made by
Endress+Hauser

ISO 9001

Endress+Hauser

The Power of Know How

Need information on the instrument?
Please read the following chapters:

General information

Safety

You wish to install the instrument.
The required steps are described in this chapter:

Installation

You wish to operate or reconfigure the instrument.
The operating concept is explained in these chapters:

Operation

Instrument configuration

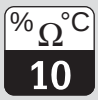
Interfaces

Need help with problems or maintenance? Please refer to these chapters:

Diagnosis

Maintenance

Accessories



Technical data

Appendix

Index

Table of contents

1 General information

1.1 Symbols used

Warning:

This symbol alerts to hazards which could cause serious injuries as well as damage to the equipment if ignored.

Caution:

This symbol alerts to possible faults which could arise from incorrect operation. They could cause damage to the equiment if ignored.

Note:

This symbol indicates important items of information.

Double insulation

Equipment protected by double insulation.

Alarm relay

Input

Output

1.2 Storage and transport

The packaging material used to store or transport the transmitter must provide shock protection. Optimal protection is provided by the original packaging materials.

Conformance with the ambient conditions (see Technical data) must be assured.

1.3 Unpacking

Verify that the packaging and the contents are undamaged! Inform the post office or freight carrier of any damage.
Damaged merchandise must be retained until the matter has been settled.

Check that the delivery is complete and agrees with the shipping documents and your order (refer to nameplate for type and version).

Keep the original packaging materials for future storage or shipping of the instrument.

If you have any questions, consult your supplier or the Endress+Hauser sales agency in your area (see back cover of these operation instructions for addresses).

The delivery includes:

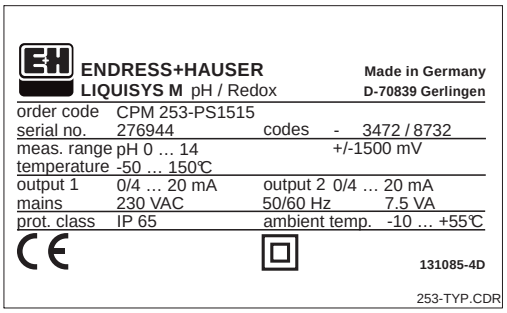
- Transmitter CPM 223 or CPM 253
- Operating instructions BA 194C/07/en
- Field instrument:
  - 1 plug-in screw terminal
  - 1x cable gland Pg 7
  - 1x cable gland 16 reduced
  - 2x cable glands Pg 13.5
  - 1x NPT adapter set
    (optional for CSA versions)
- Panel-mounted instrument:
  - 1 set of plug-in screw terminals
  - 2 fastening clips
  - 1 BNC connector (solder-free measuring cable connection)

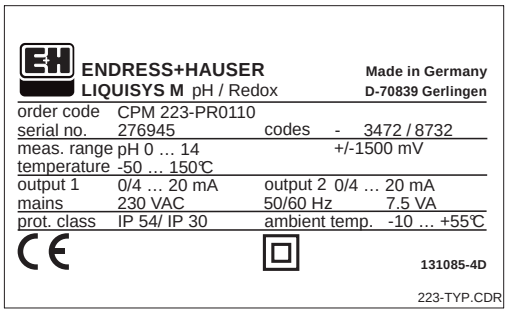
1.4 Dismantling, packaging and disposal

Package the assembly properly for reuse at a later point in time. Optimal protection is provided by the original packaging materials. Observe local regulations for disposal.

1.5 Product structure

You can identify the instrument version by the order code on the nameplate.
Sub “codes” are the release codes for Software upgrade shown for ChemoClean (left of diagonal line) or Plus package (right of diagonal line).





left: Nameplate CPM 253
right: Nameplate CPM 223

Fig. 1.1

Liquisys M CPM 223 / 253

Version
- IS pH/redox measurement with IsFET or glass electrode
- PR pH/redox measurement with glass electrode
- PS pH/redox measurement with glass electrode, with additional functions (Plus package)

Power supply
- 0 Power supply 230 V AC
- 1 Power supply 115 V AC
- 2 Power supply 230 V AC, CSA Gen. Purp.
- 3 Power supply 115 V AC, CSA Gen. Purp.
- 5 Power supply 100 AC
- 7 Power supply 24 AC, CSA Gen. Purp.
- 8 Power supply 24 V AC/DC

Measurement output
- 0 1 output signal: pH / redox
- 1 2 output signals: pH / redox and temp. / pH or redox / set value
- 3 1 output signal: PROFIBUS-PA
- 4 1 output signal: PROFIBUS-DP
- 5 1 output signal: pH / redox with HART®
- 6 2 output signals: pH / redox, HART® and temperature

Contacts
- 05 No additional contacts
- 10 2 contacts (limit values / PID / timer)
- 15 4 contacts (limit values / PID / timer / ChemoClean)
- 16 4 contacts (limit values / PID / timer)
- 20 2 contacts with current input (limits / PID / timer)
- 25 4 contacts with cleaning, current input (limit / PID / ChemoClean)
- 26 4 contacts with timer, current input (limits / PID / timer)

CPM253-				
CPM223-				

complete order code

Additional functions of the Plus package (IS / PS version)
- Current output table, fields O23x
- Monitoring for sensor and process, function group P
- Neutralisation controller, fields R 26x
- Automatic start of cleaning function Field F8

2 Safety

2.1 Intended application

The CPM 223/253 transmitter is a field-tested and reliable transmitter used to determine the pH or redox (ORP) value.

The CPM 223/253 is particularly suitable for use in the following areas of application:

- Chemical industry
- Pharmaceutical industry
- Foodstuff industry
- Drinking water processing
- Condensate processing
- Municipal sewage treatment plants
- Water conditioning
- Electroplating

2.2 General safety instructions

This device has been manufactured for safe operation according to the state of the art in engineering and conforms to the applicable regulations and European standards (see Technical data). It has been designed according to EN 61010-1 and has left the manufacturer's works in perfect condition.

However, if used improperly or for purposes other than the intended purpose, it may be dangerous, e.g. due to incorrect connection.

Warning:

- Operating this instrument in any way other than as described in these instructions may compromise the safety and function of the measuring system and is therefore impermissible.
- The notes and warnings in these installation and operating instructions must be strictly adhered to.

2.3 Installation, start-up, operation

Warning:

- This device may only be installed, connected electrically, commissioned, operated and serviced by properly trained personnel authorized by the system operator.
- Technical personnel must be familiar with these operating instructions and must adhere to the instructions described therein.
- Make sure that the power supply ratings match the data specified on the nameplate before you connect the instrument to a power source.
- A clearly identified mains disconnecting device must be installed close to the instrument.
- Live components can be touched through the vent slots in the housing and the openings on the rear of the housing. Do not insert tools, wires, etc., in these slots (CPM 223 only).
- Check that all connections have been properly made before powering up the system!
- Damaged equipment that may be dangerous must not be operated and should be clearly identified as being defective.
- Any troubleshooting of the measuring system is to be performed exclusively by authorized, trained personnel.
- If faults cannot be remedied, the instrument must be removed from service and secured to prevent accidental start-up.
- Repairs not described in these operating instructions may only be performed at the manufacturer's works or by the Endress+Hauser Service Organization.

2.4 Monitoring and safety features

Safety features

The transmitter is protected against external influences and damage by the following design measures:

- Rugged housing
- Degree of protection provided by enclosure: IP 65 (CPM 253)
- UV resistance

Monitoring features

In the event of a system error or power failure, an alarm condition is signalled via a fault-signalling contact.

2.5 Immunity to interference

This instrument has been tested according to the applicable European standards for industrial applications with regard to electromagnetic compatibility. It is protected against electromagnetic interference by the following design measures:

- Cable screen
- Interference suppressor filter
- Interference suppression capacitors

Warning:

The specified immunity to interference only applies for devices connected as outlined in these operating instructions.

2.6 Declaration of conformity

The CPM 223/253 transmitter has been developed and manufactured in accordance with currently valid European standards and directives.
E+H certifies the compliance with the standards by using the CE sign.

3 Installation

The following procedure should be followed for a complete measuring system installation:

- Installation or attachment of transmitter (see chapter 3.3)
- Selection and connection of cable and electrode (see chapters 3.4, 3.5 and 9)
- Installation is followed by start-up (see chapter 5)

3.1 Measuring system

The complete measuring system comprises:

- The Liquisys M CPM 223 or CPM 253 transmitter
- A pH or redox electrode with or without an integrated temperature sensor
- An immersion or flow assembly
- pH measuring cable (e. g. CPK 9)

Optionally:

- Extension cable
- Junction box VBA or VBM

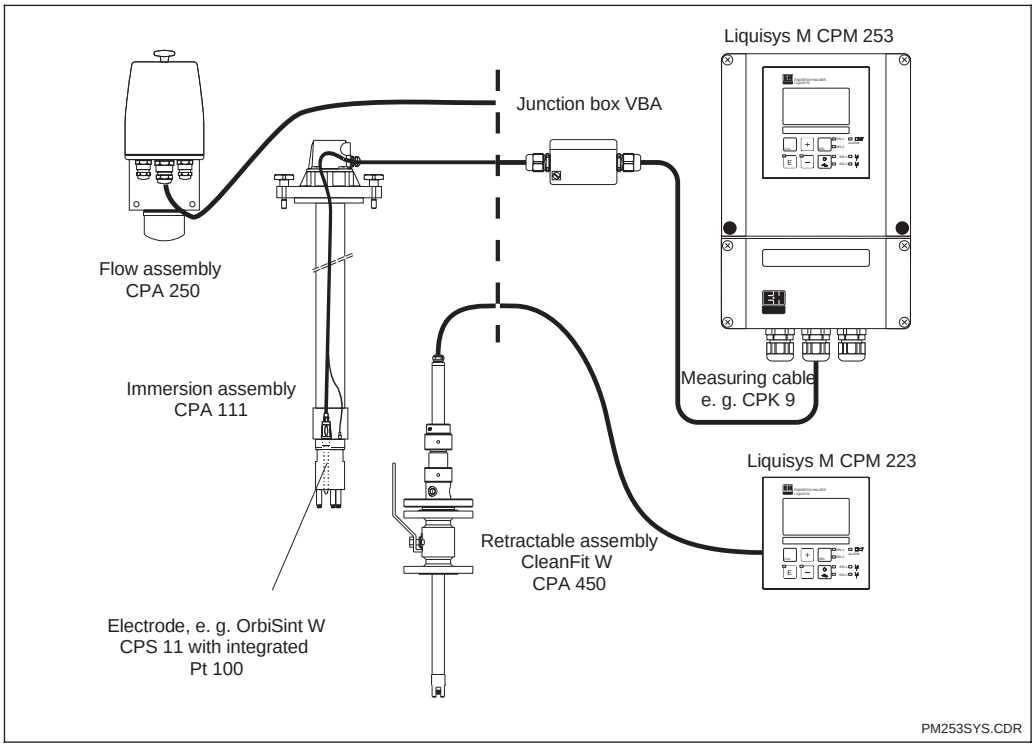
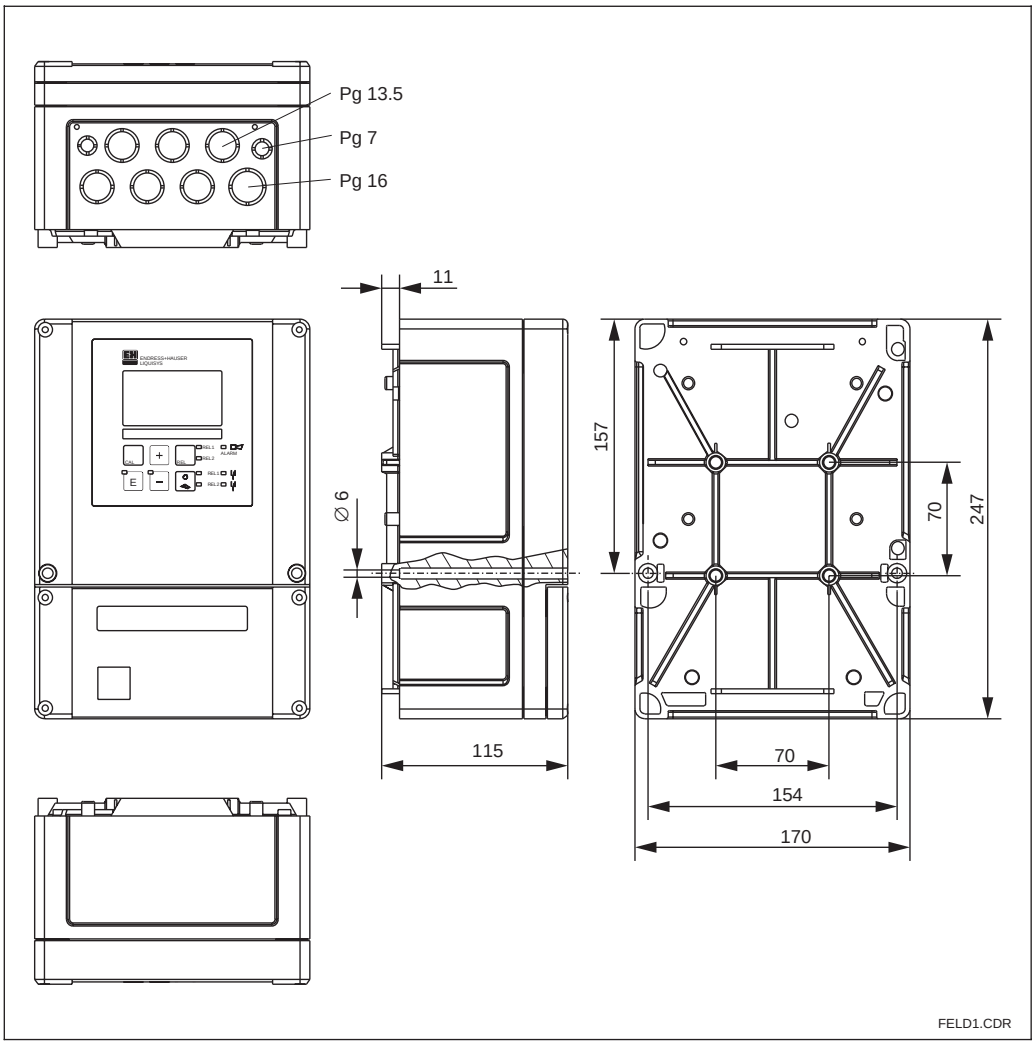


Fig. 3.1 Complete measuring systems Liquisys M CPM 223 / 253 with measuring cable, assemblies and pH or redox electrodes

3.2 Dimensions



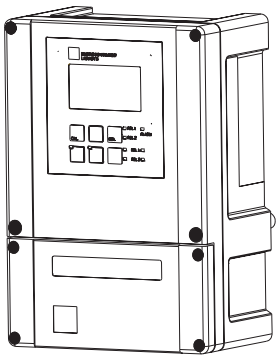


Fig. 3.2 Dimensions of Liquisys M CPM 253

Note:

There is a hole in the punching for Pg 16 cable entry. It serves as a pressure balance during air freight dispatching. Make sure that there is no moisture penetrating into the housing before cable installation. After cable installation, the housing is completely tight.

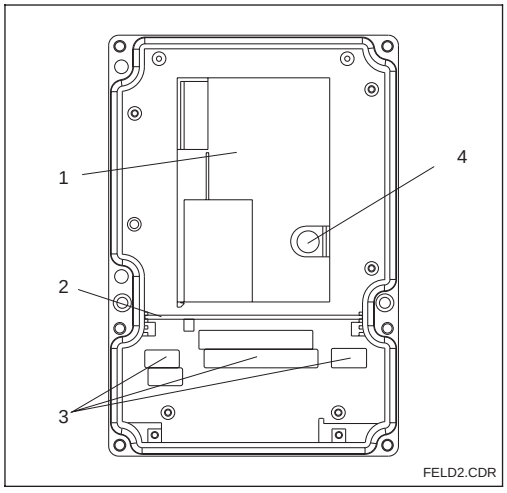
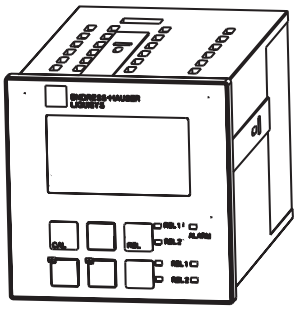


Fig. 3.3 Inside of housing of Liquisys M CPM 253:
1 Removable electronics box
2 Partition plate
3 Terminal blocks
4 Fuse



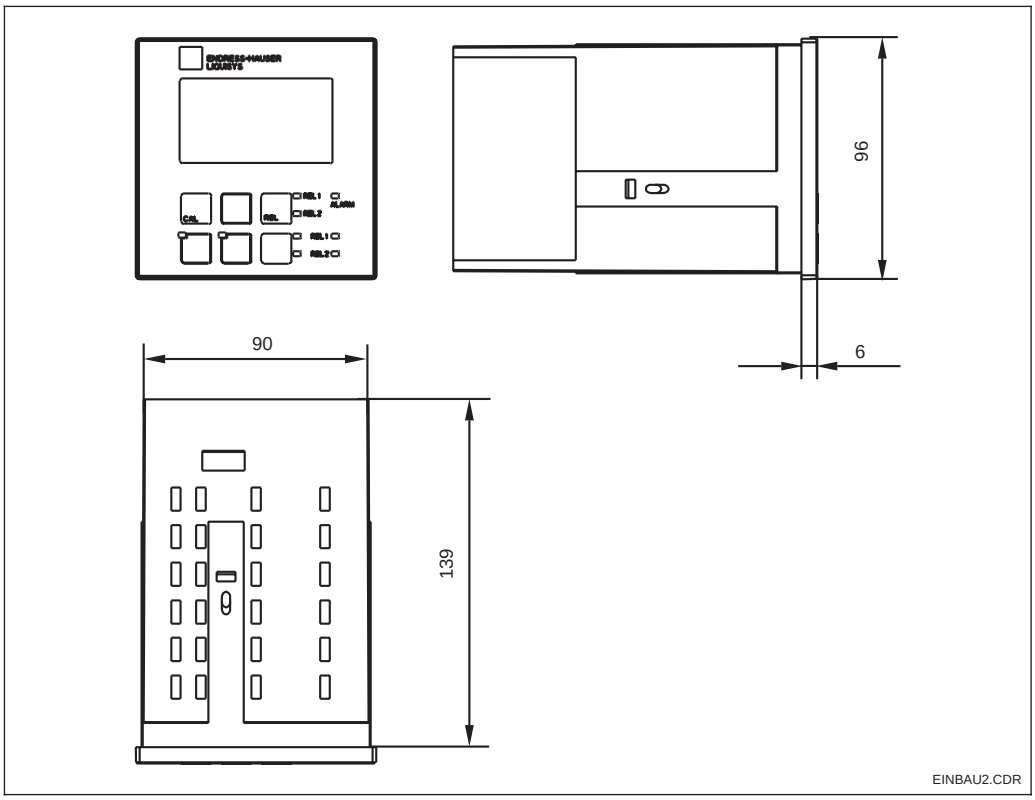


Fig. 3.4 Liquisys M CPM 223, Mounting version

3.3 Mounting

3.3.1 Field instrument

Several mounting options are available for the Liquisys M in the field instrument version:

- Post mounting on cylindrical pipes
- Post mounting on a square post
- Wall mounting with fastening screws.

Weather protection cover CYY 101 can be used for outdoor installation in conjunction with all mounting variants.

Weather protection cover CYY 101

Weather protection cover for outdoor installation, to be mounted on field instrument; SS 304 stainless steel material;
order no.: CYY101-A

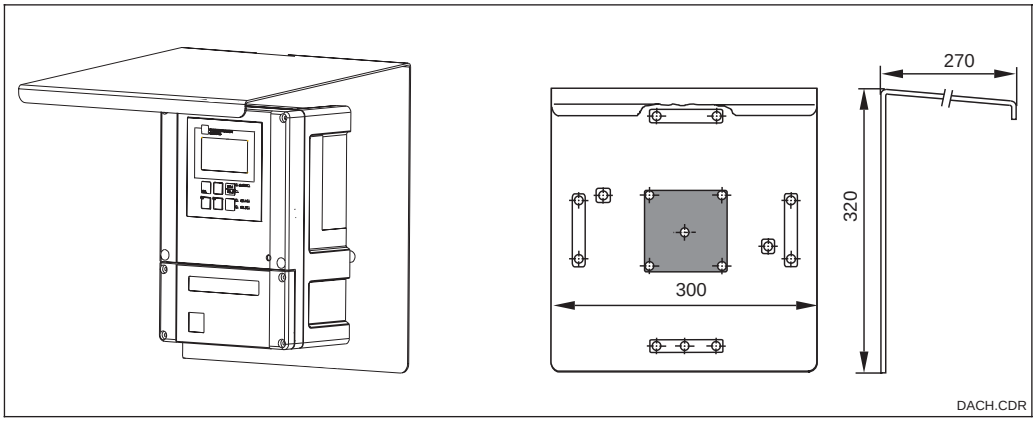


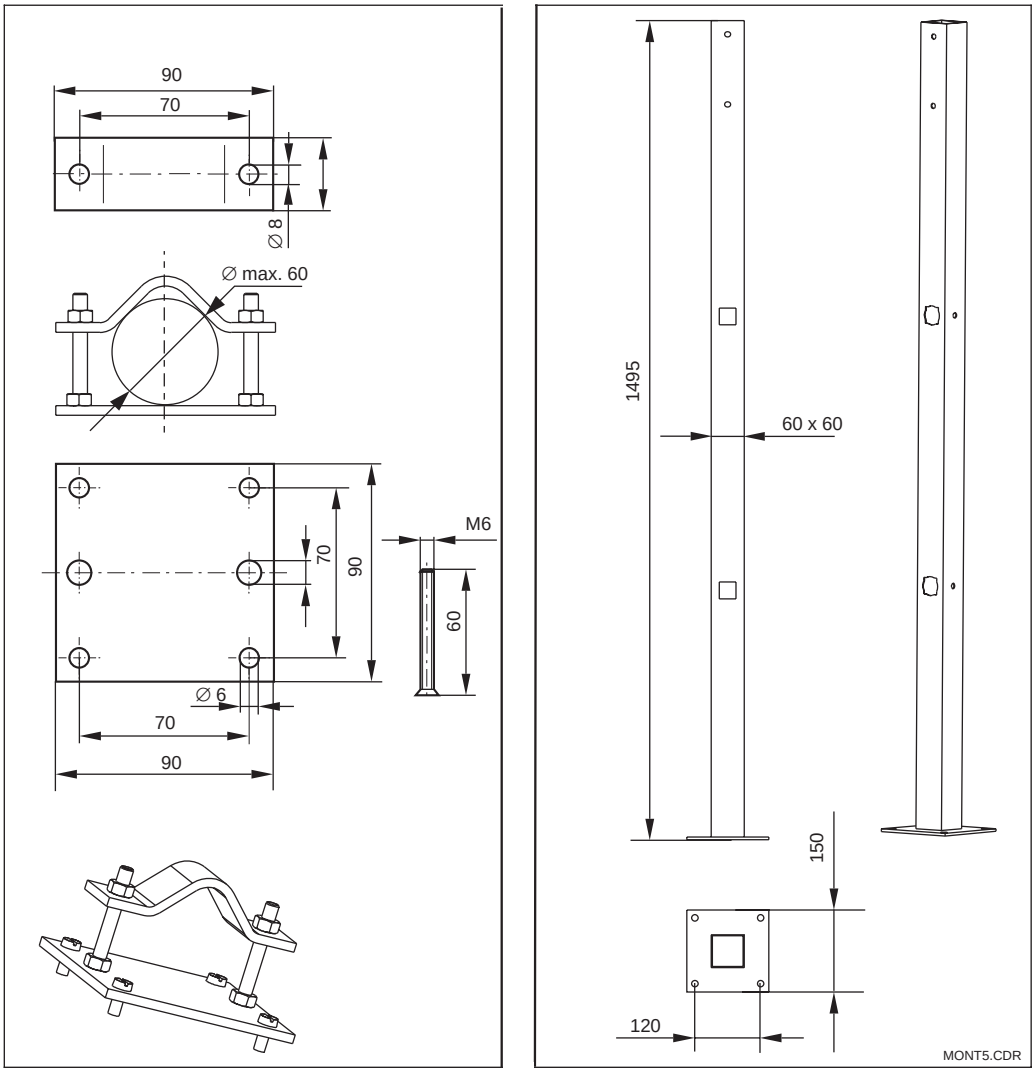
Fig. 3.5 Weather protection cover for field instruments

Post mounting kit

Mounting kit for installation of field housing on horizontal and vertical pipes (max. ∅ 60 mm); material: stainless steel SS 304 (AISI 304); order no. 50086842

Universal mounting post CYY 102

Square tube for mounting of measuring transmitters; SS 304 material; order no.: CYY102-A



left:
Mounting kit for post mounting on cylindrical pipes

right:
Fig. 3.6 Square mounting post

3.3.2 Mounting examples

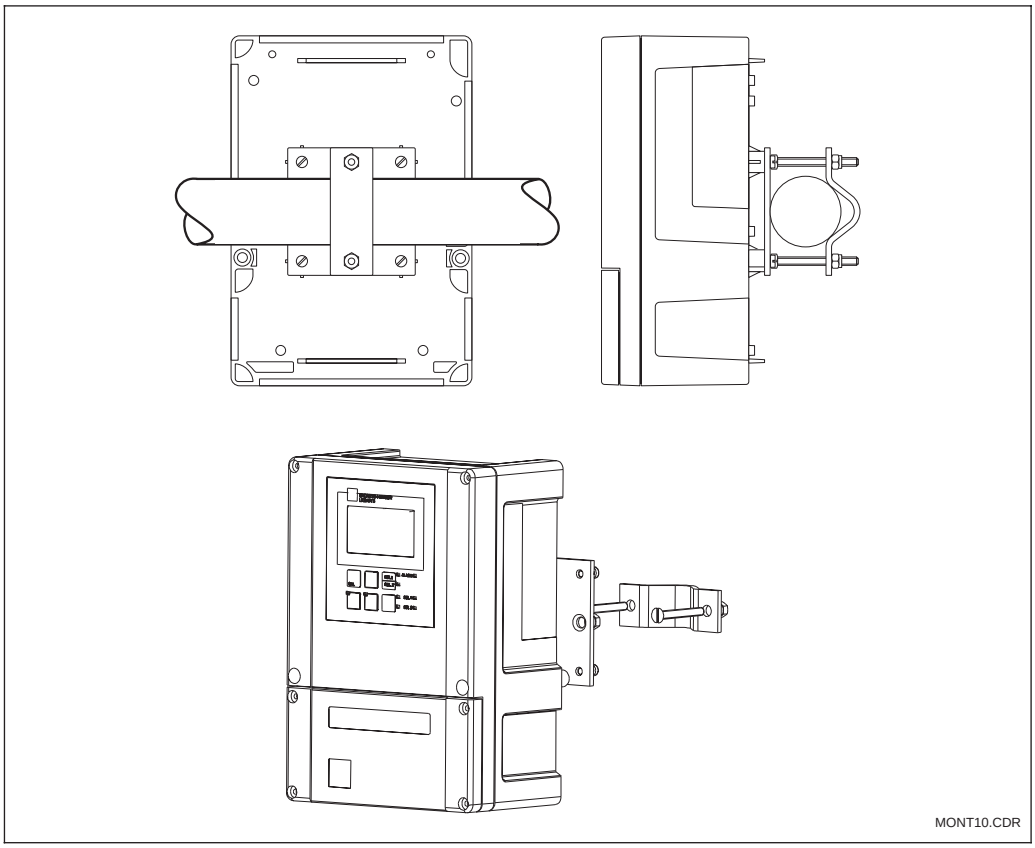


Fig. 3.7 Pipe mounting of Liquisys M field instrument

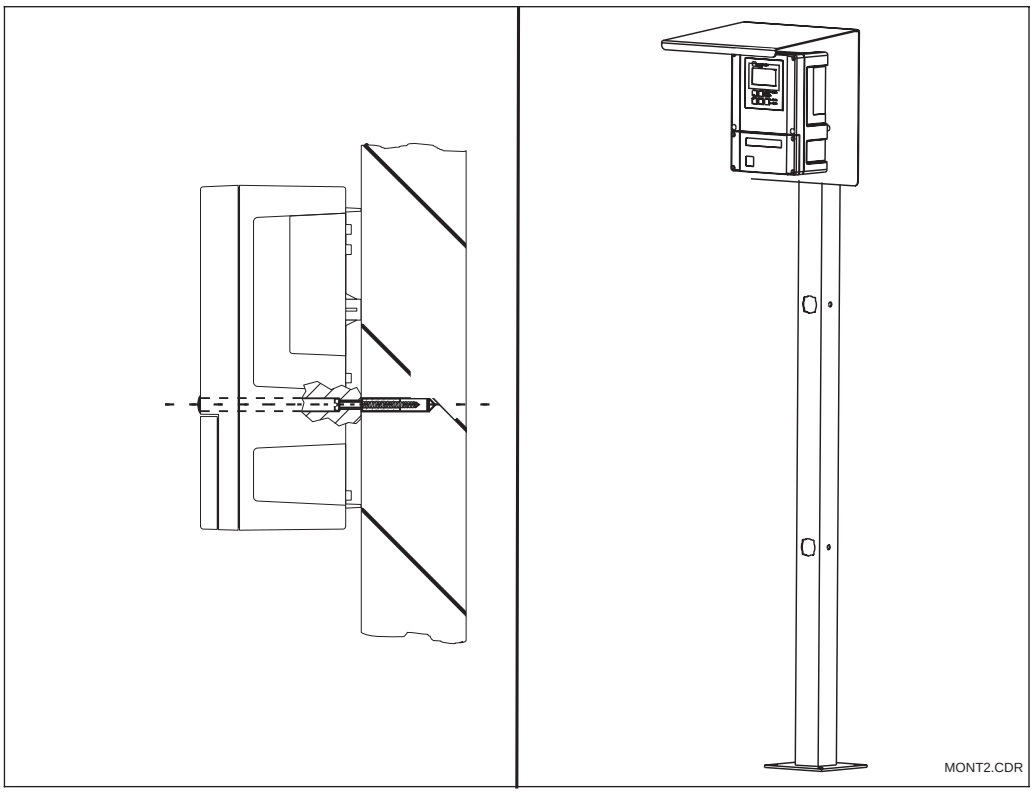


Fig. 3.8 Liquisys M field instrument

left:
Wall mounting

right:
Mounting with universal post and weather protection cover

3.3.3 Panel-mounted instrument

The device is attached using the supplied tensioning screws (see Fig. 3.9).
The required overall installation depth is approx. 165 mm.

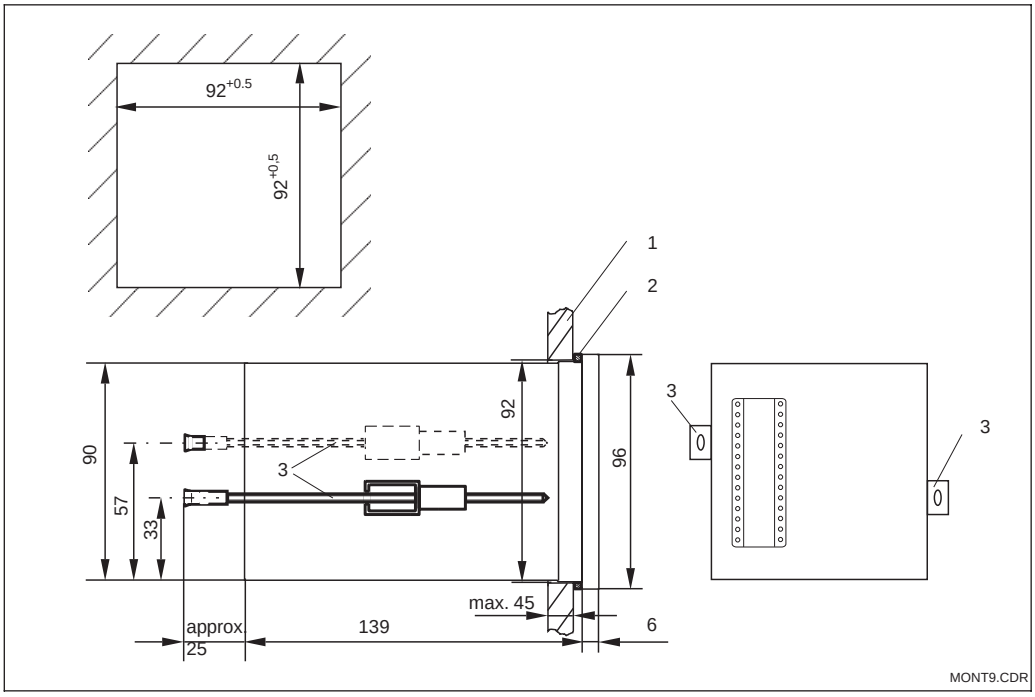


Fig. 3.9 Attachment of panel-mounted instrument
1 Wall of control cabinet
2 Gasket
3 Tensioning screws

3.4 Electrical connection

Connection diagram

The connection diagram depicted in Fig. 3.10 shows the connections of an instrument equipped with all the options. The connection of the various electrodes with the measuring cables is shown in more detail in the subsequent figures.

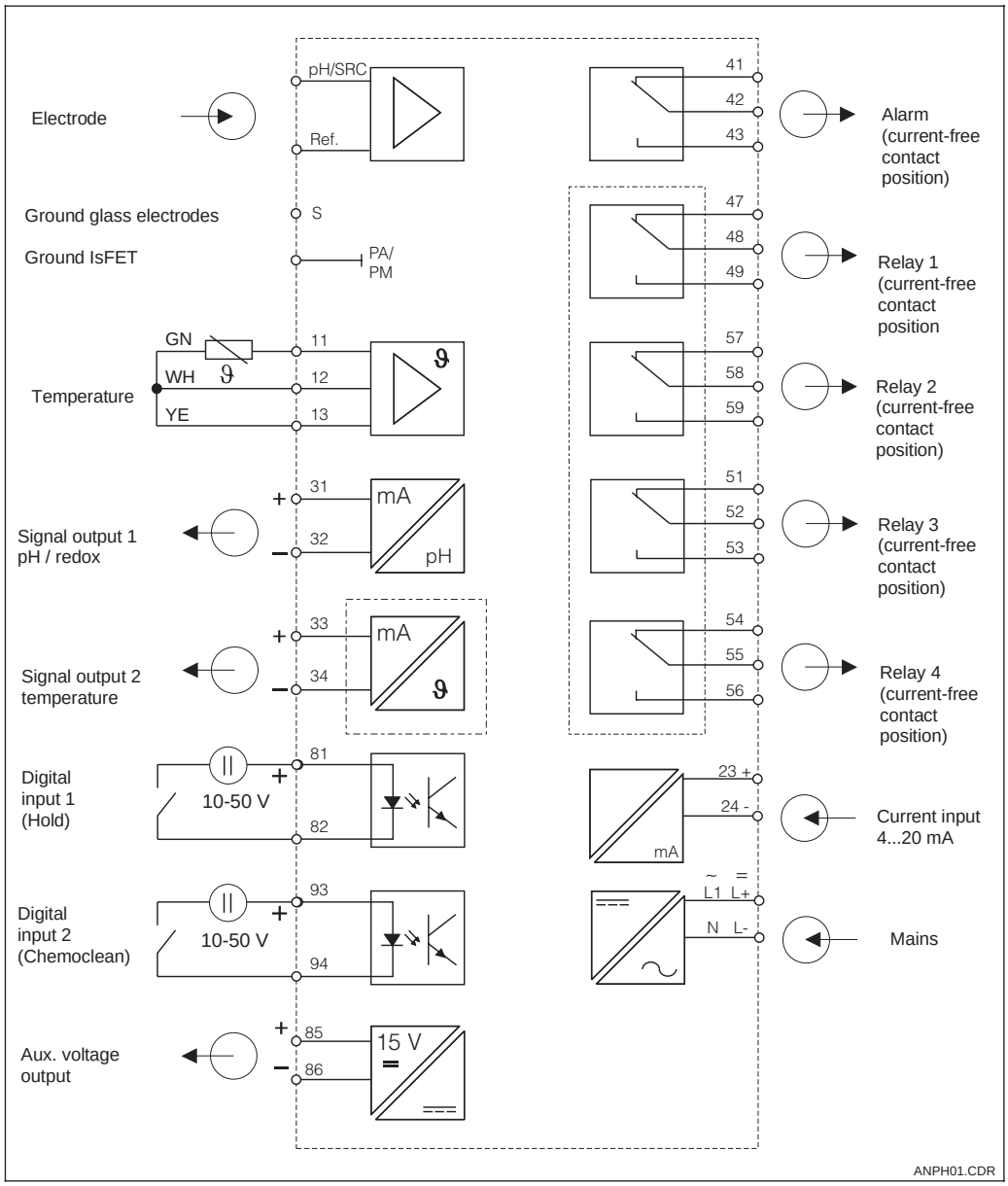


Fig. 3.10 Electrical connection of Liquisys M CPM 223/253 with full wiring

Note:

- The instrument has protection class II and is generally operated without protective earth connection.
- Mains supply voltage fluctuations should not exceed ten percent of the nominal supply voltage.
- 24V AC/DC models must be supplied from an energy limiting SELV source in accordance with dir. IEC 1010.1 Annex H.
- Ground the sensor screen in order to ensure functional safety and measuring stability of the measuring system.
  Glass electrodes: Terminal “S”.
  IsFET: PE ground terminal. The ground terminal is located on the cover frame of the panel-mounted instrument CPM 223 and in the connection compartment in the field instrument CPM 253.

Note:

- Please label the sensor terminal block with the enclosed sticker.
- Connect the ground terminal with PE.

Caution:

- Terminal designated as NC may not be switched.
- Undesignated terminals may not be switched.

Connection of field instrument

For connection, insert the measuring cables through the cable glands of the field instrument and connect according to the wiring diagram as shown in the following figure.

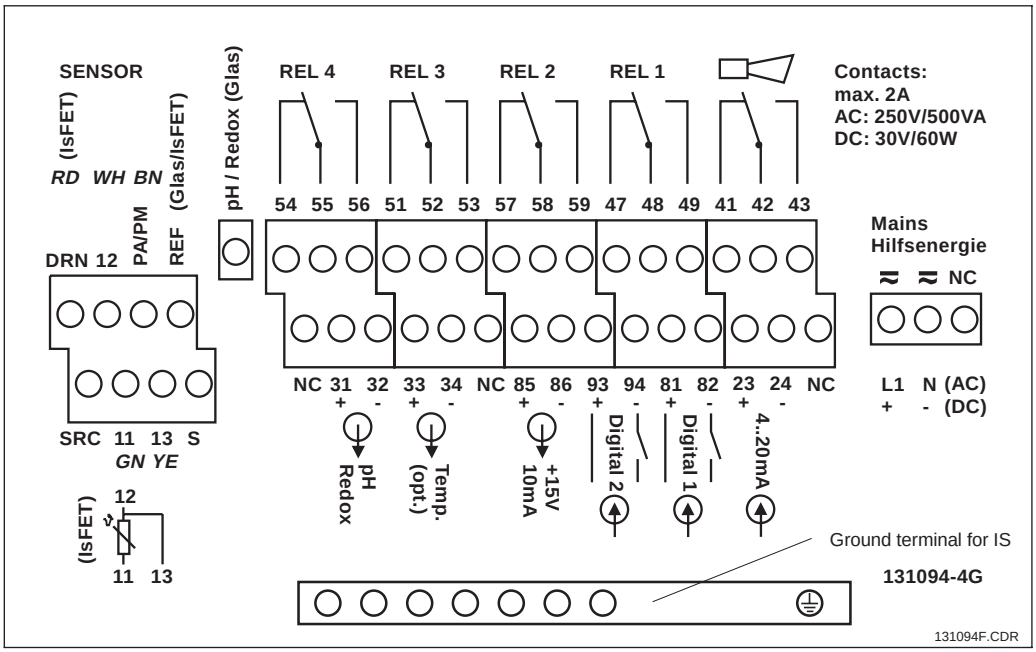


Fig. 3.12 Connection compartment sticker of field instrument

Connection of panel-mounted instrument

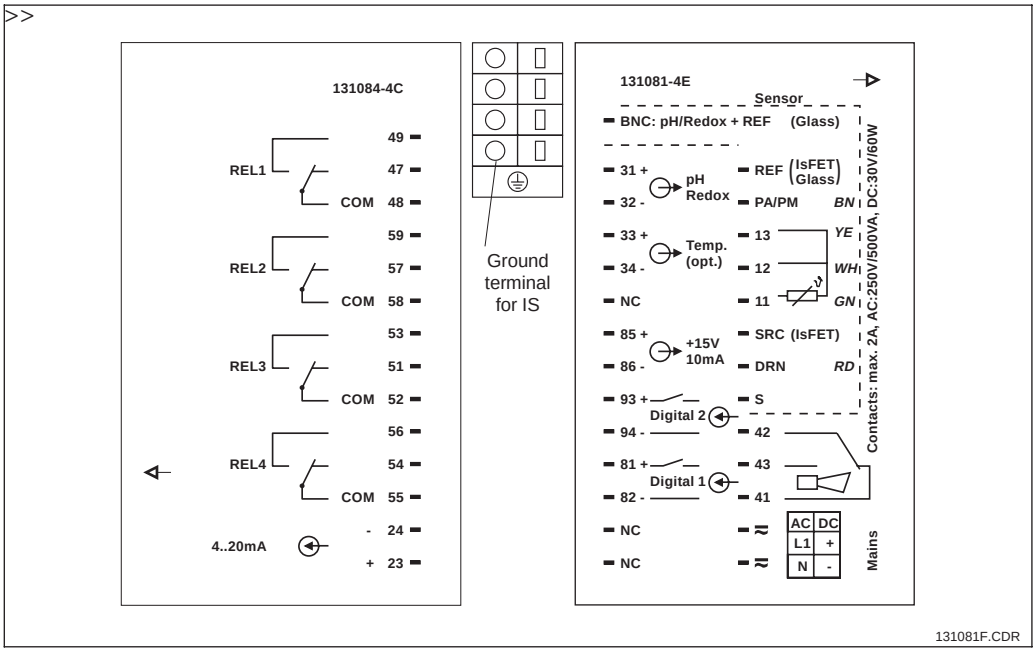


Fig. 3.11 Connection sticker of panel-mounted instrument

3.5 Electrode installation and measuring cable connection

Measuring cable connection

The terminal block is located in a separate connection compartment which is accessible by opening the plastic cover. Remove the pre-pressed knock-outs for cable entry.

The pH and redox electrodes are connected using special terminated and shielded multi-core cables. The measuring cable can be extended with junction box VBA or VBM. Termination instructions are supplied with the measuring cables.

Note:

- Protect connectors, cable ends and terminals against moisture to prevent inaccurate measurement!
- For futher information on cables and junction boxes refer to chap. 9 Accessories.

Measuring cable requirements		
Sensor type	**Cable**	**Extension**
Electrode without temperature sensor	CPK 1	VBA / VBM box + CYK 71 cable
Electrode with temperature sensor Pt 100 and TOP 68 plug-in head	CPK 9	VBA / VBM box + CYK 71 cable
IsFET electrode with temperature sensor Pt 100 / Pt 1000 and TOP 68 plug-in head	CPK 12	VBA / VBM box + CYK 12 cable
pH single electrode with reference electrode and separate temperature sensor	CPK 2	VBA / VBM box+ PMK cable

Structure and termination of the measuring cable

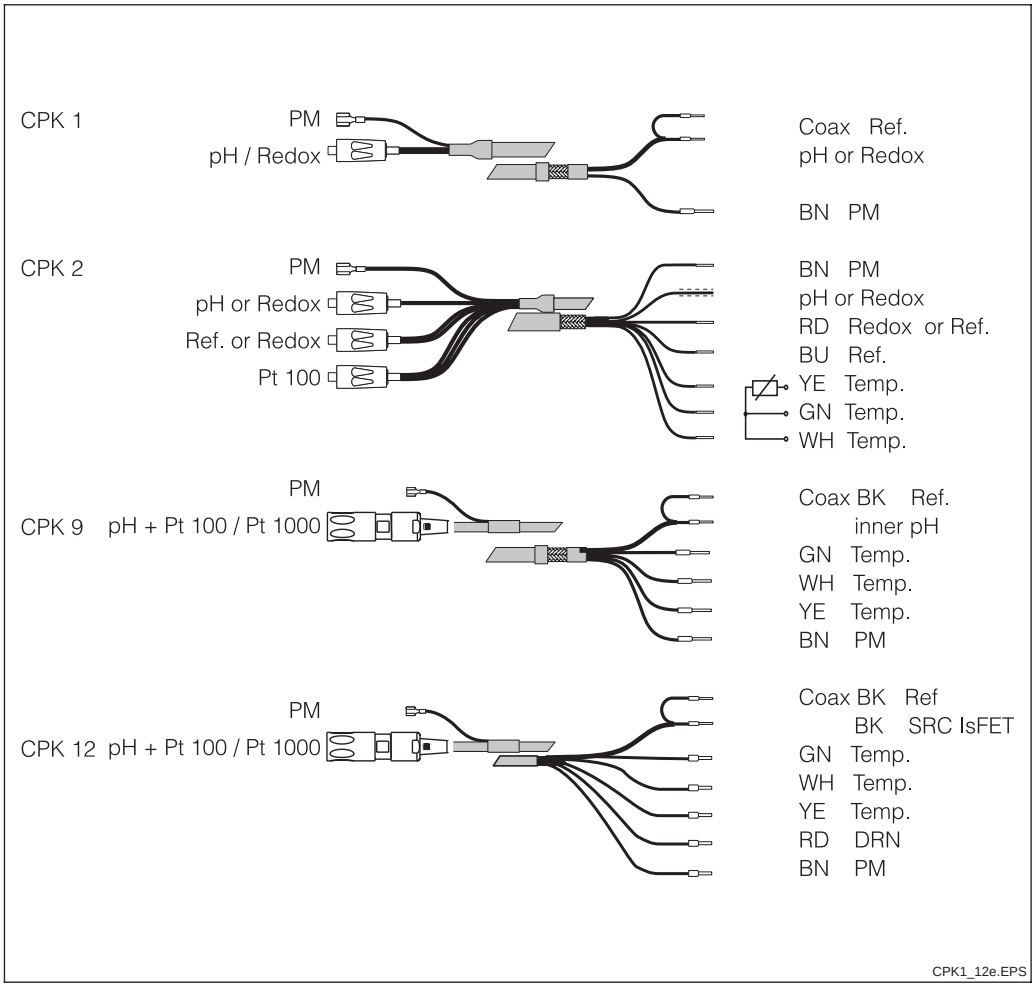


Fig. 3.13 Construction of special measuring cable

Cable termination for panel-mounted instrument CPM 223 with solder-free BNC plug (for glass electrodes only)

1. Cut off wire end sleeves of the coaxial cable.

2. Insert cable gland (①) and washer (②) on cable, remove inner insulation (13 mm), then screw clamping ring (③) onto insulation.
Please note: Parts ① to ③ are supplied for cable diameters of 3.2 mm and 5 mm.

3. Fold braided screen (④) of screen back over clamping ring and cut off excess material.

4. Strip the black semiconductor layer (⑩) to the screen (reference signal).

5. Remove inner insulation (4 mm).
Use the supplied end sleeves (⑨) for the stranded inner conductor. When using a cable of another manufacturer use the end sleeves only in case of single stranded conductors.

6. Push BNC connector shell (⑤) over the cable (inner conductor must be located in clamping notch (⑥) in the connector pin). Tighten cable gland (①). Clamp the inner conductor in the notch by inserting the clamping piece (⑦) and screwing on the cover (⑧), thereby establishing proper contact.

Connection examples

Choice: symmetrical or asymmetrical?

The pH and redox electrodes can be connected in either a symmetrical or an asymmetrical configuration. General rule:

- Potential matching connection does not exist – asymmetrical connection (Figs. 3.18 and 3.19).
- Potential matching connection exists – symmetrical connection (Figs. 3.18 and 3.19).

However, which arrangement to use may also depend on operating conditions.

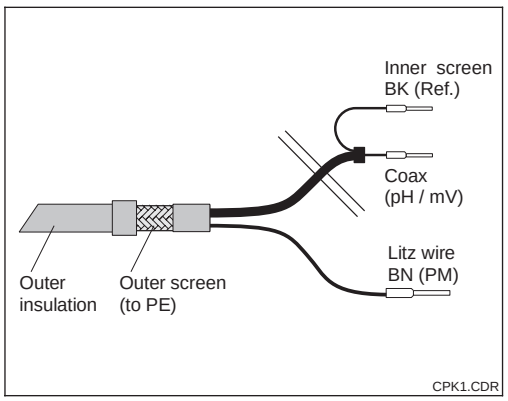


Fig. 3.14 CPK 1 cable: instrument connection

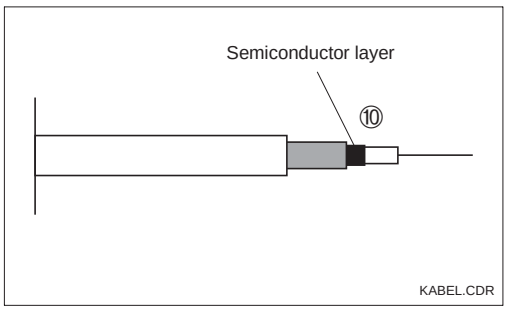


Fig. 3.15 Coaxial cable construction

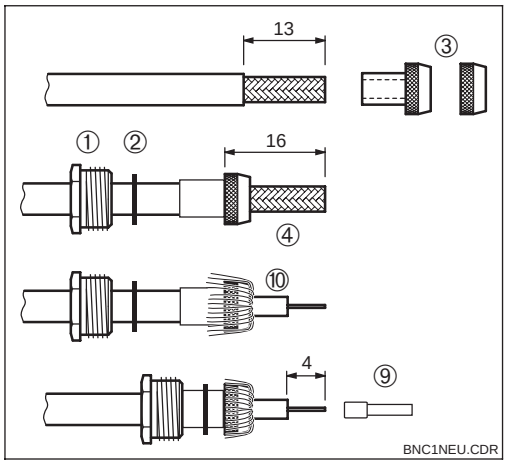


Fig. 3.16 Termination of pH connecting line for installation of BNC elbow plug

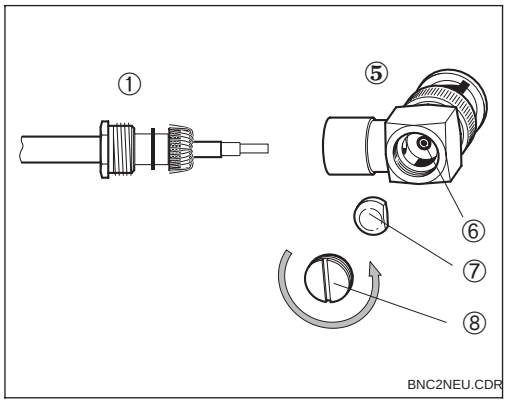
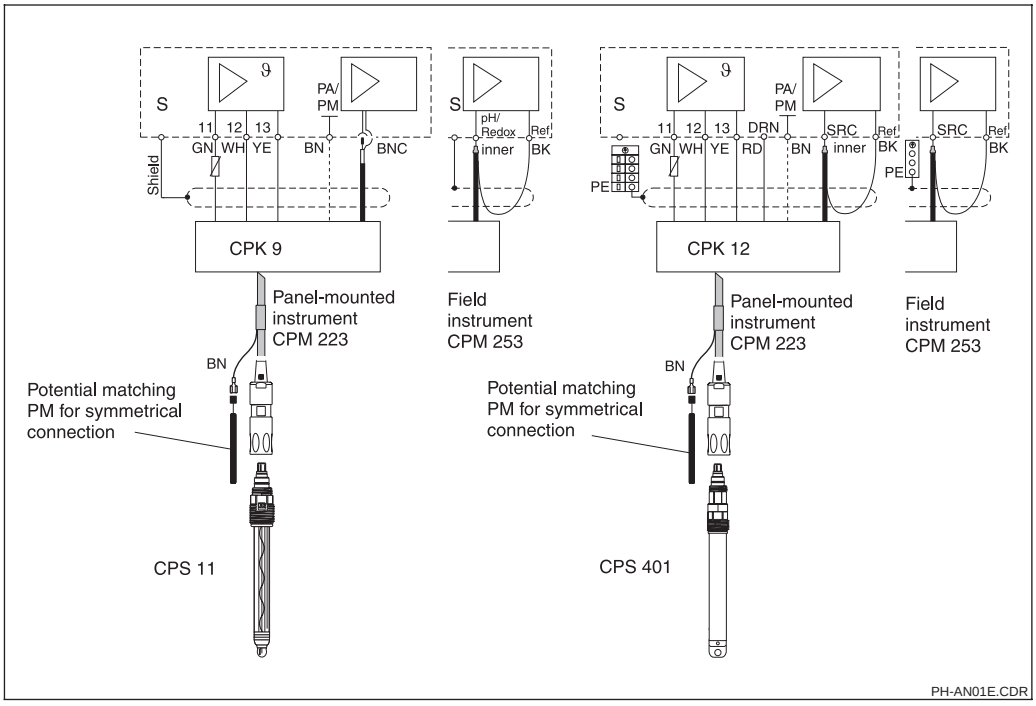


Fig. 3.17 Installation of terminated pH connecting line in BNC elbow plug

Note:

- The instrument is pre-configured for symmetrical measurement. Change the configuration in field A2 for asymmetrical measurement (see chapter 5.2.1).
- The conductor for the potential matching pin must be connected to the “PA/PM” terminal of the instrument for symmetrical measurement.
- If the software setting “asymmetrical” is chosen for a symmetrical connection, this will reduce the service life of the reference electrode.
- The instrument is approved for protection class II and is generally connected without protective earth.
- Cable termination is only required for CPM 223.



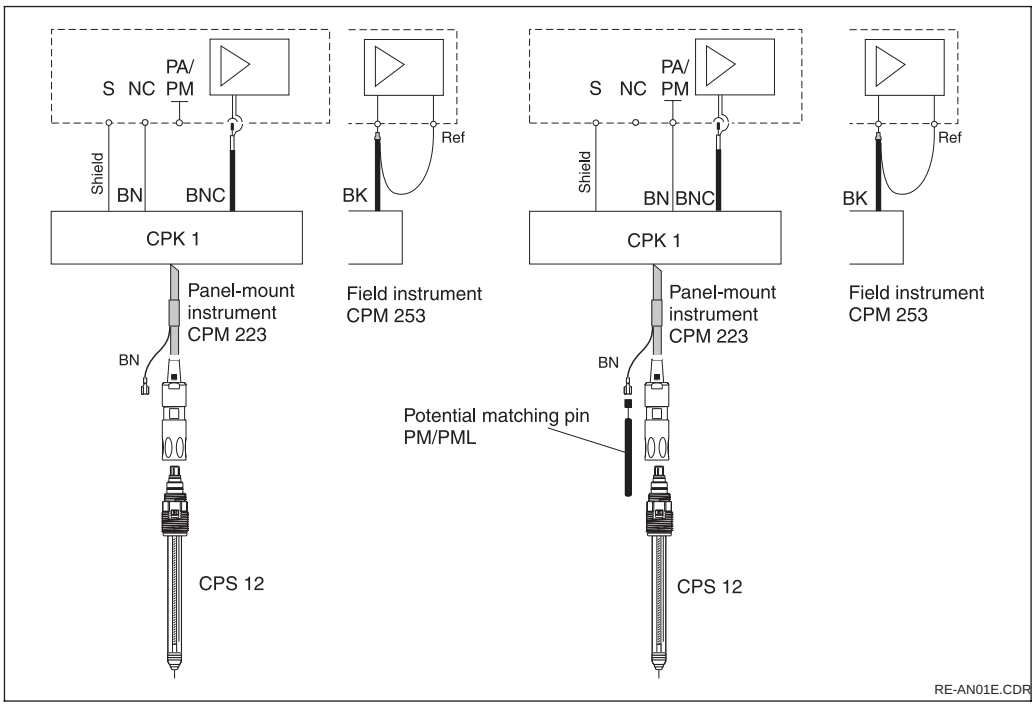
PH-AN01E.CDR

pH electrode connection to Liquisys M CPM 223 / 253

left:
Connection of CPS 11 with CPK 9

right:
Connection of CPS 401 with CPK12

Fig. 3.18



RE-AN01E.CDR

Redox electrode connection to Liquisys M CPM 223 / 253

left:
Asymmetrical (without PM)

right:
Symmetrical (with PM)

Fig. 3.19

4 Operation

4.1 Operator interface

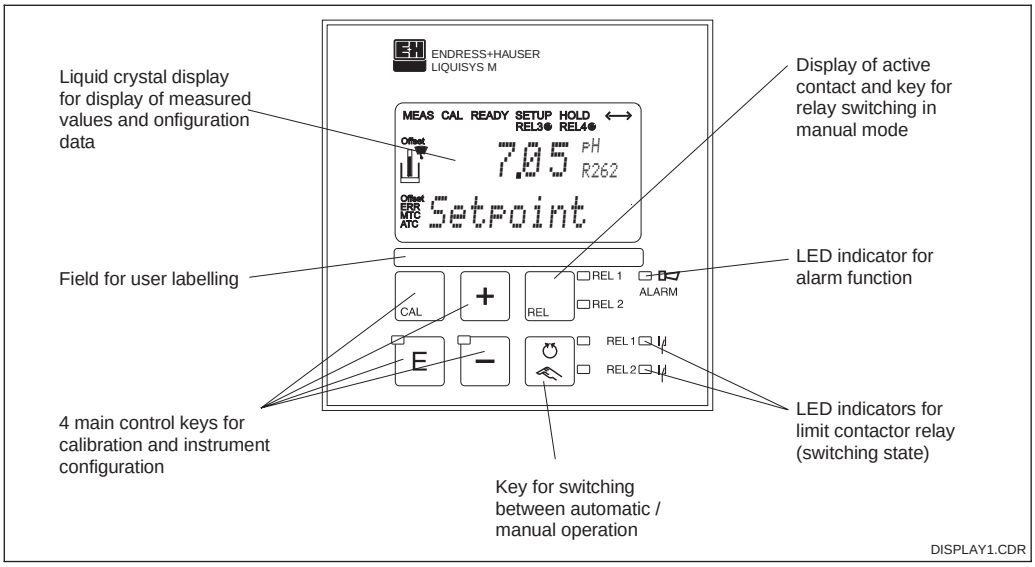


Fig. 4.1 Operating elements Liquisys M

4.2 Display

LED indicators

Indication of current operating mode “Auto” (green LED) or “Manual” (yellow LED)

Indication for relay controlled “Manual” mode (red LED)

Indicates the state of relays 1 and 2
LED green: measured value within permissible limits, relay is inactive
LED red: measured value outside permissible limits, relay is active

Alarm indication e.g. for continuous limit violation, temperature sensor failure or system error (see error list in chapter 7)

Liquid crystal display

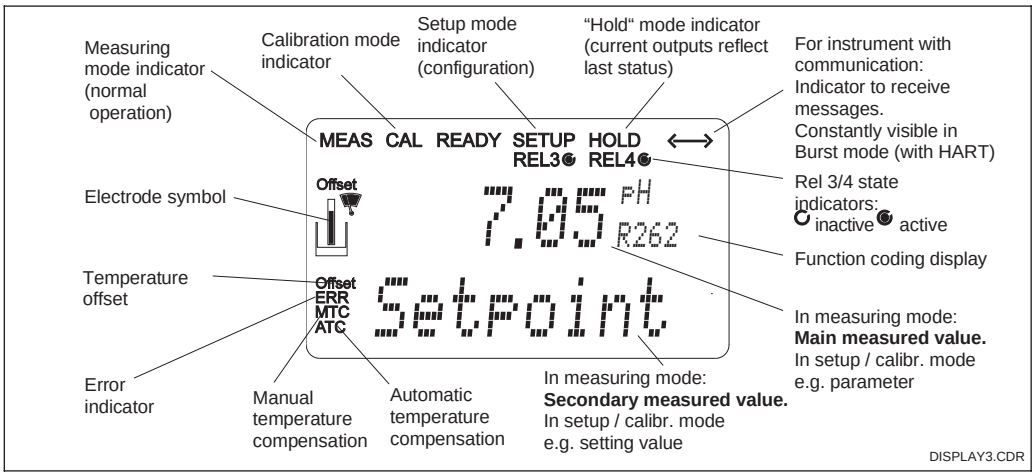
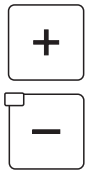
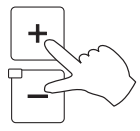
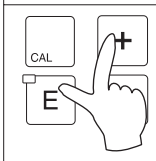
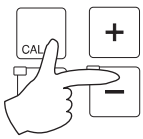
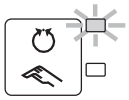
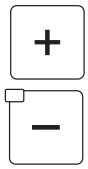
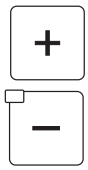
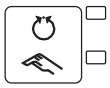


Fig. 4.2 Liquid crystal display

4.3 Keys

	**CAL key** When the CAL key is pressed, the instrument prompts for the calibration access code: Code 22 for calibration Code 0 or any code for calibration data checking. Press the CAL key to acknowledge the calibration data or to proceed within the calibration menu.
	**ENTER key** The ENTER key has serveral functions: Opens the Setup menu in measuring mode Stores (acknowledges) data entered in Setup mode Moving on within the function groups.
	**PLUS key and MINUS key** The PLUS and MINUS keys have the following functions: Selection of function groups Setting of parameters and numeric values Relay operation in manual mode (see Ch. 4.4). Pressing the **PLUS key** allows you to switch between the current input in % and mA. **Repeatedly pressing the PLUS key** displays the following settings in sequence as secondary measured values: 1. Temperature display in °F 2. Hide temperature display 3. Measured value display in mV 4. Current input signal in % 5. Current input signal in mA 6. Back to basic setting **Repeatedly pressing the MINUS key** outputs errors: 1. The current errors are displayed one after the other (max. 10) 2. After all the errors are displayed, the standard display is unhidden. In function group F, you can define an alarm for each error code separately.
	**REL key** The REL key toggles between the relay and manual cleaning start in manual mode. In automatic mode you can output the corresponding switch-on points (limit contactor) ot set points (PID controller) when pressing the REL key. Pressing the PLUS key allows you to display the settings of the following relay. Press the REL key to return to measuring mode (automatic return after 30s).
	**AUTO key** The AUTO key is used to toggle between the automatic and manual modes of operation.
	**Escape function** Press the PLUS and MINUS keys simultaneously to return to the main menu. Press the PLUS and MINUS keys again to return to measuring mode.
	**Locking the keypad** Pressing the PLUS and ENTER keys simultaneously for minimum 3s locks the keypad against unintentional entries. However, all settings can still be read. The code prompt displays the code 9999.
	**Unlocking the keypad** Pressing the CAL and MINUS keys simultaneously for minimum 3s unlocks the keypad. The code prompt displays the code 0:

4.4 Auto / manual mode of operation

	**Auto mode** In this mode of operation, the relays are controlled by the transmitter.
	**REL key** In manual mode, the REL key is used to select one of the relays or the cleaning function present in the instrument.
	**Switching to manual mode** The instrument is switched to the manual mode for relay setting by pressing the following keys:
	Press AUTO key.
	Enter code 22. Confirm with ENTER key.
	Select relay or function. Press the REL key to toggle between the relays. The display shows the selected relay and the switching status (ON / OFF) in the second line. In manual mode, the measuring value is continuously displayed(e.g. for monitoring during dosage).
	Set the relays. Switch on with PLUS, switch off with MINUS. The relay state remains in effect until it is actively reset.
	Press AUTO key for returning to the measuring mode. All relais are controlled by the transmitter again.

Note:

- Enable the manual mode by entering access code “22”.
- The operating modes remains in effect even after a power failure.
- The manual mode takes precedence over any other automatic function (hold).
- Hardware locking in the manual mode is not possible.
- The manual settings remain in effect until they are actively reset.
- Error code E102 is signalled in the manual mode.

4.5 Operating concept

4.5.1 Operating modes

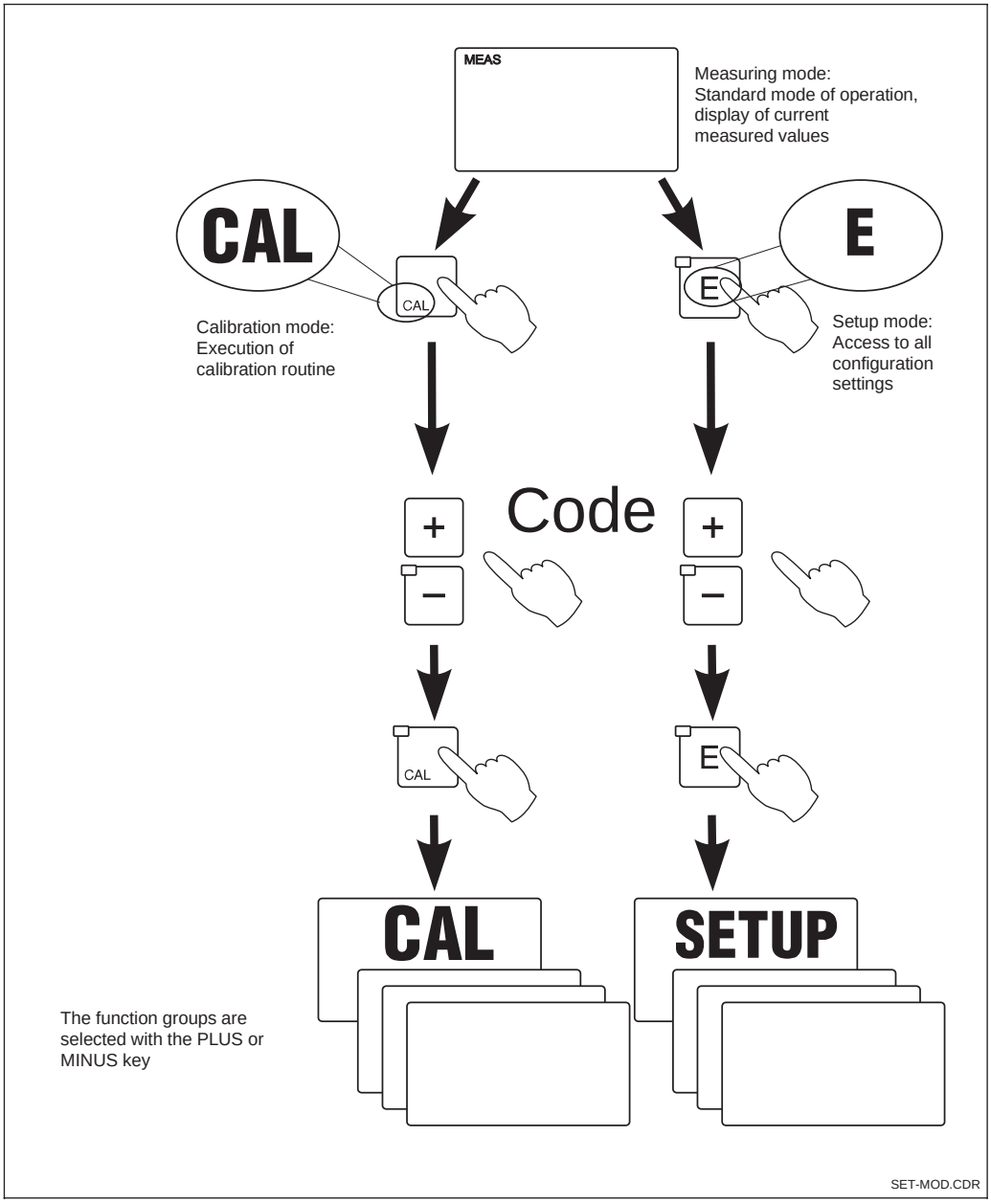


Fig. 4.3 Description of possible operating modes

Note:

- Remains in Setup mode for approx. 15 mins., the system automatically jumps back to measuring mode. An active hold function (Hold at Setup) is then reset.

4.5.2 Access codes

All instrument access codes are fixed, i.e. they cannot be modified. When the instrument requests the access codes, it recognises the difference between codes (cf. Fig. 5.3):

- **CAL key + Code 22:** Access to Calibration and Offset menus.
- **ENTER + Code keys 22:** Access to the Configuration menus, allowing configuration and user-specific settings.
- **PLUS + ENTER + Code keys 9999:** Locks the keypad.
- **CAL + MINUS + Code keys 0:** Unlocks the keypad.
- **CAL or ENTER + Code keys**: access to Read mode, i.e. all settings can be read but not changed.

4.5.3 Menu structure

The configuration and calibration functions are arranged in a menu structure by function groups.

The function groups are selected in the setup mode with the PLUS and MINUS keys. The ENTER key is used to move from one function to the next within a function group.
The PLUS and MINUS keys are used for option selection and editing. Selections must be confirmed by pressing the ENTER key. This also moves the cursor to the next function.
Pressing the PLUS and MINUS keys at the same time terminates programming (return to main menu).

Note:

- If a change is made but not confirmed by pressing the ENTER key, the previous setting is retained.
- See the appendix of these operating instructions for an overview of the Liquisys M menu structure.

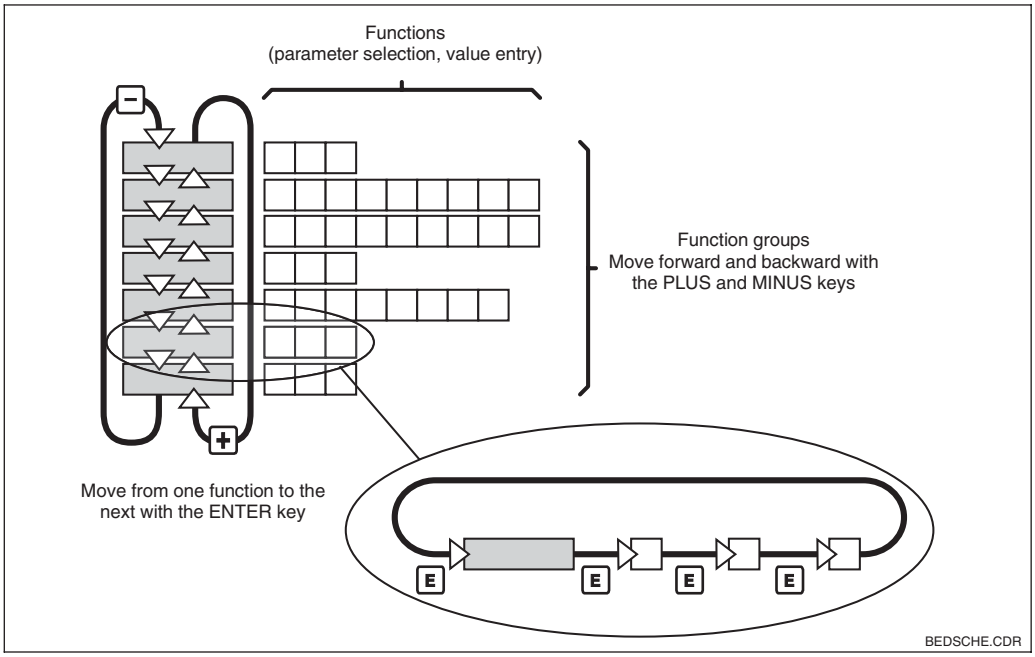


Fig. 4.4 Schematic representation of Liquisys M menu structure

4.5.4 Hold function: “freezing” of outputsfreezes” the outputs

The current output is “frozen” in the setup mode and during calibration, i.e. the last current value is constantly output. The display shows the “HOLD” message. In case of steady control (4... 20 mA) on current output 2, it is set to 0/4 mA during Hold.

Note:

- Hold settings can be found in chapter 5.5, function S2.
- During automatic operation, all contacts will go to their normal positions.
- An active hold has priority over all other automatic functions.
- With every hold, the I component of the controller is set to zero.
- A possibly accumulated alarm delay is reset to “0".
- The hold function can also be activated externally via the hold input (see wiring diagram in Fig. 3.10; digital input 1).
- The manual hold (field S3) remains active even after a power failure.

5 Instrument configuration

After power-up the instrument performs a self-test and then enters to measuring mode.

Now it can be configured and calibrated for the first time. The values set by the user are kept even in the event of a power failure.

The following function groups are available on the Liquisys M (the function groups that are only available in the Plus package are marked accordingly in the functional descriptions):

Setup mode

- ➜ SETUP 1 (A) see chap. 5.2.1
- ➜ SETUP 2 (B) see chap. 5.2.2
- ➜ CURRENT INPUT (Z) see chap. 5.3
- ➜ CURRENT OUTPUT (O) see chap. 5.4
- ➜ ALARM (F) see chap. 5.5.1
- ➜ CHECK (P) see chap. 5.5.2
- ➜ RELAY (R) see chap. 5.6
- ➜ SERVICE (S) see chap. 5.7
- ➜ E+H SERVICE (E) see chap. 5.8
- ➜ INTERFACE (I) see chap. 5.9

Calibration and Offset mode

- ➜ CALIBRATION (C) see chap. 5.10.1
- ➜ NUMERIC (N) see chap. 5.10.2
- ➜ OFFSET (V) see chap. 5.11

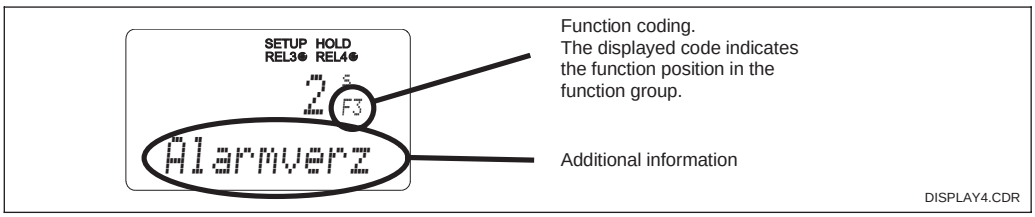


Fig. 5.1 Function display
Notes for the user

Selecting and locating functions is facilitated by a code displayed for each function in a special display field. The structure of this coding is shown in Fig. 5.2.
The first column indicates the function group as a letter (see group designations). The functions in the individual groups are counted from the top to the bottom and from the left to the right.

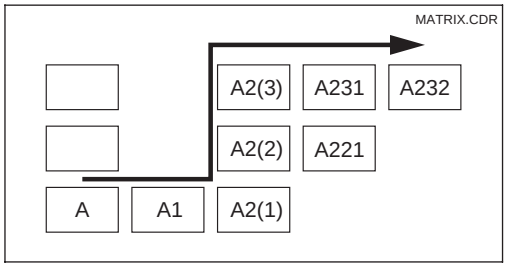


Fig. 5.2 Function coding

Factory settings

When the instrument is switched on for the first time, the factory settings are in effect. The following table provides an overview of all major settings. Please refer to the description of the individual functions in chapter 5 for all other factory settings (the factory settings are printed in **bold** face).

Function	Factory setting
Mode of measurement	pH or Redox absolute, Temperature in °C
Type of temperature compensation	linear with reference temperature 25.0 °C
Temperature compensation	automatic (ATC on)
Limit value for controller 1	pH 16 (redox: –1500 mV or 0 %)
Limit value for controller 2	pH 16 (redox: +1500 mV or 100 %)
Hold	active during configuration and calibration
Contact 1 / 3	pH limit contactor, function off
Contact 2 / 4	pH limit contactor, function off
Current outputs 1 and 2*	4 ... 20 mA
Current output 1: measured value for 4 mA signal current	pH 2
Current output 1: measured value for 20 mA signal current	pH 12
Current output 2: temperature value for 4 mA signal current*	0.0 °C
Current output 2: temperature value for 20 mA signal current*	100.0 °C

* equipped accordingly

Alarm contact

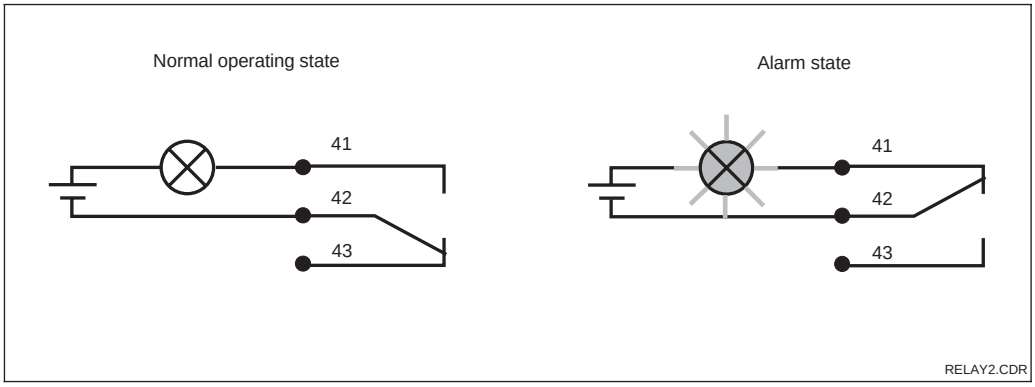


Fig. 5.3 Recommended fail-safe circuit for an alarm contact

Normal operating state:

- Instrument in operation
- No error message available (Alarm LED off)

→ Relay picked up
→ Contact 42/43 closed

Alarm state:

- Error message available (Alarm LED red) or
- Instrument defective or voltage-free (Alarm LED off)

→ Relay dropped out
→ Contact 41/42 closed

5.1 Start-up

After switching the instruement on, make the following settings to the specified function groups:

- **Function group SERVICE (S)**
  S1: Select language and exit function group.
- **Function group SETUP 1 (A)**
  Adjust all the parameters in this group, see chapter 5.2.1.
- **Function group SETUP 2 (B)**
  Make all settings in this group, see chapter 5.2.2.

Other configuration options are explained in the chapters to follow for each menu.

5.2 System configuration

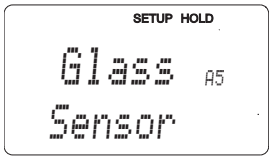
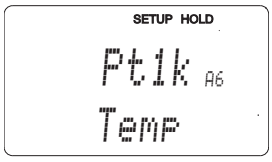
The system is configured using the function groups SETUP 1 and SETUP 2. The measurement type and electrode are selected here, and the settings for the temperature measurement are made. All the parameters in these two function groups are to be configured to avoid measuring errors or failure to measure at all.

5.2.1 Setup 1 (pH / Redox)

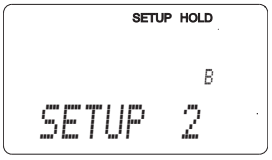
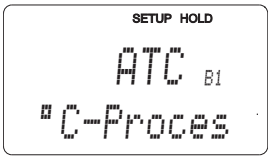
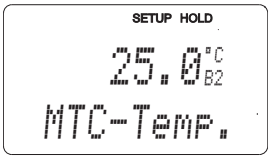
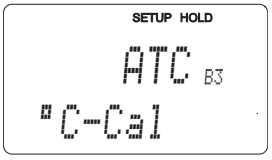
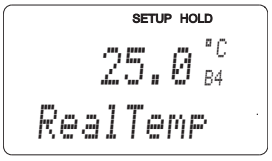
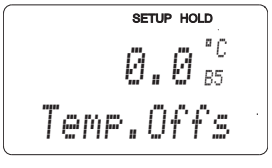
For access to the SETUP menu, please enter Code 22.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
A	**Function group SETUP 1**		SETUP HOLD A SETUP 1	Initial display in function group SETUP 1.
A1	Operating mode selection	**pH** ORP (= Redox) mV ORP (= Redox) %	SETUP HOLD pH A1 Oper.Mode	Any change in operating mode causes an automatic reset of basic settings.
A2	Select display unit	**pH** mV %	SETUP HOLD pH A2 Unit	
A3	Select connection mode	**sym** = **symmetrical** asym = asymmetrical	SETUP HOLD sym A3 wiring	See chapter 3.
A4	Enter measured value damping	**1** 1 ... 60	SETUP HOLD 1 A3 Damping	Measured value damping causes averaging over the specified number of individual measured values and is used e. g. to stabilise the display and the signal output. There is no damping if “1" is entered.

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

Coding		Field	Selection or range Factory setting (bold)	Display	Info
	A5	Selection of electrode	**Glass** Antim = Antimony IsFET		For glass electrodes: glass For IsFET sensors: IsFET Only glass electrodes with the zero point at pH 7 may be used.
	A6	Selection of temperature sensor	Pt 100 **Pt 1K** NTC 30K None		For glass electrodes: Pt 100 For IsFET sensors: Pt 1k Selection of Pt 1K (Pt 1000) and NTC 30K only with CPM 2x3-IS version.

5.2.2 Setup 2 (Temperature)

Coding		Field	Selection or range Factory setting (bold)	Display	Info
B		**Function group SETUP 2**			Initial display in function group SETUP 2.
	B1	Selection of type of temperature compensation (during process)	– For pH operating mode: **ATC** MTC – For ORP operating mode: **Off** On		At B1 = ATC: Move to B3. At B1 = MTC: Enter the process temperature in B2, which is to be used for compensation.
	B2	Enter process temperature	**25.0 °C** –50.0 ... 150.0 °C		Only at A1 = pH and B1 = MTC. The display value can be edited. The setting can only be performed in °C.
	B3	Selection of type of temperature compensation (for calibration)	**ATC** MTC		At B3 = ATC: Move to B5. At B3 = MTC: Enter the compensated temperature in B4. A separate temperature sensor must also be immersed in the buffer solution.
	B4	Enter correct process temperature	**25.0 °C** –50.0 ... 150.0 °C		Only at B1 = ATC and B3 = ATC. The display value can be edited.
	B5	Temperature difference (offset) is displayed	**0.0 °C** –5.0 ... 5.0 °C		Only at B1 = ATC. The difference between the temperatures measured and entered is displayed.

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

5.3 Current input

This function group offers two independent application solutions, provided that the current output of an external measured quantity, e.g. flow meter, is connected to the 4 … 20 mA input of Liquisys M CPM 223 / 253. The following assignments then apply:

	Flow in main stream	Current signal in mA	**Current input signal in %**
Lower range limit current input	Lower setting value flow meter	**4**	**0**
Upper range limit current input	Upper setting value flow meter	**20**	**100**

5.3.1 Monitoring the flow rate in the main stream

This arrangement is highly practical when the sample stream flowing through the flow assembly (e.g. CPA 250) is totally independent of the flow rate in the main stream. This permits the signalling of an alarm state in the main stream (flow rate too low or totally stopped) and trigger a dosing switch-off, even if the measuring water stream is retained due to the installation configuration.

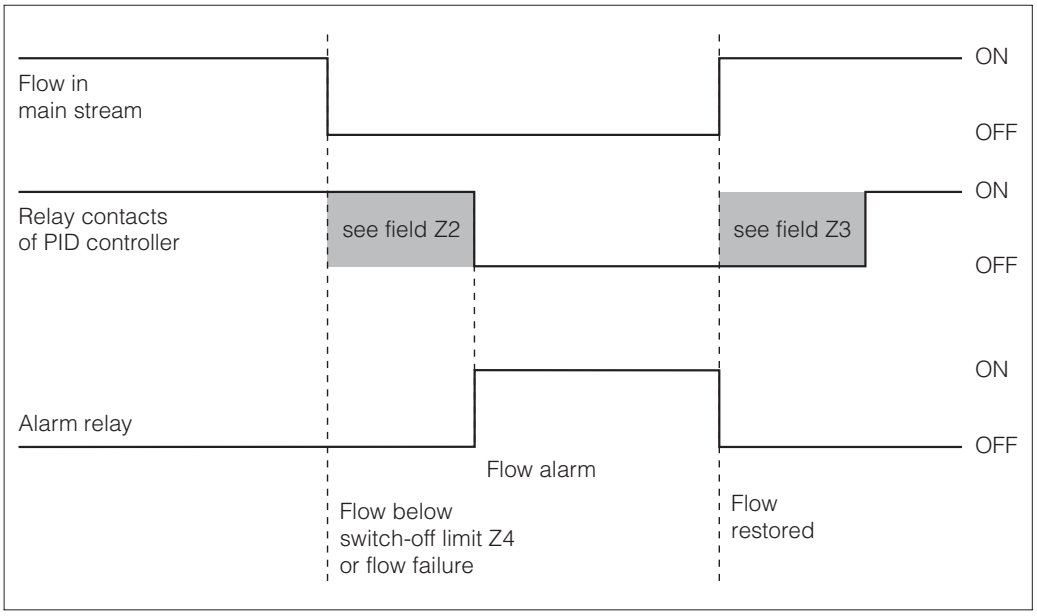


Fig. 5.4 Alarm signalling and dosing switch-off by the main stream

5.3.2 Feedforward control to PID controller

In processes with very short response times it may be practical to apply the flow rate to the controller, if the flow rate fluctuates, in order to optimise the control process.

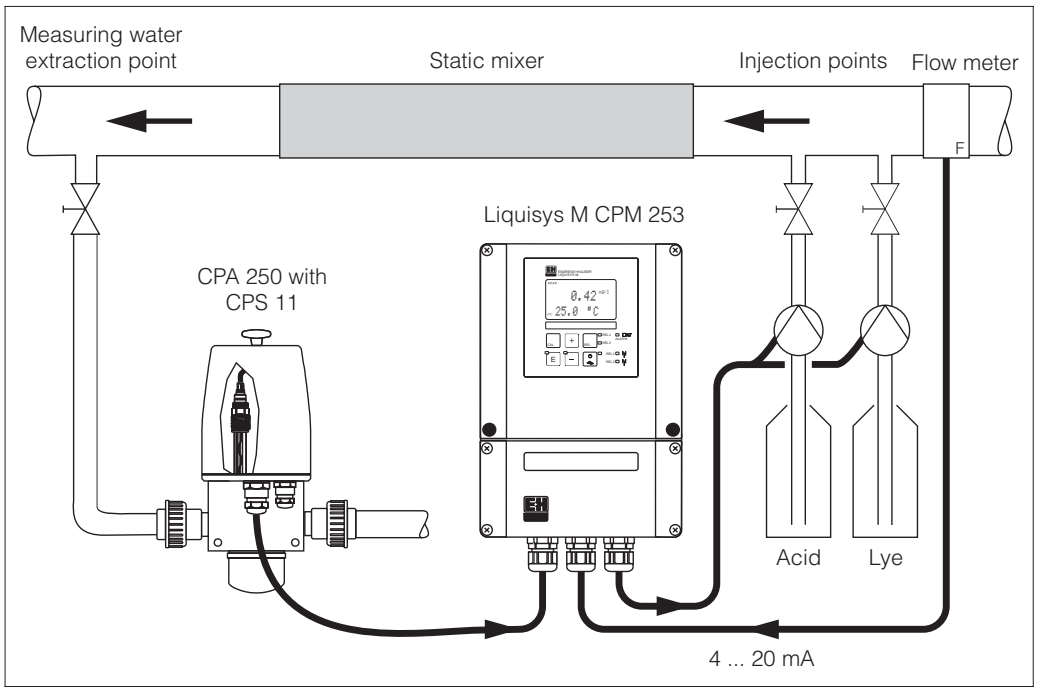


Fig. 5.5 Arrangement example for feedforward control of the flow rate in the main stream to the PID controller(s)

Feedforward control is a multiplying function as depicted in the below figure (factory setting as example):

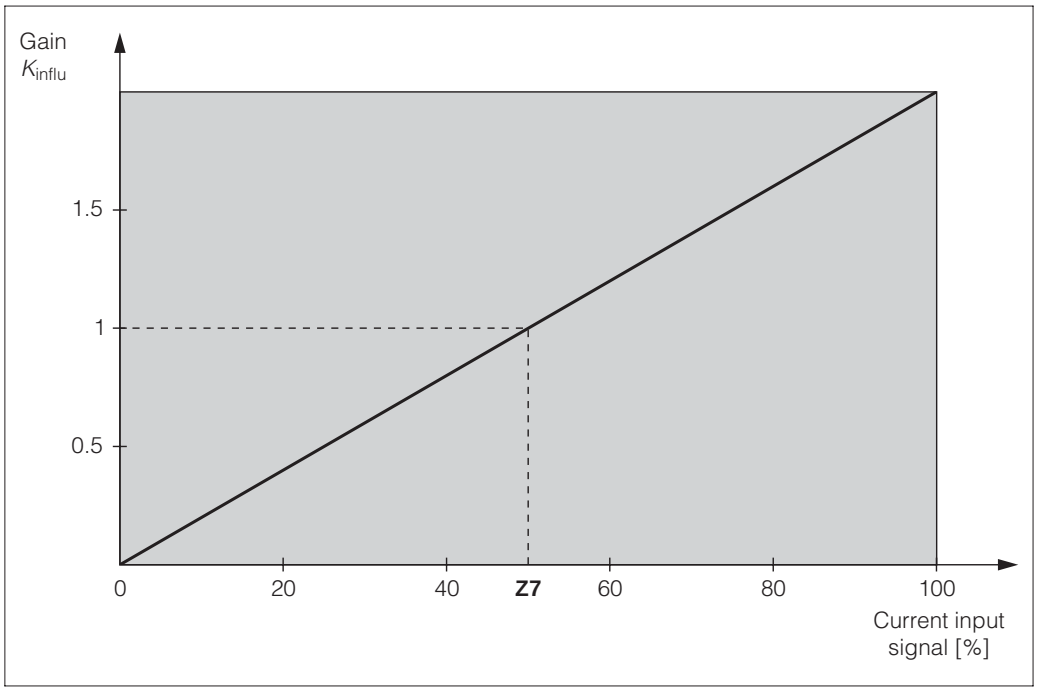
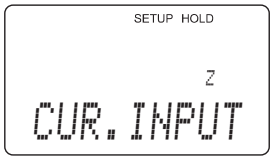
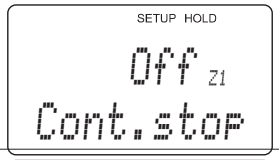
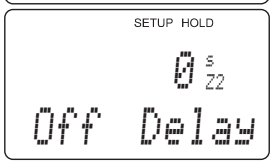
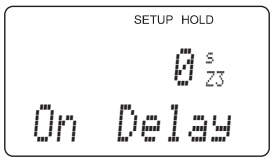
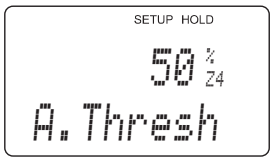
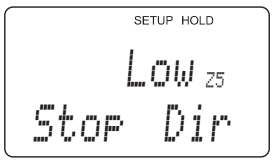
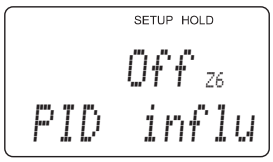
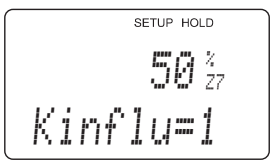


Fig. 5.6 Multiplying feedforward control

Coding		Field	Selection or range Factory setting (bold)	Display	Info
Z		**Function group CURRENT INPUT**			Initial display in function group CURRENT INPUT.
	Z1	Select flow rate monitoring of main stream (with controller switch-off)	**Off** Input		Only switch on when flow meter is connected in main stream. When Z1 = Off, fields Z2 to Z5 do not exist.
	Z2	Enter delay for controller switch-off by current input	**0 s** 0 ... 2000 s		Short-term flow rate undershots can be suppressed by delay and will not cause controller switch-off.
	Z3	Enter delay for controller switch-on by current input	**0 s** 0 ... 2000 s		With acid / lye monitoring, a delay up until reception of a representative measured value is preferred after a long flow rate failure.
	Z4	Enter switch-off threshold for current input	**50%** 0 ... 100%		0 … 100% corresponds to 4 … 20 mA at current input. Note the measured value allocation to the current output of the flow meter.
	Z5	Select orientation stop for current input	**Low** High		If the value entered in Z4 is exceeded low or high, the controller switches off.
	Z6	Select feedforward control for PID controller	**Off** lin = linear		When Z6 = Off, Z7 does not exist. Basic = Feedforward control only affects the basic load (alternatively dosage in proportion to quantity, if common PID control is not possible, e.g. due to sensor defect)
	Z7	Enter value for feedforward control at which modulation gain = 1	**50%** 0 ... 100%		When the value is set, the controller manipulated value with feedforward control on is identical to feedforward control off.

5.4 Current outputs

The function group CURRENT OUTPUT is used to configure the individual outputs. Either a linear (O3 (1)) or, in conjunction with the plus package, a user-defined current output characteristic (O3 (3)) can be entered.
Furthermore, a current output value can be simulated to check the current outputs (O3 (2)).
The controller set value in field R 237 / R 266 can be output via current output 2, if available.

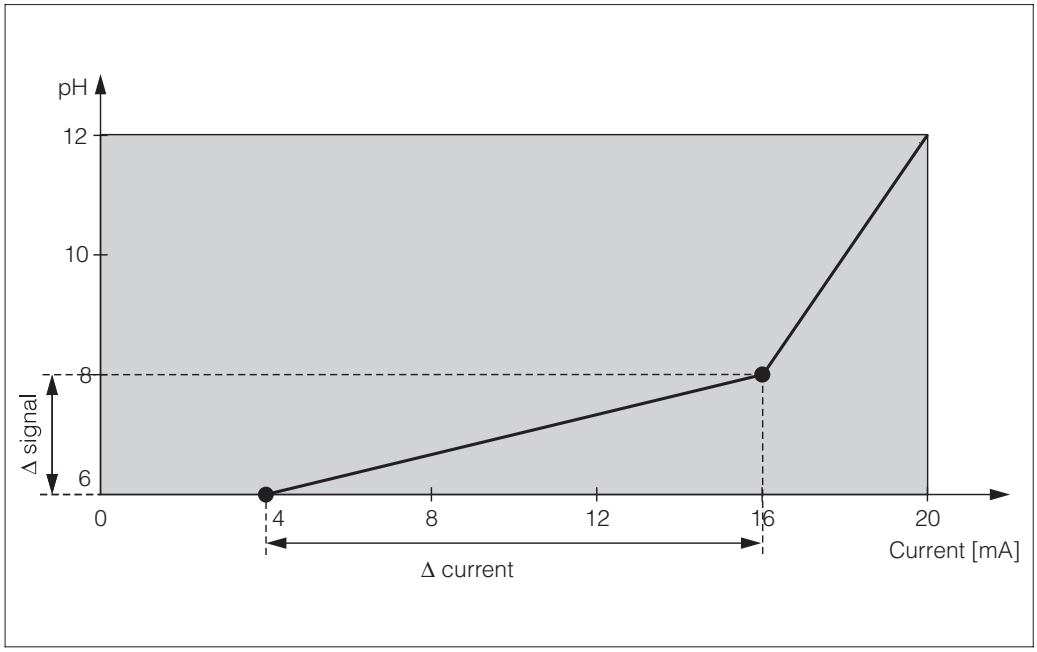


Fig. 5.7 User-defined current output characteristic

The distance Δ signal per mA between two table value pairs must exceed:

- pH: 0.03
- Redox: 5 mV
- Temperature: 0.25 °C

First enter the current output configuration you require in the following blank table. Ensure the required minimum distance by calculating the resulting signal distance **per mA**. Then enter the result in the instrument.

	Current output 1			Current output 2		
Value pair	**pH / mV / % / °C [ ]**	**Current [mA]**	**Distance per mA**	**pH / mV / % / °C [ ]**	**Current [mA]**	**Distance per mA**
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Coding	Field	Selection or range Factory setting (bold)	Display	Info
O	**Function group CURRENT OUTPUT**		SETUP HOLD 0 OUTPUT	Initial display in function group CURRENT OUTPUT.
O1	Selection of current output	**Out1** *Out2*	SETUP HOLD Out1 01 Sel.Out	A different characteristic can be selected for each output.
O2	Selection of measuring quantity for 2nd current output	**°C** mV Contr	SETUP HOLD °C 02 Sel. Out2	Selection of Curr (= current output 2) in field R237 / R266 is only possible, if field O2 = Contr is selected.
O3 (1)	Enter or output linear characteristic	**lin** = **linear** (1) sim = Simulation (2) *Tab = Table (3)*	SETUP HOLD lin 03 Sel.Type	The characteristic can have a positive or negative slope at the measured value output. At set value output (O2 = Contr), the increasing current corresponds to an increasing set value.
O311	Selection of current range	**4–20 mA** 0–20 mA	SETUP HOLD 4-20 0311 Sel.Range	
O312	0/4 mA value; enter corresponding pH (redox) or temperature value	**pH 2.00** pH –2.00 ... 16.00 **–1500 mV** –1500 ... 1500 mV **0.0 %** 0.0 ... 100.0 % **0.0 °C** –20.0 ... 150.0 °C	SETUP HOLD 2.00 pH 0312 0/4 mA	Enter the measured value corresponding the the minimum current value (0/4 mA) at the transmitter output. (Spreading see Technical data.)
O313	20 mA value; enter corresponding pH (redox) or temperature value	**pH 12.00** pH –2.00 ... 16.00 **1500 mV** –1500 ... 1500 mV **100.0 %** 0.0 ... 100.0 % **100.0 °C** –20.0 ... 150.0 °C	SETUP HOLD 12.00 pH 0313 20 mA	Enter the measured value corresponding to the maximum current value (20 mA) at the transmitter output. (Spreading see Technical data.)

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
O3 (2)	Current output simulation	lin = linear (1) **sim** = **simulation** (2) *Tab = Tabelle (3)*	SETUP HOLD sim 02 Sel.Type	The simulation is terminated by selecting (1) or (3). See O2 (1), O2 (3) for other characteristics.
O321	Enter simulation value	**current value** 0.00 ... 22.00 mA	SETUP HOLD 10.20 mA 0321 Simulat.	The current value entered here is output through the current output.
O3 (3)	Enter current output table (only for S version)	lin = linear (1) sim = simulation (2) ***Tab*** = ***Table*** *(3)*	SETUP HOLD table 02 Sel.Type	Values may also be added or changed at a later point in time. The values entered are automatically sorted in ascending order by current value. See O2 (1), O2 (2) for other characteristics.
O331	Selection of table option	**read** edit	SETUP HOLD read 0331 Sel.Table	
O332	Enter number of table value pairs	**1** 1 ... 10	SETUP HOLD 1 0332 No.Elem.	Enter the number of x and y value pairs (measured value and associated current value).
O333	Selection of table value pair	**1** 1 ... No. Elem. asign	SETUP HOLD 1 0333 Sel.Elem.	
O334	Enter x value	**pH 0.00** pH –2.00 ... 16.00 **0 mV** –1500 ... 1500 mV **0.0 %** 0.0 ... 100.0 %	SETUP HOLD 0.00 pH 0334 Meas.val.	x value = Measured value determined by user.
O335	Enter y value	**0.00 mA** 0.00 ... 20.00 mA	SETUP HOLD 0.00 mA 0335 mA value	y value = current value determined by user to be associated with O234.
O336	Enter whether or not the table status is okay	**yes** no	SETUP HOLD yes 0336 Status ok	Return to O3. If status = “no”, set table correctly (all previous settings are kept) or back to measurement mode (table will be deleted).

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

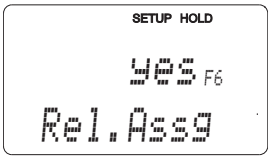
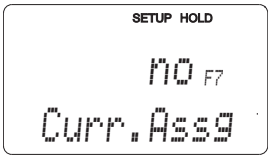
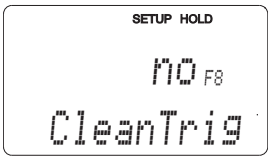
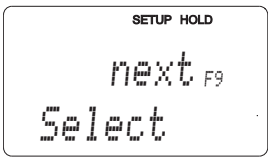
5.5 Monitoring functions

The monitoring functions are used to define various alarms and to set output contacts. Each individual error can be defined to be effective or not (at the contact or error current) Moreover, the eletrode can be checked for glass breakage, or for leak current at the electrode (P1, P2, P7). An alarm condition can be defined to activate a cleaning function (F8).

5.5.1 Alarm

Coding	Field	Selection or range Factory setting (bold)	Display	Info
F	Function group **ALARM**		SETUP HOLD F ALARM	Alarm function settings.
F1	Selection of contact type	**Stead** = **steady contact** Fleet = fleeting contact	SETUP HOLD Stead F1 Cont.Type	The contact type selected here only applies to the alarm contact.
F2	Selection of time unit	**s** min	SETUP HOLD s F2 Time Unit	
F3	Enter alarm delay	**0 s (min)** 0 ... 2000 s (min)	SETUP HOLD 0 s F3 Err.Delay	Depending on the unit selected in F2, the alarm delay is entered in s or min.
F4	Selection of error current	**22 mA** 2.4 mA	SETUP HOLD 22mA F4 Err.Curr	This selection must be made even if all errors are suppressed in F5.
F5	Selection of error	**1** 1 ... 255	SETUP HOLD 1 F5 Sel.Error	This is where the errors are selected that are to trigger an alarm signal. The errors are selected via the error number. Please refer to the table in chapter 7, p. 59. The factory settings remain in effect for all errors not edited.

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
F6	Set alarm contact to be effective for selected error	**yes** no		If set “no” all the other alarm settings (e. g. alarm delay) are also deactivated. The settings themselves are retained. This setting **only** applies to the error selected in F5. Factory setting is **no** starting with E080.
F7	Set error current to be effective for selected error	**no** yes		The error selected in F4 becomes effective or is suppressed when it occurs. This setting **only** applies to the faults selected in F5.
F8	*Automatic start of cleaning function?*	***no*** *yes*		*This field only exists for some errors, see chapter 7.1.*
F9	Return to menu or select next error	**Next = Next error** <—R		If <—R is selected, the display returns to F; if next is selected the display returns to F5.

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

5.5.2 Check

The function group CHECK is only accessible for instruments equipped with the Plus packet. Two different monitoring functions can be selected for the measurement in the function group CHECK:

SCS electrode monitoring

The sensor check system monitors the pH and reference electrode for inaccurate measurement and total failure.

The SCS detects:
- Breakage of electrode glass
- Fine short circuits in the pH measuring circuit, e.g. moisture or dirtbridges in clamping points
- Soiling or blocking of reference electrode
- Leakage current on IsFET sensor

Three methods are used:
- Monitoring of pH electrode for high resistance (an alarm is signalled when the impendance drops below a minimum value of 500 kΩ). This function cannot be selected when using an antimony or IsFET electrode (A4).
- Monitoring of reference electrode impedance (an alarm is signalled when the defined threshold is exceeded). This function can only be selected with a symmetrical connection.
- Monitoring of leakage current with IsFET sonsors (pre-alert E168 at I_{Leak}>200 nA, error E008 at I_{Leak}>400 nA).

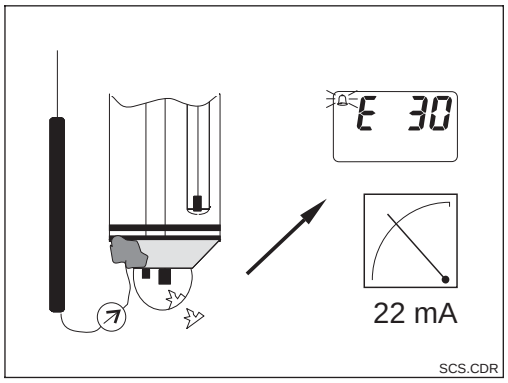


Fig. 5.8 SCS alarm

Caution:

- Do not remove the electrode from the process without Hold. Since the SCS is measured against PMC, no contact between the inner conductor and PMC would trigger an alarm.

PCS alarm (Process Check System)

Function AC is used to examine the measuring signal for deviations. If the measuring signal is constant for a specific period of time (several measured values), an alarm is issued. This type of behaviour may be caused by soiling, blocking, etc.

Function CC monitors the relay activity. Due to freely selectable monitoring periods for the limit functions, a relay failure will be recognised and an alarm will be triggered.

Note:

- Reference electrode monitoring is only possible in conjunction with the symmetrical connection (with PMC).
- A current PCS alarm is automatically deleted as soon as the sensor signal changes.
- Due to its semiconductor component, the IsFET sensor is light-sensitive and reacts with measured value fluctuations. For this reason, avoid direct solar radiation during calibration and operation. Normal ambient light does not affect the measurement.

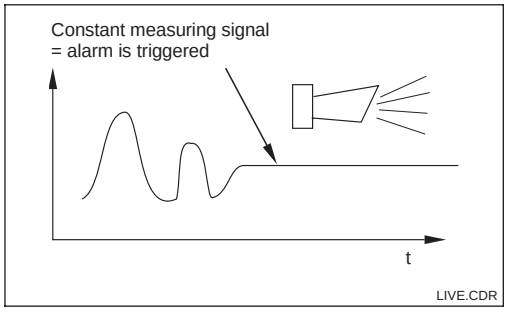


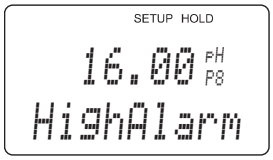
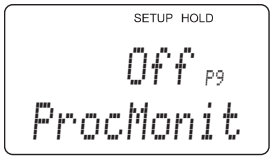
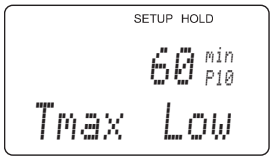
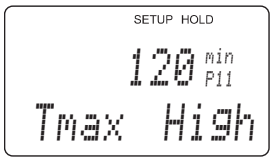
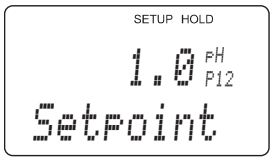
Fig. 5.9 PCS alarm (live-check)

Limit monitoring

This function monitors the measuring value for exceeding monitoring limits and triggers an alarm.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
P	***Function group CHECK***		SETUP HOLD P CHECK	*Settings for measuring electrode and process monitoring*
P1	*Switch SCS alarm for measuring electrode on or off*	***Off*** *On*	SETUP HOLD Off P1 SCS Glass	*The glass electrode is monitored for glass breakage (Error no. E071.) Response time approx. 30s.* *SCS monitoring is inactive during calibration.*
P2	*Switch SCS alarm for reference electrode on or off*	***Off*** *On*	SETUP HOLD Off P2 SCS Ref	*The reference electrode is monitored for soiling and blocking. (Error no. E152.) Response time approx. 60s.* ***Only at A2 = sym.***
P3	*Enter SCS alarm threshold for reference electrode*	***50.0 kΩ*** *0.5 ... 50.0 kΩ*	SETUP HOLD 50.0 kΩ P3 SCSThresh	*The measuring value contains also the impedance of the medium.* *The impedance of the reference electrode increases with the degree of soiling.*
P4	*Leakage current display for IsFET*	*0.0 ... 9.9 µA*	SETUP HOLD 0.0 P4 Leak Curr	*Only if A4 = IsFET and P1 = on.* *Display only.* *Leakage currents > 0.4 µA indicate a damage of the IsFET sensor.*
P5	*Select process monitoring*	***Off*** *Low* *High* *Lo Hi = low + high* *Lo!* *Hi!* *LoHi!*	SETUP HOLD Off P5 A.Thresh	*Alarm signalling optionally with or without simultaneous controller switch-off.* *xxxx = without controller switch-off* *xxxx! = with controller switch-off*
P6	*Enter error delay*	***0 s (min)*** *0 ... 2000 s (min)*	SETUP HOLD 0 s P6 Err.Delay	*Depending on your selection in F2, you can enter the error delay in min or s. Only after this does a high or low limit violation cause an alarm as per field P7 / P8.*
P7	*Enter lower alarm threshold*	***-2.00 pH*** *-2.00 ... 16.00 pH*	SETUP HOLD -2.00 pH P7 LowAlarm	*Omitted when P5 = Off.*

Factory settings are printed in **bold** face;
base version does not include functions in *italic.*

Coding	Field	Selection or range Factory setting (bold)	Display	Info
P8	*Enter upper alarm threshold*	***16.00 pH*** *-2.00 ... 16.00 pH*		*Omitted when P5 = Off.*
P9	*Select process monitoring (PCS alarm)*	***Off*** *AC* *CC* *AC+CC* *AC!* *CC!* *ACCC!*		AC = Sensor alternation check, CC = Controller check. Alarm signalling optionally with or without simultaneous controller switch-off. xxxxx = without controller switch-off, xxxx! = with controller switch-off.
P10	*Enter maximum permissible period for lower alarm threshold*	***60 min*** *0 ... 2000 min*		*Only when P9 = CC or AC+CC.*
P11	*Enter maximum permissible period for upper alarm threshold*	***120 min*** *0 ... 2000 min*		*Only when P9 = CC or AC+CC.*
P12	*Enter alarm threshold (for P10 / P11)*	***1.00 pH*** *-2.00 ... 16.00 pH*		*Selected value is an absolute value. This function is mainly used for batch process and single-sided limit switches.*

Factory settings are printed in **bold** face;
base version does not include functions in *italic*.

5.6 Relay contact configuration

The function group RELAYS is only accessible for instruments equipped with the Plus packet.

The relay contacts described below can be selected and configured as required (max. four contacts depending on options installed):

- Limit contactor for pH / redox value: R2 (1)
- Limit contactor for temperature value: R2 (2)
- P(ID) controller: R2 (3)
- Timer for cleaning function: R2 (4)
- ChemoClean function: R2 (5) (for Plus package)
- Neutralisation controller: R2 (6) (for Plus package)

5.6.1 Limit contactor for pH/redox measured value and temperature

The relay contacts in the Liquisys M can be assigned different functions.
Switch-on and switch-off points and pickup and dropout delays can be defined for the limit contactor. Moreover, an alarm threshold can be set to issue an error message and to start a cleaning function.
These functions may be used for pH/redox and temperature measurement.

Please refer to Fig. 5.10 for a graphic representation of the contact states of any relay or alarm contact.

When the measured value increases (max. function), the relay contact is closed at time t_2 when the switch-on point has been exceeded (t_1) and the pickup delay ($t_2 - t_1$) has expired. When the alarm threshold (t_3) is reached and the alarm delay ($t_4 - t_3$) also has expired, the alarm contact is switched.
When the measured value decreases, the alarm contact is reset when the measured value drops below the alarm threshold (t_5). The relay contact is also reset (t_7, after the dropout delay t_7 - t_6).
When the pickup and dropout delays are set to 0 s, the switch-on and switch-off points are identical to the contact switching points. Settings analogous to the max function can also be made for a min function.

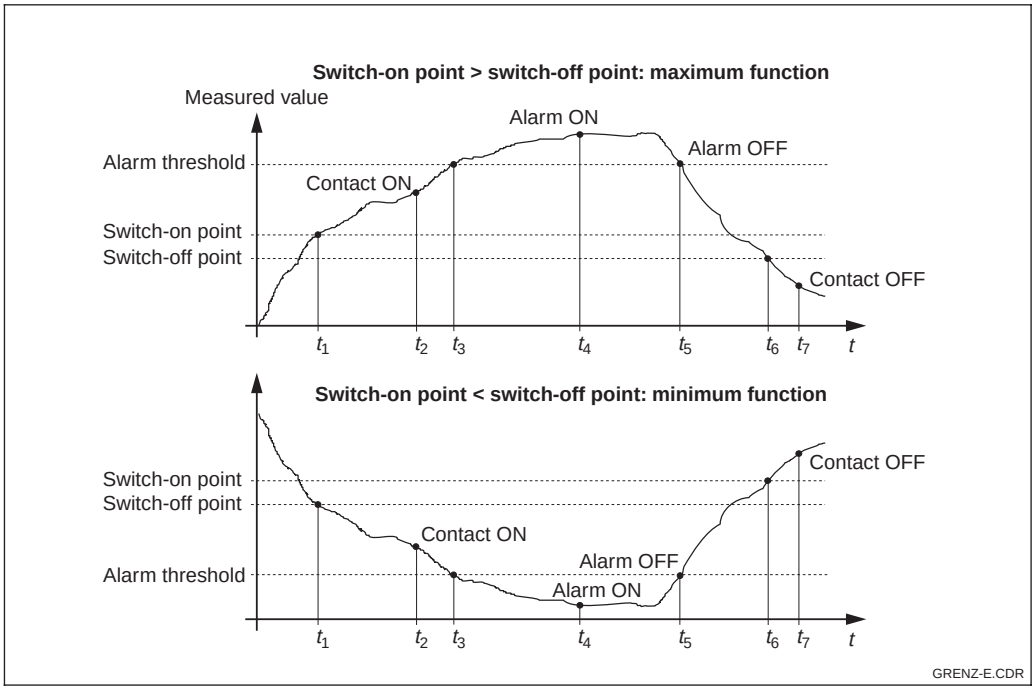


Fig. 5.10 Depiction of alarm and limit functions

5.6.2 P(ID) controller

The Liquisys M supports the definition of various controller functions. On the basis of the PID controller, P, PI, PD and PID controllers can be implemented. The best control response is obtained using the controller best suited to the application in question.Depending on the selection in field R 237 / R 266, the set value can be output via relay or current output 2.

- **P controller:** Used for simple linear control purposes with small system deviations. Where major changes are to be controlled, overshooting may occur. A control offset is to be expected.
- **PI controller:** Used for processes where overshooting is to be avoided and permanent offsets are not allowed.
- **PD controller:** Used for processes that require quick response and where peaks are to be corrected.
- **PID controller:** Used for processes for which the type of control provided by a P, PI or PD controller is inadequate.

Setting options of PID controller

There are three setting options for a PID controller:

- Control gain Kp (P impact)
- Integral action time T_n (I impact)
- Derivative action time T_v (D impact)

Start-up

If there are no empirical values available for setting the control parameters, use values that provide the greatest possible stability of the control loop. To optimise the control loop further:

- Increase the control gain K_p until the control variable just starts to overswing.
- Decrease K_p again slightly and shorten the integral action time T_n to achieve the shortest possible correction time without overswing.
- In order to shorten the response time of the controller, you also have to set the derivative action time T_v.

Control and fine-optimisation of set parameters using a recorder

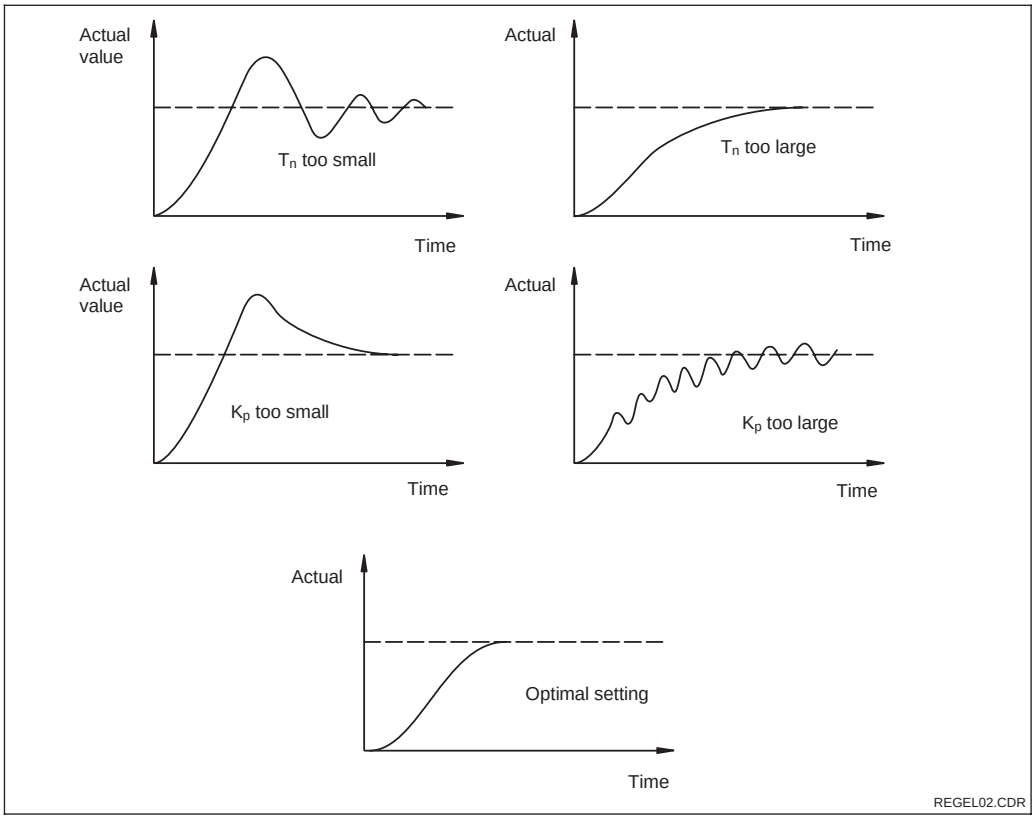


Fig. 5.11 Optimisation of settings T_n and K_p

Actuating signal outputs (R237 ... R2310)

The control contact in question outputs a switched signal. The intensity of this signal is proportional to the controller's control output. A distinction is made according to the type of signal output:

- *Pulse length modulation*
  The greater the calculated control output the longer the contact in question remains picked up. The period can be adjusted between 0.5 and 99 s. Pulse length-modulated outputs are used to control solenoid valves.
- *Pulse frequency modulation*
  The greater the calculated control output, the higher the switching frequency of the contact. The maximum switching frequency 1/T can be adjusted between 60 and 180 min^{-1}. The ON period t_{ON} is constant. Pulse frequency-modulated outputs are used to control solenoid operationed metering pumps.

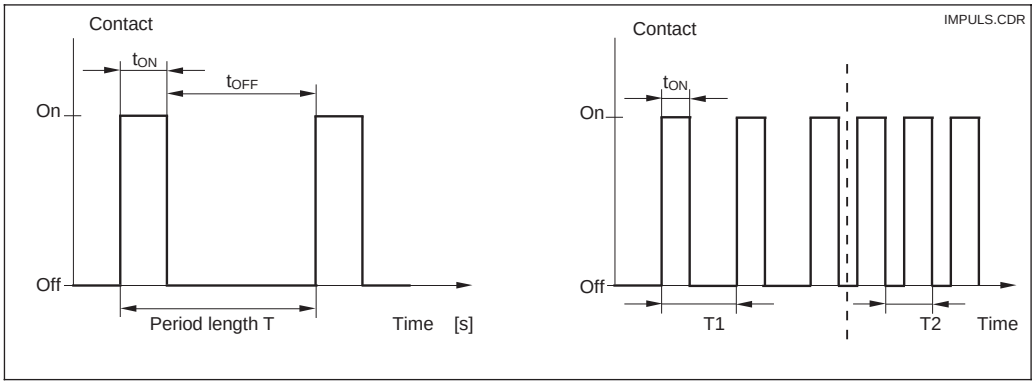


Fig. 5.12 Signal of a pulse length-modulated (left) and a pulse frequency-modulated (right) regulating contact

Control characteristic for direct and inverted control action

Field R236 offers two control characteristics for selection which have the effects shown in the following diagram.

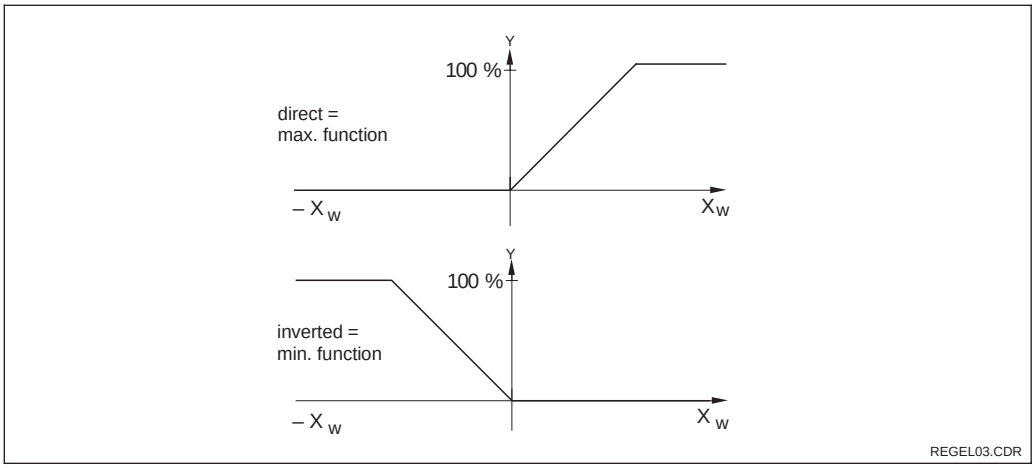


Fig. 5.13 Control characteristic of a proportional-action controller with direct and inverted control action

5.6.3 Timer for cleaning function

This function can be used to implement a simple cleaning routine. The user can specify a time interval after which cleaning is to start; i.e. only constant intervals can be defined.

More extended cleaning functions can be implemented in conjunction with the ChemoClean function (version with four contacts, see chapter 5.5.4).

Note:

The timer and ChemoClean do not work independently of each other. Whilst one of the functions is active, the other cannot be started.

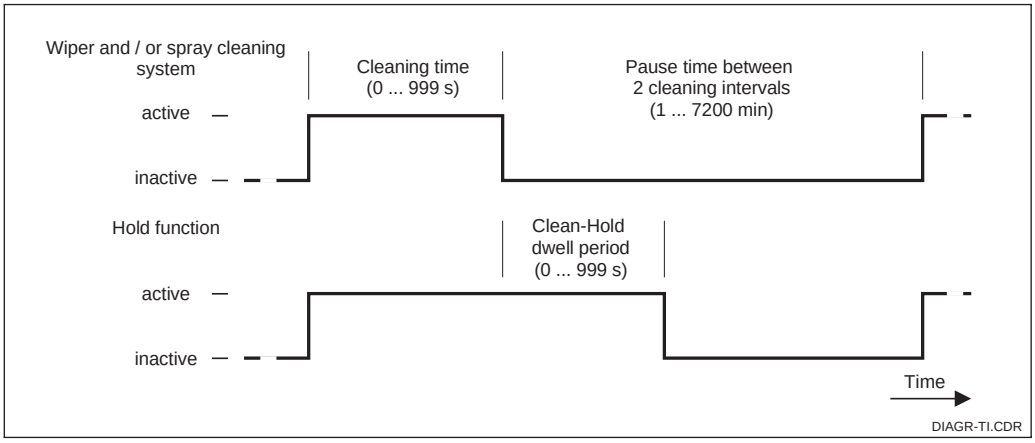


Fig. 5.14 Relationship among cleaning time, pause time and hold dwell period

5.6.4 ChemoClean function

Just like the timer function, ChemoClean can also be used to start a cleaning cycle. However, ChemoClean supports different cleaning and rinse intervals.

Thus, irregular cleaning with different repeat cycles is possible, and cleaning times with post-rinse times can be individually defined.

Note:

- Use relays 3 (water) and 4 (cleaner) for the ChemoClean function.
- Abortion of the cleaning process is always followed by a post-rinse time.
- When “Economy” is selected, cleaning is performed with water only.

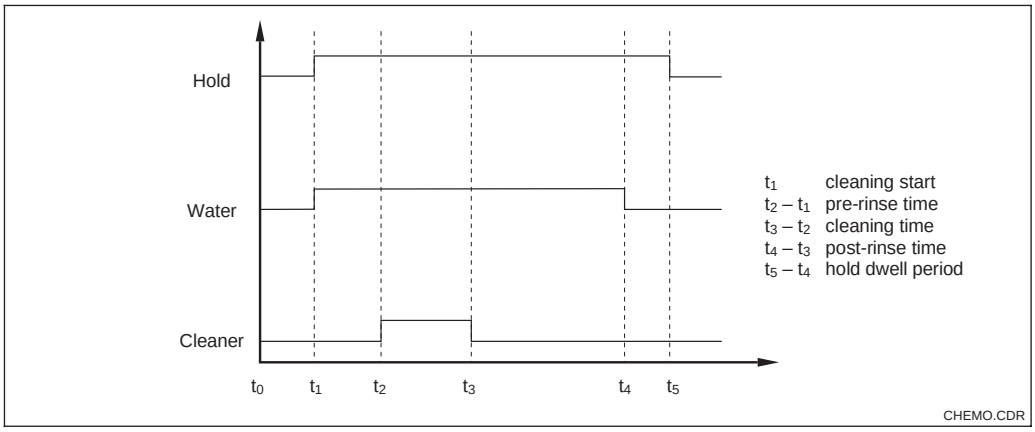
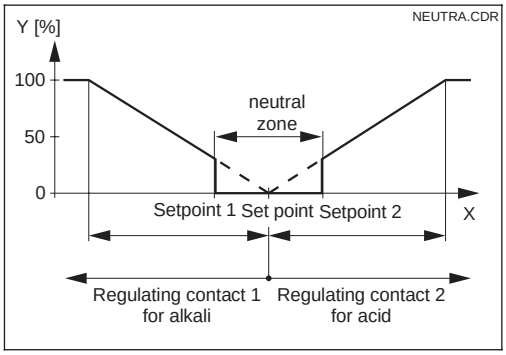


Fig. 5.15 Cleaning cycle sequence

5.5.5 Neutralisation controller



Characteristic of a proportionalneutralisation controller

Fig. 5.16

Note:

Use relays 1 and 2 for the neutralisation control.

Neutralisation control means that the pH value of a medium is held constant by adding acid or alkali as required. This task requires two separate actuating signals – one for acid and one for alkali.

The neutralisation controller is a controller with two relay contacts specifically tailored to this application. A P(ID) controller is available to handle this task.
The controller gain K_p for acid and alkali can be separately adjusted. Integral action time T_n and derivative action time T_v apply to both controllers (compared to chap. 5.5.2, p. 39).

The “neutral zone” is located between the set-point 1 and setpoint 2. In the case of a controller without an integral component (P, PD), there is no alkali or acid dosing ink the “neutral zone” (Y = 0, see Fig. 5.16). In the case of a controller with an integral component (PI, PID), there is constant alkali/acid dosing ($Y_{new} = Y_{old}$). The behaviour of the I component within the “neutral zone” depends on the process type (Inline / Batch).
The “neutral zone” can be shifted in the X direction as desired via the set points 1 and 2.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
R	**Function group RELAIS**		SETUP HOLD R RELAY	Relay contacts can be selected and adjusted.
R1	Selection of contact to be configured	***Rel1*** *Rel2* *Rel3* *Rel4*	SETUP HOLD Rel1 R1 Sel.Relay	Rel3 (water) and Rel4 (cleaner) are only available on instrument equipped accordingly. If ChemoClean selected as the cleaning type, Rel4 is not available.
R2 (1)	Configuration of limit contactor for pH / redox measurement	**LC PV** = **pH/redox** **limit contactor** (1) LC °C = limit contactor T (2) PID-controller (3) Timer (4) *Clean = ChemoClean (5)* *Neutra controller (6)*	SETUP HOLD LC PV R2 Sel.Type	PV = Process value If Rel4 is selected in Field R1 clean = ChemoClean can not be selected. Confirmation with ENTER switches off a different, already switched-on function and its settings are reset to the default.
R211	Switch function of R2 (1) off or on	**off** on	SETUP HOLD off R211 Function	All settings are retained.
R212	Enter switch-on point of the contact	**pH 16.00** pH –2.00 ... 16.00 **1500 mV** –1500 ... 1500 mV **100.0 %** 0.0 ... 100.0 %	SETUP HOLD 16.00 pH R212 On value	Never set switch-on point and switch-off point to the same value. (Only the operating mode selected in A1 appears.)
R213	Enter switch-off point of the contact	**pH 16.00** pH –2.00 ... 16.00 **1500 mV** –1500 ... 1500 mV **100.0 %** 0.0 ... 100.0 %	SETUP HOLD 16.00 pH R213 Off value	The switch-off point entry selects a max contact (switch-off point < switch-on point) or a min contact (switch-off point > switch-on point), thereby implementing an always required hysteresis function (see Fig. 5.10).
R214	Enter pickup delay	**0 s** 0 ... 2000 s	SETUP HOLD 0 s R214 On Delay	
R215	Enter dropout delay	**0 s** 0 ... 2000 s	SETUP HOLD 0 s R215 Off Delay	

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base version does not include functions in *italic*.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
R216	Enter alarm threshold (as an absolute value)	**pH 16.00** pH –2,00 ... 16.00 **1500 mV** –1500 ... 1500 mV **100.0 %** 0.0 ... 100.0 %	SETUP HOLD 16.00 pH R216 A.Thresh	When the alarm threshold is violated, the measuring transmitter issues an alarm with an error message and error current (note alarm delay in field F3). When defining the min contact, the alarm threshold must be set to a lower value than the switch-off point.
R217	Show status for limit contact	**MAX** MIN	SETUP HOLD MAX R217 LC State	Only display.
R2 (2)	Configure limit contactor for temperature measurement	LC PV = limit contactor pH/redox (1) **LC °C = limit contactor T** (2) PID-controller (3) Timer (4) *Clean = ChemoClean (5)* *Neutra controller (6)*	SETUP HOLD LC °C R2 Sel.Type	Confirmation with ENTER switches off a different, already switched-on function and its settings are reset to the default.
R221	Switch function of R2 (2) off or on	**off** on	SETUP HOLD off R221 Function	
R222	Enter switch-on temperature	**150.0 °C** –50.0 ... 150.0 °C	SETUP HOLD 150.0 °C R222 On value	Never set switch-on point and switch-off point to the same value.
R223	Enter switch-off temperature	**150.0 °C** –50.0 ... 150.0 °C	SETUP HOLD 150.0 °C R223 Off value	The switch-off point entry selects a max contact (switch-off point < switch-on point) or a min contact (switch-off point > switch-on point), thereby implementing an always required hysteresis function (see Fig. 5.10).
R224	Enter pickup delay	**0 s** 0 ... 2000 s	SETUP HOLD 0 s R224 On Delay	
R225	Enter dropout delay	**0 s** 0 ... 2000 s	SETUP HOLD 0 s R225 Off Delay	

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Coding	Field	Selection or range Factory setting (bold)	Display	Info
R226	Enter alarm threshold (as an absolute value)	**150.0 °C** –50.0 ... 150.0 °C	SETUP HOLD 150.0 °C R226 A.Thresh	When the alarm threshold is violated, the measuring transmitter issues an alarm with an error message and error current (note alarm delay in field F3). When defining the min contact, the alarm threshold must be set to a lower value than the switch-off point.
R227	Show status for limit contact	**MAX** MIN	SETUP HOLD MAX R227 LC State	Only display.
R2 (3)	Configure P(ID) controller	LC PV = limit contactor pH/redox (1) LC °C = limit contactor T (2) **PID controller** (3) Timer (4) *Clean = ChemoClean (5)* *Neutr = Neutra controller (6)*	SETUP HOLD PID R2 Sel.Type	Confirmation with ENTER switches off a different, already switched-on function and its settings are reset to the default.
R231	Switch function R2 (3) off or on	**Off** On Basic PID+B	SETUP HOLD off R231 Function	On = PID control Basic = only basic load dosage PID+B = PID control with basic load dosage
R232	Enter set point	**pH 16.00** pH –2.00 ... 16.00 **1500 mV** –1500 ... 1500 mV **0.0 %** 0.0 ... 100.0 %	SETUP HOLD 16.00 pH R232 Setpoint	The set point is the value to be maintained by the control. This value is to be re-established by the control in the event of any deviation (up or down).
R233	Enter control gain K_p	**1.00** 0.01 ... 20.00	SETUP HOLD 1.00 R233 Kp	See chapt. 5.5.2
R234	Enter integral action time T_n (0.0 = no I component)	**0.0 min** 0.0 ... 999.9 min	SETUP HOLD 0.0 min R234 Time Tn	See chap. 5.5.2 At every hold the I component is set to zero. Hold can be deactivated in S2, but not for ChemoClean and timer!
R235	Enter derivative action time T_v (0.0 = no D component)	**0.0 min** 0.0 ... 999.9 min	SETUP HOLD 0.0 min R235 Time TV	See chap. 5.5.2

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Coding	Field	Selection or range Factory setting (bold)	Display	Info
R236	Selection of characteristic controller	**dir** = **direct** inv = inverted	SETUP HOLD dir R236 Direction	Setting may or may not be required depending on control deviation (up or down deviation, see chap. 5.5.4).
R237	Selection of pulse length or pulse frequency	**len** = **pulse length** freq = pulse frequency curr = current output 2	SETUP HOLD len R237 Oper.Mode	Pulse length e. g. for solenoid valve, pulse frequency e. g. for solenoid-operated metering pumps, see chap. 5.5.2, S. 40. Selection of current output 2 is only possible, if O2 = Contr is selected
R238	Enter pulse interval	**10.0 s** 0.5 ... 999.9 s	SETUP HOLD 10.0 s R238 PulsePer.	This field only appears if pulse length is selected in R237. When pulse frequency is selected, R238 is skipped and input continues in R239.
R239	Enter maximum pulse frequency of actuator	**120 min^{-1}** 60 ... 180 min^{-1}	SETUP HOLD 120 1/min R239 Max.PFreq	This field only appears if pulse frequency is selected in R237. When pulse length is selected, R239 is skipped, and input continues in R2310.
R2310	Enter minimum ON time t_{ON}	**0.3 s** 0.1 ... 5.0 s	SETUP HOLD 0.3 s R2310 Min.PTime	This field only appears if pulse length is selected in R237.
R2311	Enter basic load	**0%** 0 ... 40%	SETUP HOLD 0 % R2311 BasicLoad	Selecting the basic load, you choose the desired dosage quantity. 100% basic load corresponds to: steadily on at R237 = on F_{max} at R237 = freq 20 mA at R237 = curr
R2312	Enter process type	**Batch** Inlne	SETUP HOLD Batch % R2312 Proc.Type	Batch = discontinuous process Inlne = continuous process Selecting “Batch”, there is no further dosage within the setting range. The I component is being decreased. Selecting “Inline”, there is a constant dosage within the setting range. The I component is effective.

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Coding	Field	Selection or range Factory setting (bold)	Display	Info
R2 (4)	Configure cleaning function (timer)	LC PV = Limit contactor pH/redox (1) LC °C = Limit contactor T (2) PID-controller (3) **Timer** (4) *Clean = ChemoClean (5)* *Neutra controller (6)*	SETUP HOLD Timer R2 Sel.Type	Cleaning is performed using only one cleaning agent (usually water); see Fig. 5.14. Confirmation with ENTER switches off a different, already switched-on function and its settings are reset to the default.
R241	Switch function of R2 (4) off or on	**off** on	SETUP HOLD off R241 Function	
R242	Enter rinse / cleaning time	**30 s** 0 ... 999 s	SETUP HOLD 30 s R242 RinseTime	The hold and relay settings are activated for the period of time specified here.
R243	Enter pause time	**360 min** 1 ... 7200 min	SETUP HOLD 360 min R243 PauseTime	The pause time is the time between two cleaning cycles (see chap. 5.5.3, S. 41).
R244	Enter minimum pause time	**120 min** 1 ... R243 min	SETUP HOLD 120 min R244 Min.Pause	The minimum pause time prevents continuous cleaning when the cleaning trigger is present.
R2 (5)	Configure cleaning with ChemoClean (on version with four contacts and appropriate assignment of contacts 3 and 4)	LC PV = Limit contactor pH/redox (1) LC °C = Limit contactor T (2) PID controller (3) Timer (4) ***Clean*** = ***ChemoClean*** *(5)* *Neutra controller (6)*	SETUP HOLD Clean R2 Sel.Type	See chap. 5.5.4, p.37. Confirmation with ENTER switches off a different, already switched-on function and its settings are reset to the default.
R251	Switch function of R2 (5) off or on	**off** on	SETUP HOLD off R251 Function	
R252	Selection of start pulse	**int** = **internal (timer-contr.)** ext = external (digital input 2) i+ext = intern. + extern. i+stp = internal, suppressed by external	SETUP HOLD int R252 CleanTrig	The “int” cycle is triggered by the end of the pause time (R257). There is no real-time clock. External suppression is required for irregular time intervals (e.g. weekends).

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Coding	Field	Selection or range Factory setting (bold)	Display	Info
R253	Enter pre-rinse time	**20 s** 0 ... 999 s	SETUP HOLD 20 s R253 PreRinse	Water is used for rinsing.
R254	Enter cleaning time	**10 s** 0 ... 999 s	SETUP HOLD 10 s R254 CleanTime	Cleaning agent and water are used for cleaning
R255	Enter rinse time	**20 s** 0 ... 999 s	SETUP HOLD 20 s R255 PostRinse	Water is used for rinsing.
R256	Enter number of repeat cycles	**0** 0 ... 5	SETUP HOLD 0 R256 Rep.Rate	R253 ... R255 is repeated.
R257	Enter pause time	**360 min** 1 ... 7200 min	SETUP HOLD 360 min R257 PauseTime	The pause time is the time between two cleaning cycles (see Chap. 5.5.3, S. 41).
R258	Enter minimum pause time	**120 min** 1 ... R357 min	SETUP HOLD 120 min R258 Min.Pause	The minimum pause time prevents continuous cleaning when the cleaning trigger is present.
R259	Enter number of cleaning cycles without cleaning agent (economy function)	**0** 0 ... 9	SETUP HOLD 0 R259 EconomyCl	Cleaning with cleaner can be followed by up to 9 cleaning cycles that use only water until the next cleaning cycle with cleaner is performed.
R2 (6)	Configure neutralisation controller	LC PV = limit contactor pH/redox (1) LC °C = limit contactor T (2) PID controller (3) Timer (4) *Clean = ChemoClean (5)* ***Neutra controller** (6)*	SETUP HOLD Neutr R2 Sel.Type	Only if A1 = pH. If the neutralisation controller is selected for Rel1, only the neutra controller option is offered for Rel2. Confirmation with ENTER switches off a different, already switched-on function and its settings are reset to the default.
R261	Switch function of R2 (6) off or on	**off** on	SETUP HOLD off R261 Function	

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Coding	Field	Selection or range Factory setting (bold)	Display	Info
R262	Enter setpoint 1 (or 2)	**pH 6.00** pH –2.00 ... 16.00	SETUP HOLD 6.00 pH R262 Setpoint1	Assignment of relay 1 and relay 2 for neutra controller: Rel 1 = Setpoint 1 Rel 2 = Setpoint 2
R263	Enter control gain K_p1 (or K_p2)	**1.00** 0.10 ... 20.00	SETUP HOLD 1.00 R263 Kp Rel1	Assignment of relay 1 and relay 2 for neutra controller: Rel 1 = Kp 1 Rel 2 = Kp 2
R264	Enter integral action time T_n (0.0 = no I comp.)	**0.0 min** 0.0 ... 999.9 min	SETUP HOLD 0.0 min R264 Tn Rel1	
R265	Enter derivate action time T_v (0.0 = no D comp.)	**0.0 min** 0.0 ... 999.9 min	SETUP HOLD 0.0 min R265 TV Rel1	
R266	Selection of pulse length or pulse frequency	**len** = **pulse length** freq = pulse frequency curr = current output 2	SETUP HOLD len R266 Oper.Mode	Pulse length e. g. for solenoid valve, pulse frequency e. g. for solenoid-operated metering pumps, see chap. 5.5.2, S. 40. Selection of current output 2 is only possible, if O2 = Contr is selected
R267	Enter pulse interval	**10.0 s** 0.5 ... 999.9 s	SETUP HOLD 10.0 s R267 Puls Per.	This field only appears if pulse length is selected in R266. When pulse frequency is selected, R267 is skipped and input continues in R268.
R268	Enter maximum pulse frequency of actuator	**120 min^{-1}** 60 ... 180 min^{-1}	SETUP HOLD 120 1/min R268 Max.PFreq	This field only appears if pulse length is selected in R266. When pulse frequency is selected, R268 is skipped and input continues in R269.
R269	Enter minimum ON time t_{ON}	**0.3 s** 0.1 ... 5.0 s	SETUP HOLD 0.3 s R269 Min.PTime	
R2610	Enter process type	**Batch** Inline	SETUP HOLD Batch % R2312 Proc.Type	Batch = discontinuous process Inline = continuous process Selecting “Batch”, there is no further dosage within the setting range. The I component is being decreased. Selecting “Inline”, there is a constant dosage within the setting range. The I component is effective.

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5.7 Service

Coding	Field	Selection or range Factory setting (bold)	Display	Info
S	Function group **SERVICE**		SETUP HOLD S SERVICE	
S1	Selection of language	**ENG** = **English** GER = Deutsch FRA = Francais ITA = Italiano NEL = Nederlands ESP = Espanol	SETUP HOLD ENG S1 Language	This field must be set once during start-up. Then you can exit S1 and continue.
S2	Hold configuration	**S+C = during setup and calibrating** CAL = during calibrating Setup = during configuring none = no hold	SETUP HOLD S+C S2 Auto HOLD	S = setup, C = calibration.
S3	Manual hold	**off** on	SETUP HOLD aus S3 Man. HOLD	Setting retains even after a power failure.
S4	Enter hold dwell period	**10 s** 0 ... 999 s	SETUP HOLD 10 s S4 Cont.Time	
S5	Enter software upgrade release code (Plus package)	**0000** 0000 ... 9999	SETUP HOLD 0000 S5 PlusCode	Entering an incorrect code returns you to the measurement menu. The number is edited with the PLUS or MINUS key and confirmed with the ENTER key. “1" is displayed if the code is active.
S6	Enter software upgrade release code ChemoClean	**0000** 0000 ... 9999	SETUP HOLD 0000 S6 CleanCode	Entering an incorrect code returns you to the measurement menu. The number is edited with the PLUS or MINUS key and confirmed with the ENTER key. “1" is displayed if the code is active.
S7	Order code is displayed		SETUP HOLD order S7 PR0005	The order code is changed automatically to reflect an upgrade.
S8	Serial number is displayed		SETUP HOLD SerNo S8 12345678	

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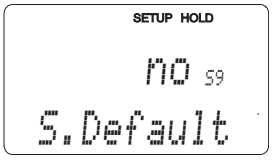
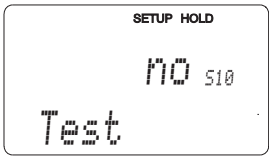
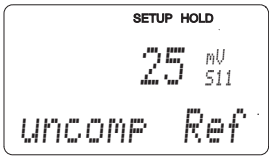
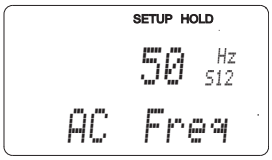
Coding	Field	Selection or range Factory setting (bold)	Display	Info
S9	Reset of instrument (restore default values) ⚠	**no** Sens = sensor data Facty = factory settings		Facty = All data (except A1 and S1) are erased and reset to the factory settings! Sens = Last calibration will be erased and reset to the defaults.
S10	Perform instrument test	**no** displ = display test		
S11	Reference voltage is displayed	current value in mV		Is used for checking the reference potential. Values >50 mV indicate galvanic voltage in the medium. Values >1000 mV may falsify the measuring value.
S12	Select AC frequency	**50 Hz** 60 Hz		Select 60 Hz only if the voltage frequency of the measuring point is 60 Hz and the measuring value changes or produces sporadical SCS errors.

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5.8 E+H Service

Coding	Field	Selection or range Factory setting (bold)	Display	Info
E	**Function group E+H SERVICE**		SETUP HOLD E E+H SERV	
E1	Selection of module	**Contr** = **controller (1)** Trans = transmitter (2) Main = power unit (3) Rel = relay (4)	SETUP HOLD Contr E1 Select	
E111 E121 E131 E141	Software version is displayed		SETUP HOLD xx.xx E111 SW-Vers.	Cannot be edited. If E1 = Contr: Instrument software If E1 = Trans, Main, Rel: Module firmware
E112 E122 E132 E142	Hardware version is displayed		SETUP HOLD xx.xx E112 HW-Vers.	Cannot be edited.
E113 E123 E133 E143	Serial number is displayed		SETUP HOLD SerNo E113 12345678	Cannot be edited.
E114 E124 E134 E144	Module name is displayed		SETUP HOLD LSG E114 Modul-ID	Cannot be edited.

5.9 Interfaces

Coding	Field	Selection or range Factory setting	Display	Info
I	**Function group INTERFACE**		SETUP HOLD I INTERFACE	
I1	Enter address	Address HART: **0** ... 15 or PROFIBUS: 1 ... **126**	SETUP HOLD 126 I1 Address	Only for communication.

Coding		Field	Selection or range Factory setting	Display	Info
	I2	Tag description		SETUP HOLD Tag I2 @@@@@@@@	Only for communication.

5.10 Calibration

This function group is used to calibrate the transmitter. Two types of calibration are possible:

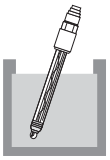
- Calibration by means of measurement in two calibration solutions with a known pH value.
- Calibration by entering daa for slope and zero point
- For redox measurement by entering the mV value or two different % values.

Note:

- If the calibration procedure is aborted by pressing the PLUS and MINUS keys at the same time (return to C19, C25 or C36) or if the calibration is faulty, then the previous calibration data is reinstated. A calibration error is indicated by the “ERR” message and flashing of the sensor symbol on the display.
  Repeat the calibration!
- The instrument is automatically switched to hold during calibration (factory setting).
- An offset entered by the user is automatically cancelled when the calibration is accepted.
- If the slope or zero point is outside the ranges defined in C16 and C17, error 32 is activated for slope or error 33 for zero. The electrode should be then checked and replaced if necessary.

5.10.1 Wet calibration

For access to the CALIBRATION menu, please enter Code 22.

Coding	Field	Selection or range Factory setting (bold)	Display	Info
C (1)	Function group CALIBRATION: pH calibration	**pH calibration**	CAL C CALIBRAT	Only if A1 = pH. Calibration with two different buffer solutions
C11	Enter calibration temperature	**25.0 °C** –50.0 ... 150.0 °C	CAL HOLD 25.0 °C C11 MTC temP.	Only if B1 = MTC.
C12	Enter the pH value of the first buffer solution	**Buffer value of the last calibration** pH 0.00 ... 14.00	CAL HOLD 7.00 pH C12 Buffer 1	The displayed value can be edited. The value is given by the buffer solution in question.
Place the electrode in the indicated buffer. ATC mode: the temperature sensor must also be immersed in the buffer solution. Then start calibration with CAL. The current measured value is displayed. 1. **Manual continuation:** When the value is stable, the user can accept the calibration in buffer solution 1 by pressing the CAL key. 2. **Automatic continuation:** Takes place when the value is stable (difference between values measured ≤ 0.05 and value constant over 10 s). If the value does not stabilise within 5 min, error 44 is set, and the calibration is aborted.				**Connect the potential matching line with the buffer in case of symmetrical measuring mode.**
C13	Calibration is performed		CAL HOLD 7.00 pH C13 Buffer 1	Acceptance when stability is reached: ≤ ±pH 0.05 for more than 10 s.
C14	Enter the pH value of the second buffer solution	**Buffer value of the last calibration** pH 0.00 ... 14.00	CAL HOLD 4.00 pH C14 Buffer 2	The buffer must have a different pH value to buffer 1. Plausibility check takes place.
Buffer 2: proceed as for buffer 1.				
C15	Calibration is performed		CAL HOLD 4.00 pH C15 Buffer 2	Acceptance when stability is reached ≤ ±pH 0.05 for more than 10 s.
C16	Slope is displayed	Glass: **59.16 mV/pH** 38.00 ... 65.00 mV/pH Antimony: **59.16 mV/pH** 25.00 ... 65.00 mV/pH IsFET: **59.16 mV/pH** 38.00...65.00 mV/pH	CAL HOLD 59.16 mV/pH C16 Slope	

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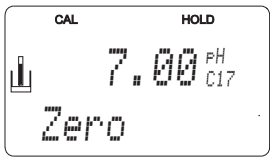
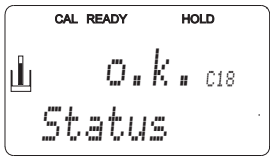
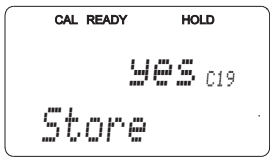
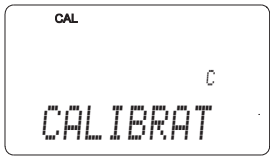
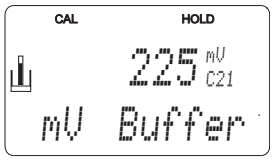
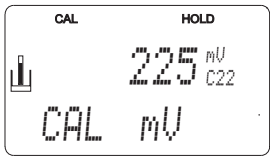
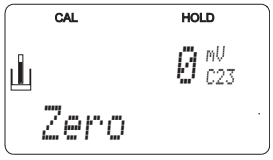
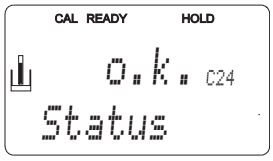
Coding	Field	Selection or range Factory setting (bold)	Display	Info
C17	Zero point (U_is) is displayed	Glass: **pH 7.00** pH 5.00 ... 9.00 Antimony: **pH 1.00** pH –1.00 ... 3.00 IsFET: **present value** –500...+500 mV		The zero point of the IsFET sensor is displayed in mV.
C18	Calibration status is displayed	o.k. E xxx		
C19	Store calibration result	**yes** no new		If C18 = E xxx, then only no or **new.** If new, return to C. If yes/no, return to "Measurement".
The electrode can now be installed into the process again.				
C (2)	Function group CALIBRATION: Calibration for redox mV	**Calibration Redox mV**		Only if A1 = ORP (mV).
The transmitter has a calibrated mV display range. An absolute mV value with a single buffer solution is entered (measuring chain offset adaptation). Use a buffer solution preferably with 225 or 475 mV.				The maximum calibration offset is ±100 mV.
C21	Enter mV value corresponding to the redox buffer used	**Current measured value** –1500 ... 1500 mV		**Connect the potential matching line with the buffer in case of symmetrical measuring mode.**
C22	Calibration is performed	mV value		Acceptance when stability is reached ≤ ±1 mV for more than 10 s.
C23	Zero is displayed	–100 ... 100 mV		
C24	Calibration status is displayed	o.k. E xxx		

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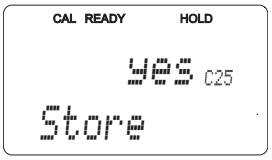
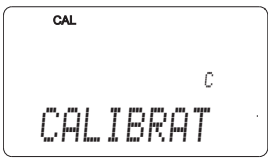
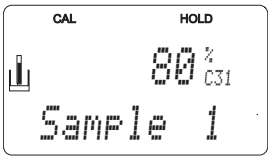
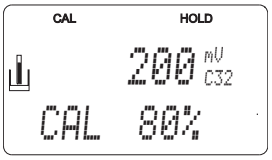
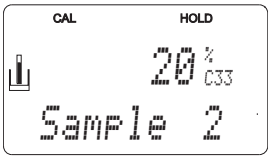
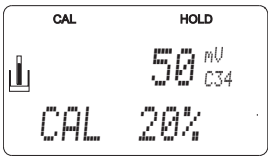
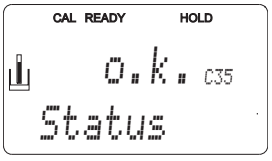
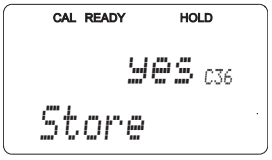
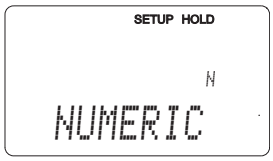
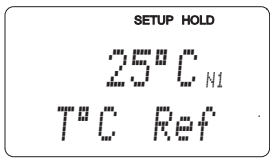
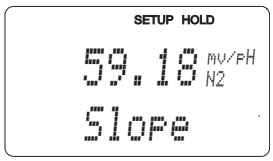
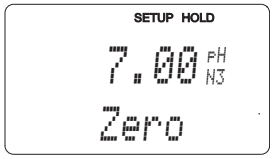
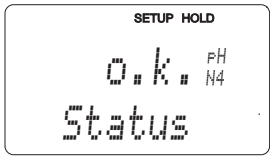
base version does not include functions in *italic.*

Coding	Field	Selection or range Factory setting (bold)	Display	Info
C25	Store calibration result?	**yes** no new		If C24 = E xxx, then only no or **new.** If new, return to C. If yes/no, return to "Measurement".
The electrode can now be installed into the process again.				
C (3)	Function group CALIBRATION: Calibration for redox %	**Calibration Redox %**		Only at A1 = ORP (%).
For calibration, a medium sample is drawn and place in two buckets. The contents of the first bucket are detoxicated. The contents of the second bucket remains unchanged. A relative value of 80 % is enterd for the "toxic" sample. The "non-toxic" sample is used for a relative value 20 %.				Default values: 0 % = –1000 mV 100 % = +1000 mV
C31	Determine 80% value of the "toxic" sample	**80%** 0 ... 100%		Start the calibration with the "toxic" sample by pressing the CAL key. The value is accepted, as soon as it is stable or is confirmed with the CAL key (see pH calibration).
C32	Calibration is performed	mV value is displayed		Acceptance when stability is reached: ≤ ±pH 0.05 for more than 10 s.
C33	Determine 20 % value of "non-toxic" sample	**80%** 0 ... 100%		The procedure started in C31 is repeated with the "non-toxic" sample to calibrate value 2.
C34	Calibration is performed	mV value is displayed		Acceptance when stability is reached: ≤ ±pH 0.05 for more than 10 s.
C35	Calibration status is displayed	o.k. E xxx		
C36	Store calibration result	**yes** no new		If C35 = E xxx, then only no or **new.** If new, return to C. If yes/no, return to "Measurement".
The electrode can now be installed into the process again.				

Factory settings are printed in **bold** face;
base version does not include functions in *italic.*

5.10.2 Numeric calibration

With the numeric calibration you can enter or correct slope and zero point manually.

Coding		Field	Selection or range Factory setting (bold)	Display	Info
N		**Funktionsgruppe NUMERIC CALIBRATION**			
	N1	Enter reference temperature	**25 °C** -50.0 ... 150.0 °C		
	N2	Enter slope	**Glass 59.18 mV/pH** 38.00 ... 65.00 mV/pH **Antimony 59.18 mV/pH** 25.00 ... 65.00 mV/pH **IsFET 59.18 mV/pH** 38.00 ... 65.00 mV/pH		If A5 = IsFET: Enter slope from quality certificate
	N3	Enter zero point	**Glass 7.00 pH** 5.00 ... 9.00 pH **Antimony 1.00 pH** -1.00 ... 3.00 pH **IsFET 0 mV** -500 ... + 500 mV		If A5 = IsFET: Enter voltage U_{IS} from quality certificate
	N4	Calibration status is displayed	**o.k.** E---		

Factory settings are printed in **bold** face;
base version does not include functions in *italic.*

5.11 Offset

The settings in the OFFSET function group can be used to calibrate the measurement to a reference measurement. This requires a linear shift of all values measured, i.e. the adjustment is determined for one measured value, and all others are calculated using the same offset.

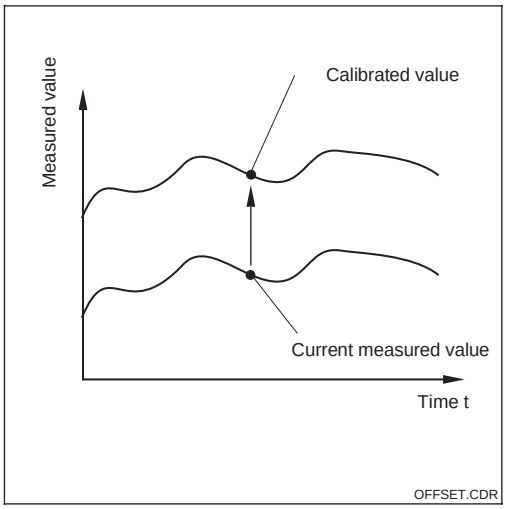


Fig. 5.17 Offset

Note:

The offset is automatically reset to zero after calibration.

Coding		Field	Selection or range Factory setting (bold)	Display	Info
V		**Function group OFFSET for pH or redox**		CAL V OFFSET	Either pH or redox appears depending on the operating mode in A1.
	V1	Enter desired value	**Current measured value** pH –2.00 ... 16.00 –1500 ... 1500 mV 0.0 ... 100.0 %	CAL HOLD 0.00 pH V1 Real PV	Display can be edited.
	V2	Current offset is displayed	**pH 0.00** pH –2.00 ... 2.00 **0 mV** –120 ... 120 mV **0.0 %** –50.0 ... 50.0 %	CAL HOLD 0.00 pH V2 PV Offset	
	V3	Calibration status is displayed	o.k. E xxx	CAL READY HOLD o.k. V3 Status	
	V4	Store calibration result	**yes** no new	CAL READY HOLD yes V4 Store	If V3 = E xxx, then only no or **new.** If new, return to V. If yes/no, return to "Measurement".

Factory settings are printed in **bold** face;
base version does not includde functions in *italic.*

6 Interfaces

For instruments equipped with a communication interface, please refer to separate operating instructions BA 208C/07/en (HART®) or BA 209C/07/en (PROFIBUS®).

7 Maintenance and troubleshooting

Maintenance:

- Maintenance means that all measures which will guarantee the safety of operation and reliability of the entire measuring system are taken in due time.

Maintenance of CPM 223 / 253 includes:
- Calibration (see chapter 5.9)
- Cleaning of assembly and sensor
- Checking of cables and connections

Troubleshooting:

Determination and elimination of the cause of the problem in the case of an operating fault. Troubleshooting refers to measures that can be performed without intervention in the instrument (for instrument defects, see chapter 8, Corrective maintenance).

Troubleshooting of the CPM 223/253 and the measuring system is performed with the aid of the troubleshooting table in chapter 7.1.

Warning:

- Please be aware of effects work performed on the instrument might have on the process control system or the process itself.
- When removing the sensor during maintenance or calibration, please consider potential hazards due to pressure, high temperatures and contamination.

Note:

- Please contact your E+H support office if you have any queries. You can also send your queries to the E+H Service Organisation via the Internet.
  www.endress.com

7.1 Troubleshooting common problems

Error	Possible cause	Remedy	Equipment need, spare parts
Device cannot be operated, value 9999	– Operation locked	Press simultaneously the CAL and MINUS keys	See chap. 4.3
Measuring chain not adjustable	– Reference system poisened	Test with new Sensor	pH/mV sensor
	– Diaphragma clogged	Clean or grind down diaphragma	HCl 3 %, use file (only file in one direction)
	– Measuring line open	Short-circuit pH input on instrument ⇒ display pH 7	
	– Sensor asymmetry voltage too high	Clean diaphragma test with other sensor	HCl 3 %, use file (only file in one direction)
	– Potential matching (PA/PM) Liquisys ⇔ wrong medium	asymm.: no PA or PA conn. to PE symm.: PA connection mandatory	See chap. 3.5
No or creeping change of display	– Sensor soiled	Clean sensor	See chap. 8.6.2
	– Sensor ageing	Replace sensor	new sensor
	– Sensor defective (ref. electrode)	Replace sensor	new Sensor
	– No internal buffer	Check KCl supply (0.8 bar above medium pressure!)	KCl (CPY 4-x)
Measuring chain slope / **slope too low**	– No high-resistance connection (moisture, dirt)	Check cables, connectors and junction boxes	pH simulator, Insulation see chap. 8.6.5
	– Instrument input defective	Check instrument directly	pH simulator
	– Sensor ageing	Replace sensor	pH sensor
Measuring chain slope not adjustable / no slope	– Hair crack in glass membrane	Replace sensor	pH sensor
	– No high-resistance connection (moisture, dirt)	Check cables, connectors and junction boxes	pH simulator, insulation see chap. 8.6.5

Error	Possible cause	Remedy	Equipment need, spare parts
Fixed, incorrect measure value	– Sensor not immersed or protective cap not removed	Check installation, remove protective cap	
	– Air cushion in assembly	Check assembly and installation	
	– Short to ground on/in instrument	Test measurement in insulated container, poss. with buffer solution	Plastic container, buffer solutions
	– Hair crack in glass membrane	Replace sensor	pH sensor
	– Impermissible instrument operating state (no response to key actuation)	Switch instrument off and back on	EMV problem: check grounding and line routing if problem persists
Incorrect temperature value	– Incorrect sensor connection	Verify connections using connection diagram	Connection diagram chap. 3.4
	– Measuring cable defective	Check cable	Ohmmeter
	– Incorrect sensor type	Select sensor type on instrument (field B1)	Glass electrode: Pt 100 IsFET: Pt 1000
Incorrect pH value in process	– No / incorrect temperature compensation	ATC: activate function MTC: set process temperature	
	– Conductivity of medium too low	Choose pH sensor with salt reservoir or liquid KCl	e.g. Orbisint CPS 11-xASxxxx e.g. Ceraliquid CPS 41
	– Flow rate too high	Reduce flow rate or measure in a bypass	
	– Potential in medium	Try grounding with/at PA pin (PA/PE connection)	Problem mainly occurs with plastic lines
	– Sensor soiled or coated	Clean sensor (see chap. 8.6.2)	Heavily soiled media: use spray cleaning
Measured value fluctuates	– Measuring cable interference	Connect cable screen acc. to connection diagram	See chap. 3.5
	– Signal output line interference	Check line routing, try separate line routing	Signal output and meas. input lines
	– Interference potential in medium	Use symmetric measurement (with PMC)	Try grounding medium via PA/PE connection
	– No potential matching (PA/PM) with symmetrical input	Connect PA pin in assembly to PA/PM on instrument	
Controller or timer cannot be activated	– No relay module installed	Install LSR1-2 or LSR1-4 module	See chap. 8.2 and 8.3
Controller / limit contact does not work	– Controller switched off	Activate controller	See chap. 5.5 or fields R2xx
	– Controller in “Manual / Off” mode	Choose “Auto” or “Manual On” mode	Keyboard, REL key
	– Pickup delay setting too long	Disable or shorten pickup delay	See fields R2xx
	– “Hold” function active	“Autom. hold” during calibration, “hold”-input activated; “hold” via keyboard active	See fields S2 to S4
Controller / limit contact works continuously	– Controller in “Manual / On” mode	Set controller to “Manual / Off” or “Auto”	Keyboard, REL and AUTO keys
	– Dropout delay setting to long	Shorten dropout delay	See fields R2xx
	– Control loop interruption	Check measured value, current output or relay contacts, actuators, chemical supply	
No pH/mV current output signal	– Line open or short-circuit	Disconnect line and measure directly in instrument	mA meter 0–20 mA DC
	– Output defective	See chap. 8.1	
Fixed current output signal	– Currenct simulation active	Switch-off simulation	See field O2
	– Processor system out of sync	Switch instrument off and back on	EMV problem: Check installation if problem persists
Incorrect current output signal	– Incorrect current assignment	Check current assignment: 0–20 mA or 4–20 mA?	Field O211
	– Total load in current loop excessive (> 500 Ω)	Disconnect output and measure directly on instrument	mA meter for 0–20 mA DC
Current output table not accepted	– Value interval too small	Use sensible intervals	

Error	Possible cause	Remedy	Equipment need, spare parts
No temperature output signal	– Instrument only has one current output – Instrument with Profibus PA	Refer to nameplate for variant, change LSCH-x1 module if nec. PA instrument has no current output!	LSCH-x2 module, see chap. 8.2.4 and 8.3.4
Chemoclean function not available	– No relay module (LSR1-x) or only LSR1-2 installed	Install LSR1-4 module. Chemoclean is enabled via release code supplied by E+H with Chemoclean upgrade	LSR1-4 module, see chap. 8.2.4 and 8.3.4
Plus ackage functions not available	– Plus package not enabled (enable with code that depends on serial number and is received from E+H with order of Plus package)	– Plus package upgrade: code received from E+H ⇒ enter – Following replacement of defective LSCH/LSCP module: first enter instrument serial number (see nameplate) manually, then enter code	Detailed description see chap. 8.3.5
No HART or PROFIBUS communication	– Several devices on the same address	Check addresses and reset if necessary	
No HART®-communication	– No central HART module – No or wrong DD (device description) – HART interface missing – Instrument not registered with HART server – Load < 230 Ω – HART receiver (e.g. FXA 191) not connected via load – Incorrect device address (addr. = 0 for single operation, addr. > 0 for multidrop operation) – Line capacitance too high – Line interference	Verify by looking at nameplate: HART = -xxx5xx und -xxx6xx For further information, see additional Operating Instructions BA 208C, “HART® – Field communication with Liquisys M CxM 223 / 253”	Upgrade to LSCH-H1 / -H2 module
No PROFIBUS®-communication	– No central PA module – Wrong SW version (without PA) – Commuwin (CW) II: CW II version and instrument SW version incompatible – No or wrong DD/DLL – Incorrect baud rate setting for segment coupler in DPV-1 server – Incorrect station (master) address or duplicate address – Incorrect station (slaves) address – Bus line not terminated – Line problems (too long, cross section too small, not shielded, screen not grounded, wires not twisted) – Bus voltage too low (bus supply voltage typ. 24 V DC for non-Ex, 13,5 V DC for Ex)	Verify by looking at nameplate: PROFIBUS-PA = -xxx3xx For further information, see additional Operating Instructions BA 209C, “PROFIBUS-PA/-DP – Field communication with Liquisys M CxM 223 / 253” Voltage at instrument PA connector must be at least 9 V.	Upgrade to LSCP module Notes on project planning for PROFIBUS ® can be found in Technical Information TI 260F, detailed information on instrumentation and accessories in the operating instructions BA 198F.

7.2 Troubleshooting using the error messages

Display and select error messages by pressing the MINUS key.

Error no.	Display	Measures	Contakt		Error current		Automatic start of cleaning	
			Fact	User	Fact	User	Fact	User
E001	EEPROM memory error	Switch instrument off and back on, return instrument to your local Endress+Hauser sales agency for repair or replace instrument. Load software compatible with hardware. Load measuring parameter specific instrument software.	yes		no		—	—*
E002	Instrument not calibrated, calibration data invalid, no user data invalid (EEPROM error. Instrument software not suitable for hardware (controller).		yes		no		—	—*
E003	Download error	Invalid configuration. Repeat download, check optoscope.	yes		no		no	
E004	Instrument software version not compatible with module hardware version	Load software compatible with hardware. Load measuring parameter specific instrument software.	yes		no		no	
E007	Transmitter malfunction Software not compatible with hardware (transmitter)		yes		no		—	—*
E008	SCS alarm: glass electrode: glass breakage IsFET: Leakage current > 400nA	Check glass electrode for glass breakage and hairline cracks; examine electrode plug-in head for moisture and dry if necessary; check medium temperature. Replace IsFET.	yes		no		no	
E010	Temperature sensor defective, not connected of short-circuited	Check temperature sensor and connection; if necessary, check instrument and measuring cable with temperature simulation. Check correct selection in field A5.	yes		no		no	
E030	SCS reference electrode error	Inspect reference code for soiling and damage; clean reference electrode; check medium temperature.	yes		no		no	
E032	Slope range exceeded or below range	Repeat calibration and renew buffer solution; replace electrode if necessary, and check instrument and measuring cable with simulator.	yes		no		—	—*
E033	pH value zero too low or too high		yes		no		—	—*
E034	Redox offset range exceeded or below range		yes		no		—	—*
E041	Calculation of calibration parameters aborted	Repeat calibration and renew buffer solution; replace electrode if necessary, and check instrument and measuring cable with simulator.	yes		no		—	—*
E042	Distance of calibration value for buffer pH2 from zero (pH7) too short	Slope calibration requires a buffer solution with a difference of at least ΔpH = 2 from the electrode zero point.	yes		no		—	—*
E043	Distance between calibration values for pH1 and pH2 too short	Use buffer solutions that are at least ΔpH = 2 apart.	yes		no		—	—*

Error no.	Display	Measures	Contakt		Error current		Automatic start of cleaning	
			Fact	User	Fact	User	Fact	User
E044	Stability requirement for calibration not fulfilled	Repeat calibration and renew buffer solution; replace electrode if necessary, and check instrument and measuring cable with simulator.	yes		no		—	—*
E045	Calibration aborted	Repeat calibration and renew buffer solution; replace electrode if necessary, and check instrument and measuring cable with simulator.	yes		no		—	—*
E055	Below main parameter measuring range	Check measurement and connections; check instrument and measuring cable with simulator if necessary.	yes		no		no	
E057	Main parameter measuring range exceeded	Check measurement and connections; check instrument and measuring cable with simulator if necessary.	yes		no		no	
E059	Below temperature measuring range		yes		no		no	
E061	Temperature measuring range exceeded		yes		no		no	
E063	Below current output range 1	Check configuration in “current output” menu; check measurement and connections; check instrument and measuring cable with simulator if necessary.	yes		no		no	
E064	Current output range 1 exceeded		yes		no		no	
E065	Below current output range 2		yes		no		no	
E066	Current output range 2 exceeded		yes		no		no	
E067	Set point exceeded controller 1	Check configuration.	yes		no		no	
E068	Set point exceeded controller 2		yes		no		no	
E069	Set point exceeded controller 3		yes		no		no	
E070	Set point exceeded controller 4		yes		no		no	
E080	Current output 1 range too small	Expand range in “current output” menu.	no		no		—	—*
E081	Current output 2 range too small	Expand range in “current output” menu.	no		no		—	—*
E100	Current simulation active		no		no		—	—*
E101	Service function yes	Switch service function off or switch instrument off and back on	no		no		—	—*
E102	Manual mode active		no		no		—	—*
E106	Download yes	Wait for download to end.	no		no		—	—*
E116	Download error	Repeat download.	no		no		—	—*
E152	PCS alarm	Check sensor and connection.	no		no		no	

When this error is present, the cleaning function cannot be started.
(Field F8 does not exist for this error.)

Error no.	Display	Measures	Contakt		Error current		Automatic start of cleaning	
			Fact	User	Fact	User	Fact	User
E154	Below lower alarm threshold for period exceeding alarm delay	If necessary perform manual reference measurement. Repair sensor and recalibrate.	yes		no		no	
E155	Above upper alarm threshold for period exceeding alarm delay		yes		no		no	
E156	Actual value undershoots alarm threshold for longer than the set permissible maximum period		yes		no		no	
E157	Actual value exceeds alarm threshold for longer than the set permissible maximum period		yes		no		no	
E162	Dosage stop	Check settings in CURRENT INPUT or CHECK function group.	yes		no		no	
E164	Dynamic range of pH convertor exceeded	Check cable and sensor.	yes		no		-	
E165	Dynamic range of reference convertor exceeded	Check cable and sensor.	yes		no		-	
E168	Warning: IsFET leakage current > 200 nA	Check IsFET for abrasion and tightness, replace soon.	no		no		no	
E171	Flow in main stream loo low or zero	Restore flow.	yes		no		no	
E172	Switch-off limit for current iput exceeded	Check process variables at sending measuring instrument.	yes		no		no	
E173	Current input < 4 mA	Check process variables at sending measuring instrument. Change range assignment if required.	yes		no		no	
E174	Current input > 20 mA	Check process variables at sending measuring instrument. Change range assignment if required.	yes		no		no	

8 Diagnosis and corrective maintenance

Diagnosis
- Diagnosis refers to the identification of instrument malfunctions and defects.

Corrective maintenance:
- replacement of parts diagnosed to be defective;
- testing of instrument and measuring system function;
- restoration of complete functionality.

Diagnosis based on the error table below and depending on difficulty and measuring equipment at hand is to be performed by:
- trained operator personnel
- operator's electricians
- company responsible for system installation/operation
- E+H Service.

Please refer to the tables in chap. 8.2 and 8.3 for identification of spare parts required.

Warning:

- Disconnect the instrument from the power source before opening it up. Work under tension may only be performed by trained electricians.
- Switched contacts may be supplied from external circuits. These circuits must also be de-energized before work on the terminals is performed.

Caution: ESD!

- Electronic components are sensitive to electrostatic discharges. Personal protective measures, such as discharge via PE or permanent grounding using a wrist strap, are to be taken.
- For your own safety, use only original spare parts. Original parts will guarantee functionality, accuracy and reliability after repairs.

8.1 Diagnosis

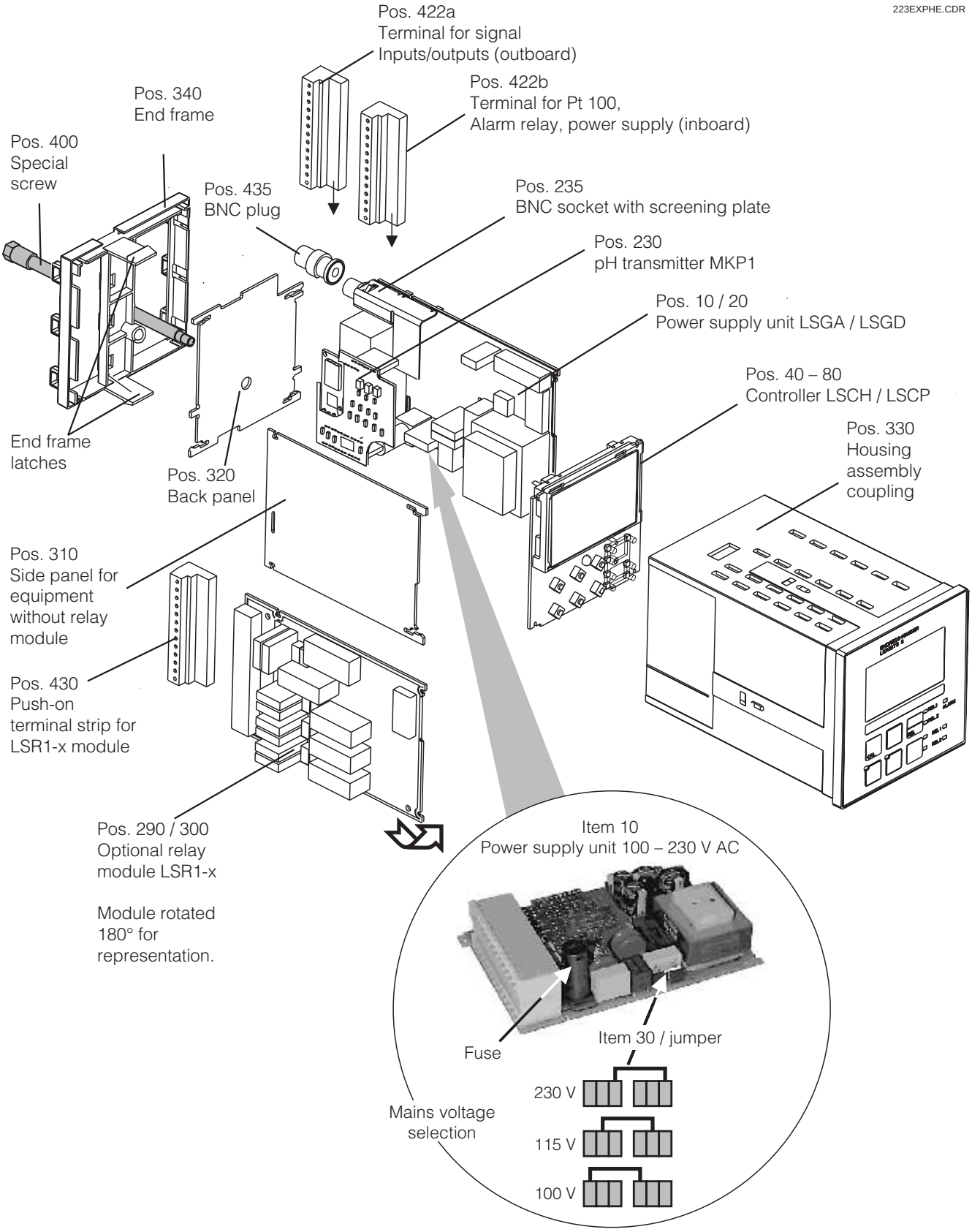
The table below will help you diagnose problems and specifies the spare parts required. Please refer to chap. 8.2.3 and 8.3.3 for information on the exact designations of the spare parts and their installation.

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Display dark, no LEDs active	– No mains voltage	Check if mains voltage is available	Electrician / e.g. multimeter
	– Wrong supply voltage / voltage too low	Compare mains voltage and rating on nameplate	Operator (utility company specification or multimeter)
	– Connection fault	Terminal not tightened; insulation clamped in terminal; wrong terminal used	Electrician
	– Instrument fuse defective	Replace fuse, first compare mains voltage and rating on nameplate	Electrician / see drawings in chap. 8.2.1 and 8.3.1 for corrected fuse
	– Power supply unit defective	Replace power supply unit, using correct variant	On-site diagnosis by E+H Service (test module required)
	– Controller defective	Replace controller, using correct variant	On-site diagnosis by E+H Service (test module required)
	– CPM 253: ribbon cable Pos. 310 loose or defetive	Check ribbon cable, replace if necessary	See spare parts for CPM 253
Display dark, but LED(s) active	Controller defective (Module: LSCH/LSCP)	Replace controller	On-site diagnosis by E+H Service (test module required)

Error	Possible cause	Tests and / or remedial measures	Equipment, spare parts, personnel
Display shows measured values but – value does not change and / or – instrument cannot be operated	– Instrument or module not properly installed in instrument – Impermissible operating system state	CPM 223: Reinstall module CPM 253: Reinstall display module Switch instrument off and back on	Refer to assembly drawings in chapters 8.2.1 and 8.3.1 Possible EMC problem: if problem persists, call E+H Service to have installation checked
Instrument gets hot	– Incorrect voltage / too high – Power supply unit defective	Compare mains voltage and rating of nameplate Replace power supply unit	 Can only be diagnosed by E+H Service
Incorrect meas. pH / mV and / or temperature value	– Transmitter module defective (module: MKP1), please perform tests and take measures according to chap. 7.1	Test measuring inputs: – Connectc pH, Ref and PA directly on instrument with wire jumpers = display pH 7 – Connect 100 Ω resistance to terminals 11 / 12 + 13 = display 0 °C	If test fails: replace module (using correct variant), refer to exploded views in chap. 8.2.1 and 8.3.1
Current output, incorrect current	– Not calibrated correctly – Load excessive – Shunt / short-circuit to frame in current loop – Incorrect mode of operation	Test with built-in current simulation, connecting mA meter directly to current output Check whether 0–20 mA or 4–20 mA has been selected	If simulation value is incorrect: recalibration at factory or new LSCxx module required. If simulation value is correct: check current loop for load and shunts.
No current output signal	– Current output stage defective (module: LSCH/LSCP)	Test with built-in current simulation, connecting mA meter directly to current output	If test fails: Replace controller (using correct variant)
Additional relays do not work	– CPM 253: ribbon cable Pos. 320 loose or defective	Make sure ribbon cable is properly connected, replace cable if nec.	See Spare parts COM 253 F
Only 2 additional relays can be used	– Relay module LSR1-2 with 2 relays installed	Convert to LSR1-4 with 4 relays	Operator or E+H Service
Enhanced functions (S package) not available	– No or incorrect release code used – Incorrect serial number of instrument stored in LSCH/LSCP) module	If upgraded: verify that correct serial number has been used to order S package Check whether serial number on nameplate matches serial number of LSCH/LSCP (field S8).	Handled by E+H Sales Serial number of instrument is required to enable S package.
Enhanced functions (S package and / or Chemoclean) are not available after replacement of LSCH-/LSCP module	– Serial number entered for replacement module LSCH or LSCP at factory is 0000. S package or Chemoclean has not been enabled with release codes.	For LSCH / LSCP with SNR 0000 an instrument serial number can be entered **once** in fields E114 to E116. Next step is to enter release codes for S package and/or Chemoclean.	A detailed description can be found in chap. 8.3.5.
No HART or PROFIBUS interface function	– Wrong controller – Wrong software – Bus problem	HART: LSCH-H1 or -H2 PROFIBUS-PA/-DP: LSCP-PA/-DP module, see field E112 SW version see field E111 Remove some instruments and repeat testing	Replace controller; operator or E+H Service Contact E+H Service for support

8.2 Corrective maintenance of Liquisys M CPM 223

8.2.1 Exploded view



8.2.2 Disassembly of CPM 223

- Consider potential effects on process when removing the instrument from service!
- First pull off the terminal block (Pos. 422 b) on the rear side of the device, to make the device voltage-free.
- First pull off the terminal blocks (Pos. 422 a and if necessary 430) on the rear side of the device, to make the device voltage-free.
- Press the latches of the end frame (Pos. 340) inwards and pull off the frame towards the rear.
- Loosen the special screw (Pos. 400) by turning it counterclockwise.
- Remove the complete electronics block from the housing. The modules are plugged together mechanically and can be easily separated:
  - Simply pull processor/display module forwards
  - Pull flaps on the back panel gently outwards, the lateral modules can then be removed.
- Dismantling the pH/mV Transmitter (Pos. 230):
  – Bend the screen plate upward
  – Pull off the stranded wire (plug-in connection; pH input from BNC socket), then pull off the module towards the top.

8.2.3 Assembly of CPM 223

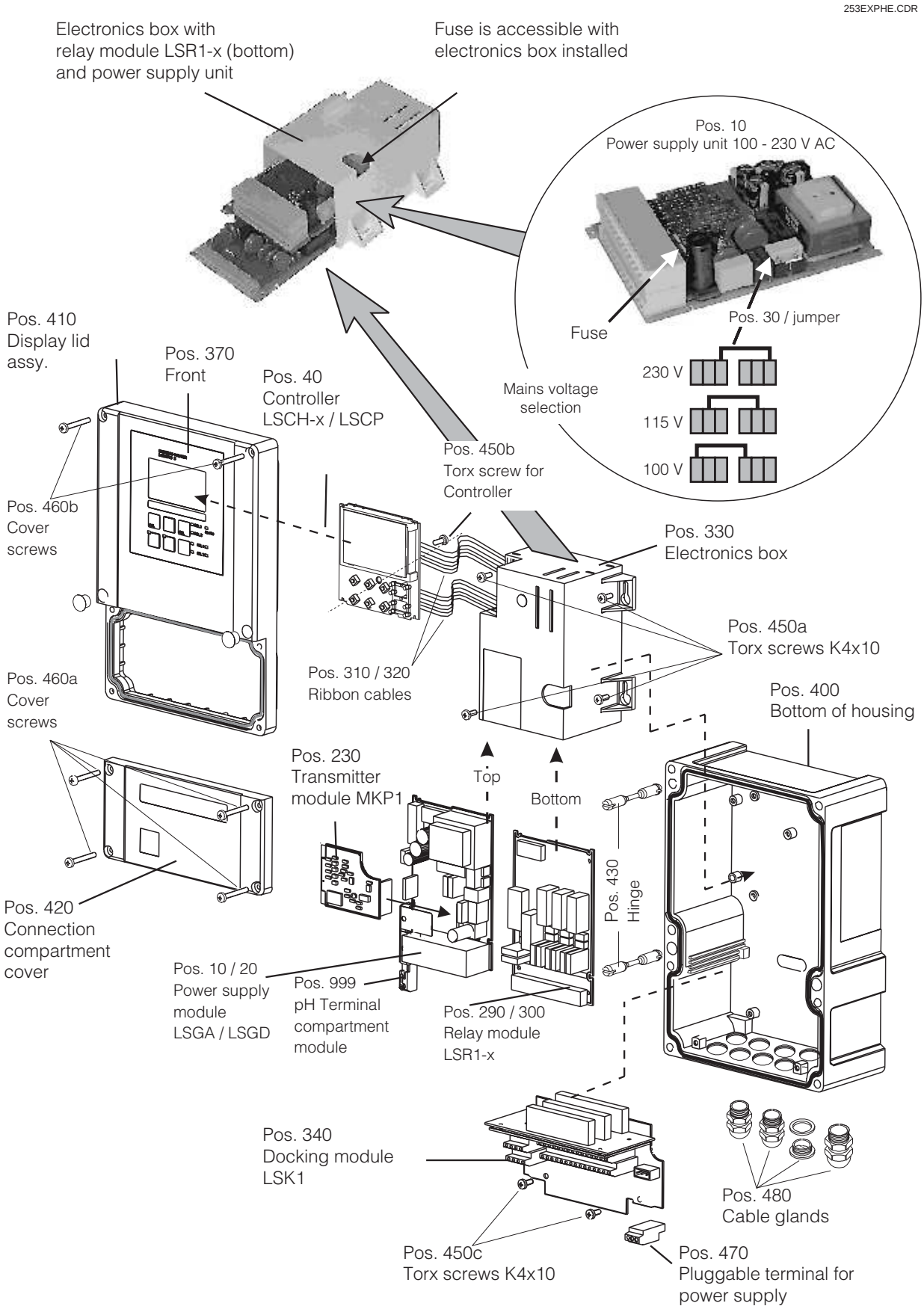
- Reverse the dismantling sequence for assembly.
- Hand-tighten the special screw without using a tool.
- Incorrect assembly is not possible! A module block which has been plugged together incorrectly cannot be inserted into the housing.

8.2.4 Spare parts for CPM 223

Pos.	Designation	Name	Function	Order number
10	Power supply unit	LSGA	100/115/230 V AC	51500317
20	Power supply unit	LSGD	24 V AC + DC	51500318
40	Controller	LSCH-S1	1 current output	51501081
40	Controller	LSCH-S2	2 current outputs	51501082
40	Controller	LSCH-H1	1 current output + HART	51501083
40	Controller	LSCH-H2	2 current output + HART	51501084
40	Controller	LSCP	Profibus PA / no curr. output	51501085
40	Controller	LSCP	Profibus DP /no curr. output	51502503
230	pH/mV transmitter	MKP1	pH/mV +temperature input glass electrode	51501080
230	pH/mV transmitter	MKP2	pH/mV + temperature input IsFET sensor	51507096
235	pH/mV input		BNC socket + screening plate	51501070
290	Relay module	LSR1-2	2 Relays	51500320
290	Relay module	LSR2-2i	2 Relays + current input 4..20 mA	51504304
300	Relay module	LSR1-4	4 Relays	51500321
300	Relay module	LSR2-4i	4 Relays + current input 4..20 mA	51504305
310	Side panel		Kit with 10 parts	51502124
310, 320, 340, 400	Housing mechanical component		Back panel, side panel, connection compartment, Special screw	51501076
330, 400	Housing assembly		Housing with front membrane, sensorytappets, seal, specialscrew, tension dogs, connection and name plates	51501075
340	Back panel		Back panel for PROFIBUS-DP	
422a, 422b	Terminal strips set		Complete terminal strips set Standard version + HART	51501077
422a, 422b	Terminal strips set		Complete terminal strips set PROFIBUS-PA	51501077
422a, 422b	Terminal strips set		Complete terminal strips set PROFIBUS-DP	51501077
430	Terminal strip		Terminal strip for relay module	51501078
435	Inclined BNC plug		pH/mV connection	50074961

8.3 Corrective maintenance Liquisys M CPM 253

8.3.1 Exploded view



8.3.2 Disassembly of CPM 253

- Open and remove the connection compartment cover (Pos. 420).
- Pull out the mains terminal (Pos. 470) to make the device voltage-free.
- Open the display cover (Pos. 410) and loosen the ribbon cable (Pos. 310 / 320) on the side of the electronics box (Pos. 330).
- Dismantling the controller (Pos. 40): Loosen screw (Pos. 450b) in the display lid.
- Removal of electronics box (Pos. 330): Loosen screws (Pos. 450a) in the bottom of the housing 2 revolutions, then slide entire box backward and remove towards the top.

  Make absolutely sure that the module locks do not open!
  Bend the module latches outward and remove the module(s).
- Dismantling the docking module (Pos. 340): Loosen screws (Pos. 450c) in the bottom of the housing and remove entire module towards the top.
- Dismantling the pH/mV Transmitter (Pos. 230):
  – Bend the screen plate upward
  – Pull off the stranded wire (plug-in connection; pH input from BNC socket), then pull off the module towards the top.

8.3.3 Assembly of CPM 253

- Insert the module(s) in the electronics box guide rails carefully and latch into the lateral lugs in the box.
- Incorrect assembly is not possible! Modules incorrectly inserted into the electronics box can not be put into operation because the ribbon cables can not be plugged in if this is the case.
- Make sure that the cover gaskets are intact since they are required to guarantee protection class IP 65.

8.3.4 Spare parts for CPM 253

Pos.	Designation	Name	Function	Order number
10	Power supply unit	LSGA	100/115/230 V AC	51500317
20	Power supply unit	LSGD	24 V AC + DC	51500318
40	Controller	LSCH-S1	1 current output	51501081
40	Controller	LSCH-S2	2 current outputs	51501082
40	Controller	LSCH-H1	1 current output + HART	51501083
40	Controller	LSCH-H2	2 current output + HART	51501084
40	Controller	LSCP	Profibus PA/no current output	51501085
40	Controller	LSCP	Profibus DP /no current output	51502503
230	pH/mV transmitter	MKP1	pH/mV +temperature input glass electrode	51501080
230	pH/mV transmitter	MKP2	pH/mV + temperature input IsFET sensor	51507096
230	pH/mV transmitter	MKP1	pH/mV + temperature input	51501080
290	Relay module	LSR2-2	2 Relays	51500320
290	Relay module	LSR2-2i	2 Relays + current input 4..20 mA	51504304
300	Relay module	LSR2-4	4 Relays	51500321
300	Relay module	LSR2-4i	4 Relays + current input 4..20 mA	51504305
310, 320	Ribbon cables		2 ribbon cables	51501074
330, 340, 450	Internal housing parts		Docking assembly, empty electronics box, small parts	51501073
370, 410, 420, 430, 460	Housing cover		Display cover, connection compartment cover, Front membrane, hinges, cover screws, small parts	51501068
400, 480	Lower housing section		Lower section	screw union
430	Hinges		2 pairs of hinges	51501069
470	Terminal strip		Terminal strip for power supply	51501079
999	pH/mV terminal asembly 1		pH/mV terminal+screen plate	51501071

8.3.5 Special case: replacement of central module

Note:

- After controller replacement all the editable data are reset to the factory settings.
- The serial number can only be entered – and **only once** – in the case of a new module from the factory with serial number 0000! Make sure that your entry is correct before confirming with ENTER!
  Entry of an incorrect code will prevent the enhanced functions from being enabled. An incorrect serial number can only be corrected at the factory.

Proceed as described below after central module replacement:

- If possible, record the user settings of the instrument, e.g.:
  – Calibration data
  – pH / mV and temperature current assignments
  – Relay function selections
  – Limit / controller settings
  – Cleaning settings
  – Monitoring functions
  – Interface parameters
- Dismantle the device as described in Chap. 8.2.2 or 8.3.2 .
- Refer to the part no. of the central module to determine whether the new module has the same part no. as the old one.
- Reassemble the device with the new module, as described in chap. 8.2.3 or 8.3.3.
- Put the device into operation again and check the fundamental function (e.g. measured value and temperature display, operability via keyboard).
- Enter the instrument serial number:
  – Read the serial number ("user-no.") of the device from the nameplate.
  – Enter this number in the fields E115 (year, one-digit), E116 (month, one-digit), E117 (sequence number, four-digit).
  – Field E118 displays the complete number for verification; acknowledge with ENTER or abort and re-enter.
- Check if the S packet has been activated (e. g. by calling up the function group CHECK / P code) or the Chemoclean function.
- Restore the user settings of the instrument.

8.4 Spare parts orders

Spare parts are to be ordered from your local E+H Sales Agency. The address is on the back cover of these operating instructions. Use the order numbers listed in Chapters 8.2.4 and 8.3.4

To be on the safe side, you should **always** specify the following data with spare parts orders:

– Instrument order code (order code)
– Serial number (user-no.)
– Software version where available

Refer to the nameplate for the order code and serial number.
The software version is displayed in field E111 when the instrument processor system is functional.

8.5 Service equipment "Optoscope" with "Scopeware"

The Optoscope together with the "Scopeware" software offers the following possibilities, **without** having to remove or open the Liquisys M and **without** galvanic connection to the device:

- Documentation of the instrument settings in conjunction with Commuwin II
- Software update by the service technician
- Upload/download a hex dump to duplicate configurations.

The optoscope serves as an interface between the Liquisys M and PC / laptop. The information exchange takes place via the optical interface on the Liquisys M and via an RS 232 interface on the PC / laptop.

Handling and operation are described in the optoscope operating instructions. The user-friendly Windows software required for the PC or laptop is supplied with the optoscope.

The optoscope is supplied in a sturdy case with all the accessories required.

Order number of optoscope: 51500650

8.6 Corrective maintenance of measuring system

8.6.1 pH/redox transmitter

Cleaning the front panel

To clean the front panel, only use standard cleaning agents.

The front panel is resistant to the following cleaning agents (acc. to test methode DIN 42 115):
- Isopropanol
- Thinned acids (3 %)
- Thinned alkalis (5 %)
- Ester
- Hydrocarbons
- Ketone
- Household cleaners

Caution!

Do not use any concentrated mineral acids or alkalis, benzyl-alcohol, methylene chloride or high-pressure water vapour at over 100 °C.

8.6.2 pH/mV electrodes

Clean soilings on the glass electrodes as follows:

- *Clean oily and greasy coatings*
  Clean with detergent (fat solvent, e.g. alcohol, acetone, poss. detergent).

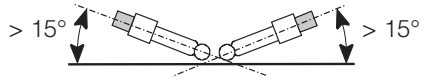
Warning:

Hands, eyes and clothes are to be protected when using the cleaning agents described below.

- *Limestone deposits or metal hydroxide coatings*
  Loosen coatings with diluted hydrochlorid acid (3 %), then rinse thoroughly.
- *Coatings containing sulphide (from flue gas desulphurising plants or sewage treatment plants)*
  Use mixture of hydrochlorid acid (0.5 %) and thiourea (8 %), then rinse thoroughly.
- *Coatings containing protein (food industry)*
  Use mixture of hydrochlorid acid (0.5 %) and pepsin (1 %), then rinse thoroughly.

Blocked diaphragms can under certain circumstances be mechanically cleaned (does not apply for teflon diaphragms and open ring junction electrodes):
- Use a small key file
- File in one direction only

Air bubbles in the electrode
- Air bubbles may indicate an assembly problem; check installation position
- The range from 15° to 165° from the horizontal is permissible
- Horizontal installation or installation with the plug-in head pointing down is not allowed



Redox electrodes
Careful mechanical cleaning of coated metal pins or surfaces is possible.

8.6.3 Assembly

Please refer to the operating instructions for the assembly in question for maintenance and troubleshooting instructions. The operating instructions also include instructions for assembly and dismantling, sensor and gasket replacement as well as information on resistance, spare parts and accessories.

8.6.4 Liquid KCl supply

- KCl must flow without bubbles. Unpressurised version: cotton thread present?
- For counterpressure: pressure in KCl reservoir must exceed medium pressure by at least 0.8 bar.
- KCl consumption should be low but noticeable. Approx. 1 ... 10 ml per day is typical.
- Refill opening of sensors with KCl refill opening on glass shaft must be open.

8.6.5 Connecting lines and junction boxes

Check cables and connections for moisture. Moisture reduces the sensor slope. If the display can not be called up or is fixed on pH 7, please check the following components:

- Sensor head
- Sensor plug
- pH measuring cable
- Junction box if present
- Extension cable

Note:

The sensor head and junction box can be cleaned and dried with a hair-drier.

Caution:

If moisture is found on the measuring cable, the cable absolutely must be replaced.

A shunt in the cable of > 20 MΩ cannot be measured with normal multimeters, but is very detrimental to pH measurement. Reliable testing is possible with a commercially available insulation resistance meter:

- Disconnect the pH measuring cable from the sensor and instrument.
- If a junction box is used, the incoming and outgoing pH cables should be checked separately.
- Preferably test the cable with a test voltage of 1000 V DC (but least with 500 V DC) test.
- Insulation resistance of an intact cable is > 100 GΩ.
- Defective (moist) cables will cause flashover.
  Cable replacement is mandatory!

9 Accessories

Mounting accessories

- Weather protection cover CYY 101
  For mounting on field housing, for outdoor installation.
  Dimensions (H × W × D):
  320 × 300 × 270 mm
  Material: Stainless steel SS 304
  Order no.: CYY 101-A

- Universal upright post CYY 102
  Square tube for mounting of field housing.
  Dimensions (H × W × D):
  1495 × 60 × 60 mm
  Material: Stainless steel SS 304
  Order no.: CYY 102-A

Electrodes

- **OrbiSint W CPS 11/12/13**
  pH / redox combination electrode with PTFE diaphragms, with gel filling, applicable for up to 6 bar.
  Technical Information TI 028C/07/en
  Order no.: 50054649

- **OrbiTex W CPS 21**
  pH combination electrode with open ring junction, with gel filling, applicable for up to 6 bar.
  Technical Information TI 029C/07/de
  Order no.: 50054650

- **CeraTex W CPS 31**
  pH combination electrode with ceramic diaphragms, with electrolyte filling, applicable for up to 0.6 bar.
  Technical Information TI 030C/07/de
  Order no.: 50054651

- **CeraLiquid P CPS 41/42/43**
  pH combination electrode with ceramic diaphragms, electrolyte connection via threaded hose coupling, applicable for up to 8 bar.
  Technical Information TI 049C/07/de
  Order no.: 50059346

- **CeraGel P CPS 71/72**
  Sterilisable pH/redox electrode with double chamber reference and integrated bridge electrolyte.
  Technical Information TI 245C/07/de
  Order no.: 51505837

- **TopHit H CPS 401**
  IsFET sensor for glass-free pH measurement from PEEK. With long-term stable contamination-resistant reference system.
  Technical Information TI 283C/07/de
  Order no.: 51506685

Connection accessories

Technical information about all cable types:
TI 118C/07/en
Order no.: 50068526

- **CPK1**
  Measuring cable with auxiliary core and additional outer screen, in PVC sheath, ∅ 7.2 mm; extension with cable CYK 71

- **CPK 2**
  Coaxial measuring cable with six auxiliary cores and additional outer screen, in PVC sheath, ∅ 12 mm; extension with cable PMK

- **CPK 9**
  Coaxial measuring cable with four auxiliary cores and additional outer screen, in PVC sheath, ∅ 7.2 mm; with waterproof TOP 68 plug-in head, IP68 ingress protection, extension with cable CYK 71

- **CPK 12**
  Coaxial measuring cable with four auxiliary cores and additional outer screen, in PVC sheath, ∅ 7.2 mm; for IsFET sensors, with waterproof TOP68 plug-in head, IP 68 ingress protection, extension with cable CYK 71

- **Junction box VBM**
  Junction box for extension of cable connection between electrode and instrument. Pg 13.5 cable entries.
  Material: cast aluminium;
  Ingress protection: IP 65.
  Order no.: 50003987

- **Junction box VBA**
  Junction box for extension of cable connection between electrode and instrument. Pg 13.5 cable entries.
  Material: cast aluminium;
  Ingress protection: IP 65
  Order no.: 50005276

Assemblies

- **DipFit W CPA 111**
  Immersion assembly for pH and redox electrodes with bayonet system, applicable for up to 4 bar.
  Technical Information TI 112C/07/de
  Order no.: 50066450

- **CleanFit W CPA 450**
  Manual change assembly for pH and redox electrodes, applicable for up to 4 bar.
  Technical information TI 183C/07/en
  Order no.: 50090677

- **CleanFit P CPA 471**
  Process retractable assembly for pH and redox electrodes, for manual or pneumatic operation, applicable for up to 6 bar.
  Stainless steel material.
  Technical information TI 217C/07/en
  Order no.: 51502596

- **CleanFit P CPA 472**
  Process retractable assembly for pH and redox electrodes, for manual or pneumatic operation, applicable for up to 6 bar.
  Plastic material.
  Technical information TI 223C/07/en
  Order no.: 51502645

- **FlowFit CPA 250**
  Flow assembly for pH and redox electrodes, applicable for up to 6 bar
  Technical information TI 041C/07/en
  Order no.: 50036058

Buffer solutions

- **CPY 1 High precision buffer solution**
  for pH calibration
  pH 2.0 / 11.0
  Content: 100 ml

- **CPY 2 Technical buffer solution**
  for pH calibration
  pH 4.0 / 7.0 / 9.2 / 10.00
  Content: 100 / 1000 / 5000 ml

- **CPY 3**
  for redox calibration
  +220 mV (pH 7,0)
  + 468 mV (pH 0,0)
  Content: 100 / 5000 ml

- **CPY 4**
  KCl electrolyte solution
  for liquid filled electrodes
  3 mol (-10 °C ... 100 °C)
  1.5 mol (-30 °C ... 100 °C)
  Content: 100 / 1000 ml

Instrument upgrade

(Order only possible with serial number of relevant device)

- Plus package
  Order no.: 51500385

- ChemoClean
  Order no.: 51500963

- Two-relay card (standard version)
  Order no.: 51500320

- Two-relay card (CSA version)
  Order no.: 51511446

- Four-relay card (standard version)
  Order no.: 51500321

- Four-relay card (CSA version)
  Order no.: 51511447

- Two-relay card with current input (standard version / CSA version)
  Order no.: 51504304

- Four-relay card with current input (standard version / CSA version)
  Order no.: 51504305

10 Technical data

General specifications

Manufacturer	Endress+Hauser
Product designation	Liquisys M CPM 223 Liquisys M CPM 253

Input

Measured variables	pH, redox, temperature

pH measurement

Measuring range	pH –2 ... 16
Display range	pH –2 ... 16 with indication of measuring range violation
pH offset range	±pH 2
Slope	Glass: 38.00 ... 65.00 mV/pH (nominal 59.16 mV/pH) Antimon: 25.00 ... 65.00 mV/pH (nominal 59.16 mV/pH) IsFET: 38.00 ... 65.00 mV/pH (nominal 59.16 mV/pH)
Zero point	Glass: pH 5.00 ... 9.00 (nominal pH 7.00) Antimon: pH –1.00 ... 3.00 (nominal pH 1.00) IsFET: –500 ... +500 mV
Terminal cross-section	2.5 mm^2
Required conductor cross-section CPM 223 CPM 253	0.75 mm^2 / AWG 18 1.50 mm^2 / AWG 14
Maximum cable length to pH electrode	50 m

pH signal input

Input resistance for nominal operating conditions	> 1×10^{12} Ω

Redox measurement

Display and measuring range	–1500 ... +1500 mV / 0 ... 100 %
Redox offset range	±120 mV / ±50 %
Terminal cross-section	2.5 mm^2
Required conductor cross-section CPM 223 CPM 253	0.75 mm^2 / AWG 18 1.50 mm^2 / AWG 14
Maximum cable length to pH electrode	50 m

Redox signal input

Input resistance for nominal operating conditions	> 1×10^{12} Ω

Temperature measurement

Temperature sensor	Pt 100, Pt 1000, NTC 30K
Measuring range Pt 100, Pt 1000 NTC 30K	–50 ... +150 °C –20 ... +100 °C
Temperature offset range	±5 °C

Digital inputs 1 and 2

Voltage	10 ... 50 V
Current consumption	max. 10 mA

Current input

Current range	4 ... 20 mA, galvanically separated
Load	260 Ω at 20 mA (voltage drop 5.2 V)

Output

pH signal output

Current range	0 / 4 ... 20 mA, galvanically separated; error current 2.4 / 22 mA
Max. resolution	700 digits / mA
Load	max. 500 Ω
Output range	adjustable, min. Δ 1 pH
Isolation voltage	max. 350 V_{rms} / 500 V DC
Overvoltage protection (lightning protection)	to EN 61000-4-5:1995

Redox signal output

Current range	0 / 4 ... 20 mA, galvanically separated
Max. resolution	700 digits / mA
Load	max. 500 Ω
Output range	absolute: adjustable, min. Δ 50 mV relative: fixed, 0 ... 100 %
Separation voltage	max. 350 V_{rms} / 500 V DC
Overvoltage (lightning) protection	to EN 61000-4-5:1995

Temperature signal output (optional)

Current range	0 / 4 ... 20 mA, galvanically separated
Max. resolution	700 digits / mA
Load	max. 500 Ω
Transfer range	adjustable, Δ 10 ... Δ 100 % from measuring range end
Separation voltage	max. 350 V_{rms} / 500 V DC
Overvoltage (lightning) protection	to EN 61000-4-5:1995

Auxiliary voltage output

Output voltage	15 V ± 0.6 V
Output current	max. 10 mA

Contact outputs (potential-free changeover contacts)

Switching current with ohmic load (cos φ = 1)	max. 2 A
Switching current with inductive load (cos φ = 0.4)	max. 2 A
Switching voltage	max. 250 V AC, 30 V DC
Switching power with ohmic load (cos φ = 1)	max. 1250 VA AC, 150 W DC
Switching power with inductive load (cos φ = 0,4)	max. 500 VA AC, 90 W DC

Limit contactor

Pickup / dropout delay	0 ... 2000 s

Controller

Function (adjustable)	pulse length / pulse frequency controller
Controller response	PID
Control gain K_p	0.01 ... 20.00
Integral action time T_n	0.0 ... 999.9 min
Derivative action time T_v	0.0 ... 999.9 min
Period for pulse-length controller	0.5 ... 999.9 s
Frequency for pulse frequency controller	60 ... 180 min^{-1}
Basic load	0 ... 40% of max. set value

Alarm

Function (switchable)	steady / fleeting contact
Alarm threshold adjustment range	pH / temperature: entire measuring range
Alarm delay	0 ... 2000 s (min)

Accuracy

pH measurement

Reference temperature	+25 °C
Measured value resolution	0.01 pH
Display deviation[1]	max. 0.5 % of measuring range
Repeatability[1]	max. 0.2 % of measuring range
Measurement deviation[1] pH signal output	max. 0.75 % of measuring range

Redox measurement

Measured value resolution	1 mV / 0.1 %
Display deviation[1]	max. 0.5 % of measuring range
Repeatability[1]	max. 0.2 % of measuring range
Measurement deviation[1] redox signal output	max. 0.75 % of measuring range

Temperature measurement

Measured value resolution.	01 °C
Display deviation[1]	max. 1.0 % of measuring range
Measurement deviation[1] temperature signal output	max. 1.25 % of current output range

Ambient conditions

Ambient temperature (nominal operating conditions)	–10 ... +55 °C
Ambient temperature (limit operating conditions)	–20 ... +60 °C
Storage and transportation temperature	–25 ... +65 °C
Relative humidity (nominal operating conditions)	10 ... 95 %, non-condensing
Ingress protection of panel-mounted instrument	IP 54 (front panel), IP 30 (enclosure)
Ingress protection of field instrument	IP 65
Pollution degree	2 acc. to IEC 61010-1
Installation category	II
Maximum altitude	2000 m above sea level
Electromagnetic compatibility	Interference emission and interference immunity acc. to EN 613261:1998 / A1:1998

Mechanical construction

Dimensions of panel-mounted unit (H × W × D)	96 × 96 × 145 mm
Installation depth	approx. 165 mm
Dimensions of field instrument (H × W × D)	247 × 170 × 115 mm
Weight of panel-mounted unit	max. 0.7 kg
Weight of field instrument	max. 2.3 kg
Measured value display	LC display, two lines, five and nine digits, with status indicators

Materials

Housing of panel-mounted unit	Polycarbonate
Front membrane	Polyester, UV-resistant
Field instrument standard versions / CSA GP version	ABS PC Fr / Polycarbonate

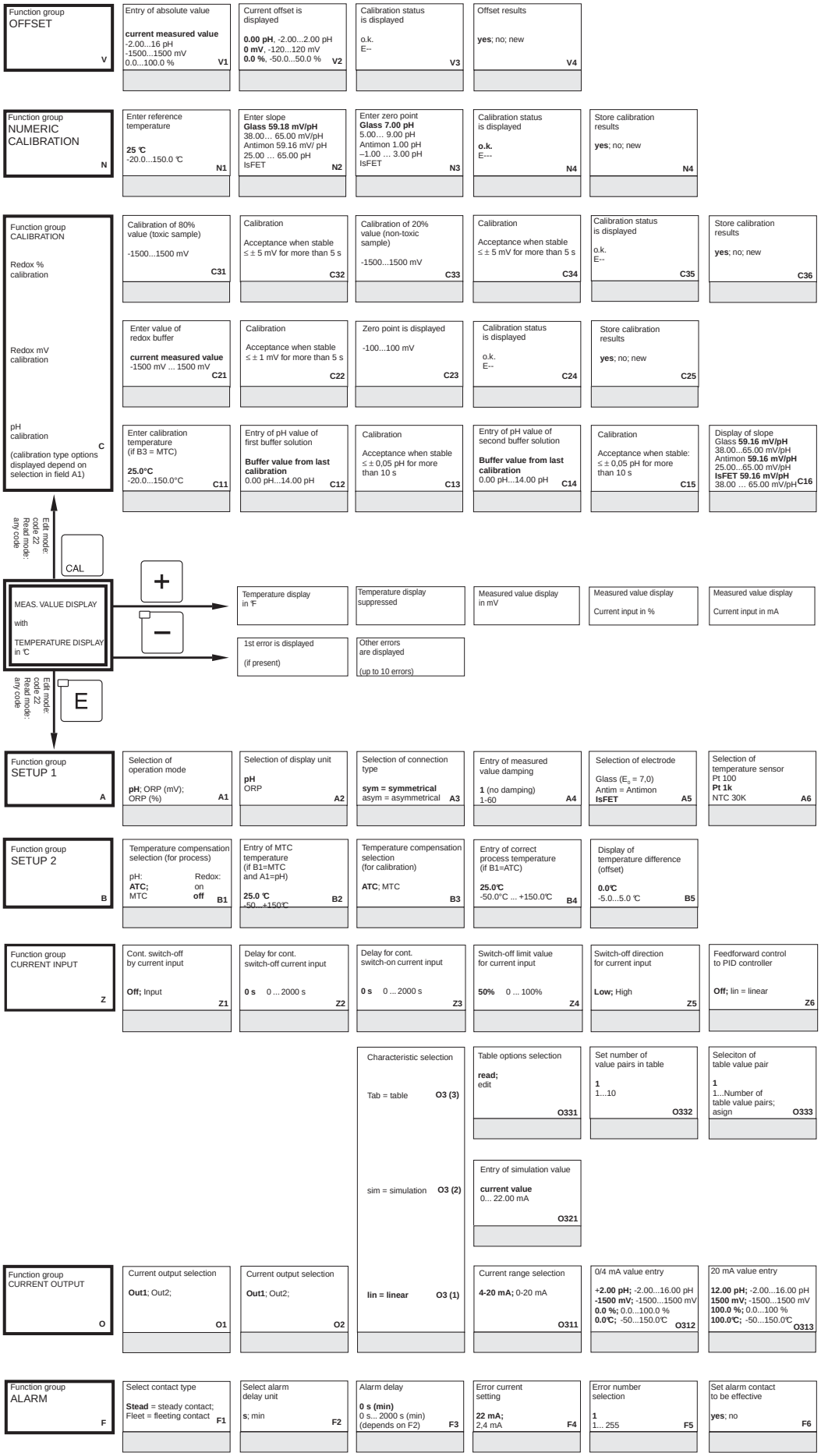
Power supply

Supply voltage	100 / 115 / 230 V AC +10 / –15 %, 48 ... 62 Hz 24 V AC/DC +20 / –15 %
Power consumption	max. 7.5 VA
Mains protection	microfuse, medium slow 250 V / 3.15 A

[1]According to IEC 746-1, for nominal operating conditions

Subject to modification.

11 Appendix


Function group OFFSET V
Entry of absolute value current measured value -2.00...16 pH -1500...1500 mV 0.0...100.0 % V1
Current offset is displayed 0.00 pH, -2.00...2.00 pH 0 mV, -120...120 mV 0.0 %, -50.0...50.0 % V2
Calibration status is displayed o.k. E-- V3
Offset results yes; no; new V4
Function group NUMERIC CALIBRATION N
Enter reference temperature 25 °C -20.0...150.0 °C N1
Enter slope Glass 59.18 mV/pH 38.00… 65.00 mV/pH Antimon 59.16 mV/ pH 25.00 … 65.00 pH IsFET N2
Enter zero point Glass 7.00 pH 5.00… 9.00 pH Antimon 1.00 pH –1.00 … 3.00 pH IsFET N3
Calibration status is displayed o.k. E--- N4
Store calibration results yes; no; new N4
Function group CALIBRATION C
(calibration type options displayed depend on selection in field A1)
Redox % calibration
Calibration of 80% value (toxic sample) -1500...1500 mV C31
Calibration Acceptance when stable ≤ ± 5 mV for more than 5 s C32
Calibration of 20% value (non-toxic sample) -1500...1500 mV C33
Calibration Acceptance when stable ≤ ± 5 mV for more than 5 s C34
Calibration status is displayed o.k. E-- C35
Store calibration results yes; no; new C36
Redox mV calibration
Enter value of redox buffer current measured value -1500 mV ... 1500 mV C21
Calibration Acceptance when stable ≤ ± 1 mV for more than 5 s C22
Zero point is displayed -100...100 mV C23
Calibration status is displayed o.k. E-- C24
Store calibration results yes; no; new C25
pH calibration
Enter calibration temperature (if B3 = MTC) 25.0°C -20.0...150.0°C C11
Entry of pH value of first buffer solution Buffer value from last calibration 0.00 pH...14.00 pH C12
Calibration Acceptance when stable ≤ ± 0,05 pH for more than 10 s C13
Entry of pH value of second buffer solution Buffer value from last calibration 0.00 pH...14.00 pH C14
Calibration Acceptance when stable: ≤ ± 0,05 pH for more than 10 s C15
Display of slope Glass 59.16 mV/pH 38.00...65.00 mV/pH Antimon 59.16 mV/pH 25.00...65.00 mV/pH IsFET 59.16 mV/pH 38.00 … 65.00 mV/pH C16
Edit mode: code 22 Read mode: any code
CAL
MEAS. VALUE DISPLAY with TEMPERATURE DISPLAY in °C
+
–
Temperature display in °F
Temperature display suppressed
Measured value display in mV
Measured value display Current input in %
Measured value display Current input in mA
1st error is displayed (if present)
Other errors are displayed (up to 10 errors)
E
Function group SETUP 1 A
Selection of operation mode pH; ORP (mV); ORP (%) A1
Selection of display unit pH ORP A2
Selection of connection type sym = symmetrical asym = asymmetrical A3
Entry of measured value damping 1 (no damping) 1-60 A4
Selection of electrode Glass (E$_a$ = 7,0) Antim = Antimon IsFET A5
Selection of temperature sensor Pt 100 Pt 1k NTC 30K A6
Function group SETUP 2 B
Temperature compensation selection (for process) pH: ATC; MTC Redox: on off B1
Entry of MTC temperature (if B1=MTC and A1=pH) 25.0 °C -50...+150°C B2
Temperature compensation selection (for calibration) ATC; MTC B3
Entry of correct process temperature (if B1=ATC) 25.0°C -50.0°C ... +150.0°C B4
Display of temperature difference (offset) 0.0°C -5.0...5.0 °C B5
Function group CURRENT INPUT Z
Cont. switch-off by current input Off; Input Z1
Delay for cont. switch-off current input 0 s 0 ... 2000 s Z2
Delay for cont. switch-on current input 0 s 0 ... 2000 s Z3
Switch-off limit value for current input 50% 0 ... 100% Z4
Switch-off direction for current input Low; High Z5
Feedforward control to PID controller Off; lin = linear Z6
Characteristic selection Tab = table O3 (3) sim = simulation O3 (2) lin = linear O3 (1)
Table options selection read; edit O331
Set number of value pairs in table 1 1...10 O332
Seleciton of table value pair 1 1...Number of table value pairs; asign O333
Entry of simulation value current value 0... 22.00 mA O321
Function group CURRENT OUTPUT O
Current output selection Out1; Out2; O1
Current output selection Out1; Out2; O2
Current range selection 4-20 mA; 0-20 mA O311
0/4 mA value entry +2.00 pH; -2.00...16.00 pH -1500 mV; -1500...1500 mV 0.0 %; 0.0...100.0 % 0.0°C; -50...150.0°C O312
20 mA value entry 12.00 pH; -2.00...16.00 pH 1500 mV; -1500...1500 mV 100.0 %; 0.0...100 % 100.0°C; -50...150.0°C O313
Function group ALARM F
Select contact type Stead = steady contact; Fleet = fleeting contact F1
Select alarm delay unit s; min F2
Alarm delay 0 s (min) 0 s... 2000 s (min) (depends on F2) F3
Error current setting 22 mA; 2,4 mA F4
Error number selection 1 1... 255 F5
Set alarm contact to be effective yes; no F6

Zero point is displayed
Glass **7.00 pH**
5.00...9.00 pH
Antimon **1.00 pH**
-1.00...3.00 pH
ISFET **current value**
–500...+500 mV **C17**

Calibration status
is displayed

o.k.
E--
C18

Store calibration
results

yes; no; new
C19

Feedforward control =1
at

50% 0 ... 100%
Z7

Entry of x value
(measured value)

0.00 pH; -2.00...16.00 pH
0 mV; -1500...1500 mV
0.0 %; 0.0...100.0 %
O334

Entry of y value
(current value)

0.00 mA
0.00...20.00 mA
O335

Table status ok

yes; no
O336

Activate error current
for previously set
error

no; yes **F7**

Automatic start of
cleaning function
no; yes
(not always displayed,
see error messages) **F8**

Select "next error"
or return to menu

next = next error;
←R **F9**

Field for customer settings

Function group CHECK **P**	SCS alarm measuring electrode **off**; on **P1**	SCS alarm for reference electrode (if A2=sym) **off**; on **P2**	SCS alarm threshold **50 kΩ** 1.5...50 kΩ **P3**	Display of leakage current (only with IsFET sensor) 0,0 ... 9,9 µA **P4**	Select process monitoring **Off;** Low; High; LoHi; Lo!; Hi!; LoHi! **P5**	Alarm delay **0 min (s)** 0 … 2000 min (s) **P6**
		Limit contactor configuration Neutr = neutralisation controller (only with rel1 and rel2 and with A1 = pH) **R2 (6)**	Function **R2 (6)** Switch off or on **off;** on **R261**	Set point 1 (or 2) **6.00 pH** -2.00...16.00 pH **R262**	Entry of control gain Kp1 (or Kp2) **1.00** 0.01...20.00 **R263**	Entry of integral action time Tn (0.0 = no I component) **0.0 min** 0.0...999.9 min **R264**

		Clean = Chemoclean (only with rel3) **R2 (5)**	Function **R2 (5)** Switch off or on
			off; on **R251**
				Start pulse selection
				int = internal;
				ext = external;
				i+ext = internal +external;
				i+stp = internal, suppressed by ext **R252**
					Entry of pre-rinse time
					30 s
					0...999 s **R253**
						Entry of cleaning time
						10 s
						0...999 s **R254**

		Timer **R2 (4)**	Function **R2 (4)** Switch off or on **off**; on **R241**	Rinse time setting **30 s** 0...999 s **R242**	Pause time setting **360 min** 1...7200 min **R243**	Entry of minimum pause time **120 min** 1...3600 min **R244**
		PID controller **R2 (3)**	Function **R2 (3)** Switch off or on **off**; on **R231**	Entry of set point **pH 16.00;** -2.00...16.00 pH **1500 mV;** -1500...1500 mV **100.0 %;** 0...100.0 % **R232**	Entry of control gain Kp **1.00** 0.01...20.00 **R233**	Entry of integral action time Tn (0.0 = no I component) **0.0 min** 0.0...999.9 min **R234**
		LC °C = limit contactor T **R2 (2)**	Function **R2 (2)** Switch off or on **off**; on **R221**	Entry of switch-on temperature **150.0 °C** -50.0...+150.0°C **R222**	Entry of switch-off temperature **150.0 °C** -50.0...+150.0°C **R223**	Pickup delay entry **0 s** 0...2000 s **R224**
Function group RELAY **R**	Select contact to be configurd **Rel1;** Rel2; Rel3; Rel4; **R1**	**LC PV = pH/redox limit contactor** **R2 (1)**	Function **R2 (1)** Switch off or on **off**; on **R211**	Select contact switch-on point **16.00 pH**; -2.00...16.00 pH **1500 mV**; -1500...1500 mV **100.0 %**; 0...100.0 % **R212**	Select contact switch-off point **pH 16.00;** pH -2.00...16.00 **1500 mV;** -1500...1500 mV **100.0 %;** 0...100.0 % **R213**	Pickup delay entry **0 s** 0...2000 s **R214**
Function group SERVICE **S**	Language selection **ENG;** GER ITA; FRA ESP; NEL **S1**	Hold configuration **s+c** = **during setup and calibration** CAL = during calibration Setup = during setup none = no hold **S2**	Manual hold **off;** on **S3**	Entry of hold dwell period **10 s** 0...999 s **S4**	Entry of SW upgrade release code (Plus package) **0000** 0000...9999 **S5**	Entry of SW upgrade release code Chemoclean **0000** 0000...9999 **S6**
	Module selection Rel = Relay **E1(4)**	Software version SW version **E141**	Hardware version HW version **E142**	Serial number is displayed **E143**	Module name is displayed **E144**	
	MainB = mainboard **E1(3)**	Software version SW version **E131**	Hardware version HW version **E132**	Serial number is displayed **E133**	Module name is displayed **E134**	
	Trans = transmitter **E1(2)**	Software version SW version **E121**	Hardware version HW version **E122**	Serial number is displayed **E123**	Module name is displayed **E124**	
Function group E + H SERVICE **E**	Contr = controller **E1(1)**	Software version SW version **E111**	Hardware version HW version **E112**	Serial number is displayed **E113**	Module name is displayed **E114**	
Function group INTERFACE **I**	Entry of address HART: **0**...15 or PROFIBUS 1...**126** **I1**	Display of tag @@@@@@@@ **I2**				

Set lower alarm threshold

pH -2.00 pH -2 ... 16 **P7**

Set upper alarm threshold

pH 16.00 pH -2 ... 16 **P8**

Select process monitoring

Off; AC; CC; AC CC AC!; CC!; ACCC! **P9**

Set max. perm. period for lower limit exceeded

60 min 0 ... 2000 min **P10**

Set max. perm. period for upper limit exceeded

120 min 0 ... 2000 min **P11**

Set monitoring value

pH 1.00 pH -2 ... 16 **P12**

Entry of derivative action time Tv (0.0 = no D component)

0.0 min
0.0...999.9 min **R265**

Selection

len = pulse length
freq = pulse frequency **R266**

Entry of pulse interval

10.0 s
0.5...999.9 s **R267**

Entry of max. pulse frequency

120 1/min
60...180 1/min **R268**

Entry of min. ON time t_{on}

0.3 s
0.1...5.0 s **R269**

Enter process type

Batch
Inlne **R2610**

Entry of post-rinse time

20 s
0...999 s **R255**

Number of repeat cycles

0
0...5 **R256**

Set interval between two cleaning cycles (pause time)

360 min
1...7200 min **R257**

Entry of minimum pause time

120 min
1...R357 min **R258**

Number of cleaning cycles without cleaning agent

0
0...9 **R259**

Entry of derivative action time Tv (0.0 = no D component)

0.0 min
0.0...999.9 min **R235**

Selection of control characteristic

dir = direct;
inv = inverted; **R236**

Selection

len = pulse length
freq = pulse frequency **R237**

Entry of pulse interval

10.0 s
0.5...999.9 s **R238**

Entry of max. pulse frequency

120 1/min
60...180 1/min **R239**

Entry of min. ON time t_{on}

0.3 s
0.1...5.0 s **R2310**

Enter basic load

0%
0 ... 40% **R2311**

Enter process type

Batch
Inlne **R2312**

Dropout delay entry

0 s
0...2000 s **R225**

Entry of alarm threshold (as an absolute value)

150.0 °C
-20.0...+150.0 °C **R226**

Dropout delay entry

0 s
0...2000 s **R215**

Entry of alarm threshold (as an absolute value)

16.00 pH; -2.00...16.00 pH
1500 mV; -1500...1500 mV
100.0 %; 0...100.0 % **R216**

Order number is displayed **S7**

Serial number is displayed **S8**

Reset intrument (restore default values)
no;
Sens = sensor data;
Facty = factory settings **S9**

Perform instrument test

no; display **S10**

Reference voltage is displayed **S11**

Select AC frequency **S12**

12 Index

Declaration of contamination

Dear customer,
Because of legal determinations and for the safety of our employes and operating equipment we need this "Declaration of contamination" with your signature before your order can be handled. Please put the completely filled in declaration to the instrument and to the shipping documents in any case. Add also safety sheets and/or specific handling instructions if necessary.

type of instrument / sensor: _____ serial number: _____

medium / concentration: _____ temperature: _____ pressure: _____

cleaned with: _____ conductivity: _____ viscosity: _____

Warning hints for medium used:

☐ radioactive ☐ explosive ☐ caustic ☐ poisonous ☐ harmful of health ☐ biological hazardous ☐ inflammable ☐ safe

Please mark the appropriate warning hints.

Reason for return:

_____

_____

Company data:

company: _____ contact person: _____

_____ _____

_____ department: _____

address: _____ phone number: _____

_____ Fax/E-Mail: _____

_____ your order no.: _____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

_____ _____

(Date) (company stamp and legally binding signature)

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BA 194C/07/en/07.02
Printed in Germany / CV5 / DT