BA 234C/07/en/05.03
51513615
Software version 1.20 or later

Mycom S
CLM 153
Conductivity Transmitter

Operating Instructions





Quality made by
Endress+Hauser

ISO 9001

Endress+Hauser
The Power of Know How

First commissioning ..... page 23

Using the menu "Quick Setup" in the chapter "First commissioning" you can configure the transmitter with the most important parameters quickly and easily. Important basic functions such as language, measured variable, temperature compensation and current outputs are configured directly with the help of the on-site display.
You carry out further configuration in the corresponding menus as required.

Brief operating instructions



"PARAM": Parameter entry menu

"PARAM" allows you to return to the previous "return field" from any point in the menu.



"DIAG": brings you to the instrument diagnosis menu.



Help page: Press "DIAG" and "PARAM" together



"MEAS": Measuring mode

Press "MEAS" to exit any of the menus ("PARAM", "DIAG", "CAL") without having completed the settings / calibration.



"CAL": Calibration



"E": (Enter): Continue in menu / confirm your selection

LED: "green" = everything OK. "red" = error.



Arrow keys:
- Scroll through items and highlight a selection or
- increment/decrement numbers by one step with "+" / "-".
  Next digit: using the "right arrow" (editor type 1) or
- "Activate" with the "right arrow" and scroll through the selection with "+" / "-" (editor type 2).

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1 Safety instructions

1.1 Notes on safety conventions and icons

General safety instructions



Warning!
This symbol alerts you to hazards which could cause serious injuries as well as damage to the instrument if ignored.



Caution!
This symbol alerts you to possible faults which could arise from incorrect operation. They could cause damage to the instrument if ignored.



Note!
This symbol indicates important items of information.

Electrical symbols



DC voltage
A terminal at which DC voltage is applied or through which DC flows.

AC voltage
A terminal at which (sine-form) AC voltage is applied or through which AC flows.



Ground connection
A grounded terminal, which, from the user's point of view, is already grounded using a ground system.



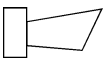
Protective earth terminal
A terminal which must be grounded before other connections may be set up.



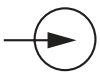
Equipotential connection
A connection which must be connected to the grounding system of the equipment. This can be, for example, a potential matching line of a star-shaped grounding system, depending on national or company practice.



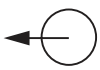
Double insulation
The equipment is protected with double insulation.



Alarm relay



Input



Output

1.2 Designated use

The transmitter Mycom S CLM 153 is a device for measuring conductivity. The transmitter is designed for measuring or control tasks in applications in the following industries:

- Chemical process systems
- Pharmaceuticals
- Foodstuff industry
- Water treatment and monitoring

The Ex-version of the Mycom S CLM 153 makes operation in hazardous atmospheres also possible (see "Certificates" in the product structure on page 7).

Any other use than the one described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

1.3 Installation, Commissioning, Operation

Please note the following items:

- Installation, electrical connection, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel. The technical personnel must be authorised for the specified activities by the system operator.
- Technical personnel must have read and understood theses Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections for correctness. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning.
- Measuring point faults may only be rectified by authorised and specially trained personnel.
- If faults can not be rectified, the products must be moved from service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturer's or by the Endress+Hauser service organisation.

1.4 Operational safety



Warning!
If the device is used for any application other than those described in these Operating Instructions, it may lead to unsafe and improper functioning of the measuring system and is therefore not permitted.

The instrument has been designed and tested according to the state of the art and left the factory in perfect functioning order. The instrument meets all the prevailing regulations and EC directives - see "Technical data".

However, always pay attention to the following points:
- Measuring systems used in Ex areas have a separate document (XA 233C/07/a3) which forms a *component part* of these Operating Instructions. Always follow the installation regulations and the - partly deviating - connection data of the Ex documentation as well. You can find the following symbols on the front page of the additional

Ex documentation (according to approval and test centre
(Ex Europe, FM USA, CSA Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326, and NAMUR Recommendation NE 21, 1998.
- The manufacturer reserves the right to change the technical data in line with technical progress at any time. You can obtain information on the current version of these Operating Instructions and possible additions from your E+H sales centre.

1.4.1 Immunity to interference

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

- cable screening
- interference suppression filter
- interference suppression capacitors



Warning!
Protection against interference as specified above is valid only for an instrument connected according to the instructions in these Operating Instructions.

1.5 Return

If the transmitter has to be repaired, please return it *cleaned* to the E+H sales centre responsible. You can find the address on the last page of these instructions. For returns please use the original packaging.
With the instrument, please enclose a completed copy of the "Declaration of Contamination" form. You can find this at the end of these Operating Instructions.

2 Identification

2.1 Device designation

2.1.1 Product structure

Conductivity transmitter in aluminium housing for wall mounting with one alarm and two output contacts for NAMUR, ChemoClean and controller functions as well as three binary inputs, logbooks, data loggers, USP limit functions. Plain text operation. 247x167x111 mm (HxWxD). Degree of protection IP 65.

Certificates		
A	Basic equipment: non-Ex	
G	With Atex approval, Atex II (1) 2G EEx em ib[ia] IIC T4	
O	With FM approval; NI Cl. I, Div. 2, Sensor IS Cl. I, Div. 1	
P	With FM approval; NI Cl. I, Div. 2	
S	With CSA approval; NI Cl. I, Div. 2, Sensor IS Cl. I, Div. 1	
T	With TIIS approval	
	Measuring input	
1	1 measuring circuit for conductive sensors, conductivity/resistance and temperature	
2	1 measuring circuit for inductive sensors, conductivity/resistance and temperature	
3	2 measuring circuits for conductive sensors, conductivity/resistance and temperature	
4	2 measuring circuits for inductive sensors, conductivity/resistance and temperature	
		Measuring output
A	2 current outputs 0/4 ... 20 mA, passive (Ex and non-Ex)	
B	2 current outputs 0/4 ... 20 mA, active (non-Ex)	
C	HART with 2 current outputs 0/4 ... 20 mA, passive (Ex and non-Ex)	
D	HART with 2 current outputs 0/4 ... 20 mA, active (non-Ex)	
E	PROFIBUS-PA, without current outputs	
		Contacts, current input
0	Without additional contacts	
1	3 additional contacts	
2	2 additional contacts, 1 passive current input (Ex and non-Ex)	
3	2 additional contacts, 1 resistance input (non-Ex)	
4	1 additional contact, 2 passive current inputs (Ex and non-Ex)	
5	1 additional contact, 1 passive current input, 1 active resistance input (non-Ex)	
		Power supply
0	100 ... 230 V AC	
8	24 V AC / DC	
		Language versions
A	E / D	
B	E / F	
C	E / I	
D	E / ES	
E	E / NL	
F	E / J	
		Cable connection
0	Cable glands M 20 x 1.5	
1	Adapter for cable gland NPT ½"	
2	Adapter for cable gland G ½	
		Additional equipment
0	Without additional equipment	
1	Additional equipment: DAT module	
		Configuration
0	Factory settings	
CLM 153-		Complete order code

2.1.2 Nameplate

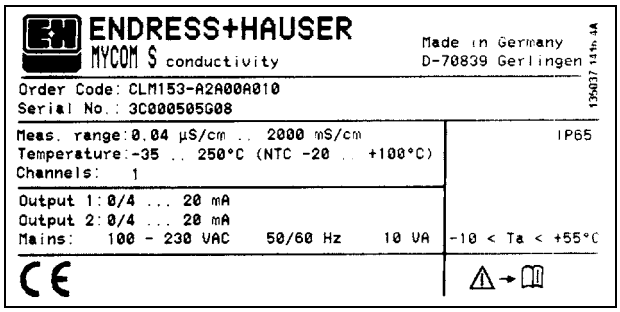


Fig. 1: Example of a nameplate for the transmitter Mycom S CLM 153.

2.2 Scope of delivery

The scope of delivery comprises:
- Instrument type and version acc. to the nameplate (s. chap. 2.1.2)
- Operating Instructions BA 234C/07/en (for Ex-system also the XA 233C/07/a3)

2.3 Certificates and approvals

Declaration of conformity
The product meets the legal requirements of the harmonised European standards. Endress+Hauser confirms compliance with the standards by affixing the CE symbol.

3 Installation

3.1 Incoming acceptance, transport, storage

- Make sure the packaging is undamaged!
  Inform the deliverer about damage to the packaging.
  Keep the damaged packaging until the matter has been clarified.
- Make sure the contents are undamaged!
  Inform the deliverer about damage to the delivery contents.
  Keep the damaged products until the matter has been clarified.
- Use the delivery papers and your order to check that the scope of delivery is complete.
- For storage and transport purposes, pack the instrument so that it is protected against impacts and humidity. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your nearest Endress+Hauser sales centre, (see the back page of these Operating Instructions).

3.2 Installation conditions

3.2.1 Dimensions

You can find the dimensions and lengths of the transmitter in the Technical data on page 101 ff.

3.3 Installation

3.3.1 Installation instructions

- The *standard* use of the Mycom S CLM 153 transmitter is as a field instrument.
- The Mycom S CLM 153 transmitter can be fixed to vertical or horizontal pipes using the round post fixture available from Endress+Hauser (see Accessories). When installing the instrument outdoors, you also require the weather protection cover CYY 101. This cover is compatible with all field instrument installations options.
- Always install the transmitter so that the cable entries point downwards.
- The transmitter can be installed as a panel-mounted unit as well.

3.3.2 Wall mounting



Caution!
- Check that the temperature does not exceed the maximum permitted ambient temperature (–20° ... +60°C). Install the instrument in a shady location. Avoid direct sunlight.
- Mount the wall mounting housing so that the cable entries always point downwards.

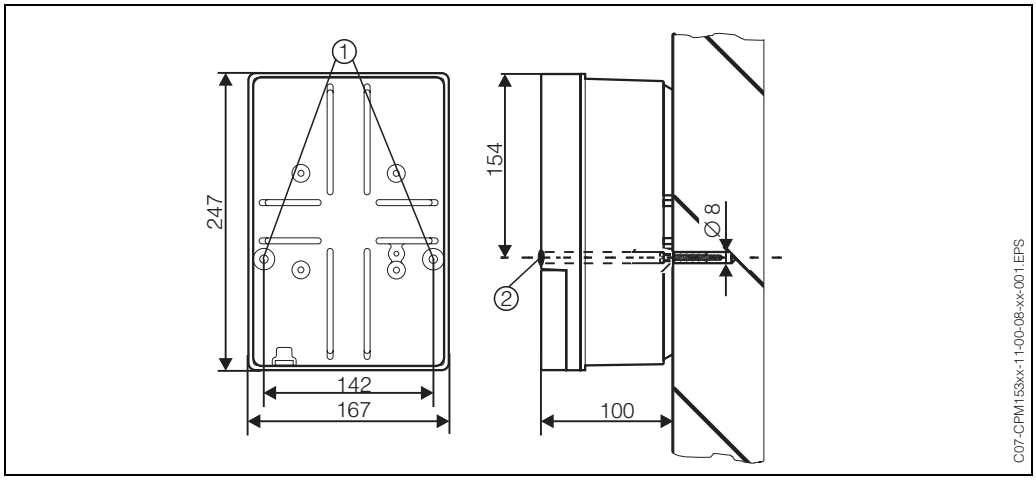


Fig. 2: Dimensions for wall mounting: Fixing screw: dia. 6 mm
Wall plug: dia. 8 mm
1: Fixing drillholes
2: Plastic cover caps

For the wall mounting of the transmitter proceed as follows:

1. Prepare drill holes acc. to fig. 2
2. Push the two fixing screws from the front through the appropriate fixing bores ①.
   – Fixing screws (M6): max. dia. 6.5 mm
   – Screw head: max. dia. 10.5 mm
3. Mount the transmitter housing on the wall as shown.
4. Cover the drill holes with the plastic cover caps ②.

3.3.3 Post mounting and panel mounting

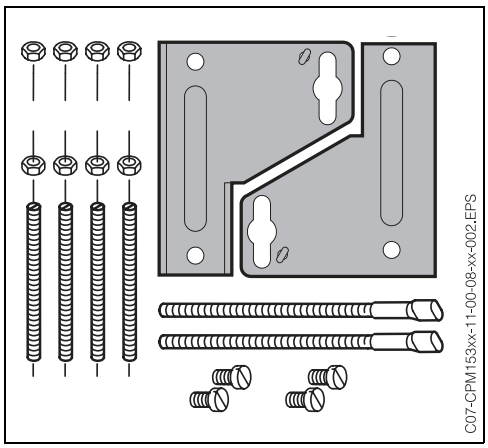


Fig. 3: Mounting kit Mycom S CLM 153

Mount the parts of the mounting kit (see accompanying figure) at the back of the housing as depicted in fig. 4.

Required mounting cutout for panel mounting: 161 x 241 mm
Installation depth: 134 mm
Pipe diameter: max. 70 mm.

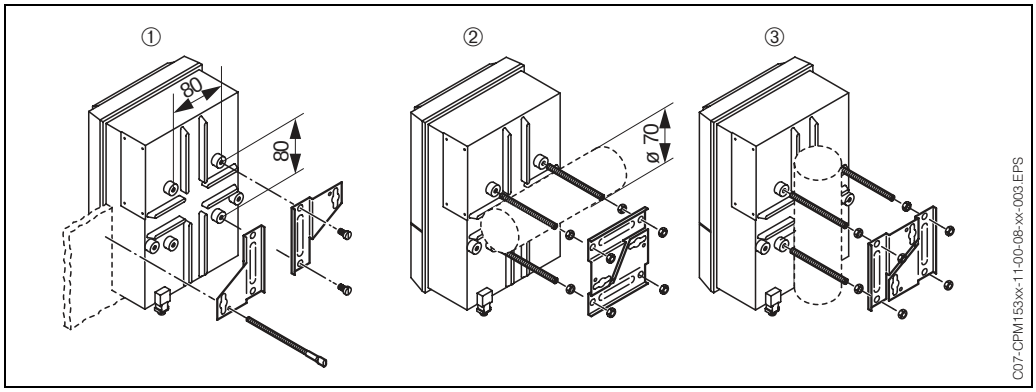


Fig. 4: Panel mounting ① and post mounting for CLM 153, horizontal ② and vertical ③

Caution!
Danger of device failure. For outdoor use, the weather protection cover CYY 101 is required, (see fig. 5 and Accessories).

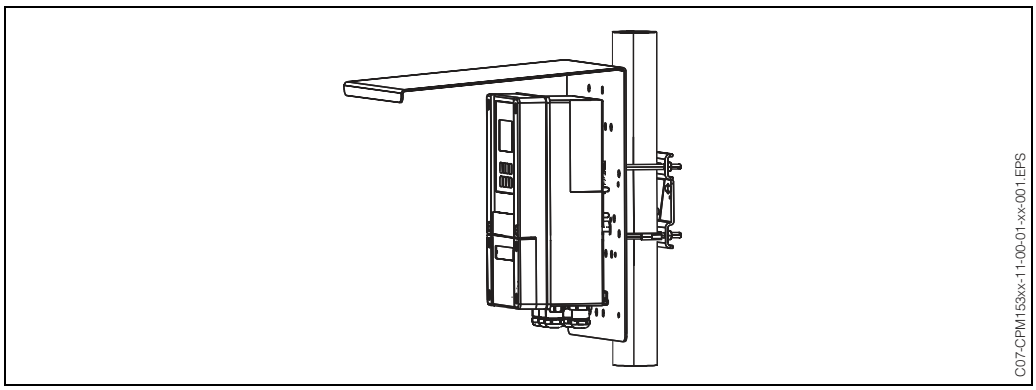


Fig. 5: Post mounting for the transmitter CLM 153 with weather protection cover CYY 101.

3.4 Post-installation check

After installing the transmitter, carry out the following checks:

Instrument status and specifications	**Note**
Is the transmitter undamaged?	Visual inspection
Installation	**Note**
Are the measuring point number and the labelling correct?	Visual inspection
Process environment/conditions	**Note**
Is the transmitter protected against rainfall and direct sunlight?	For outdoor installation, the weather protection cover CYY 101 is required (see Accessories).

4 Wiring

4.1 Quick wiring guide

4.1.1 Wiring diagram

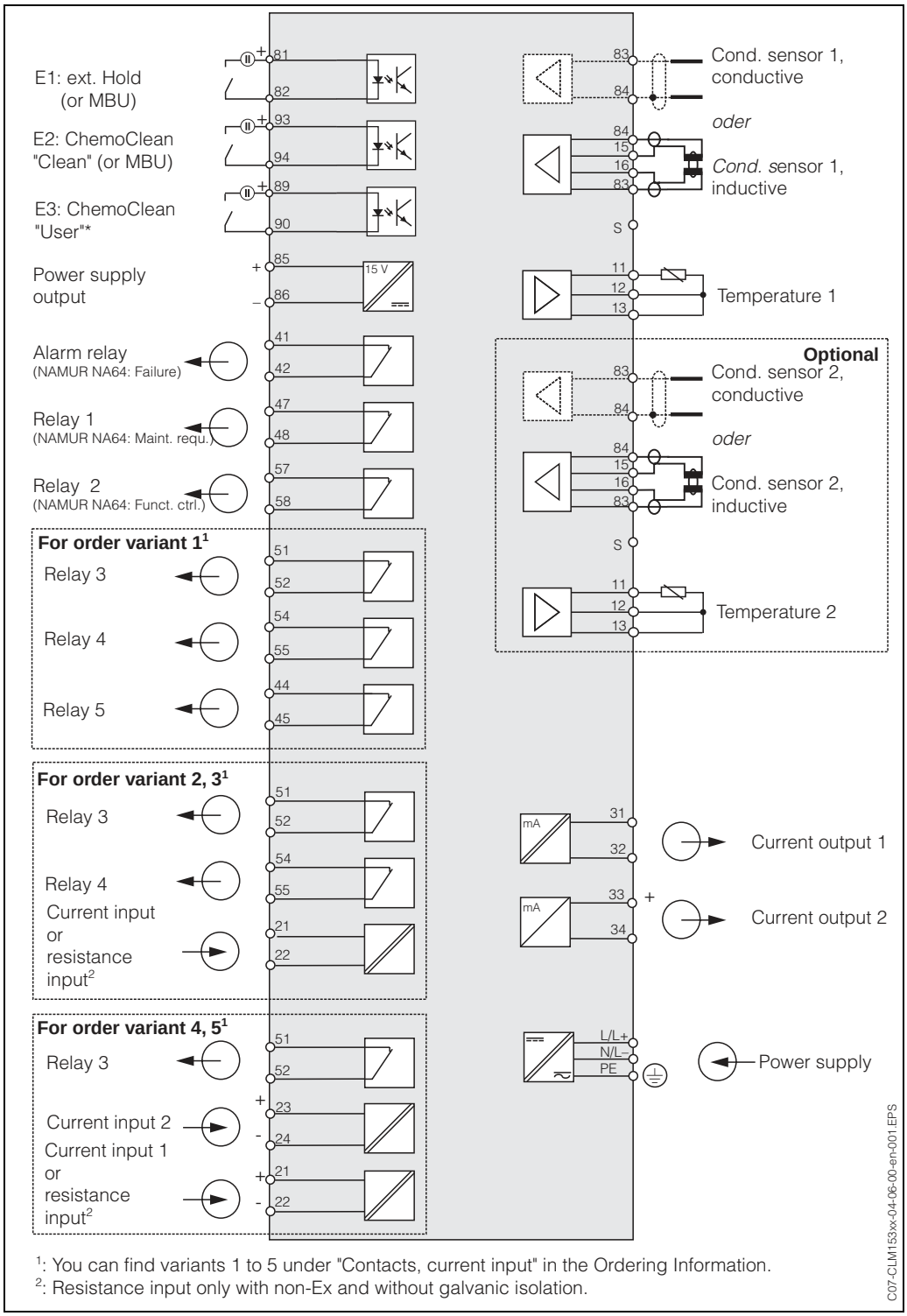


Fig. 6: Electrical connection CLM 153

Warning!
A mains disconnecting device must be installed near the instrument and must be identified as the mains disconnection device for the Mycom S CLM 153 (see EN 61010-1).

Note!
- Connect unused signal wires from input and output lines to the internal PE rail of the CLM 153.
- The current/resistance input may only be connected using a screened cable, whereby the screen at the transmitter must be applied to the PE rail.

4.1.2 Connection compartment label

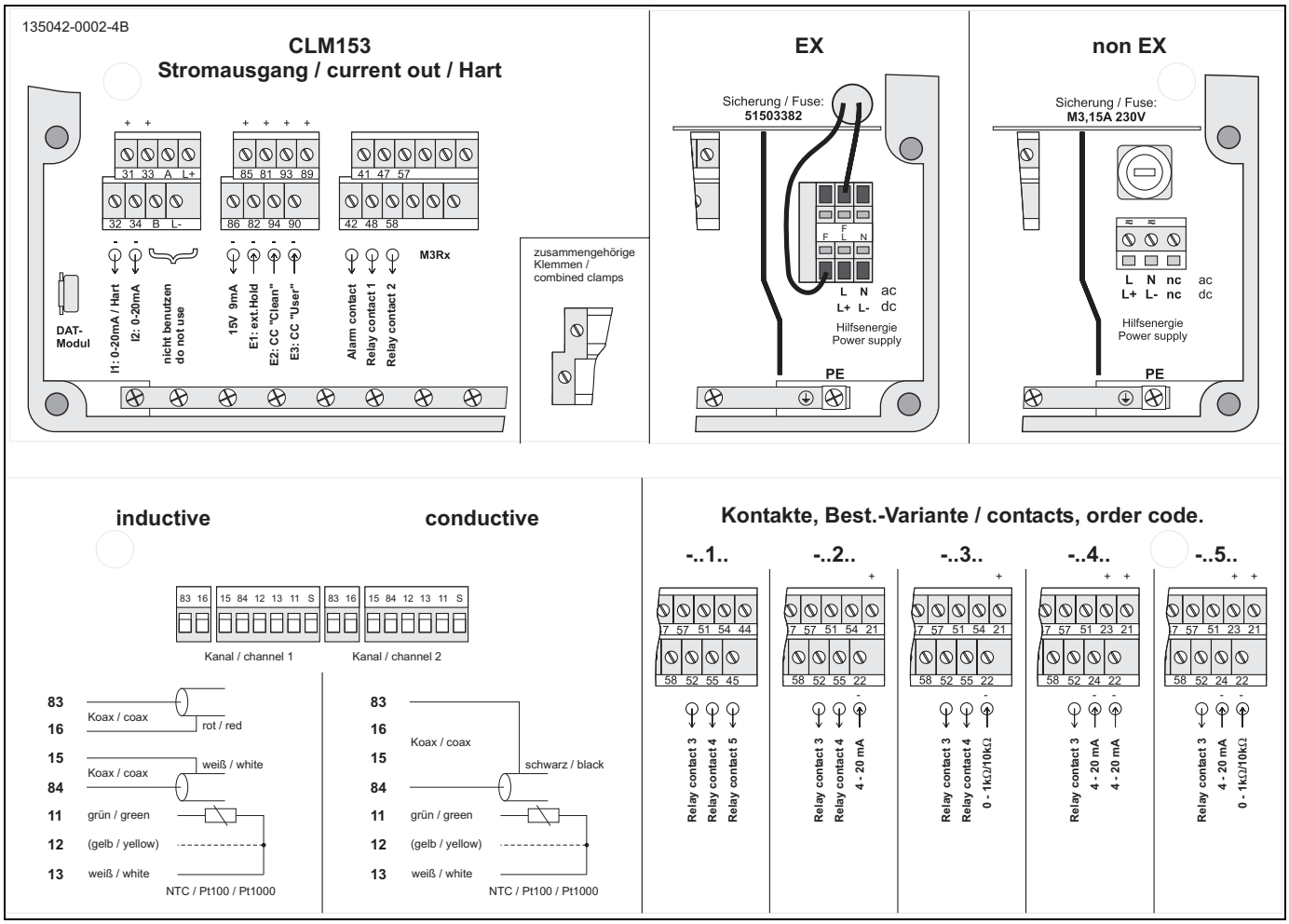


Fig. 7: Connection compartment label (in the connection compartment of the transmitter)

4.2 Connecting the measuring system

Connections in the housing cover

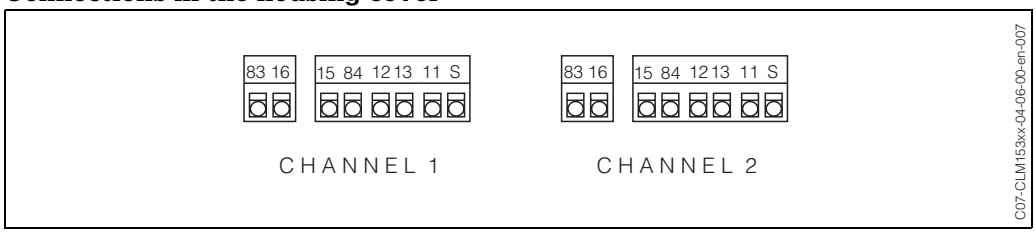


Fig. 8: Terminal arrangement in the housing cover of the transmitter

Connections in the lower housing section

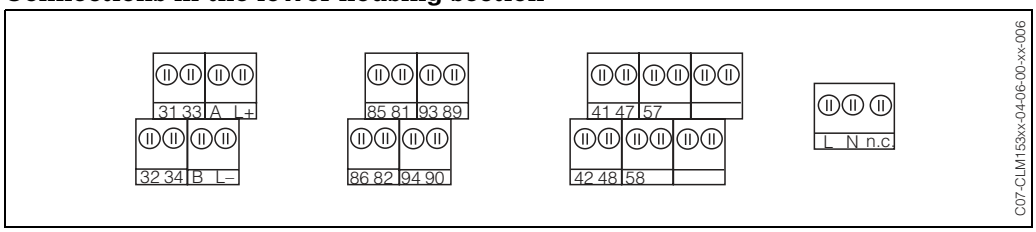


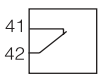
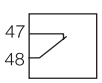
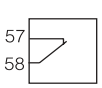
Fig. 9: Terminal arrangement in the lower housing section of the transmitter

4.2.1 Contact assignment

In the basic version, the Mycom S CLM 153 possesses 1 alarm contact and 2 additional contacts. The instrument can be upgraded with the following **additional** equipment:
- 3 contacts
- 2 contacts and 1 current or resistance input (only for non-Ex)
- 1 contact, 2 current inputs or
- 1 contact, 1 current and 1 resistance input (only for non-Ex)

The available contacts can be assigned via the software (see the "PARAM" menu "Set up 1" "Contacts" from page 38).

✎ Note!
- If you use NAMUR contacts acc. to working sheet NA64, the contacts are set to the relays as follows:
  – "Failure" to ALARM
  – "Maintenance required" to RELAY 1 and
  – "Function check" to "RELAY 2".

Selection by software	NAMUR on	NAMUR off
ALARM 	Failure	Alarm
RELAY 1 	Warning when maintenance required	freely selectable
RELAY 2 	Function check	freely selectable

- You can assign up to three relays to the controllers.

4.2.2 Sensor connection and measuring cable

Cable types
You require screened special cables to connect conductivity sensors.
You can use the following multicore and preterminated cable types:

- CYK 71 for conductive conductivity sensors (CYK 71-Ex for Ex applications)
- CPK 9 with TOP68 plug-in head for conductive conductivity sensors with and without integrated temperature sensor (for high-temperature applications, IP 68 / NEMA 6X, also for Ex).
- CLK 5 for inductive conductivity sensors.

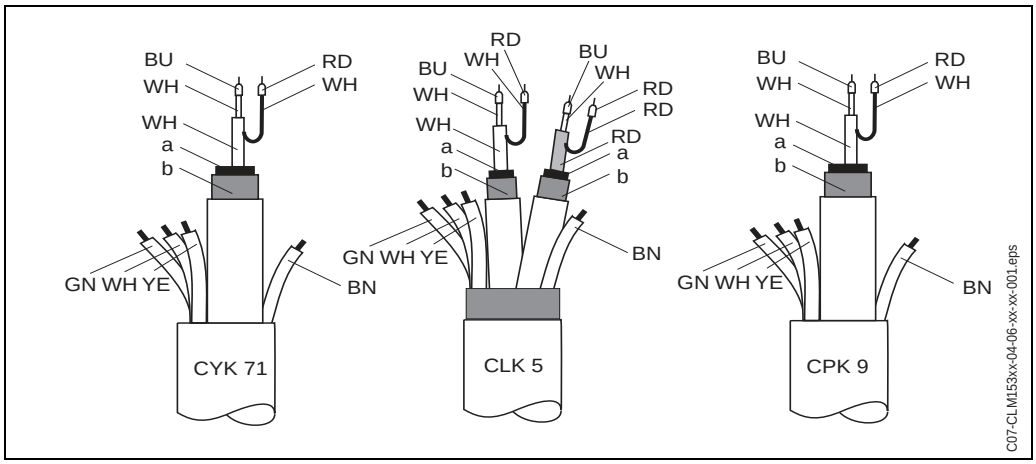


Fig. 10: Preterminated special measuring cables for connecting conductivity sensors.

Cable pin	CYK 71	CLK 5	CPK 9	Terminal
Coax WH: Inner cond. WH	Conductivity	Conductivity	Conductivity	84
Coax WH: Shield WH	Conductivity	Conductivity	Conductivity	15
Coax RD: Inner cond. WH	-	Conductivity	-	83
Coax WH: Shield RD	-	Conductivity	-	16
GN	Temp.	Temp.	Temp.	11
WH	Temp.	Temp.	Temp.	12
YE	Temp.	Temp.	Temp.	13
BN	n.c.	n.c.	n.c.	-
a	Semiconductor	Semiconductor	Semiconductor	-
b	Shield	Shield	Shield	-

Outer screen connection

Caution!
Danger of inaccuracy.
Always protect plugs and terminals against humidity.

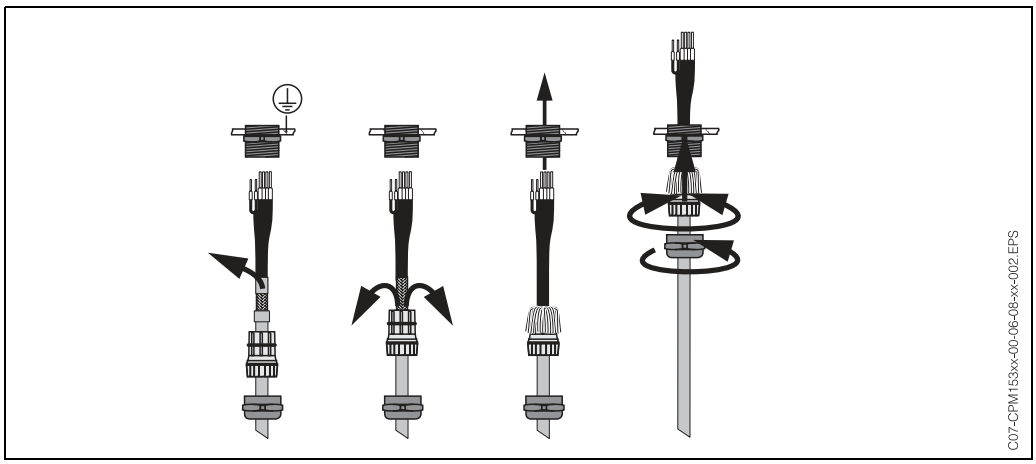


Fig. 11: Outer screen connection for CPK 9 with metal cable gland. The screen contact is within the cable gland.

Cable extension

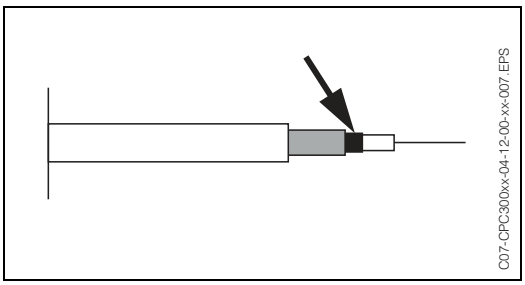
If a cable extension is necessary, use
- junction box VBM or VBM-Ex

and the following types of non-terminated measuring cables:
- for CPK 9: cable CYK 71 or CYK 71-Ex
- for CLK 5: cable CLK 5

Maximum cable length

Conductivity measurement, conductive	Conductivity measurement, inductive
max. 100 m with CYK 71 (corresp. 10 nF). When k=1, you should reckon with reduced accuracy in the range 200 mS/cm at line resistances > 5 Ω (5 Ω corresponds to approx. 20 m CYK cable). If necessary, use a cable with a larger cross-section.	Max. 55 m (with CLK 5 and sensor cable)
Max. cable length for resistance measurement: 15 m	

✎ Note!
With all cable types, the inner coaxial cable has a black, plastic, semi-conductor layer (arrow), which you must remove.



4.3 Post-connection check

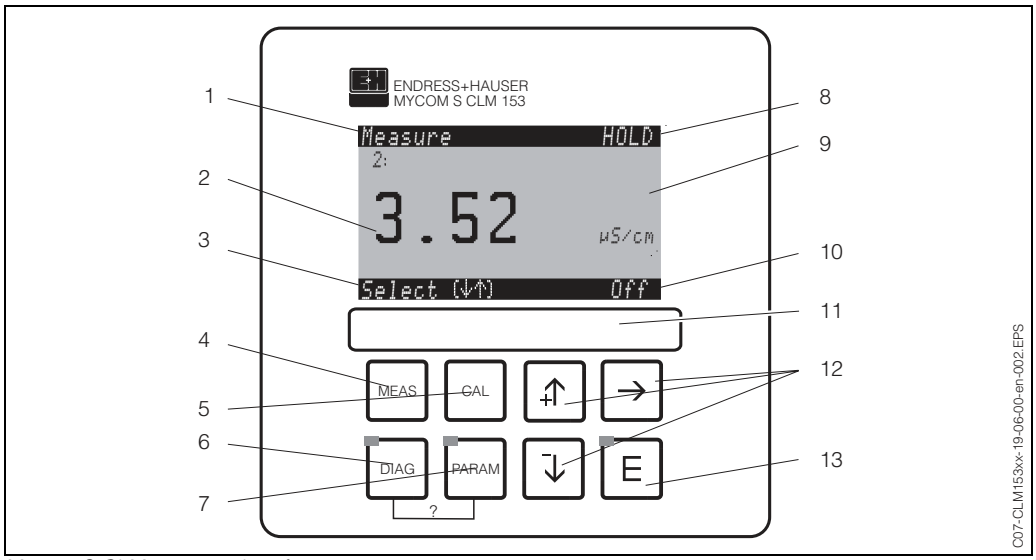
After wiring up the electrical connection of the measuring instrument, carry out the following checks:

Instrument status and specifications	Note
Is the measuring instrument or the cable damaged externally?	Visual inspection
Electrical connection	Note
Does the supply voltage match the specifications on the nameplate?	100 V ... 230 V AC long-range 24 V AC / DC
Do the cables used fulfil the required specifications?	Use a genuine E+H cable for sensor and sensor connection, see Accessories chapter.
Are current/resistance inputs connected screened?	
Are the mounted cables strain-relieved?	
Is the cable type route completely isolated?	Along the whole cable length, run the power supply and signal line cables separately to avoid any mutual influence. Cable channels are best.
No loops and cross-overs in the cable run?	
Are the power supply and signal cable correctly connected according to the wiring diagram?	
Are all the screw terminals tightened?	
Are all the cable entries installed, tightened and sealed? Cable run with "water sag"?	"Water sag": cable circuit hanging down so that water can drip off.
Are all the housing covers installed and tightened?	Check seals for damage.

5 Operation

5.1 Display and operating elements

5.1.1 Display reading/symbols



Mycom S CLM 153 user interface
1: Current menu
2: Current parameter
3: Navigation bar: Arrow keys for scrolling, "E" for browsing, note for Cancel
4: "Meas" (Measuring mode) key
5: "CAL" (Calibration) key
6: "DIAG" (Diagnosis menu) key
7: "PARAM" (Parameter entry menu) key
? = Press DIAG and PARAM simultaneously to open the help pages
8: HOLD display, if HOLD active; PS1 = parameter set 1
9: Current primary measured value
10: "Failure" display, "Warning", if the NAMUR contacts respond
11: Labelling strip
12: Arrow keys for scrolling and editing
13: Enter key

5.1.2 Key assignment



"PARAM" brings you to the menu for configuring the Mycom S CLM 153.

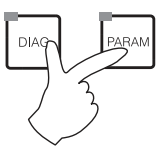
✎ Note!
PARAM" allows you to return to the previous "return field" from any point in the menu. These are marked in bold in the menu overview (s. chap. 11.1).

LED: This is the send LED for the service adapter "Optoscope" (see "Accessories").



Brings you to the instrument diagnosis menu.

LED: This is the receive LED for the service adapter "Optoscope" (see "Accessories").



Help:
Press the "DIAG" and "PARAM" keys simultaneously to open the help page.

MEAS

"MEAS" switches to Measuring mode. This displays the measured values. Use the arrow keys to scroll through the different measuring menus.

✎ Note!
Press "MEAS" to exit any of the "PARAM", "DIAG", "CAL" menus without terminating the settings / calibration.

CAL

"CAL" switches to the calibration menu for calibrating the sensors.

E

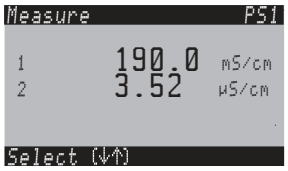
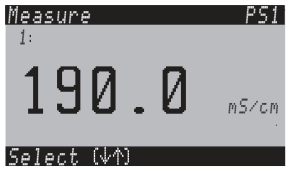
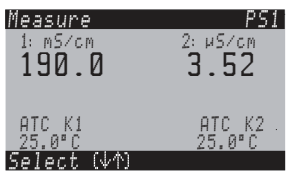
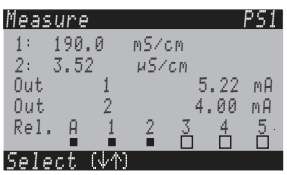
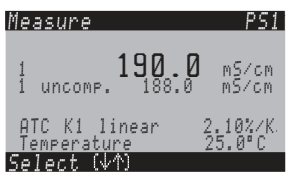
"E" (Enter) moves you one step forward in a menu or confirms a selection you made.

LED (status display)
Green: everything OK.
Red: an error has occurred.

- You can scroll through the items with the arrow keys, and then highlight your selection (if there is a choice offered)
  or
- Increment or decrement numbers by one step with "+" / "-".
  Move to the next digit with the "right arrow" (editor type 1) or
- "Activate" with the "right arrow" and scroll through the selection with "+" / "-" (editor type 2) (for information on editor types, see page 22).

5.1.3 Measuring menus

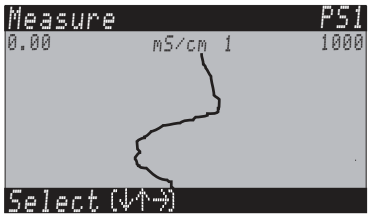
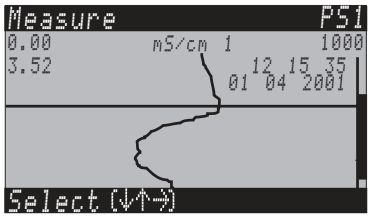
You can choose between the different measuring menus. Use the arrow keys to scroll between the different menus.

							
Two-circuit: Both primary values are displayed.		One-circuit/Two-circuit: The current measured value of circuit 1 is displayed.		Two-circuit: The current measured value of circuit 2 is displayed.		One-circuit/Two-circuit: If you have activated one (both) data logger, you can see the current measured value(s) characteristic here in the record mode (subsequently).	
							
Two-circuit: With a two-circuit device and combined circuits you can display a selected characteristic value and the temperatures of both circuits.		Two-circuit: With a two-circuit device, in this measuring menu you can see both measured values next to each other and their corresponding temperatures.		In this measuring menu, you can see the current and voltage values and the contact states of the relay at a glance (one-circuit device: only primary value 1). Active relay = ■ (with function) Inactive relay = ❒		One-circuit: With a one-circuit device you can see the primary value (temperature compensated and below non-temperature compensated) with the corresponding temperature.	

5.1.4 Data logger

In the CLM 153, you have two data loggers available. With these data loggers you can
- record a parameter with 500 sequential measuring points or
- two parameters each with 250 sequential measuring points.

To be able to use the function, activate the data logger(s) in the "PARAM" menu → "Set up 2" → "Data Logger" (s. page 52). The function is active immediately.
You can view the measured values by scrolling through the different measuring menus (see above).
– The current measured values are recorded in Record mode.
– In Scroll mode, you can open saved data by stating the date and time. You can find this under the item "PARAM" → "Set up 2" → "Data logger".

	
Record mode	Scroll mode

5.1.5 Operation access authorisation

To protect the transmitter against an unintended or undesired change in the configuration and calibration data, functions can be protected using four-digit access codes.

Access authorisation has the following levels:

Display level (accessible without a code):
The complete menu can be viewed. The configuration cannot be altered. No calibration is possible. On this level, only the control parameters for new processes can be changed in the "DIAG" menu branch.

Maintenance code

Maintenance level (can be protected by the maintenance code):
This code allows access to the calibration menu.
Use this code to operate the temperature compensation item. The factory functions and the internal data can be viewed.
Factory setting Code = 0000, i.e. the levels are not protected.
In case you have mislaid/forgotten the supplied maintenance code, contact your E+H service office.

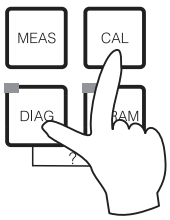
Specialist code

Specialist level (can be protected by the specialist code):
All menus can be accessed and changed.
Factory setting Code = 0000, i.e. the levels are not protected.
In case you have mislaid/forgotten the supplied specialist code, contact your E+H service.

To activate the codes (= functions locked) see the item "PARAM" → "Set up 1" → "Access codes" (s. page 33). Enter your desired codes here. If the code is activated, you can only edit the protected areas with the rights mentioned above.

Note!
- Note down the selected code as well as the universal code and keep it in a place where unauthorised persons do not have access to it.
- If you reset the code to "0000", all the levels are freely accessible again for editing. The code can only be reset by a "specialist".

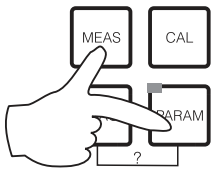
Locking the operation



This key combination locks the instrument from in-field configuration operations. To lock it, press "CAL" and "DIAG" simultaneously.

At the code prompt, the code appears as "9999". Only the settings in the "PARAM" menu can be seen.

Unlocking the operation



Press the "MEAS" and "PARAM" keys simultaneously to unlock the operation.

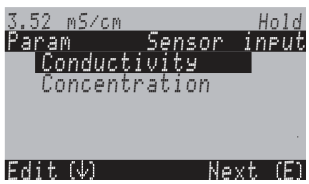
5.1.6 Description of the menu editor types

At parameter setting, the functions can be selected in two different modes, depending on the setting type.

Editor type E1

Editor type 1 (E1)

for functions, which can be directly selected from the display. The editing row shows "Edit".

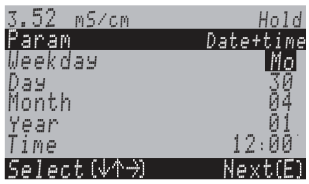


- A selection can be highlighted with the arrow keys.
- Confirm the selection by pressing "E" (=Enter).

Editor type E2

Editor type 2 (E2)

for settings, which have to be defined more precisely, e.g. day, time. The editing row shows "Select".



- Use the arrow keys ↑ and ↓ to highlight a selection (e.g. "Mo").
- Activate the selected option with the right arrow key →. *The highlighted option flashes.*
- Scroll through the selection (e.g. the weekdays) with the arrow keys ↑ and ↓.
- Confirm the selection by pressing "E" (=Enter).
- If you make your selection and confirm it by pressing "E" (*no flashing display*), you can exit the item by pressing "E".

5.2 Replaceable memory

The DAT module is a memory device (EEPROM) which is plugged into the connection compartment of the transmitter.

Using the DAT module you can

- *save* the complete settings, the logbooks and the data logger of a transmitter and
- *copy* the complete settings to other CLM 153 transmitters with identical hardware functionality.

This considerably reduces the effort to install or service several measuring points.

6 Commissioning

6.1 Function check



Warning!
Before power-up, make sure there is no danger to the measuring point. Uncontrolled actuated pumps, valves or similar could lead to damage to instruments.



Caution!
- Before switching on, check all the connections again for correctness.
- Make sure that the conductivity sensor and, if necessary, the temperature sensor are in the medium or in a calibration solution, as otherwise no plausible measured value can be displayed.
- Make sure also that the post-connection check has been carried out (s. chap. 4.3).

6.2 Switching on the measuring device

Before first start-up, make sure you understand how to operate the transmitter. You should make particular reference to chapters 1 (Safety instructions) and 5 (Operation).

First commissioning
On first switch-on, the instrument starts automatically with the Quick Setup menu. This asks you about the most important instrument settings. After you close the menu, the instrument is ready for use and measurement in its standard configuration.

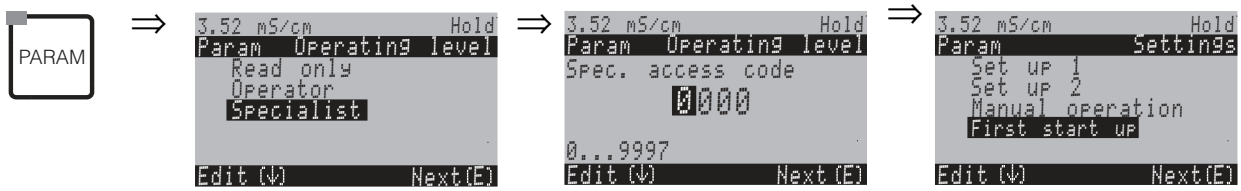


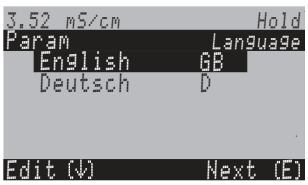
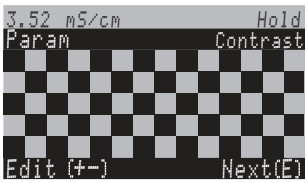
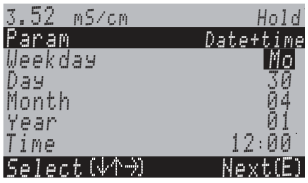
Note!
- You must completely run through the Quick Setup menu. If you do not, the instrument will not be operational. If you interrupt Quick Setup, it will start again the next time you start it up until **all** the items have been processed and completed.
- For parameter setting, you have to enter the specialist code (default setting 0000).

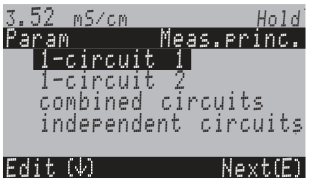
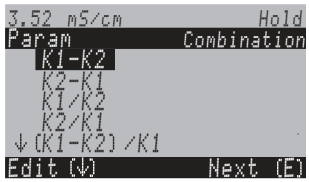
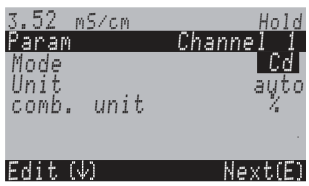
6.3 Quick Setup

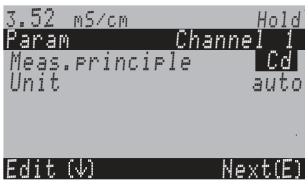
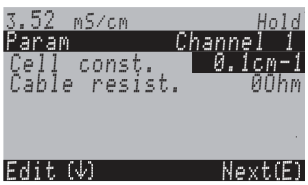
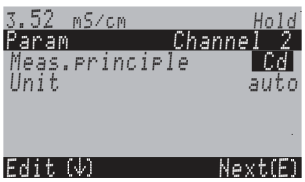
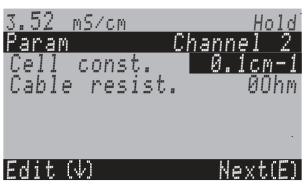
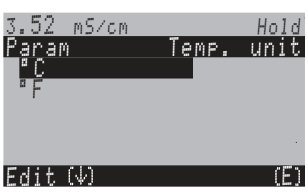
In this menu, configure the most important transmitter functions required for measurement.

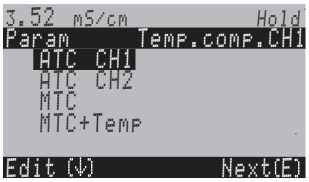
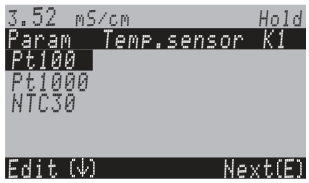
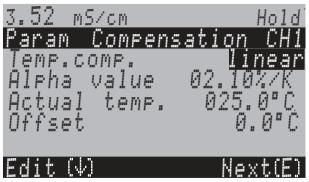
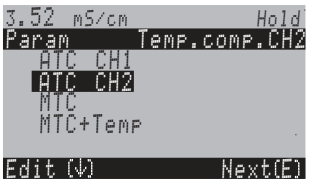
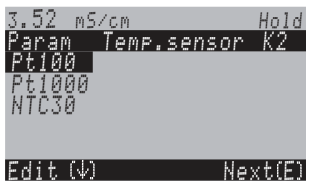
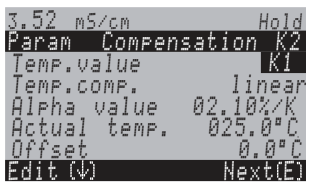
The Quick Setup ist started automatically when starting the instrument. You can open the Quick Setup at any time from the menu structure.
To enter the menu, proceed as follows:

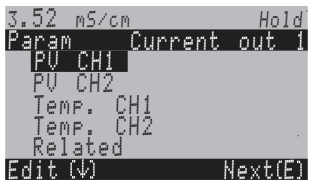
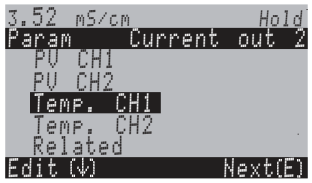


CODE	DISPLAY	CHOICE (default = bold)	INFO
T1		**E** D	**Select language** Depending on ordered language version. Language versions: Version -A: E / D Version -B: E / F Version -C: E / I Version -D: E / ES Version -E: E / NL Version -F: E / J
T2			**Contrast setting** You can increase and reduce the contrast with the +/- keys.
T3		**Mo** **01** **04** **01** **12:00**	**Entry of date and time** Enter the complete date and time here.

CODE	DISPLAY	CHOICE (default = bold)	INFO
T4		**One circuit input 1** One circuit input 2 Combined circuits Independent circuits Comb. circuits look-ahead Ind. circuits look-ahead	**Select measuring principle** (only for two-circuit device) *One circuit input 1 / input 2* = measurement via sensor input 1 **or** 2 *Combined circuits* = measurement via both sensor inputs with the option of creating a characteristic value (see next field) *Independent circuits* = independent measurement via **both** sensor inputs *Combined / Independent circuits look-ahead* = look-ahead control with combined / independent circuits measurement (only for instruments with 2 current outputs) ✎ Note! • If a two-circuit device is configured as such, it keeps these settings even if a transmitter (circuit) is removed or is defective. • If, with a defective transmitter, the error message E006, E007 is not required, then you can switch the device to "one circuit". As each relay is assigned to a circuit (alarm, rel. 1, rel. 2 to input 1; rel. 3, 4, 5 to input 2), you should keep in mind that, in such a case, functions which access the deactivated relay are no longer functionable.
T5		**K1 – K2** K2 – K1 K1/K2 K2/K1 (K1 – K2)/K1 (K2 – K1)/K1 (K1 – K2)/K2 (K2 – K1)/K2	**Select characteristic value** (only combined circuits) Here, you can define a process-related characteristic value as a further output parameter.
T5		**Mode:** **Cd.** Unit/ auto medium Comb. unit %	**Select operating mode** (only combined circuits) If the operating mode changes, the user settings are automatically reset. The settings you make here apply to both measuring circuits. *Mode*: Cd. (conductivity), resistance (with conductive sensors), concentration (with inductive sensors) *Unit* (with Cond. operating mode, difference calculation): auto, µS/cm, mS/cm, S/cm, µS/m, mS/m, S/m *Unit* (with resistance operating mode, difference calculation): auto, kΩ•cm, MΩ•cm, kΩ•m, MΩ•m. *Unit* with concentration operating mode: %, for customer specific tables. see Chp. 6.4.7 The optimum unit is automatically selected with "auto". *Medium* (with "concentration" operating mode): NaOH, HNO3, H3PO4, H2SO4, Table 1 to 4 *Rel. unit* (with ratio calculation)*:* Unit of the characteristic value defined in the previous field (options: none, %)

CODE	DISPLAY	CHOICE (default = bold)	INFO
T6		**Mode** **Cond.** Unit/ auto medium	**Select the operating mode measuring circuit 1** (not for combined circuits) If the operating mode changes, the user settings are automatically reset. *Mode*: Cd. (conductivity), resistance (with conductive sensors), concentration (with inductive sensors) *Unit* (with cond. / resistance operating mode, difference calculation): auto, mS/cm, µS/cm / auto, kΩ, MΩ. *Unit* with concentration operating mode: %, for customer specific tables. see Chp. 6.4.7 The optimum unit is automatically selected with "auto". *Medium* (with "concentration" operating mode): NaOH, HNO3, H3PO4, H2SO4, Table 1 to 4 *Rel. unit* (with ratio calculation)*:* Unit of the characteristic value defined in the previous field. Options: none, %
T7		inductive: Cell const.: **1.98cm-1** Install.factor **1** (adaption factor) conductive: Cell const.: **0.1cm-1** Cable resist. **0Ω**	**Select measuring circuit 1** *Cell constant*: The exact cell constant is provided in the sensor quality certificate. *Cable resistance* (for conductive): Enter the cable resistance. *Installation factor* (adaption factor) (only inductive): Enter the installation factor here.
T8		**Mode:** **Cond.** Unit/ auto medium	**Select the operating mode for measuring circuit 2** (not for combined circuits; only two circuit) If the operating mode changes, the user settings are automatically reset. *Mode*: Cd. (conductivity), resistance (with conductive sensors), concentration (with inductive sensors) *Unit* (with cond. / resistance operating mode): auto, mS/cm, µS/cm / auto, kΩ, MΩ. *Unit* with concentration operating mode: %, for customer specific tables. see Chp. 6.4.7 The optimum unit is automatically selected with "auto". *Medium* (with "concentration" operating mode): NaOH, HNO3, H3PO4, H2SO4, Table 1 to 4
T9		inductive: Cell const.: **1.98cm-1** Install.factor **1** conductive: Cell const.: **0.1cm-1** Cable resist. **0Ω**	**Select measuring circuit 2** (only two circuit) *Cell constant*: The exact cell constant is provided in the sensor quality certificate. *Cable resistance* (for conductive): Enter the cable resistance. *Installation factor* (adaption factor) (only inductive): Enter the installation factor here.
T10		**°C** °F	**Select temperature unit** °C: Degrees Celsius °F: Degrees Fahrenheit

CODE	DISPLAY	CHOICE (default = bold)	INFO
T11		**ATC CH1** ATC CH2 MTC MTC+Temp	**Select temperature compensation channel 1/2** *ATC:* Automatic temperature compensation via temperature sensor *MTC:* Temperature compensation via manual value entry *MTC+Temp:* Temperature compensation via manual temperature entry. The displayed temperature, however, is measured by the temperature sensor.
T12		**Pt 100** Pt 1000 NTC 30k	**Select temperature sensor channel1**
T13		Temp.comp **linear** Alpha **2.1%/K** value: **25.0°C** Actual **0.0°C** temp.: Offset:	**Temperature compensation input 1** *Temp. value*: Automatic temperature compensation with a temp. sensor input 1 or input 2 *Temp. comp.*: Selection of the temperature compensation – none, linear, NaCl, Table 1 to 4 *Alpha value:* Entry of the conductivity coefficient α. *Actual temp.*: The measured temperature is displayed. *Offset*: Temperature difference between measured and output temperature (–10 ... +10 °C).
T14		ATC CH1 **ATC CH2** MTC MTC+Temp	**Select temperature compensation channel 2** (only two circuit)
T15		**Pt 100** Pt 1000 NTC 30k	**Select temperature sensor input 2** (only two circuit)
T16		Temp.value **Input 1** Temp.comp **none** Alpha value: **2.1%/K** Actual temp.: **25.0°C** Offset: **0.0°C**	**Temperature compensation input 2** (only two circuit) *Temp. value*: Automatic temperature compensation with a temp. sensor input 1 or input 2 *Temp. comp.*: Selection of the temperature compensation – none, linear, NaCl, Table 1 to 4 *Alpha value:* Entry of the conductivity coefficient α. *Actual temp.*: The measured temperature is displayed. *Offset*: Temperature difference between measured and output temperature (–10 ... +10 °C).

CODE	DISPLAY	CHOICE (default = bold)	INFO
T17		NAMUR **off** Relay 1: **free** Relay 2: **free**	**Contact functions** Depending on the equipment available, you can assign the function of up to 5 relays here. When you switch on the status message acc. to NAMUR NA64, relays 1 and 2 are assigned and are not available for another function, (compare page 14). Selection: Free / Controller / LC / CCW / CCC *Controller:* Controller control using relay *LC*: Limit contactor function *CCW*: ChemoClean water. Water supply for the ChemoClean function. *CCC*: ChemoClean Cleaner. Cleaner supply for the ChemoClean function. (Together, CCC and CCW form the "ChemoClean" function. You can find information on ChemoClean on page 70) ✎ Note! If you want to use the USP function, select the limit contactor function for a relay and configure this in the limit value menu for USP (p. 68).
T18		**Measured value CH1** Measured value CH2 Temperature CH1 Temperature CH2 Related	**Select the measured value** which should be output at the current output 1. Selection possibilities related to the instrument variant and the selected output. *Measured value 1/2*: Selection of the primary measured value which you selected, (conduct., conc., resist.) *Temperature 1/2*: Selection of the temperature to be output to the current output. *Related (only for combined circuits):* The characteristic value from Field T5 is output at the current output. *Continuous controller (only at current output 2!)*: Controller output
T19		Measured value CH1 Measured value CH2 **Temperature CH1** Temperature CH2 Related Continuous controller *(only at current output 2)*	**Select measured value** which should be output at the current output 2. Selection possibilities see above, *Continuous controller (only at current output 2!)*: The controller actuating variable is output via the current output (see also Controller menu page 54). ✎ Note! *Danger of data loss.* If you change the assignment for the current output from "continuous controller" to a different function **after** you have configured the controllers, the **entire** controller configuration (s. page 54) is reset to the default values.

CODE	DISPLAY	CHOICE (default = bold)	INFO
T20		**(0 ... 9; A ... Z)**	**Enter your customer specific instrument number.** 32-digit tag number. This is saved in the DAT module which is obtainable as an option.
T21		**restart** end	**Exit Quick Setup?** *restart* = Run through settings in Fields T1-T22 again *end* = Save the settings in Fields T1-T22 and exit Quick Setup.

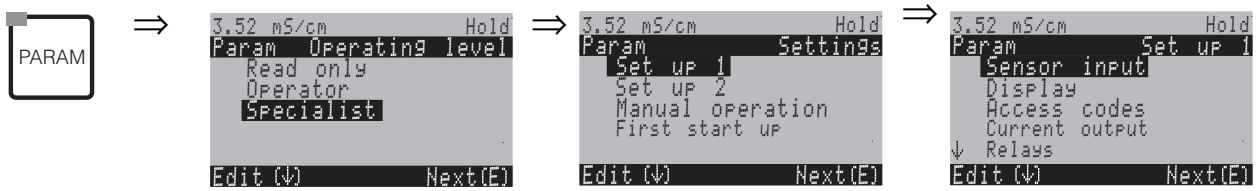
6.4 Description of functions

6.4.1 Set up 1 – Sensor input

In this menu, you can change the measured value acquisition settings, such as the operating mode, the measuring principle, or the electrode type.

Apart from the measured value attenuation, you have already made all the settings in the menu at the first commissioning in Quick Setup (s. page 23). You can change the selected values in this menu.

For the first entry to the parameter setting, you have to insert your specialist code (s. page 20). To enter the menu, proceed as follows:

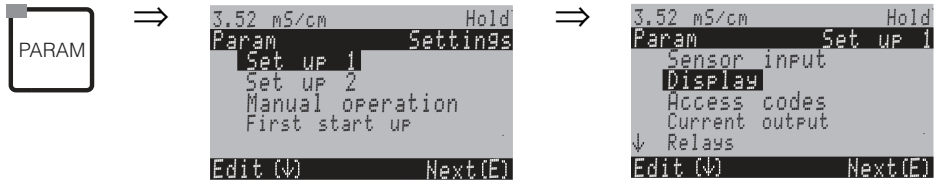


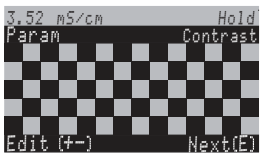
CODE	CHOICE (default = bold)	INFO
A1	**One circuit CH1** One circuit CH2 Combined circuits Independent circuits Comb. circuits look-ahead Ind. circuits look-ahead	**Select measuring principle** (only for two-circuit device) *One circuit channel 1 / channel 2* = measurement via sensor input 1 **or** 2 *Combined circuits* = measurement via both sensor inputs with the option of creating a characteristic value (see next field) *Independent circuits* = independent measurement via **both** sensor inputs *Combined / Independent circuits look-ahead* = look-ahead control with combined / independent circuits measurement (only for instruments with 2 current outputs) ✎ Note! • If a two-circuit device is configured as such, it keeps these settings even if a transmitter (circuit) is removed or is defective. • If, with a defective transmitter, the error message E006, E007 is not required, then you can switch the device to "one circuit". As each relay is assigned to a circuit (alarm, rel. 1, rel. 2 to input 1; rel. 3, 4, 5 to input 2), you should keep in mind that, in such a case, functions which access the deactivated relay are no longer functionable.
A2	**CH1 – CH2** CH2 – CH1 CH1/CH2 CH2/CH1 (CH1 – CH2)/CH1 (CH2 – CH1)/CH1 (CH1 – CH2)/CH2 (CH2 – CH1)/CH2	**Select characteristic value** (only combined circuits) Here, you can define a process-related characteristic value as a further output parameter.

CODE	CHOICE (default = bold)		INFO
A3	**Mode:** Unit/ Medium Comb. unit	**Cd.** auto %	**Select operating mode** (only combined circuits) If the operating mode changes, the user settings are automatically reset. The settings you make here apply to both measuring circuits. *Mode*: Cd. (conductivity), resistance (with conductive sensors), concentration (with inductive sensors) *Unit* (with Cond. operating mode, difference calculation): auto, µS/cm, mS/cm, S/cm, µS/m, mS/m, S/m *Unit* (with resistance operating mode, difference calculation): auto, kΩ•cm, MΩ•cm, kΩ•m, MΩ•m. *Unit* with concentration operating mode: %, for customer specific tables. see Chp. 6.4.7 The optimum unit is automatically selected with "auto". *Medium* (with "concentration" operating mode): NaOH, HNO3, H3PO4, H2SO4, Table 1 to 4 *Rel. unit (*ratio calculation)*:* Unit of the characteristic value defined in the previous field. Options: none, %
A4	**Measuring circuit 1** Measuring circuit 2		**Select measuring circuit**
Measuring channel 1 (or 2):			
AA1	**Mode:** Unit/ medium	**Cond.** auto	**Select operating mode** (not for combined circuits) If the operating mode changes, the user settings are automatically reset. *Mode*: Cd. (conductivity), resistance (with conductive sensors), concentration (with inductive sensors) *Unit* (with cond. / resistance operating mode): auto, mS/cm, µS/cm / auto, kΩ, MΩ. *Unit* with concentration operating mode: %, for customer specific tables. see Chp. 6.4.7 The optimum unit is automatically selected with "auto". *Medium* (with "concentration" operating mode): NaOH, HNO3, H3PO4, H2SO4, Table 1 to 4
AA2	**Cell const.:** Cable resist. Installation factor (adaption factor)	**1.98cm-1** 00.00 Ω 1	**Select measuring channel 1 or 2** *Cell constant*: The exact cell constant is provided in the sensor quality certificate. *Cable resistance* (for conductive): Enter the cable resistance. *Installation factor (adaption factor*) (only inductive): Enter the installation factor here.
AA3	Measured value: Temp.:	**01 s** **01 s** (01 ... 30 s)	**Set measured value damping** The mean value over the set time is displayed.

6.4.2 Set up 1 – Display

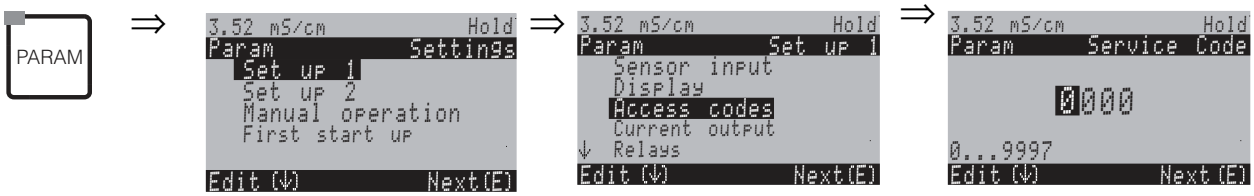
To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
B1	**E** D	**Select language** Depending on ordered language version. Language versions: Version -A: E / D Version -B: E / F Version -C: E / I Version -D: E / ES Version -E: E / NL Version -F: E / J
B2		**Contrast setting as necessary** You can increase and reduce the contrast of the display with the +/- keys.
B3	Weekday: **Su** Day: **01** Month: **04** Year: **01** Time: **08:00**	**Entry of the date and time** Enter the complete date and time here.
B5	**°C** °F	**Select temperature unit** °C: Degrees Celsius °F: Degrees Fahrenheit
B6	**00000000** (0 ... 9; A ... Z)	**Enter your customer specific instrument number.** 32-digit tag number. This is saved in the DAT module which is obtainable as an option.

6.4.3 Set up 1 – Access codes

To enter the menu, proceed as follows:

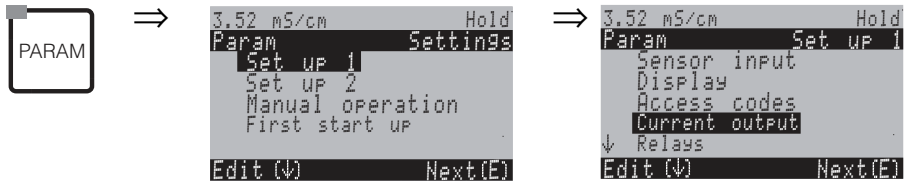


CODE	CHOICE (default = bold)	INFO
D1	**0000** (0 ... 9997)	**Enter maintenance code** In the range 0000 ... 9997, the code can be freely selected. 0000 = no Security Locking.
D2	**0000** (0 ... 9997)	**Enter specialist code** In the range 0000 ... 9997, the code can be freely selected. 0000 = no Security Locking.

Note!
Danger of misuse. Make sure that the codes you enter and the universal code (s. page 20) are protected against misuse by unauthorised persons. Note down the codes and keep the in a place where unauthorised persons do not have access.

6.4.4 Set up 1 – Current outputs

The transmitter is equipped with two current outputs.
To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
E1	**Current output 1** Current output 2	**Select a current output** for which the settings apply.
Current output 1 (or 2):		
EA1	**PV input 1** PV input 2 Temperature input 1 Temperature input 2 Characteristic value Continuous controller *(only at current output 2)*	**Select the measured value,** which should be output at the current output. Selection possibilities related to the instrument variant and the selected output (see selection table above). *PV 1/2 (=primary value)*: Selection of the primary measured value which you selected, (conduct., conc., resist.) *Temperature 1/2*: Selection of the temperature to be output to the current output. *Related (only for combined circuits):* The characteristic value from Field A3 is output at the current output. *Continuous controller (only at current output 2!)*: The controller actuating variable is output via the current output (see also Controller menu page 54). ✎ Note! *Danger of data loss.* If you change the assignment for the current output from "continuous controller" to a different function **after** you have configured the controllers, the **entire** controller configuration (s. page 54) is reset to the default values.
EA2	!!Caution!! The configuration is changed.	**Note in display (for changed setting):** Cancel by pressing "PARAM" Continue (= confirm change) by pressing "E"
EA3	0 ... 20mA **4 ... 20 mA**	**Select current range**
EA4	!!Caution!! Current output 0...20mA and error current = 2.4 mA leads to uncontrolled behaviour.	**Note in display:** Error current is in the measuring current range. When the current range is "0 ... 20 mA" and "Min" is selected under Alarm in Field H1, (see page 44). Recommended combinations: Current range 0...20 mA and error current max (22 mA) or Current range 4...20 mA and error current min (2.4 mA)
EA5	**Linear** Logarithmic	**Select the characteristic** **Linear**: The characteristic is linear from the lower to the upper value. **Logarithmic** The characteristic is logarithmic from the lower to the upper value.

CODE	CHOICE (default = bold)	INFO
Linear:		
EAA1	0/4 mA: **0.000 µS/cm / 00.00 % / -35.0 °C** 20 mA: **02000 mS/cm / 99.99 % / 250.0 °C**	**Entry of the upper and lower measured value limits** Entry of the measured values at which the minimum / maximum current value is applied to the outputs.
EAA6	Linear characteristic active.	**Note in display:** The linear characteristic is activated after confirmation by pressing "E". Cancel by pressing "PARAM".
Logarithmic:		
EAB1	20 mA: **02000 mS/cm / 99.99 % / 100.0 °C / 0500 MΩ·cm**	**Entry of the upper measured value limits** Entry of the measured values at which the maximum current value is applied to the outputs. The 0/4 mA value is automatically set to 1 % of the 20 mA value. In fig. 13 you can see the course of the current output signal with logarithmic characteristic. (Distribution: see technical data, p. 101)
EAB6	Logarithmic characteristic active	**Note in display:** The logarithmic characteristic is activated after confirming by "E". Cancel by pressing "PARAM".

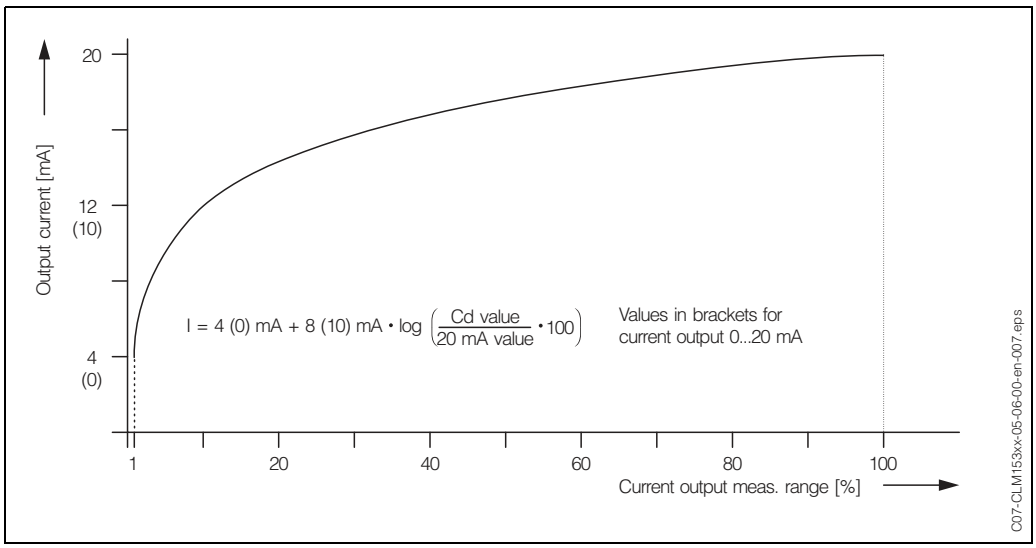


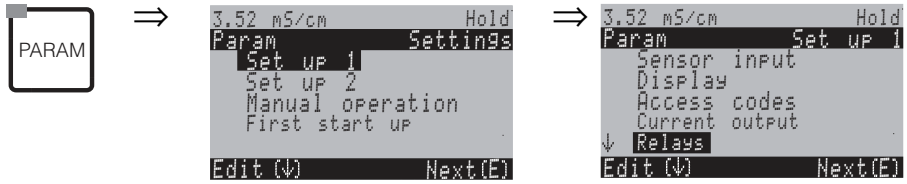
Abb. 12: Current output signal with logarithmic characteristic

Note!
The controller function "continuous controller" can only be assigned to current output 2.

One-circuit instrument		Two-circuit instrument	
Current output 1 (Terminals 31 +, 32 –)	**Current output 2** (Terminals 33 +, 34 –)	**Current output 1** (Terminals 31 +, 32 –)	**Current output 2** (Terminals 33 +, 34 –)
Conduct./conc./resist. Temperature	Conduct./conc./resist. Temperature Continuous controller	Cond./conc./resist.1 Cond./conc./resist. 2 Temperature input 1: Temperature input 2	Cond./conc./resist. 1 or 2 Temperature input 1 or 2 Characteristic value Continuous controller

6.4.5 Set up 1 – Relays

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
F1	NAMUR: **off** Relay 1: **free** Relay 2: **free** Relay 3: **free** Relay 4: **free** Relay 5: **free**	**Contact functions** Depending on the equipment available, you can assign the function of up to 5 relays here. When you switch on the status message acc. to NAMUR NA64, relays 1 and 2 are assigned and are not available for another function, (compare page 14). Selection: Free / Controller / LC1 / LC2 / LC3 / LC4 / LC5 / CCW / CCC *Controller:* Controller control using relay *LC*: Limit contactor function *CCW*: ChemoClean water. Water supply for the ChemoClean function. *CCC*: ChemoClean Cleaner. Cleaner supply for the ChemoClean function.(Together, CCC and CCW form the "ChemoClean" function. You can find information on ChemoClean on page 70). The limit value contacts are configured in the menu "PARAM" → "Set up 2" → "Limit switch". The controller contacts are configured in the menu "PARAM" → "Set up 2" → "Controller settings". ✎ Note! • *Danger of data loss.* If the controller is already completely configured for output via relay and you reduce the number of relays assigned to the controller, the **entire** controller configuration (s. page 54) is reset to the default values. • If you change the relay assignment for the controllers, you must use the controller menu (s. page 54) to reassign a relay all the functions selected there. *Example*: Relays 4 and 5 are assigned to the controller and you change the controller assignment to relays 5 and 6 (number of relays remains 2) (no data loss, providing the number of assigned relays is not reduced!). • You can only activate NAMUR if the required relays 1 and 2 (compare page 14) are free. • If you want to use the USP function, first select the limit contactor function n the menu "PARAM" → "Set up 1" → "Contacts" for a relay and configure this in the menu "PARAM" → "Set up 2" → "Limit switch" for USP. Activate the contact with "Function: on".

CODE	CHOICE (default = bold)	INFO
F2	NC contact **NO contact**	**Selection acc. to NAMUR:** (only, if NAMUR is activated) Assignment of NAMUR contacts as NC contact (= normally closed contact, opens when relay active) or NO contact (= normally open contact, closes when relay active). If the NAMUR function is enabled, the Alarm, Relay 1 and Relay 2 contacts are given the following functions: If the NAMUR function is enabled, the Alarm, Relay 1 and Relay 2 contacts are given the following functions: • "Failure" = Fault-signalling contact (terminals 41/42): Failure alarms are active if the measuring system is not working correctly or if process parameters have reached a critical value. • "Maintenance required " = Relay 1 (Terminals 47/48): Warning messages become active when the measuring system is working correctly but requires maintenance or a process parameter has reached a value which requires intervention. • "Function check" = Relay 2 (Terminals 57/58): This contact is active during calibration, maintenance, configuration and during the automatic cleaning/ calibration cycle.
F3	NC contact **NO contact**	**Select controller contacts as NC contact or NO contact.**
F4	NC contact **NO contact**	**Select limit values as NC contact or NO contact.**
F5	**Steady contact** Wiping contact	**Contact type: Fault-signalling contact** (only, when NAMUR function = off) *Steady contact* = Active for as long as an error is present. *Wiping contact* = Active for 1 second when an alarm signal occurs
F6	Chemoclean is always a NO contact.	**Note in display** **(only, when the full ChemoClean function is selected in field F1, which means CCC and CCW)** With the ChemoClean function, the valves of injector CYR 10 are effected with a NO contact.

6.4.6 Set up 1 – Temperature

Temperature compensation must only be carried out in the conductivity operating mode (operating mode selection, Field A1, p. 31).

✎ Note!
The settings described in this chapter are not effective for the concentration operating mode. If you use the predefined concentration tables, the temperature will be compensated without further configuration. If you use the customer specific tables, configure the temperature compensation as decribed in Chp. 6.4.7.

The *temperature coefficient* α indicates the relative change in conductivity per degree of temperature change. It depends on both the chemical composition of the solution as well as on the temperature itself.
To include the dependency, three different types of compensation can be selected in the Mycom S CLM 153 :
• Linear compensation
• NaCl compensation
• Compensation via table (four different tables are available).

Linear compensation
The conductivity change between two temperatures is taken as constant (i.e. α = const., see adjacent fig. 13.).
You can edit this α value in linear compensation.
Likewise, you can enter the associated reference temperature. Please refer to the data sheets for the reference temperature.

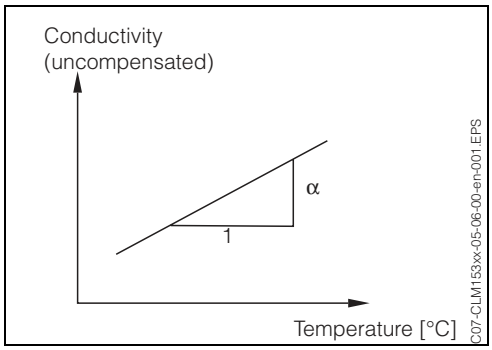


Fig. 13: Linear temperature compensation

NaCl compensation
For NaCl compensation (in accordance with IEC 60746), a fixed non-linear curve is stored which determines the relationship between the temperature coefficient and the temperature. This curve applies to low concentrations of approx. 0.1 ... 5% NaCl.

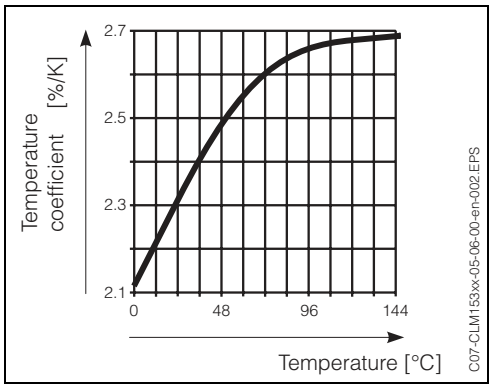


Fig. 14: NaCl compensation

Temperature compensation with table
The following conductivity data of the medium to be measured are required if using the alpha table function for temperature compensation:

Value pairs of temperature T and conductivity *k* with:
- *k* for the reference temperature T_0 and
- *k*(T) for temperatures which occur in the process.

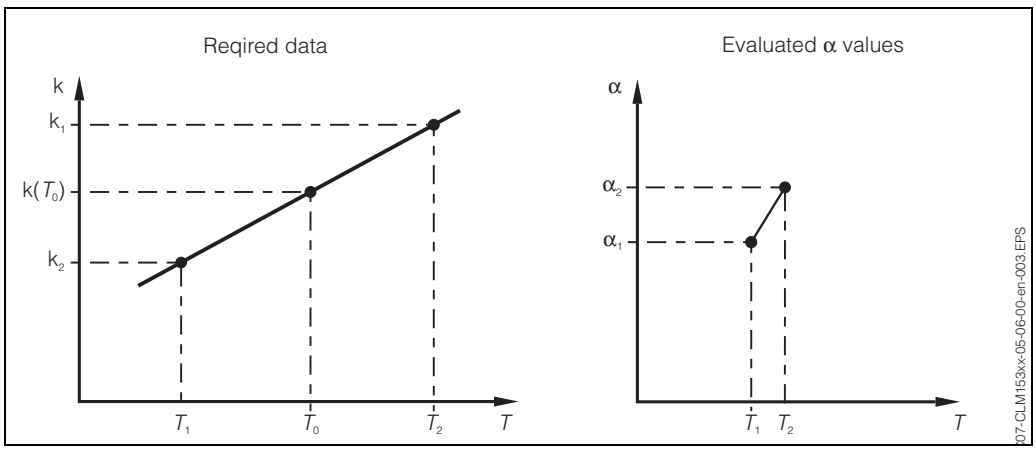


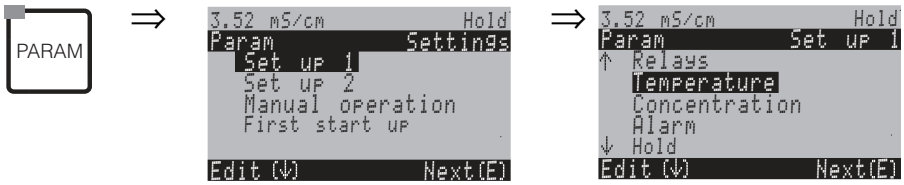
Fig. 15: Data required and α values determined with temperature compensation with table

Use the following formula to calculate the α values depending on the temperatures occurring in your process:

$$\alpha = \frac{100}{k(T_0)} \cdot \frac{k(T) - k(T_0)}{T - T_0}; (T \neq T_0)$$

Enter the α-T value pairs calculated with this formula into the table in Field GBB3. The transmitter is then ready for operation.

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
G1	**Temperature** Create alpha table Reference temperature	**Selection for temperature compensation** *Temperature* = automatic (ATC) or manual (MTC) temperature compensation. *Create alpha table*: Enter conductivity/temperature value pairs for a temperature compensation by means of the table created. *Reference temperature:* The temperature to which you apply to.
Temperature:		
GA1	**Measuring circuit 1** Measuring circuit 2	**Select the measuring circuit** you wish to configure.
Measuring circuit 1 (or 2, optional):		
	ATC CH1 ATC CH2 MTC MTC+Temp	**Select temperature compensation channel 1/2** *ATC:* Automatic temperature compensation via temperature sensor *MTC:* Temperature compensation via manual value entry *MTC+Temp:* Temperature compensation via manual temperature entry. The displayed temperature, however, is measured by the temperature sensor.
GAA1	**Pt 100** Pt 1000 NTC 30k	**Select temperature sensor channel 1/2**
GAA2	Temp.comp.: **linear** Alpha value: **2.10%/K** Actual temp.: **25.0 °C** Offset: **0.0 °C**	**Temperature compensation channel 1/2** *Temp. comp.*: Selection of the temperature compensation – none, linear, NaCl, Table 1 to 4 *Alpha value:* Entry of the conductivity coefficient α. *Actual temp.*: The measured temperature is displayed. *Offset*: Temperature difference between measured and output temperature (–10 ... +10 °C).

CODE	CHOICE (default = bold)	INFO
Create alpha table:		
GB1	**Table 1** Table 2 Table 3 Table 4	**Select table** Select a table to edit.
GBB2	**01** (1 ... 10)	**Entry of the number of support points (value pairs)** Value pair: Temperature and conductivity coefficient α.
GBB3	°C %/K 000.0 00.00	**Entry of the value pairs** Enter temperature and conductivity coefficient, (number of value pairs required = number of support points desired in Field GBB2).
GBB4	**OK** Delete element(s)	**Selection:** Are the value pairs OK or do you want to delete elements?
GBB5	°C %/K **020.0 °C** **02.00** 025.0 °C 04.00	**Delete:** Select the rows to be deleted, delete them with → and confirm this with "E".
GBB6	Valid table	**Note in display:** The table is active after confirmation by pressing "E". Cancel by pressing "PARAM".
Reference temperature:		
GBC1	For laboratory measurement: **25.0 °C** (-35 ... +250 °C)	**Entry of the reference temperature** to which the medium temperature should be compensated. Here, enter the temperature at which the α value was determined, (you can take this from the data sheets from which you also took the α value).

6.4.7 Set up 1 – Concentration

The transmitter can convert conductivity values to concentration values. To do so, you must first switch the operating mode to concentration measurement (s. page 31, Field A3).

Then select the basic data to which the concentration measurement should refer. These data are already stored in the transmitter for the most common substances. You can select one of these substances in Field A3 / AA1 (Chp. 6.4.1).

You can also determine the concentration of a sample which is not stored in the device. For this, you require the conductivity characteristics of the medium. To get the characteristics, you can either
refer to the data sheets of the medium or
determine the characteristics your self.

1. To do so, create samples of the medium with the *concentrations occurring in the process*.
2. Measure the uncompensated conductivity of these samples at temperatures which likewise occur in your process.

   – *For variable process temperature*:
   If the variable process temperature should be taken into account for concentration measurement, you must measure the conductivity of each sample created at two different temperatures at least, (ideally at the lowest and highest process temperature). However, the difference between the temperatures must be at least 0.5 °C. A minimum of four samples is necessary, since the transmitter requires a minimum of four references.

   – *For constant process temperature*:
   Measure the differently concentrated samples at this constant process temperature. Again, a minimum of four samples is necessary for four references.

Impermissible curve profiles
The characteristics received from the measuring points must be extremely monotone increasing or extremely monotone decreasing in the range of the process conditions. Therefore, neither maxima / minima nor ranges with a constant behaviour can occur. Curve profiles such as those in fig. 16 are not permitted.

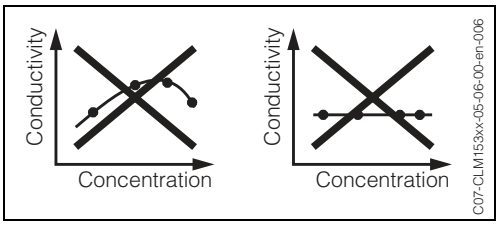


Fig. 16: Impermissible curve profiles

Finally you should have measuring data which are similar to those shown in the following illustrations:

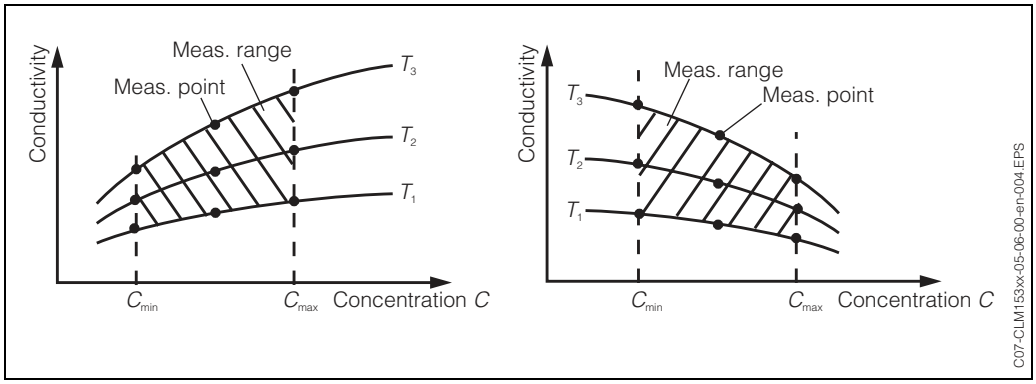


Fig. 17: Measuring data in the event of variable process temperature

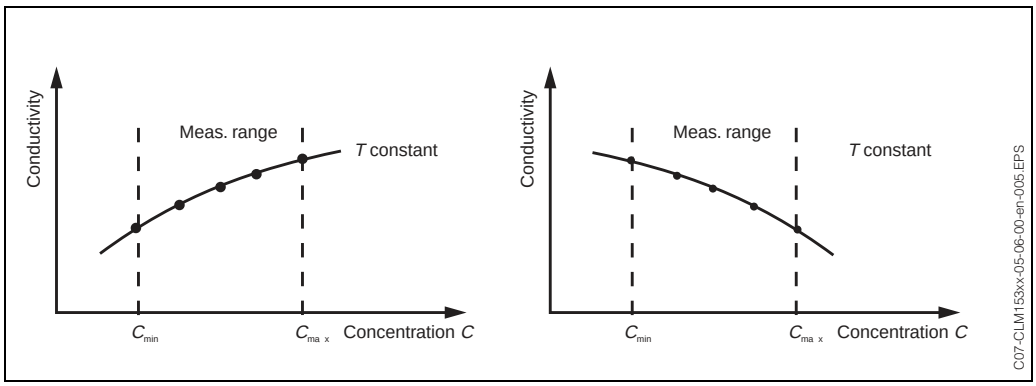


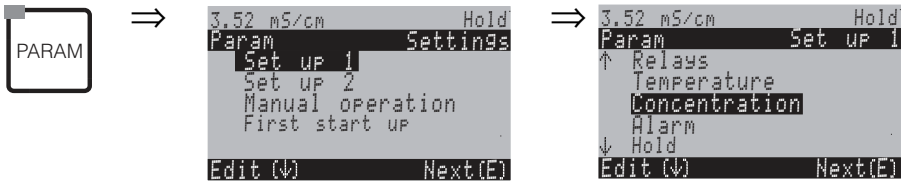
Fig. 18: Measuring data in the event of constant process temperature

Note!

- *Danger of inaccuracy.* Please ensure that the concentrations and temperatures measured for your samples also correspond to the measuring range of the process. If the measured values of the process are outside the range of your sample values, this considerably reduces the level of accuracy and the device generates an error message.
- You can work without error messages from the start of measuring range if you enter an additional triple value set with 0 µS/cm and 0 % for each temperature used, with ascending characteristic (see diagrams above).

Enter the three characteristic quantities (triple value set with conductivity, temperature and concentration) for each measured sample into the field Z5.

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
Z1	**1** (0.5 ... 1.5)	**Select the correction factor** If it is necessary, you can select a correction factor for the user table here.
Z2	**Table 1** Table 2 Table 3 Table 4	**Select table** Select the table to be read or edited. If you are editing a curve, you should select another curve for calculating the current readings.
Z3	**%** ppm mg/l TDS ohne	**Select concentration unit**
Z4	4 (4 ... 20)	**Entry of the number of table support points** Each support point consists of a set of three numbers (see above)
Z5	mS/cm ppm °C **000.00 00.00 000.0** **000.00 00.00 000.0** **000.00 00.00 000.0** **000.00 00.00 000.0** Expl.: mS/cm % °C 223 94.0 50 331 94.0 75 450 94.0 100 212 95.0 50 315 95.0 75 429 95.0 100 157 98.0 50 236 98.0 75 322 98.0 100	**Entry of triple pairs** Entry of minimum 4 triple pairs for conductivity, concentration (with the unit selected above) and the correspondent temperature. ✎ Note! Enter the values in the order of increasing concentration (see opposite example).
Z6	**OK** Delete element(s)	**Selection:** Are the value pairs OK or do you want to delete elements?
Z7	Valid table	**Note in display:** The table is active after confirmation by pressing "E". Cancel by pressing "PARAM".

6.4.8 Set up 1 – Alarm

The transmitter continuously monitors the most important functions. If an error occurs, an error message (list of all error messages s. page 88) is set, which can trigger one of the following actions:

- The fault-signalling contact is made active
- Current output 1 outputs the set error current (2.4 or 22 mA).
  Current output 2 outputs the set error current, if it has not been configured for the "Continuous controller" function.
- ChemoClean cleaning is started

In the list of error messages on page 88 you can see how the error numbers are assigned according to the factory settings. However, in the "ALARM" menu, you have the option of outputting the error messages individually to the alarm relay, the current output or as a cleaning trigger.

✎ Note!
- Please refer to page 88 for the complete list of possible error messages.
- Errors E001 to E029 are assigned to NAMUR functions and cannot be assigned individually.

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
H1	Min (2.4 mA) **Max (22 mA)** off	**Selection for error current** Set the error current at which an error message is active.
H2	!!Caution!! Current output 0...20mA and error current = 2.4 mA leads to uncontrolled behaviour.	**Note in display:** Error current is in the measuring current range. If, in Field EA3, the current range is "0 ... 20 mA" and "Min" is selected under Alarm in Field H1. Recommended combinations: Current range 0...20 mA and error current max (22 mA) or Current range 4...20 mA and error current min (2.4 mA)
H3	**0000 s** (0 ... 2000s)	**Entry of alarm delay** Delay between error occurrence and alarm trigger.
H4	Function **off** Maintenance: **100** Failure **200**	**Alarm for characteristic value monitoring** (only combined circuits) Monitoring of measured value difference for two-circuit measurement. Entry of the maximum permitted difference at which the maintenance or failure alarm should be triggered.

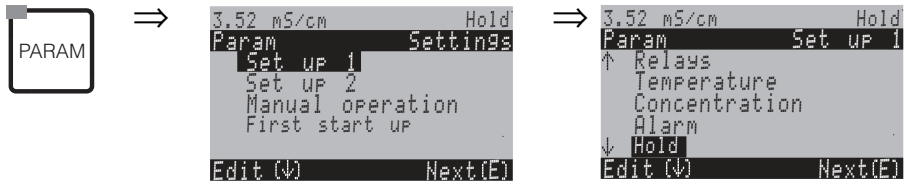
CODE	CHOICE (default = bold)		INFO
H5	No. A I CC	E025 **On** **On** **On**	**Error/contact assignment** Each error can be assigned individually: *No.* = error number E025 (only display) *A* = Assignment to the alarm relay (activate/ deactivate). An active error triggers an alarm. *I* = This error triggers an error current *CC* = ChemoClean®. This error message triggers cleaning.
H6	Function: Time input:	off 0000 s (2...9999s)	**Dosing time alarm** *Function:* Switch on/off the function "Alarm when dosing time exceeded". *Time input*: Entry of the maximum allowed dosing time. After this time has elapsed, an error is output.

6.4.9 Set up 1 – Hold

Hold function = "Freezing the outputs"
The current outputs can be "frozen" for each menu. This means that the value which you define in this menu is output. With hold, "Hold" appears in the display.
This function can also be activated externally via the hold input, (see wiring diagram on page page 12, digital input E1). The on-site hold has a higher priority than an external hold.

✎ Note!
- If a hold is active, no programme can be started.
- If current output 2 is configured for the controller, it complies with the controller hold (see Field I5).

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
I1	CAL **On** DIAG **On** PARAM **On**	**Selection: Automatic hold active when:** CAL = Calibration DIAG = Service/Diagnosis PARAM = Parameter entry menu
I2	**Last** Set Min (0/4 mA) Max (22 mA)	**Select the current for hold** *Last* = The current value is "frozen" *Set* = The value set in Field I3 (below) is output for hold. *Min / Max* = The minimum or maximum current value is output.
I3	**000%** (0 ... 100%)	**Enter Hold current** (only for Set) Number settable from 0% = 0/4 mA to 100% = 20 mA
I4	**010 s** (0 ... 999s)	**Enter hold delay time** The hold remains active for the given hold delay time after leaving the CAL, PARAM, DIAG menus. During the hold delay time, the "Hold" indicator flashes in the display.
I5	Freeze actuating variable: **Yes** no	**Controller hold** Freeze actuating variable (dosing): *Yes*: During an active hold, the last actuating variable is output. *No*: During a hold, no dosing takes place. PWM or PFM relays remain in the dropped-out state. An actuator drive is controlled until it is closed. ✎ Note! If the set value is output via an actuating variable with feedback, the actuator remains active. It also reacts in the hold should the position suddenly change.

6.4.10 Set up 1 – Parameter sets

Use this item to enter complete parameter sets for a maximum of four media.You can set the following individually for each parameter set:

- Operating mode (conductivity, temperature, ...),
- Temperature compensation,
- Current output (main parameter and temperature),
- Concentration table,
- Limit relay.

Assignment of the binary inputs
You can switch the parameter sets (measuring ranges) externally by means of the binary inputs (MRS). To do so, in Field J1 select the number of inputs which should be controlled externally for measuring range switching:

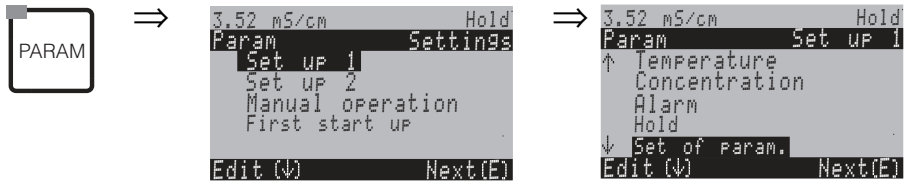
Field J1: Number of inputs	Function
0	You can activate the four parameter sets by means of the local operation. The parameter set cannot be switched by means of the binary inputs. The binary input 1 can be used for external hold.
1	You can switch between two parameter sets by means of the binary input 2. The binary input 1 can be used for external hold. No measuring range can be activated by means of the local operation.
2	You can switch between four parameter sets by means of the binary inputs 1 and 2. No measuring range can be activated by means of the local operation.

Configuration of the four parameter sets (Example: CIP cleaning)

Field No.	Setting	Parameter set			
		1 (e.g.: beer)	2 (e.g..: water)	3 (e.g.: alkali)	4 (e.g..: acid)
	Operating mode	Conductivity	Conductivity	Concentration	Concentration
	Current output	1 ... 3 mS/cm	0.1 ... 0.8 mS/cm	0.5 ... 5 %	0.5 ... 1.5 %
	Temperature compensation	User tab. 1	Linear	–	–
	Concentration table	–	–	NaOH	User tab.
	Limit values	on: 2.3 mS/cm off: 2.5 mS/cm	on: 0.7 µS/cm off: 0.8 µS/cm	on: 2 % off: 2.1 %	on: 1.3 % off: 1.4 %
Binary input 1		0	0	1	1
Binary input 2		0	1	0	1

✎ Note!
If the USP function and/or controller is activated, the parameter set cannot be switched since the inputs for parameter set switching (MRS) are no longer available. The menu is then no longer available. The parameter set 1 configured in the remaining "PARAM" menu is then automatically used.

To enter the menu, proceed as follows:



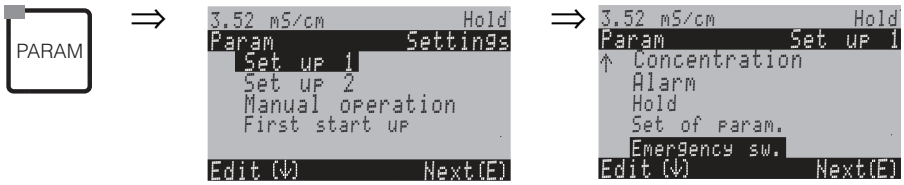
CODE	CHOICE (default = bold)	INFO
J1	No. inp.: **0** (0 ... 2) Edit MR: **1** Act. MR: **2**	**Select the parameter set (measuring range)** *No. input.*: Number of inputs by means of which parameter sets can be switched externally (0...2). *Edit MR*: Selection of the parameter set to be edited. The parameter sets are always configured by means of the local operation or the PC Tool (1...4, if inp.=0 or 2; 1...2, if inp.=1). *Act. MR:* Activation of a parameter set (1...4, if inp.=0; only display for inp.=1 or 2).
J2	Caution! Controller and/or USP is selected. MRS not possible.	**Note in display:** If the USP function and/or controller is activated, the parameter set cannot be switched externally since the inputs for parameter set switching (MRS) are no longer available.
J3	Input 1: Input 2 0/0: **MR 1** **MR 1** 0/1: **MR 1** **MR 1** 1/0: **MR 1** **MR 1** 1/1: **MR 1** **MR 1**	**Configuration** For both circuits, select the parameter sets (measuring ranges, MR) which should be selected by external control of the inputs. 0/0: Input 1 = 0, Input 2 = 0 0/1: Input 1 = 0, Input 2 =1 1/0: Input 1 = 1, Input 2 = 0 1/1: Input 1 = 1, Input 2 =1
J4	**Measuring channel 1** Measuring channel 2 General	**Selection**
Measuring circuit 1 (or 2):		
JA1 / JB1	**Conductivity** Resistance Concentration	**Select operating mode**
JA2 / JB2	Temp.comp.: **none** Alpha value: **%/K**	**Compensation** (only conductivity and resistance) *Temp. comp.*: Selection of temperature compensation – none, linear, NaCl, Table 1 to 4 *Alpha value:* Entry of the conductivity coefficient α.
JA3 / JB3	**NaOH** HNO3 H2SO4 H3PO4 Table 1 .... Table 4	**Medium** (only concentration)

CODE	CHOICE (default = bold)	INFO
	General:	
JC1	**Function:** **Linear** 0/4 mA: 20 mA:	**Select current output 1 / 2:**
JC2	Function **off** Maintenance **100** Failure **200**	**Alarm for characteristic value** (only combined circuits) Monitoring of measured value difference for two-circuit measurement. Entry of the maximum permitted difference at which the maintenance or failure alarm should be triggered.

6.4.11 Set up 1 – Emergency switching

If the hardware (e.g. sensor or transmitter) is defective, you can change the function of the transmitter using the emergency switching. You can set the sensor of one circuit to the transmitter of the other circuit.

To enter the menu, proceed as follows:



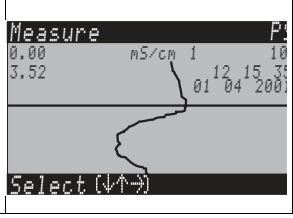
CODE	CHOICE (default = bold)	INFO
N1	Caution! Being switched to one-circuit measurement.	**Note in display**
N2	Switching off Sensor 1 --> input 2 Sensor 2 --> input 1	**Emergency switching** Sensor 1 is set to input 2 or vice versa. The settings you made for the circuits are kept.The circuit data apply after switching, with the exception of the sensor-specific data.

6.4.12 Set up 2 – Data log

The data logger records two freely selectable parameters with their date and time. You can start it using the measuring menus:
Use the arrow keys to scroll through the measuring menus until to you reach the Record mode of the data logger. Pressing the "Enter" key brings you to the Scroll mode of the data logger. Here you can open the saved measured values with their date and time.

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
K1	**Measuring interval** Data logger 1 Data logger 2 View 1 View 2	**Data logger settings** Using the data logger you can • Record a parameter with 500 sequential measuring points or • two parameters each with 250 sequential measuring points. *View 1/2*: You can view the data recorded in the data logger.
Measuring interval:		
KA1	**00005s** (2 ... 36000s)	**Enter measuring interval** Enter the time interval after which the next measured value is recorded in the data logger.
Data logger 1 (or 2):		
KB1 / KC1	Measured value: **Measured value input 1** Function: **On**	**Selection** Set the measured value for recording (measured value input 1, measured value input 2, temp. input 1, temp. input 2, characteristic value) and then activate by means of the "on" function. ✎ Note! The data logger starts recording the measured value when you return to operation.
KB2 / KC2	Min: 0,00 Max: 2000,00	**Set recording range** Values outside the defined range are not recorded.
View 1 (or 2):		
KD1 / KE1		**View of the recorded data** Using the date and time, you can call up data recorded in the past.

6.4.13 Set up 2 – Check

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
L1	PCS input 1: **off** PCS input 2: **off**	**PCS (= Process check system) time** If the measuring signal changes over the period entered, an alarm is signalled with error message E152. Settable times: off, 1h, 2h, 4h. Monitoring limit: 0.3 % of mean value over the set period of time. ✎ Note! An active PCS alarm signal will be deleted automatically as soon as the sensor signal changes.

6.4.14 Set up 2 – Controller settings

Requirements for controller configuration:
You have carried out the following settings **which are necessary for the controller settings** either in the Quick Setup, page 23 or on the appropriate menu page.
If you have not yet made the settings, please do this **before** configuring the controller.
- Specify the relays available for the controllers (Field T18, page 28, or Field F1, page 36) and/or
- Current output **2** must be defined as a continuous controller if you want to control the actuator via a 20 mA interface. (Field T20, page 29, or Field EA1, page 34).

✎ Note!
- *Danger of data loss.* If you assign the relays which are used by the controller with another function (Field F1, page 36), the **entire** controller configuration is reset to the default values.
- If you change the relay assignment for the controllers in the Contacts menu (Field F1, page 36), you must use the Controller menu to reassign a relay to all the functions selected there.
  Example: Relays 4 and 5 are assigned to the controller and you change the controller assignment to relays 2 and 3 (number of relays remains 2)
  (*no* data loss, provided the number of assigned relays is not reduced!)
- Relays 3, 4 and 5 are located on the additional plug-in card. If you have used one of these relays for the controller function and want/have to remove this card from the device, then we would recommend that you change the controller settings before removing the second card, so that all the relays used by the controller are located on card 1. Otherwise, you cannot use the controller function during the time in which the additional card is not plugged into the device, as the controller needs to access the relays on the second card.

Definition of terms

Actuators:
Valves, gate valves, pumps and similar

Upward/ downward controller:
The terms "up" (=upward controller) and "down" (=downward controller) used in the menu are used in relation to the direction of action:
Down = The control doses only if the measured value is greater than the setpoint.
Up = The control doses only if the measured value is smaller than the setpoint.

Process:
The controller or the process (to simplify matters this will, from henceforth, be referred to as the "process") can be differentiated on account of their different features:

Direction of action, one or two-sided:
One-sided control only works in one of two directions. It influences the process in such a way that the measured value either rises (upward controller) or drops (downward controller).
With a *two-sided* process, control can generally work in both directions, ("up" *and* "down"). This means that you can both increase and decrease the value of the controlled variable (here = measured value).

Batch or inline process arrangement:
With active control, the batch and inline processes are different in their relationship to the medium current:
Pure batch process: The batch container is filled with the medium. During the subsequent batch process, no additional medium is fed in. The change in the measured value is caused only by the control. To be able to compensate for possible so-called "overshoots", use a two-sided control (see above). For as long as the actual value is within the neutral zone, no additional dosing agent is added.

Pure inline process: Here, the control works with the medium flowing past. The measured value of the medium in the inflow may be subject to strong deviations for which the control should compensate. The volume of medium which has already flowed past can no longer be influenced by the controller. For as long as the actual value corresponds to the setpoint, the actuating variable has a constant value.

The Mycom S controller takes this differing behaviour into account. It is the internal handling of the integral part of the PI or PID controller which is different for these settings.
In practice, the most common option is the *semi-batch process*. Depending on the ratio of inflow to tank size, this process shows the behaviour of an inline or a batch process.

Look-ahead control
To be able to optimally resolve the general problems of a purely inline process, the CLM 153 is able to "look into the future" using a second sensor and a flowmeter. This means that the controller can react to strong variations in the inflow at an early stage.

Controlling the actuators
The CLM 153 has four different methods for controlling the actuators (seeabove.)

1. PWM (Pulse-width modulation, "pulse-length controller")
Pulse-width modulated outputs aid control e.g.of solenoid valves. With PWM, one side (i.e. "up" *or* "down") of the internal, analog actuating variable is output to a relay as a rhythmic signal.
The larger the calculated actuating variable, the longer the appropriate contact remains picked up (i.e. the longer the switch-on period t_{ON}; s. fig. 19 is). You can set the period length freely between 1 and 999.9 seconds. The minimum switch-on period is 0.4 seconds.
A two-sided process requires two PWM relays or one PWM and a three-point step controller (seebelow.) One PWM relay on its own can only output an actuating variable of
- –100% ... 0% *or*
- of 0% .... +100%.

To avoid pulses which are too short, enter a minimum switch-on period. Pulses which are too short are not given to the relay/or the actuators. This benefits the actuator.

2. *PFM (pulse-frequency modulation; "pulse-frequency controller")*
Pulse-frequency modulated outputs aid control e.g.of solenoid dosing pumps. As with PWM, PFM is output as a rhythmic signal by the relay.
The greater the calculated actuating variable, the higher the frequency of the related contact. The maximum settable frequency 1/T is 120 min^{-1}. The switch-on period t_{ON} is a constant factor of the entered frequency (s. fig. 19).
Here too, two PFM relays are required for a two-sided process.

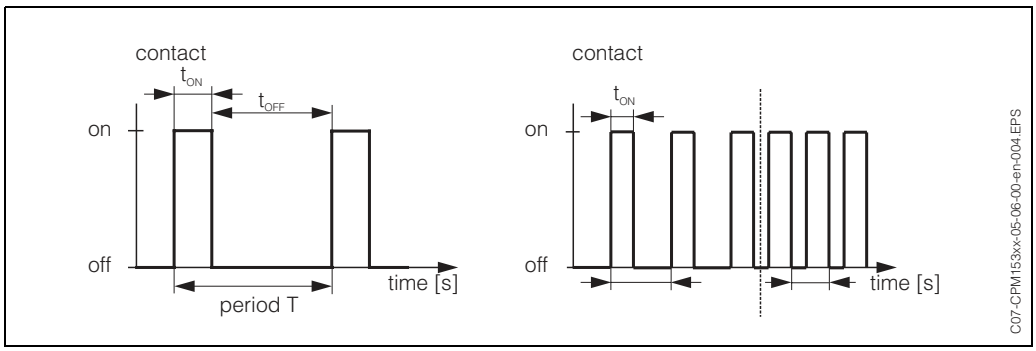


Fig. 19: left: pulse-width modulation (PWM)
Right: pulse-frequency modulation (PFM)

3. *Three-point step controller*
With Mycom S, this type of control is only possible for *one* process side ("Up" *or* "Down"). With two-sided processes, either PWM or PFM must be used for the other process side.

Select this type of control for actuator drives (e.g. valves, butterfly valves etc.), which must be controlled by means of two relays and which have position feedback. Only actuator drives with position feedback are supported. If the "+relay" picks up, the valve opens (flow increases) until the "+relay" drops out again. The "–relay" closes the valve in a similar way.

The Mycom S has an internal position controller which compares the set and actual positions of the valve, (set position from the primary controller and actual position from the position feedback). The relay in question picks up as soon as the position error exceeds the set switching differential X_{SD}. The actuator drive is controlled more frequently and more precisely, the smaller the X_{SD} selected. This also results in a more accurate overall control. However, if the switching differential is too small, there is the risk that the position control starts to oscillate.
For your process, you must find the optimum value between a large switching differential which protects the actuators and a small switching differential which ensures better control quality.

The set motor run time aids valve monitoring.

✎ Note!
If using a driven valve, gate valve orsimilar, you must determine this motor run time *before* starting with the menu settings.

4. Analogue (via current output 2, 20 mA)
The current output can be used to output the *analogue* actuating variable for one or two-sided processes and *cannot* be combined with the method described above.

- With *one-sided* processes, the actuating variable range 0% ... 100% (or –100% ... 0%) is represented on the selected current range (0 ... 20 mA or 4 ... 20 mA). The output current is proportional to the actuating variable.
- With a *two-sided* process, the complete actuating variable range from –100% ... +100% is represented on the given current range. An actuating variable of 0% leads to a current of 10 mA (at 0 ... 20 mA) or 12 mA (at 4 .. 20 mA), (see fig. 20).

Note!
With a two-sided process, it should be noted that the actuator uses this method (also known as "split range").

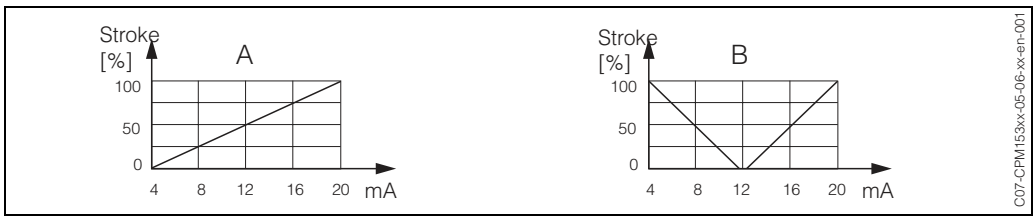


Fig. 20: A: Stroke diagram for a control valve
B: Stroke diagram for two contrarotating control valves ("split range")

You can refer to the following selection aids to find the required hardware equipment level for your process.
This selection is not complete. If you wish to use additional functions such as NAMUR or ChemoClean, please check to see if you require additional relays (NAMUR: Alarm relay + 2 relays; ChemoClean: 2 relays).

Selection aid for online processes

Process	Path	Dosing actuators		Required hardware equipment for control: Circuits	Relay	Current inputs	Current outputs
2-sided control	looking-ahead · 2-circuit · flow	2 PWM		2	2	1	–
		2 PFM		2	2	1	–
		1 three-PS 1 PWM/PFM	with signal	2	3	2	–
			without signal	2	3	1	–
		current output split range		2	–	1	1
	not looking-ahead	2 PWM		1	2	–	–
		2 PFM		1	2	–	–
		1 three-PS 1 PWM/PFM	with signal	1	3	1	–
			without signal	1	3	–	–
		current output		1	–	–	1

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Selection aid for online processes

Process	Path	Dosing actuators	Required hardware equipment for control: Circuits	Relay	Current inputs	Current outputs
2-sided control	looking-ahead · 2-circuit · flow	2 PWM	2	2	1	–
		2 PFM	2	2	1	–
		1 three-PS 1 PWM/PFM – with signal	2	3	2	–
		1 three-PS 1 PWM/PFM – without signal	2	3	1	–
		current output split range	2	–	1	1
	not looking-ahead	2 PWM	1	2	–	–
		2 PFM	1	2	–	–
		1 three-PS 1 PWM/PFM – with signal	1	3	1	–
		1 three-PS 1 PWM/PFM – without signal	1	3	–	–
		current output	1	–	–	1

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Selection aid for batch processes

Process	Dosing actuators	Required hardware equipment for control: Circuits	Relays	Current inputs	Current outputs
1-sided control	1 PWM	1	1	–	–
	1 PFM	1	1	–	–
	1 three-PS 1 PWM/PFM – with signal	1	2	1	–
	1 three-PS 1 PWM/PFM – without signal	1	2	–	–
	current output	1	–	–	1
2-sided control	2 PWM	1	2	–	–
	2 PFM	1	2	–	–
	1 three-PS 1 PWM/PFM – with signal	1	–	1	1
	1 three-PS 1 PWM/PFM – without signal	1	3	–	–
	current output split range	1	3	–	–

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PWM = pulse length proportional
PFM = pulse frequency proportional
Three PS = Three-point step controller

The controller in the CLM 153:
The CLM 153 contains a multi-faceted PID controller which can be adapted to the process. It has the following features:

- Separate configuration of both process sides,
- Simple adaptation to batch or inline processes,
- Switching option between constant and range-dependent modulation gain.

Relating to the effect on the gain factor, a difference is made between two standard implementations:

- The factor $K_R(X)$ is the total gain (see fig. 21. This is implemented in the CLM 153).
- The gain factor $K_P(X)$ is the purely proportional gain.

The following diagram shows the schematic structure of the CLM 153 controller. Because of the simplicity of the diagram, the Laplace transform of subfunctions is given.

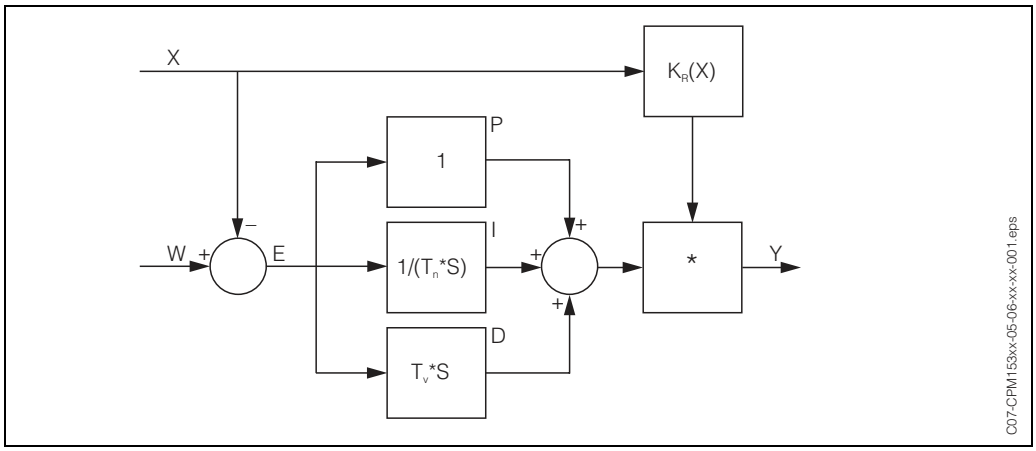


Fig. 21: Schematic diagram of the CLM 153 controller with $K_R(X)$ as the total gain

X	Actual value
W	Setpoint
E	Control difference
Y	Actuating variable
K_R	Modulation gain (total gain)
T_n	Integral action time (I component)
T_v	Derivative action time (D component)

Range-dependent modulation gain
In contrast to normal PID controllers, with Mycom S you have the option of setting a range-dependent modulation gain in addition to a constant controller gain. With range-dependent gain, the controller gain used depends on the “range”, i.e. on the present actual value.

Areas of application for range-dependent gain are:
- Compensation of non-linearities:
  The conductivity process is no longer linear at medium and high concentrations (approx. > 15 %).
- For critical control systems,
  you need a control which works very carefully near the setpoint and doses very powerfully in the event of large control difference. If *constant* controller gain cannot do this to your satisfaction, then you can achieve this by using range-dependent modulation gain.

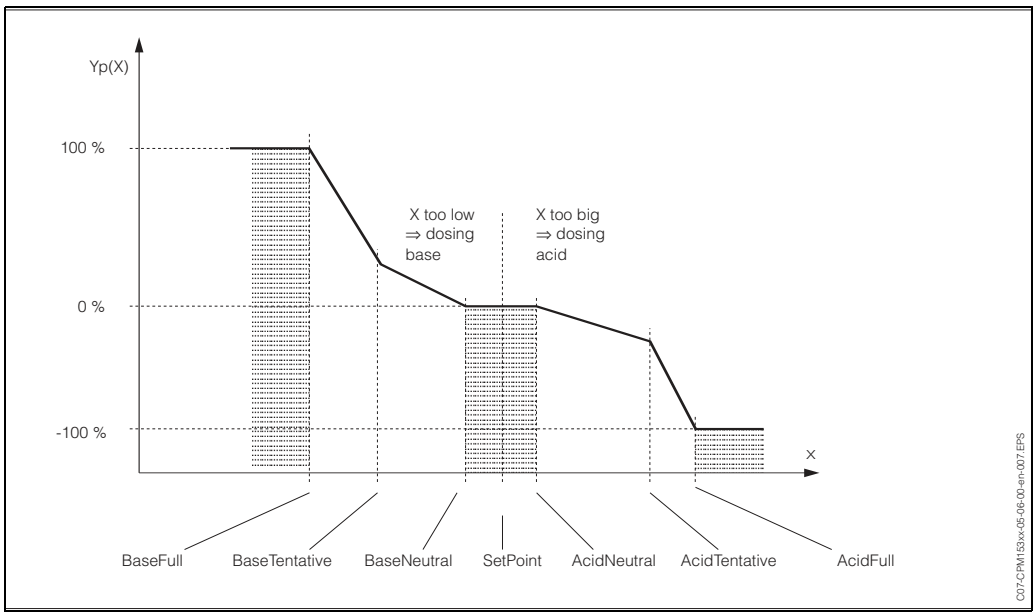


Fig. 22: Diagram to describe the most important corner points for control

With such a range-dependent characteristic, a set actuating variable is prescribed to the controller for each measured value.

Neutral zone:
If the actual value (X) is within the neutral zone, then
- the dosing does not take place for the Batch process type,
- also not for the Inline process type and without an I component (Tn=0).
- If the controller is configured as a PI or PID controller for the Inline type, the controller decides itself if dosing will be carried out or not. This is dependent on the measured value history.

Points of the characteristic:
For *constant control gain* ("linear characteristic"), you require:
Setpoint W,
Neutral zone
– Two-sided: "Start of the neutral zone" and "End of neutral zone"
– One-sided: only one of the two points

For *range-dependent modulation gain* ("segmented characteristic"), you require two-sided control of all the points.

A point usually consists of two coordinates: an x coordinate (here = measured value) and a y coordinate (here = actuating variable). You only need enter the y coordinates for the optimisation points. For the other points, the CLM 153 sets the y coordinates itself.
However, you cannot change the sequence of these defined points. It is, for example, not possible to enter a larger measured value for the "Start neutral zone" than for the setpoint.

Configuring the CLM 153
Please configure the relays in the following order:
1. Actuators
2. Sensor technology
3. Feedback (e.g. look-ahead control, position feedback with three-point step controller, if available)
4. Characteristic:

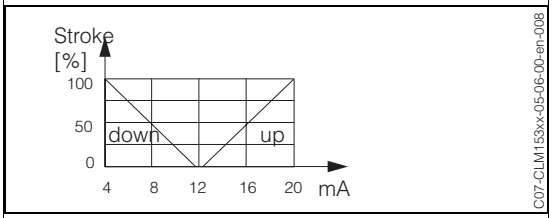
In the user settings (seebelow) you switch directly to a controller simulation and can check the settings made and change them if necessary.

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
M1	**off** On	**Select controller functions** ✎ Note! You must activate the controller function **after** you have configured the controllers in this menu branch.
M2	Batch 1-s. up Batch 1-s. down Batch 2-sided **Inline 1-s. up** Inline 1-s. down Inline 2-sided	**Select the process type,** which describes your process. *1-s. = one-sided:* The control is either "up" *or* "down". *Two-sided*: The control is "up" *and* "down". You can only select this function if you have defined two controllers (in the "Contacts" menu and/or via the current output).

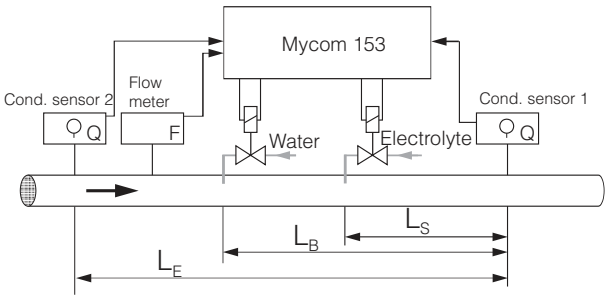
CODE	CHOICE (default = bold)	INFO
M3	Actuators Sensor technology Feedback **Characteristic**	Select external hardware For correct operation, you must completely configure these four submenus. *Actuators*: here, you can select and configure the methods which the controller uses to output the actuating variable. *Sensor technology:* Here you configure the look-ahead control or switch channels (only with two circuit). *Feedback:* Here you configure the position feedback of an actuator drive (only with the selection of three PS and position feedback = on; see Fields 162, 165 / 170, 165) *Characteristic*: Here, you enter the controller parameters (neutral zone, setpoint, etc.). With this selection, you can also reach the controller simulation (see Field ME6).
Actuators: With selection "one-sided" in Field M2:		
MA1	Up Down	**Dosing** Select the control type with which you wish to dose.
MA2	Pulse length Pulse frequency 3-point step controller Current output	**Select control type**
MA3	+relay **n.c.** –Relay **n.c.** Motor run time off Position feedback	**Relay selection** (for three-point step controller) *+Relay*: Open the valve further (= increase dosing) *–Relay*: Close the valve further (= reduce dosing) Selection: n.c. (= not connected). After this, those relays which are released in the Contacts menu are always offered as the default. *Motor run time*: The time the motor drive requires to move the valve from completely closed to completely open. The CLM 153 requires this to be able to calculate the required pick-up time of the relay for any required position change. *Position feedback*: Without position feedback, the current valve position is calculated using the entered motor run time and the relay activity. With switched-on position feedback, the CLM 153 expects feedback from the actuator drive about the current valve position via a current or resistance input. ✎ Note! If you cannot select a relay here, use the "Contacts" menu to make relays available for the controller function.
MA4	Relay: **n.c.** max. pulse frequency 120/min.	**Relay selection** (for pulse frequency) *Relay:* Relay selection *Max. pulse frequency*: Input of the maximum pulse frequency. (Pulses with a higher frequency are not forwarded to the relay). (Maximum setting: 120 1/min)

CODE	CHOICE (default = bold)	INFO
MA5	Relay: **n.c.** Period: **000.0s** t_E min: **000.0s**	**Relay selection** (for pulse length) *Relay:* Relay selection *Period*: *Period length T in seconds* *(Range 0.5 ... 999.9 s)* *t_E min*: Minimum switch-on period. (Shorter pulses are not forwarded to the relay and treat therefore the actuators with care).
MA6	0 ... 20mA 4 ... 20 mA	**Current output** Selection of the current range, which should be output at the current output.
MA7	0/4 mA 20 mA	**Current output** Assign the current value which corresponds to 100 % dosing medium provision.
Actuators With selection "two-sided" in Field M2:		
MB1	Dosing via: 1 output 2 outputs	**Control:** (This is only if you selected the constant controller under current output 2.) *1 output*: for control using the current output in the "split range" method. Control logics are required which can control two valves/pumps over one current input. *2 outputs*: If the valves are controlled with two relays.
1 Output:		
MBA1	0 ... 20mA 4 ... 20 mA	**Current output** Selection of the current range, which should be output at current output 2. The neutral position (= current value which the controller outputs when it is not dosing) is in the middle of the selected range. For 0 ... 20 mA, the neutral position is at 10 mA, for 4 ... 20 mA at 12 mA.
MBA2	0 (or 4) mA 20 mA	**Current output 2** Assign the current value, corresponding to 100 % dosing. ✎ Note! From the current value selection for the dosing of 100 % dosing agent, you can derive the current ranges for up and down dosing, (see fig. 23) in the "split range" method.  *Fig. 23: Two-sided control over one current output*

CODE	CHOICE (default = bold)	INFO
2 outputs:		
MBB1	Acid: l length Alkali: l length	**Select the control type** Dosing can be carried be carried out using: PWM (= pulse length proportional), PFM (= pulse frequency proportional) or 1x three-PS (= three-point step controller)
MBB2	+relay **n.c.** –Relay **n.c.** Motor run time Xsd %	**Downward dosing: Relay selection** (for three-point step controller) *Xsd*: Switching differential *Description see above.)*
MBB3	Relay: **n.c.** max. pulse frequency 1/min.	**Downward dosing: Relay selection** (for pulse frequency) *Description see above.)*
MBB4	Relay: **n.c.** Period: **000.0s** t_E min: **000.0s**	**Downward dosing: Relay selection** (for pulse length) *Description see above.)*
MBB5	+relay **n.c.** –Relay **n.c.** Motor run time Position feedback off	**Upward dosing: Relay selection** (for three-point step controller) *Description see above.)*
MBB6	Relay: **n.c.** max. pulse frequency 1/min.	Upward dosing: Relay selection (for pulse frequency) *Description see above.)*
MBB7	Relay: **n.c.** Period: **000.0s** t_E min: **000.0s**	**Upward dosing: Relay selection** (for pulse length) *Description see above.)*
Sensor technology:		
MC1	Look-ahead control: Meas. value input 1 = controller Meas. value input 2 = look-ahead	**Note in display: Look-ahead measurement** (only look-ahead) In Quick Setup one process with look-ahead control was selected. ✎ Note! Control with look-ahead measurement is only possible in conjunction with a flowmeter and a two-circuit transmitter.
MC2	Control with: Meas. value input 1 Meas. value input 2	**Electrical assignment:** (only redundancy) Selection of with which measured value, control is effective.
MC3	L_B: 0.5 m L_S: 0.5 m L_E: 1.5 m	**System arrangement** Enter sensor/dosing point distances: L_S: Distance between the controlling sensor and the acid dosing point L_B: Distance between the controlling sensor and the alkali dosing point L_E: Distance between the controlling sensor and the look-ahead sensor Notes on fig. : Sensor 1 is the controlling sensor, sensor 2 is the look-ahead el.

CODE	CHOICE (default = bold)	INFO

Two-sided pipe flow neutralisation (inline) with forward-locking conductivity measurement



Schematic diagram of a two-sided control with look-ahead control

	MC4	Unit: Unit: 4 mA value: 20 mA value:	m3/h s ___ ___	**Flowmeter volume flow** *Unit:* Entry of the volume flow in m^3/h or yd^3/h *4 mA value:* Enter minimum flow velocity value. *20 mA value:* Enter maximum flow velocity value.
	MC5	Diameter	00 mm	**Pipe diameter** Entry of the internal diameter of the pipe located between the two sensors.
	MC6	Function Limit value Kdisturb=1: Kmax: Kdisconnect:	**On** **050.0** **050.0** 1.7 1.0	**Feedforward control** (only if 2 current inputs are available) Feedforward control has a multiplying effect, i.e. the controller actuating variable is multiplied by the gain Kdist (s. fig. 24). *Limit value* If the current input signal undershoots the value set here, dosing is stopped (actuating variable = 0). The dosing stop is not active if you enter 0 (= no limit value) here. (Range 0...100%) $K_{disturb}$ = *1*: Here, enter the current input value in % at which the feedforward gain should have the value 1. At this point the output actuating variable is the same for switched-on or switched-off feedforward control. (Range 0...100%) K_{max}: Here, the value of Kdisturb is displayed for a current input signal of 100%. $K_{disconnect}$: Here, the value of Kdisturb is displayed for current input signal which is equal to the limit value.

CODE	CHOICE (default = bold)	INFO

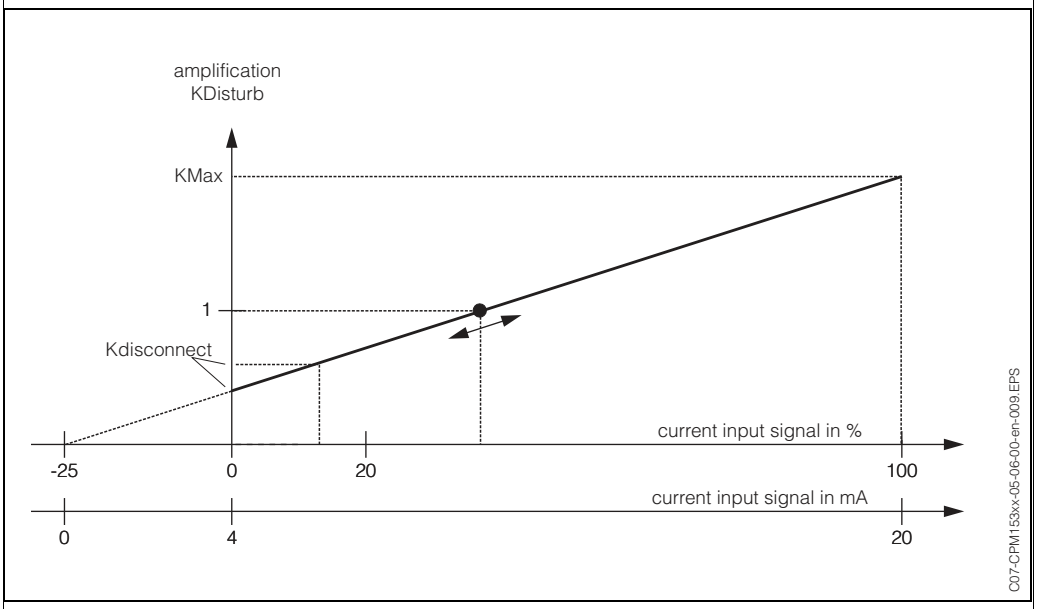


Fig. 24: Multiplying feedforward control

	Feedback: The following selection is dependent on whether you have a resistance or a current input.		
	With resistance input		
	MD1	0 ... 1 kΩ 0 ... 10 kΩ	**Select range** for resistance.
	MD2	act. resistance ____ kΩ	**Assign a value for y = 0%** Drive the valve to y = 0%. The current resistance is displayed. You can change the valve position either manually or by pressing the arrow keys on the transmitter. Confirm the position for y = 0 % by pressing the "E" key. ✎ Note! If you cannot change it using the arrow keys, please check the "Actuators" menu (Field 165) to see if the relays have been assigned to valve control.
	MD3	act. resistance ____ kΩ	**Assign a value for y = 100%** Drive the valve to y = 100%. Proceeding as in the previous field.
	For current input 1:		
	MD4	y = 0 ... 100 % mA: 4 ... 20 20 ... 4	**Select current range** and assign the percentage range.

CODE	CHOICE (default = bold)	INFO
MD5	act. mA value: ____ mA	**Assign a value for y = 0%** Drive the valve to y = 0%. The current current value is displayed. You can change the valve position either manually or by pressing the arrow keys on the transmitter. Confirm the position for y = 0 % by pressing the "E" key. ✎ Note! If you cannot change it using the arrow keys, please check the "Actuators" menu (Field 165) to see if the relays have been assigned to valve control.
MD6	act. mA value: ____ mA	**Assign a value for y = 100%** Drive the valve to y = 100%. Proceeding as in the previous field.
Characteristic:		
ME1	Constant characteristic Segmented characteristic	**Characteristic type selection** *Constant characteristic :* Corresponds to a constant control gain. *Segmented characteristic :* Corresponds to a range-dependent control gain.
ME2	Setpoint 1000 mS/cm St.ntr. zone 800 mS/cm End zone 1500 mS/cm K_R 1 200 mS/cm K_R 2 200 mS/cm	**Characteristic values for constant characteristic (constant control gain) ; K_R** *Setpoint*: The value which should be set. *St. ntr. zone:* Start neutral zone *End ntr. zone:* End neutral zone K_R *1* (only with alkali dosing): Modulation gain for alkali dosing K_R *2* (only with acid dosing): Modulation gain for acid dosing
ME3	Setpoint 1000 mS/cm St.ntr. zone 990 mS/cm End zone 1010 mS/cm O.pnt. X1 900 mS/cm O.pnt.Y1 0.20 O.pnt. X2 1100 mS/cm O.pnt.Y2 -0.20 Ctrl.pnt. 1 800 mS/cm Ctrl.pnt. 2 1200mS/cm	**Characteristic values for segmented characteristic (range-dependent control gain)** *Setpoint*: The value which should be set. *St. ntr. zone:* Start neutral zone *End ntr. zone:* End neutral zone *Optimisation point 1 and 2:* Entry with x and y coordinates *Control point 1*: The dosing is 100% alkali for measuring values < control point 1. *Control point 2*: The dosing is 100% acid for measuring values > control point 2.
ME4	Rapid process Standard process Slow process User settings	**Select process character** If you have no experience in setting control parameters, the defaults *rapid* / *standard* / *slow process* are intended as an aid to adapting the controller behaviour to the process. Select a default and use the "controller simulation" (see below) to check if these settings are relevant for your process. Enter all the characteristic values yourself with the *user settings*.
ME5	K_R 1 = K_R 2 = Tn 1 = Tn 2 = Tv 1 = Tv 2 =	**Characteristic values for user settings:** (K_R 1 and K_R 2 only with linear characteristic; Index 1 only for alkali dosing, Index 2 only for acid dosing) K_R *1*: Modulation gain for alkali dosing K_R *2*: Modulation gain for acid dosing *Tn*: integral action time *Tv*: derivative action time

CODE	CHOICE (default = bold)	INFO
ME6	Simulation **Off** On	**Select controller simulation** Here, you can switch a configuration loop on or off. The hold is removed with an active controller simulation. *Simulation on*: The characteristic values entered in the previous field are used in the next field to simulate the controller behaviour. *Off*: Press "E" to leave the controller simulation.
ME7	Function auto Set: 1000 mS/cm act.: 1000 mS/cm y: 000	**Controller simulation** *Function*: Here, you set whether an actuating variable calculated by the controller ("auto"), or an actuating variable y entered by the user ("manual") is to be output. *Set*: Displays the current setpoint. If necessary, you can change the setpoint. The other points (start/end of neutral zone, optimization points, control points) change accordingly. *Actual*: Displays the current actual/measured value. *Y*: With the "auto" function: displays the actuating variable determined by the controller. With the "manual" function, you can enter an actuating variable here. Values < 0 % mean downward dosing, values > 0 % mean upward dosing.

To best adapt the controller parameters to the process, we recommend the following:
- Set values for controller parameter (Field ME5), activate simulation (Field ME6), deflect process:
  Field ME7: set function to "manual" and enter an actuating variable. Using the actual value, you can observe how the process is deflected.
- Switch the function to "auto". Now you can observe how the controller returns the actual value to the setpoint.
- If you want to set other parameters, press the "Enter" key and you will return to Field ME5. During this time, the controller continues to run in the background.
- If you have made your settings, press the "Enter" key again to return to Field ME6. There, you can continue or exit the simulation.

✎ Note!
Only exit the controller simulation in Field ME6 with "Simulation off". Otherwise, the simulation will continue to run in the background.

6.4.15 Set up 2 – Limit switch

The transmitter has several possibilities for assigning a relay contact. The limit contactor can be assigned an on and off point, as well as a pickup and dropout delay. In addition, an error message can be generated when an alarm threshold is set. You can trigger cleaning in connection with this error message (see error/contact assignment page 45). These functions can be used both for conductivity/concentration/resistance measurement and for temperature measurement.

To illustrate the contact states of any relay contact or fault-signalling contact, refer to fig. 25:

On-point > off-point (with increasing measured values):
– The relay contact closes after the on-point at t_1 is exceeded and the pickup delay (t_2 - t_1) expires.
– When the alarm threshold at t_3 is reached and the alarm delay (t_4 - t_3) also expires, the fault signalling contact switches.
– With returning measured values, the fault-signalling contact reopens when the alarm threshold is undershot at t_5. The appropriate error message is deleted.
– The relay contact opens again after the off-point is reached at t_6 and the dropout delay has elapsed (t_7 - t_6).

✎ Note!
- If the pickup and dropout delays are set to 0 s, the on and off points are the switch points of the contacts.
- You can make identical settings for a minimum function similar to the maximum function.

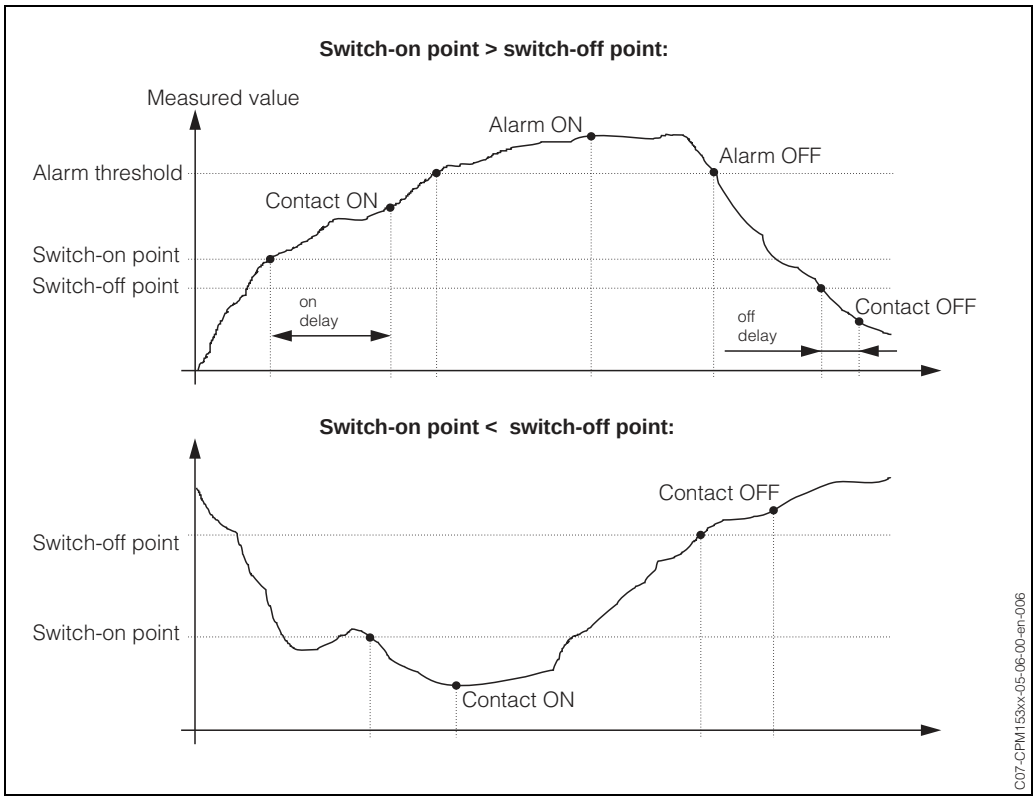


Fig. 25: Diagram of the relationship between on and off points and on and off delay

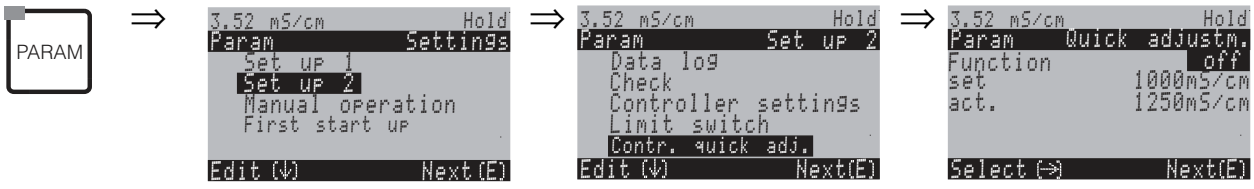
To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
O1	Limit switch 1 Limit switch 2 Limit switch 3 Limit switch 4 Limit switch 5	**Selection** of the limit switch which you wish to configure. There are five limit switches available.
Limit switch 1 / 2 / 3 / 4 / 5:		
OA1 / OB1 / OC1 / OD1 / OE1	Function **off** Assignment **PV CH1** On point: **2000mS/cm / 0500 MΩ·cm / 99.99%** Off point: **2000mS/cm / 0500 MΩ·cm / 99.99%**	**Limit switch configuration:** *Function*: Activation of function as limit switch *Assignment*: Selection of the measured value to which the limit value should apply. Selection: primary value CH1, temperature CH1, primary value CH2, temperature CH2, USP CH1, USP CH2, related (only if operating mode = combined circuits) *On-point*: Entry of the value at which the limit function is activated. *Off-point*: Entry of the value at which the limit function is deactivated. (Settable range: 0 ... 2000 mS/cm / 0 ... 100 % / 0 ... 100 MΩ / –50 ... +150 °C)
OA2 / OB2 / OC2 / OD2 / OE2	On delay: **0000 s** Off delay: **0000 s** Alarm threshold: **2000mS/cm / 500 MΩ / 99.99%**	**Limit switch configuration:** *On delay*.: Entry of the switch-on delay of the (range 0 ... 2000 s) *Off delay*: Entry of the switch-off delay (range 0 ... 2000 s) *Alarm threshold*: Entry of the value (alarm threshold) at which the fault signalling contact switches.

6.4.16 Set up 2 – Controller quick adjustment

To enter the menu, proceed as follows:



6.4.17 Set up 2 – ChemoClean

ChemoClean® is a system to automatically clean conductivity sensors. Water and cleaner are conveyed to the sensor by means of an injector (e.B. CYR 10).

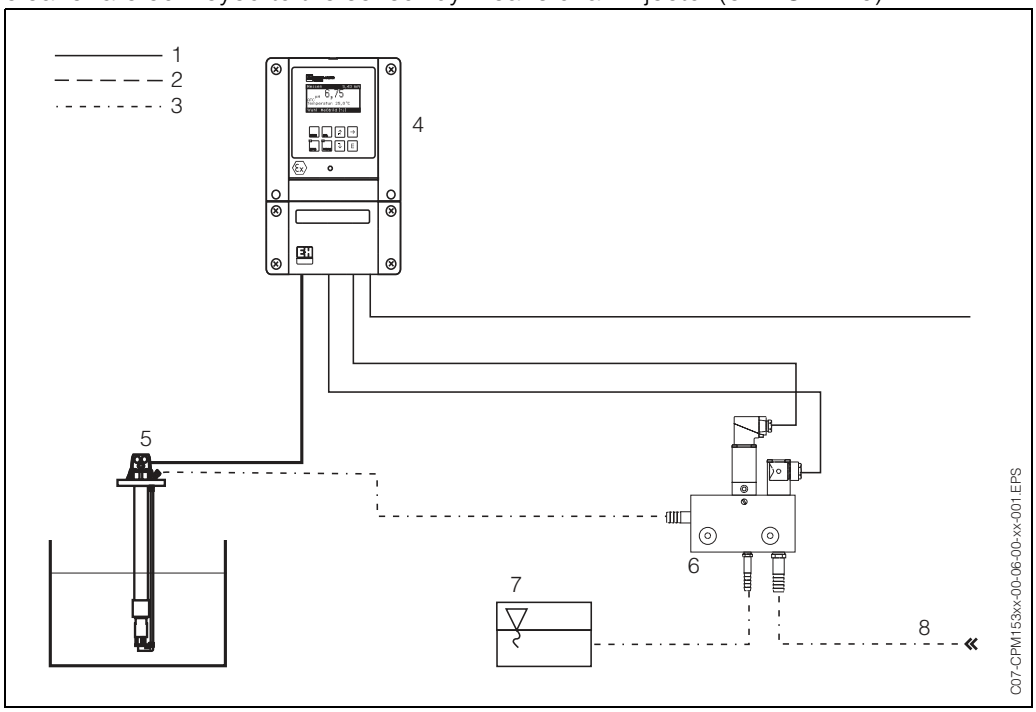


Fig. 26: 1: Electric line
2: Pressurised air
3: Water/cleaning liquid
4: CLM 153 transmitter
5: Immersion assembly
6: Injector CYR 10
7: Cleaning liquid
8: Motive water

Operation:

1. In the menu "Set up 1" → "Contacts" (Field F1, s. page 38), the ChemoClean® function must be switched on and the appropriate contacts connected to the injector.
2. The cleaning processes are configured in the menu "PARAM" → "Set up 2" → "ChemoClean". Here, the automatic or event-controlled cleaning can be adapted to the process conditions.
   One or more of the following controls are possible:
   – Weekly programme (see below, Fields OA1 to OAA5): Any number of cleanings can be started on each weekday
   – External control: a start can be triggered via the digital input. For this, external control must be activated in Field O1, "Select control levels": Ext. control "on")
   – Clean trigger: Cleaning is carried out if an error with a cleaning trigger occurs, (see also Field LM1 under "Set up 2" → "Check systems")
   – Power failure: cleaning is started after a power failure.

Manual operation:
Rapid on-site cleaning can be carried out with the menu:
"PARAM" → "Manual operation" → "ChemoClean" → press "E" twice ("start cleaning")

Weekly programming:
"PARAM" → "Set up 2" → "ChemoClean":
Each day can be programmed individually. The following programmes are available

- "Clean": Cleaning started by entering the start time (s. fig. 27).
- "Clean Int": Cleaning is carried out at intervals with a defined spacing (s. fig. 27). This programme cannot be started via the binary inputs directly.
- "User": User-defined cleaning programmes (create in Programme Editor; from Field NAD1).

Programme sequences (cleaning example)
Monday:
2 x cleaning (at 11:00 and at 18:00) with 120 s. water, of which 60 s. additionally with cleaner.
Clean every 30 mins. between 18:20 and 24:00 (= 1800 s.) with 120 s. water, of which 60 s. additionally with cleaner.

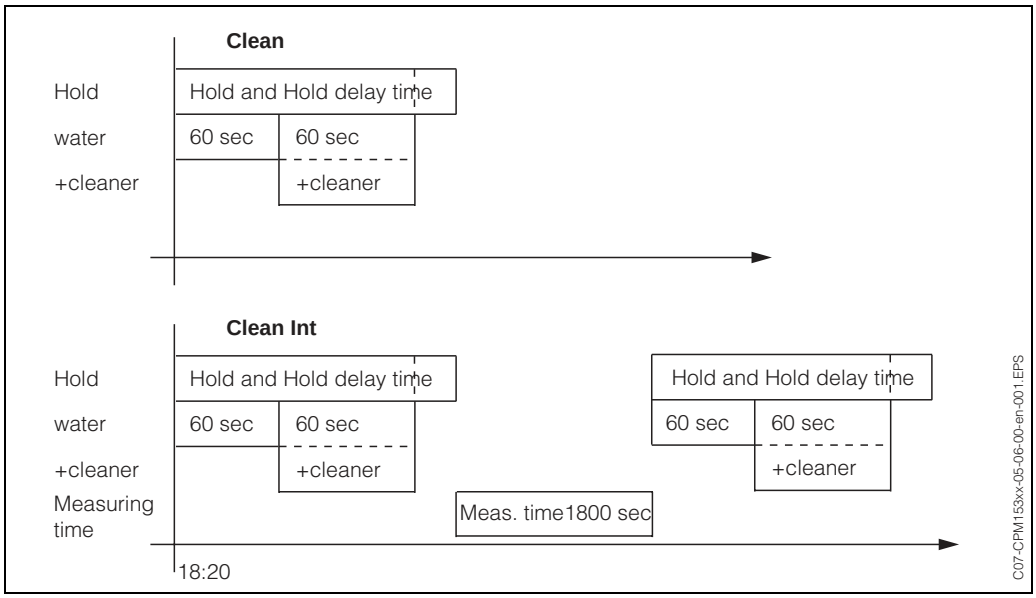


Fig. 27: Graphic representation of the above example

Required settings according to the example
(bold: to be set by user):

Field OAA1		**Field OAA2 (with "Clean")**		**Field OAA2 (with "Clean Int")**	
Clean		01 Water	**60 s**	01 Water	**60 s**
11:00	11:02	02 +Cleaner	**60 s**	02 +Cleaner	**60 s**
Clean		03 Water	**0s**	03 Water	**0s**
18:00	18:02	04 Rep. Clean	**0x**	Measuring time	**1800s**
Clean Int					
18:20	24:00				

In this way, each day can be programmed (or copied) individually.

To enter the menu, proceed as follows:



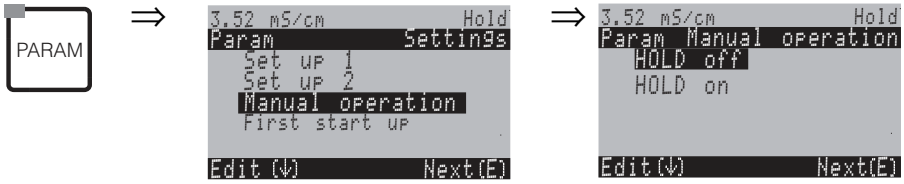
CODE	CHOICE (default = bold)	INFO
P1	Weekly progr. **off** Clean trigger **off** Ext. Control **off**	**Select control levels** Activate the function which should trigger ChemoClean cleaning.
P2	Weekly progr. **off** Clean trigger **off** Ext. Control **off**	**Note in display:** Displays the current system status
P3	**Weekly progr.** User prg.	**Select the configuration menu** *Weekly programme*: Select only with "weekly programme on" *User programme*: Here you create customer-specific programmes using the Programme Editor (see Programme Editor, p. 71).
Weekly programme:		
PA1	Monday 1 Tuesday 2 ..... Sunday 0	**Weekday selection menu** Select cleaning day. The number of cleaning triggers for the day is shown behind each day.
PA2	Edit day? Copy day?	**Select day function** *Edit day*: You edit the cleaning sequence for this day. *Copy day*: The day selected in OA1 is copied to the day selected in the field below.
Edit day:		
PAA1	Clean 18:22 18:23 **No progr.**	**View/edit day programme** You can see the complete daily programme or "No Progr.". You can overwrite the option and also the already set programmes by making a new selection. The start and finish times are always given. Example: Clean 18:22 (start time) 18:23 (finish time) User prog.: Use of a programme you created (see Programme Editor, p. 71)

CODE	CHOICE (default = bold)	INFO
PAA2	01 Water 0 s 02 +Cleaner 30 s 03 Water 30 s 04 Rep. cleaning 0x	**Select programme blocks** The times for individual programme steps can be individually adjusted here. Select a block for editing by pressing "E". *+Cleaner*: Cleaner is conveyed in addition to water. *Rep. cleaning*: Number of repetitions of the previous steps 01 ... 03 ✎ Note! • When you change one of this programme blocks the changes will affect every cleaning. • Leave this selection by pressing "PARAM".
PAA3	**0010 s** (0 ... 9999s)	**Water / cleaner:** Enter the time during which the valve remains open to allow the conveyance of water or cleaner.
PAA4	Repeat x number of times **00** (0 ... 10)	**Repeat cleaning** How often should the previous step (cleaner or water) be repeated?
Copy day:		
PAB1	Tuesday Wednesday ... Sunday	**? = Monday** **Select the day** to which you want to copy Monday (example). ✎ Note! Danger of data loss. When copying one day to another, the cleaning programmes of the *target day* are overwritten.
User programme: ***(Programme Editor)***		
PAB1	**User prog. 1**	**Select user programme** With ChemoClean there is *one* user programme available.
PAB1	**Edit** Insert template Enable Disable Rename	**Select edit function** *Insert template*: An installed programme (e.g. *Clean*) can be inserted into the user programme. ✎ Note! • After a programme is disabled, it can be re-enabled at any time. • Leave this item by pressing "PARAM".
Edit:		
PBA1	01 02	**Select rows** The row with the selected position number can be edited with "E". ✎ Note! Leave this selection by pressing "PARAM".

CODE	CHOICE (default = bold)	INFO
PBA2	**Change** Insert Move to Delete	**Select the edit function for the selected block** *Change*: The function is changed for the selected position *Insert*: A new block is inserted before the highlighted position. *Move to*: The highlighted function is moved to a different position. *Delete*: The highlighted function is deleted (there is **no** query whether you really want to delete!)
Change / insert:		
PBAA1	**Water** +Cleaner Wait Back to ...	**Select function** *Back to* : You can create a programme loop with this function (for repeats). Possible selection: Water, +cleaner, wait, back to
Move to:		
PBAA2	(Displays blocks as list) 01 Water 02 +Cleaner 03 Wait	**Select rows** You move the function selected in Field NADA1 to the highlighted position. ✎ Note! The highlighted function will be overwritten.
Insert template:		
PBB1	User prog. = ? **No prog.** Clean ———	**Select the template** you want to copy to the user programme.
Enable programme:		
PBC1	Programme is enabled	**Note in display (no entry):** The created or edited programme is enabled.
PBC2	**User prog.** (0 ... 9; A ... Z)	**Change name** 9-character name for your user programme, freely selectable.
Disable programme		
PBD1	Do you want to disable the programme?	**Query** Pressing "E" (= Continue) disables the programme. Pressing "PARAM" (= Cancel) takes you back without disabling the programme.
PBD2	The programme was disabled.	**Note in display (no entry)**
Rename programme:		
PBE1	**User prog.** (0 ... 9; A ... Z)	**Change name** 9-character name for your user programme, freely selectable.

6.4.18 Manual operation

To enter the menu, proceed as follows:



CODE	CHOICE (default = bold)	INFO
R1	ChemoClean Hold	**Select manual operation** ✎ Note! • Leave the manual operating menu by pressing "PARAM", "DIAG" or "MEAS". • The settings are only active in this menu. Nothing is saved when you leave.
R2	!!!Caution!! You are now leaving manual operation.	**If you leave the manual operation:** Note in display Confirm by pressing "Enter": Leave the manual operation. Cancel by pressing "PARAM": Continue with manual operation.
	ChemoClean:	
RB1	Weekly progr. off Clean trigger off Ext. Control off	**Note in display (no entry):** System status
RB2	abort **start**	**ChemoClean cleaning** Start / Abort. Here, each external programme start is suppressed. ✎ Note! Leave this item by pressing "PARAM".
	HOLD:	
RC1	**HOLD off** HOLD on	**Select manual operation** Activate / deactivate Hold The "HOLD" function freezes the current outputs as soon cleaning/calibration is undertaken. ✎ Note! If the controller function lies on current output 2, it follows the instructions of the defined "controller hold" (s. page 46).

6.4.19 Diagnosis

To enter the menu, proceed as follows:

DIAG ⇒



⇒

CODE	CHOICE (default = bold)	INFO
U	**Error list** Error log Operation log Calibration log service	*Error list*: Displays the current active errors. (Complete error list with description s. page 88) *Error log*: Lists the last 30 signalled errors with date and time. *Operation log* (service code necessary)*:* Lists the last 30 registered operating steps with date and time. *Calibration log*: Lists the last 30 calibrations undertaken with date and time. ✎ Note! • Use the arrow keys to scroll through the lists. • Leave the lists by pressing "E".
	Service:	
Y	**Factory settings** Simulation Instrument check Reset DAT handling Instrument version ChemoClean Factory function	**Selection for service diagnosis** *Factory settings*: Different data groups can be reset to the factory settings. *Simulation*: The transmitter behaviour can be simulated after entering various parameters. *Instrument check*: The instrument functions (display, keys, etc.) can be tested individually. *Reset*: Device reset ("warm start") *DAT handling*: Copy data into/out of the DAT module. *Instrument version*: Device internal data e.g. serial number can be queried. *ChemoClean* (only, if the complete ChemoClean function is activated): Inspecting programmes, inputs, mechanics. *Factory function*: Reset counter, write access

CODE	CHOICE (default = bold)	INFO
Factory settings:		
YA1	**cancel** Setting data Calibration data All data Service data Operation log Error log Calibration log	**Set default** Here you can select the data which you wish to reset to the factory settings. ✎ Note! *Danger of data loss*. Selecting a point and confirming with "Enter" deletes all the settings you made in this area! Pressing *Cancel* leaves this field without changing the values. Calibration data: All the saved data for calibrations such as zero point, slope, and offset. Setting data: The remaining data to be set. All data: Calibration data + setting data Service data: All data + logbooks + reset counters. Service data / logbooks: These functions are only for authorised service personnel. The service code is required.
Service data / logbooks:		
YAA1	**0000**	**Entry of the service code required** ✎ Note! For service code setting, see Field D1, p. 33.
YAA2		**Note in display:** Incorrect service code entry (back to the last field)
Simulations:		
YB1	Simulation: **off** Output 1: 12.00 mA Output 2: 04.00 mA	**Adapt simulation (current outputs)** *Simulation off*: The frozen values from the last measurement are used for the simulation. *Simulation on*: The current values for the outputs can be changed (Output 1, Output 2)
YB2	Simulation: **off** Measured value 1: 1mS/cm Temperature: 025.0 °C Measured value 2: 0mS/cm Temperature: 000.0 °C	**Adapt simulation (measured value/ temperature)** *Simulation off*: The frozen values from the last measurement are used for the simulation. *Simulation on*: The values (measured value/ temperature) can be changed.
YB3	Simulation: **off** Failure contact: off Contact 1: off Contact 2: off	**Adapt simulation (contacts)** *Simulation off*: The last statuses are frozen and used for the simulation. *Simulation on*: The contacts can either be opened (on) or closed (off). ✎ Note! If you return to the measurement mode with the simulation switched on, "Simul" and "Hold" flash in the display.

CODE	CHOICE (default = bold)	INFO
Instrument check:		
YC1	Display Keypad RAM EEPROM Flash	**Selection for check** *Display*: All the fields are queried alternately. Defective cells become visible. *Keypad*: All the keys must be pressed one after the other. If the system is functioning perfectly, the appropriate symbols appear in the display. *RAM*: "RAM O.K" message if there are no errors. *EEPROM*: "EEPROM O.K" message if there are no errors. *Flash* (memory): "Flash OK" message if there are no errors. ✎ Note! Leave this item by pressing "PARAM".
DAT handling:		
YD1	**Save to DAT** Read from DAT Erase DAT	**DAT selection** *Save to DAT*: You can save the both the configuration and the logbooks of your transmitter to the DAT module. *Read from DAT*: Copy the configuration saved on the DAT module into the EEPROM of the transmitter. *Delete DAT*: Delete all data on the DAT module. ✎ Note! • After the "Read from DAT" copying procedure, a reset is triggered automatically, and the device is configured with the copied values. (See below for reset). • If there is no DAT module inserted, a message appears on the display.
Save to DAT:		
YD2	!!Caution!! All the data on the DAT module will be deleted.	**Note in display** For safety reasons, you are asked if you really want to overwrite the existing data.
Read from DAT:		
YD3	in process	**Data were written to the DAT module**
Erase DAT:		
YD4	!!Caution!! All the data on the DAT module will be deleted.	**Note in display** For safety reasons, you are asked if you really want to overwrite the existing data.
Reset		
YE1		**Reset** You can restart the Mycom S with this function (similar to the "warm start" on your computer). You can use this function if the Mycom S does not react as expected. ✎ Note! This reset does not change saved data.

CODE	CHOICE (default = bold)	INFO
Instrument version:		
YF1	SW Version: 1.2 HW Version: 1 Serial No.: 1234567 Card ID: 8 A1B	**Controller data** Open controller data and the hardware version.
YF2	SW Version: 1.2 HW Version: 1 Serial No.: 1234567 Card ID: 8 A1B	**Basic module data**
YF3	SW Version: 1.2 HW Version: 1 Serial No.: 1234567 Card ID: 8 A1B	**Transmitter 1 data** Open transmitter data (1).
YF4	SW Version: 1.2 HW Version: 1 Serial No.: 1234567 Card ID: 8 A1B	**Transmitter 2 data** Open transmitter data (2).
YF5	SW Version: 1.2 HW Version: 1 Serial No.: 1234567 Card ID: 8 A1B	**DC-DC converter data** (only for two circuit)) Module for power supply of transmitter 2
YF6	SW Version: 1.2 HW Version: 1 Serial No.: 1234567 Card ID: 8 A1B	**Relay data**
YF6	12345678901234	**Enter serial number** 14 digit number consisting of 0 ... 9 and A ... Z
YF7	CLM153-A2B00A010	**Order Code** 15 digit number consisting of 0 ... 9 and A ... Z
ChemoClean:		
YH1	Weekly progr. off Clean trigger off Ext. Control off	**Note in display (no entry):** System status
YH2	With E running programme is aborted.	**Note in display (no entry):** To be able to carry out the diagnosis, you must abort the programme currently running by pressing the "Enter" key.
YH3	Ext. Inputs Mechanics	**Selection ChemoClean diagnosis**

CODE	CHOICE (default = bold)	INFO
Ext. Inputs:		
YHA1	Start Userprog Auto stop On Wait trigger On Ass. measurement On Ass. service On	**Info field: status of external digital inputs**
Hardware:		
YHB1	Water Cleaner Water and cleaner	**Select mechanics** Select a function which shall be tested.
YHB2	Weekly progr. **off** Clean trigger **off** Ext. Control **off**	**Note in display (no entry):** System status
Factory functions:		
YI1	**0**	**Reset counter** (only triggered by watchdog) Can be reset via Set Default → service data.
YH2	**0**	**Write access** Number of write accesses to the EEPROM is reported here.

6.4.20 Calibration

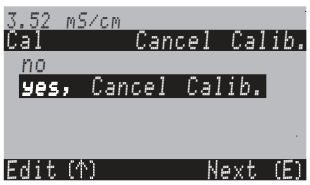
The calibration can be protected with the maintenance and the specialist codes. No calibration can be carried out at the display level (compare with page 33).

Procedure:

1. Move assembly to service position (when a rectractable assembly is used).
2. Remove sensor.
3. Clean sensor before calibration.

Calibration can be performed in two different ways:
- By measuring with a known conductivity (Fields xx to yy) in a calibration solution
- By entering the precise cell constant of the conductivity sensor (Field A5, p. 31).

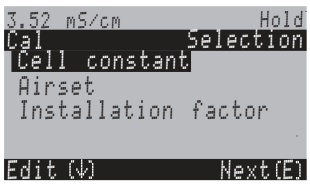
✎ Note!
- For the calibration described below, the transmitter must be in "Conductivity" operating mode. If the transmitter shows the resistance or concentration mode, you have to switch to conductivity mode throughout calibration.
- If automatic temperature compensation is selected for calibration (s. page 27), the corresponding temperature sensor must also be immersed in the calibration solution.
- The instrument switches automatically to Hold (factory setting) whenever it is calibrated.
- Cancel calibration by pressing the "MEAS" key.



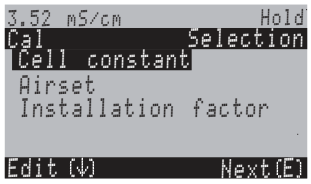
- If you confirm this with "yes, cancel cal.", you return to the measurement mode.
- If you select "no", calibration is continued.

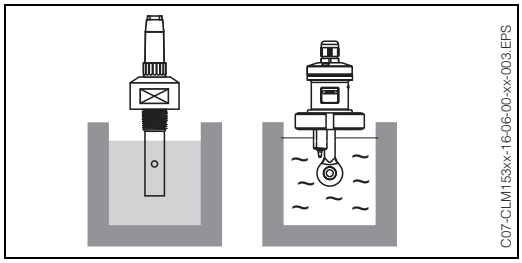
To enter the menu, proceed as follows:

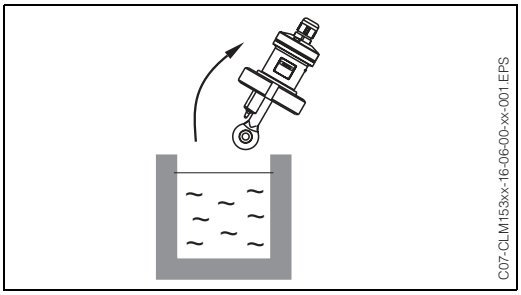
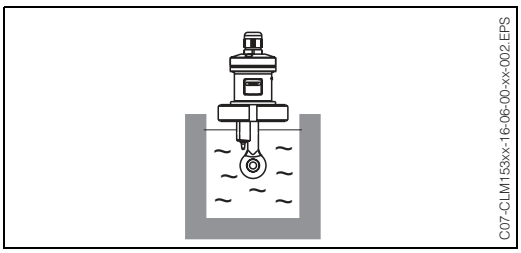
CAL ⇒



⇒



CODE	CHOICE (default = bold)	INFO
C1	**Sensor 1** Sensor 2 End calibration	**Selection for calibration** (only two circuit) Select sensor 1 *or* 2, and then run through calibration for each individual sensor.
C2	**Cell constant** Airset Installation factor (adaption factor)	**Selection** *Cell constant*: Calculate the cell constant of the sensor. *Airset* (only inductive): The sensor must be calibrated at air and in a dry state. *Installlation factor (adaption factor*) (only inductive): Sensor calibration with compensation for the wall effect.
	Cell constant:	
	Immerse the sensor (inductive or conductive) into the calibration solution. ✎ Note! Immerse the sensor in such a way that there is a minimum distance of 15 mm to the vessel wall, so that the installation factor does not play a role.	
	CB1	**025.0 °C** (–35.0 ... 250°C)	**Entry of MTC temperature** (only MTC)
	CB2	**2.10 % / K** (0.00 ... 20.00% / K)	**Alpha value (TC value)** Enter the α value of the calibration solution. This value is specified for the E+H calibration solutions or is calculated from the imprinted table
	CB3	**Current measured value** (0.0 ... 9999 mS/cm)	**Current measured value** Enter the correct conductivity value of the calibration solution. It makes sense to use a calibration solution which is at >40 % of the measuring range of the sensor used. The display is always in mS/cm.
	CB4	**5.9 cm-1** (0.1 ... 9.99 cm-1)	**Cell constant** The calculated cell constant is displayed and applied to Field A5 (s. page 31).
	CB5	**ok**	**Calibration status**
	CB6	**Accept** Reject Recalibrate	**End of calibration** *Accept*: Pressing "E" accepts the new calibration data. *Reject*: The data are not accepted, a recalibration will not be started. *Recalibrate*: The data are rejected and a new calibration will be started.

CODE	CHOICE (default = bold)	INFO
	Proceed with E	
Airset (only inductive):		
Remove sensor from the liquid and dry **thoroughly**. ✎ Note! As long as the sensor is out of the medium during Airset, an error code referring to measuring range violation (E055/E056) can be ignored.		
CA1	**0.0µS/cm**	**Current measured value** Start calibration residual coupling using CAL key.
CA2	**42µS/cm** (–80 ...80 µS/cm)	**Residual coupling** The residual coupling of the system (sensor and transmitter) is displayed.
CA3	**ok**	**Calibration status**
CA4	**Accept** Reject Recalibrate	**End of calibration** *Accept*: Pressing "E" accepts the new calibration data. *Reject*: The data are not accepted, a recalibration will not be started. *Recalibrate*: The data are rejected and a new calibration will be started.
	Proceed with E	
Installation factor (adaption factor) (only inductive):		
The sensor remains in the place of application.		
CC1	**025.0 °C** (–35.0 ... 250°C)	**Entry of MTC temperature** (only MTC)
CC2	**2.10 % / K** (0.00 ... 20.00% / K)	**Alpha value (TC value)** Enter the α value of the calibration solution. This value is specified for the E+H calibration solutions or is calculated from the imprinted table
CC3	**Current measured value** (0.0 ... 9999 mS/cm)	**Current measured value** Enter the correct conductivity value of the calibration solution. It makes sense to use a calibration solution which is at >40 % of the measuring range of the sensor used. The display is always in mS/cm.
CC4	**1** (0.10 ... 5.00)	**Installation factor((Adaption factor)** The calculated installation factor is displayed and applied to Field A5 (s. page 31).

CODE	CHOICE (default = bold)	INFO
CC5	**Accept** Reject Recalibrate	**End of calibration** *Accept*: Pressing "E" accepts the new calibration data. *Reject*: The data are not accepted, a recalibration will not be started. *Recalibrate*: The data are rejected and a new calibration will be started.
	Proceed with E	

7 Maintenance

The transmitter Mycom S CLM 153 itself does not contain wear parts and is maintenance free.
Measuring point maintenance comprises:

- Cleaning of assembly and sensor,
- Inspecting cables and connections,
- Calibration (s. page 81).



Warning!
Danger to persons. If you have to remove the sensor for servicing or calibration work, pay attention to the hazards caused by pressure, temperature and contamination.



Caution!
Remember that any maintenance work on the instrument, assembly or sensors may have impacts on process control and the process itself.

7.1 Maintaining the measuring system

7.1.1 Cleaning

Depending on the process, and as far as necessary, the assembly, cables and sensor must be cleaned externally before inspection and calibration. For your own safety always follow the safety instructions (see above). If necessary wear protective clothing.

Remove dirt and deposits:
The selection of cleaning agent depends on the type of soiling. The most frequent soiling and the associated cleaning agents are listed in the table below:

Type of soiling	Cleaning agent
Greases and oils	Substances containing tensides (alkaline) or water-soluble organic solvents (e.g. alcohol)
⚠ Warning! Danger of caustic burns! Protect your hands, eyes and clothing when you use the following detergents.	
Calciferous deposits, metal hydroxide deposits, heavy biological deposits Light biological deposits	3% HCl or with ChemoClean: HCl (10%) in injector thinned to approx. 3%
Sulphide deposits	Mixture of hydrochloric acid (3%) and thiocarbamide (commercially available)
Protein deposits	Mixture of hydrochloric acid (0.1 molar) and pepsin (commercially available)
Light biological deposits	Water under pressure

7.1.2 Inspecting cables and connections

Please check cables and connections using the following checklist. As there are many different combination possibilities, these instructions are kept to a general level and must be applied to the current installation.

- Check the sensor plug-in head for airtightness and humidity.
- Check the sensor cable and particularly the outer insulation for breaks.
- Sensor cables which have become damp on the inside must be replaced. Drying alone is not sufficient!
- If you are using a junction box: The inside of the box must be clean and dry. Moist dehydrating bags must be replaced.*
- Retighten the terminals in the junction box.*
- For in-field instruments: Retighten the terminals in the instrument. Also check that the interior and the PCBs are clean, dry and free of corrosion (if not, check the seals and threaded joints for leaks and breaks). *, **
- For panel-mounted instruments: Retighten the terminals on the instrument, check the BNC connector. *, **
- Cable screens must be connected exactly as shown in the wiring diagram. If the screen is connected incorrectly or not at all, the fail-safety of the instrument could be impaired.

**: The frequency of these checks is dependent on environmental influences. In a normal climate and non-aggressive environment, an annual check is sufficient.*

***: This work may only be carried out on a voltage-free instrument, as some of the terminals carry mains voltage.*

7.1.3 Simulation of conductive sensors for device test

You can check the transmitter for conductive conductivity by substituting resistances for the measurement section and temperature sensor. The accuracy of the simulation depends on the accuracy of the resistances.

Temperature
The temperature values in the table on the right apply if a temperature offset is not set at the Mycom S.
All temperature values are increased by factor 10 for temperature sensor type Pt 1000.

✎ Note!
- Connect the temperature equivalent resistance in three-wire technology.
- You can use the service kit "Cond. test adapter" (Order No.: 51500629) when connecting resistance decades instead of the cond. sensor.

Pt 100 equivalent resistances:

Temperature	Resistance value
–20 °C	92.13 Ω
–10 °C	96.07 Ω
–0 °C	100.00 Ω
10 °C	103.90 Ω
20 °C	107.9 Ω
25 °C	109.73 Ω
50 °C	119.40 Ω
80 °C	130.89 Ω
100 °C	138.50 Ω
200 °C	175.84 Ω

Conductivity
If the cell constant *k* is set to the value in the second column of the table on the right, then the conductivity values of this table apply.
Otherwise the following applies:
Conductivity[mS/cm] = *k* · 1/R[kΩ]

Resistance R	Cell constant *k*	Display with conductivity
10 Ω	1 cm-1	100 mS/cm
	10 cm-1	1000 mS/cm
100 Ω	0.1 cm-1	1 mS/cm
	1 cm-1	10 mS/cm
	10 cm-1	100 mS/cm
1000 Ω	0.1 cm-1	0.1 mS/cm
	1 cm-1	1 mS/cm
	10 cm-1	10 mS/cm
10 kΩ	0.01 cm-1	1 µS/cm
	0.1 cm-1	10 µS/cm
	1 cm-1	100 µS/cm
	10 cm-1	1 mS/cm
100 kΩ	0.01 cm-1	0.1 mS/cm
	0.1 cm-1	1 µS/cm
	1 cm-1	10 µS/cm
1 MΩ	0.01 cm-1	0.01 µS/cm
	0.1 cm-1	0.1 µS/cm
	1 cm-1	1 µS/cm
10 MΩ	0.01 cm-1	0.001 µS/cm
	0.1 cm-1	0.01 µS/cm

7.1.4 Simulation of inductive sensors for device test

An inductive sensor alone cannot be simulated using resistances. However, you can use equivalent resistances to check the entire system CLM 153 (inductive) including the sensor. Please pay attention to the cell constant *k* (e.g. $k_{nominal}$ = 2 for CLS 50, $k_{nominal}$ = 5.9 for CLS 52).

For an exact simulation, use the cell constant actually used (can be read off in Field C124) for calculating the reading:
Display cond.[mS/cm] = *k* · 1/R[kΩ]

Reference values for the simulation CLS 52 at 25 °C:	Simulation resistance R	Cell constant *k*	Display cond.
Carrying out the simulation: Guide a line through the opening of the sensor and connect it to a resistance decade, for example.	6.8 Ω	5.90 cm-1	8.68 mS/cm
	33 Ω	5.90 cm-1	178.8 mS/cm
	330 Ω	5.90 cm-1	17.88 mS/cm
	3.3 kΩ	5.90 cm-1	1.788 mS/cm

7.1.5 Checking conductive conductivity sensors

- Measuring surface connection:
  The measuring surfaces are directly connected with connections of the sensor plug. Check with ohmmeter at < 1 Ω.
- Measuring surface shunt:
  A shunt may not exist between the measuring surfaces. Check with ohmmeter at > 20 MΩ.
- Temperature sensor shunt:
  A shunt may not exist between the measuring surfaces and the temperature sensor. Check with ohmmeter at > 20 MΩ.
- Temperature sensor
  Refer to the sensor nameplate for the type of temperature sensor used.
  The sensor can be checked with an ohmmeter at the sensor plug:
  – Pt 100 at 25 °C = 109.79 Ω
  – Pt 1000 at 25 °C = 1097.9 Ω
  – NTC 10k at 25 °C = 10 kΩ
- Connection:
  Make sure the terminals are correctly assigned for sensors with terminal connection (CLS 12/13). Check that the terminal screws are secure.

7.1.6 Checking inductive conductivity sensors

The following data apply to sensors CLS 50 and CLS 52.

- Test send coil and receive coil (white and rot coaxial cable, each measured between inner connector and screen):
  – ohmic resistance approx. .5 ... 2 Ω
  – Inductance approx. 260 ... 450 mH (at 2 kHz).
- Test coil shunt:
  A shunt may not exist between the coils (from red coax to white coax). Check with ohmmeter at > 20 MΩ.
- Test temperature sensor:
  You can use the table in chap. 7.1.3 to check the Pt 100. The resistance values between the green and white cores and green and yellow cores must be identical.
- Test temperature sensor shunt:
  Shunts may not exist between the temperature sensor (green, white or yellow lines) and the coils (red coax or white coax). Check with ohmmeter at > 20 MΩ.

7.1.7 Checking line extension and boxes

- Use the methods described in Chap. 8.7.2 or 8.7.3. to carry out a quick functional check from the sensor plug (for conductive sensors) or from the sensor (for inductive sensors) to the device. The easiest way to connect the resistance decades is with the "conductivity test adapter" service kit, Order No: 51500629.
- Check the junction boxes for:
  – moisture (impact at low conductivity, if necessary dry box, replace seals, insert dehydrating bag)
  – correct connection of all lines
  – connection of the outer screening
  – security of the terminal screws.

8 Troubleshooting

Trouble-shooting relates not only to measures which
- can be carried out without opening the instrument but also
- to instrument defects which require the replacement of components.

8.1 Troubleshooting instructions

In this chapter, you will find diagnosis information and information on eliminating errors which occur:

chap. 8.1.1, p. 88: Error number list → List of all occurring error numbers.
chap. 8.1.2, p. 91: Process-specific errors → e.g. temperature value is incorrect.
chap. 8.1.3, p. 93: Device-specific errors → e.g. display is dark.

Before starting the repair work, please note the following safety instructions:



Warning!
Danger to life.
- De-energise the instrument before you open it. Check that there is no voltage and secure the switch(es) against switch-on.
- If work is required under voltage, this may only be carried out by an electrician, but a second person must be present for safety reasons.
- Switching contacts may be powered by separate circuits. Also de-energise these circuits before you work on the terminals.



Caution!
Danger to components through electrostatic discharge (ESD).
- Electronic components are sensitive to electrostatic discharge. Take protective measures, e.g. remove the charge from your person by touching the PE or wear a permanent grounding in the form of a wrist strap.
  Highly dangerous: Plastic floors at low air humidity and clothing made of synthetic materials.
- For your own safety, always use genuine spare parts. Only genuine spare parts ensure the correct function, accuracy and reliability after repairs.

8.1.1 Error number list: Troubleshooting and configuration

In the following error list, you can find a description of all the error numbers occurring. For each error number there is also data on whether the factory setting (= Fact.) of this error triggers
- an alarm,
- an error current or
- cleaning.

To enter the error list, proceed as follows:

DIAG ⇒ 

⇒

✎ Note!
- Please process the errors as shown in Field H5 (Alarm menu) on page 45.
- The second column shows the assignment acc. to NAMUR work sheet NA64 (failure, maintenance, function control).

Error no.	NAMUR class	Error message	Possible causes / measures	Alarm contact		Error current		Automatic cleaning start	
				Fact.	User	Fact.	User	Fact.	User
E001	Failure	Memory error	Switch instrument off and back on. Corrective maintenance in the factory, if necessary.	yes		no		–	–
E002	Failure	User data invalid		yes		no		–	–
E003	Failure	No valid configuration							
E004	Failure	Erro invalid hardware or software	The new software cannot recognise the module.						
E006	Failure	Transmitter 2 error	Test with new transmitter.	yes		no		–	–
E007	Failure	Transmitter 1 error		yes		no		–	–
E008	Failure	Sensor error 1	Check sensor and sensor connection (chap. 7.1.5 / chap. 7.1.6 or by E+H service)	yes		no		no	
E009	Failure	Sensor error 2		yes		no		no	
E010	Failure	Temperature sensor 1 defective	Check temperature sensor and connections; if necessary, check transmitter with temperature simulator.	yes		no		no	
E011	Failure	Temperature sensor 2 defective		yes		no		no	
E019	Failure	Delta exceeded failure	Check single measured values (input 1 / input 2) for plausibility	yes		no		–	–
E025	Failure	Limit Airset Offset CH 1 exceeded	Carry out airset again (only inductive; at air) or replace sensor. Clean and dry sensor before airset.						
E026	Failure	Limit Airset Offset CH 2 exceeded							
E034	Failure	Cell constant sensor 1 exceeded	Clean sensor and recalibrate; if necessary, check sensor, line and connections.	yes		no		–	–
E035	Failure	Cell constant sensor 1 undershot		yes		no		–	
E036	Failure	Cell constant sensor 2 exceeded		yes		no		–	
E037	Failure	Cell constant sensor 2 undershot		yes		no		–	

Error no.	NAMUR class	Error message	Possible causes / measures	Alarm contact		Error current		Automatic cleaning start	
				Fact.	User	Fact.	User	Fact.	User
E038	Maintenance	Delta limit exceeded	Check single measured values (input 1 / input 2) for plausibility Measuring can still continue until failure error E019 occurs.	yes		no		–	–
E046	Failure	Installation factor CH 1exceeded	Check pipe diameter, clean sensor and carry out calibration again (only for inductive).						
E047	Failure	Installation factor CH1 undershot							
E048	Maintenance	Installation factor CH 2 exceeded		yes		no		–	–
E049	Maintenance	Installation factor CH 2 undershot		yes		no		–	–
E053	Failure	Actuator error							
E054	Maintenance	Dosing time monitor	Feedback to controller defective	yes		no		–	–
E055	Failure	Display / measuring range of main parameter 1 undershot	Immerse sensor in conductive medium. For inductive: Carry out airset. As long as the sensor is out of the medium during Airset, an error code referring to measuring range violation can be ignored.	yes		no		no	
E056	Failure	Display / measuring range of main parameter 2 undershot		yes		no		no	
E057	Failure	Display / measuring range of main parameter 1 exceeded		yes		no		no	
E058	Failure	Display / measuring range of main parameter 2 exceeded		yes		no		no	
E059	Failure	Temperature measuring range 1 undershot	Temperature sensor defective; Sensor line interrupted or short-circuited; Incorrect sensor type selected Simulation s. chap. 7.1.3 / chap. 7.1.4.	yes		no		no	
E060	Failure	Temperature measuring range 2 undershot		yes		no		–	–
E061	Failure	Temperature measuring range 1 exceeded		yes		no		no	
E062	Failure	Temperature measuring range 2 exceeded		yes		no		–	–
E063	Failure	Current range current output 1 undershot	Measured value outside specified current range: Check measured value for plausibility, if necessary adjust current output assignment 0/4 mA and/or 20 mA.	yes		no		no	
E064	Failure	Current range current output 1 exceeded		yes		no		no	
E065	Failure	Current range current output 2 undershot		yes		no		–	–
E066	Failure	Current range current output 2 exceeded		yes		no		–	–
E067	Maintenance	Setpoint controller / LS 1 exceeded	Dosing devices defective; chemical supply empty; measured value incorrect → check for plausibility and function; Incorrect control direction set; incorrect contact assigned; Incorrect control function assigned	yes		no		–	–
E068	Maintenance	Setpoint controller / LS 2 exceeded		yes		no		–	–
E069	Maintenance	Setpoint controller / LS 3 exceeded		yes		no		–	–
E070	Maintenance	Setpoint controller / LS 4 exceeded		yes		no		no	
E071	Maintenance	Setpoint controller / LS 5 exceeded		yes		no		no	

Error no.	NAMUR class	Error message	Possible causes / measures	Alarm contact		Error current		Automatic cleaning start	
				Fact.	User	Fact.	User	Fact.	User
E072	Failure	Polarisation error 1	Clean sensor. Use higher cell constant.						
E073	Failure	Polarisation error 2		yes		no		no	
E074	Failure	Temperature out of alpha table 1	Check measurement and tables for plausibility; if necessary, adjust or extend table.	yes		no		no	
E075	Failure	Temperature out of conc table 1		yes		no		no	
E076	Failure	Cond out of conc table 1		yes		no		no	
E077	Failure	Temperature out of alpha table 2	Check measurement and tables for plausibility; if necessary, adjust or extend table.						
E078	Failure	Temperature out of conc. table 2							
E079	Failure	Cond out of conc. table 2							
E080	Funct. check	Range for current output 1 too small	Increase measuring range span for current output assignment	no		no		no	
E081	Funct. check	Range for current output 2 too small		no		no		no	
E100	Funct. check	Current simulation active	Check if functions were consciously selected	no		no		no	
E101	Funct. check	Service function active		no		no		no	
E106	Funct. check	Download active	Wait for download to end.	no		no		no	
E116	Failure	Download error	Repeat download.	no		no		no	
E117	Failure	DAT updownload error	Check with other DAT memory module; when writing to DAT: repeat write process	yes		no		–	–
E152	Maintenance	PCS circuit 1 alarm	Conductivity sensor defective or totally soiled; measured water flow in bypass interrupted; air cushion in assembly; measuring line interrupted	no		no		no	
E153	Maintenance	PCS circuit 2 alarm		no		no		no	
E154	Maintenance	USP error 1	Conductance too high, check process. Check temperature for plausibility.	no		no			
E155	Maintenance	USP temp error 1		no		no			
E156	Maintenance	USP error 2		no		no		no	
E157	Maintenance	USP temp error 2		no		no			
E171	Maintenance	Current/resistance input 1 below range	Measure input signal. Permitted: 4 ... 20 mA Resistance input: see controller configuration (feedback) also	no		no			
E172	Maintenance	Current/resistance input 1 above range		no		no			
E173	Maintenance	Current input 2 below range	Cause is the connected device or the wiring.	no		no			
E174	Maintenance	Current input 2 above range		no		no			

8.1.2 Process-specific errors

Error	Possible cause	Remedial action	Equipment needed, spare parts
Instrument unconfigurable, Display for code prompt is 9999	Instrument hardware is locked via keypad (Keys "CAL" + "DIAG" simultaneously = security locking)	Press "MEAS" and "PARAM" simultaneously to unlock.	
Permanent, incorrect measured value	Sensor does not immerse completely	Check installation position	
	Air cushion in assembly	Check assembly and installation position	
	Earth fault at or in the instrument	Test measurement in insulated vessel, possibly with calibration solution	Plastic vessel, calibration solutions. Behaviour, when instrument is connected to process?
	Instrument in impermissible operating state (no response on pressing key)	Switch instrument off and on	EMC problem: If repeated, check grounding and wire routing
Incorrect temperature reading	Incorrect sensor connection	Check connections using wiring diagram	Wiring diagram s. chap. 4.1.1
	Measuring cable defective	Check cable	Ohmmeter
	Incorrect sensor type selected	Set sensor type on instrument (Field 141)	Check temperature sensor with Ohmmeter.
	Sensor defective	Check sensor	
Measured values fluctuate	Interference in measuring cable	Connect cable screens as per terminal diagram	Wiring diagram s. chap. 4.1.1
	Faults in signal output line	Check line installation, possibly route line separately.	
Div. controller, timer or clean functions cannot be activated	Relay module not available for relay 3 - 5	Install 3 relay module M3R-3	Order number and installation s. page 95.
Controller / limit contact does not work	Controller switched off	Activate controller s. chap. 6.4	
	Controller in “Manual / Off” mode	Select "Auto" or "Manual on" mode.	Keypad / PARAM / manual operation / contacts
	Pick-up delay setting too long	Switch off or shorten pick-up delay period	
	"Hold" function active "Auto hold" during calibration "Hold" input activated Manual "hold" active using keypad "Hold" active during configuration	Determine cause of hold and eliminate if not desired	"Hold" is indicated in display when active
Controller / limit contact work continuously	Contact in "Manual/on" mode	Set controller to "Manual/off" or "Auto".	
	Dropout delay setting too long	Shorted dropout delay period	
	Control circuit interrupted	Check measured variable, current output or relay contacts, actuators, chemical supply	
No conductivity/mV current output signal	Line open or short-circuited	Disconnect both (!) lines and measure directly on instrument	mA meter 0–20 mA DC
	Output defective	Replace controller module	
Fixed current output signal	Current simulation active	Switch off simulation	s. DIAG / Service / Simulation
	Processor system inactive	Switch instrument off and on	EMC problem: If repeated, check installation
	"Hold" is active.	"Hold" status see display.	

Error	Possible cause	Remedial action	Equipment needed, spare parts
Current output signal incorrect or different than expected	Incorrect current assignment	Check current assignment: 0–20 mA or 4–20 mA selected?	
	Incorrect signal assignment	Any current output can be assigned to any measured value (conduct. 1 or 2, temp. 1 or 2, characteristic value)	Check under "PARAM" / current output.
	Total load in current circuit too high (> 500 ohms)	Disconnect output and measure current directly on instrument	mA Meter for 0–20 mA DC
Feed forward control does not work	Additional module M3R-x missing	Additional module M3R-2I with 1 or M3R1I with 2 current inputs	See spare parts list in chap. 8.3
	Incorrect version		Resistance input only permissible with non-Ex.
Feedback input does not work	Additional module M3R-x missing		See spare parts list in chap. 8.3 Resistance input only permissible with non-Ex.
Feedback incorrect	Feedback potentiometer outside range	Smallest permissible potentiometer 1 kOhm, largest permissible potentiometer 10 kOhms	
	Feedback range not set or not set correctly	Set lower and upper range value in "PARAM" menu	
Feedback varies	Connecting cable in non-screened version	Replace cables with screened cables.	
	Cable screening not applied to transmitter.	Apply cable screening to PE rail.	
	Feedback cable is parallel to h.c. power line (inductive coupling).	Apply cable screening on PE, both sides.	
Data cannot be saved	No DAT memory module available		DAT available as accessory, s. chap. 9

8.1.3 Instrument-specific errors

Error	Possible cause	Tests and / or remedial action	Equipment, spare parts, personnel
Display dark, no LEDs active	No mains voltage	Check whether mains voltage is applied	Electrician / e.g. multimeter
	Incorrect supply voltage or too low	Compare actual mains voltage with nameplate data	
	Connection defective	Terminal not picked-up; insulation clamped	
	Instrument fuse defective (non-Ex)	Replace fuse after comparing mains voltage and nameplate data	Electrician / correct fuses; s. drawings in chap. 8.7
	Power unit defective	Replace power unit, pay attention to variant	On-site diagnosis: all 6 red LEDs on the M3G module must be lit
	Central module defective (if all 6 LEDs on the power unit are lit)	Replace central module pay attention to variant	On-site diagnosis by E+H Service (test module required)
	Ribbon cable loose or defective	Check ribbon cable	Cable soldered onto the site of the M3G module
Display dark, but LED active	Central module defective (Module: M3Cx-x)	Replace central module M3Cx-x	On-site diagnosis by E+H service (test module required)
Display functioning, but not change in display and/or instrument cannot be operated	Instrument or module in instrument not correctly installed	Check module connections	See device view on page 96
	Operating system in impermissible state	Switch instrument off and on	Possibly EMC problem: if problem persists, have installation checked by E+H Service
Instrument gets hot	Incorrect mains voltage or too high	Compare mains voltage and nameplate data	
	Power unit defective	Replace power unit	all 6 red LEDs on the M3G module must be lit
Incorrect conductivity measured value / and / or temperature measured value	Transmitter module defective (module: MKIC), first carry out tests and take measures as per chap. 8.1.2.	Test measuring inputs: Connect resistances as per simulation tables p. 85/p. 85 and check display. Temp.: Resistance 100 W of terminals 11 to 12+ 13. Display must be 0 °C	If test negative: Replace module MKIC, bushing using the device view on page 96
Current output, Current value incorrect	Calibration incorrect	Test with integrated current simulation, connect mA meter directly to current output	If simulation value incorrect: new module M3Cx-x required. If simulation value correct: check current circuit for load and shunts
	Load too high		
	Shunt / short-circuit to frame in current circuit		
	Incorrect operating mode	Check, whether 0–20 mA or 4–20 mA is selected	
No current output signal	Current output stage defective (Module: M3CH-x)	Test with integrated current simulation, connect mA meter directly to current output	If test negative: Replace module M3CH-x (Check variants, see spare parts list in chap. 8.3)
	Instrument with PROFIBUS® interface	PROFIBUS® instruments do not have a current output	For information, see "DIAG" / instrument version

8.2 Response of outputs to errors

8.2.1 Response of current outputs

If an error occurs in the system, an error current is output at the current outputs. You can adjust the value of this error current in the Alarm menu (see page 44).
If you have configured the controller for functioning with a current output, no error current is output on this current output should an error occur.

8.2.2 Response of contacts to errors

You can select the assignment of which instrument error messages trigger an alarm individually for each error message, (see table on page 88, editing errors on page 45). In "NAMUR" mode, failure messages (E 001 – E 029) always trigger an alarm.

Behaviour with standard setting

Instrument status	Alarm relay	Limit value / Controller
Normal operation	picked-up (Fail-safe behaviour)	Appropriate configuration and operating status
Alarm	Dropped out	
Voltage-free	Dropped out	Dropped out

Behaviour with NAMUR setting

Instrument status	Alarm relay	Maintenance relay	Function check	Limit value / Controller
Normal operation	picked-up (Fail-safe behaviour)			Appropriate configuration and operating status
Failure	Dropped out			
Maintenance required	Picked up			
Function check	Picked up			
Voltage-free	Dropped out			Dropped out

8.2.3 Response of contacts to power failure

In the "Set up 1" menu → "Contacts", you can define the contacts as NC contacts or NO contacts (s. page 38). In the case of a power failure, the contacts will act according to the setting you make.

8.3 Spare parts

For your own safety, always use genuine spare parts. Only genuine spare parts ensure the correct function, precision and reliability after repair.

You receive all spare parts in the form with a unique code, optimally adapted packaging including ESD protection for modules and a set of instructions.

Spare parts list

No.	Kit name	Contents / Use	Order code
10	Terminal module non-Ex	Module M3K	51507084
30	Power supply 100 ... 230 VAC non-Ex	Module M3G, power unit + 3 relay	51507087
30	Power supply 24 VAC/DC non-Ex	Module M3G, power unit + 3 relay	51507089
40	DC/DC convertor for measuring circuit 2	Module M3DC / Ex and non-Ex	51507091
50	Controller module cond., 2 x current output	Module M3CH-S / Ex + non-Ex	51509506
50	Controller module cond., 2 x current + HART	Module M3CH-H / Ex + non-Ex	51509507
50	Controller module cond., PROFIBUS-PA	Module M3CH-PA / Ex + non-Ex	51507094
50	Controller module cond., PROFIBUS-DP	Module M3CH-DP / Ex + non-Ex	51507095
60	Cond. input module	Module MKIC / Ex + non-Ex	51501206
70	Relay module 3 additional relays	Module M3R-3 / Ex and non-Ex	51507097
70	Relay module 2 Rel. + 1 current input	Module M3R-2 / Ex and non-Ex	51507098
70	Relay module 2 Rel. + 1 resistance input	Module M3R-2 / Ex and non-Ex	51509510
70	Relay module 1 Rel.+ 2 current inputs	Module M3R-1 / Ex and non-Ex	51507099
70	Relay module 1 Rel. + 1 current input + 1 resistance input	Module M3R-1 / Ex and non-Ex	51509513
80	Terminal set for cond. input	6-pin terminal + two-pin terminal	xx
90	Jumper set	Five sets of all three jumper types	51507102
100	Partition plate for connection compartment	Five partition plates	51507103
110	Housing upper section non-Ex	Upper section with keypad sheet, connection compartment cover, hinge, des. sign	51507104
120	Housing lower section non-Ex	For one and two-circuit instruments, cpl.	51507106

8.4 Installation and removal of parts

Please observe the danger instructions in chap. 8.3.
The position designations relate to the spare parts list on page 94.

8.4.1 Instrument view

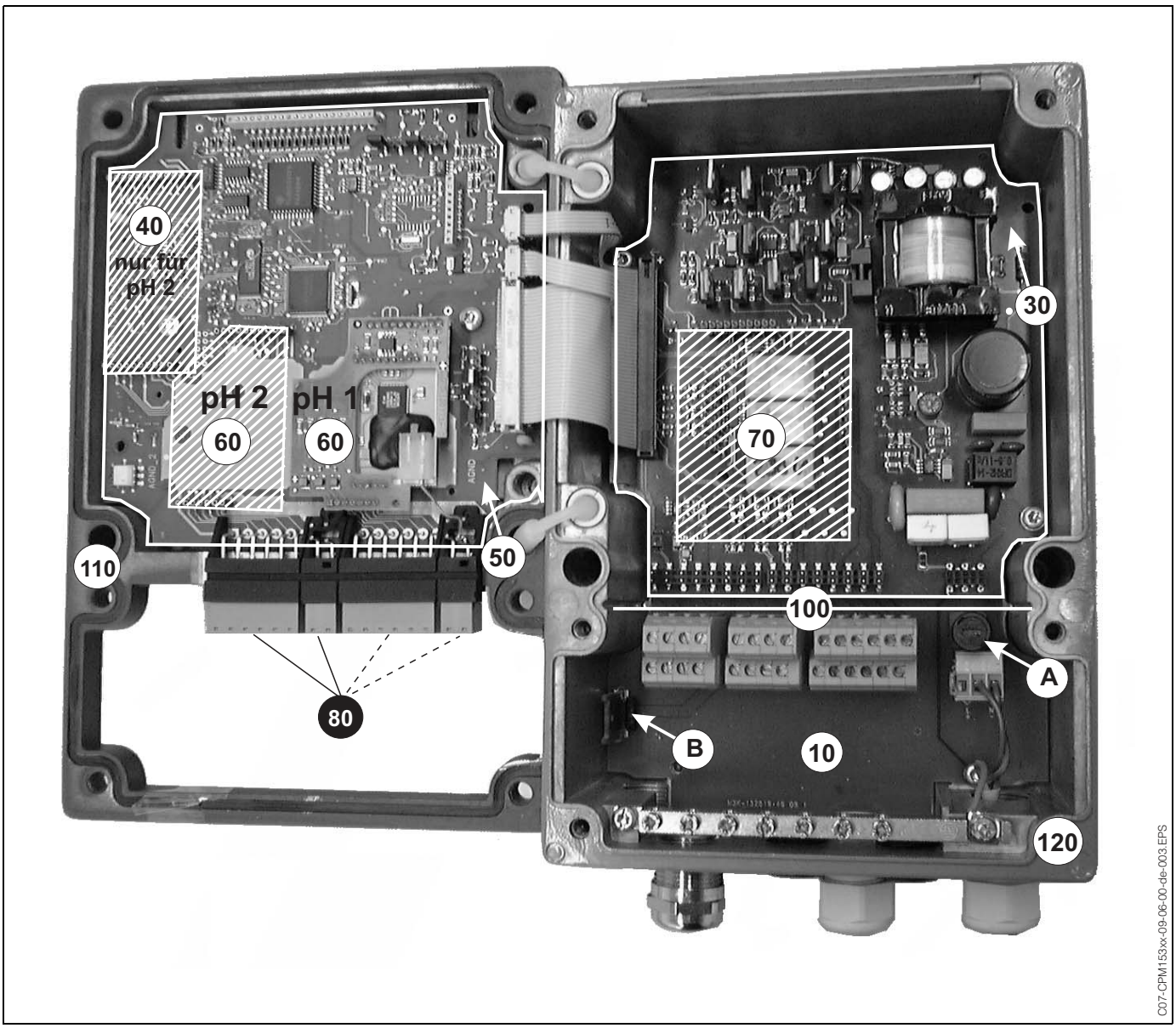


Fig. 28: Interior view of the transmitter Mycom S
Remarks:
A: The figure shows the non-Ex fuse.
B: Slot for DAT memory module
40 ... 70: Figure shows module 40. Modules 50, 60 and 70 look somewhat different.
90 ... 120: Figure shows module 90. Modules 100, 110 and 120 look somewhat different.
190: Partition plate (not shown in photo)
80, 130 and dotted position 170: Only available with two-circuit device

8.4.2 Coding

Current outputs active or passive:
For instrument versions CLM 153 xxA/Bxx (2 current outputs) and CLM 153 xxC/Dxx (2 current outputs with HART) the current outputs can be operated as active or passive. Jumpers on the controller module M3CH allow recoding.

For non-Ex instruments, these modules may be recoded to active outputs.



Warning!
Ex instruments must **not** be recoded. Doing so will cause loss of intrinsic safety!

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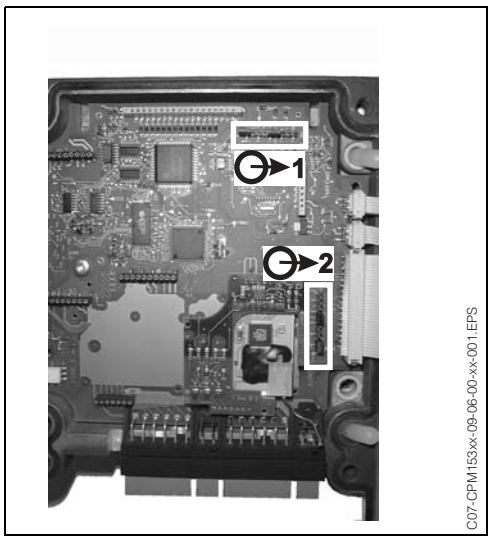


Fig. 29: Coding for current outputs (Interior view of the housing upper section)

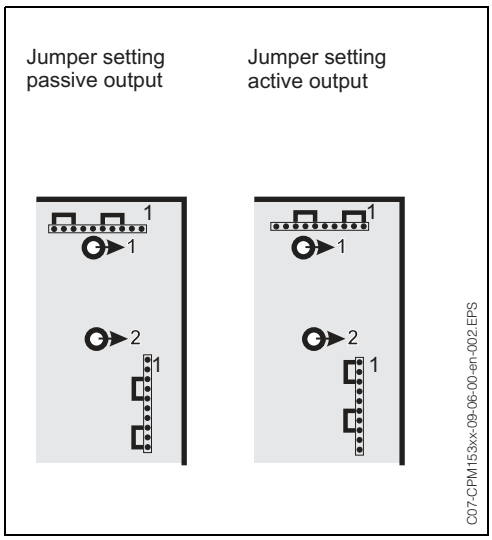


Fig. 30: Active/passive coding of the current outputs

8.5 Replacing the device fuses

For non-Ex devices



Warning!
Danger to persons. Before replacing the fuse, make sure the device is voltage-free.

- Position of the fuse holder: "A" in fig. 28
- Use only a 5 x 20 mm fine-wire fuse with 3.15 mA, semi time-lag fuse. All other fuses are not permitted.



Caution!
If the fuse should fail again, have the device checked.

8.6 Disposal

The Mycom S CLM 153 is a transmitter which contains electronic components and PCBs and therefore must be disposed of as electronic refuse. Please keep to the local regulations.

9 Accessories

Offline configuration

The PC tool provides you with a tool for configuring your measuring point at the PC using a simple and self-explanatory menu structure. Write the configuration to the DAT module using the RS232 interface on the PC. The module can then be plugged into the transmitter. You can switch the language via software. The offline configuration system consists of a DAT module, the DAT interface (RS 232) and the software for use with Windows NT/95/98/2000. Order No.: 51507133

DAT module

The DAT module is a memory device (EEPROM) which can be easily plugged into the connection compartment of the transmitter. Using the DAT module you can
- *save* the complete settings, the logbooks and the data logger of a transmitter and
- *copy* the complete settings to other CLM 153 transmitters with identical hardware functionality.

This considerably reduces the effort to install or service several measuring points. Order No.: 51507175

Assemblies

Type	Properties	Applications
DipFit W CLA 111	Immersion and installation assembly with flange DN 100. The Chemoclean sensor cleaning system can be integrated without any conversion needed. Technical Information: TI 135C/07/en, Order No.: 50076858	• Water • Wastewater • Process industry
DipFit W CYA 611	Immersion assembly with thread G 1, G ¾ or NPT ¾". Technical Information: TI 166C/07/en, Order No.: 50085985	• Water • Wastewater
DipFit P CLA 140	Immersion assembly with flange DN 80 PN 16, ANSI 3" 150 lbs or JIS 10K 80A. Sensor holder in bayonet style. Technical Information: TI 1196C/07/en, Order No.: 51500081	• Wastewater, paper industry

Conductivity sensors

Type	Properties	Applications
ConduMax W CLS 12/13	Can be adapted to the process for optimum results thanks to different designs. Installation in pipe or flow vessel at temperatures to 250 °C and pressures to 40 bar. Sensor shaft made of die-cast aluminium, sensors of stainless steel 1.4571 (AISI 316 Ti). Technical Information: TI 082C/07/en, Order No.: 50059349	• Industry • Power plants (e.g. condensate measurement) • Low conductivities at high pressures and high temperatures
ConduMax W CLS 15	Sterilisable up to 150°C Polished shaft made of stainless steel 1.4435 (AISI 316L). High accuracy thanks to individually measured cell constant. Installation in pipe or flow vessel. Technical Information: TI 109C/07/en, Order No.: 50065950	• Monitoring ion exchangers • Reverse osmosis • WFI (Water for Injection) • Chip cleaning
ConduMax H CLS 16	Pure and ultrapure water sensor: Measuring range from 0.04 to 500 µS/cm. Water-proof connection TOP68 or fixed cable. Sterilisable up to 150°C EHEDG and 3A certificates. Technical Information: TI 227C/07/en, Order No.: 51503431	• Pure water • Ultrapure water • Electro-deionisation • Distillation • WFI (Water for Injection)
ConduMax W CLS 21	High chemical, thermal and mechanical stability. Sensor shaft in PES (polyethersulphon). Technical Information: TI 085C/07/en, Order No.: 50059352	• Monitoring low concentrated saline solutions • Potable water treatment • Wastewater treatment

Type	Properties	Applications
InduMax P CLS 50	Very chemically stable sensor thanks to PFA jacketing. PEEK version for high temperatures to 180 °C. With Ex approval. Overall cable length to 55 m. Technical Information: TI 182C/07/en, Order No.: 50090385	• Chemical industry: • Concentration measurement of acids and alkalis • Product monitoring • Phase separation of product/ product mixtures
InduMax H CLS 52	Sensor shaft made of highly resistant, plastic (PEEK) which can be used with foodstuffs. Very short temperature response times (t_{90} < 5s). Measuring range from 10 µS/cm to 2000 mS/cm. Technical Information: TI 167C/07/en, Order No.: 50086110	• Foodstuff industry • Control of CIP systems

Service adapter Optoscope

The service adapter aids communication between Endress+Hauser transmitters and the PC using the service interface. You can use it to load new firmware and to save/write customer data (using a PC with the Windows 95/98 or Windows NT operating system).

ChemoClean cleaning

Sensor cleaning can be automated with the injector CYR 10 and the appropriate accessories for the different assemblies.

Sensor measuring cable

- Sensor measuring cable CPK 9 with TOP68 plug-in head (for high temperature applications, IP 68 / NEMA 6X, also for Ex). Extension with cable CYK 71 possible, see table "Measuring cable as yard goods".
- Measuring cable CLK 5 for inductive sensors
- Measuring cable CYK 71 for conductive sensors
- *Junction box VBM:* Junction box for extending measuring cable connection between sensor and transmitter. Two threaded joints for e.g. combination sensor. Material: aluminium casting, ingress protection IP 65. Order No. 50003987

Measuring cable as yard goods

Cable	Description	Order number
CYK 71	Measuring cable for conductive conductivity sensors, consisting of a coaxial cable and 4 pilot wires	50085333
	Measuring cable for Ex applications	50085673
CLK 5	Extension measuring cable for inductive conductivity sensors CLS 50 and CLS 52. To be used with the connection box VBM.	50085473

Flat seal

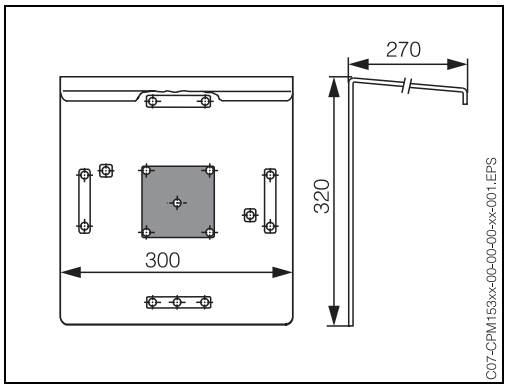
Flat seal for sealing the front panel mounting of the CLM 153. Order No.: 50064975

Weather protection cover CYY 101

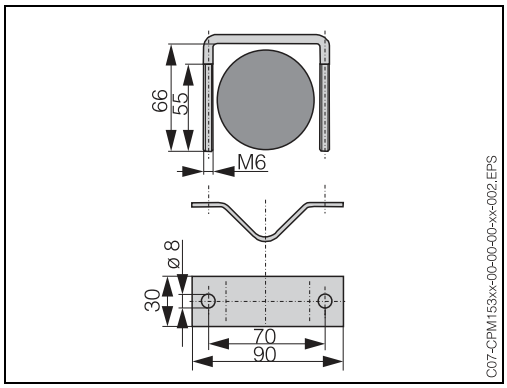
For installing the transmitter outdoors.

Round post fixture for weather protection cover

To fix the weather protection cover to vertical or horizontal posts with diameters of up to 60 mm. Order No.: 50062121



Weather protection cover CYY 101



Round post fixture for CYY 101

Technical Information TI 092C/07/en, Order No. 50061228

10 Technical data

10.1 Input

Measured variable	Conductivity, temperature		
Conductivity, inductive	Measuring range, non-compensated		0.04 µS/cm... 2000 mS/cm
	Measuring range, compensated		0.04 µS/cm ... 1000 mS/cm
Conductivity, conductive,	**Cell constant *k***	**Measuring range**	**Display range**
	0.01 cm^{-1}	0.0 nS/cm ... 600.0 µS/cm	0.0 µS/cm ... 200.0 µS/cm
	0.1 cm^{-1}	0.000 µS/cm ... 6000 µS/cm	0.000 µS/cm ... 2000 µS/cm
	1 cm^{-1}	0.00 µS/cm ... 60.00 mS/cm	0.00 µS/cm ... 20.00 mS/cm
	10 cm^{-1}	0.0 µS/cm ... 600.0 mS/cm	0.0 µS/cm ... 200.0 mS/cm
Resistance measurement	**Cell constant *k***	**Measuring range**	**Display range**
	0.01 cm^{-1}	20.0 kΩ·cm ... 80.0 MΩ·cm	20.0 kΩ·cm ... 37.99 MΩ·cm
	0.1 cm^{-1}	2.00 kΩ·cm ... 2000 kΩ·cm	2.00 kΩ·cm ... 3799 kΩ·cm
	1 cm^{-1}	0.200 kΩ·cm ... 200.0 kΩ·cm	0.200 kΩ·cm ... 379.9 kΩ·cm
Concentration measurement	**Selection**	**Conductivity range**	**Concentration**
	NaOH	0.0 mS/cm ... 410 mS/cm	0 ... 15 %
	HNO_3	0.0 mS/cm ... 781 mS/cm	0 ... 20 %
	H_2SO_4	0.0 mS/cm ... 723 mS/cm	0 ... 20 %
	H_3PO_4	0.0 mS/cm ... 73 mS/cm	0 ... 12 %
	User 1 ... 4	0.0 µS/cm ... 2000 mS/cm	0 ... 99.99 %
Temperature	Temperature sensor		Pt 100 (three-wire circuit) Pt 1000 NTC 30k
	Measuring range (can also be displayed in °F)		–50 ... +150 °C (NTC: –20 ... 100 °C)
	Measured value resolution		0.1 K
	Temperature offset		± 5K
Current inputs 1 / 2 (passive, optional)	Signal range		4 ... 20 mA
	Measured error[1]		max. 1% of measuring range
	Input voltage range		6 ... 30 V

Resistance input (active, optional, only with non-Ex)	Resistance ranges (software switchable)	0 ... 1 kΩ 0 ... 10 kΩ
	Measured error[1]	max. 1% of measuring range
Digital inputs	Input voltage	10 ... 50 V
	Internal resistance	R_i = 5 kΩ

[1]: acc. to IEC 746-1, under nominal operating conditions

10.2 Output

Output signal	Conductivity, resistance, concentration, difference, efficiency, temperature		
Current outputs	Current range	0 / 4 ... 20 mA	
	Error current	2.4 mA or 22 mA	
	Measured error[1]	< 0.2 % of current range maximum	
	Transmission characteristic	Linear, bilinear	
	Output distribution, temperature	17 ... 170 °C	
	Output distribution, minimum (maximum up to 100% of the measuring range):		
	For conductivity measurement for measured values in the range of:	0 ... 19.99 µS/cm: 20 ... 199.9 µS/cm: 200 ... 1999 µS/cm: 2 ... 19.99 mS/cm: 20 ... 2000 mS/cm:	2 µS/cm 20 µS/cm 200 µS/cm 2 mS/cm 20 mS/cm
	For resistance measurement for measured values in the range of:	0 ... 199.9 kΩ·cm: 200 ... 1999 kΩ·cm: 2 ... 19.99 MΩ·cm: 20 ... 200 MΩ·cm:	20 kΩ·cm 200 kΩ·cm 2.0 MΩ·cm 20 MΩ·cm
	For concentration measurement	No minimum spacing	
	Active current output (only non-Ex): Load	Max. 600 Ω	
	Passive current output: Input voltage range	6 ... 30 V	

[1]: acc. to IEC 746-1, under nominal operating conditions

Auxiliary voltage output (for digital inputs E1-E3)	Voltage	15 V DC
	Output current	max. 9 mA
Limit value and alarm functions	Setpoint adjustments	0 ... 100% of display range
	Hysteresis for switching contacts	1 ... 10% of display range
	Alarm delay entry	0 ... 6000 s

Controller output	Function (selectable):	Pulse-length controller (PWM) Pulse-frequency controller (PFM) Three-point step controller (3-PS) Analogue (via current output)
	Switch behaviour	P / PI / PID
	Control gain K_R	0.01 … 20.00
	Integral action time T_n	0.0 … 999.9 min
	Derivative action time T_v	0.0 … 999.9 min
	With the maximum settable frequency in PFM	120 min^{-1}
	With the maximum settable period length in PWM	1 ... 999.9 s
	With PWM minimum switch-on period	0.4 s
Relay contacts	The NC/NO contact type can be set by software.	
	Switching voltage	max. 250 V AC / 125 V DC
	Switching current	max. 3 A
	Switching power	max. 750 VA
	Lifespan	≥ 5 million switching cycles
Galvanic isolation	At the same potential are: • Current output 1 and power supply • Current output 2 and resistance input. The remaining circuits are galvanically isolated from each other.	
Electrical connection	Power supply for CLM 153-xxxx**0**xxxx	100 ... 230 V AC +10/–15%
	Frequency	47 ... 64 Hz
	Power supply for CLM 153-xxxx**8**xxxx	24 V AC/DC +20/–15%
	Power consumption	max. 10 VA
	Separation voltage between galvanically isolated circuits	276 V_{rms}
	Terminals, max. cable cross-sectional area	3 x 2.5 mm^2

10.3 Performance characteristics

Measured value resolution	Conductivity: Temperature:	0.001 µS/cm 0.1 K
Measured error[1] display	Conductivity, resistance, concentration: Temperature:	±0.5% ±2 digits of measured value < 0.5 K
Measured error[1] current output	additionally max. 0.2% of current range maximum	
Repeatability[1]	Conductivity, resistance, concentration: Temperature:	±0.2% ±2 digits of measured value max. 0.1% of measuring range

[1]: acc. to IEC 746-1, under nominal operating conditions

10.4 Environment

Ambient temperature range	–10 ... +55 °C
Ambient temperature limits	–20 ... +60 °C
Storage and transport temperature	–30 ... +80 °C
Relative humidity	10 ... 95%, non-condensing
Degree of protection	IP 65
Electromagnetic compatibility	Interference emission to EN 61326: 1997 / A1:1998; Class B resource (Housing sector) Interference emission to EN 61326: 1997 / A1:1998; Appendix A (Industrial sector)
Safety requirements	Complies with general safety requirements acc.to EN 61010. Complies with NAMUR Recommendations NE 21,1998.

10.5 Mechanical construction

Design, dimensions

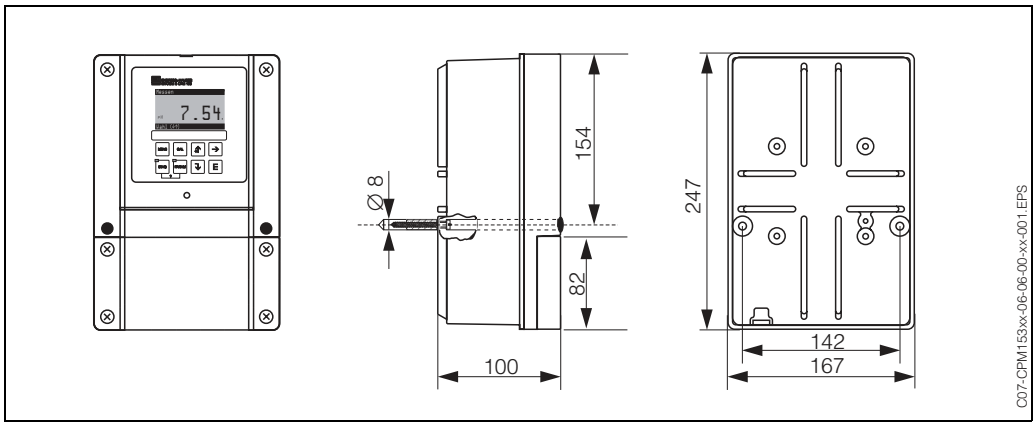


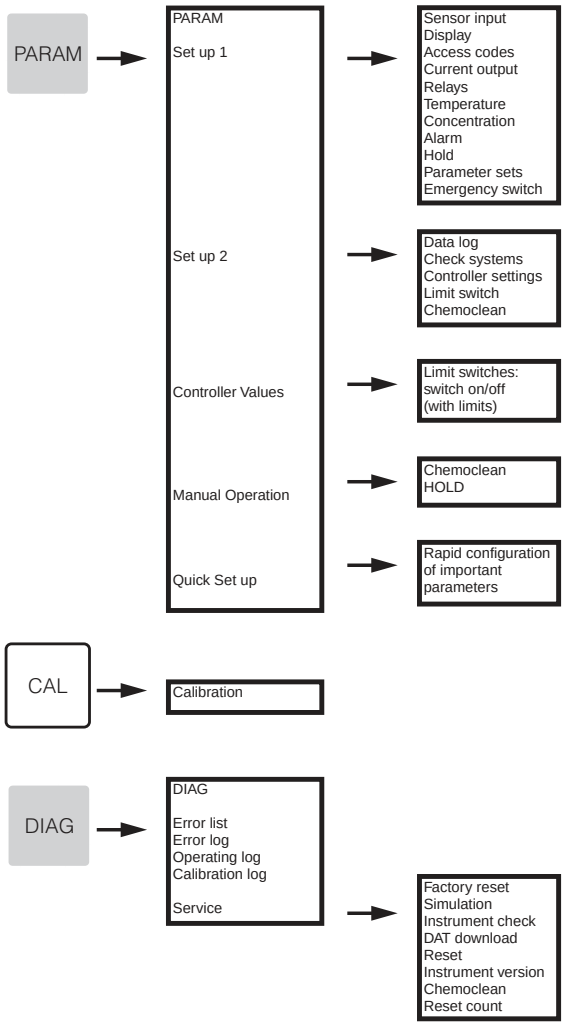
Fig. 31: Dimensions of transmitter Mycom S.

Weight	max. 6 kg	
Material	Housing	GD-AlSi 12 (Mg content 0.05%), plastic-coated
	Front	Polyester, UV-resistant

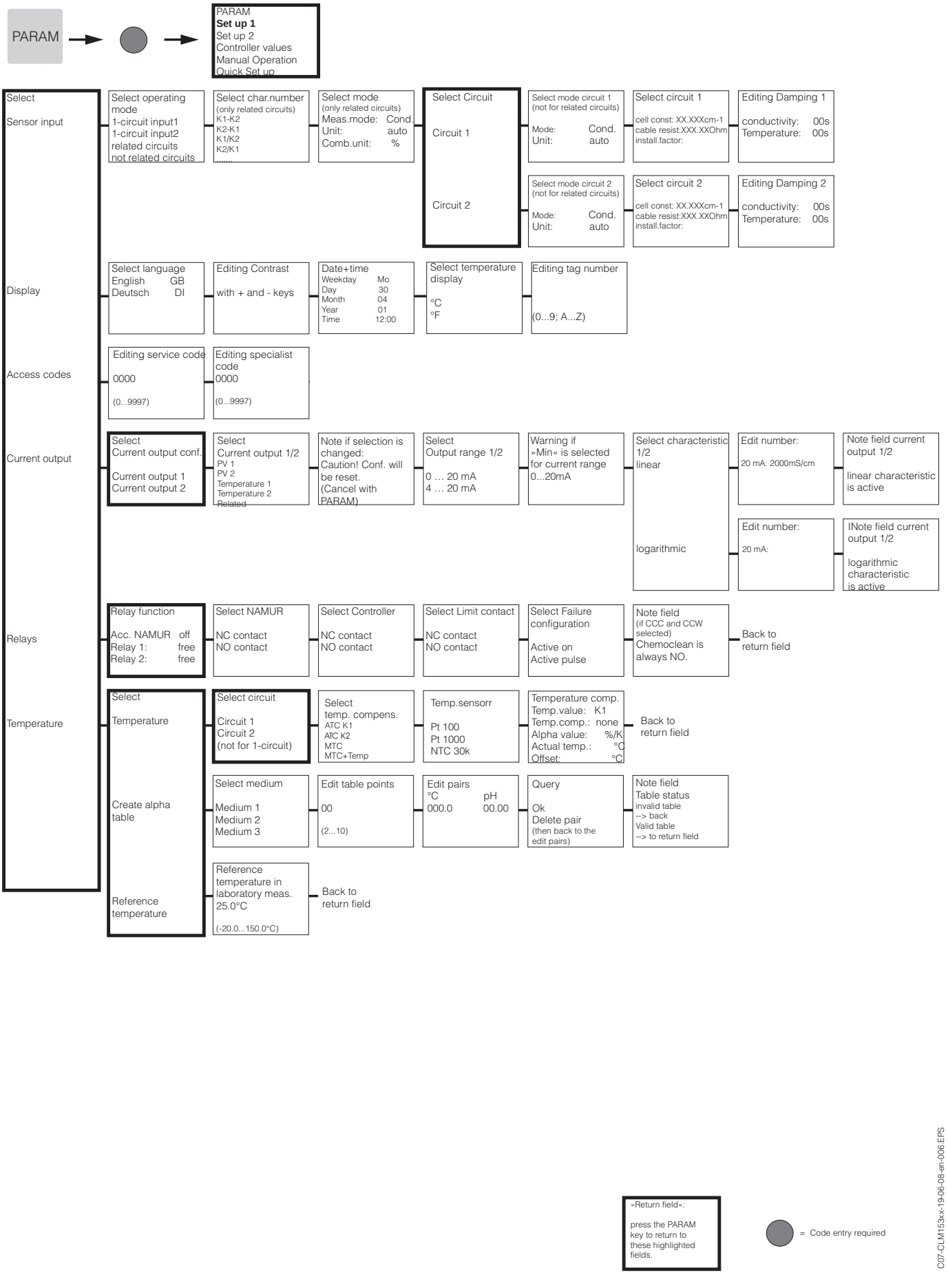
11 Appendix

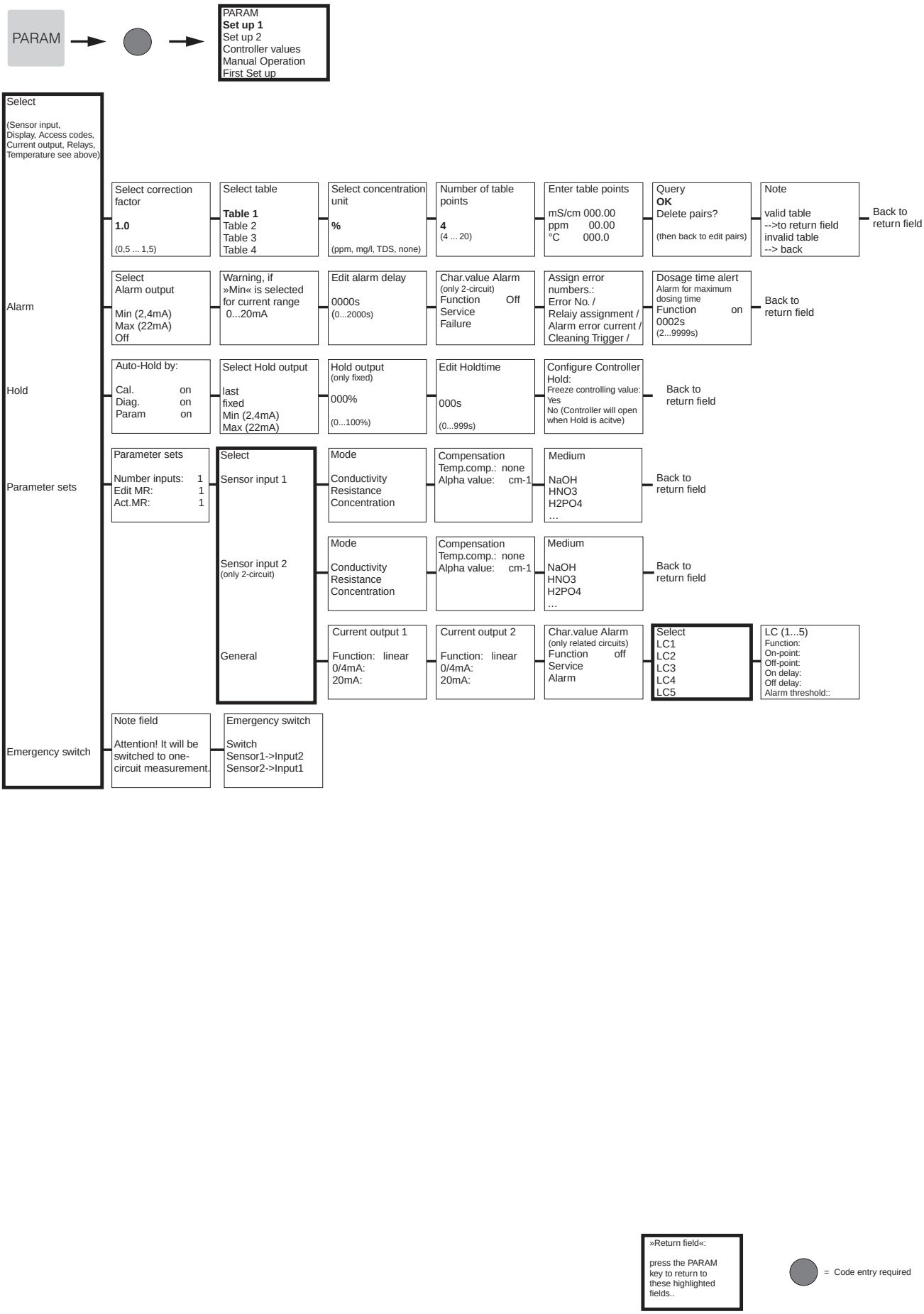
11.1 Operating matrix

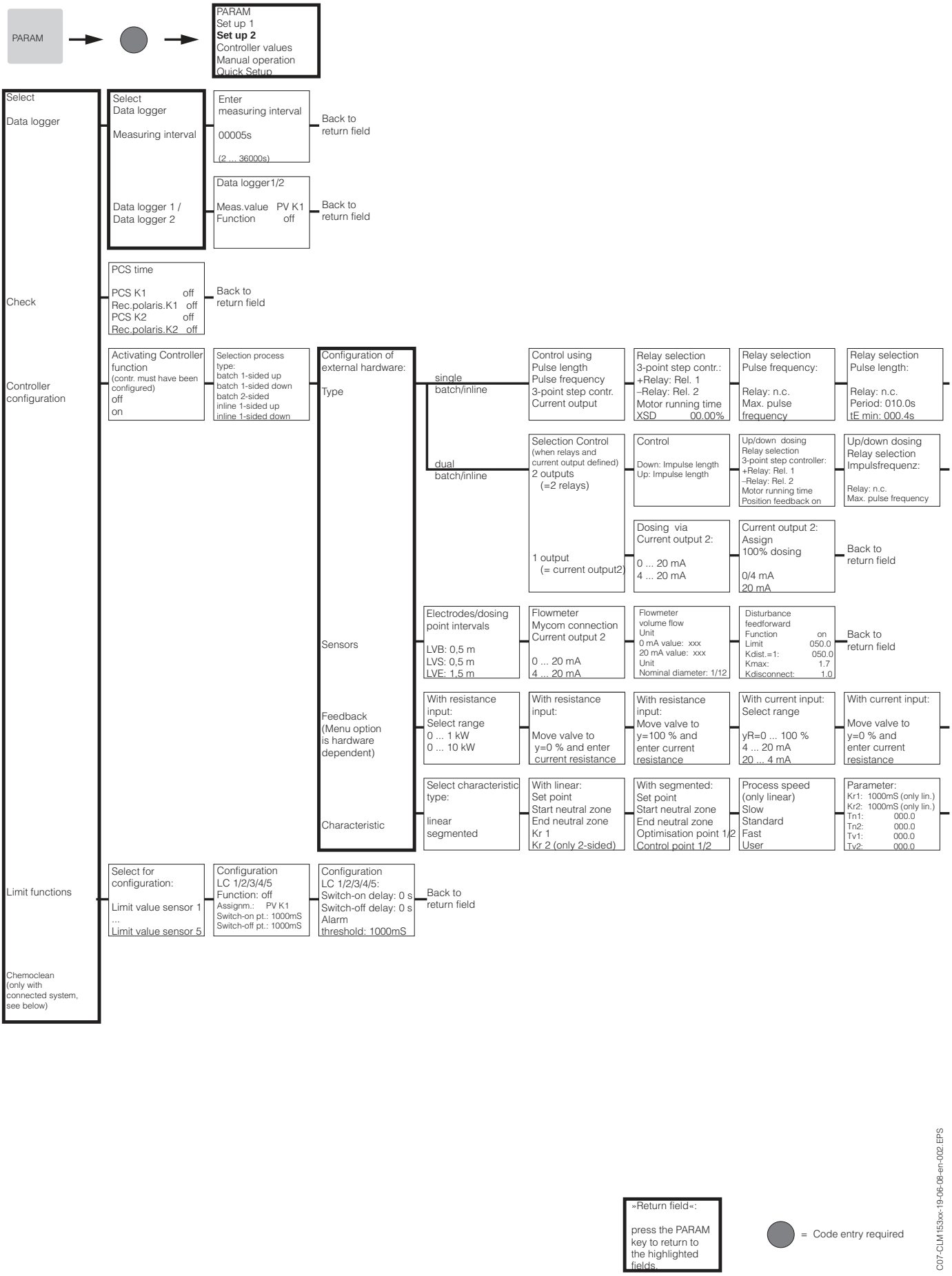
The basic structure of the operating menu is shown below.

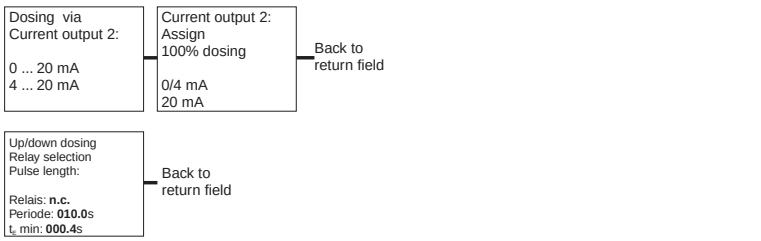


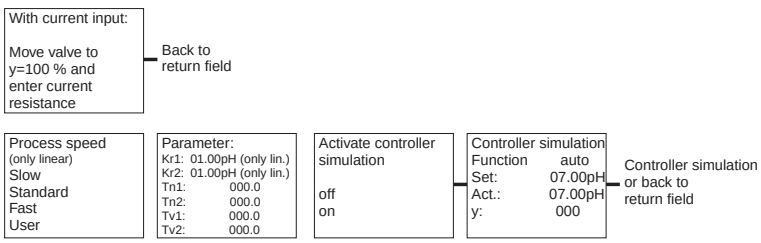
C07-CLM153xx-19-06-08-en-005.EPS

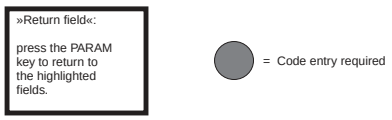

PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual Operation
Quick Set up
Select
Sensor input
Select operating mode
1-circuit input1
1-circuit input2
related circuits
not related circuits
Select char.number
(only related circuits)
K1-K2
K2-K1
K1/K2
K2/K1
Select mode
(only related circuits)
Meas.mode: Cond.
Unit: auto
Comb.unit: %
Select Circuit
Circuit 1
Circuit 2
Select mode circuit 1
(not for related circuits)
Mode: Cond.
Unit: auto
Select circuit 1
cell const: XX.XXXcm-1
cable resist:XXX.XXOhm
install.factor:
Editing Damping 1
conductivity: 00s
Temperature: 00s
Select mode circuit 2
(not for related circuits)
Mode: Cond.
Unit: auto
Select circuit 2
cell const: XX.XXXcm-1
cable resist:XXX.XXOhm
install.factor:
Editing Damping 2
conductivity: 00s
Temperature: 00s
Display
Select language
English GB
Deutsch DI
Editing Contrast
with + and - keys
Date+time
Weekday Mo
Day 30
Month 04
Year 01
Time 12:00
Select temperature display
°C
°F
Editing tag number
(0...9; A...Z)
Access codes
Editing service code
0000
(0...9997)
Editing specialist code
0000
(0...9997)
Current output
Select
Current output conf.
Current output 1
Current output 2
Select
Current output 1/2
PV 1
PV 2
Temperature 1
Temperature 2
Related
Note if selection is changed:
Caution! Conf. will be reset.
(Cancel with PARAM)
Select
Output range 1/2
0 … 20 mA
4 … 20 mA
Warning if »Min« is selected for current range 0...20mA
Select characteristic 1/2
linear
logarithmic
Edit number:
20 mA: 2000mS/cm
Edit number:
20 mA:
Note field current output 1/2
linear characteristic is active
INote field current output 1/2
logarithmic characteristic is active
Relays
Relay function
Acc. NAMUR off
Relay 1: free
Relay 2: free
Select NAMUR
NC contact
NO contact
Select Controller
NC contact
NO contact
Select Limit contact
NC contact
NO contact
Select Failure configuration
Active on
Active pulse
Note field
(if CCC and CCW selected)
Chemoclean is always NO.
Back to return field
Temperature
Select
Temperature
Select circuit
Circuit 1
Circuit 2
(not for 1-circuit)
Select
temp. compens.
ATC K1
ATC K2
MTC
MTC+Temp
Temp.sensorr
Pt 100
Pt 1000
NTC 30k
Temperature comp.
Temp.value: K1
Temp.comp.: none
Alpha value: %/K
Actual temp.: °C
Offset: °C
Back to return field
Create alpha table
Select medium
Medium 1
Medium 2
Medium 3
Edit table points
00
(2...10)
Edit pairs
°C pH
000.0 00.00
Query
Ok
Delete pair
(then back to the edit pairs)
Note field
Table status
invalid table
--> back
Valid table
--> to return field
Reference temperature
Reference temperature in laboratory meas.
25.0°C
(-20.0...150.0°C)
Back to return field
»Return field«:
press the PARAM key to return to these highlighted fields.
= Code entry required
C07-CLM153xx-19-06-08-en-006.EPS


PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual Operation
First Set up
Select
(Sensor input, Display, Access codes, Current output, Relays, Temperature see above)
Alarm
Hold
Parameter sets
Emergency switch
Select correction factor
1.0
(0,5 ... 1,5)
Select table
Table 1
Table 2
Table 3
Table 4
Select concentration unit
%
(ppm, mg/l, TDS, none)
Number of table points
4
(4 ... 20)
Enter table points
mS/cm 000.00
ppm 00.00
°C 000.0
Query
OK
Delete pairs?
(then back to edit pairs)
Note
valid table
-->to return field
invalid table
--> back
Back to return field
Select
Alarm output
Min (2,4mA)
Max (22mA)
Off
Warning, if »Min« is selected for current range 0...20mA
Edit alarm delay
0000s
(0...2000s)
Char.value Alarm
(only 2-circuit)
Function Off
Service
Failure
Assign error numbers.:
Error No. /
Relaiy assignment /
Alarm error current /
Cleaning Trigger /
Dosage time alert
Alarm for maximum dosing time
Function on
0002s
(2...9999s)
Back to return field
Auto-Hold by:
Cal. on
Diag. on
Param on
Select Hold output
last
fixed
Min (2,4mA)
Max (22mA)
Hold output
(only fixed)
000%
(0...100%)
Edit Holdtime
000s
(0...999s)
Configure Controller Hold:
Freeze controlling value:
Yes
No (Controller will open when Hold is acitve)
Back to return field
Parameter sets
Number inputs: 1
Edit MR: 1
Act.MR: 1
Select
Sensor input 1
Sensor input 2
(only 2-circuit)
General
Mode
Conductivity
Resistance
Concentration
Compensation
Temp.comp.: none
Alpha value: cm-1
Medium
NaOH
HNO3
H2PO4
…
Back to return field
Current output 1
Function: linear
0/4mA:
20mA:
Current output 2
Function: linear
0/4mA:
20mA:
Char.value Alarm
(only related circuits)
Function off
Service
Alarm
Select
LC1
LC2
LC3
LC4
LC5
LC (1...5)
Function:
On-point:
Off-point:
On delay:
Off delay:
Alarm threshold::
Note field
Attention! It will be switched to one-circuit measurement.
Emergency switch
Switch
Sensor1->Input2
Sensor2->Input1
»Return field«:
press the PARAM key to return to these highlighted fields..
= Code entry required
C07-CLM153xx-19-06-08-en-008.EPS

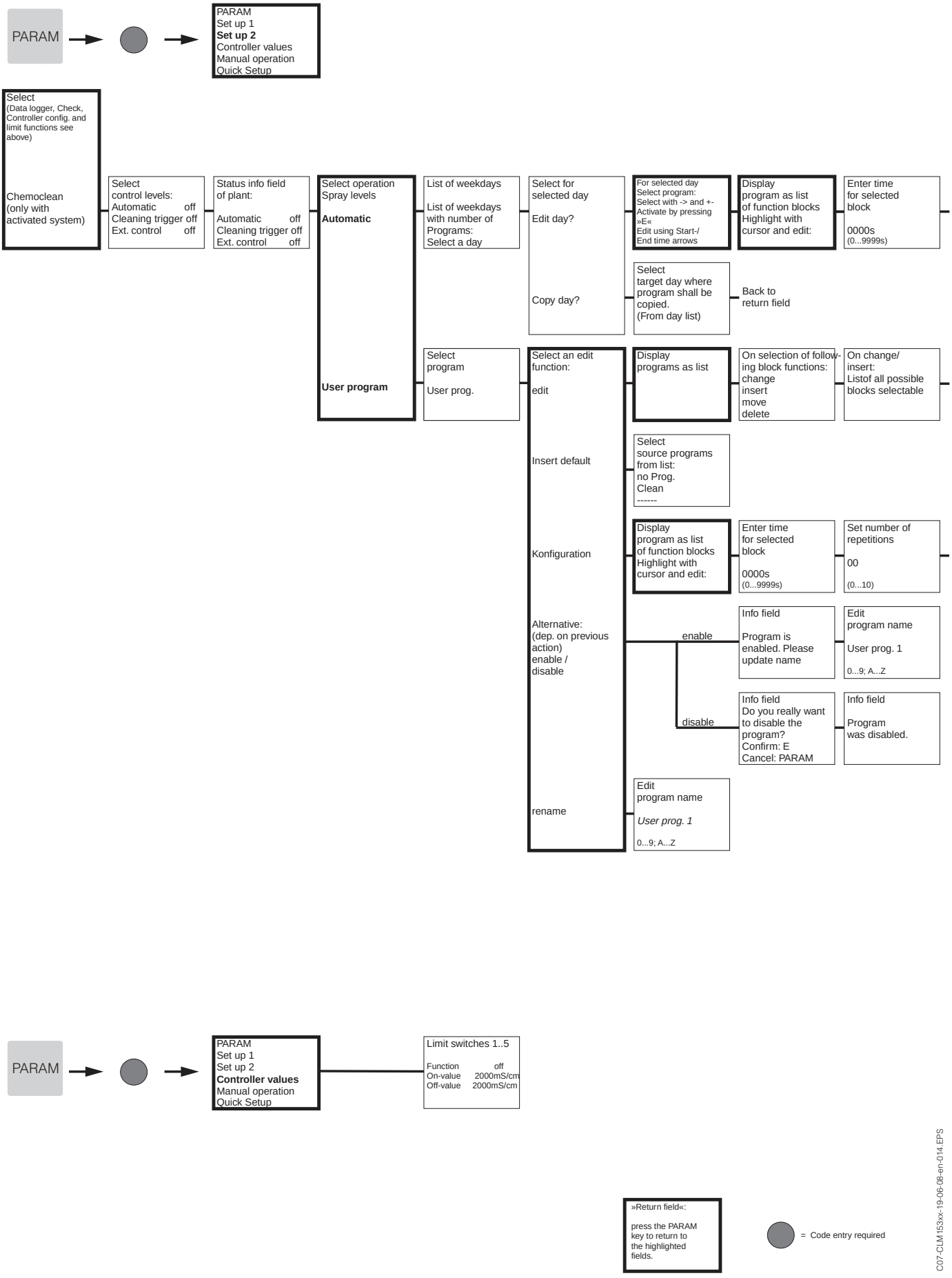

PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual operation
Quick Setup
Select
Data logger
Check
Controller configuration
Limit functions
Chemoclean (only with connected system, see below)
Select Data logger
Measuring interval
Data logger 1 / Data logger 2
Enter measuring interval
00005s
(2 ... 36000s)
Back to return field
Data logger1/2
Meas.value PV K1
Function off
PCS time
PCS K1 off
Rec.polaris.K1 off
PCS K2 off
Rec.polaris.K2 off
Activating Controller function
(contr. must have been configured)
off
on
Selection process type:
batch 1-sided up
batch 1-sided down
batch 2-sided
inline 1-sided up
inline 1-sided down
Configuration of external hardware:
Type
Sensors
Feedback (Menu option is hardware dependent)
Characteristic
single batch/inline
dual batch/inline
Control using Pulse length Pulse frequency 3-point step contr. Current output
Relay selection 3-point step contr.: +Relay: Rel. 1 –Relay: Rel. 2 Motor running time XSD 00.00%
Relay selection Pulse frequency: Relay: n.c. Max. pulse frequency
Relay selection Pulse length: Relay: n.c. Period: 010.0s tE min: 000.4s
Selection Control (when relays and current output defined)
2 outputs (=2 relays)
1 output (= current output2)
Control
Down: Impulse length
Up: Impulse length
Up/down dosing Relay selection 3-point step controller: +Relay: Rel. 1 –Relay: Rel. 2 Motor running time Position feedback on
Up/down dosing Relay selection Impulsfrequenz: Relay: n.c. Max. pulse frequency
Dosing via Current output 2:
0 ... 20 mA
4 ... 20 mA
Current output 2: Assign 100% dosing
0/4 mA
20 mA
Back to return field
Electrodes/dosing point intervals
LVB: 0,5 m
LVS: 0,5 m
LVE: 1,5 m
Flowmeter Mycom connection Current output 2
0 ... 20 mA
4 ... 20 mA
Flowmeter volume flow Unit 0 mA value: xxx 20 mA value: xxx Unit Nominal diameter: 1/12
Disturbance feedforward Function on Limit 050.0 Kdist.=1: 050.0 Kmax: 1.7 Kdisconnect: 1.0
With resistance input: Select range 0 ... 1 kW 0 ... 10 kW
With resistance input: Move valve to y=0 % and enter current resistance
With resistance input: Move valve to y=100 % and enter current resistance
With current input: Select range yR=0 ... 100 % 4 ... 20 mA 20 ... 4 mA
With current input: Move valve to y=0 % and enter current resistance
Select characteristic type: linear segmented
With linear: Set point Start neutral zone End neutral zone Kr 1 Kr 2 (only 2-sided)
With segmented: Set point Start neutral zone End neutral zone Optimisation point 1/2 Control point 1/2
Process speed (only linear) Slow Standard Fast User
Parameter: Kr1: 1000mS (only lin.) Kr2: 1000mS (only lin.) Tn1: 000.0 Tn2: 000.0 Tv1: 000.0 Tv2: 000.0
Select for configuration:
Limit value sensor 1
...
Limit value sensor 5
Configuration LC 1/2/3/4/5 Function: off Assignm.: PV K1 Switch-on pt.: 1000mS Switch-off pt.: 1000mS
Configuration LC 1/2/3/4/5: Switch-on delay: 0 s Switch-off delay: 0 s Alarm threshold: 1000mS
»Return field«: press the PARAM key to return to the highlighted fields.
= Code entry required
C07-CLM153xx-19-06-08-en-002.EPS



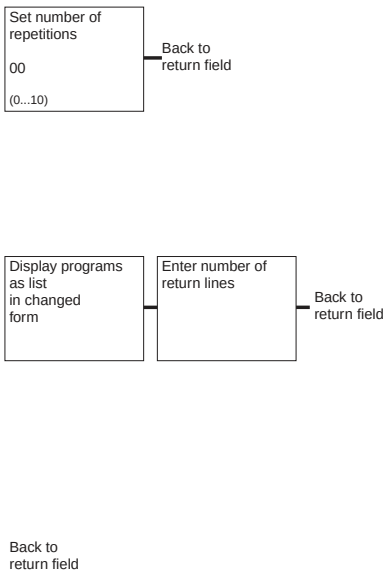


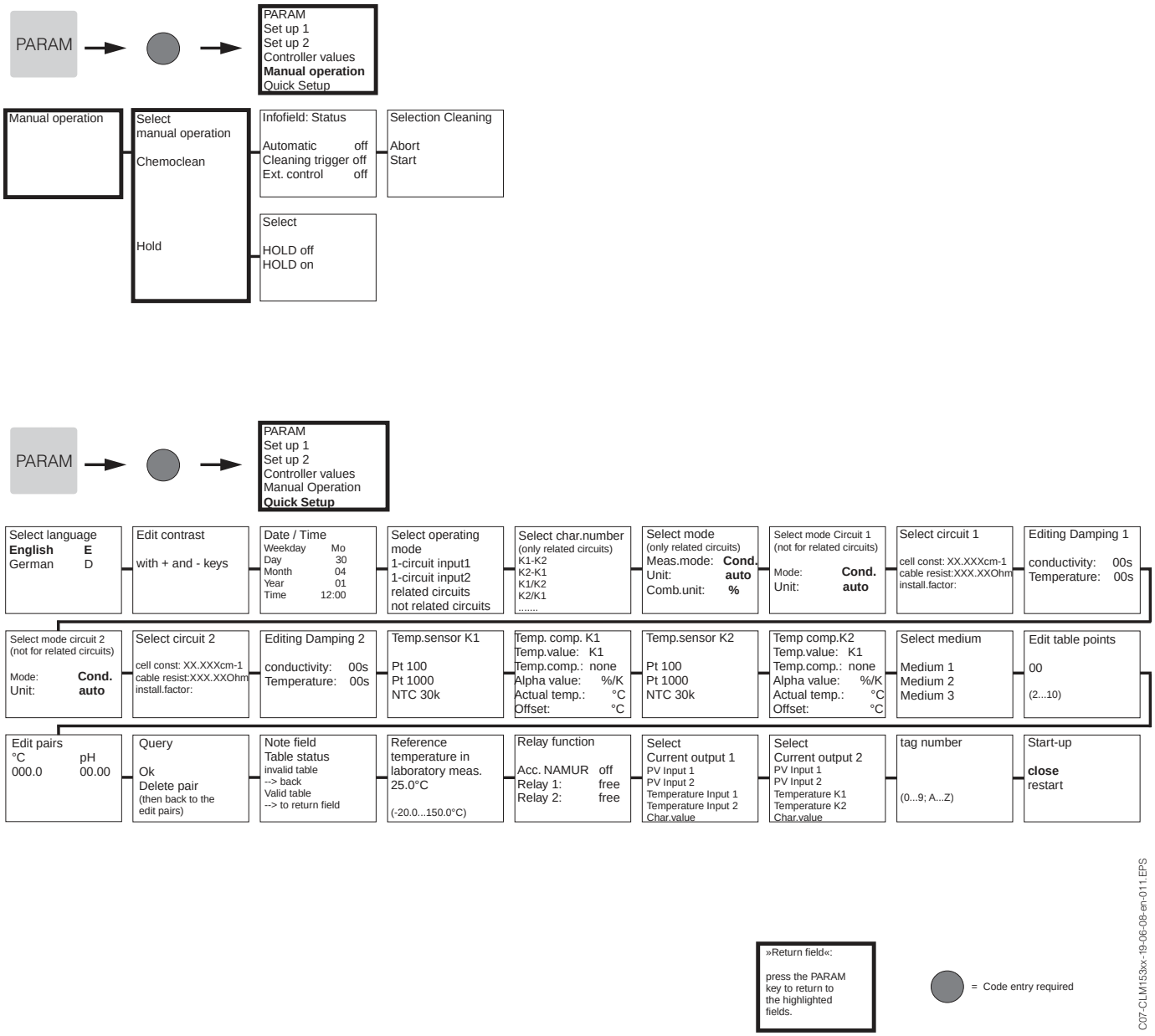


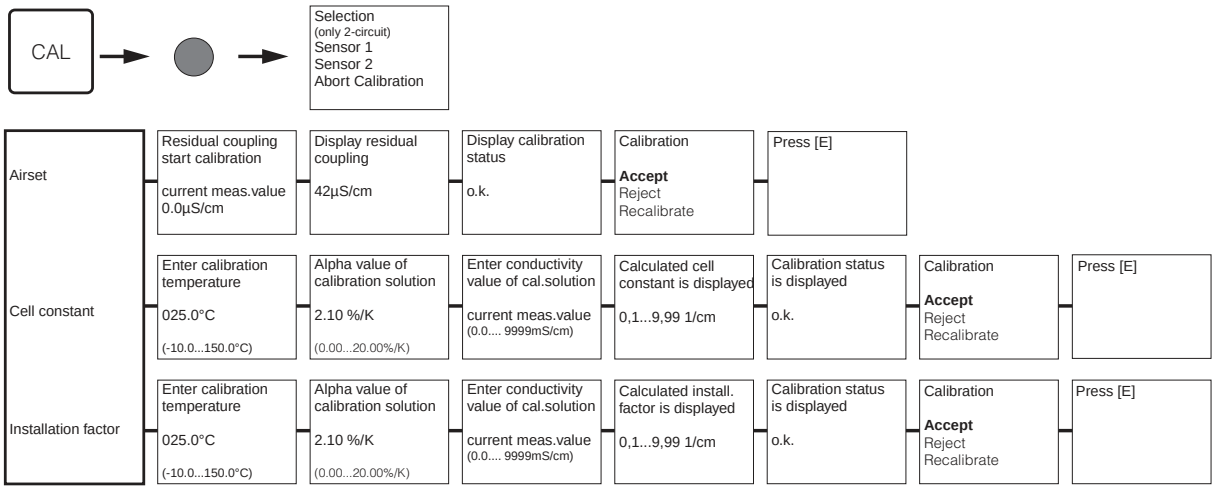
C07-CLM153xx-19-06-08-en-003.EPS


PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual operation
Quick Setup
Select
(Data logger, Check, Controller config. and limit functions see above)
Chemoclean (only with activated system)
Select control levels:
Automatic off
Cleaning trigger off
Ext. control off
Status info field of plant:
Automatic off
Cleaning trigger off
Ext. control off
Select operation
Spray levels
Automatic
User program
List of weekdays
List of weekdays with number of Programs:
Select a day
Select program
User prog.
Select for selected day
Edit day?
Copy day?
Select target day where program shall be copied. (From day list)
Back to return field
For selected day
Select program:
Select with -> and +-
Activate by pressing »E«
Edit using Start-/ End time arrows
Display program as list of function blocks
Highlight with cursor and edit:
Enter time for selected block
0000s
(0...9999s)
Select an edit function:
edit
Insert default
Konfiguration
Alternative: (dep. on previous action) enable / disable
rename
Display programs as list
On selection of following block functions:
change
insert
move
delete
On change/ insert:
Listof all possible blocks selectable
Select source programs from list:
no Prog.
Clean

Display program as list of function blocks
Highlight with cursor and edit:
Enter time for selected block
0000s
(0...9999s)
Set number of repetitions
00
(0...10)
enable
disable
Info field
Program is enabled. Please update name
Edit program name
User prog. 1
0...9; A...Z
Info field
Do you really want to disable the program?
Confirm: E
Cancel: PARAM
Info field
Program was disabled.
Edit program name
User prog. 1
0...9; A...Z
PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual operation
Quick Setup
Limit switches 1..5
Function off
On-value 2000mS/cm
Off-value 2000mS/cm
»Return field«:
press the PARAM key to return to the highlighted fields.
= Code entry required
C07-CLM153xx-19-06-08-en-014.EPS


Set number of repetitions
00
(0...10)
Back to return field
Display programs as list in changed form
Enter number of return lines
Back to return field
Back to return field
»Return field«:
press the PARAM key to return to the highlighted fields.
= Code entry required
C07-CPM153xx-19-06-08-en-015.EPS

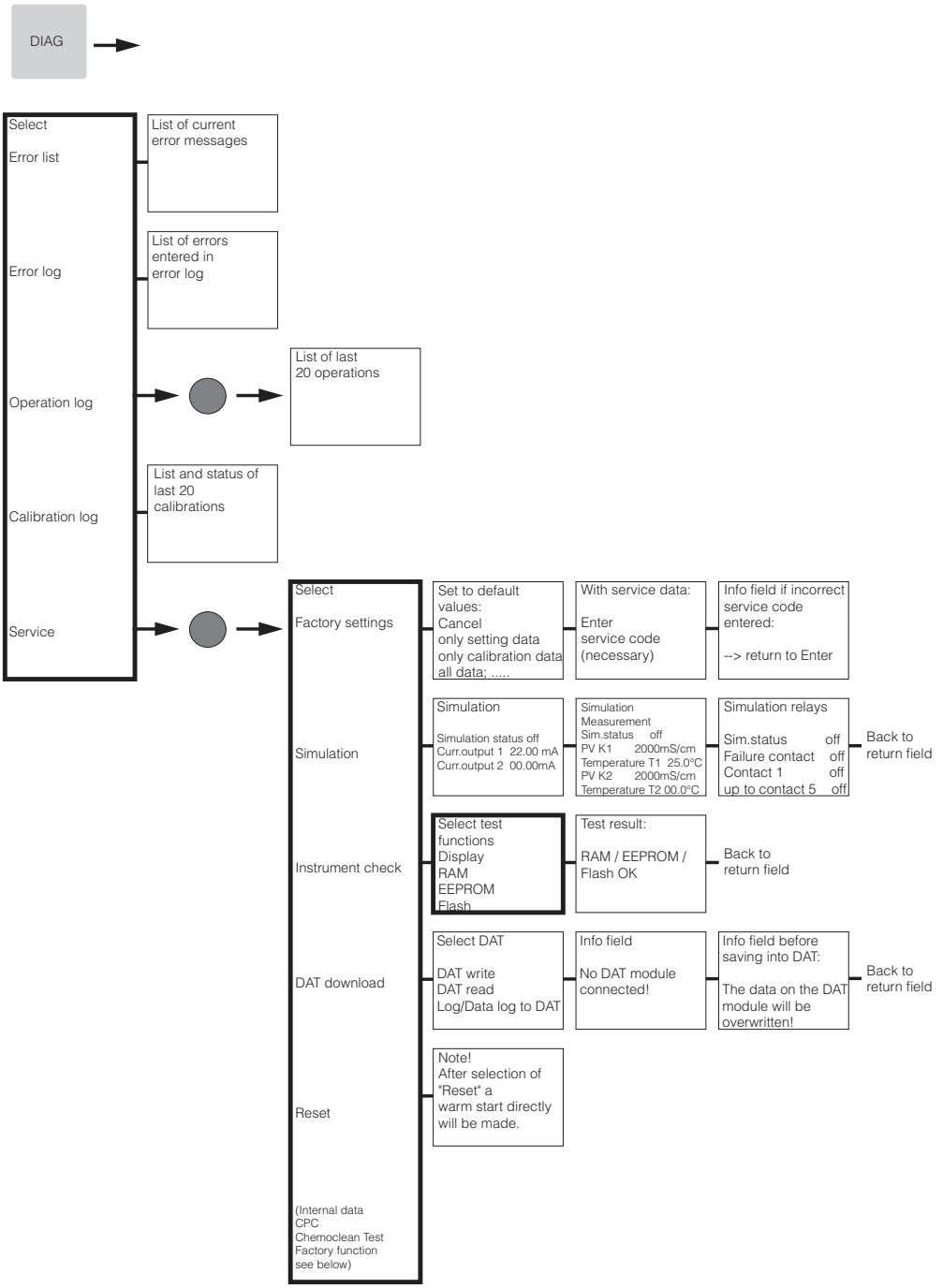

PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual operation
Quick Setup
Manual operation
Select
manual operation
Chemoclean
Hold
Infofield: Status
Automatic off
Cleaning trigger off
Ext. control off
Selection Cleaning
Abort
Start
Select
HOLD off
HOLD on
PARAM
PARAM
Set up 1
Set up 2
Controller values
Manual Operation
Quick Setup
Select language
English E
German D
Edit contrast
with + and - keys
Date / Time
Weekday Mo
Day 30
Month 04
Year 01
Time 12:00
Select operating mode
1-circuit input1
1-circuit input2
related circuits
not related circuits
Select char.number
(only related circuits)
K1-K2
K2-K1
K1/K2
K2/K1
.....
Select mode
(only related circuits)
Meas.mode: Cond.
Unit: auto
Comb.unit: %
Select mode Circuit 1
(not for related circuits)
Mode: Cond.
Unit: auto
Select circuit 1
cell const: XX.XXXcm-1
cable resist:XXX.XXOhm
install.factor:
Editing Damping 1
conductivity: 00s
Temperature: 00s
Select mode circuit 2
(not for related circuits)
Mode: Cond.
Unit: auto
Select circuit 2
cell const: XX.XXXcm-1
cable resist:XXX.XXOhm
install.factor:
Editing Damping 2
conductivity: 00s
Temperature: 00s
Temp.sensor K1
Pt 100
Pt 1000
NTC 30k
Temp. comp. K1
Temp.value: K1
Temp.comp.: none
Alpha value: %/K
Actual temp.: °C
Offset: °C
Temp.sensor K2
Pt 100
Pt 1000
NTC 30k
Temp comp.K2
Temp.value: K1
Temp.comp.: none
Alpha value: %/K
Actual temp.: °C
Offset: °C
Select medium
Medium 1
Medium 2
Medium 3
Edit table points
00
(2...10)
Edit pairs
°C pH
000.0 00.00
Query
Ok
Delete pair
(then back to the edit pairs)
Note field
Table status
invalid table
--> back
Valid table
--> to return field
Reference temperature in laboratory meas.
25.0°C
(-20.0...150.0°C)
Relay function
Acc. NAMUR off
Relay 1: free
Relay 2: free
Select
Current output 1
PV Input 1
PV Input 2
Temperature Input 1
Temperature Input 2
Char.value
Select
Current output 2
PV Input 1
PV Input 2
Temperature K1
Temperature K2
Char.value
tag number
(0...9; A...Z)
Start-up
close
restart
»Return field«:
press the PARAM key to return to the highlighted fields.
= Code entry required
C07-CLM153xx-19-06-08-en-011.EPS

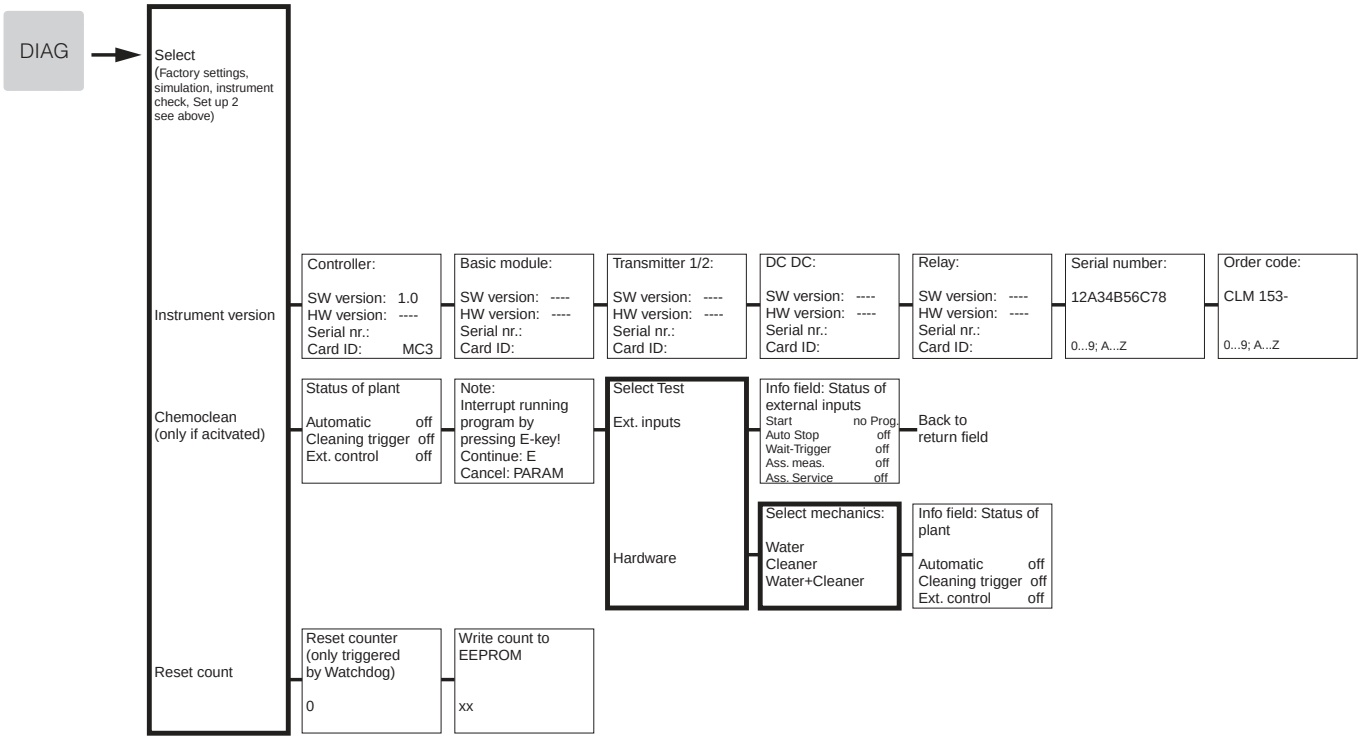


If you press the MEAS key, a message will appear asking if you want to abort the calibration.

= Code entry required

C07-CLM153xx-19-06-08-en-010.EPS


DIAG
Select
Error list
List of current error messages
Error log
List of errors entered in error log
Operation log
List of last 20 operations
Calibration log
List and status of last 20 calibrations
Service
Select
Factory settings
Set to default values:
Cancel
only setting data
only calibration data
all data; .....
With service data:
Enter service code (necessary)
Info field if incorrect service code entered:
--> return to Enter
Simulation
Simulation status off
Curr.output 1 22.00 mA
Curr.output 2 00.00mA
Simulation
Measurement
Sim.status off
PV K1 2000mS/cm
Temperature T1 25.0°C
PV K2 2000mS/cm
Temperature T2 00.0°C
Simulation relays
Sim.status off
Failure contact off
Contact 1 off
up to contact 5 off
Back to return field
Instrument check
Select test functions
Display
RAM
EEPROM
Flash
Test result:
RAM / EEPROM / Flash OK
Back to return field
DAT download
Select DAT
DAT write
DAT read
Log/Data log to DAT
Info field
No DAT module connected!
Info field before saving into DAT:
The data on the DAT module will be overwritten!
Back to return field
Reset
Note!
After selection of "Reset" a warm start directly will be made.
(Internal data
CPC
Chemoclean Test
Factory function
see below)
»Return field«:
press the PARAM key to return to the highlighted fields
= Code entry required
C07-CLM153xx-19-06-08-en-012.EPS



»Return field«:

press the PARAM key to return to the highlighted fields.

= Code entry required

C07-CLM153xx-19-06-08-en-013.EPS

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Declaration of contamination

Dear customer,
Because of legal determinations and for the safety of our employees 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 to health ☐ biologically 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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