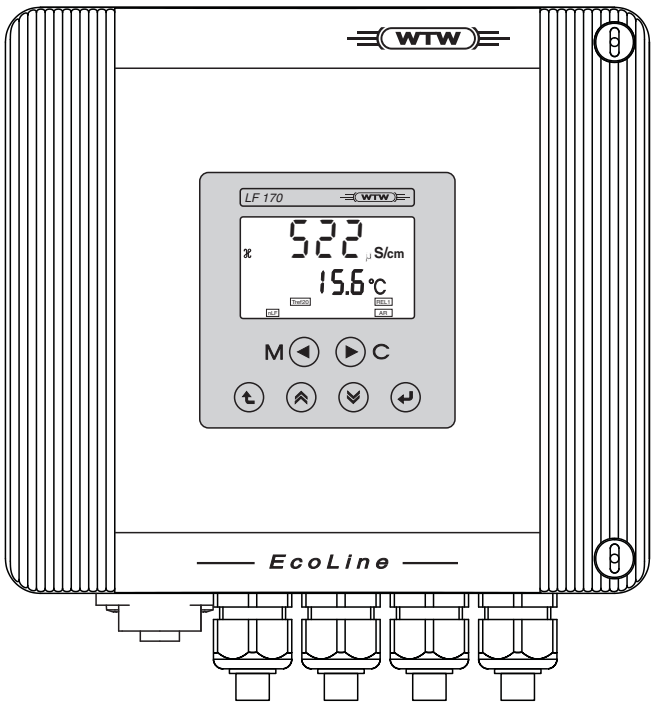
Operating instructions

LF 170



Conductivity Monitor

ba54104e09 11/2010

Accuracy when going to press

The use of advanced technology and the high quality standard of our instruments are the result of continuous development. This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

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LF 170 - Contents

1 Overview

1.1 General features

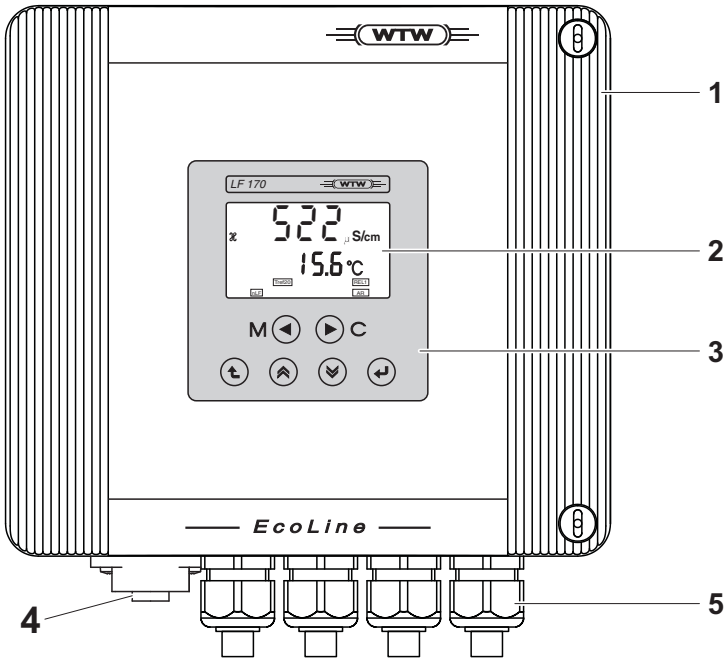


Fig. 1-1 LF 170

1	Watertight housing (IP 66)
2	Display
3	Operating keys
4	Sensor input socket
5	Cable glands

1.2 Outputs and interfaces

1.2.1 Overview

The monitor has the following outputs and interfaces depending on the instrument version:

Instrument version	Relays	Current outputs	Digital interfaces
LF 170 (standard)		1 x analog output for measured conductivity value	-
LF 170 RT	2 x freely configurable relays	1 additional analog output for the measured temperature value	-
LF 170 RT RS	as RT option	as RT option	1 x RS 485

1.2.2 Freely configurable relay (RT and RT RS option)

Both potential-free K1 and K2 relays of the RT and RT RS instrument versions can be used as follows:

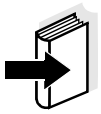
- As a fault indicator if the power fails
- As an indicator relay for a frozen measured value (e.g. when calibrating)
- As a threshold indicator if a specified threshold is undercut or exceeded (main measured value)
- As a control relay with timer function, e.g. for time-controlled sensor cleaning operated by compressed air.

1.2.3 RS 485 digital interface (RT RS option)

The monitor can communicate with other instruments via the RS 485 digital interface of the RS instrument versions.

The following operating modes are possible:

- Master mode (Prn mode): Unidirectional mode for the output of measured values. The main and auxiliary measured values are sent. The interface is constantly active in master mode. The data are sent to a data terminal (e.g. PC with terminal software or printer).
- Slave mode (SL mode): Bidirectional mode in the bus network. In this operating mode the monitor ("slave") works together with a control computer ("master") on the master/slave principle. A total of 31 slave devices can be connected to one master in the bus network. All slave devices are addressed by the control computer under their bus address and execute the transferred commands, e.g. sending measured values, calibration data and relay states.



Note
The RS 485 interface that accompanies the RT RS instrument versions is described in detail in a separate manual.

PROFIBUS connection

The monitor can be connected to a PROFIBUS DP network via the RS 485 interface with the PROFIBUS converter PKV 30-DPS that is available as an accessory.

1.3 Nameplate

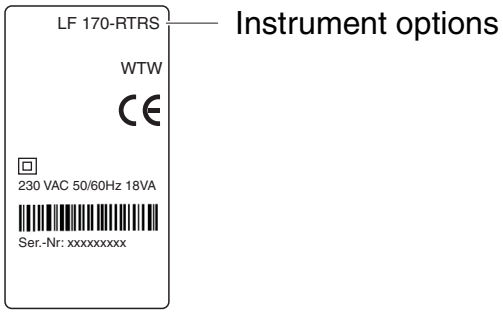


Fig. 1-2 Nameplate (example)

The nameplate also includes the serial number as well as details of the supply voltage and the installed instrument options. The nameplate is located on the right side of the housing.

2 Safety instructions

This operating manual contains essential instructions that have to be followed during the commissioning, operation and maintenance of the LF 170 monitor. Thus, it is essential for the operator to read this component operating manual before carrying out any work with the system. Always keep this operating manual available close to the LF 170 monitor.

General safety instructions

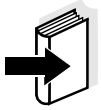
Safety instructions in this operating manual are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "'CAUTION") indicates the severity of the danger:

WARNING
indicates instructions that must be followed precisely in order to prevent serious danger to personnel.

CAUTION
indicates instructions that must be followed precisely in order to avoid slight injury to personnel or damage to the instrument or the environment.

Other labels

Note
This symbol indicates instructions that describe special features.



Note
This symbol indicates cross-references to other documents, e.g. component operating manuals.

2.1 User qualification

Special user qualifications

The following installation activities may only be performed by a qualified electrician:

- Connection of the LF 170 monitor to the mains supply.
- Connection of external, mains voltage conducting power circuits to the LF 170 monitor.

2.2 Authorized use

The authorized use of the LF 170 monitor consists solely of stationary measurement in water and wastewater applications, seawater, brackish water and aquacultures. Read the technical specifications in accordance with chapter 8 TECHNICAL DATA. Only operation and use according to the instructions in this operating manual is authorized.

Any other use is considered as **unauthorized**. Unauthorized use invalidates any claims with regard to the guarantee.

2.3 General safety instructions

The LF 170 monitor is manufactured and tested in accordance with the relevant guidelines and standards for electronic instruments (see chapter 8 TECHNICAL DATA). It left the factory in perfect condition.

Function and operational safety

The flawless functioning of the LF 170 monitor is only guaranteed if attention is paid to the generally accepted safety measures and the special safety instructions in this operating manual during use.

The flawless functioning and operating safety of the LF 170 monitor is only guaranteed under the ambient conditions specified in chapter 8 TECHNICAL DATA.

Safe operation

Assuming that risk-free operation is no longer possible, take the LF 170 monitor out of operation and secure it against unintentional operation. Risk-free operation is no longer possible if the LF 170 monitor:

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If in doubt, contact the supplier of the LF 170 monitor.

3 Installation

3.1 Onsite installation: General instructions

The measurement location must meet the environmental conditions specified in chapter 8 TECHNICAL DATA.

Outdoor mounting

Pay attention to the following points for outdoor installations:

- Always protect instruments installed outdoors against rough weather conditions with a protective cover.
- Close the housing cover after installation to ensure tightness (IP 66).
- Also seal all cable glands that are not required with matching dummy plugs.

Installation on a wall or under a protective cover

The instrument is mounted on a wall or under a protective cover through 4 boreholes in the rear panel of the housing. The boreholes are accessible when the housing cover is open.

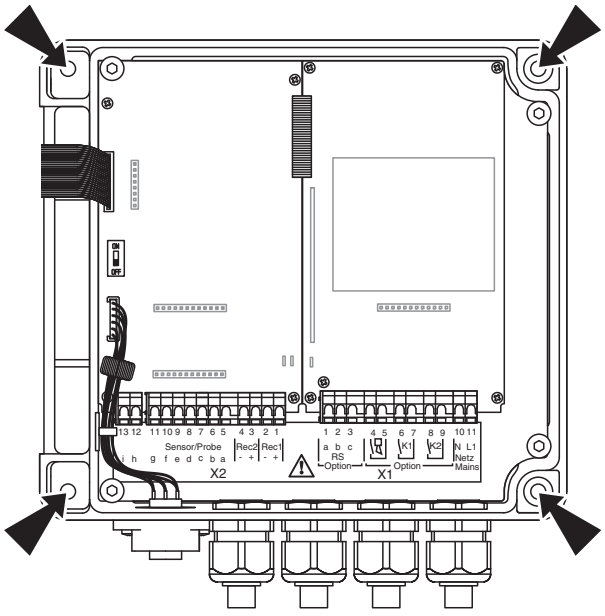


Fig. 3-1 Mounting boreholes of the LF 170

The clearances of the boreholes are given in the dimensional drawing in the chapter 8 TECHNICAL DATA. For wall mounting, use the suitable material (screws, wall plugs, etc.).

3.2 Electrical terminal strip

The terminal strip of the LF 170 is accessible after the housing cover has been opened:

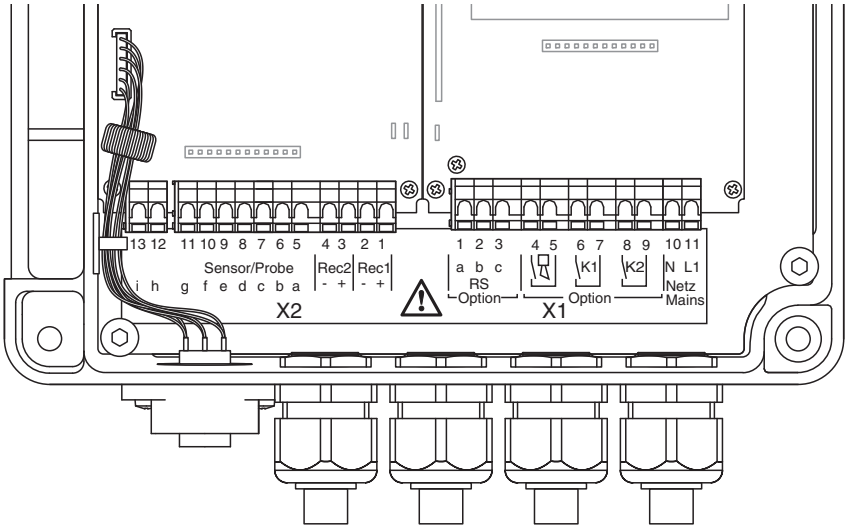


Fig. 3-2 Terminal strip LF 170 inside the housing

Terminal connections

No.	X1	X2
1	RS 485 A (RS option)	Current output REC1+
2	RS 485 B (RS option)	Current output REC1-
3	RS 485 GND (RS option)	Current output REC2+ (RT option)
4	-	Current output REC2- (RT option)
5	-	a / Sensor
6	Relay K1 (RT option)	b / Sensor
7	Relay K1 (RT option)	c / Sensor
8	Relay K2 (RT option)	d / Sensor
9	Relay K2 (RT option)	e / Sensor
10	N (mains) *	f / Sensor
11	L1 (mains) *	g / Sensor
12	-	h / Sensor
13	-	i / Sensor

* Connection of monitors with 24 V DC supply voltage:

– N = GND

– L1 = +24 V DC

3.3 Electrical connection

3.3.1 General installation instructions

Pay attention to the following points when connecting cable wires to the terminal strip:

- Shorten all the wires to be used to the length required for the installation
- Fit all wires with wire sleeves before connecting to the terminal strip
- Any wires that are not used and project into the housing must be cut off as closely as possible to the cable gland. Seal all open cable glands with matching blind plugs.

WARNING
Free wires must not protrude into the housing of the LF 170. Danger of short-circuit and fire! Touch-proof circuits can also come into contact with dangerous voltages if touched and lead to life threatening situations when working with the LF 170. Always cut off any unused wires as closely as possible to the cable gland.

3.3.2 Line power connection

WARNING

If the power supply is connected incorrectly, it may represent a danger to life from electric shock. Pay attention to the following points during installation:

- **The monitor must only be connected by an electrician.**
- **The monitor must only be connected in a voltage-free condition.**
- **The power supply must fulfill the specifications given on the nameplate and in chapter 8 TECHNICAL DATA.**
- **A switch or circuit breaker must be provided in the building installation as an interrupt facility for the monitor. The interrupt facility must be**
  - **installed close to the monitor and easy to reach by the user and**
  - **marked as an interrupt facility for the monitor.**
- **The monitor must only be opened after installation if the mains voltage has been switched off beforehand.**

The correct voltage is given on the nameplate (see section 1.3 NAMEPLATE). In all cases check that the correct mains voltage is present prior to installing the instrument.

3.3.3 Relay contacts and current outputs

WARNING

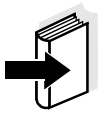
If external electrical circuits that are subject to the danger of physical contact are incorrectly connected to the relay contacts, there may be a danger of life threatening electric shock. Electrical circuits are regarded to be subject to the danger of physical contact when there are voltages higher than the Safety Extra Low Voltage (SELV).

Pay attention to the following points during installation:

- **Electrical circuits subject to the danger of physical contact must only be connected by a qualified electrician.**
- **Electrical circuits subject to the danger of physical contact must only be connected when they are voltage-free.**
- **Switching voltages and switching currents on the relay contacts must not exceed the values specified in chapter 8 TECHNICAL DATA. Protect electrical circuits against currents that are too high with an electrical fuse.**
- **After the monitor has been installed, it may only be opened if the mains voltage and all external voltages have been switched off beforehand.**

An overview of the relay and current outputs of the individual instrument versions can be found in section 1.2 OUTPUTS AND INTERFACES. The configuration and parameterization is described in sections 4.4 to 4.5.

3.3.4 RS 485 digital interface (RS option)

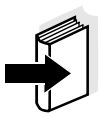


Note

The connection of the monitor to other instruments via the RS 485 interface is described in detail in a separate manual that accompanies the RT RS instrument versions.

3.4 Connecting a conductivity measuring cell

3.4.1 Measuring cell types and connection options



Note
Ordering information on the respective articles (connection cables, adapters, terminal boxes etc.) is given in chapter 7 ACCESSORIES.

Measuring cell	Connection type	Connection cable/ adapter	See page
TetraCon® 700 TetraCon® 700 (SW) LRD 01 LRD 325	Connect the plug adaptor of the connection cable with the sensor input socket	-	82
TetraCon® 325 TetraCon® 325/C LR 325/01 LR 325/001	Connect the conductivity measuring cell to the sensor input socket using an adapter	ADA/AMPH-LAB-LF	83
TetraCon® DU/T TetraCon® DU/TH	Connect the conductivity measuring cell to the sensor input socket using a connection cable and an adapter	KKDU 325 + ADA/AMPH-LAB-LF	83

3.4.2 Measuring cells with 7-pin plug adapter

This section describes the connection of the following conductivity measuring cells:

- TetraCon® 700
- TetraCon® 700 (SW)
- LRD 01
- LRD 325

Connection Connect the plug adapter of the sensor connection cable with the sensor input jack of the monitor:

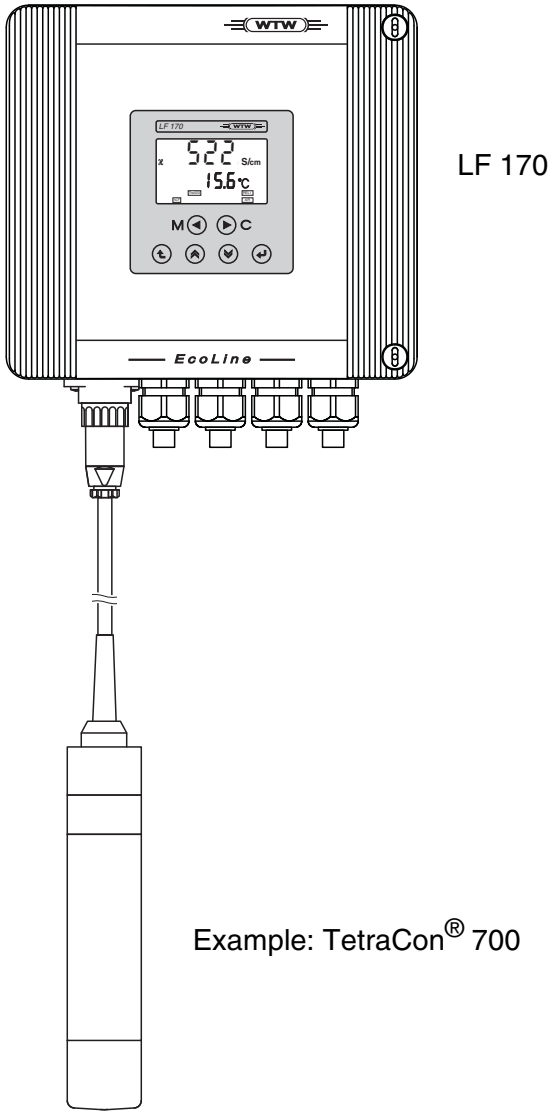


Fig. 3-3 Connection of conductivity measuring cells with plug adapters

3.4.3 Measuring cells with 8-pin plug

This section describes the connection of the following conductivity measuring cells:

- TetraCon® 325
- TetraCon® 325/C
- LR 325/01
- LR 325/001
- TetraCon® DU/T (with KKDU 325 connection cable)
- TetraCon® DU/TH (with KKDU 325 connection cable)

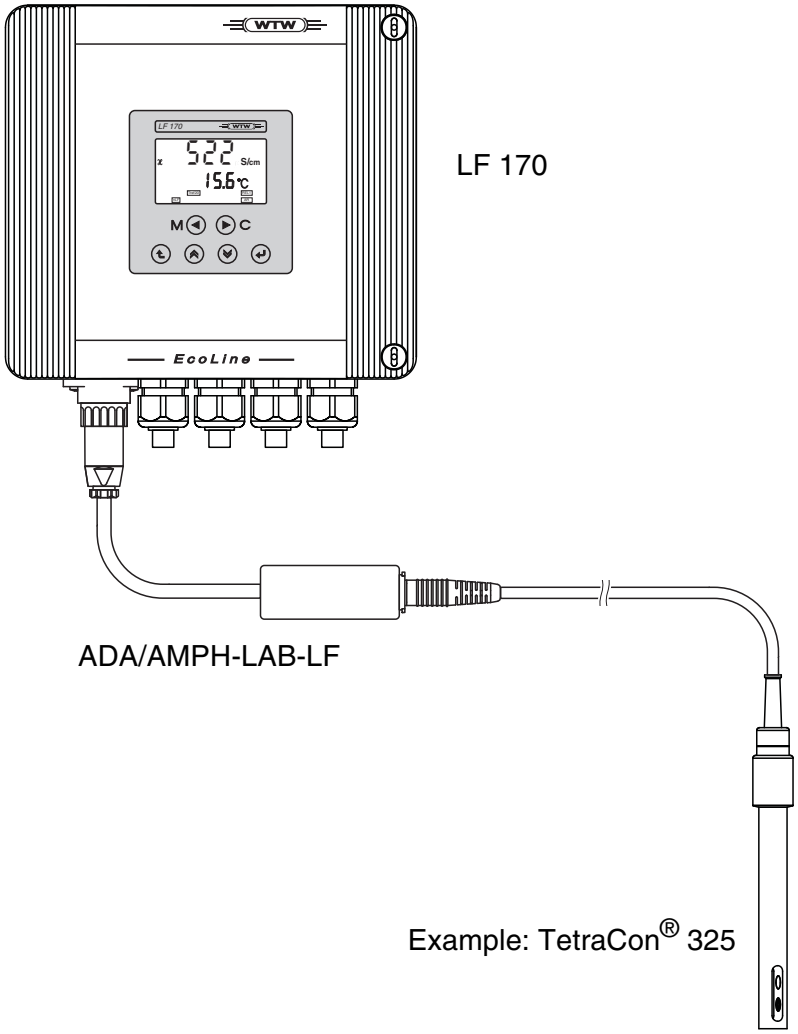


Fig. 3-4 Connection of a conductivity measuring cell with 8-pin plug

3.4.4 Cable extension

The EK 170 cable (order no. 108 206) can be used in conjunction with the KI/S terminal box (order no. 108 606) as a cable extension between the conductivity measuring cell and the monitorand the K 160 cable plug (order no. 109 508) .

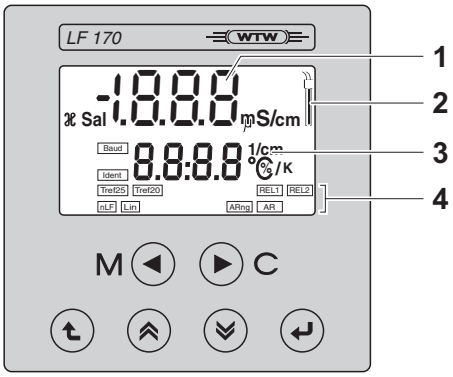
The maximum cable length between the electrode and monitor including the length of the sensor connection cable is 100 m.

Note
The wiring is described in the mounting instructions of the KI/S terminal box.

4 Operation

4.1 Display

Display elements



1	Upper display line: Measured conductivity value, operator guidance
2	Sensor symbol
3	Lower display line: Measured temperature value, operator guidance
4	Status displays, depending on instrument status and operating situation

4.2 Operating keys

The monitor is operated via the following six keys below the display:

Key functions

Key	Function
M 	Call up measuring mode **<M>**
 C	Start calibration (only active in measuring mode) **<C>**
	In measuring mode: Display the sensor slope Confirm current selection **<ENTER>**
	Leave the menu **<ESC>**
	Increase the value, scroll upwards in the selection, or navigate one menu level upwards **<UP>**
	Decrease the value, scroll downwards in the selection, or navigate one menu level downwards **<DOWN>**

4.3 Operating levels and general operating principles

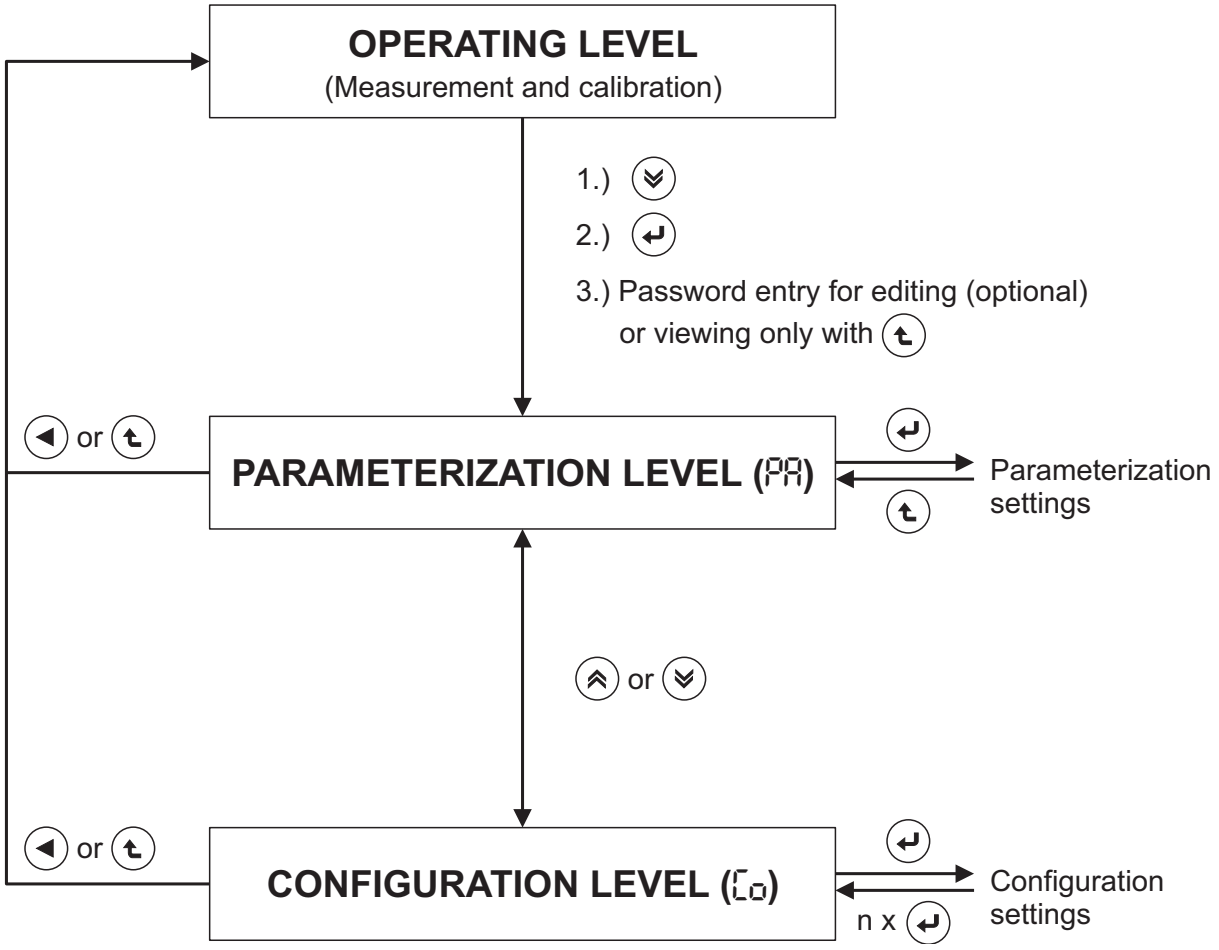


Fig. 4-1 Operating levels

The operation of the monitor is differentiated into three levels:

Operating level In normal measuring mode and during calibration the monitor is in the so-called 'operating level'.

Parameterization level All instrument settings are made in this level (e.g. measuring ranges, limits).

Configuration level The functions of the monitor are defined in this level. The configuration is carried out after the installation of the instrument, mostly only during the initial commissioning.

Password protection All settings of the parameterization and configuration level can be protected with a three-digit numeric code against unauthorized or unintentional modification.

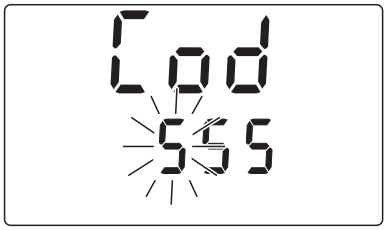
4.4 Configuration

4.4.1 Call up configuration level

Call up the configuration level from the operating level as follows:

1 Press **<DOWN>**.

2 Press **<ENTER>**.



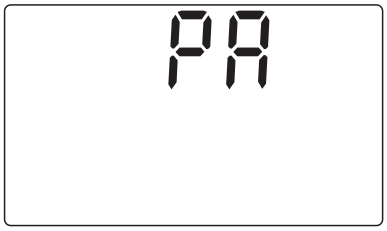
3 The menu for the password prompt appears.

When delivered, no password protection is set up. In this case proceed to the next operating step by pressing **<ENTER>** three times.

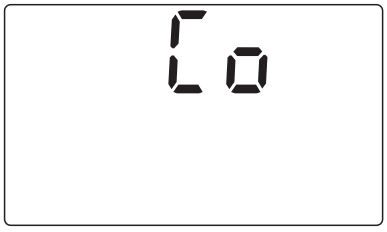
If password protection is set up, the password must be entered in order to change settings. Enter the password as follows:

– Set the first (flashing) digit with **<UP><DOWN>** and confirm with **<ENTER>**.

– Set the other two digits in the same way.



4 After the last digit you reach the parameterization level first.



5 Press **<UP>** or **<DOWN>**.

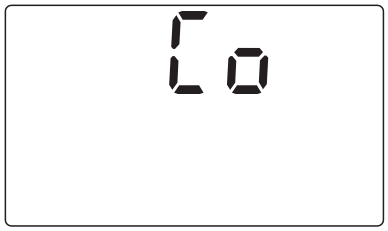
You are now at the starting point of the configuration level. From here you can reach the settings with **<ENTER>** (see section 4.4.2).

Note
If an incorrect password is entered or after pressing the **<ESC>** key during password entry, access to the configuration is only possible in view mode, i.e. settings can be viewed but not changed.

4.4.2 Configuration setting table

General operating instructions

The starting point for the settings is the start display of the configuration level (see section 4.4.1):



Swap to the first setting with **<ENTER>**.

Operation:

- All settings of the following setting table are run through step by step.
- Select the desired value from the selection in each case with **<UP><DOWN>** and confirm this with **<ENTER>**. After that you reach the next setting.
- Certain settings or choices are only available with specific instrument variants or depend on other preceding configuration settings. Settings that are not available will be skipped.
- After running through all the settings you again reach the starting point of the configuration level. From here change to the operating level with **<M>** or **<ESC>** or go to the parameterization level with **<UP><DOWN>**.
- In view mode you can change to the operating level from any point with **<M>**.

Setting table:

Setting	**Selection/Values**	**Explanation** (values in bold typeface = values on delivery)
CIn	• 700 • 600 • 300 • 10 • 1 • 0.1 • 0.01 • vAr	Connected sensor type: 700 TetraCon® 700 (SW) 600 TetraCon® 600 300 TetraCon® 300 10 Cell with cell constant, 10 cm^{-1} 1 Cell with cell constant, 1 cm^{-1} 0.1 Cell with cell constant, 0.1 cm^{-1} 0.01 Cell with cell constant, 0.01 cm^{-1} vAr ("variable") Cell with different cell constant, adjustable in the range 0.090 ... **1.000** ... 1.500 cm^{-1}. How to adjust the value, see section 4.7.
CFu	• $\mathcal{X}$ • SAL	Conductivity ($\mathcal{X}$) or salinity (Sal) measuring mode.

Setting	Selection/Values	Explanation (values in bold typeface = values on delivery)
Crn	● Auto ● 1.999 µS/cm ● 19.99 µS/cm ● 199.9 µS/cm ● 1999 µS/cm ● 19.99 mS/cm ● 199.9 mS/cm ● 1000 mS/cm	Measuring range. This menu item only appears if the conductivity measuring mode (𝒳) is selected. The set value indicates the upper measuring range limit. The measuring range always starts at zero. If Auto is selected, the monitor automatically uses the measuring range with the highest possible resolution.

Interrelationship between adjusted sensor type (setting, C in) and adjustable measuring range:

Adjustable measuring range	Setting, C in							
	700	600	300	10	1	0.1	0.1	uAr
Auto	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
0 ... 1,999 µS/cm							**x**	**x**
0 ... 19.99 µS/cm						**x**	**x**	**x**
0 ... 199.9 µS/cm	**x**	**x**	**x**		**x**	**x**	**x**	**x**
0 ... 1999 µS/cm	**x**	**x**	**x**		**x**	**x**		**x**
0 ... 19.99 mS/cm	**x**	**x**	**x**		**x**			**x**
0 ... 199.9 mS/cm	**x**	**x**	**x**	**x**	**x**			**x**
0 ... 1000 mS/cm				**x**				**x**

Cr1	● rEC 𝒳 / Sal	Operating mode of the REC 1 current output (measured conductivity value). After confirming the rEC (𝒳 or Sal) selection with **<ENTER>** you can adapt the upper and lower final value. Operating notes: – The setting is carried out in the order: upper final value -> lower final value – Press 1x **<ENTER>** in between.

(continues on the next page)

Setting	**Selection/Values**	**Explanation** (values in bold typeface = values on delivery)
Cr 1 (continued)		The following settings are possible: 𝒳, Measuring range 0.000 ... 1.999 µS/cm: Upper final value: 0,000 µS/cm Lower final value: 1.999 µS/cm (fixed range) 𝒳, Measuring range 0,00 ... 19,99 µS/cm: Upper final value: 2.00 ... **19.99** µS/cm Lower final value: 0.00 ... 15.00 µS/cm Minimum spacing: 2 µS/cm (step size 1 µS/cm) 𝒳, Measuring range 0.0 ... 199.9 µS/cm: Upper final value: 20.0 ... **199.9** µS/cm Lower final value: 0.0 ... 150.0 µS/cm Minimum spacing: 20 µS/cm (step size 10 µS/cm) 𝒳, Measuring range 0 ... 1999 µS/cm: Upper final value: 500 ... **1999** µS/cm Lower final value: 0 ... 1500 µS/cm Minimum spacing: 500 µS/cm (step size 100 µS/cm) 𝒳, Measuring range 0.00 ... 19.99 mS/cm: Upper final value: 5.00 ... **19.99** mS/cm Lower final value: 0.00 ... 14.99 mS/cm Minimum spacing: 5 mS/cm (step size 1 mS/cm) (continues on the next page)

Setting	Selection/Values	Explanation (values in bold typeface = values on delivery)
Cr1 (continued)		%, Measuring range 0.0 ... 199.9 mS/cm or Auto: Upper final value: 50.0 ... **199.9** mS/cm Lower final value: 0.0 ... 149.9 mS/cm Minimum spacing: 50 mS/cm (step size 10 mS/cm) Sal, measuring range 0.0 ... 70.0: Upper final value: 10 ... **70** Lower final value: 0 Minimum spacing: 10 (step size 5) Note: If a measuring range is exceeded (OFL), the analog output outputs a constant signal of 20.5 mA. The analog output automatically returns to the selected range after the violation of the measuring range has ended.
Cr2 (only with RT and RT RS option)	● rEC °C	Measured value range of the REC 2 analog output (temperature value). After confirming the rEC (°C) selection with **<ENTER>** you can adapt the upper and lower final value. Operating notes: – The setting is carried out in the order: upper final value -> lower final value – Press 1x **<ENTER>** in between. The following settings are possible: Sensor type 700, 600 or 300: Upper final value: 15 ... **50** ... 60 °C Lower final value: -5 ... **0** ... 40°C Minimum spacing: 20 °C (step size 1 °C) (continues on the next page)

Setting	**Selection/Values**	**Explanation** (values in bold typeface = values on delivery)
Cr2 (continued)	● rEC °C	Other sensor types: Upper final value: 15 ... **50** ... 130 °C Lower final value: -5 ... **0** ... 110°C Minimum spacing: 20 °C (step size 1 °C) Note: If the range is exceeded, the recorders output a constant value of 20.5 mA (OFL display). The instrument automatically returns to the defined recorder range when the value is within the range again.
Crc REL 1/2 (only with RT and RT RS option)	● nF ● PS ● FrC ● UL.LL ● CS	Functions of the freely configurable relays REL 1 and REL 2. The configuration of these relays is described in detail in section 4.6.1. The REL 1 or REL2 status display shows for which relay the setting has just been made. Neither relay has a function when it is delivered (**nF**).
CrF REL 1/2 (only with RT and RT RS option)	● O ● C	Switching behavior of the freely configurable relays REL 1 and REL 2. "O" (open) = normally closed contact "**C**" (closed) = normally open contact The switching behavior indicates the state of the switching contact for an active relay. This setting only appears if the limit value control (UL.LL) function and frozen measured value (FrC) are set for the relay. The REL 1 or REL2 status display shows for which relay the setting has just been made.

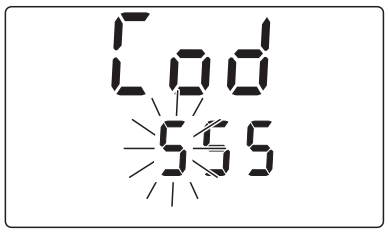
4.5 Parameterization

4.5.1 Calling up the parameterization level

Call up the parameterization level from the operating level as follows:

1 Press **<DOWN>**.

2 Press **<ENTER>**.



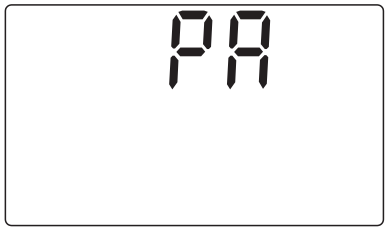
3 The menu for the password prompt appears.

When delivered, no password protection is set up. In this case proceed to the next operating step by pressing **<ENTER>** three times.

If password protection is set up, the password must be entered in order to change settings. Enter the password as follows:

– Set the first (flashing) digit with **<UP><DOWN>** and confirm with **<ENTER>**.

– Set the other two digits in the same way.



4 After the last digit you reach the starting point of the parameterization level. From here you can reach the settings with **<ENTER>** (see section 4.5.2).

Note
If an incorrect password is entered or after pressing the **<ESC>** key during password entry, access to the parameterization is only possible in view mode, i.e. settings can be viewed but not changed.

4.5.2 Setting table of parameterization

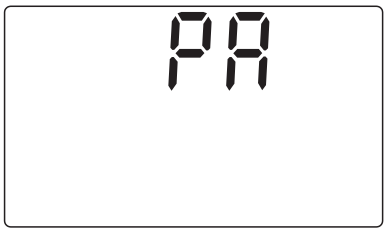
Overview of the settings (main level)

Display	Description	Instrument version		
		Stan-dard	RT	RT RS
Pr 1	Current output 1	x	x	x
Pr2	Current output 2		x	x
PL	Relay limits [1]		x	x
P IF	RS 485 interface			x
PCd	Password protection	x	x	x
Pt	Temperature balancing	x	x	x
Ptr	Reference temperature [2]	x	x	x
PtF	Temperature compensation [2]	x	x	x
PCS	Timer function		x	x

x Menu appears for the corresponding instrument variant
1) For relays that are configured as limit indicators
2) Menu only appears if the conductivity ($\mathcal{X}$) measuring mode is selected

General operating instructions

The starting point for the settings is the start display of the parameterization level (see section 4.5.1):



Switch to the first setting of the main level with **<ENTER>**.

Operation:

- Navigate in the main level to the next or previous setting with **<UP><DOWN>**. The entry level with further settings is reached by subsequently pressing **<ENTER>**.
- In the entry level select the desired value from the selection in each case with **<UP><DOWN>** and confirm this with **<ENTER>**. This puts the setting into effect and you go to the next setting or return to the main level.
- Certain settings or choices depend on the instrument variant or specific configuration settings. Settings that are not available will be

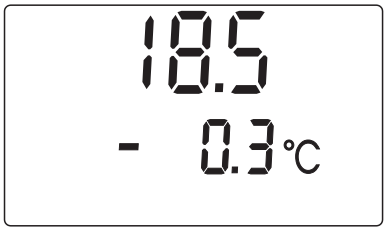
skipped.

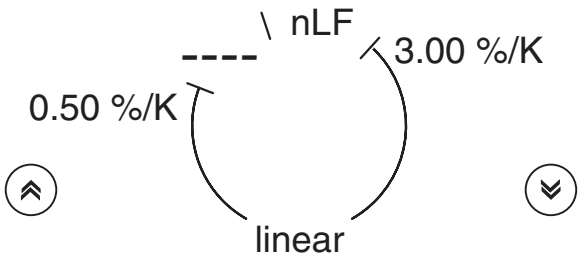
- From any point of the main level press **<ESC>** to return to the starting point of the parameterization level. From here change to the operating level with **<M>** or **<ESC>** or to the configuration level with **<UP><DOWN>**.
- From any point of the main level press **<M>** to also go directly to the operating level.
- In view mode you can change to the operating level from any point with **<M>**.

Setting table:

Setting	**Selection/Values**	**Explanation** (values in bold typeface = values on delivery)
Pr 1	• 4:20 • 0:20 or d 1:0.1 ... d 1:20	Current range and attenuation of the REC 1 current output in rEC operating mode (analog output). Operating notes: – The setting is carried out in the order: current range -> attenuation – Press 1x **<ENTER>** in between. The following values can be set: • Current range: – **4 to 20 mA**, or – 0 to 20 mA • "dI" = attenuation dI/dt (in mA/s): – 0.1 – 1 – 5 – **20** Attenuation is the change speed of the current signal in the case of erratic changes of the input signal.
Pr2 (only with RT and RT RS option)	• 4:20 • 0:20 or d 1:0.1 ... d 1:20	Current range and attenuation of the REC 2 current output in rEC operating mode (analog output). For setting possibilities, see Pr 1 (rEC operating mode).

Setting	**Selection/Values**	**Explanation** (values in bold typeface = values on delivery)
PL UL / LL REL 1/2 HS td (only with RT and RT RS option)	(depending on the configuration)	Settings for the REL 1 and REL 2 relays configured as limit indicators. The parameterization of the limit indicator is described in detail in section 4.6. The REL 1 or REL2 status display shows for which relay the setting has just been made.
P IF (only with RT RS option)	(depending on master/slave operating mode)	Interface parameter (Baud rate, address etc.). The parameterization of the RS 485 interface is described in a separate manual that is included in the scope of delivery of the instrument variant with RS 485 interface (RT RS option).
PCd	000 ... 999	Password against unintentional changes of configuration and parameterization. 000 = password protection is deactivated (state on delivery) Operating note: – Set the first (flashing) digit with **<UP><DOWN>** and confirm with **<ENTER>**. – Set the other digits in the same way. Notes: After setting up password protection the instrument can only be configured and parameterized after entry of the correct password. The password "555" is not permissible.

Setting	Selection/Values	Explanation (values in bold typeface = values on delivery)
PL	-0.5 ... 0.5 °C	Comparison of the measured temperature value against a reference thermometer. Notes: – Due to the thermal capacity of the sensor, it is necessary to place it in a container with at least 2 liters of water. – Leave the sensor and reference thermometer in the vessel for at least 15 minutes (in the case of temperature differences of more than 10 °C for at least one hour) with occasional stirring so that the temperatures equalize. Carry out the balancing: – Press **<ENTER>**.  – Set the measured temperature value (upper display line) to the value of the reference thermometer with **<UP><DOWN>**. The lower display line shows the correction value.
PLr	20 °C 25 °C	Reference temperature for the conductivity measurement. This menu item only appears if the conductivity measuring mode (𝒳) is selected.

Setting	Selection/Values	Explanation (values in bold typeface = values on delivery)
PtF	nLF 0.50 ... 3.00 %/K ----	Temperature compensation and temperature function. This menu item only appears if the conductivity measuring mode (𝒳) is selected. The following settings are possible: – nLF: Temperature compensation using nonlinear temperature function – 0.50 ... 3.00 %/K: Temperature compensation using linear temperature function with adjustable temperature coefficients. – ----: No temperature compensation Operating note: Pressing the **<UP><DOWN>** runs through all options as follows: 
PCS tr tc th REL 1/2 (only with RT and RT RS option)	(depending on the configuration)	Timer settings for relays that are configured as control relays for a sensor cleaning system. The timer settings are described in detail in section 4.6. The REL 1 or REL2 status display shows for which relay the setting has just been made.

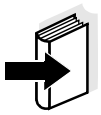
4.6 Freely configurable relays (RT and RT RS option)

4.6.1 Configuration

Relay functions

The two potential-free relays of the RT and RT RS instrument variants can be freely configured.

The following functions are possible:



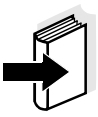
Note
The relay functions are selected in the configuration level under the setting Lrc (see section 4.4.2).

Function	Description
nF (no function)	Relay has no function
PS (Power Supply)	Monitoring the mains voltage. The relay contact is closed when mains voltage is applied and opens if there is a power failure.
FrC (Freeze)	The relay is active when the measured value is frozen, e.g. during a calibration. The relays can be configured as normally closed or normally open.
UL.LL (Limits) UL % / Sal LL % / Sal UL °C LL °C	The relay can be set as an upper or lower limit indicator for both the conductivity/ salinity value as well as for the measured temperature value. It becomes active if a specified limit is exceeded or undercut. The relays can be configured as normally closed or normally open. A limit indicator is set as follows: – Press **<ENTER>**. – Select the desired option with **<UP><DOWN>** and then press **<ENTER>**. Note what appears on the display: UL = upper limit LL = lower limit % / Sal = conductivity or salinity °C = measured temperature value The specification of the limits and other parameterization of the relay is described in section 4.6.2.

Function	Description
CS (Cleaning System)	The relay controls an external sensor cleaning unit. The relay works as a closer (i.e. normally open). During the cleaning process the measured value is frozen. The parameterization of the relay is described in section 4.6.3.

Switching behavior (normally closed/open)

The relay can be configured as normally closed or open for the functions FrC (Freeze) and UL.LL (limits). The relay works as normally open for all other functions.



Note
The switching behavior is set in the configuration level (section 4.4.2).

4.6.2 Limit indicator

Basics

With a limit indicator, a relay switches when a specified limiting value is exceeded or undercut. The switching contact opens or closes according to the selected switching behavior.

Limit indicators can be used in the following way:

- Monitoring a limiting value using a relay:
  When a limiting value (upper or lower limiting value) is exceeded or undercut, a relay switches.
- Monitoring two limiting values using two relays:
  If the upper limiting value is exceeded or undercut, a relay switches and, if the lower limiting value is exceeded or undercut, another relay switches.

Example: Monitoring of limit values with one or two relays

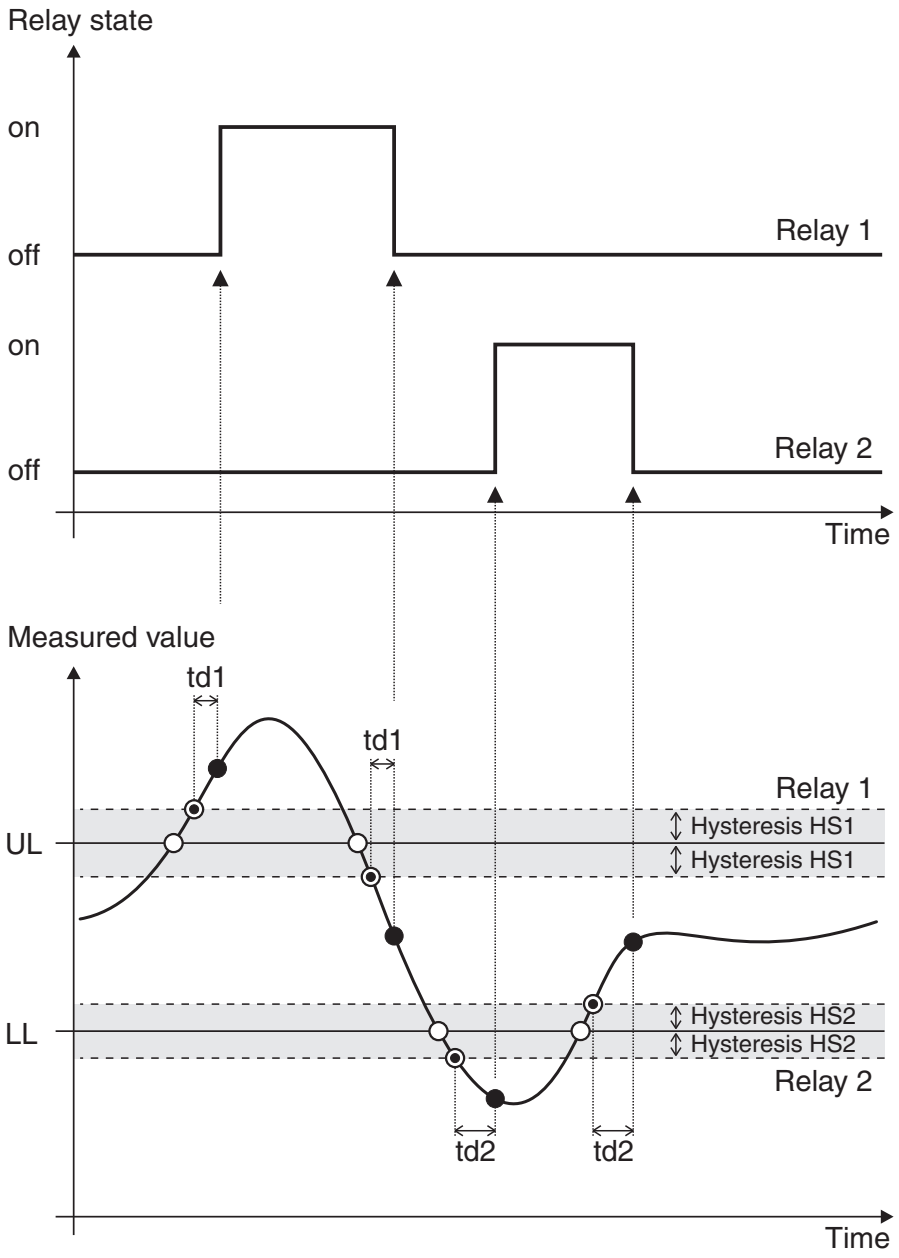


Fig. 4-2 Switching points of relays working as limit indicators

○	The selected limit value (UL/LL) is exceeded/undercut.
◉	The hysteresis HS that was set for the limit value is exceeded/ undercut. The switching delay td for the limit value is started.
●	If the limit value including the hysteresis is still exceeded/ undercut and the switching delay for the limit value has expired the relay switches.

Setting table for limit indicators:

Setting	Selection/Values	Explanation
UL or LL	Any within the measurement range	Upper or lower limit. Setting tolerance according to the measured value display. Operating note: – Set the first (flashing) digit with **<UP><DOWN>** and confirm with **<ENTER>**. – Set the other digits in the same way.
HS	0 to 10 % of the measuring range	Hysteresis. Difference between switching point and limit value, if the measured value moves away from the limit value. Operating note: – Set the first (flashing) digit with **<UP><DOWN>** and confirm with **<ENTER>**. – Set the other digits in the same way.
td	00:00 ... 59:59	Switching delay (in Min:Sec). The time period for which the limit value including the hysteresis must be exceeded before the relay switches. Operating note: – Set the seconds (right flashing digits) with **<UP><DOWN>** and confirm with **<ENTER>**. – Then set the minutes (left flashing digits) with **<UP><DOWN>** and confirm with **<ENTER>**.

Note
Hysteresis and switching delay prevent frequent switching for measured values that are close to the limit value.

4.6.3 Timer for external sensor cleaning system

Function

The cleaning function enables the timing of a sensor cleaning system through one relay of the monitor. The relay always works as a closer (normally open).

Setting table for sensor cleaning:

Setting	Selection/Values	Explanation
tr	1 ... 168 (hours)	Time interval between two cleaning processes
tc	10 ... 300 (seconds)	Duration of the cleaning process. During the cleaning process the measured value is frozen.
th	10 ... 900 (seconds)	Time for adapting the sensor to the measured medium after the cleaning process. During the adaptation period the measured value is frozen.

Operating notes on setting the numerical values:

- Set the first (flashing) digit with **<UP><DOWN>** and confirm with **<ENTER>**.
- Set the other digits in the same way.
- After the last digit you reach the next setting
- After entry of all three values the setting of the sensor cleaning is complete

Note

No checking/adjustment of the cell constant is possible during the cleaning process (tc) and the adjustment duration (th). If a cleaning process is due during an ongoing checking/adjustment routine, the start is delayed until the routine has ended. The starting time of all subsequent cleaning processes is moved back according to the delay.

4.6.4 Display of the relay states in the operating level

For an active relay the REL 1 or REL 2 status display appears in the operating level. Depending on the selected switching behavior the relay contact is either open or closed.

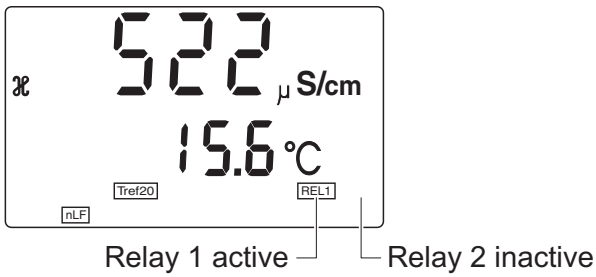


Fig. 4-3 Display of the relay states in the operating mode

4.7 Checking/Setting the cell constant

Normally the cell constant specified by the manufacturer is given in the delivery documentation or the relevant labeling on the sensor.

Note
For conductivity measuring cells with the cell constants, 1 cm^{-1}, 0.1 cm^{-1} and 0.01 cm^{-1} (see configuration, setting C in), the cell constant cannot be changed.

Why check/set the cell constant?

Over time the characteristics of the cell change slightly, e.g. due to sediments. This results in an inexact measured value being displayed. The original characteristics of the cell can often be restored just by cleaning the cell. In the process described below the current cell constant is determined, stored in the monitor and used for all future measurements.

Setting range

The setting range for the cell constant depends on the sensor type (see configuration, setting C in):

Sensor type	Setting range
700	0.090 ... 1.500 cm^{-1}
600	0.090 ... 1.500 cm^{-1}
300	0.090 ... 1.500 cm^{-1}
10	5.00 ... 15.00 cm^{-1}
1	(no setting possible)
0.1	
0.01	
uAr	0.090 ... 1.500 cm^{-1}

Process

In order to determine the cell constant, the conductivity measuring cell is immersed in a conductivity standard (0.01 mol/l potassium chloride solution). The reference temperature is automatically set to 25 °C. At this temperature the control standard has a conductivity of 1413 µS/cm. If there is any deviation, the measured value can be matched to the set value by varying the cell constant.

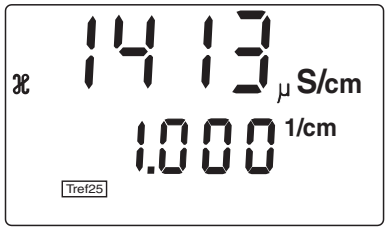
Note
Only immerse the conductivity measuring cell in the control standard when it is in a clean and virtually dry condition. Impurities or water alter the conductivity of the control standard. Only use the control standard once.

Checking/Setting routine

1 In the measured value display: Press **<C>**.

Note: The states of all relays and current outputs linked with the measured conductivity value are frozen during the checking/setting routine.

2 Immerse the conductivity measuring cell in the control standard.



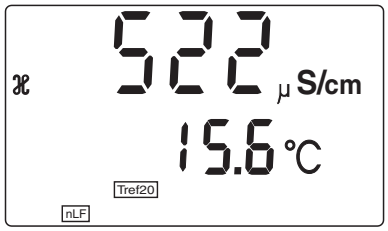
The following values are shown on the display:

– Upper line: The measured conductivity of the control standard

– Lower line: The selected cell constant

3 If the measured conductivity deviates from the set value (= 1413 µS/cm), the cell constant can be changed until the set value or the nearest possible value is displayed (1 digit of the cell constant roughly corresponds to a little more than 1 µS/cm) with **<UP><DOWN>**.

4 Put the conductivity measuring cell back into the measuring position.



5 Press **<ENTER>** or **<M>**.

The display switches to the normal measured value display.

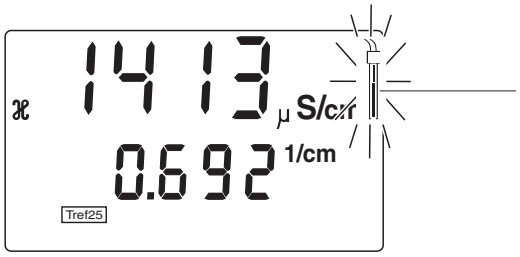
The states of all relays and current outputs linked with the measured conductivity value again follow the measured value.

Invalid setting

With the 700, 600 and 300 sensor types, the entry is invalid if the value deviates from the nominal cell constant by more than ±10 %:

Sensor type	Validity range
700	0.826 ... 1.008 cm^{-1} (0.917 cm^{-1}±10 %)
600	0.826 ... 1.008 cm^{-1} (0.917 cm^{-1}±10 %)
300	0.549 ... 0.669 cm^{-1} (0.609 cm^{-1}±10 %)

If the validity range is left, this is already visible from the flashing sensor symbol during the setting process:



Measurement is not possible with an invalid setting. After swapping to the measured value display the sensor symbol and an invalid measured value are displayed ("----"). The states of all relays and current outputs linked with the measured conductivity value remain frozen.

Remedial measures:

- Clean the measuring cell (see measuring cell operating manual)
- Check the conductivity control standard and renew if necessary
- Then repeat the checking/setting routine.

If these measures are not successful or cannot be carried out and a further measurement is still required, the checking/setting routine can be repeated and a valid value selected for the cell constant. However note that the subsequent measured values contain a larger measuring error and the measuring system no longer meets the stated specifications.

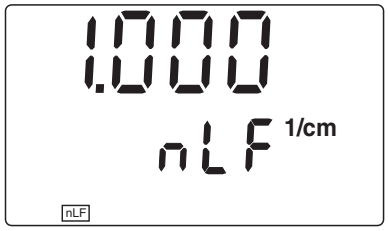
4.8 Display of instrument information

The following information can be called up:

- Configuration data. For this, switch to the configuration level. Press **<ESC>** during the password prompt to view all settings in view mode (see section 4.4.1 CALL UP CONFIGURATION LEVEL).
- Parameterization data. For this, switch to the parameterization level. Press **<ESC>** during the password prompt to view all settings in view mode (see section 4.5.1 CALLING UP THE PARAMETERIZATION LEVEL).
- Cell constant
- Process for temperature compensation
- Software version

Viewing the cell constant and software version

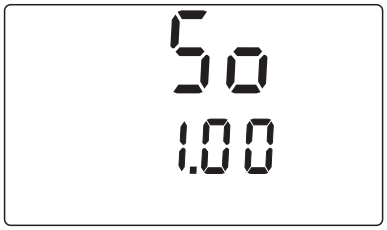
To call up the selected cell constant, press **<ENTER>** in the measured value view (operating level)



The set process for temperature compensation is also displayed in the second display line:

– nLF: Temperature compensation using nonlinear temperature function
– (numeric value) %/K: Temperature compensation using nonlinear temperature function with the specified temperature coefficients.
– ----: No temperature compensation

Swap to the display of the software version (So) with **<UP><DOWN>**:



Return to the measured value display with **<M>**.

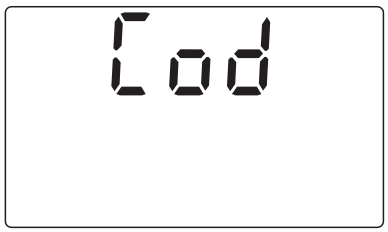
4.9 Test mode

General information

Test mode can be used for the following purposes:

- Set specific current values on the current outputs for test purposes
- Switch the relays on and off for test purposes (RT and RT RS option)
- Check the RS 485 communication (RT RS option)

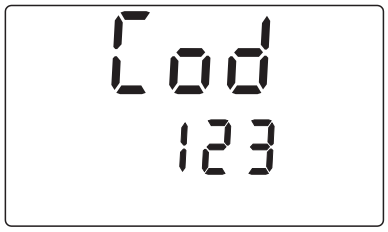
Test procedure



1 Keep **<ESC>** pressed and briefly press **<UP>** at the same time.

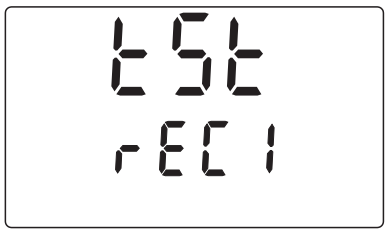
Note: To leave the test mode again at any time, press **<M>** or **<C>**.

2 Press **<ENTER>**.



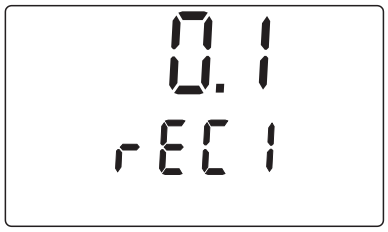
The set password is displayed ("000" = password protection deactivated).

3 Proceed to the next test item with **<ENTER>**.



Test of current output 1.

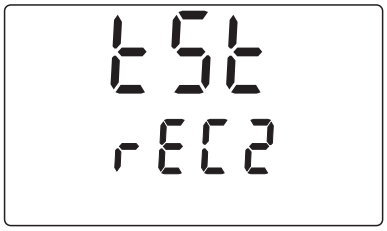
4 Press **<ENTER>**.



A fixed current value can be set on current output 1 here:

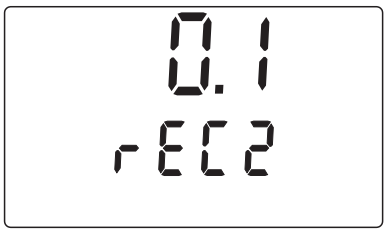
- Set 0.1 mA with **<M>**
- Set 20.0 mA with **<C>**
- Increase or decrease the value as necessary (adjustment range 0.0 to 20.5 mA) with **<UP><DOWN>**

5 Proceed to the next test item with **<ENTER>**.



Test of current output 2
(only for RT and RT RS option).

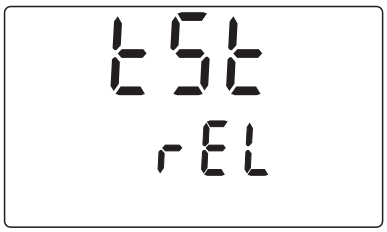
6 Press **<ENTER>**.



Here a fixed current value can be set on current output 2:

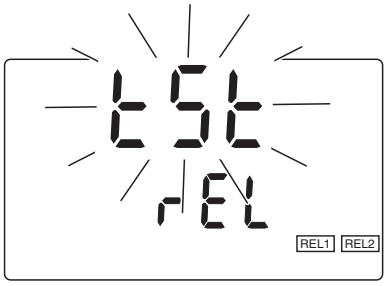
- Set 0.1 mA with **<M>**
- Set 20.0 mA with **<C>**
- Increase or decrease the value as necessary (adjustment range 0.0 to 20.5 mA) with **<UP><DOWN>**

7 Proceed to the next test item with **<ENTER>**.



Test the relays
(only with RT and RT RS option).

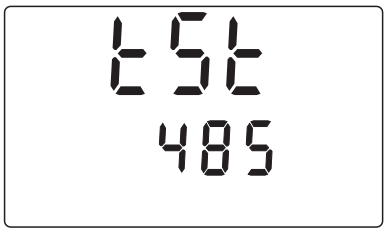
8 Press **<ENTER>**.



The tSt display flashes. Now individual relays can be manually switched on and off:

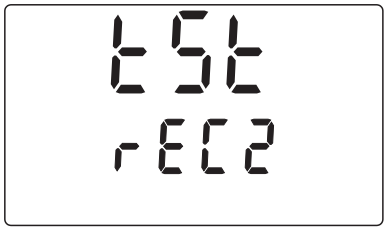
- Switch relay 1 on/off with **<ESC>**
- Switch relay 1 on/off with **<UP>**

9 Proceed to the next test item with **<ENTER>**.



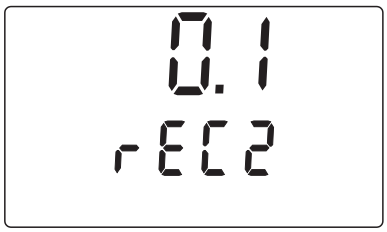
Test of the RS 485 communication
(RT RS option).

10 Press **<ENTER>**.



Test of current output 2
(only for RT and RT RS option).

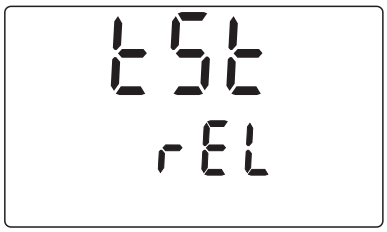
6 Press **<ENTER>**.



Here a fixed current value can be set on current output 2:

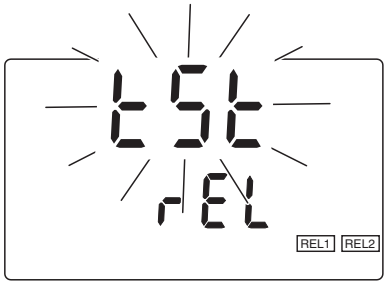
- Set 0.1 mA with **<M>**
- Set 20.0 mA with **<C>**
- Increase or decrease the value as necessary (adjustment range 0.0 to 20.5 mA) with **<UP><DOWN>**

7 Proceed to the next test item with **<ENTER>**.



Test the relays
(only with RT and RT RS option).

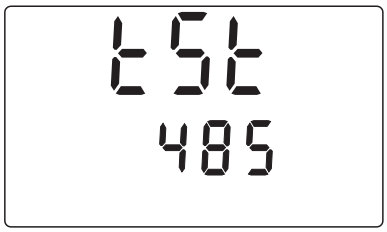
8 Press **<ENTER>**.



The ESC display flashes. Now individual relays can be manually switched on and off:

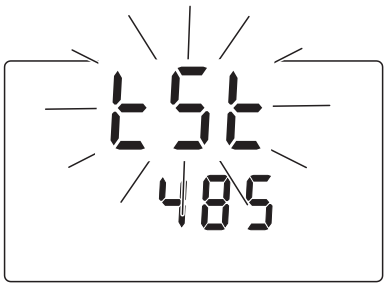
- Switch relay 1 on/off with **<ESC>**
- Switch relay 1 on/off with **<UP>**

9 Proceed to the next test item with **<ENTER>**.



Test of the RS 485 communication
(RT RS option).

10 Press **<ENTER>**.



The tSt display flashes. The RS 485 communication test is active.

The RS 485 interface works as a repeater, i.e. all received blocks are sent back again.

Special commands:

– The monitor sends the instrument identification according to the RS command "RSID" with RS 485 protocol with **<ESC>**

– The monitor sends the instrument identification according to the RS command RSID" without RS 485 protocol (e.g. for printer output) with **<UP>**

– Terminate the test with **<ENTER>**.

11 Return to the operating level with **<M>**.

5 Maintenance and cleaning

5.1 Maintenance

The measurement instrument is maintenance free.

5.2 Cleaning

Occasionally wipe the outside of the measuring instrument with a soft, damp cloth.

CAUTION
Do not use high-pressure water blasters for cleaning (danger of water penetration!). Also do not use aggressive cleaning agents such as alcohol, organic solvents or chemical detergents. These types of cleaning agent can attack the surface of the housing.

6 What to do if ...

The conductivity measuring cell cannot be activated

Cause	Remedy
– Contact problems	– Check the connections of the conductivity measuring cell

Display OFL

Cause	Remedy
– The measured conductivity or temperature value is outside the measuring range	– Check the measurement conditions

The cell constant is outside the valid range

Cause	Remedy
– Conductivity measuring cell soiled	– Clean conductivity measuring cell acc. to operating manual
– Control standard soiled	– Use new control standard – Only immerse clean and virtually dry conductivity measuring cell in the control standard Note: Only ever use the control standard once.
– Fluctuating temperature measured values	– Ensure stable temperatures

The measurement provides implausible measured values

Cause	Remedy
– Contact problems	– Check the electrode connections
– Conductivity measuring cell soiled	– Clean conductivity measuring cell acc. to operating manual
– Air trapped in the vicinity of the measuring cell electrode	– Ensure a measuring environment free of air bubbles
– Incorrect temperature compensation	– Use the linear temperature function to check/correct compensation temperature during compensation

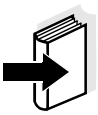
Cause	Remedy
– Incorrect reference temperature set	– Correct set reference temperature

The current output delivers no current

Cause	Remedy
– When wiring with the flow control its switching threshold was undercut	– Check the current output in test mode (see section 4.9). – Reset the flow-through

Err
AoPt

Cause	Remedy
– Hardware error	– Contact WTW

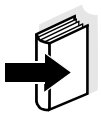


Note
More possible errors and their remedies are given in the operating manual of the conductivity measuring cell.

7 Accessories

Cable and terminal box for cable extension

Description	Model	Order no.
Cable plug	K170	109 508
Cable	EK/170	108 206
Passive terminal box	KI/S	108 606



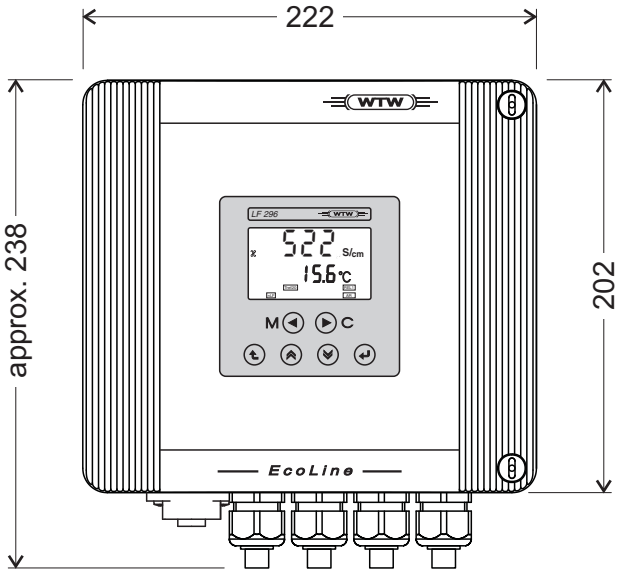
Note
More accessories are available in the WTW catalog or on the Internet under www.WTW.com.

8 Technical data

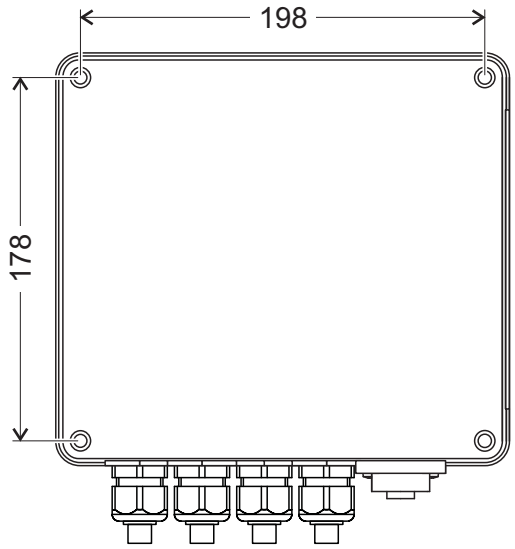
8.1 General data

Dimensions

Front view:



Rear view:



Side view:

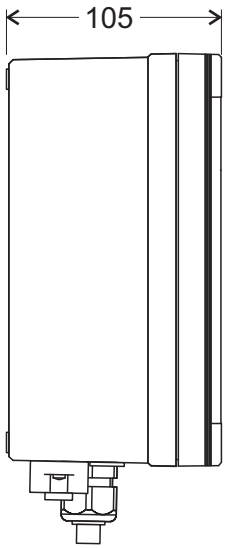


Fig. 8-1 Dimension drawing of the LF 170 (dimensions in mm)

Test certificates

CE

Mechanical construction

Housing material	Glass fiber reinforced Polycarbonate
Membrane keyboard	Polyester
Weight	approx. 2,2 kg
Type of protection	IP 66

Ambient conditions

Temperature	
Operation	-25 °C ... +55 °C (-13 ... 131 °F)
Storage	-25 °C ... +65 °C (-13 ... 149 °F)
Relative humidity	
Yearly average	≤ 90 %
Dew formation	Possible

Electrical data

Supply voltage	Nominal voltage (depending on variant):	● 230 V AC (-15 % + 10 %) ● 115 V AC (-15 % + 10 %) ● 24 V AC (-15 % + 10 %) ● 24 V DC (-30 % + 20 %)
	AC frequency:	48 - 62 Hz
	Connection:	2 pin
Protective class		II
Overvoltage category		II
Power consumption		Maximum approx. 18 W

Electrical connections

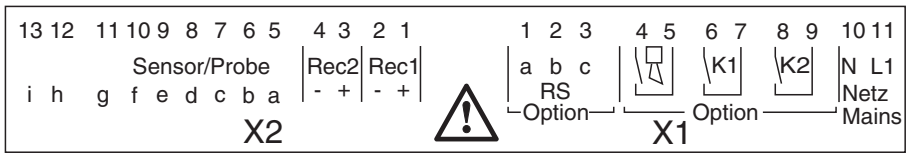


Fig. 8-2 Terminal strip

Connection technique

Connections	– 7-pin sensor input jack on the underside of the housing – Screwless plug-in connections in the housing using cable glands
Connection cross section	0.5 ... 2.5 mm^2
Cable feeds	4 cable glands PG 13,5 / terminal range 10 ... 14 mm

Relay (RT and RT RS option)

Relay contacts	Galvanically separated
Max. switching voltage	250 V AC or 30 V DC
Max. switching current	5 A (AC and DC)
Max. switching power	150 W (resistive load)
Relay K1 and K2	Programmable as: – Signaling relay for failure of supply voltage – Signaling relay for "frozen" outputs – Limit monitor – Timer Switching behavior adjustable

Current outputs

Output	Galvanically separated from the sensors
Current range	Adjustable: – 0 - 20 mA – 4 - 20 mA
Accuracy	0.1 % of current value ± 50 µA, load max. 600 Ω
Functions	– 1 x analog output for measured conductivity value – 1 x analog output for measured temperature value (RT and RT RS option) Attenuation adjustable

Digital interfaces

1x RS 485 (RS option)

EMC product and system characteristics

EN 61326	EMC requirements for electrical resources for control technology and laboratory use – Interference immunity according to EN 61326/A1 Table A.1 – Resources for industrial areas, intended for indispensable operation – Interference emission limits for resources of class B
System lightning protection	Extended protective characteristics as opposed to EN 61326/A1 Table A.1
FCC, class A	

Instrument safety

Applicable norms	– EN 61010-1

8.2 Measurement characteristics

8.2.1 Conductivity measurement

Connectable conductivity measuring cell	Two- or four-electrode measuring cells
Display and measuring range	Adjustable (depending on the measuring cell type): – 0.000 ... 1.999 µS/cm – 0.00 ... 19.99 µS/cm – 0.0 ... 199.9 µS/cm – 0 ... 1999 µS/cm – 0.00 ... 19.99 mS/cm – 0.0 ... 199.9 mS/cm – 0 ... 1000 mS/cm – Auto (automatic meas. range selection)
Resolution	Depending on the measurement range: – 0.001 µS/cm ... 1 mS/cm
Accuracy	0.5 % of measured value ± 1 digit
reference temperature	Adjustable: – 25 °C or 20 °C
"Calibration"	Checking and setting the cell constant with the control standard (0.01 molar potassium chloride solution)
Permissible range for the cell constant	0.090 ... 1.500 cm^{-1}

Adjustable temperature compensation

Compensation procedure	**Temperature range**
Linear with adjustable temperature coefficient in the range 0.50 ... 3.00 %/K	0 ... 60 °C (32 ... 140 °F)
Nonlinear	5 ... 35 °C (41 ... 95 °F) according to DIN EN 27888 / ISO 7888 35 ... 60 °C (95 ... 140 °F) according to WTW procedure
None	

8.2.2 Salinity measurement

Display and measuring range	0.0 ... 70.0 Sal
Resolution	0,1 Sal
reference temperature	20 °C

8.2.3 Temperature measurement

Temperature sensor	NTC (integrated in the sensor)
Measuring range	0.0 ... 130.0 °C (depending on the measuring cell type)
Resolution	0.1 K
Accuracy	0.2 K ± 1 digit
Adjustment method	Manual via comparative measurement of ± 0.5 K

FCC Class A Equipment Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Changes or modifications not expressly approved by the manufacturer could void the user‘s authority to operate the equipment.

9 Indexes

This chapter provides additional information and orientation aids.

- List of display abbreviations (see section 9.1)
- Definition of terms (see section 9.2)
- Index (see section 9.3)

9.1 Display abbreviations

Configuration	CodE	Password
	CO	Starting point of the configuration level
	Cnn	Measuring mode and range
	Cr1	Current output 1
	Cr2	Current output 2
	rEC	Analog output
	Crc	Relay function
	nF	No function
	PS	Mains voltage monitoring
	FrC	Signaling relay with "frozen" output
	UL.LL	Limit monitor
	CS	Cleaning system
	CrF	Relay switching behavior
	O	Normally closed (relay)
	C	Normally open (relay)
Parameterization of main level	PA	Starting point of the parameterization level
	Pr1	Current output 1
	Pr2	Current output 2
	PL	Limit monitor
	P IF	RS 485 interface
	PCd	Password
	Pt	Temperature balancing
	Ptr	Reference temperature

	PtF	Temperature compensation
	vAr	Variable cell constant
	nLF	Nonlinear function
	PCS	Cleaning system
Parameterization of relay	UL	Upper limit
	LL	Lower limit
	HS	Hysteresis
	td	Switching delay
	tr	Cleaning interval
	tc	Cleaning duration
	th	Adjustment duration
Parameterization of current outputs	d1	Attenuation
Miscellaneous	So	Software version
	tSt	Test mode

9.2 Glossary

The glossary briefly explains the meaning of the specialist terms. However, terms that should already be familiar to the target group are not described here.

AutoRange Name of the automatic selection of the measuring range.

Cell constant, k Characteristic parameter of a conductivity measuring cell, depending on the geometry.

Conductivity Short form of the expression 'specific electrical conductivity'. It is a measured value of the ability of a substance to conduct an electric current. In water analysis, the electrical conductivity is a dimension for the ionized substances in a solution.

Conductometry Name of the conductivity measuring technique.

Measured parameter The measured parameter is the physical variable determined by measuring, e.g. conductivity or temperature.

Measured value The measured value is the special value of a measured parameter to be determined. It is given as a combination of the numerical value and unit (e.g. 3 m; 0.5 s; 5.2 A; 373.15 K).

Measuring system The measuring system comprises all the devices used for measuring, e.g. meter and sensor. In addition, there is the cable and possibly an amplifier, terminal strip and armature.

Reference temperature Fixed temperature value to compare temperature-dependent measured values. For conductivity measurements, the measured value is converted to a conductivity value at a reference temperature of 20 °C or 25 °C.

Resolution Smallest difference between two measured values that can be displayed by a measuring instrument.

Salinity The absolute salinity S_A of seawater corresponds to the relationship of the mass of dissolved salts to the mass of the solution (in g/kg). In practice, this dimension cannot be measured directly. Therefore, the practical salinity is used for oceanographic monitoring. It is determined by measuring the electrical conductivity.

Salt content General designation for the quantity of salt dissolved in water.

Temperature coefficient Value of the slope of a linear temperature function.

Temperature compensation

Name of a function that considers the temperature influence on the measurement and converts it accordingly. Depending on the measured parameter to be determined, the temperature compensation functions in different ways. For conductimetric measurements, the measured value is converted to a defined reference temperature. For potentiometric measurements, the slope value is adjusted to the temperature of the test sample but the measured value is not converted.

Temperature function

Name of a mathematical function expressing the temperature behavior of a test sample, a sensor or part of a sensor.

Test sample

Designation of the test sample ready to be measured. Normally, a test sample is made by processing the original sample. The test sample and original sample are identical if the test sample was not processed.

9.3 Index

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