Operating Instructions
Testomat 2000® THCL

Combined process photometer for total chlorine 0 – 2.5 ppm

and process titrator for water hardness 4.47 – 44.7 ppm $CaCO_3$

GB

Contents

Important safetyinformation

- Please read these operating instructions carefully and completely prior to working with the instrument.
- Ensure that these operating instructions are always available for all users.
- These operating instructions must always be passed on to the new owner should Testomat 2000® THCL change hands.
- Always adhere to hazard warnings and safety tips when using reagents, chemicals and cleaning agents. Please adhere to the respective safety data sheet! Download the safety data sheets for the supplied reagents at http://www.heyl.de .

Intended use

Testomat 2000® THCL is used for the automatic determination and monitoring of residual total hardness (water hardness from 0.25 to 2.5 °dH) and the determination of total chlorine content from 0 to 2.5 mg/ltr (ppm) in water. The feed water must be clear, colourless and free of undissolved particles.

- Always adhere to the performance limits stated in the section entitled “Technical data”.
- Always observe the application areas/application limits of the indicators and the requirements of the medium being measured.

To ensure correct and intended usage, always read and understand these instructions, especially the section entitled “Important safety information”, prior to use.

The instrument is not used as intended if

- it is used in areas not specified in these instructions.
- it is used in areas which do not correspond to the ones described in these instructions.

Qualification of the staff

Assembly and commissioning require fundamental electrical and process engineering knowledge as well as knowledge of the respective technical terms. Assembly and commissioning should therefore only be carried out by a specialist or by an authorised individual supervised by a specialist.

A specialist is someone who due to his/her technical training, know-how and experience as well as knowledge of relevant regulations can assess assigned tasks, recognise potential hazards and ensure appropriate safety measures. A specialist should always adhere to the relevant technical regulations.

Warning notices in these instructions

The warning notices in these instructions warn the user about potential dangers to individuals and property resulting from incorrect handling of the instrument. The warning notices are structured as follows:

SIGNAL WORD

Description of the type or source of danger

Description of the consequences resulting from non-observance

➢ Preventive measures. Always adhere to these preventive measures.

"**DANGER**" indicates an immediate hazardous situation which, if not avoided, will result in death or serious injury.

"**WARNING**" indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

"**CAUTION**" indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injuries or property damage.

"**NOTE**" indicates important information. If this information is not observed, it may result in an undesirable result or state.

Further documents

Testomat 2000® THCL is a plant component. Therefore, always observe the maintenance manual of Testomat 2000® / ECO® and the documentation of the plant manufacturer.

Pay particular attention to

General instructions

WARNING

- Please adhere to health and safety regulations, electrical equipment safety regulations, and environmental protection regulations valid in the country of use and at the installation site.
- Adhere to national and local regulations during installation and commissioning.
- Always protect the instrument against moisture and humidity. It should never come into contact with condensation or splash water.
- Do not carry out any changes or actions at the instrument which are not described in these instructions; failure to adhere to these instructions will negatively affect any warranty claims that you make thereafter.

Installation

WARNING

- Always completely disconnect the relevant plant part before installing the instrument or connecting/disconnecting it to/from the power supply. Secure the plant against reconnection.
- Only connect the instrument to the mains voltage specified on the rating plate.
- Always observe technical data and ambient parameters.

HINWEIS

- Testomat 2000® THCL requires an interference free and stable power supply. If necessary, use a mains filter to protect Testomat 2000® THCL against interference voltages caused, e.g., by solenoid valves or large motors. Never lay connecting cables parallel to power cables.

Operation

- Ensure that the maximum electrical load capacity of the relay outputs is never exceeded.
- Immediately switch off Testomat 2000® THCL and contact service staff if malfunctioning occurs. The warranty will be void if you tamper with or attempt to repair Testomat 2000® THCL. Repairs must be carried out by authorised service staff.

Cleaning

- Only use a dry, lint-free cloth for cleaning.

De-installation

- Prior to de-installing a defective instrument, always write down a description of the error (failure effect). It is only possible to repair a defective instrument (irrespective of the warranty period) if it has been de-installed and returned to us with a description of the error.

Disposal

- Dispose of the instrument in accordance with national regulations.

Scope of delivery

1 Testomat 2000® THCL

1 plastic bag with screw caps with a hole and an insert for the screw caps of the indicator bottles

1 operating instructions

Performance specifications

Testomat 2000® THCL is used for the automatic determination and monitoring of residual total hardness (water hardness from 0.25 to 2.5 °dH) via titration and the determination of total chlorine content from 0 to 2.5 mg/ltr (ppm) in water. The analysis of total chlorine is carried out by adding three reagents; the analysis result is displayed after a reaction time of approx. 1 minute (without flushing times).

- Simple, menu-driven operating and programming via a plain text display
- Measurement via titration of residual hardness and photometric determination of the total chlorine content
- Freely selectable hardness units in °dH, °f, ppm CaCO3 or mmol/l and chlorine units in mg/l or ppm
- High measuring accuracy provided by a precise piston-dosing pump
- Analysis initiation:
  - Automatic interval operation
    (interval pause can be set from 0-99 minutes)
  - External control
  - Quantity dependent via impulse water meter
- One limit value with hysteresis (1, 2 or 3 bad analyses) for residual hardness (LV1) and total chlorine (LV2) and settable switch functions
- Monitoring of both measuring points (change-over via external solenoid valves)
- Internal error documentation
- Programmable service address
- Programmable maintenance interval for a maintenance request
- Extended operating periods due to 500 ml indicator storage bottle
- **optional**

  Interface card (0/4-20 mA or 0/2-10 V)

  Interface RS 232 (for a protocol printer)

Indicators/Reagents for Testomat 2000®-THCL

		Water hardness	
		Indicator type TH 2025	
Unit	**°dH** (Resolution)	0.25 – 2.50 (0.05)	
	°f (Resolution)	0.45 – 4.48 (0.1)	
	ppm $CaCO_3$ (Resolution)	4.47 – 44.7 (0.9)	
	mmol/l (Resolution)	0.04 – 0.45 (0.01)	

		Total chlorine	
		Reagent CL2250A, CL2250B, CL2250C	
Unit	**mg/l (ppm)** (Resolution)	0.0 – 2.5 (0.1)	

Application instructions

- Wait at least 5 seconds before switching the instrument on and then off again at the main switch.
- In order for Testomat 2000® THCL to operate reliably, use Heyl Testomat 2000® indicators in the pH-range 4 – 10.5!
- With Testomat® instruments for water hardness monitoring, larger quantities of heavy metal ions in the softened water might influence the colour reaction, especially iron above 0.5 mg/l, copper above 0.1 mg/l and aluminium above 0.1 mg/l (brownish-red colour display).
- If the measuring water contains more than 20 mg/l CO_2 (carbonic acid), incorrect evaluations cannot be excluded.
- The concentration of influencing contents can be determined by using our colourimetric TESTOVAL® test kit.
- Careful handling of the instrument increases both its operational reliability and service life! Therefore, carry out a visual inspection at regular intervals as described below.
  - Has the use-by date of the indicator expired?
  - Are the hose connections of the dosing pump free of leaks?
  - Is there air inside the dosing hoses?
  - Are all the water connections free of leaks?
  - Are the doors of the instrument closed properly?
  - Is the instrument heavily soiled?
  - Are the measuring chamber and the drain duct/drain hose clean?
- Trouble-free operation is only possible when maintenance is carried out on a regular basis (For maintenance and service instructions, please refer to the section entitled “Maintenance” and the "Maintenance manual of Testomat 2000® / ECO®")
- If problems occur, please refer to the section entitled "Error messages/Troubleshooting.

Installation

WARNUNG

Risks resulting from incorrect installation!

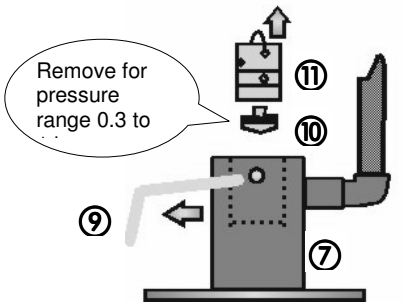
- Install Testomat 2000® THCL at a location where it is protected against dripping or splash water, dust and aggressive substances – e. g. in a switch cabinet or on a suitable wall.

NOTE

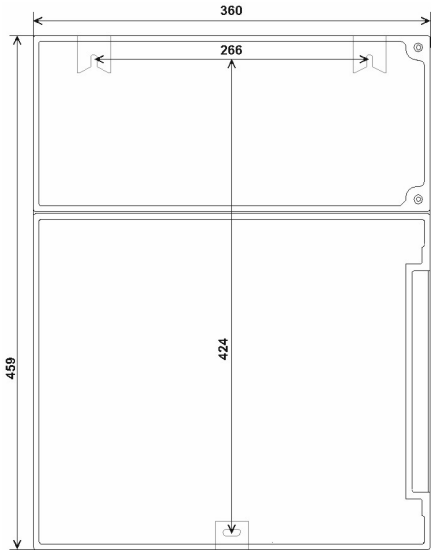
Information for trouble-free operation

- Install Testomat 2000® THCL vertically and without mechanical stress.
- Install Testomat 2000® THCL at a vibration-free site.

Operating Testomat 2000® THCL in the pressure range 0.3 to 1 bar



Prior to installation, please check whether lower operating pressure is required. The instrument is factory set for the operating range 1 to 8 bar. Remove the flow controller valve body ⑩ to operate the instrument in the operating range 0.3 to 1 bar (e.g. when using an aerator type R). This involves removing the retaining pin ⑨ from the controller / filter receiver ⑦. Subsequently use the metal bracket to remove the controller plug ⑪ from the borehole. Subsequently remove the flow controller valve body ⑩ and reinsert the controller plug and the retaining pin.



Installing Testomat 2000® THCL

Select an installation site where the water inlet hose can be kept as short as possible (max. 5 m).

- Please leave sufficient space on the left-hand side of the instrument to open the door.
- Drill the mounting holes as shown in the drawing on the left.
- Use three screws to attach the instrument at a suitable position in the switch cabinet or on a wall.

Connecting the water inlet and outlet

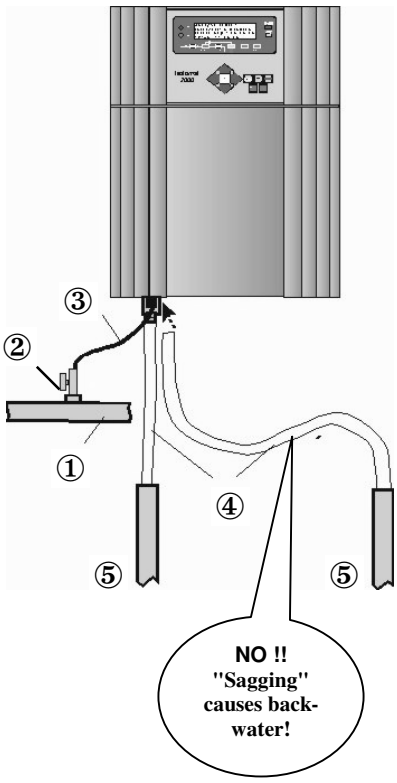
Information for trouble-free operation

NOTE

- The water pressure must be between 0.3 bar and 8 bar
- Avoid strong pressure fluctuations
- The measuring water temperature must be between 10 °C and 40 °C
- For temperatures above 40°C, the KCN type cooler should be installed in the branch line of Testomat 2000® THCL.

Water inlet

The measuring water is taken from the main water line of the water treatment plant and fed to the inlet connection of Testomat 2000® THCL. The instrument is equipped with a plug connector for plastic hoses 6/4 x 1 (external diameter 6 mm/ internal diameter 4 mm, wall thickness 1 mm) as standard.



- Install the connection for the branch line of Testomat 2000® THCL directly at the main water line ① directly after the water treatment plant
- It is important that the branch line connection is laid vertically upwards in order to prevent dirt particles from entering the instrument from the main water line.
- Install a manually operated shut-off valve ② in the branch to Testomat 2000® THCL.
- Use an opaque plastic hose 6/4 x 1 (max. length 5 m) for the water inlet ③.
- Flush the inlet to remove any dirt particles

When operating within a pressure range of 0.3 to 1 bar, please remove the valve body from the controller and the filter housing.

When using a cooler

CAUTION

- **The hot water can cause burns and damage wetted parts of Testomat 2000® THCL.**

Water outlet

The feed water flows through the measuring chamber to the drain via the outlet hose.

- Connect the outlet connection of Testomat 2000® THCL to an opaque outlet hose④ (internal diameter 14 mm).
- Lay this hose without **backwater development** and any syphoning effect, e.g. via an open funnel, to the drain.⑤

Connecting the power supply and devices

WARNING

Risk of electric shocks during installation!

If the power supply is not disconnected prior to installation, it may result in personal injuries, destruction of the product or damage to plant parts.

- Always disconnect the relevant plant parts before installing Testomat 2000® THCL.
- Only use tested cables with sufficient cross-sections for the connections.

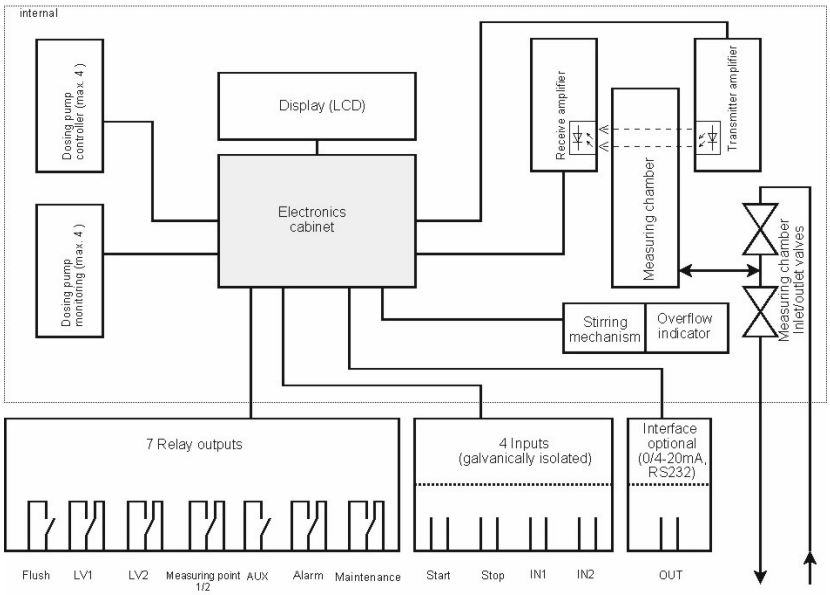
NOTE

Risk of damages caused by electromagnetic fields!

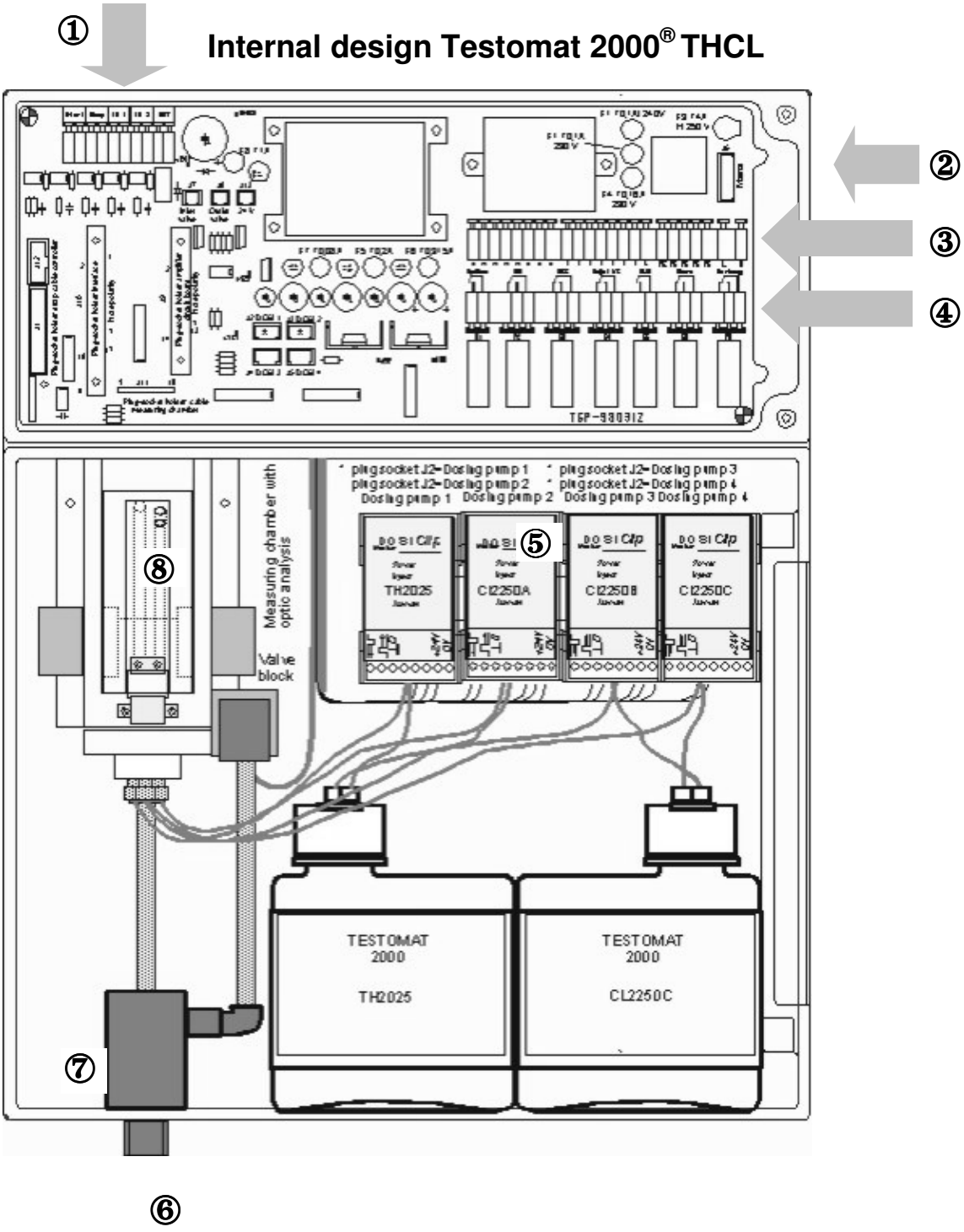
- If Testomat 2000® THCL or the connecting cables are installed parallel to power cables or in close proximity to electromagnetic fields, the instrument may be damaged or measurements incorrect.
- Ensure that connecting cables are as short as possible.
- Always install connecting cables and power cables separately.
- Connect the instrument to the protective earth conductor (for 230/115 VAC).
- Protect Testomat 2000® THCL against interference voltages – e.g. via a mains filter.
- Shield the instrument against strong electromagnetic fields.

Block diagram Testomat 2000® THCL

Drawn relay positions: Instrument de-energised

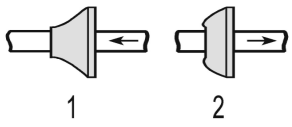


Internal design Testomat 2000® THCL



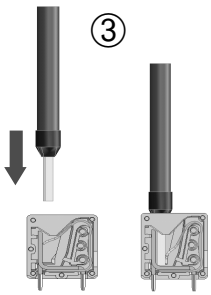
①	Terminal block for inputs Start, Stop, IN1, IN2, and output OUT
②	Mains switch
③	Terminal block for mains inputs and mains outputs
④	Terminal block relay outputs
⑤	Dosing pumps (DosiClip1=left, DosiClip4=right))
⑥	Water connections, inlet and outlet
⑦	Controller / Filter receiver
⑧	Measuring chamber

Connecting the mains voltage

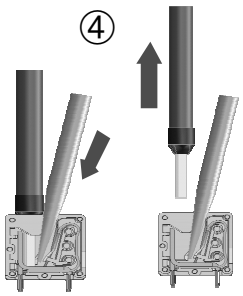


Only connect the instrument to the specified mains voltage. Refer to the rating plate for the appropriate mains voltage. Connect the cables as follows:

- Loosen both fastening screws ① and open the upper door. The terminal box is now accessible.
- Pierce the required rubber cable glands ② with a screwdriver and insert the cable through the bush into the terminal box (1)
- Subsequently pull back the cable until the bush has been turned over (2).
- Connect the power supply to terminals PE,N,L or for 24 V instruments to terminals U, V.
- Connect the conductor to the terminal block as shown on the left ③ .
- Ensure that the leads are held securely in the terminals.
- Proceed as shown in figure④ to loosen the connection.

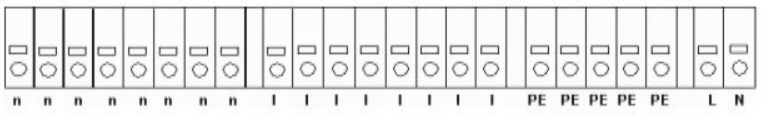


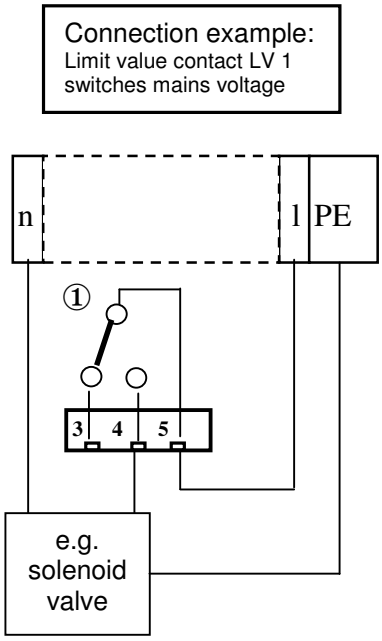
Insert the conductor with ferrule or the solid conductor into the round input.



1. Insert a screwdriver into the square opening without force in order to open the terminal.
2. Once the terminal has been opened, remove the conductor.

Terminal description	Type	Function	Comment
PE	IN	Mains – protective earth (5x)	Only with mains 115/230 V !
N (U) **L (V)**	IN	Mains, N=neutral (U=24 V) Mains, L=live (V=24 V)	Mains input 24 V / 115 V / 230 V
n **l**	OUT	Neutral, switched (8x) Live, switched (8x)	Mains for consumers, max. 4 A

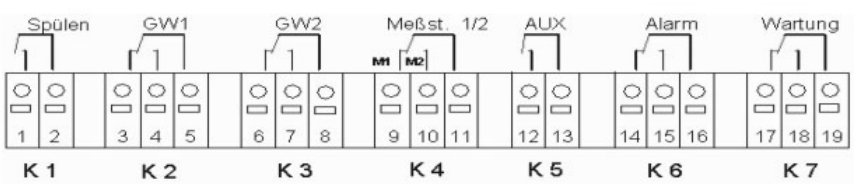




Connecting the plant components

- Connect the plant components to the output terminals of relays 1 to 19 (e.g. valves).
- If the plant components require mains voltage, connect the switched mains voltage (**l**) to the common contact ① of the respective relay (see the connection example for 230 VAC on the left).
- Connect the neutral conductor of the plant component to one of the terminals (n).
- For components with a protective earth conductor connection, connect it to the PE connection.
- Ensure that the leads are held securely in the terminals.

No.	Terminal description	Type	Function	Comment
1 **2**	**flushing**	OUT	External flush valve	Volt-free relay output, max. 240 VAC, 4 A
3 **4** **5**	**LV1**	OUT	Limit value output 1 – Normally closed Limit value output 1 – Normally open Limit value output 1 – Common	Volt-free relay output, max. 240 VAC, 4 A
6 **7** **8**	**LV2**	OUT	Limit value output 2 – Normally closed Limit value output 2 – Normally open Limit value output 2 – Common	Volt-free relay output, max. 240 VAC, 4 A
9 **10** **11**	**Measuring points 1/2**	OUT	Measuring point 1 – Normally closed Measuring point 2 – Normally open Measuring point switch-over - Common	Volt-free relay output, max. 240 VAC, 4 A
12 **13**	**AUX**	OUT	Universal output	Volt-free relay output, max. 240 VAC, 4 A
14 **15** **16**	**Alarm**	OUT	Fault message output – Normally closed Fault message output – Normally open Fault message output – Common	Volt-free relay output, max. 240 VAC, 4 A
17 **18** **19**	**Maintenance**	OUT	Maintenance message – Normally closed Maintenance message – Normally open Maintenance message – Common	Volt-free relay output, max. 240 VAC, 4 A

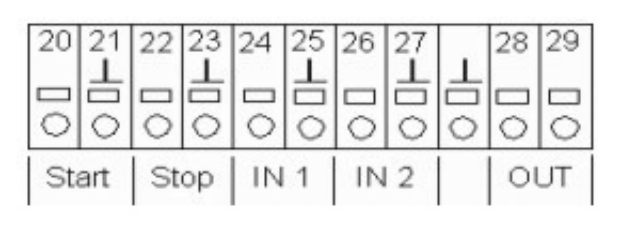


Connecting the inputs and outputs

Testomat 2000® has the following connections for control and monitoring functions.

- Do not connect external voltage to these connections!
- Ensure that the leads are held securely in the terminals.
- Use the two fastening screws to close the upper door once installation has been completed.

No.	Terminal description	Type	Function	Comment
20 **21**	**Start**	IN	External analysis start Common earth for inputs	Only for volt-free normally open
22 **23**	**Stop**	IN	External analysis stop Common earth for inputs	Only for volt-free normally closed/normally open
24 **25**	**IN1**	IN	Universal input 1 Common earth for inputs	Only for volt-free normally closed/normally open
26 **27**	**IN2**	IN	Universal input 2 (water meter) Common earth for inputs	Only for volt-free normally open
⊥ **28** **29**	**OUT**	OUT	Earth 0/4 - 20 mA galvanically separated or serial interface RS232	Earth = ⊥ 28 = (+) or (TxD) 29 = (-) or (RxD)



For more information, please refer to the section entitled "Description of the signal inputs/outputs".

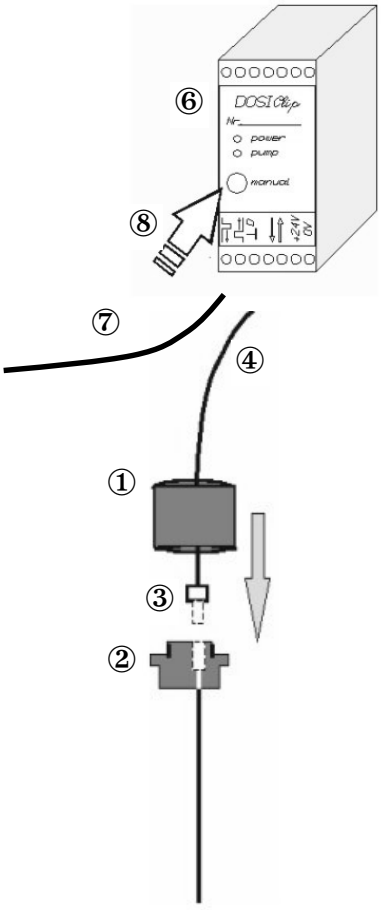
Commissioning

Handling of reagents/indicators

CAUTION

- Please adhere to the respective safety data sheets!
- Trouble-free operation of Testomat 2000® THCL is only possible when using Heyl Testomat 2000® indicators/reagents!

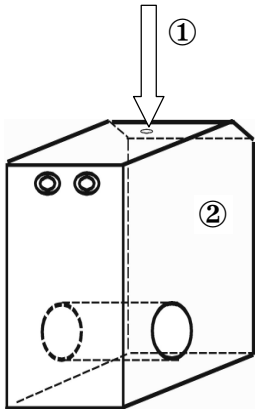
Inserting indicator bottles



- Open the lower housing door by pulling on the right-hand side.
- Remove the caps from the indicator bottles.
- Remove the plastic bag from inside the housing. The plastic bag contains the screw caps with hole ① and the inserts ② for the screw caps.
- Connect the parts as shown on the left.
- Obeserve correction allocation of the indicators to the pumps: TH2025=DosiClip1 (left), CL2025A=DosiClip2, CL2025B= DosiClip3 and CL2025C=DosiClip4 (right)
- Screw the hose connectors ③ of the intake hoses ④ hand-tight into the inserts ②.
- Place the inserts with the screwed-in intake hoses into the indicator bottles.
- Now screw the screw caps with hole ① hand-tight onto the indicator bottles. ⑤
- Switch the instrument on and press the "STANDBY" key.
- Enter the filling levels of **all** the indicator bottles in "%":
  In the menu, select >SERVICE I
  => INPUT REAGENTS=> INDICATOR TH FILLING (100%)
  (New/Full bottle = 100% filling level)
- Press "ENTER" to confirm the entry
- Enter further filling levels accordingly

Extracting indicators

- Switch the instrument on and press the "STANDBY" key
- During operation, the pumps (DOSIClip1 - 4) ⑥ automatically extracts the indicator.
- To ensure that indicator is available for the initial analyses, the intake hose ④ and the transport hose ⑦ must be filled with indicator from the pump up to the measuring chamber.
- Press the "manual" ⑧ key several times until the intake hose ④ and the transport hose ⑦ are filled with indicator up to the measuring chamber
- If necessary, manually tighten the hose connectors of the intake and transport hose slightly in case of bubble formation



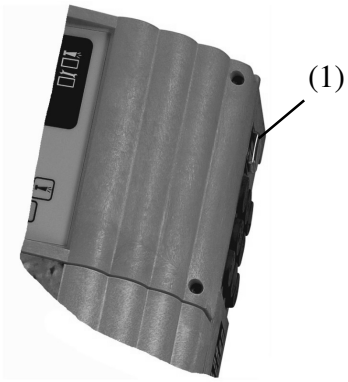
Opening the water inlet

- Open the lower housing cover.
- Slowly open the manually operated shut-off valve to prevent the measuring chamber overflowing. The flow regulator requires a few seconds to function correctly.
- Make sure that the water conducting parts are not leaky.
- If water sprays from the vent hole ① of the measuring chamber ②, reduce the amount of inlet water via the manually operated shut-off valve. It should take 2 to 6 seconds to fill the measuring chamber!

Instrument settings and data input

- Please read the following information before carrying out settings and entering data for operating the instrument.

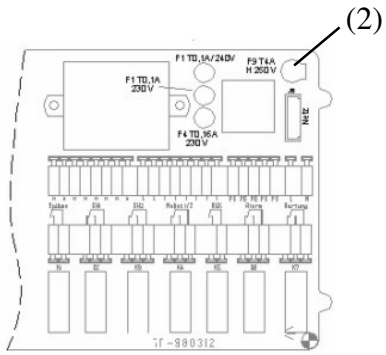
Functions of the operating and display elements



The Testomat 2000® THCL display shows operating statuses and measured values. The input keys for programming (cursor block) and the function keys are located underneath the display.

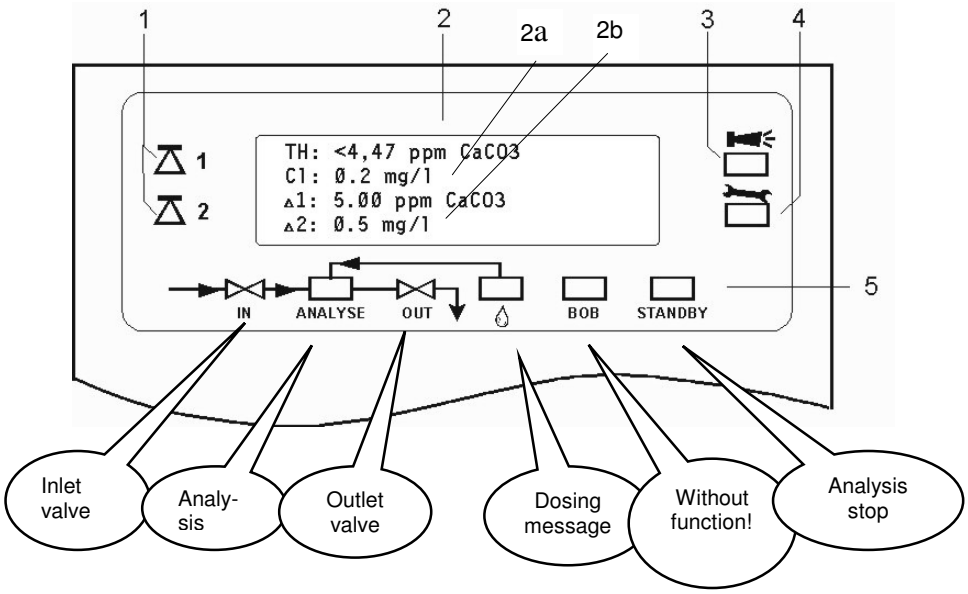
Switching Testomat 2000® THCL on/off

(1) Mains switch
Use this switch to switch the instrument on or off.



(2) Instrument fuse (inside the instrument)
This fuse protects Testomat 2000® THCL and the outputs against overloads and short circuits.

Display functions



1 Status of limit value displays (red/green)

The display 1 illuminates red if limit value 1 (water hardness) has been reached or exceeded. The display 1 illuminates green if the value falls below the limit value. The same principle applies to limit value 2 (total chlorine) and display 2.

2 Text display (4 lines)

Displays the current analysis result as well as all important statuses and programming data.

2a = The current measured value for measuring point 1 (water hardness) is displayed in **Line 1**.
Value falls below the measuring range = "<" e.g. < 4.47 ppm $CaCO_3$
Value exceeds the measuring range = ">" e.g. > 44.7 ppm $CaCO_3$
The current measured value for measuring point 2 (total chlorine) is displayed in **line 2**.
Value exceeds the measuring range = ">" e.g. > 2.5 ppm

2b = The set limit values GW1 (water hardness) and GW2 (total chlorine) are displayed in **line 3 and 4**

All error and warning messages are alternately shown in line 1 of the standard display!

3 Alarm (red)

Indicates malfunctioning/error message or warning message

4 Maintenance message (yellow)

Indicates current maintenance requests

5 Status display of the active instrument components (line)

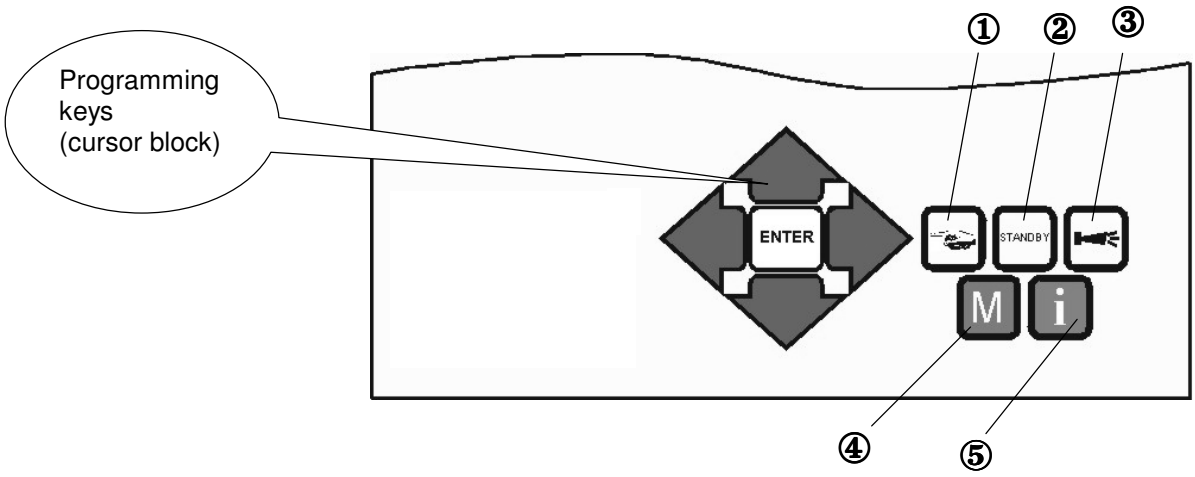
Six displays indicate the current instrument and analysis status

NOTE

Cancelling error messages/warning messages

➤ Press  to acknowledge the message and, if necessary, eliminate the cause of the fault.

Operating elements and function keys



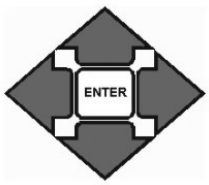
Function keys

	Manually start an analysis via the **"Manual"** ① key
	Set the instrument to standby mode via the **"STANDBY"** ② key (automatic analyses are not carried out: analysis stop)
	Acknowledge error and warning messages via the **"Horn"** ③ key
	Open the program menu for user-specific and instrument-specific settings via the **"M"** ④ key
	Retrieve all instrument information and settings via the **"i"** key ⑤

(M)neu key

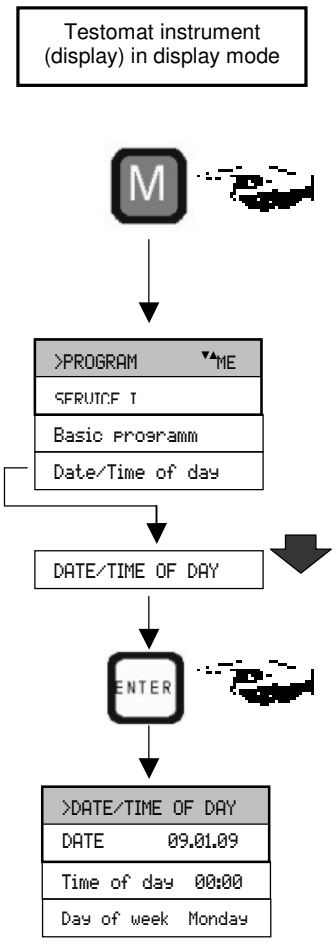
If you wish to carry out settings or enter data, or if alterations are necessary, press the **"M" key** to open the programming mode. Use this key when *in the menu* to go to the higher order menu items or to exit the programming mode. Please note: The basic program is password protected!

Cursor block



Programming keys (cursor block)

Use the programming keys (cursor block) to navigate in the menu, to select the desired functions and to enter necessary instrument and plant specific data. Press the "ENTER" key to select the submenu item and to confirm and accept the selection or data input.



Operating system

Instrument settings and data input

Date, time and weekday input

- Press the "M" key
  The basic menu ">PROGRAM" appears
- Use the cursor block ↓↑ to select the desired menu item "Date / Time"
  The selection appears in CAPITAL LETTERS.
- Press "ENTER" to confirm your selection
  The selected submenu ">DATE / TIME" appears

The menu item "DATE" has already been selected (capital letters)

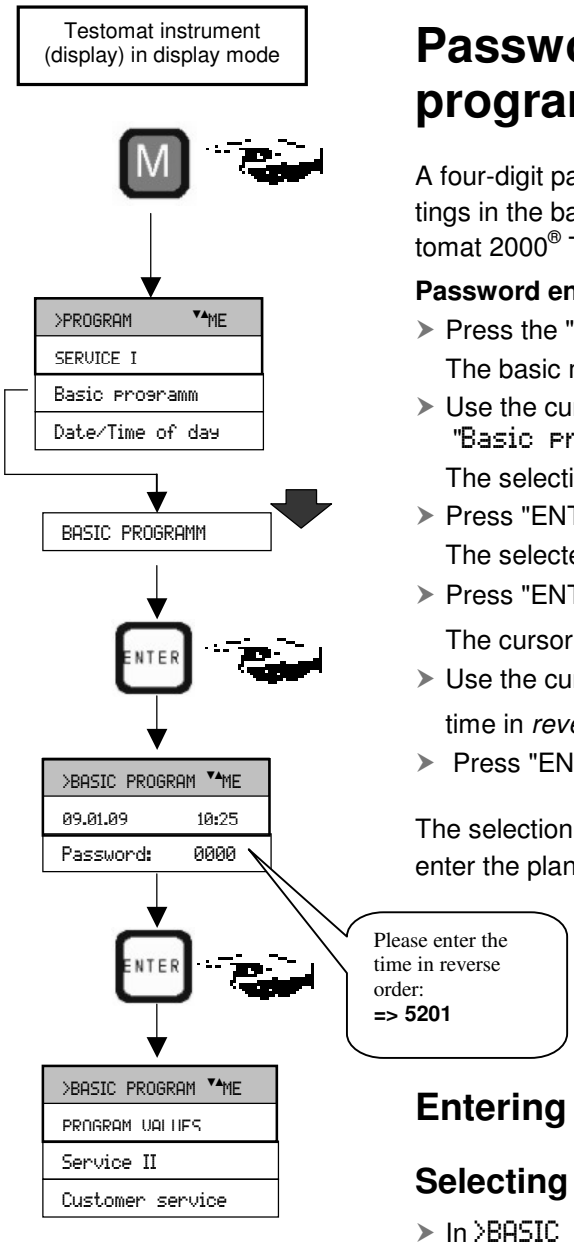
- Press "ENTER" to confirm the menu item "DATE"
  The cursor flashes in the date field: "09.01.09"
- Use the cursor keys ↓↑ to select the desired number
- Use the keys ←→ to move the cursor to the next input field
- Repeat this input process until the year has been entered
- Press "ENTER" to confirm the entry
  The date has now been entered.

Exit the menu item "DATE" in order to set the time.

- Use the cursor block ↓↑ to select the desired menu item "TIME"
- Press "ENTER" to confirm your selection
  The cursor flashes at the first position of the time: "00:00"
- Use the cursor keys ↓↑ to select the desired number
- Use the keys ←→ to move the cursor to the next input field
- Repeat this input process until the seconds have been entered
- Press "ENTER" to confirm the entry
  The time has now been entered.

Exit the menu item "TIME" to set the weekday

- Use the cursor block ↓↑ to select the desired menu item "WEEKDAY"
- Press "ENTER" to confirm your selection
- Use the cursor block ↓↑ to select the selected weekday
- Press "ENTER" to confirm the entry
- Press the "M" key twice to end programming
  The standard measured value display appears on the display



Password protection and basic program

A four-digit password is required to enter data and to carry out settings in the basic program. The password is the current time of Testomat 2000® THCL in reverse order.

Password entry

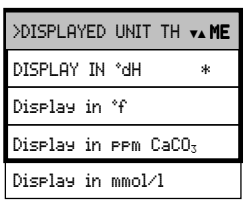
- Press the "M" key
  The basic menu ">PROGRAM" appears
- Use the cursor block to select the desired menu item "Basic program"
  The selection appears in CAPITAL LETTERS.
- Press "ENTER" to confirm your selection
  The selected submenu ">BASIC PROGRAM" appears
- Press "ENTER" to confirm the menu item "BASIC PROGRAM"
  The cursor flashes in the "Password:" field ■000
- Use the cursor keys to enter the time in *reverse order*: "5201"
- Press "ENTER" to confirm the entry

The selection menu for the basic program appears. You can now enter the plant specific data.

Entering basic program data

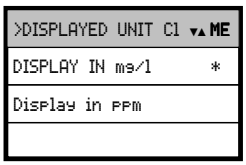
Selecting the display units

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => DISPLAY UNIT TH
- Press "ENTER" to confirm the selection



The "DISPLAY UNIT TH" menu shown on the left appears

- Select the desired unit
  (°dH " * " is factory set)
- Press "ENTER" to confirm the selection
  (An asterisk " * " appears at the end of the line)



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => DISPLAY UNIT CI

The "DISPLAY UNIT CI" menu shown on the left appears

- Select the desired unit
  (mg/l " * " is factory set)
- Press "ENTER" to confirm the selection
  (An asterisk " * " appears at the end of the line)

Selecting the operating mode

Under the menu item "Operating mode" it is possible to select the type of analysis controller. Testomat 2000® THCL provides numerous selection options: Time control, quantity control via water meter, external analysis triggering.

Time control

Internal start via timer.

Shortest interval = 0 minutes between analyses. Largest interval = 99 minutes.

The analysis interval (time between two analyses) is determined by the duration of the supplementary program AUX, the set flush times (internal and external), the programmed interval and the duration of the analysis. The analysis duration depends **directly** on the measured value.

>MODE OF OPERATION ▾▴ ME	
TIME CONTROLLED	*
Volume interval	
External (Start)	

Selecting the time control

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> OPERATING MODE=> TIME CONTROLLED
- Press "ENTER" to confirm the selection
  (An asterisk " * " appears at the end of the line)
  ("TIME CONTROLLED" " * " is preset)

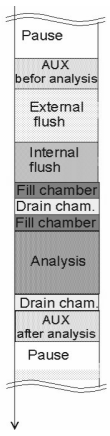
>FLUSH TIMES/INTERVAL ▾▴ ME	
INTERNAL FLUSH TIME	00s
External flush time	00s
Interval pause	01m

Enter the interval pause and the flush times

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> FLUSH TIMES/INTERVAL
  => INTERVAL PAUSE
- Enter the "INTERVAL PAUSE" in minutes (m)
  (1 minute is preset)
- Enter the "INTERNAL FLUSH TIME" in seconds (s)
  (00 seconds (s) is preset)
- Enter the "EXTERNAL FLUSH TIME" in seconds (s)
  (00 seconds (s) is preset)
- Press "ENTER" to complete all the entries

Analysis interval

Sequence of times



NOTE

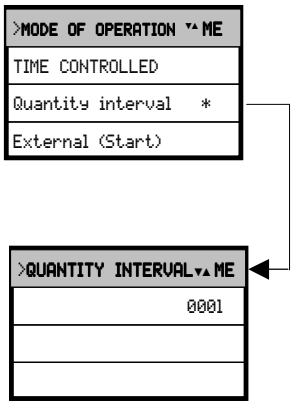
Duration of the analysis interval

- The analysis interval is the addition of the "AUX before/after analysis", "Internal flush" and "External flush" times and the measuring value dependent analysis duration (see diagram on the left)

Quantity control

Start via water meter

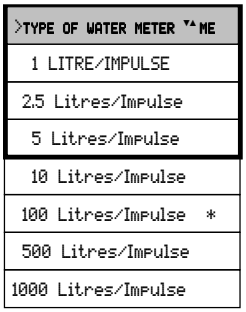
Minimum interval = 1 litre, maximum interval = 9999 litres. The analysis is carried out once the programmed water quantity has been measured. The line and the measuring chamber are flushed prior to the analysis (observe the programmed flush times).



Selecting the quantity control

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> OPERATING MODE=> QUANTITY INTERVAL
- Press "ENTER" to confirm the selection
  (An asterisk " * " appears at the end of the line)

  The menu >QUANTITY INTERVAL appears
- Enter the respective flow rate in litres
- Press "ENTER" to confirm the entry



Selecting the type of water meter

- Select the >BASIC PROGRAM menu
  => PROGRAM VALUES=> WATER METER=> WATER METER TYPE
- Select the water meter constant (litre/impulse)
  (100 litres/impulse " * " is factory set)
- Press "ENTER" to confirm the selection

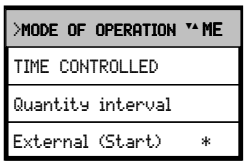
External analysis start

Start via input

Select external analysis triggering

External analysis triggering occurs via a contact at the ***start input.***

Note: The current analysis interval can be interrupted by triggering a contact at the ***stop input***.



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> OPERATING MODE=> EXTERNAL (START)
- Press "ENTER" to confirm the selection
  (An asterisk " * " appears at the end of the line)

Entering further basic program data

For selecting and entering data for these functions, please proceed as described under "Entering basic program data".

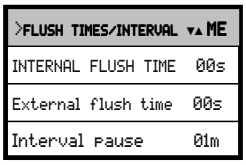
Internal flushing

To ensure that the analysed sample represents the current value, the sampling line must be sufficiently flushed. If the plant has been out of operation for a longer period or in case of long analysis intervals, we recommend you to select a flushing time greater than 60 seconds. Flushing starts by simultaneously opening the inlet and the outlet valve of Testomat 2000®.

NOTE

Duration of the analysis interval

- The analysis interval depends directly on the programmed flushing time. If, e.g., a flushing time of 90 seconds has been set, the actual analysis interval cannot be less than 90 seconds.



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => FLUSH TIMES/INTERVAL
- Enter the "FLUSH TIME/INTERNAL" in seconds (s)
- Press "ENTER" to confirm the entry

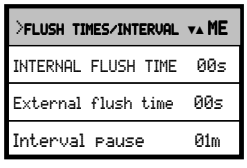
NOTE

Setting the internal flushing time

- For connections longer than 3 m and with an internal hose diameter of 6 mm a minimum internal flushing time of 10 seconds is required to ensure that a valid sample is taken from the sampling line. The required quantity of flush water for one-minute internal flushing is 0.5 litres.

External flushing

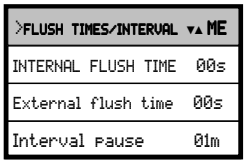
If very short analysis intervals are required, or if a very long (several metres) sampling line or a line with a large diameter is used, an external flush valve should be installed upstream of Testomat 2000® THCL. The external flush valve has to be connected to the "Flush" outlet. If the unit is used for monitoring two measuring points, external flushing prevents incorrect measurements caused by sample mixing. The external flushing time for the valve depends, just as the flushing time for unit flushing does, on the length and diameter of the supply line to Testomat 2000® THCL.



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => FLUSH TIMES/INTERVAL
- Enter the "FLUSH TIME/EXTERNAL" in seconds (s)
- Press "ENTER" to confirm the entry

Interval pause

If the analysis is triggered via a timer, the interval between two analyses (plus flushing time) is determined by the interval pause. The shortest interval can be 0 minutes. In this case, analyses are carried out continuously. The longest interval is 99 minutes.



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => FLUSH TIMES/INTERVAL
- Enter the "INTERVAL PAUSE" in minutes (m)
- Press "ENTER" to confirm the entry

Limit value monitoring

It is possible to program the limit values on a continuous scale. The limit value range corresponds to the measuring range of the respective parameter (water hardness or total chlorine). Two limit value outputs are available for monitoring. This means that two parameters (water hardness at measuring point 1, LV1 and total hardness at measuring point 2, LV2) can be monitored. The functions of the allocated relay outputs can be programmed independently of each other.

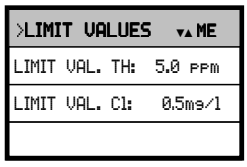
Monitoring of two limit values

The instrument monitors *two measuring points*. Water hardness is measured at measuring point 1 and total chlorine at measuring point 2. The measuring points are strictly allocated to the limit value outputs:

1 LV1 = Measuring point 2 (water hardness)

2 LV2 = Measuring point 2 (total chlorine)

If the limit value LV1 has been exceeded, the limit value control display **1** lights up RED and the relay output LV1 reacts as programmed in the switch function. If the limit value has not been exceeded, the display lights up GREEN**.** The same applies for the limit value LV2.



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => LIMIT VALUES
- Enter the values for "LIMIT VALUE TH" or "LIMIT VALUE Cl"
- Press "ENTER" to confirm the entry

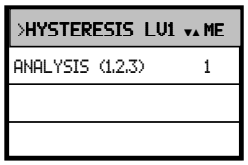
Suppression of bad analyses

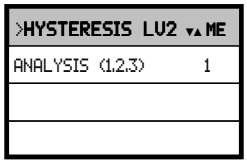
Hysteresis

The respective limit value output only switches after the first, second or third bad analysis (suppression of the first or the second measured value). This increases the reliability of the analysis evaluation, e.g. after the measuring point has been switched over or if the sampling line has not been flushed sufficiently. The hystereses of the two outputs LV1 and LV2 can be set independently of each other.

With a hysteresis of "2", the next analysis is immediately carried out when the limit value of this analysis has been exceeded. The respective output is only switched after the limit value of this analysis has been exceeded for a second time. With a hysteresis of "3", the respective output only switches when the limit value of this analysis has been exceeded for a third time. This setting is only reactivated once the value has fallen below the limit value!

(The basic setting for LV1 and LV2 is "1")

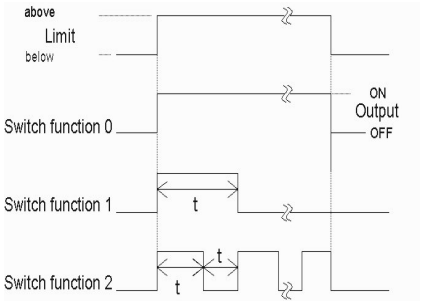




- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> HYSTERESIS LV1 or HYSTERESIS LV2
- Enter the number of analyses
- Press "ENTER" to confirm the entry

Switch functions of the limit value outputs LV1 and LV2

Switch functions diagram



Switch function 0, duration

If the limit value LV1 or LV2 has been exceeded, the output relay LV1 or LV2 switches. If the measured value falls below the limit value LV1 or LV2 without locking, the relevant relay drops out again.

Switch function 1, impulse

If the measured value exceeds the limit value LV1 or LV2, the relevant output switches for a settable time (t).

The respective output always remains switched for the set time, irrespective of how long the limit value has been exceeded. A new impulse is only possible once the value has fallen below the limit value!

Switch function 2, interval

If the limit value has been exceeded, the respective output switches at intervals with the settable time (t) = impulse or interval as long as the limit value is exceeded. The switching on times and the intervals are the same.

>FUNCTION LV1 ▾▴ME	
DURATION	*
Impulse	
Interval	
Time	00m:10s

>FUNCTION LV2 ▾▴ME	
DURATION	*
Impulse	
Interval	
Time	00m:10s

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> FUNCTION LV1 or FUNCTION LV2
- Select duration, impulse, interval
- Enter the time (only for switch function 1 and 2)
- Press "ENTER" to confirm the entry

Function IN1

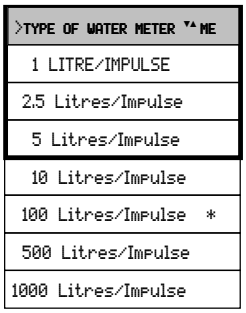
For dynamic analysis control or programmed plant monitoring, the regeneration message from the controller of the water treatment plant must be connected to IN1 (isolated contact required!). The active status of IN1 has to be programmed according to the output function of the controller.

>FUNCTION IN1 ▾▴ME
NORMALLY OPEN CONTACT *
Normally closed contact

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> FUNCTION IN1
- Select a normally closed or normally open contact
- Press "ENTER" to confirm the entry

Water meter

It is necessary to connect a water meter to **input IN2** for quantity-dependent analysis triggering, for dynamic analysis control and for monitoring the operation of the water treatment plant (plant monitoring). Program the corresponding water meter rating.

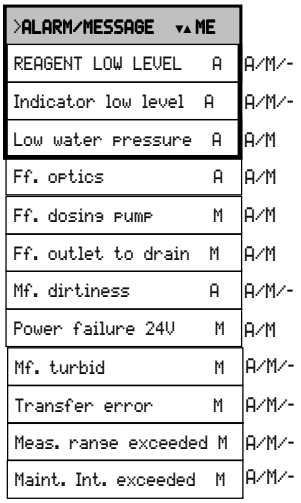


- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => WATER METER
- Select the water meter rating
- Press "ENTER" to confirm the entry

Alarm / Message

The instrument is equipped with an alarm relay output for signalling faults. The events which mean a fault at the instrument or are intended to trigger a message, can either trigger an alarm "A" (continuous contact) or a message "M" (2-second impulse).

The faults are recorded and stored in the error history if the event has been programmed as an alarm or message. For example, if a low indicator level has not been programmed as an ALARM/MESSAGE, it is not registered in the error history. Up to 20 error messages can be stored. A list of these errors can be opened in the information menu. The information stored per event is the time (day, month, year and hour) and the type of the error.



A=Alarm, M=Message
- = no action
Ff.=Function fault
Mf.=Measuring fault

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES => ALARM/MESSAGE
- Select the type of monitoring A=alarm, M=message or - = no action for the individual menu items
- Press "ENTER" to confirm the respective entry

NOTE

Error messages

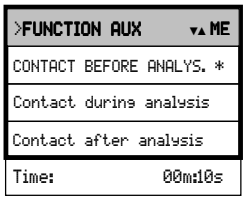
- All error messages are lost after a power failure.
- Certain instrument faults always trigger an alarm or a message!

Function AUX

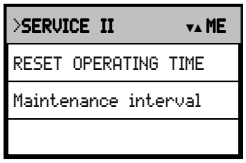
The AUX relay output can be programmed for the following control functions:

- As a function output for the contact with programmable duration prior to and/or during the analysis, or after an analysis.

For example, it is possible to control the cooling water inlet of an upstream cooler via a solenoid valve. This ensures that the cooling water only flows when required, i.e. when an analysis is being carried out.



- ➤ In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> FUNCTION AUX
- ➤ Select the program step at which the AUX contact is to be activated
- ➤ Under "Time" enter the contact duration in minutes (m) and seconds (s)
- ➤ Press "ENTER" to confirm the entry



Service II

The service II menu contains various functions for monitoring the operation of the instrument:

Programming the maintenance interval, editing (reset) the operating time.

Use of the Service II menu

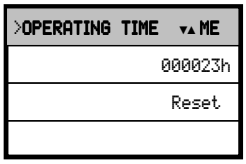
CAUTION

The functions in the service II menu directly influence the operation and monitoring functions of the unit!

- ➤ These tasks should only be carried out by trained and qualified staff.

Reset operating time

After replacing a dosing pump or the measuring chamber holder, it is possible to reset the current operating time to 0 hours.

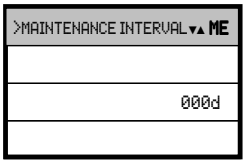


- ➤ In >BASIC PROGRAM menu, select
  => SERVICE II=> RESET OPERATING TIME
- ➤ Select "Reset" to reset the operating time
- ➤ Press "ENTER" to confirm the selection

The operating time "000000h" appears on the display

Maintenance interval

Observance of the maintenance intervals is monitored and displayed by Testomat 2000®. Program the desired maintenance interval in days here. (0 days equals no maintenance interval)



- In >BASIC PROGRAM menu, select
  => SERVICE II=> MAINTENANCE INTERVAL
- Enter the maintenance interval in days (T)
- Press "ENTER" to confirm the entry

Description of the signal inputs/outputs

CAUTION

Connecting the signal inputs

➤ Only connect the signal inputs "Start", "Stop", "IN1" and "IN2" with *volt-free contacts*!

The connection of external voltages would damage the instrument!

Start
Terminals 20,21

Function	Test time	Action
Start External analysis triggering (only normally open)	None	In EXTERNAL operating mode an analysis is started by triggering an impulse contact at the input; analyses are carried out at regular intervals with a continuous contact.

Stop
Terminals 22,23

Function	Test time	Action
Stop External analysis stop (e.g. via flow controller or process controller)	None	As long as the contact at the input is 'open' or 'closed', no analyses are carried out

An active Stop input prevents an analysis start, e.g. via a current interval. This can be necessary if
the plant does not supply water. A current analysis is stopped when the input valve is opened (while the measuring chamber is being flushed or filled). The water which has already entered the measuring chamber remains there. If the measuring chamber is already full, the analysis is executed. Manual start has priority over the Stop input, i.e. if the Stop input is active, an analysis can be started manually or a manually started analysis cannot be stopped by the stop signal. In the operating mode “time-controlled”, the interval time continues when the Stop input has been activated.

➤ In >BASIC PROGRAM menu, select
=> PROGRAM VALUES=> FUNCTION STOP

➤ Select the type of contact

➤ Press "ENTER" to confirm the selection

IN1
Terminals 24,25

Function	Test time	Action
IN1 Message from the process controller (normally closed or normally open)	Fixed, 10 seconds	Measuirng points switch-over is suppressed. If IN1 is active, only measuirng point 1 is measured.

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> FUNCTION IN1
- Select the type of contact
- Press "ENTER" to confirm the selection

IN2
Terminals 26,27

Function	Test time	Action
IN2 Water meter input	None	Quantity recording for starting an analysis

OUT
Terminals ⊥, 28,29

Function	Connection	Action
OUT Programmable interface 0-20 mA or 4-20 mA	max. load 500 Ohms	Interface supplies a measured value proportional current
OR Programmable voltage interface 0 - 10 V or 2 - 10 V		Interface supplies a measured value proportional voltage
OR Serial interface RS 232	Serial bus (2-wire cable)	See description of interface card RS 910
The section "Interfaces" contains a detailed description		

Interfaces (optional)

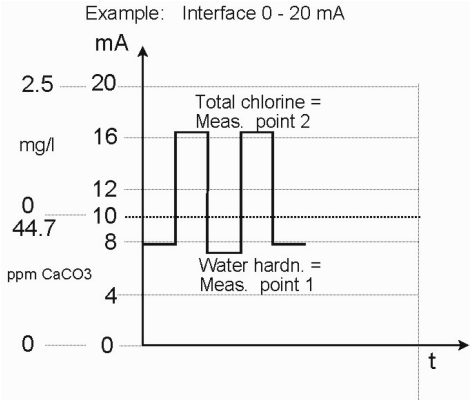
Current interface 0/4-20 mA

Current interface load

NOTE

- The maximum load of 500 Ohms should not be exceeded!

  In case of possible faults and when using very long cables (approx. 20 m), a screened cable should be used, if possible



Monitoring the measuring points

Measuring point 1 (residual hardness) and measuring point 2 (total chlorine) are measured alternatively. The example on the left displays the current profile in the 0 - 20 mA range. The range of the current interface is divided. The range 0 – 10 mA is available for the measured value from measuring point 1 and range 10 – 20 mA for the measured value from measuring point 2. If the 4 - 20 mA range is selected, the ranges are divided as 4 - 12 mA and 12 - 20 mA.

The measured value 1 is shown in display line 2 (M1:) and the measured value 2 in line 3 (M2:). The currently analysed measuring point is indicated by an asterisk on the right.

>INTERFACES ▾▴ ME	
TYPE 0-20mA	*
Type 4-20mA	
Type RS232	

- In >BASIC PROGRAM menu, select
  => PROGRAM VALUE => INTERFACES
- Select the desired current range
- Press "ENTER" to confirm the selection

Calculating the output currents

How is the current calculated for a certain measured value?

The current range is divided for two measuring points (residual hardness and total chlorine). The value of measuring point 1 (residual hardness) is displayed in the lower half (0 – 10 mA or 4 – 12 mA), and the value of measuring point 2 (total chlorine) is displayed in the upper half (10 – 20 mA or 12 – 20 mA).

1 measuring point 0 - 20 mA

$$\text{Current 1} = \frac{\text{Measured value 1}}{\text{Maximum value}} \times 10\ \text{mA}$$

$$\text{Current 2} = \frac{\text{Measured value 2}}{\text{Maximum value}} \times 10\ \text{mA} + 10\ \text{mA}$$

2 measuring points 0 - 20 mA

$$\text{Current 1} = \frac{\text{Measured value 1}}{\text{Maximum value}} \times 8\ \text{mA} + 4\ \text{mA}$$

$$\text{Current 2} = \frac{\text{Measured value 2}}{\text{Maximum value}} \times 8\ \text{mA} + 12\ \text{mA}$$

Measuring range not reached (e.g. <4.47 ppm $CaCO_3$)

The current is set to 0 or 4 mA. (at measuring point 1) and at 10 or 12 mA (at measuring point 2)

Measuring range exceeded (e.g. >4.47 ppm $CaCO_3$)

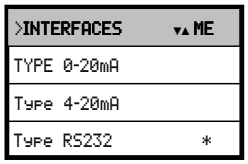
The current is set to 20 mA.

Measured value = Value displayed in the selected measuring unit

Maximum value = Final value of the used indicator
(e.g. indicator type TH 2025 = 44.7 ppm $CaCO_3$)

Serial interface RS232

Testomat 2000® THCL can also be connected to a log printer via the serial interface RS232 to enable the printout of measuring results and error messages. Analyses can then be continuously logged. This option is only possible in connection with the interface card RS232 (Art. no. 270310).



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> INTERFACES
- Select the desired interface
- Press "ENTER" to confirm the selection

Description of the relay outputs

All relay outputs are neutral contacts. This ensures that all connection options are available. The switching of mains voltage and external voltage, and the direct switching of inputs, e.g. a process controller, can be realised.

Flush valve
Terminals 1,2

Flushing (external flush valve)

Immediately before each analysis the external flush valve is opened for the programmed period allowing the line up to Testomat 2000® THCL to fill with measuring water. Please ensure that the programmed flush time is sufficient.

Please refer to "Entering further basic program data" ➔ "External flush" for programming details

LV1 and LV2 limit value outputs

Two volt-free relay contacts are available to signal that a limit value has been exceeded. The limit values, the hysteresis and the function can be freely programmed for both contacts:

Limit value 1
Terminals 3,4,5

Function	Contact	Action
LV1 Relay switches if limit value 2 Limit value 1 (resdidual hardness) (measuring point1)	Volt-free change-over contact	programmable: - Continuous contact - Impulse (1 -99 seconds/minutes) - Interval (1 -99 seconds/minutes) - Hysteresis (1, 2 or 3 limit value exceeded)

Limit value 2
Terminals 6,7,8

Function	Contact	Action
LV2 Relay switches if limit value 2 Limit value 2 (total chlorine), (measuring point 2)	Volt-free change-over contact	programmable: - Continuous contact - Impulse (1 -99 seconds/minutes) - Interval (1 -99 seconds/minutes) - Hysteresis (1, 2 or 3 limit value exceeded)

For a detailed description and programming refer to the section entitled "Switch functions of the limit value outputs LV1 and LV2"!

Measuring points 1 or 2 (measuring point switch-over)

Measuring point switch-over
Terminals 9,10,11

To monitor both measuring points, the solenoid valves (individual valves or one 3/2-way control valve) of the corresponding sampling line have to be connected to this output. Switch-over occurs automatically. The analyses are carried out alternately from measuring point 1 and measuring point 2. The terminals are strictly allocated to the measuring points.

Terminal 9 = Measuring point 1 , Terminal 10 = Measuring point 2

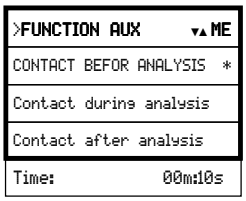
IN1 active = Measurements only from measuring point 1

AUX (programmable function output)

AUX
Terminals 12,13

The functioning of this volt-free relay output is programmable:

1. For reporting a current analysis and/or
2. For contact prior to an analysis, e.g. to operate a cooler or
3. Contact after an analysis



- In >BASIC PROGRAM menu, select
  => PROGRAM VALUES=> FUNCTION AUX
- Select the program step at which the AUX contact is to be activated
- Under "Time" enter the contact duration in minutes (m) and seconds (s)
- Press "ENTER" to confirm the entry

Alarm (fault message output)

Alarm
Terminals 14,15,16

The following faults activate the "Alarm" output and are displayed:

Always fault message for:

Power failure
Low water level
Function fault optics
Function fault dosing pump
Function fault drain outlet
Function fault failure 24V

Programmable fault messages for:

Low reagent level
Low indicator level
Function fault dosing error
Function fault soiling
Measuring fault turbid
Transmission error
Measuring range exceeded
Maintenance exceeded

The "Alarm" output is a volt-free change-over relay contact. During trouble-free operation, the contact between the terminals 15 – 16 is closed and the one between terminals 14 – 16 is open. In case of a voltage breakdown, the contact between the terminals 14 – 16 is closed and the one between terminals 15 – 16 is open.

The instrument is equipped with a range of monitoring functions. You can define the individual statuses as a fault and program the corresponding message either as a continuous contact (A) or as a message impulse (M).

Functions/Behaviour of the "Alarm" output:

- With a continuous contact, the "Alarm" output remains activated (terminals 14 – 16 closed) as long as the fault persists.
- With a message impulse, the output is switched 'on' for 2 seconds and then switched 'off' for 5 seconds.
- If several faults with differently programmed messages are signalled simultaneously, the output is switched to continuous contact.
- The red LED "Alarm" and the text on the display indicate a fault.
- The fault message signal at the "Alarm" output is deleted by confirming the fault via the "Horn" key.
- The error message can only be deleted if the fault has been eliminated.
- Exception: The maintenance date has been exceeded. This message is confirmed in the M menu, see below (Maintenance).
- Each new fault is entered into the error history (also see "i menu").
- There is ***no*** additional alarm via the fault message output when the limit value is exceeded!

The error messages are described under "Error messages / Troubleshooting"

Maintenance (output for maintenance message)

Maintenance
Terminals 17,18,19

Activation of the maintenance output for:

Low indicator level
Function fault dosing error
Function fault soiling
Maintenance date reached

The "Maintenance" output is a volt-free change-over contact. During trouble-free operation without a programmed maintenance interval, the contact between the terminals 17 – 19 is closed and the one between terminals 18 – 19 is open.

The instrument is equipped with a range of monitoring functions and a programmable maintenance interval. The respective maintenance message is always a continuous contact.

A maintenance request is displayed via the yellow "Maintenance" LED. The maintenance display can only be deleted once the status has been corrected or after the maintenance request has been confirmed.

Please refer to the section "Password protection and basic programming" for further programming details.

Customer service (2)

Display of the customer service address or e.g. a service hot-line number.
You can freely program these three lines in the basic program (password protected).

Operating values (3)

Display of the current values.

Program values (4)

Use the arrow keys to open the menu item "Program values". Press the "ENTER" key to open the list of the set values. Press the "ENTER" key to request the current setting of a parameter

An asterisk indicates the selected functions. (There are no active lines.)

Error history (5)

Open the error history by pressing the "i" and "ENTER" key. The error history is a list of the errors or statuses which have occurred during current operation. This list is lost after a power failure and the recording is restarted.

If no errors have occurred since start-up, the last switch-on time of the unit is displayed, e.g.:

POWER FAILURE
From 16.06.09 06:56
until 16.06.09 07:09

Maintenance (6)

Display of the next maintenance date and programmed maintenance interval.
It is possible to set the maintenance interval in the basic program (**password protected**):
Please refer to "Maintenance" for further information

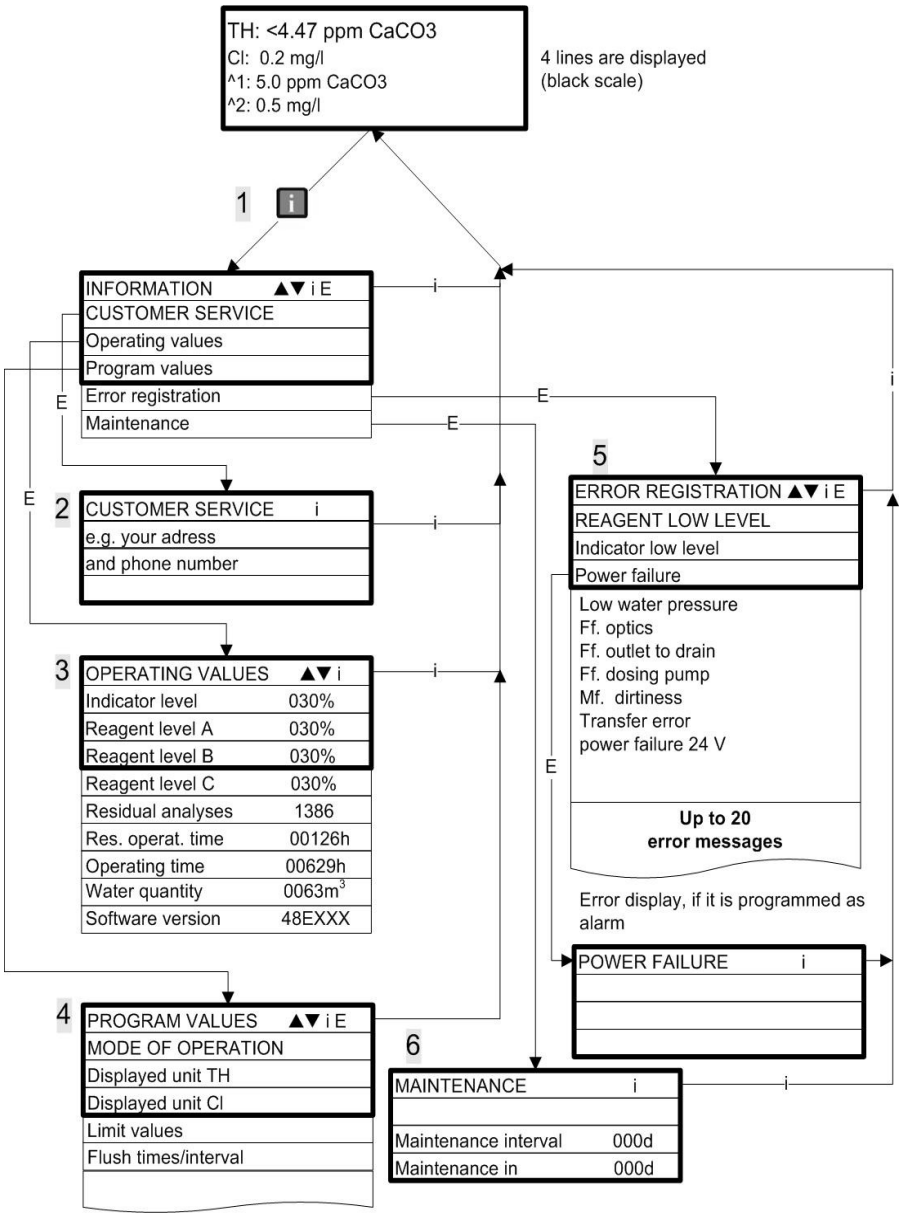
Information menu "i"

In the information menu, it is possible to request active settings and statuses of the instrument, the error history, the date for the next maintenance and the customer service address.

Call (1)

Use the key to open the information menu "i".

Request options: Customer service, operating values, program values, error history, maintenance



Please refer to the section "Password protection and basic programming" for further programming and setting details for the individual menu items

Program menu "M"

Service I (2)

Input indicator (3)
Enter the new filling levels after **each** refill or indicator bottle change. Once you have selected the menu item for entering the filling level "Indicator filling (0 - 100%)" via the "ENTER" key, the value is preset to 100%. If you have connected a full bottle, press "ENTER" to confirm the value. If the filling level of the bottle differs, enter the corresponding value.

Manual operation (4)
After confirming the information message (4) via the "ENTER" key, it is possible to select and activate the desired function by using the arrow keys and pressing the "ENTER" key. These functions are used for checking the functions and for commissioning.

Flush (5)
Press the "ENTER" key to start the flushing of the sampling line via the internal valves. Press the "ENTER" key again to cancel this function.

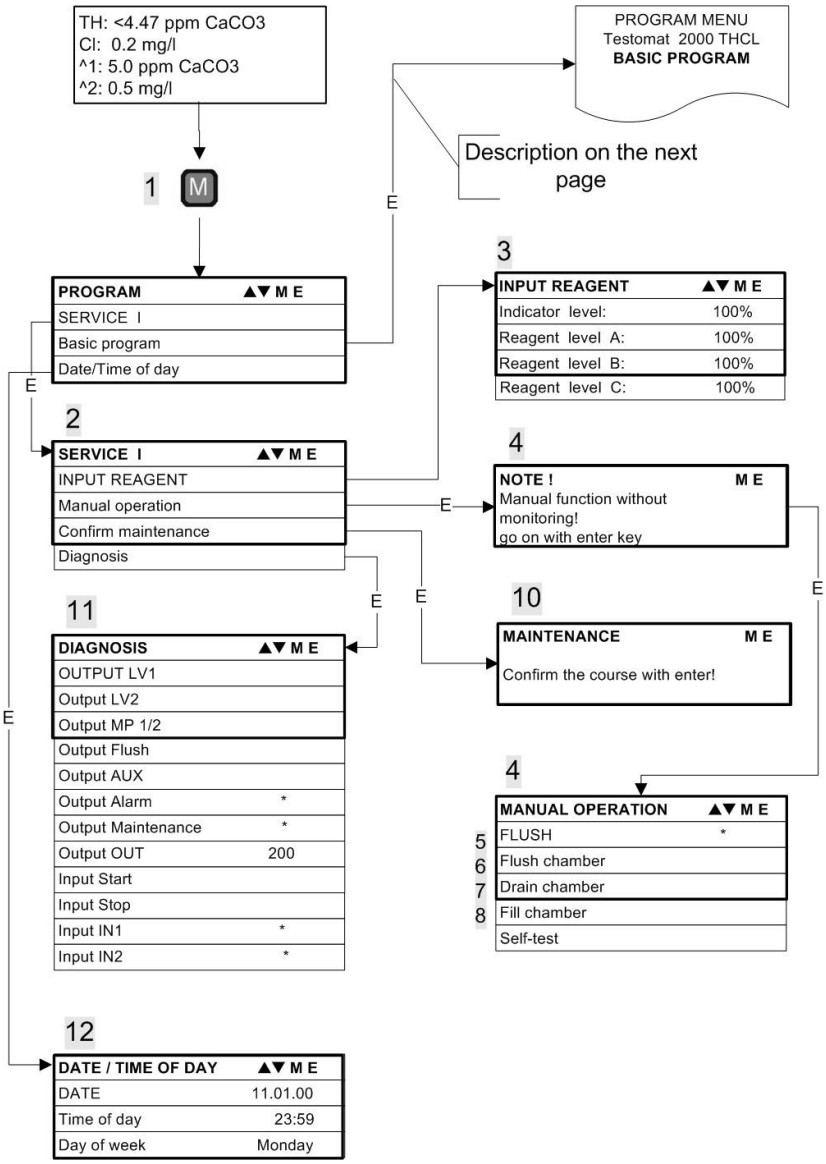
Flush chamber (6)
Press the "ENTER" key to flush the measuring chamber once.

Drain chamber (7)
Press the "ENTER" key to open the outlet valve in order to drain the water from the measuring chamber. Press the "ENTER" key again to cancel this function.

Fill chamber (8)
Press the "ENTER" key to fill the measuring chamber.

Call: (1)
Use the M key to open the program menu "M".
It is possible to call up all the functions without password protection except for the basic program.

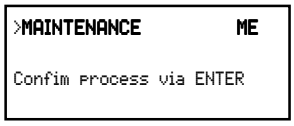
Programming of: Indicator, manual mode, flushing, flush chamber, drain chamber, fill chamber, self-test, confirm maintenance, diagnosis, date, time, basic program with password



NOTE

Availability of functions

- All manual functions can only be selected during an analysis pause. Analyses are not carried out during manual operation. All signal inputs and outputs are locked.

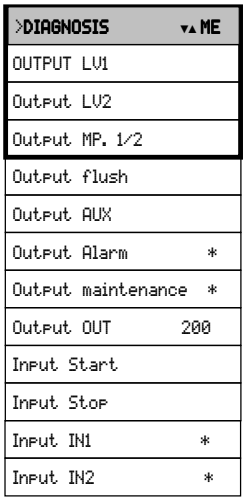


Confirm maintenance (10)

After maintenance has been carried out, confirm it by pressing the "ENTER" key and exit this item via the "M" key. The maintenance interval is restarted.

Confirm a maintenance request in the M menu once the maintenance interval has expired. The displayed message is deleted and the “maintenance” output reset.

Refer to the section entitled "Maintenance" for further details on maintenance intervals.



Diagnosis (11)

It is possible to request a list of the current statuses of the signal inputs and outputs. Active statuses are marked with an *. (see "Structure of the basic program").

The current interface can be checked under "OUT output". Press the "Enter" key to toggle between minimum and maximum current. Change-over occurs between 000 and 200 at 0-20 mA!

Time/Date (12)

Set the time and date by selecting and activating the desired function via the arrow keys and the "ENTER” key. Subsequently press the "M" key again to save the setting and to return to the display function.

Refer to "Functions of the operating and display elements" ➔ "Operating system" for more details

Call the *factory* default setting:

Press the "M" and "i" key and switch on Testomat 2000® THCL.
Caution: All previously entered data is overwritten!

The values and settings of the basic default setting are described in the "structure of the basic program".

Basic program

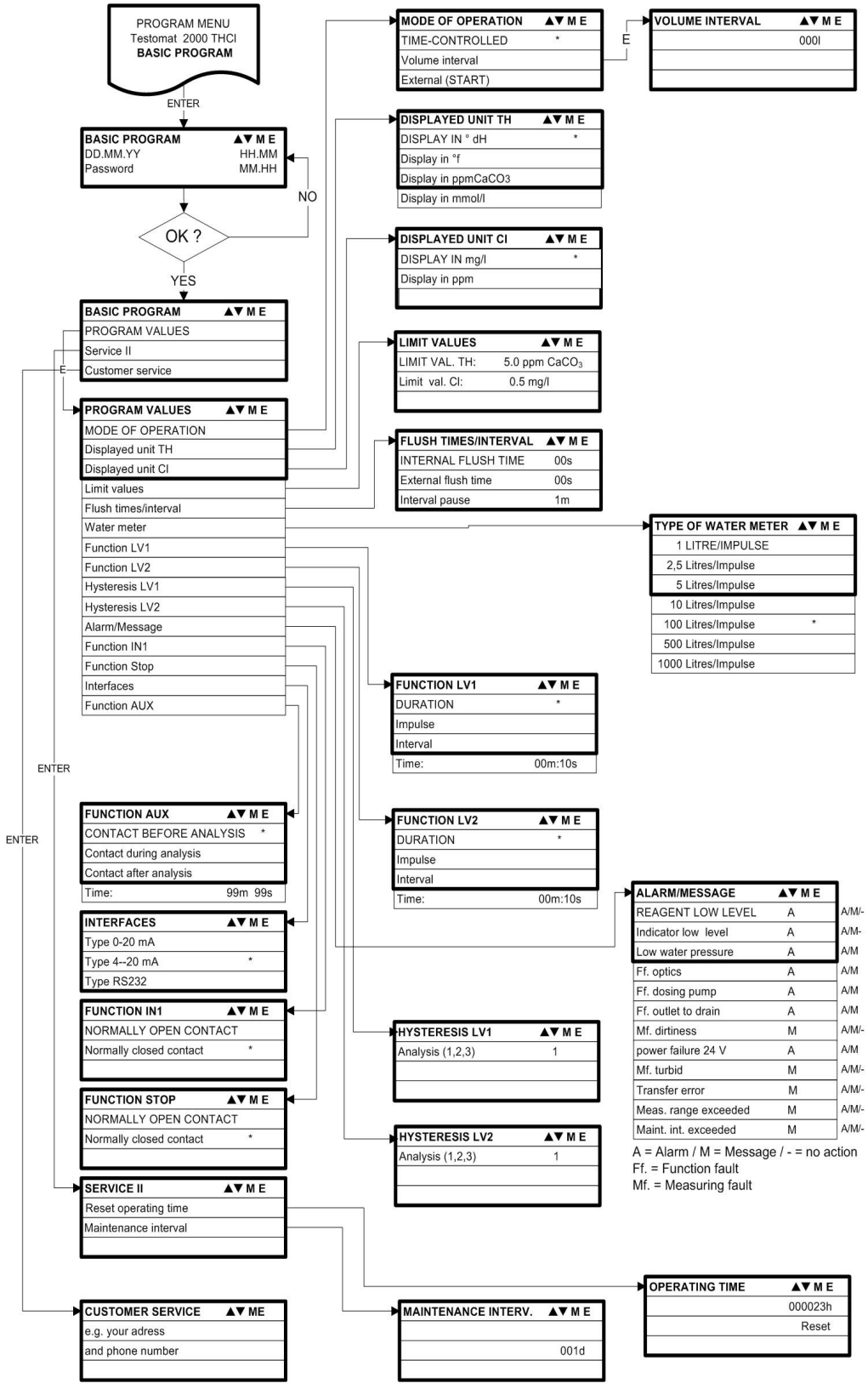
This menu item can only be accessed after entering the password!

After entering the password and confirming it via the "ENTER" key, it is possible to carry out basic programming of the instrument and to select various service functions (e.g. calibration).

In the basic program, the following abbreviations are used in the respective menu items:

s = seconds; m = minutes; h = hours; d = days; l = litres

Structure of the basic program



Call the basic factory program by simultaneously pressing and holding down the "M" and "i" keys while switching on the instrument. ACHTUNG, die letzte Programmierung geht verloren!

Error messages / Troubleshooting

Displayed message (flashes at selected display)	Instrument result functions	Possible causes	Remedies
Ff. POWER FAILURE 24 V ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses - Standby	- Internal power failure of the 24 V supply	➢ Replace fuse F4 or F8 (The control lamp "Power" of the dosing pump should illuminate)
Ff. DOSING PUMP ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses - Standby	- Dosing pump is defective - No dosing message from dosing pump	➢ Replace dosing pump . ➢ Check cable to the dosing pump for correct connection .
Mf. TURBID ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses or no message - Continue measurements	- The water is turbid / soiled	
MEASURING RANGE EXCEEDED ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses or no message - Continue measurements	- The measuring range has been exceeded	➢ Select another type of indicator (basic program)
LOW WATER LEVEL ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses - Standby	- no water input although LED "IN" lights up - Inlet pressure too low - Overflow detection does not react	➢ Check water inlet ➢ Connector at the inlet valve oxidised ➢ Clean filter strainer ➢ Replace valve block Extract pressure controller valve body ➢ Replace fuse F6
Ff. OUTLET TO DRAIN ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses - Standby	- Water remains in the measuring chamber although LED "OUT" illuminates	➢ Check water outlet ➢ Connector at the outlet valve oxidised ➢ Replace valve block
LOW INDICATOR LEVEL ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses or no message - LED and output "maintenance" on - Continue measurements	- Minimum indicator quantity not reached: 50 ml (10%)	➢ Check indicator level and, if necessary, refill (enter the filling quantity!):
REAGENT LOW (A,B,C) ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses or no message - LED and output "maintenance" on - Continue measurements	- Minimum reagent quantity not reached	➢ Check indicator level and, if necessary, refill (enter the filling quantity!):
Mf. SOILING ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses or no message - LED and output "maintenance" on - Continue measurements	- Sight-glass windows are soiled	➢ Clean sight-glass windows
Ff. OPTICS ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses - Standby	- Plug-in circuit board defective - Error at the optical component (transmitter or receiver defective)	➢ Replace plug-in circuit board ➢ Measuring chamber holder holder
Abbreviations: Ff.: = function fault, Mf. = Measuring fault			

Displayed message (flashes at selected display)	Instrument result functions	Possible causes	Remedies
MAINTENANCE INTERVAL EXCEEDED BY XXX DAYS ➢ CANCEL WITH HORN KEY	- After programming: Continuous alarm or message impulses or no message - LED and output "maintenance" on - Continue measurements	- Programmed maintenance date reached or exceeded	➢ Carry out maintenance and subsequently cancel or confirm
Abbreviations: Ff.: = function fault, Mf. = Measuring fault			

Further information

Error	Possible causes	Remedies
Current interface functions incorrectly	- Incorrect measured value at the output or no power supplied	➢ Replace fuse F7 ➢ Replace the interface circuit board
Unit is not functioning, even though it is switched on No display	- Fuse F9, F5 or F2 (240 V: F1) defective - Power switch defective - Ribbon cable at display circuit board or base circuit board is loose - Error at display circuit board or base circuit board	➢ Replace fuses ➢ Replace power switch ➢ Reconnect ribbon cable ➢ Replace display or base circuit board

Response of a protective circuit

After a protective circuit (fuse) has been tripped, attempt to eliminate the cause of malfunctioning (e.g. replace a defective valve) before reactivating the protective circuit. Frequent tripping is always due to an error which, in certain circumstances, may also cause damage to the instrument.

Malfunctioning/Repairing a defective instrument:

The repair of a defective instrument – irrespective of the warranty period - is only possible after the instrument has been dismantled and returned to us with a description of the error. Furthermore, please inform us of the indicator type being used and the measured medium. Before you return the instrument for repair work, remove the bottles and ensure that the measuring chamber has been flushed out and is empty.

Maintenance

Required maintenance measures

NOTE

➢ Regular maintenance is necessary to ensure trouble-free operation of the instrument!

Please regularly carry out the maintenance work described in the following section when

➢ the programmed maintenance date has been reached (display "maintenance date exceeded")

➢ the instrument displays the following error messages:

"Mf. soiling" or "Low indicator level"

➢ the last maintenance was carried out max. 6 months ago

Cleaning measures

CAUTION

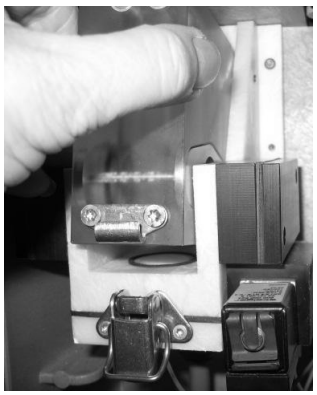
➢ Never use organic solvents to clean the measuring chamber or other plastic parts!

➢ Please observe the safety regulations when handling cleaning agents!

➢ If the measuring range of the instrument is exceeded over a longer period of time, a coloured film may form on the sight-glass windows. Use alcohol to remove this sticky film.

Description of maintenance work

The "maintenance manual Testomat 2000®/Testomat ECO®" contains a detailed description of maintenance work. The measures described here provide a brief overview.



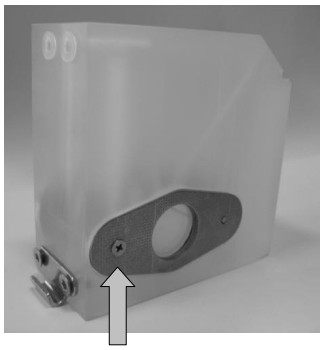
①

Cleaning the measuring chamber and sight-glass windows

➢ Switch off the instrument or press the "STANDBY" key. If required, remove any water from the measuring chamber.

M → SERVICE I → MANUAL OPERATION → Drain chamber

➢ Close the manually-operated valve of the branch line to Testomat 2000®.



②

➢ Unhook the toggle type fastener a, tilt the measuring chamber upwards and remove it.

➢ Release both sight-glass window holders b, remove and clean the sight-glass windows.

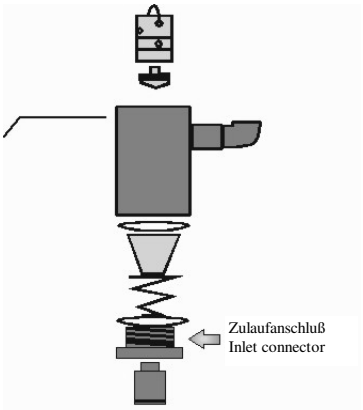
➢ Use alcohol to clean off the film on the sight-glass windows. If the instrument has been used with hard water for a longer period of time (measuring range exceeded!), a hard-to-remove film may have formed on the sight-glass windows. If this is the case, clean the sight-glass windows as described below for cleaning the measuring chamber.

- The measuring chamber can be cleaned with a cleaning agent suitable for decalcification and rust removal. Flush the measuring chamber thoroughly after cleaning.
- After cleaning, re-insert the sight-glass windows and secure them with the sight-glass window holders (Do not forget the flat seals and ensure correct fitting in the groove).
- Re-insert the measuring chamber and secure it using the toggle type fastener.

Cleaning the controller/filter housing

- Close the manually-operated valve of the branch line to Testomat 2000® THCL.
- Depressurise the lines of Testomat 2000® THCL via the function:

  M ➔ SERVICE ➔ MANUAL OPERATION ➔ Flush cham ber
- Switch off the instrument and loosen the hose connections at the filter housing.
- Unscrew the inlet connection using an open ended spanner (size 22) and remove the seal, spring and filter.
- Remove the retaining pin and extract the flow controller, subsequently remove the flow controller valve body.
- Clean the filter housing with water or alcohol; then reassemble the unit.
- If required, replace the seals.
- Insert the filter strainer with the cone facing downwards!
- Re-attach the hose connections at the filter housing.



Regler-/Filteraufnahme
Regulator/filter

CAUTION

Important maintenance information

Water leakage at sealed points can damage parts of the instrument!

Please check the instrument for leaks prior to the first analysis.

- Switch the instrument to "STANDBY"
- Manually fill the measuring chamber
- Manually dose the indicator ("Manual" key)
- Check the connections and seals for leaks.

Service instructions

The surface of the instrument has not been treated. Therefore, avoid any soiling caused by indicators, oil or grease. However, if the housing becomes soiled, please clean the surface with isopropanol (never use other solvents).

Testomat 2000® spare parts and accessories

Art. No.	Pressure controller
40125	Controller / Filter receiver, complete
40120	Controller / Filter receiver
40129	Controller plug T2000, complete
11225	Flow controller valve body, complete
11230	Retaining pin 3x38 90°
11217	Inlet filter 19.5dx25
11218	Spring for inlet filter
40121	Inlet connector
40153	Plug in connector G 1/4" -6
	Measuring chamber
40173	Sight-glass window with seal, T2000
40170	Sight-glass window 30x3
40176	Sight-glass holder, countersink and thread.
33253	Bolt M3x40, A2, DIN 965
40032	Latch fastener TL-17-201-52
11203	Plastic plug 5.3dx5 PE natural
40022	Measuring chamber T2000, complete
	Measuring chamber holder
40029	Measuring chamber holder, complete ET
40050	Magnetic stirrer, processed
40186	Plug-in connector 3/8" -10, processed
40018	Solenoid valve, 2/2-way
40181	Rear guide bar for measuring chamber 5 x 60
	Dosing pump DOSIClip®
40171	Pump block, processed upper part
40172	Pump block, processed bottom part
40201	Jet pump, exchange instrument
40001	Jet pump ET
40011	Suction hose, complete
40016	Pressure hose, complete
37232	Base circuit board TI (3)
34668	Solenoid 24 VDC
32046	Plastic cover CNH 45 N
	Bottle connection / Suction device
40131	Screw cap with bottle insert T2000
40130	Screw cap GL32 - hole
40135	Bottle insert for screw cap with push-fit suction tube

Art. No.	Unit spare parts list
31582	Fuse GS-M 5x20E 4 A
37266	Base circuit board T2000, complete 230 V
40092	Control circuit board T2000, complete
40091	Plug in circuit board driver/receiver SE-T2000 (6)
40190	Cable sleeve 5-7, grey
40191	Cable sleeve 7-10, grey
31713	Ribbon cable 10 pole with EMI filter clamp
40096	Ribbon cable 26 pole with EMI filter clamp
40060	Cable loom 2V for T2000
40062	Cable loom 2P for T2000
40200	Cable loom complete with power switch and cover
31596	Fuse, soldered T0.16A
31585	Fuse, soldered T0,315A
31595	Fuse, soldered T0.1A
31622	Fuse, soldered T0.16A
31592	Fuse, soldered T1.016A
Spare parts requirement for 2 - 3 years of operation	
40173	Sight-glass window with seal, T2000
11217	Inlet filter 19.5dx25
40124	Gasket set T2000
31585	Fuse, soldered T0,315A
31592	Fuse, soldered T1.016A

Accessories

Indicator type	Range	Art. no.:
TH2025	Water hardness 0.25 - 2.5 °dH	152025
CL2250A	Chlorine 0 – 2.5 mg/l, reagent A	156230
CL2250B	Chlorine 0 – 2.5 mg/l, reagent B	156231
CL2250C	Chlorine 0 – 2.5 mg/l, reagent C	156232

Please refer to our delivery programme for an up-to-date overview of available accessories.

Art. no.	Description
040123	Retrofit kit for water inlet T2000 *)
040315	Outlet funnel for Testomat 2000/ECO
270305	Interface card 0/4-20 mA SK 910
270310	Interface card RS232 RS 910
270315	Interface card 0/2-10 V UK 910
270500	Log printer DPN-233-24-V.24
270501	Power supply unit DSV-233, for DPN 233
270335	Maintenance lab T2000 Heyl

***) retrofit kit for water inlet, Art. no. 040123**
If fabric-reinforced pressure hoses (e.g. for existing installations) are used, please replace the plug connector at the controller and filter housing with a plug fort he quick-release coupling (not included).

Technical data

Power supply:	230 VAC, 115 VAC or 24 VAC ± 10%, 50 - 60 Hz Fuse 230 V: T0.1A Fuse 115 V: T0.2A Fuse 24 V: T1.0A
Power consumption:	max. 30 VA, without external load
Protection class:	I
Degree of protection:	IP 65
Conformity:	EN 50081-1, EN 50082-2, EN 61010-1 CE
Ambient temperature:	10 - 45°C
Measuring range:	See section "Performance specifications"
Current interface:	0/4 - 20 mA, max. load 500 Ohm
Protocol printer:	See section "Accessories"
Dimensions:	W x H x D = 380 x 480 x 280 mm
Weight:	Approx. 9.5 kg
Others:	The unit is non volatile

Water connection	
Operating pressure:	1 to 8 bar / $1x10^5$ to $8x10^5$ Pa **or** 0.3 to 1 bar / $0.3x10^5$ to $1x10^5$ Pa (After removing the valve body 11225)
Water inlet:	Opaque pressure hose with an external diameter of 6/4x1 mm
Water outlet:	Opaque hose with an internal diameter of 14 mm
Water temperature:	10 to 40 °C

We reserve the right to make technical changes without notice in the interest of constantly improving our products!

Product overview Testomat 2000® instruments

Model/Type	Measuring parameters	Measuring range	Application area/Functions
Testomat 2000®	• Water hardness • Carbonate hardness • p-value • minus m-value	0.05-25 °dH 0.5-20 °dH 1-15 mmol/l 0.05-0.5 mmol/l	• universal for water treatment plants • approved for boiler houses
Testomat 2000® Antox	same as Testomat 2000®	same as Testomat 2000®	• Dosing of reducing agent
Testomat 2000® CAL	same as Testomat 2000®	same as Testomat 2000®	• with calibration function
Testomat 2000® CLF	• Free chlorine	0-2.5 mg/l	• DPD method for swimming pools and drinking water
Testomat 2000® CLT	• Total chlorine	0-2.5 mg/l	• DPD method for swimming pools and drinking water
Testomat 2000® CrVI	• Chromate • Chromium VI	0-2.0 mg/l 0-1.0 mg/l	• Monitoring of process and waste water for electroplating
Testomat 2000® Duo	same as Testomat 2000®	same as Testomat 2000®	• Monitoring of two measuring points
Testomat 2000® Fe	• Iron II and Iron III	0-1.0 mg/l	• De-ironing plants
Testomat 2000® SO_3	• Sulphite	0-20 mg/l	• Monitoring of saturated oxygen due to sulphite in the boiler feed-water
Testomat 2000® S8 plus	same as Testomat 2000®	same as Testomat 2000®	• Automatic measuring chamber cleaning
Testomat 2000® THCL	• Total chlorine • Water hardness	0-2.5 mg/l 0.25-2.5 °dH	• DPD method for swimming pools and drinking water • Combination instrument for hardness and chlorine
Testomat 2000® V	• Water hardness • Carbonate hardness	1.0-25.0 °dH 1.0-20.0 °dH	• Blending water

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