Operating Instructions

Testomat® Limit TH

Online Analysis Instrument
for Water Hardness

EN

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Testomat_Limit_EN_251203

Original manual

Content

1 General information

1.1 Use and storage of the instruction manual

The operating instructions form part of the equipment. Therefore, observe the following principles:

Read the operating instructions carefully and in full before working with the device.

Ensure that the operating instructions are accessible at any time for all users. When an SD is used in the device, it can also be stored on the same as a PDF file.

Keep the operating instructions for the equipment's entire service life.

If transferring the device to third parties, ensure these operating instructions are always included.

The device is a system component. Accordingly, you should also observe the Testomat® Limit TH maintenance manual and the system documentation of the system manufacturer.

We reserve the right to make structural changes with continual improvement in mind!

Our operating instructions are updated at regular intervals. If you are in possession of an older version (see version number of the operating instructions), you can find the current operating instructions on our homepage http://www.heylanalysis.de under Download.

1.2 Symbols

1.2.1 Warnings and safety instructions in this manual

These instructions include warnings against specified actions that involve the risk of injury or property damage. Warnings are structured as follows:

Description of the type or source of danger
Description of the consequences of non-compliance

- Hazard prevention indications

The signal words illustrate the severity of potential injuries if the respective hazard is ignored. The following signal words are used in these instructions:

Danger denotes an imminent danger. If not avoided, death or critical injuries are the result.

Warning denotes a possibly imminent danger. If not avoided, death or critical injuries could be the result.

Caution denotes a possibly imminent danger. If not avoided, slight or minimal injuries could be the result.

NOTE

Note indicates a potentially harmful situation. If not avoided, the equipment itself or something in the vicinity may become damaged.

1.2.2 Pictograms

The following pictograms are used in these operating instructions:

Danger signs for ESD-hazardous components: Electrostatic discharges (ESD) are voltage punctures caused by large potential differences. If this symbol appears in the instructions, ESD protection must be observed.

1.2.3 Typographical highlights

The following typographical highlights are used in these operating instructions:

- Bold text: **Menu** and **Icon** names
- Blue and underlined: Cross reference

1.3 Limitation of liability

1.3.1 Failure to comply with the instructions

The manufacturer accepts no liability for damage resulting from a failure to observe these operating instructions, or from improper use.

1.3.2 Intended use

Testomat® Limit TH has been designed for use in the field of water treatment (e.g. osmosis plants, electroplating, large boiler plants, laundries, canteen kitchens, water softening systems). The instrument is a limit value measuring instrument which automatically monitors the residual total hardness (water hardness) in water.

1. Comply with the output limits specified in the chapter 3 Technical Data on page 6.
2. Observe the areas/limits of application of the reagents and the requirements imposed by the medium to be measured.

The scope of intended use presumes that you have read and under-stood the instructions and particularly the section on chapter 2 Your safety on page 4

Improper use is deemed to occur if you use the device

- outside the applicable scope, as specified in these instructions,
- under operating conditions that deviate from the scope specified in these instructions.

1.3.3 Qualification of personnel

The assembly and commissioning require basic electrical and pro-cess engineering expertise as well as knowledge of the applicable specialist terms. The assembly and commissioning must therefore be performed only by a specialist, or a properly trained person in-structed and supervised by a specialist.

A specialist is a person who can draw on professional training, knowledge and experience as well as knowledge of applicable provisions to assess work assigned to him/her, detect potential hazards and implement suitable safety measures. A specialist must comply with the applicable professional rules.

1.3.4 Use of non-approved spare parts

The equipment's trouble-free operation is only guaranteed when using original Heyl Testomat® Limit TH reagents and original Heyl spare parts. The use of other reagents or spare parts will invalidate the equipment's guarantee.

1.3.5 Unauthorised conversions

Do not make any changes (or otherwise manipulate the equipment in any way) that go beyond the handling described in these instructions; otherwise, the warranty will be voided. In the event of any malfunctions, immediately switch off the Testomat® Limit TH device and inform the service personnel. Never attempt to repair the Testomat® Limit TH device yourself. Doing so will invalidate the guarantee. Repairs must be performed by authorized service personnel only or a qualified specialist.

2 Your safety

The following safety instructions are intended to help you avoid hazards to yourself and bystanders when handling the equipment. They also serve to prevent material damage to the equipment. The measures to avert any and all dangers always apply, irrespective of specific actions.

Warnings to avoid hazards that occur during a specific activity can be found in the respective chapters.

For notes and information on handling the reagents being used, refer to the safety data sheets supplied with the indicators.

2.1 Personal injury

DANGER

Danger to life due to electric shock!
The equipment is operated with electric current. The incorrect handling of the equipment, its connections and cables can lead to death or serious injury.

- Replace any damaged cables immediately.
- Do not use extension cables.
- Fix all cables to prevent damage being caused by other equipment.
- Before mounting the equipment or connecting it to a power supply, disconnect the relevant part of the system from the power supply.
- Only connect the device to the mains voltage as specified on the type plate.
- Route the connections for mains voltage and relay outputs separately.
- Only operate the equipment when the partition walls and terminal compartment cover are installed.

DANGER

Danger to life due to electric shock!
It is possible that high voltages are present at the relay terminals which are fed in from the outside.

- Ensure that these circuits are de-energised before working on the power supply or terminals inside the device.

WARNING

Eye damage due to LED radiation!
If the measuring chamber is removed while the device is running, the eyes may be dazzled by intense LED radiation.

- Always switch off the power supply before working on the device.

CAUTION

Increased risk of accident due to lack of appropriate employee qualification!

The equipment may only be installed and serviced by adequately qualified employees. Insufficient qualification increases the risk of accidents happening.

- Ensure that all activities are conducted by qualified employees only (see chapter1.3.3 Qualification of personnel on page 2).
- Prevent unauthorised employees from gaining access to the equipment.

2.2 Property damage

NOTE

Avoiding interference voltages!

The Testomat® Limit TH device requires stable and uninterrupted supply voltage.

- Where applicable, use a mains filter to shield the device from interference voltages.
- Never lay the connecting cables in parallel to mains cables.

NOTE

Handling may cause damage or destruction of electrical components!

If you have to open the equipment's top door, electrical components may be damaged or destroyed by electrostatic discharge.

- Take the necessary safety measures to avoid electrostatic discharge onto the components (ESD safety)
- Make sure you are earthed before opening the casing.

NOTE

Measurement errors when using unapproved reagents!

The use of unapproved reagents can lead to large measurement deviations or measurement errors. Damage due to foreign particles affecting the dosing pumps, measuring chamber or valves is also possible. The use of third-party indicators will invalidate the warranty!

- Only use original Heyl reagents that are specially adapted to the requirements for the measuring equipment, and thus guarantee perfect measuring results.

3 Technical Data

	Data
Power supply:	24V DC current Device protection 24 V: T0,8 A
Power consumption:	max. 16 VA, without external load
Protection class:	II
Protection type:	IP 44
Conformity: CE UK CA	EN 61326-1, EN 61010-1 BS EN IEC 61326-1, BS EN 61010-1+A1
Ambient temperature:	10 – 40 °C
Measuring range:	Residual hardness in the range of 0,05 – 25,0 °dH .See Chapter 3.1 Available reagents
Contact load relay:	28VDC/300W or 45VAC/300W ohm resistive load
Current interface:	Output of defined values (5, 8, 11, 14, 17, 20 mA) for displaying status and error messages, max. load 500 Ohms
Serial interface RS232:	9600 Baud, 8 Bit, 1 stop bit, no parity
SD card:	Format FAT or FAT32 , max. 32GByte
Dimensions:	W x H x D = 424 x 323 x 138 mm
Weight:	4500 g
Other:	The device is protected against reverse polarity.

Water connection	
Working pressure*:	1 - 8 bar / 1 x 10^5 to 8 x 10^5 Pa *
Water intake:	Opaque pressure hose with external diameter 6/4x1 mm
Water drain:	Hose with internal diameter 12 mm
Water temperature:	10 – 40 °C

Table 1

*Under 1 bar pressure, a flow rate of 400 ml/min must be achieved for safe operation!

3.1 Available reagents

Indicators with different measuring ranges are available for use with the Testomat® Limit TH devices depending on the operational requirements. The limit value to be monitored can be freely set within the measuring ranges.

All indicator types are available in two container sizes (100 ml and 500 ml). A detailed list of the individual indicator types with the corresponding article numbers can be found in Chapter 10.3 Consumables on page 56

		Parameter/Indicator type				
		Water hardness				
		TH 2005	TH 2025	TH 2050	TH 2100	TH 2250
Unit	**°dH** (resolution)	0,05 - 0,50 (0,01)	0,25 - 2,50 (0,05)	0,5 – 5,0 (0,1)	1,0 - 10,0 (0,2)	2,5 - 25,0 (0,5)
	°f (resolution)	0,09 - 0,89 (0,02)	0,45 - 4,48 (0,1)	0,89 –8,9 (0,2)	1,8 - 17,9 (0,4)	4,5 - 44,8 (1,0)
	ppm $CaCO_3$ (resolution)	0,89 - 8,93 (0,2)	4,5 - 44,8 (0,9)	8,9 – 89 (2)	18 - 179 (3,8)	45 - 448 (10)
	mmol/l (resolution)	0,01 - 0,09 (0,01)	0,04 - 0,45 (0,01)	0,09 –0,89 (0,02)	0,18 - 1,79 (0,04)	0,45 - 4,48 (0,1)

Table 2

3.2 Other operational requirements

The following conditions must be ensured for a smooth operation:

- Only use Testomat® indicators.
- The pH range must be between 4 and 10.5.
- The water to be measured must be clean and free of bubbles!
- Only operate the device within the scope of parameters specified under chapter 3 Technical Data on page 6.
- 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. In this case, use an aerator (art. no. 130010).
- The concentrations of disruptive ingredients can be determined with colorimetric TESTOVAL® test kits from Gebr. Heyl. may lead to erroneous evaluations (see delivery program of Gebr. Heyl at www.heylanalysis.de).
- Incorrect evaluations may occur under the following conditions:
  - Carbonate hardness too high (content can be determined with Gebr. Heyl test kit Duroval C, art. no. 40060)
  - Presence of disinfectants
  - Presence of silicate >15 – 20 mg/l (to protect pipework) leads to contamination of the measuring chamber

- Careful handling of the device enhances the operational safety and the service life! With this in mind, perform a visual inspection of the device at regular intervals as follows:
  - Has the expiry date of the reagents elapsed?
  - Are the hose connections of the dosing pump leakproof?
  - Is there any air in the dosing hoses?
  - Are all water connections leakproof?
  - Is the door of the device carefully closed?
  - Is the device excessively soiled?
  - Are the measuring chamber and drain channel/drain hose clean?
- Problem-free operation is contingent on regular maintenance! Maintenance and care instructions can be found in the chapter 9 Servicing and maintenance on page 49.
- Indications of problems can be found in the chapter 7.5 Troubleshooting and repair on page 44.

4 Setup and function

4.1 Internal structure of Testomat® Limit TH

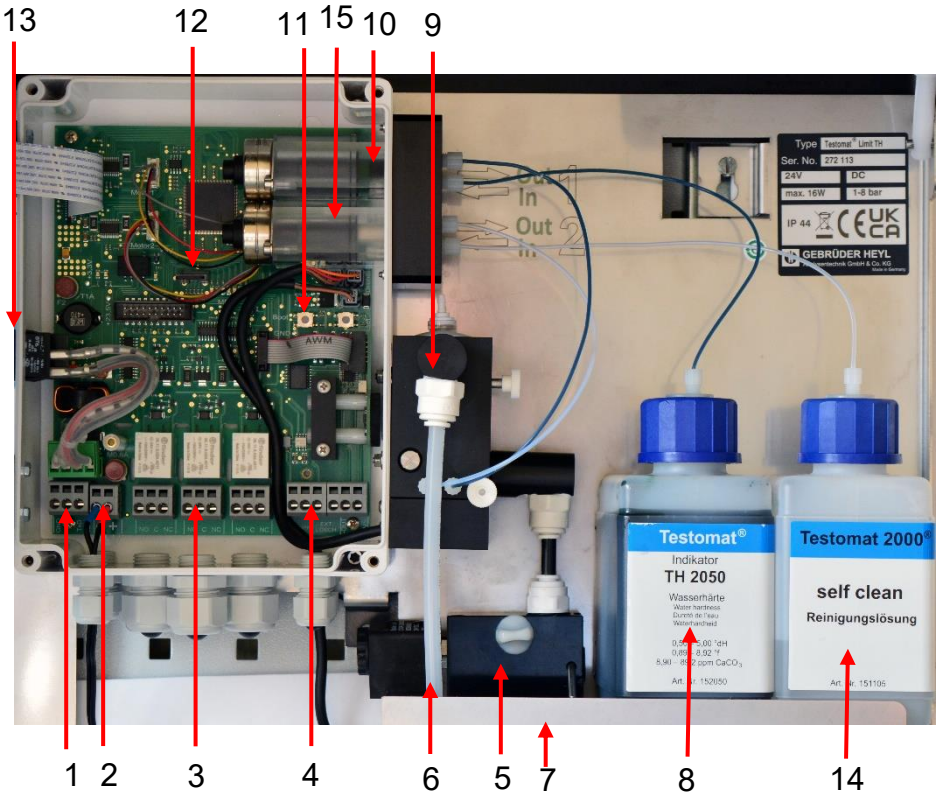


Figure 1

No.	Description
1	Terminal strip for RS232 interface
2	Terminal strip for power supply
3	Terminal strip for relays
4	Terminal strip for inputs Stop, Ext.Ack and current interface
5	Controller/filter housing
6	Water connections, outlet
7	Water connections, intake
8	Indicator
9	Measuring chamber
10	Dosing pump
11	Boot and Reset keys
12	SD card
13	On/off switch
14	Self Clean cleaning solution (only with self clean option)
15	Dosing pump for cleaning solution (only with self clean option)

Table 3

4.2 Product description

Testomat® Limit TH is used for the automatic monitoring of residual total hardness (water hardness) in water.

- Limit values for residual hardness of 0.05 – 25.0 °dH determinable by indicator selection
- Free selection of hardness units in °dH, °f, ppm $CaCO_3$ or mmol/l
- Analysis trigger:
  - Automatic interval operation
    (Interval pause can be configured from 0 – 60 minutes)
  - External control
  - Manual start
- SD card for measurement data logging and for updating the device firmware
- 4-20 mA interface for transmitting measured values and status messages
- TFT panel (touchscreen) with USB interface for updating the panel firmware
- Serial RS232 interface for transferring measurement data and messages/alarms
- Built-in loudspeaker for acknowledging touchscreen inputs
- Optional retrofittable pump for automatic cleaning of the measuring chamber (see chapter 10.2 Accessory)

4.3 Functions of the control and display elements

The operating modes and measurement values are shown on the display of the Testomat® Limit TH. Entries can be made directly via the display (touchscreen).

4.3.1 Switching the Testomat® Limit TH on/off

DANGER

Danger to life due to electric shock!
It is possible that high voltages are present at the relay terminals which are fed in from the outside.

- Make sure that these circuits are also de-energised before working on the device!

NOTE

Possible malfunction!
If the waiting time after switching off is too short, the equipment will not shut down completely, which may cause a malfunction.

- Wait at least five seconds after switching off before switching back on.

The Testomat® Limit TH can be switched on or off using the switch on the left-hand side.

During initial commissioning, please press the Pause icon immediately after switching on the device. This allows you to configure the Testomat® Limit TH immediately. Otherwise, the device starts the first measurement with the factory-set values and can only be configured after the end of the first measurement.

The different menu views are explained below, starting with the start menu that appears after switching on.

4.3.2 Menu Start

After switching on, the display shows the following start screen:

Figure 2

The display shows the user interface version, the basic firmware version and the serial number.

The device flushes and vents.

The display then switches to the Measured values menu, in which the current measured values, the indicator level and error messages are displayed. The device starts the first measurement.

4.3.3 Menu Measuring values

Symbols 4a-e:

Venting Flushing Dosing Measuring Pause

Cleaning
(with self-clean option installed)

Figure 3

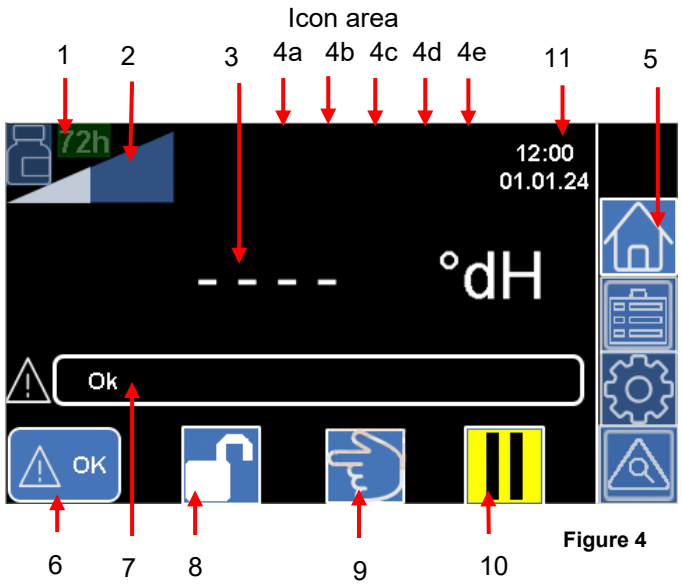


Figure 4

No.	Name	Description
1	72h	72 h operation / The indicator lights up green when the indicator supply is sufficient for more than 72 hours / 3 days of operation.
2	Indicator	Level indicator of the selected indicator.
3	Measurement result	Current measurement result Green frame = good measurement Red frame = bad measurement
4	Status indications	The respective indicator lights up when one of the following functions is active (see figure 3). 4a: The device degasses the water sample in the measuring chamber while the stirrer core rotates. 4b: Device is being flushed 4c: Device doses indicator / device is cleaning 4d: Measurement is running. It is not possible to change the menu during the measurement! 4e: External stop/pause recognised (static icon)
5	Menu change	All menus can be accessed from the bar on the right. Press the desired icon to call up the corresponding menu. The icon that belongs to the currently displayed menu is highlighted. During an ongoing measurement, the main menu shown above is always displayed; it is not possible to change the menu!
6	Alarm OK	Acknowledge any error messages or alarms with this icon.
7	Alarm/error messages	Display of the latest alarm or error message. If a new alarm occurs, the warning triangle flashes in front of the text and is highlighted in red. Pressing the **Alarm OK** button acknowledges the alarm, the warning triangle no longer flashes and is black and white.
8	Password protection	Protect device with a password, assign and change password
9	Manual start	Press the **Manual start** button to trigger a manual analysis.
10	Pause	Switches the device to **pause** mode. A yellow icon with a **pause** symbol means: Device active, pause mode on when pressed. A green icon with a **play** symbol means: Device inactive, pause mode on.
11	Date/Time	Displays the current time and date. The format can be set in the clock menu

Table 4

The **manual start** and **pause** buttons and the **menu change** are hidden when the device is starting, venting or taking a measurement. Wait until the process is complete and the buttons are displayed. Only then can the **manual start** and **pause** functions be performed and the **menu changed**.

4.3.4 Menu Measured value and message log

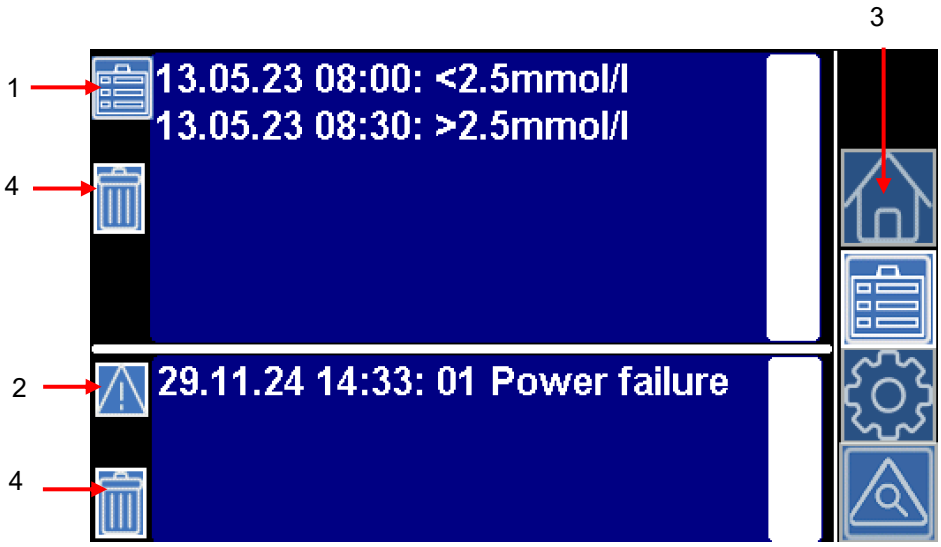


Figure 5

No.	Name	Description
1	Good/poor	Recording of limit value violations with date and time. The scroll bar on the right-hand side can be used to scroll through the list.
2	Fault/Alarm	Logging of alarm or error messages with date. The scroll bar on the right-hand side can be used to scroll through the list.
3	Menu change	All menus can be accessed from the bar on the right. Press the desired icon to call up the corresponding menu. The icon that belongs to the currently displayed menu is highlighted.
4	Delete	The corresponding log is deleted when you press the **Bin** button.

Table 5

Please note that the measurement log can only display approx. 500 entries and the error/alarm log only approx. 250 entries. The oldest values are then deleted. The display is lost when the device is switched off.

Data is always logged on the micro SD card until the card is full (see Chapter 7.9 SD card: Saving measured values and alarms on page 39).

4.3.5 Menu Device Settings

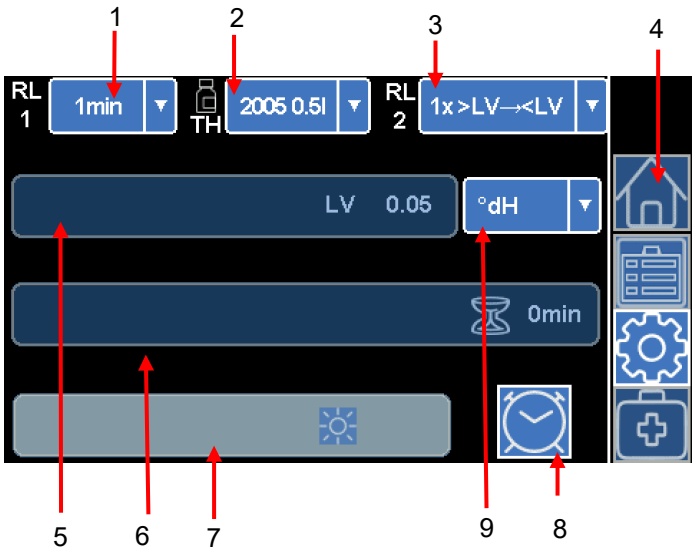


Figure 6

No.	Name	Description
1	RL1	Select the behaviour of relay RL1 after the limit value has been exceeded. A description of the switching behaviour can be found in Chapter 6.9 Setting the switching functions of relay 1 on page 34
2	Indicator type	Select the indicator type from the drop-down menu
3	RL2	Select the behaviour of relay RL2 after the limit value has been exceeded. A description of the switching behaviour can be found in Chapter 6.10 Setting the switching functions of relay 2 on page 34
4	Menu change	All menus can be accessed from the bar on the right. Press the desired icon to call up the corresponding menu. The icon that belongs to the currently displayed menu is highlighted.
5	Limit value	Set the desired limit value to be monitored. Change the limit value by swiping your finger to the right or left across the bar. The set limit value is displayed in the bar. After changing the limit value, the currently displayed measured value is deleted.
6	Interval pause	Determine the interval between two analyses with the interval pause. Change the interval pause by swiping your finger to the right or left across the bar. The set interval pause is displayed in the bar.
7	Luminosity	Change the brightness of the display by swiping your finger to the right (brighter) or left (darker) across the bar.
8	Date / Time	Tap the icon to call up the menu for setting the current date and time.
9	Measurement unit	Select the unit of the displayed measured value. You can choose between °dH, °f, ppm $CaCO_3$ and mmol/l. All subsequent entries and displays are then shown in the programmed unit.

Table 6

4.3.6 Menu Diagnosis

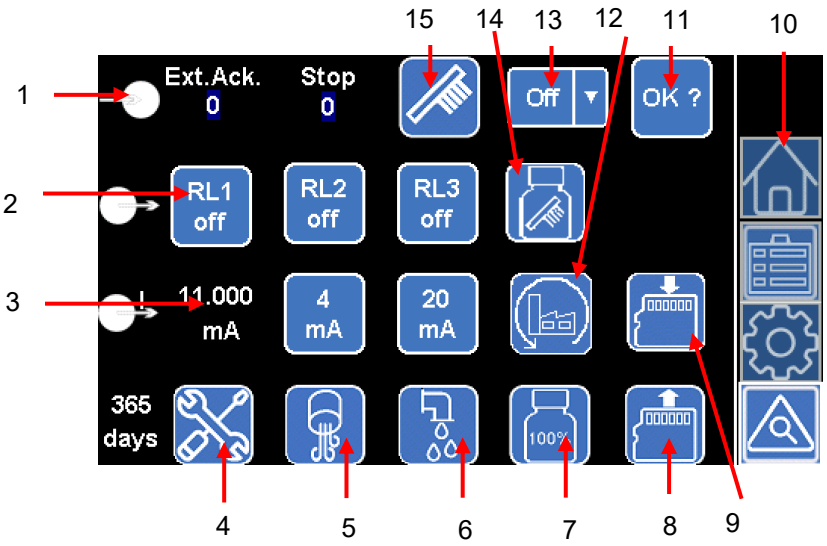


Figure 7

No.	Name	Description
1	Inputs	Display of the signal inputs Ext. Delete and stop. Active =1 or inactive=X
2	Outputs	Display of the relay states of relays RL1, RL2, RL3. If the icon has a red frame, the relay is active (C-NO connected). Press the **RL1**, **RL2** or **RL3** icon to call up the diagnostics menu for the relay. After exiting the diagnostics menu, the switching status of the relays is restored.
3	Current interface	Display of the output current of the 4-20mA current interface. For diagnostic purposes, press the **4mA** or **20mA** icon to output exactly 4mA or 20mA at the interface. A red frame indicates that the 4 or 20 mA output has been selected. Pressing again switches the power off again. If no selection has been made, the current displayed to the left of the icons is output. After exiting the diagnostics menu, the original current value is restored.
4	Service interval	Press the **Service interval** icon to reset the interval of one year. The number of days remaining is displayed to the left of the icon. The action must be confirmed with **OK** (11).
5	Venting	Press the **Vent** icon to vent the hoses between the indicator bottle and the measuring chamber. The action must be confirmed with **OK** (11). A red frame appears during venting. Press **Vent** again to end the function.
6	Flushing	Press the **Flush** icon to flush the measuring chamber manually. A red frame appears during flushing. To stop flushing, press **Flush** again.
7	Indicator level	Reset the indicator level. Press the **100%** icon to reset the indicator level to 100% after changing the indicator. The action must be confirmed with **OK** (11).
8	Import of settings	Imports settings from the SD card into the memory of the device. The action must be confirmed with **OK** (11). If successful, a green frame is displayed; if unsuccessful, a red frame is displayed.
9	Export of settings	Exports the settings from the device memory to the SD card. If successful, a green frame is displayed; if unsuccessful, a red frame is displayed.

No.	Name	Description
10	Menu change	All menus can be accessed from the bar on the right. Press the desired icon to call up the corresponding menu. The icon that belongs to the currently displayed menu is highlighted.
11	OK	Use the **OK** icon to confirm certain actions.
12	Reset	Press the **Reset** icon to reset all settings to the default values. The action must be confirmed with **OK** (11).
13	Cleaning interval	If the self clean option is installed, this drop-down list can be used to set the frequency of cleaning (by number of measurements).
14	Level cleaning solution	If the self clean option is installed, the fill level of the cleaning solution is reset to 100% after a bottle change. The action must be confirmed with **OK** (11).
15	Cleaning	If the "self clean" option is installed, this icon can be used to activate **Cleaning**. The action must be confirmed with **OK** (11).

Table 7

4.4 Operating elements on the motherboard

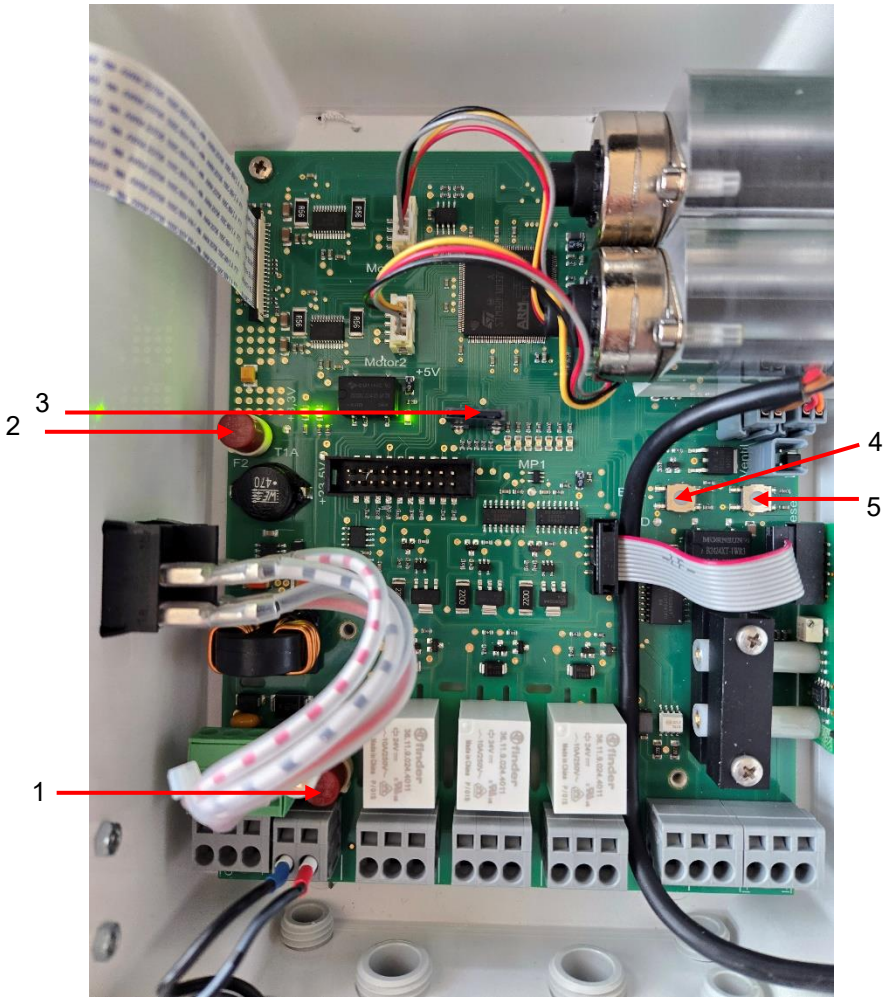


Figure 8

No.	Name	Meaning
1	Fuse	Device fuse F1 for 24V: Typ M0.8A
2	Fuse	Fuse F2 for 3.3V: Typ T1A
3	Plug-in slot for SD card	SD or SDHC cards with a maximum capacity of 32GByte are suitable. The card must be FAT or FAT32 formatted.
4	Boot	Used for firmware update
5	Reset	To reset the controller, proceed as for switching on and off.

Table 8

4.5 Relay outputs

DANGER

Danger to life due to electric shock!
It is possible that high voltages are present at the relay terminals which are fed in from the outside.

- Make sure that these circuits are also de-energised before working on the device!

NOTE

Danger of destruction due to excessive load!
The relay outputs are designed for a defined maximum load (see chapter 3 Technical Data on page 6).

- Note the load capacity of the relay outputs.
- Note the total load capacity.

All relay outputs are designed as neutral contacts. This means the full range of connection options is available to you. This facilitates the switching of mains power, external power and direct switching of inputs, e.g., a process control procedure is implemented.

Ensure that the maximum electrical load capacity of the switching outputs is not exceeded, particularly for inductive loads. The power supply for the user inclusive device is secured with a 4A fuse, which means the total of all loads must not reach 4A.

See Chapter 5.1.14. Connecting relay outputs for the terminal connection.

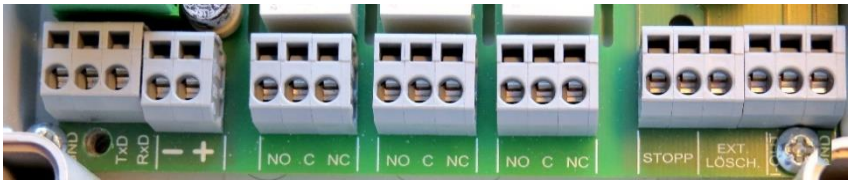
- **Relay 1 (RL1):**
  External Flush relay with programmable switching functions (see page 34)
- **Relay 2 (RL2):**
  Programmable limit value message (see page 34)
- **Relay 3 (RL3): Error message**
  Relay 3 is designed as a changeover contact and is used for signalling faults in the event of low water, low indicator, power failure and measuring errors.
  It is always active during operation (NO-C connected), as it should drop out in the event of a power failure (NC-C connected). There are no setting options for this relay.

4.6 Signal inputs and signal outputs

NOTE

Damage to the equipment due to external voltage!
Connecting the signal inputs with external voltage will damage the equipment.

- Only connect the signal inputs Stop and ext. Delete with potential-free contacts!



GND TxD RxD	- +	RL1	RL2	RL3	Stopp	Ext.	+
RS232 potentially isolated	24V= power supply		Relay		Signal inputs		4-20mA current interface

Figure 9

The following signal inputs are available:

- Stop input
- External deletion

These can be activated individually (see chapter 5.1.8 Connect inputs and outputs on page 27.**Fehler! Textmarke nicht definiert.**)

4.6.1 Stop input

The STOP input is the input for an external flow monitor or switch (potential-free, NO contact).

It has priority over the pause button. When activated, the device completes an analysis that may be running, but no new analysis is started. This applies to both the pause button and the stop input. The difference is in the deactivation.

- If the pause function is active and is cancelled by pressing the pause button, the following applies:
  Once the interval pause has expired, an analysis starts immediately. Otherwise, the analysis starts after the interval pause has expired.
- If the pause is ended via the stop input, a new analysis is started *immediately*, but only if there is no blocking alarm `(Water Low, Fault Optics` or `Press OK to continue`). This means that the stop input also acts as a start input on the falling edge of the input signal.

4.6.2 External delete (external acknowledge)

The input EXT. ACK: is used for the external deletion/acknowledgment of current errors/alarms. It reacts the same as key **OK** after a short press, i.e. all fault messages can also be acknowledged via a remote control (normally open).

4.7 Current interface 0/4 – 20 mA

NOTE

Damage to the equipment due to overloading of the interfaces!
Overloading the interfaces can cause damage to the equipment.

- Do not exceed a load of 500 ohms.
- In the event of faults and very long lines (around 20 m), the use of shielded cable is possible.

The results of the analyses or statuses can be registered via the output of the current interface (I-OUT (+) / I-IN (-)). The following defined values for status and error messages are output for this:

Current	Meaning
5 mA	Pause
8 mA	Good measurement
11 mA	Poor measurement
14 mA	Low water level
17 mA	Low indicator level (< 10%)
20 mA	Indicator is empty (not acknowledgeable) or optical fault or insufficient indicator in the measuring chamber or Device is operated outside the specification (e.g. at too low a temperature or with an expired indicator)

Table 9

4.8 Serial interface

The serial interface transfers measurement data and alarms/notifications in plain text/ASCII in CSV format:

- always active
- Potentially isolated
- Baud rate fixed: 9600baud, 1 stop bit, no parity
- The RxD connection is not used

Test option for the serial interface connection:

Each time the device is switched on, the message `Power failure` is displayed when switching from the start screen to the Measured values menu. Here is an example: `<STX>AL,01 Power failure,21.08.2023,13:28<ETX>`

Note:

`<STX>/Start of transmission` corresponds to the ASCII value 2.
`<ETX>/End of transmission` corresponds to the ASCII value 3.

4.9 Power supply

The device requires 24V= (see Chapter 3 Technical data on page 5). A suitable plug-in power supply unit is available.

5 Prepare the product for use

5.1 Installation

5.1.1 Remove the packaging material

Remove the packaging material completely before starting assembly.

Separate packaging materials according to type and size and send for further use or recycling if no other arrangements have been made with your distributor.

5.1.2 Delivery includes

1 Testomat® Limit TH

1 Screw cap including hole and an insert for the screw cap of the reagent bottle (500 ml)

1 Drain funnel

1 User manual

5.1.3 Requirements for the installation site

Ensure that the following conditions are met at the installation site:

- Use the device in indoor locations only.
- The ambient temperature is between 10 and 40°C.
- The installation site is at altitudes under 2000 m.
- The maximum relative humidity is 80% at temperatures of up to 31°C (linear declining up to 50% relative humidity at 40°C).
- The device must always be protected against wetness and moisture. Under no circumstances may it be exposed to splashed water or condensate.
- Surge category II
- Soiling degree II

5.1.4 Assemble equipment

NOTE

Interrupted operation due to faulty assembly!
In the event of faulty assembly, trouble-free operation is not guaranteed.

- Assemble the device in a location shielded from drips and splashes of water, dust and aggressive substances.
- Assemble the device vertically.
- Assemble the device without mechanical stresses.
- Assemble the device in a location free of vibration.
- Select an installation site at which the length of the water inlet hose can be minimized (max. 5 m)

NOTE

Danger of kinking and abrasion with the cables!
If the wrong cable glands are used, cables may kink or rub.

- Use cable glands with a smooth and rounded opening.
- Ensure that the bend protection is reliably fixed and is five times the maximum cable diameter.
- Use a cable gland with a strain relief that prevents the cable from slipping and cannot be loosened without the aid of tools.
- Use cable glands made of a material with a flammability classification of V1 or better.

You can order cable ducts from us as spare parts (see chapter 10.1 Spare parts on page 55).

During assembly and commissioning, observe the specific nation-al and local requirements.

Observe the accident prevention and conservation requirements in the country of use and at the installation site.

Proceed as follows when assembling the equipment:

1. Drill the mounting holes as specified in figure 10.
2. Secure the device with three screws in a suitable place in the switching cabinet or on the wall.

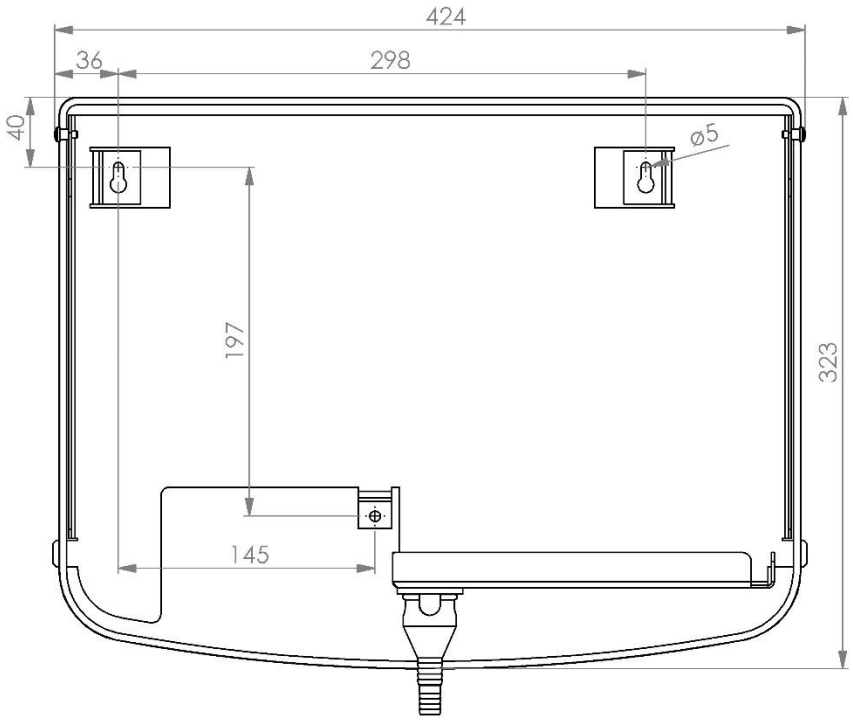


Figure 10

5.1.5 Connecting the water intake

NOTE

Damage due to measuring water that is too warm!
Water above 40°C can cause burns and damage to the parts of the Testomat® Limit TH that come into contact with water.

- The measurement water temperature must be between 10 and 40°C.
- Install a cooler in the intake when the water temperature is above 40°C.

NOTE

Interrupted operation if operating conditions are incorrect!

The following conditions must be fulfilled for the equipment's proper operation:

- Optimum operation of Testomat® Limit TH is achieved with operating pressure of between 2 and 4 bar.
- The water pressure must be in the range of 0.3 to 8 bar. Please note that at a pressure of 0.3 bar, the control core (2) must be removed beforehand. Furthermore, ensure that a minimum flow rate of 400ml/min is maintained
- Avoid significant pressure fluctuations.
- Ensure there are no foreign particles bigger than 150 µm which caused blocking. Use our candle filter (Art. No. 37583) at the front end of the device if you have problems with blocking

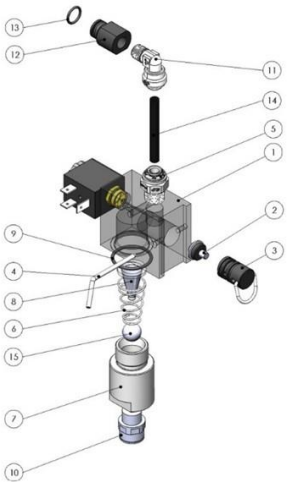


Figure 11

Figure 12

The measuring water is taken from the main water line of the water treatment plant and fed to the inlet connection of Testomat® Limit TH. 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).

Connect the water inlet as follows:

1. Install the connection for the branch line of Testomat® Limit TH directly at the main water line directly after the water treatment plant.
2. Always lay the branch line connection vertically upwards in order to prevent dirt particles from entering the instrument from the main water line.
3. Install a manually operated stop valve in the branch line to Testomat® Limit TH.
4. Use an opaque plastic hose 6/4 x 1 (max. length 5 m) for the water inlet.
5. Flush the supply line to remove any dirt particles.

5.1.6 Connecting the water drain

Figure 13

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

Connect the water outlet as follows:

1. Connect the outlet connection of Testomat® Limit TH to an outlet hose (internal diameter 12 mm).
2. Lay this hose free of back pressure and without the siphon effect to the drain.

5.1.7 Connect mains voltage

NOTE

Damage from assembly when voltage present!
You risk destruction of the product or damage to system components, unless you disconnect the power supply before commencing assembly.

- Disconnect all power to the relevant system component before assembling the Testomat® Limit TH.

NOTE

Damage possible due to the use of incorrect cables and pipes!
Use only cables and installed lines which meet the following requirements:

- Sufficient dielectric strength corresponding to the rated voltage of the appliance, see rating plate.
- Outer diameter of the laid cables: 4.5 mm - 10 mm, because the cable bushings used by Gebr. Heyl have this clamping range. Otherwise no strain relief and no protection against moisture can be achieved.
- For the terminal strips on the circuit board, a wire cross-section applies for
  - finely stranded cores with ferrule without plastic collar: 0.08 mm^2 - 2.5 mm^2. (recommendation: > 0.5 mm^2)
  - finely stranded cores with ferrule with plastic collar: 0.5mm^2 - 1.5 mm^2
  - solid cores: AWG28 - AWG12
- If wires with an incorrect cross-section are used, there is a risk of them becoming jammed when they are removed from the terminal strip.

NOTE

Danger of damage due to electromagnetic fields!
If you assemble the Testomat® Limit TH device or connecting cables parallel to mains cables or in the vicinity of strong electromagnetic fields, the device may be damaged, or the measurement disrupted.

- Keep the connecting cables as short as possible.
- Shield the device from strong electromagnetic fields.
- The stirrer core is magnetic, so very strong magnetic fields can influence the function

Connect the device only to the mains voltage for which it is de-signed. See type plate to confirm the suitable mains voltage.

Figure 14

To connect the cable, proceed as described below. Use Figures 13 and 14 as a guide.

1. Open the housing cover.
2. Loosen the two fastening screws at the top and bottom of the door to the terminal box.
3. Open the door.
4. Loosen the cable ducting strain relief (union nut)(1)(see Figure 14).
5. Lay the cable through the cable ducting underneath the housing into the terminal box.
6. Tighten the union nut of the cable ducting (1) and so establish the strain relief.
7. Connect the 24V DC supply voltage to the + and - terminals (1) (see Figure 15).
8. Ensure that the cores in the terminals are securely in place.

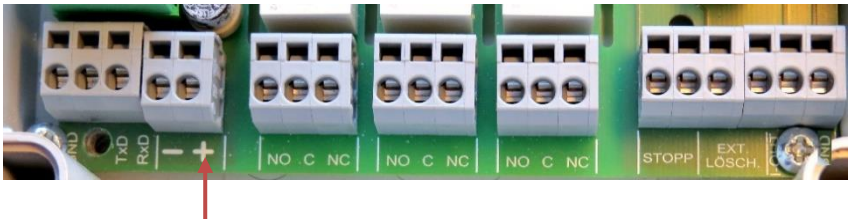


Figure 14 1

Installation example Testomat® Limit TH

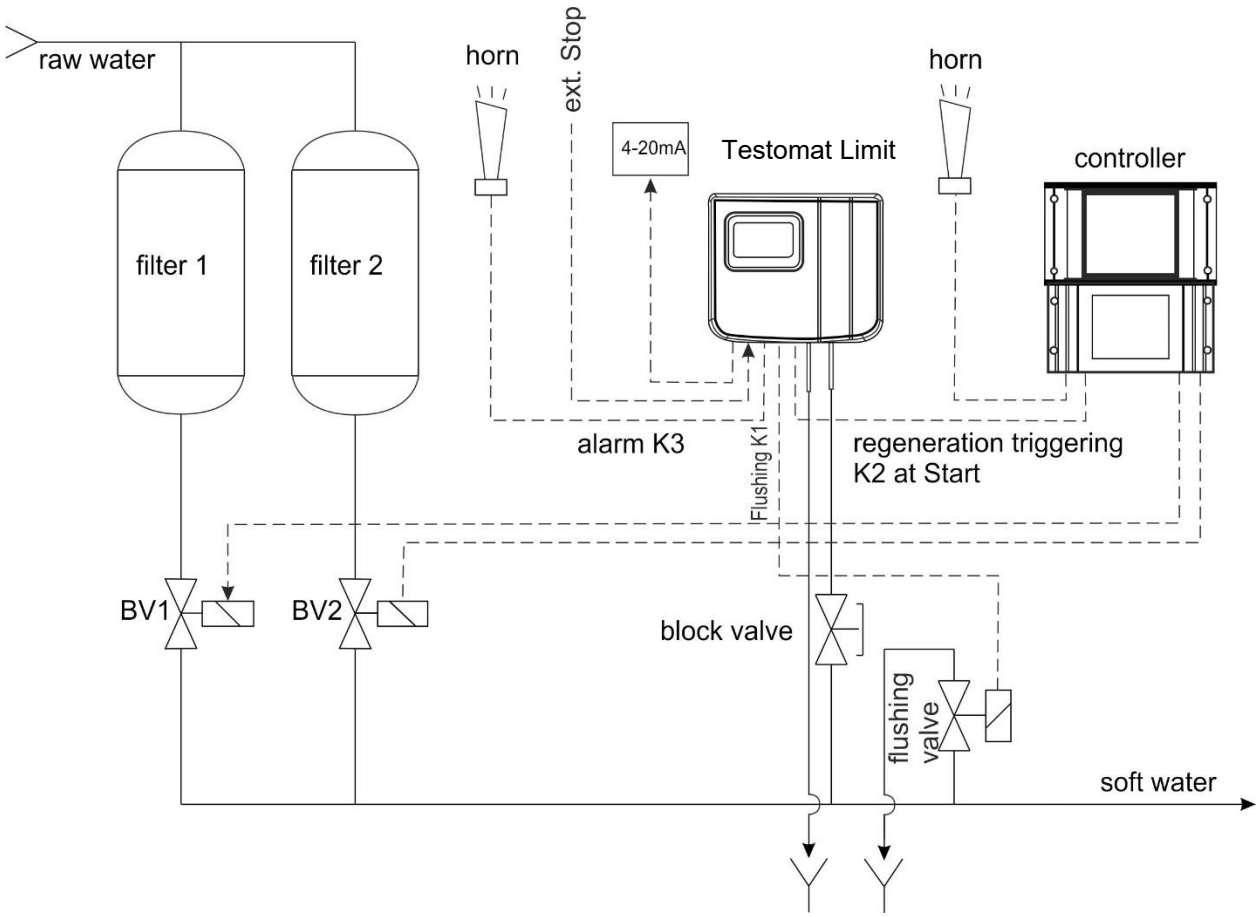


Figure 16

5.1.8 Connect inputs and outputs

NOTE

Possible damage to the equipment due to incorrect connection of the inputs and outputs!
Incorrect connection of inputs and outputs will damage the equipment.

- Do not expose the connections to any external voltage!
- Ensure that the cores in the terminals are securely in place.

The Testomat® Limit TH device has the following sockets for control and monitoring functions. Proceed as follows for connection:

Figure 17

1. Open the door to the terminal box.
2. Take out the blanking plugs of the corresponding cable ductings.
3. Push through the cable of the component.
4. Tighten the union nut of the cable ducting (1) and so establish the strain relief.
5. Connect the cables to the terminal strip.
6. Re-secure the door after installation with both fixing screws.

5.1.9 Connect relay outputs

No.	Function	Note
Relay 1	Control for external flush valve	Potential-free relay output
Relay 2	Control for external utilisation	Potential-free relay output
Relay 3	Fault signalling output – changeover contact	Potential-free relay output

Table 10

5.1.10 Connect inputs

Only connect potential-free NC/NO contacts!

Terminal designation	Function	Note
Stop	Combined start/stop input	Potential-free input
Ext. delete	Acknowledgement message input – NO contact	Potential-free input

Table 11

5.2 Commissioning

5.2.1 Insert indicator bottle

NOTE

Interrupted operation possible when using unapproved indicators!
Flawless operation of the Testomat® Limit TH device is only guaranteed when Heyl indicators are used! The use of external reagents may invalidate the guarantee.

- Use only original Heyl indicators.

The Testomat® Limit TH is supplied with a bottle connection for a 500 ml bottle. If required, please order a bottle connection for a 100 ml bottle.

Insert the reagent bottle as follows. Consider figure 17.

1. Open the housing cover to access the housing.
2. Remove the cap from the indicator bottle.
3. Remove the blue screw cap with hole (1) and the corresponding insert for the indicator bottle (500 ml) (2) from the plastic bag in the housing.
4. Assemble the parts as shown opposite
5. Screw the hose connector (3) of the suction hose (4) hand-tight into the insert (2).
6. Put the insert (2) with the screwed-in suction hose into the indicator bottle.
7. Screw the blue screw cap with hole (3) hand-tight onto the indicator bottle.
8. Place the indicator bottle (5) next to the water inlet in the housing.

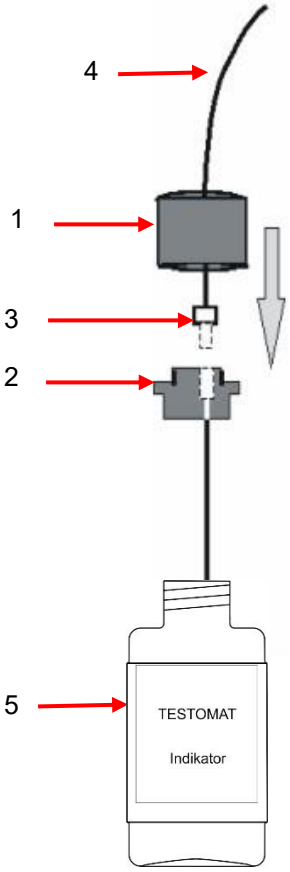


Figure 18

5.2.2 Bleeding the indicator lines

To ensure that indicator is available for the initial analyses, the intake hose and the transport hose must be filled with indicator from the pump up to the measuring chamber.

1. Switch on the instrument and press the icon **Pause**.
2. Switch to the menu **Diagnosis**
3. Press the icon **Venting** and confirm with **OK ?.**
   - ➤ The **Venting** icon is outlined in green while the function is active. The hoses from the indicator to the pump and from the pump to the measuring chamber are vented by pumping the volume of the hoses. The measuring chamber is then emptied and flushed.

Venting ends automatically.

5.2.3 Opening the water inlet

1. Slowly open the manual stop valve in the water line to open the water inlet.

5.2.4 Configuring the basic settings

1. Open the **Device settings** menu.

2. Set the **indicator type** and **bottle size** (0.1 litre or 0.5 litre).

3. Select the **measured value unit** from the dropdown menu.

4. Change the sliding bar for **the limit value LV** by sliding the bar to the right or left with your finger.
   - ➤ The limit value is displayed directly.

The device is now ready to perform a measurement.

5.2.5 Taking the first measurement

1. Open the **Measured values** menu if it is not displayed.

2. Press the **Manual start** button.

3. A measurement is carried out and takes approx. 4 minutes.
   - ➤ The symbols on the left are displayed during the measurement. The pause symbol is only displayed if the external stop input is active. A measurement is then not carried out.

The exact measurement procedure is described in Chapter 8.2.1 Analysis process on page 43.

5.2.6 Taking out of service

NOTE

No measurements with dirty pump parts!
If no indicator bottle is connected, air will enter the hose. The residual indicator in the hose and pump will dry out over time. Pump pistons, valves and sealing rings can then stick together. This will block the pump the next time it is started up. Measurements can no longer be carried out!

- Clean all components after a long period of inactivity before taking a measurement.

If the device is taken out of operation or is not used for more than two weeks, the upper pump that feeds the indicator must be flushed with water.

To do this, proceed as follows:

1. Unscrew the hose to the indicator bottle on the bottle.
2. Insert the end of the hose into a container filled with approx. 200 ml of water. You can also use the self-clean solution (art. no. 151105) instead of water.

3. Use the **Venting** function to pump the water or the self-clean solution (see chapter 7.5 Venting the device on page 37).
   ➤ Indicator residues are dissolved in the hoses and in the pump and flushed away.

6 Instrument settings and analysis

NOTE

No menu change possible during a measurement!
The main menu is active during a measurement (see Figure 19). No other menu can then be called up!

- Wait until the measurement is complete before making any entries.

The device settings required for carrying out analyses, such as the measuring interval pause, the container size of the indicator bottle and the behaviour of relays 1 and 2, are set in the touchscreen menus. A detailed description can be found in chapter 4.3 Functions of the operating and display elements on page 10.

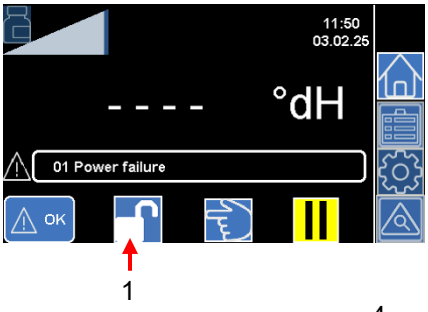


Figure 19

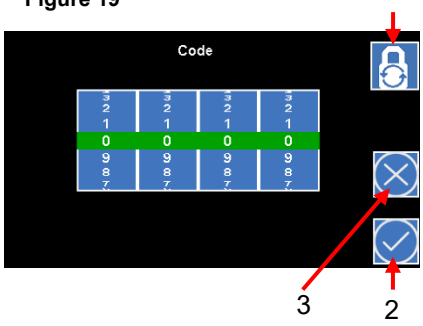
6.1 Enter password

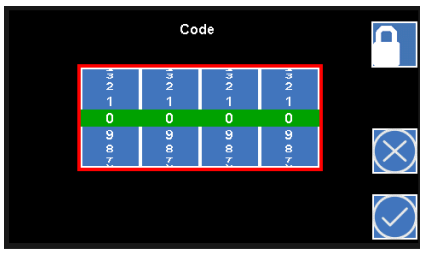
On delivery, all menus are unprotected, and all submenus can be selected (see Figure 19). The device can be protected against unauthorised access with a four-digit numerical code (password).

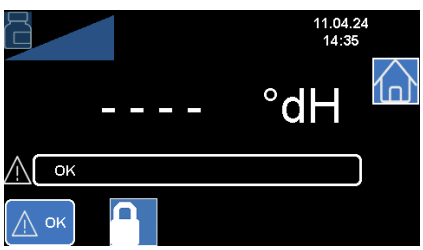
The password is preset to 0000 at the factory. It is saved directly in the panel, not on the SD card. The status (protected or unprotected) is retained when switching off. The password is not exported in the basic programme data.

If the device is protected with a password, most elements on the main screen are locked. It is still possible to acknowledge errors and enter a password. Other menus can no longer be selected. As error messages are saved in the log and on the SD card, all data is retained even if the device is protected with a password.

If the device is protected (see Figure 22), proceed as follows:







1. Press the **Password** icon in the **Measured values** menu.
   ➤ The code dialogue opens.
2. Set the code using the dials (see Figure 20).
3. Click on the **Apply** icon (2).
   ➤ The code is checked:
   – If the code is incorrect, a red border appears around the dials while the tick is pressed (see Figure 21).
   When you release the button, the code window closes and the **Measured values** menu appears unchanged. The main screen remains locked.
   – If the code is correct, the status is changed. The **Measured values** menu reappears.

You can cancel the entry with the **Back** icon (3). Changes will be discarded.

6.2 Assigning or changing the password

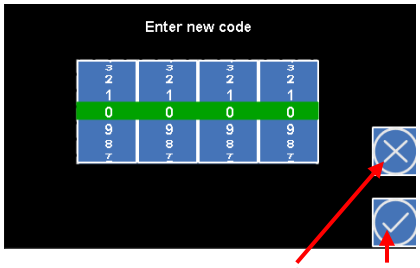


Figure 23

To set a new password or change the existing one, proceed as follows:

1. Press the **Password** icon (1) in the **Measured values** menu (see Figure 19).
   - ➤ The code dialogue opens.
2. Press the **Change password** icon (4) (see Figure 20)
   - ➤ If the code is correct, the **Enter new code** menu appears (see Figure 23).
   - ➤ If the code is not correct, there will be no change.
3. Enter the old code using the dials.
4. Set the new code using the dials.
5. Confirm the entry with the **Apply** icon (2).

You can cancel the entry with the **Back** icon (3). Changes will be discarded.

6.3 Set Date and Time

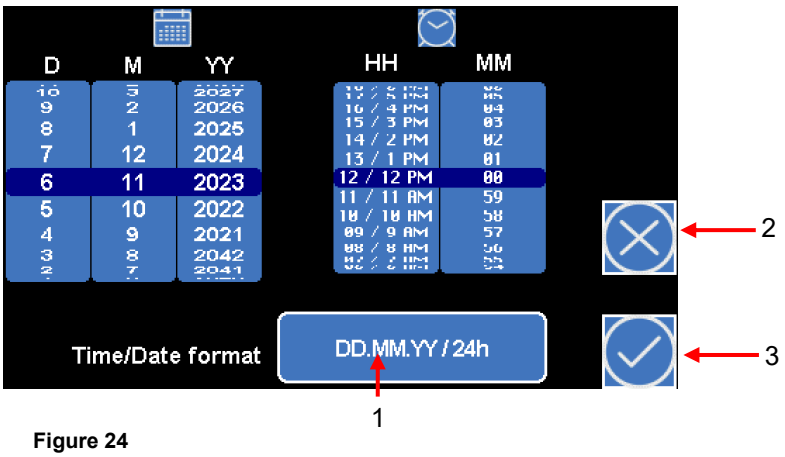


Figure 24

The date and time are set using scroll bars.

1. Select the **Settings** menu.
2. Select the **Date/Time** icon.
   - ➤ The menu for date and time appears.
3. Turn the bars D, M, YY to the desired date and HH MM to the current time.
4. Select the D**ate format** (1).
5. Press the **Apply** icon (3) to confirm the selection.
   - ➤ The set data is accepted, and you return to the **Settings** menu.
6. Exit the screen with the **Back** icon (2) without saving any changes.

6.4 Setting the brightness

You can adjust the brightness of the display. Proceed as follows:

1. Select the **Settings** menu.
2. Change the sliding bar for the **brightness** by sliding the bar to the right or left with your finger.
   ➤ The brightness of the display changes immediately.

6.5 Selecting the indicator type and bottle size

The measuring/monitoring range of the Testomat® Limit TH is determined exclusively by the indicator type you have selected. The available indicators can be found in chapter 10.3 Consumables on page 56.

All specified indicator types are available in two container sizes:

- 100 ml
- 500 ml

Set the bottle size as follows:

1. Select the **Settings** menu.
2. Select the appropriate indicator type and container size from the drop-down list.

6.6 Setting the Interval pause

If the analysis is started via a timer, the interval between two analyses (plus flush 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 60 minutes.

Set the interval pause as follows:

1. Select the **Settings** menu.
2. Change the interval pause by swiping your finger to the right or left across the bar.
   ➤ The set interval pause is displayed in the bar.

The current switch position is read after evaluating a measuring result and after a reset. The **Manual start** button is provided for immediate measurement.

6.7 Setting the limit value

The adjustable limit value range depends on the indicator type (see chapter 10.3 Consumables on page 56). It can be adjusted as required using the slider. If a measurement has already been carried out and the limit value is changed, the currently displayed measured value is deleted.

1. Select the **Settings** menu.
2. Change the limit value by swiping your finger to the right or left across the bar.
   ➤ The set limit value is displayed in the bar.

6.8 Setting the measured value unit

The device measures in the units °dH, °f, ppm and mmol/l. When the unit is changed, the current measured value is automatically converted.

1. Select the **Settings** menu.
2. Change the measured value unit in the drop-down menu.
   ➤ The set measured value unit is displayed in the button.

6.9 Setting the switching functions of relay 1

Relay 1 is intended for external flushing when limit values are exceeded. For this purpose, an external flush valve must be integrated in accordance with the procedural requirements of the process, see also chapter 7.3 External flushing on page **Fehler! Textmarke nicht definiert.**.

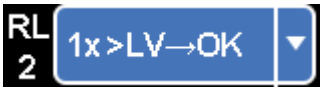
1. Select the **Settings** menu.
2. Select the desired behaviour of relay 1 under **RL1** (see Table 12) from the drop-down list.

Setting	Relay 1 (external flushing)
1min	NO contact – closes for 1 minute after limit value is exceeded.
3min	NO contact – closes for 3 minute after limit value is exceeded.
1,2min	NO contact – closes for 1 minute after the first limit value is exceeded and for 2 minutes after the second limit value is exceeded.
1,2,3min	NO contact – closes for 1 minute after the first limit value is exceeded, for 2 minutes after the second limit value is exceeded and for 3 minutes after the third limit value is exceeded.
90s	NO contact – closes for 90 s before analysis

Table 12

6.10 Setting the switching functions of relay 2

Relay 2 is generally used to signal when limit values are exceeded. The **Settings** menu cannot be opened during a measurement.



1. Select the **Settings** menu.
2. Set the desired behaviour of relay 2 under **RL2** (see Table 13)

The following switch positions are possible:

No.	Setting of RL2	Function	Note
I	1x >LV → <LV	Relay closes after a limit value is exceeded, remains closed until the next time the limit value is exceeded	
II	1x >LV → OK	Relay closes after a limit value is exceeded and remains closed until the alarm is cancelled. Device goes into pause.	The message "108 Press OK to continue" appears. Relay opens when the OK button is pressed or by a signal at the 'Ext. Ack' input
III	1x >LV → 60s	Relay closes for 1 minute after one limit value exceedance	
IV	2x >LV → <LV	Relay closes after 2 limit value exceedances, remains closed until the next limit value is exceeded	The device suspends the interval pause after the first limit value exceedance
V	2x >LV → OK	Relay closes after 2 limit value exceedances and remains closed until the alarm is cancelled	Device suspends the interval pause after the first limit value exceedance. Otherwise as II.
VI	2x >LV → 60s	Relay closes for 1 minute after 2 limit value exceedances	The device suspends the interval pause after the first limit value is exceeded.
VII	3x >LV → <LV	Relay closes after 3 limit value exceedances, remains closed until the next limit value is exceeded	Device suspends the interval pause after the first and second limit value exceedance
VIII	3x >LV → OK	Relay closes after 3 limit value violations and remains closed until the alarm is cancelled	Device suspends the interval pause after the first and second limit value exceedance Otherwise as II.
IX	3x >LV → 60s	Relay closes for 1 minute after 3 limit value exceedances	Device suspends the interval pause after the first and second limit value exceedance.

Table 13

7 Diagnosis functions

7.1 Setting the indicator quantity to 100%

NOTE

Incorrect measured values when mixing indicators!
Production dates and shelf lives are indicated on the indicator bottles. If leftover indicators are filled into a bottle together, the data is no longer correct!

- Indicators - even of the same type - must not be mixed or decanted.

After each indicator change, you must set the indicator quantity to 100%. The Testomat® Limit TH automatically calculates the number of analyses depending on the set container size. The device cannot measure the actual fill level of the indicator bottle. Therefore, only reset the analyser counter if you have inserted a new bottle indicator.

Proceed as follows:

1. Select the **Diagnostics** menu.
2. Press the **100%** icon.
3. Confirm the new fill level with OK **?**
   ➤ The display for the indicator quantity is set to 100%.

7.2 Internal flushing

To ensure that the analysed sample represents the current value, the sampling line must be sufficiently flushed.

The duration of the internal flushing time for the Testomat® Limit TH is fixed and cannot be influenced by the operator. It is 10 seconds before and after the measurement.

7.3 External flushing

If a very long (approx. 3 – 10 metres) sampling line or a line with a large diameter is used, install an external flush valve upstream of the device.

1. Connect the external flush valve to the outlet relay 1.

7.3.1 Flush process – internal/external in manual mode

Proceed as follows to additionally flush the instrument:

1. Press the **Pause** icon in the **Measured values** menu. If a measurement is in progress, wait until the end of the measurement
   ➤ The device goes into pause mode.
2. Proceed as described under internal flush or external flush.

Internal flush process:

3. Select the **Diagnostics** menu.
4. Press the **Flush** icon for as long as you want to flush.
   ➤ The valve opens and the measuring chamber is flushed.

External flush process:

3. Select the **Diagnostics** menu.
4. Press the **RL1** icon for as long as you want to flush.
   ➤ The external valve is activated via relay 1 and the line is flushed. When flushing, the icon has a red border.
5. Press the **RL1** icon again to end the flushing process.

7.4 Set-up 72 h operation (operation without permanent supervision)

The Testomat® Limit TH automatically indicates whether enough indicator is available for continuous measurement. The device calculates whether the remaining amount of indicator is sufficient for the next 72 operating hours, taking into account the remaining indicator, the set interval pause and the amount of indicator used per measurement.

72 h operation possible	72 h operation not possible
The icon **72h** lights up green	The icon **72h** is not shown.

Table 14

7.5 Venting the device

Venting is necessary if air bubbles occur in the hoses. This occurs in the following cases:

- Commissioning
- Changing the indicator bottle
- Repairs to the measuring chamber or replacement of hoses

An indicator bottle must be connected for the function to work correctly.

1. Select the **Diagnostics** menu.
2. Press the **Venting** icon.
3. Confirm with the **OK ?** icon to start the venting process

   ➤ The pump will now pump enough indicator through the tubes until the entire volume has been flushed. This should remove all air bubbles.
   ➤ This is followed by automatic flushing to remove indicator residues in the measuring chamber.

Troubleshooting

If there are still air bubbles in the hoses after venting, the function can be repeated as required. If air bubbles appear again, this means that air is being drawn in. Check the screw connections of the hoses. If this does

not improve the situation, replace the hoses. They are available as spare parts.

7.6 Using the optional cleaning function

To use the cleaning function, a second pump must be installed in the Testomat Limit TH (see chapter 10. Accessories, consumables, spare parts on page 55). The Self-Clean cleaning solution (item no. 151105) is used to clean the measuring chamber.

7.6.1 Manual cleaning

The optional cleaning function uses the Self-Clean cleaning solution to clean the measuring chamber.

1. Select the **Diagnostics** menu.
2. Press the **Cleaning** icon.
3. Press the **OK ?** icon to start cleaning immediately. During cleaning, a green frame is displayed around the button. Please note that the device cannot process any inputs during the cleaning process. As soon as the frame has disappeared, the device accepts inputs again.
   - ➤ The cleaning process takes a total of approx. 3 minutes including flushing and consists of
     a. Flushing
     b. Drawing up the cleaning solution
     c. Pumping the cleaning solution into the measuring chamber and wait for the reaction time
     d. Flushing

7.6.2 Automatic cleaning

From the drop-down list to the right of the **Cleaning** button, select the number of measurements after which cleaning should take place or **Off** so that the cleaning function is inactive.

When automatic cleaning is performed, the cleaning symbol appears on the main screen.

The bottle with the cleaning solution should be changed if one of the following messages is displayed:

```
103 Cleaning solution low.
104 Cleaning solution empty
```

7.6.3 Changing the bottle with cleaning solution

Changing the cleaning solution works in the same way as replacing the indicator (see chapter 9.2 Replacing indicator).

7.6.4 Set cleaning solution to 100% fill level

After each replacement, you must set the fill level of the bottle to 100%. The device cannot measure the actual fill level of the cleaning solution. Therefore, only reset the fill level when you have replaced the bottle.

Proceed as follows:

1. Select the **Diagnostics** menu.
2. Press the icon **Level cleaning solution**.
3. Confirm with **OK ?**

7.7 SD card: Import of settings

1. Select the **Diagnostics** menu.
2. Press the **Import** icon
3. Press the **OK** icon to import all settings from the SD card from the `bdata00.ini` file.
4. Confirm with **OK ?**
   - ➤ If the import is successful, a green frame is briefly displayed around the **Import** icon, otherwise a red frame is displayed (e.g. if no SD card or file is available).

7.8 SD card: Export of settings

The settings are saved on the microSD card. Use this function to save your settings or to assign the same settings to several devices. These are all the settings that can be adjusted in the menu of the same name, with the exception of the brightness and the time of day.

1. Select the **Diagnostics** menu.
2. Press the **Export** icon to save all settings to the SD card in the `bdata00.ini` file.
   - ➤ If the export is successful, a green frame is briefly displayed around the **Export** icon, otherwise a red frame is displayed (e.g. if no SD card or an unformatted SD card is available).

7.8.1 SD card: Operating multiple devices with identical settings

If several devices are operated with identical settings, the settings can be copied as follows:

1. Make the settings on the first device.
2. Export the settings to the factory-inserted SD card as described in chapter 7.8 SD card: Exporting the settings.
   - ➤ This SD card now contains the settings. 3.
3. Remove the factory-inserted SD card from the next device to be set.
4. Insert the SD card from the first device into this device.
5. Import the settings as described in chapter 7.8 SD card: Export of settings.
6. Remove the SD card from the first device and reinsert the original SD card.
7. Carry out steps 4-7 for each device to be set.
8. Finally, insert the SD card back into the first device.

7.9 SD card: Saving measured values and alarms

If a micro SD card is inserted, error and measured value files are stored separately in subfolders according to year and month. There are therefore annual folders (e.g. ‘2023’) and monthly folders (‘01’-‘12’) in each annual folder:

- Files are created on a monthly basis in the annual folder. The format of the file names is:
  `ME<Jahr><Monat>.csv` for measuring values and
  `AL<Jahr><Monat>.csv` for errors/alarms.
- Files are created on a daily basis in the monthly folder. The format of the file names is `ME<Jahr><Monat><Tag>.csv` for measuring values and `AL<Jahr><Monat><Tag>.csv` for errors/alarms.
- Data is stored in "Comma-Separated-Value" format so that it can be easily imported into spreadsheet programmes and databases.

Measuring values

No.	Description	Content (example)
1	Measured value/alarm labelling	ME
2	Indicator used: e.g.	TH2005
3	Designation of the measured variable, here "Total Hardness".	TH
4	Date	15.07.2023
5	Time	12:00
6	M2 is not used	-
7	Measured value. Only >LV or <LV is issued.	>5.0
8	Measured value unit (°dH, °f, ppm, mmol/l)	°dH
9	Limit (Limit val.1 or -)	-
10	LV - Limit value 1	0
11	Limit 2: not used:	-
12	LV - Limit value 2: not used	0

Table 15

Example:

```
ME,TH2005,15.07.2023,12:00,TH,-,>0.1,°dH,Limit TH
val.1,0,Limit TH val.2,0
```

Alarms

No.	Description	Content (example)
1	Measured value/alarm labelling	AL
2	Message	01 Power failure
3	Date	15.07.2023
4	Time	12:00

Table 16

Example: `AL,01 Power failure,15.07.2023,12:00`

The first line of the file explicitly sets the comma as the separator "sep=" so that it can be imported directly into Microsoft Excel. If OpenOffice/LibreOffice Calc is used, this line appears after the import. It can be deleted. Then comes the header, so that the column titles can be named in Office programmes. This is followed by the actual data.

7.10 Reset of settings

All settings (except brightness and time) are reset to the default values.

1. Select the **Diagnostics** menu.
2. Press the **Reset** icon.
3. Then press **OK ?** to reset all settings to the default values.

8 Operation

8.1 Normal operation

Limit value display

The Testomat® Limit TH is a pure limit value measuring device. The result of the analysis is displayed in colour in the **Measured values** menu.

- If the value falls below the specified limit value, the measurement result is displayed with a green frame and the time, e.g. with a set limit value LV of 5.0 and a measured value of 4.0, the displayed result is: <5.0.
- If the limit value is exceeded, the measurement result and time are displayed with a double* red frame.
  Displayed result: >5.0

  * so that people with colour blindness can also distinguish the limit value display
- Changing the limit value in the settings causes the current measurement result to be deleted.
- If the unit is changed, the measurement result is converted immediately.

If an error occurred during the previous measurement, the error is displayed as a **Message** below the measurement result.

Delayed reaction

During analysis, the response to any key presses may be delayed.

8.2 Carrying out an analysis

After switching it on, the instrument commences automatic interval mode. The first analysis starts after 15 seconds. The following analyses start automatically according to the set interval pause.

Attention! After a bad analysis, the interval pause is ignored for certain switching functions of relays 1 and 2 and another analysis is carried out immediately (see sections 6.7 and 6.8 Setting the switching functions of relay 1 and Setting the switching functions of relay 2 on page 34).

Automatic interval operation can be interrupted with the **Pause** icon and analyses can be started manually with the **Manual** icon (see table 17).

Operating mode	Function/Process
Pause 	The instrument is switched on and in standby. Switch pause on/off with the **Pause** icon. Note: During an interval pause, the instrument immediately switches to standby; a started analysis is always completed.
Hand start 	Precondition: The instrument is in standby or in an interval pause. Switch manual mode on/off with the **Manual** icon. An analysis is started immediately, irrespective of the set interval pause.

Table 17

8.2.1 Analysis process

The analysis takes approx. 2 minutes. The water analysis process for determining the residual total hardness is as follows

Analysis start

- ⇒ Indicator is drawn up in pump
- ⇒ Solenoid valve for water inlet is opened
- ⇒ Measuring chamber is flushed
- ⇒ The solenoid valve is closed after the flush time has elapsed
- ⇒ Testing for lack of water
- ⇒ Water outgasses, stirrer core rotates
- ⇒ Measurement is started
- ⇒ Dosing pump pumps indicator, optical system and stirrer core are active
- ⇒ Measured values are processed
- ⇒ Colour change in measuring chamber is evaluated
- ⇒ Switch relays if necessary, result is displayed
- ⇒ Measuring chamber is flushed
- ⇒ Testing for lack of water

Analysis end

8.3 Operational monitoring: Alarm/Message

Current alarm or error messages are:

1. shown directly on the device display below the measurement result. Only the current message is displayed there.
2. displayed in the **Alarm and error messages** menu (see Chapter 8.3.4 Alarm/error message/relay 3 on page 44) with date and time
3. saved on the micro SD card (see chapter 7.9 SD card: Saving measured values and alarms on page 39).
4. output via the serial RS232 interface (see chapter 4.8).
5. signalled via the 4-20mA current interface (see chapter 4.7).

Detailed information on possible error messages as well as their cause and remedy is found in chapter 8.4 Troubleshooting and repair on page 44.

Handling of error messages

- After a power failure, all status/error messages in the display and in the measured value and message log are deleted!
- Pending error messages can be cleared by pressing the **Alarm OK** icon or by pressing the EXT. DELETE input.
- We recommend carrying out a manual analysis after an error message to determine whether the error is still present.

8.3.1 Water shortage

Error `38 Water low` is signalled via relay RL3. Contacts C and NC are connected.

➤ Press the **Alarm OK** icon or close the contacts of the EXT DELETE input to acknowledge the alarm.

➤ After acknowledgement, the relay RL3 picks up again (contacts C and NO are connected).

The alarm is also deleted without it being acknowledged once the low water level has been eliminated after the following analysis.

8.3.2 Indicator shortage

If the calculated indicator quantity is between >0 and 10%, the alarm symbol flashes and the error message `37 Reagent low` is displayed. It can be acknowledged with **Alarm OK**. The alarm relay is not affected by this.

If the calculated indicator quantity is zero, the alarm symbol flashes and the error message `77 Reagent empty` is displayed. It can be acknowledged with **Alarm OK**. The alarm relay is not affected by this.

See also Chapter 8.4 Replacing the indicator on page 49.

8.3.3 Measuring fault analysis

In the event of a measurement error due to a lack of indicators, the device switches to pause mode. The alarm relay RL3 becomes active.

1. Acknowledge the error message with the **Alarm OK** icon.

8.3.4 Alarm/Error message/Relay 3

The relay drops out in the event of error messages that prevent measurement, see chapter 8.4. Troubleshooting and repair on page 45.

1. Acknowledge the error message with the **Alarm OK** icon.

8.4 Troubleshooting and repair

Once a protective device has been triggered (safety fuse), initially try resolving the cause of error (e.g. by replacing a defective valve), before reactivating the protective device. Frequent triggering always signifies an error, which under certain circumstances may also damage the device.

Display message	Description, possible causes	Solution, troubleshooting measures
`01 Power failure`	• Prior power failure (also when switching off)	– Check power supply
`05 SD Card not inserted`	• The function to store measurement values and/or error was activated, but no SD card was inserted	– Insert SD card
`06 SD Card write protected`	• Files or folders on the SD card are write-protected	– Remove write protection, e.g. with Windows Explorer
`07 SD Card unformatted`	• Card not formatted or formatted with an invalid file system	– Format the SD card with a FAT or FAT32 file system
`08 SD Card write error`	• Error when accessing SD card, because the file is write-protected, or the card is full or defective.	– Remove the write protection of the file – Wipe the card – Insert new card
`12 Meas. range exceeded`	• The measurement range is exceeded	– Select a different indicator type (see chapter 9.1 Replacing indicator on page 49
`13 Service exceeded`	• Maintenance interval (1 year of operation) has been exceeded	– Carry out and confirm maintenance
`33 Fault optics`	• Insufficient light at the measuring amplifier despite maximum current of the light source	– Sensor error, repair necessary – Light source defective, repair necessary – Optical measuring path blocked, remove blockage
`35 Fault soiling`	• Clear value is below 70% of the stored clear value at the last service	– Clean the measuring chamber – Clean the mirrors – Check water for sudden cloudiness
`36 Fault analysis`	• Analysis error due to overdrive of the measuring amplifier	– Complete recalibration required, service required, repair if necessary
`37 Reagent low`	• The indicator minimum of 10% is (calculated) not reached.	– Compare the indicator level displayed by the device with the bottle – If necessary, insert a new indicator bottle and set the indicator level to 100%.

Display message	Description, possible causes	Solution, troubleshooting measures
38 Water low	Is recognised indirectly according to these conditions: • During the optical measurement, the initial and final values are identical and close to the clear value → Air or only water, but no indicator in the measuring chamber • No clear value adjustment could be carried out before starting the measurement because it was too dark in the measuring chamber →There is only indicator left in the measuring chamber, but no more water Causes: • No water intake • Intake pressure too low • An error message is only displayed after three occurrences	– Check water inflow – Check in the diagnostics whether the valve switches. If not: Check the plug connector on the valve block or replace the valve block – Clean filter sieve If the pressure is too low: – Remove the pressure regulator core – Inflow must be at least 400 ml/min
39 Extraneous light influcence	• Influence of extraneous light	– Close the device flap and cover – Check that the cap is in place on the measuring chamber.
77 Reagent empty	• Indicator is (calculated) empty	– Insert new indicator bottle – Set indicator level to 100%
103 Cleaning solution low	• Amount of cleaning solution is (calculated) less than 10%	– Check fill level – If necessary, insert new bottle with cleaning solution and set fill level to 100%
104 Cleaning solution empty	• Cleaning solution is (calculated) empty	– Insert new bottle with cleaning solution – Set fill level to 100%
108 Press OK to continue	• Device has gone into pause because the function of RL2 was set this way: 1 x >LV →OK 2 x >LV →OK 3 x >LV →OK	– Press **Alarm OK** icon, acknowledge message – Select another function of RL2 – No error, normal device function

Table 18

8.4.1 Further possible errors

Error pattern	Possible causes	Solution, troubleshooting measures
Device inoperative although switched on	• Power supply unit not plugged in Fuses F1 or F2 defective • Mains switch defective • Ribbon cable between TFT screen and motherboard detached • Error on TFT screen or motherboard	– Check whether green LEDs on the circuit board light up – Replace fuses Replace mains switch – Plug the ribbon cable back in – Replace TFT screen or motherboard
Pump does not pump. No movement of the piston	• Cable connection between stepper motor and circuit board loose • Piston and sealing ring stuck together. May occur if the device has been in operation and has been standing for weeks without an indicator. • Piston jammed	– Start venting to check. Does the piston move? – Plug the cable connector into the socket – Loosen both screws at the rear of the engine and move the piston/engine forwards and backwards by hand to release the piston from the sealing ring. Then connect a bottle of water and de-aerate several times. – Replace pump
Pump does not pump, but piston moves	• Hose fitting loose • Hose kinked, draws air • Hose clogged • Valve defective	– Tighten the screw connection hand-tight – Replace hose – Flush the hose – Replace valve (service)
Stirrer core does not rotate	• Faulty plug connection • - Stirrer core missing • - Rotating field unit defective	– Check both plug connectors directly under the pump and plug in if necessary – Install spare part – Disconnect both plug connectors directly under the pump. Measure resistance on the cable between both contacts: set value < 1 kOhm.
Lack of water / sharply increasing measured values / incorrect measurements	• Inlet valve blocked • Solenoid valve does not work	– Cleaning – Check the plug connector in the second row underneath the pump and plug it in if necessary. Measure the coil resistance of the solenoid valve. Resistance must be < 300 Ohm.
After switching on, the device displays the date 01.01.01, 00:00	• The backup battery in the TFT panel (under the mini-USB port) is empty (<1.2V). The battery has a service life of approx. 2 years.	– Replace the silver oxide battery with a Varta type D377 or equivalent
The device is locked after switching on	• The backup battery in the TFT panel (under the mini-USB port) is empty (<1.2V)	– Replace the silver oxide battery with a Varta type D377 or equivalent

Table 19

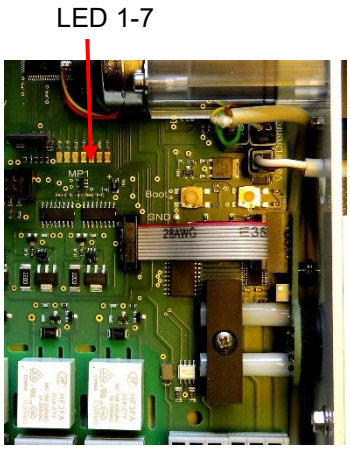


Figure 25

8.4.2 Error messages after self-test

When switched on, the Testomat® Limit TH performs a self-test automatically and then monitors its own state continuously.

Normally, only LEDs 1 and 2 are active:

LED 1 lights up red when writing to the microSD card. This is to the right of the microSD card slot.

LED 2 right of LED 1 lights up yellow when the microSD card is accessed.

LED 3..7 right of LED 2 are used to indicate errors in the hardware and then flash quickly at approx. 10 Hz (☼). The error message is also stored on the SD card in the error log (see chapter 7.9 SD card: Saving measured values and alarms on page **Fehler! Textmarke nicht definiert.**).

The following error codes are defined:

LED3	LED4	LED5	LED6	LED7	Error number/text in alarm log on SD card	Solution, troubleshooting measures
○	○	○	○	☼	500 FM24V02	1. Defective component. Repair/exchange required.
○	○	○	☼	○	589 DS1803_IC6	See 1.
○	○	○	☼	☼	572 DS1803_IC11	See 1.
○	○	☼	○	○	575 MCP4726	See 1.
○	○	☼	○	☼	523 DAC7750	See 1.
○	○	☼	☼	○	517 Init sequence	2. Loose cable between motherboard and display? If not: Defective, repair required.

Table 20

9 Servicing and maintenance

Risk of (chemical) burns from cleaning agents!
Contact with the cleaning agents used may cause (chemical) burns.

- Ensure to observe the safety instructions when handling the cleaning agents!

Danger of soiling!
The surface of the equipment is untreated. Therefore, avoid instances of contamination with reagent, oil or grease.

- If the housing is still dirty, clean the surface with isopropanol.
- Never use other solvents.
- Use only a dry, lint-free cloth.

To ensure problem-free function of the device, regular maintenance is required (semi-annually to annually)!.

Ensure at least the following specified maintenance work is performed regularly, if

- the device shows the error message `33 Fault optics`
- the device shows the error message `38 Water low`
- the device shows the error message `77 Reagent empty`
- The most recent maintenance was a maximum of six months earlier.

A detailed description of the maintenance work can be found in the maintenance manual. The measures described here only constitute an overview. For all additional maintenance instructions, refer to the Testomat® Limit TH maintenance manual.

9.1 Cleaning the housing

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

9.2 Replacing indicator

With the error message `77 Reagent empty` or if the maximum shelf life of the indicator is exceeded, it must be replaced. Proceed as follows:

1. Press the **Pause** icon. If a measurement process is in progress, wait until the measurement is complete.
2. Open the housing cover.
3. Unscrew the cap of the indicator bottle.
4. Remove the empty indicator bottle.
5. Insert the new indicator bottle (see chapter 5.2.1 Insert reagent bottle on page 28).
6. Set the indicator type and the bottle size for the indicator bottle (see chapter 6.5 Selecting the indicator type and bottle size on page 33).

9.3 Remove measuring chamber

Dismantle the measuring chamber as follows:

1. Disconnect the device from the power supply.
2. Stop the water supply to the Testomat® Limit TH.
3. You can also remove the indicator bottle for better accessibility.
4. Place a small container (20 ml) in front of the measuring chamber to collect the water in the measuring chamber.

The measuring chamber is attached to the left of the terminal compartment with 2 locking pins.

5. Pull the locking pin (1) forward and the locking pin (2) to the right to release the mounting of the measuring chamber.
6. Pull the measuring chamber slightly to the right and tilt it 90° forwards so that the water can drain out of the chamber through the opening of the hose connector (3).
7. Loosen the pump hose (4) from the measuring chamber.
8. Loosen the right hose connector (5).
9. Pull the measuring chamber out to the front right.
10. Don't lose the stirrer core!

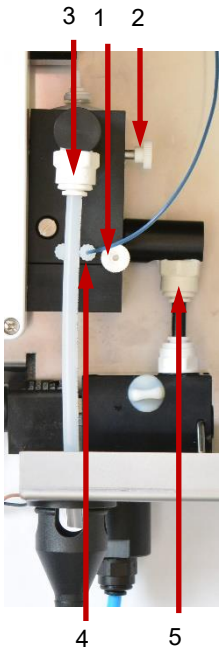


Figure 26

9.4 Cleaning measuring chamber and sight glass

⚠ WARNING

Risk of (chemical) burns from cleaning agents!
Contact with the cleaning agents used may cause (chemical) burns.

- Ensure to observe the safety instructions when handling the cleaning agents!

The measuring chamber and the sight glass must be cleaned every 3 months. If the optional self-clean function is used, the required cleaning of the viewing window, mirror and measuring chamber is extended by up to one year, depending on the entry and cleaning interval.

If the measurement scope of the device is exceeded for an extended period, this may result in the formation of a coloured film on the viewing window. This firmly adhering film can be easily removed using isopropanol.

1. Remove the film on the sight glasses with isopropanol.
2. Clean the measuring chamber with 10 % hydrochloric acid or use our Self-Clean cleaning solution if it is heavily soiled.
3. Rinse the measuring chamber thoroughly.

9.5 Installing measuring chamber and sight glass

1. Reassemble in reverse order to disassembly.
   Ensure tension-free mounting of the sight glass window. Tighten the screws (1) equally alternating both sides. Otherwise, the sight glass window may break.

2. Once all assembly work has been completed, bleed the lines before restarting the instrument (see chapter 7.5 Venting the device on page 37.

9.6 Pump maintenance

The pump's stepper motor is maintenance-free. If there are still problems with the pump, remove the pump and send it in for maintenance. The removal of the pump is described in the pump maintenance chapter of the service instructions.

9.7 Replacing fuses

NOTE

Handling may cause damage or destruction of electrical components!
If you have to open the equipment's top door, electrical components may be damaged or destroyed by electrostatic discharge.

- Take appropriate precautions to avoid electrostatic discharge (ESD protection).
- Make sure you are earthed before opening the casing.

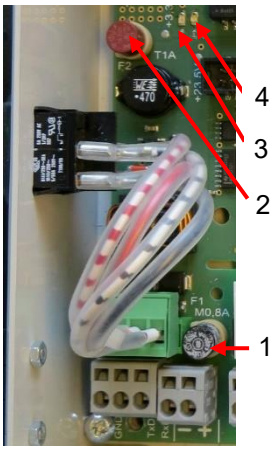


Figure 27

The following fuses can be found on the motherboard (see Figure 27 for position):

	24 V	12 V / 3,3 V
Primary (1)	F1: 24V/ M 0.8A	-
Secundary (2)	-	F2: T1A

Table 21

There are two LEDs next to the fuse F2 (2) that light up when the 3.3V (3) or 24V (4) power supply is active.

9.8 Firmware update motherboard

NOTE

Handling may cause damage or destruction of electrical components!

If you have to open the equipment's top door, electrical components may be damaged or destroyed by electrostatic discharge.

- Take appropriate precautions to avoid electrostatic discharge (ESD protection).
- Make sure you are earthed before opening the casing.

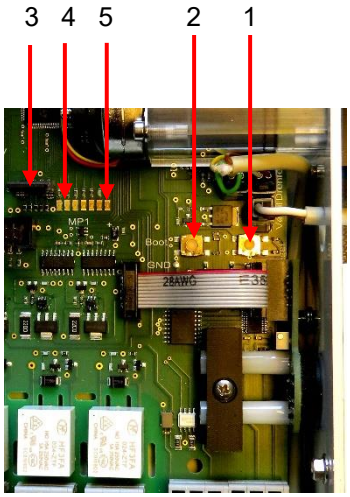


Figure 28

Implement the firmware update as follows:

1. Save the settings of the device (see chapter 7.8 SD card: Export of settings on page 39)
2. Download the firmware update for the Testomat® Limit TH from the Heyl website.
3. Unpack the package into a new folder.
4. Remove the microSD card (3) from the Testomat Limit TH.
5. Save the file 160M<Version number>S00.bin in the root directory of the micro SD card.
6. Insert the micro SD card back into the device.
7. Press and hold **BOOT** (2) on the control card. Then briefly press the **RESET** button (1).
8. Release **BOOT** when the update starts.
   - ➤ The update process progresses automatically. The progress is displayed on the screen and takes approx. 30 seconds. It is indicated by LEDs on the motherboard:
     a. LED 1 (4) to indicate that the bootloader is active.
     b. Then the yellow LED 2 when the firmware file is being read.
     c. Then LED 7 (5) when the file is being checked.
     d. LED 6 flashes during programming.
     e. Finally, all red LEDs light up briefly.
9. The device restarts after the firmware update.
10. Import the settings (see chapter 7.7 SD card: Import of settings on page 39).

Possible errors:

If errors occur, they are displayed on the screen.

During the update, an "update.txt" file is written to the SD card, in which the progress of the update and any errors that may have occurred are logged.

Open these files with any editor (e.g. Notepad) to be able to read the contents. The file is not deleted but added to. If the same SD card is always used for a device, this provides an overview of all firmware updates carried out in the device.

9.9 Firmware update TFT screen

Figure 29

It may be necessary to update the screen application. This is done using the USB cable supplied (art. no. 37928) and the **Unitransfer** programme, which is included in the firmware package that can be downloaded at from:

1. Download the firmware update package for the Testomat® Limit TH from the Heyl website (www.heylanalysis.de).
2. Unpack the package into a new folder.
3. Insert the USB cable with the angled plug into the mini-USB socket on the display.
4. Plug the USB cable with the straight USB plug into the PC or notebook.
5. Start the Unitransfer programme.

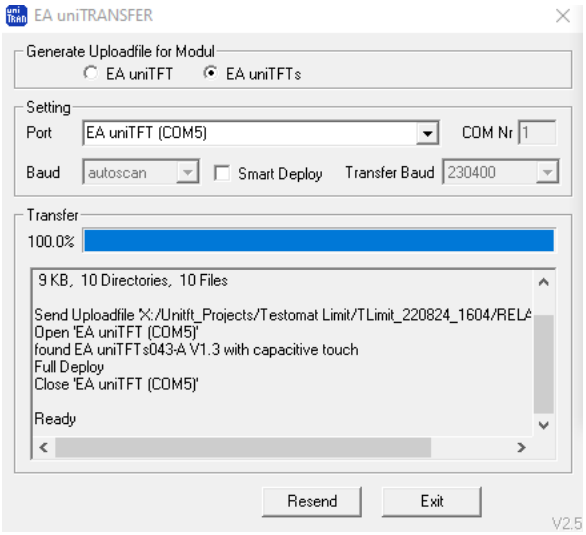


Figure 30

6. Select `EA UniTFTs`.
7. Set the `port` and `COM` (look in the device manager of your PC/notebook if necessary).
8. Move the mouse to the *.eup file in the firmware package.
9. Press and hold the left mouse button.
10. Drag and drop the file into the EA Unitransfer window.
    - ➤ Programming starts and the progress is displayed in the window.

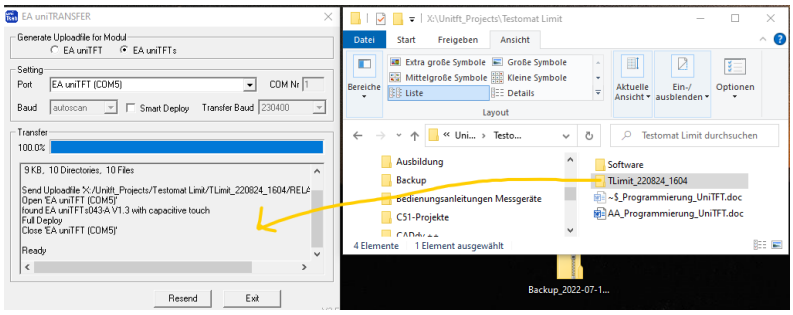


Figure 31

After programming, the TFT screen should restart. A text page with settings may be displayed.

11. Switch off the Testomat Limit TH and switch it on again after a few seconds.
    ➤ The new firmware version must be displayed on the start screen.

10 Accessories, consumables, spare parts

10.1 Spare parts

Art. no.	Component
30996	Plug-in power supply
30935	Plug adaptor GB for plug-in power supply
30936	Plug adaptor US for plug-in power supply
30969	Plug adaptor EU for plug-in power supply
40618	Rotary field recording
31593	Fuse for soldering socket F3 T0.8A
31592	Fuse for soldering socket F2 T1A
32539	Button battery 1.5V V377
40623	RGB optics board
37319	Micro SD card
40577	M12 cable gland
37734	M16 cable gland
32187	Drain funnel with locking tabs
37774	Spacer ring for funnel 40x30x3
	Drain assembly
40676	Complete procedure
	Inlet assembly
40691	Solenoid valve with complete inlet
40689	Solenoid valve
11225	Flow controller core
40129	Regulator plug T-2000
11217	Filter sieve
40608	Ball 12.7mm
	Pump assembly
40692	Replacement pump - LIMIT TH, complete
40433	Hose 250 (for indicator pump and pump measuring chamber)
	Measuring chamber assembly
40690	Measuring chamber LIMIT TH, complete
40050	Stirrer core
11245	O-ring 1,78 x 1,78 EPDM
33776	O-ring 18x2
40668	O-ring 1,78x1,02; EPDM 70; black
40675	Sight glass with groove
33253	Countersunk screw DIN EN ISO 7046-1 M3x40
37517	Mirror glass
33777	Square gasket 24x2
40603	Measuring chamber plug
	Housing cover assembly
40621	Complete bonnet
	Bottle connection /
40131	Insert for screw cap and suction tube 500 ml bottle
40143	Insert for screw cap and suction tube 100 ml bottle

Table 22

10.2 Accessory

Art. no.	Description
270339	Testomat Limit TH maintenance set
270349	Testomat Limit TH repair and service case
270359	Testomat Limit TH annual service set
40681	Retrofit kit selfclean function
151105	Self clean cleaning solution

Table 23

A current device overview of the available accessories can be found in details of our delivery scope.

10.3 Consumables

Art. no.	Indicator type	Range	Quantity
152005	TH2005	Water hardness 0,05 - 0,5 °dH	500 ml
151005	TH2005	Water hardness 0,05 - 0,5 °dH	100 ml
152025	TH2025	Water hardness 0,25 - 2,5 °dH	500 ml
151025	TH2025	Water hardness 0,25 - 2,5 °dH	100 ml
152050	TH2050	Water hardness 0,5 – 5,0 °dH	500 ml
151050	TH2050	Water hardness 0,5 – 5,0 °dH	100 ml
152100	TH2100	Water hardness 1,0 - 10,0 °dH	500 ml
151100	TH2100	Water hardness 1,0 - 10,0 °dH	100 ml
152250	TH2250	Water hardness 2,5 - 25,0 °dH	500 ml
151250	TH2250	Water hardness 2,5 - 25,0 °dH	100 ml

Table 24

11 Information on the repair of products and exchange of parts

The repairing of defective equipment is – regardless of the warranty period – only possible in a dismantled state and with a description of the fault. In addition, tell us the type of indicator currently used and the medium measured. Do not carry out any manipulations on the equipment that go beyond the handling described in these operating instructions; otherwise, the warranty will be voided.

When sending the equipment for repair, proceed as follows:

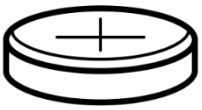
1. Note the type of error (error number, error effect, log file of the SD card).
2. Empty the measuring chamber completely.
3. Remove the indicator bottle.
4. Insert a sealing plug into the drain connection to prevent leakage during transport
5. Use the enclosed checklist to describe the fault and return the checklist with the device.

If you have any questions, contact your sales representative. The contact details of the distributor companies can be found at www.heylanalysis.de/index.php/de/en/contact.

12 Required information when the product is no longer needed

Dispose of the device in accordance with the regulations of your country.

Batteries



The unit contains a removable lithium battery (CR2032 / 3V) from VARTA or an equivalent.

Batteries must be disposed of separately from the equipment! Dispose of the batteries according to the guidelines of your country.

Conformity Declaration

EC Conformity Declaration

CE UKCA

for the following product

Testomat® Limit TH
Online Analysis Instrument for Water Hardness

We hereby confirm that the above product confirms to the principal health and safety regulations laid down in the EC Directives 2014/30/EU and 2014/35/EU.
This declaration applies to all units produced in accordance with the attached manufacturing documents which are a constituent part of this declaration.

The product was assessed with reference to the following standards:

CE

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

UKCA

BS EN IEC 61326-1 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
BS EN 61010-1+A1 Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements

This declaration is made on behalf of

GEBRÜDER HEYL
Analysentechnik GmbH & Co. KG
Orleansstraße 75b
31135 Hildesheim

by

Jörg-Tilman Heyl
General Manager

Hildesheim, 15/07/2025

Check list Testomat® Limit TH

Dear customers and service technicians,
The following checklist is no substitute for your expertise and experience applied to the process of troubleshooting. It should assist you and facilitate swifter and more systematic detection and logging of errors. No claim of completeness may be inferred from this list. We are grateful to receive supplementary feedback at any time. General operating instructions are included on the rear of this checklist.
Your device manufacturer

Block 1 / Plant and instrument data

Testomat® Limit TH			
Instrument type	Instrument number	Indicator type	Software status

Block 2 / Error message and error history — Please mark appropriately (X)

What error messages does the instrument display? (Keys “3” (Standby) and “4” (horn)=> Operating instructions)			
			(LED)
Is the LED above key 4 flashing or lit?	Flashing	Lit	
Are other LEDs lit? Which ones?	Yes	No	
			(LED)

Block 3 / Visual inspection and functional test — Please mark appropriately (X) — If applicable, values / comments

Is the correct mains voltage (according to the rating plate) being supplied to the instrument?	Yes		No	
Does colored water flow out of the discharge hose during analysis?	Yes		No	
Are the measuring chamber, sight glass and mirror clean?	Yes		No	
Are the measuring chamber and water hoses watertight?	Yes		No	
Does the indicator still have shelf life remaining? (See expiry date on the indicator bottle)	Yes		No	Expiry date:
Has the correct bottle size been set?	Yes		No	Size: 100 ml / 500 ml
Is the water pressure within the prescribed limits? (See the instrument’s rating plate)	Yes		No	System pressure:
Has the outlet been installed free of back pressure along its total length? (No “siphon effect”!!)	Yes		No	
Is the outlet hose clear? (Contamination by micro organisms or similar)	Yes		No	
Has it been ensured that fresh measuring water reaches the measuring chamber within the flushing time of 20 seconds before the measurement is carried out?	Yes		No	
Are the dosing pump hoses free of air bubbles? (Operate the pump manually / carry out a manual analysis)	Yes		No	

CARRYING OUT A MANUAL ANALYSIS

Does the indicator pump supply a dose when an analysis is triggered?	Yes		No	

PROGRAMMING DATA / OPERATING CONDITIONS

Is the Testomat instrument constantly supplied with mains power - except during maintenance work/emergencies?	Yes		No	See “General instructions for operating the Testomat® Limit TH”

Please refer to “Error messages / Troubleshooting” in the **operating instructions** for further information on error messages and possible causes of faults.
Further functional tests and service instructions can be found in the **maintenance manual**

If you have examined the instrument with the aid of the checklist and answered “Yes” to all questions in Block 3 it can be assumed that its functions are operating correctly.
We recommend that you carry out all tests contained in this checklist at every service and when faults have occurred.