Original operating instructions
TITRASENSE

Hardness control device for automated monitoring
of total hardness in the process water

Content

1. Foreword

Thank you for purchasing a TITRASENSE analyser for online monitoring of water hardness.

- The TITRASENSE analyser for monitoring water quality is part of the water treatment plant.
- This manual is intended for the manufacturer and the operator of such a unit. It contains instructions for the installation and operation of the unit.
- Please read this manual carefully before operating the unit.
- We recommend that you always keep the manual close at hand during operation.
- Operate the unit only in accordance with the instructions in this manual.
- Under no circumstances will we be liable for any damage caused by operating errors or failure to follow the instructions in this manual.
- Some details and instructions in this manual may differ from your actual purchased unit. We reserve the right to make technical changes without prior notice.

The TITRASENSE analyser automatically detects hardness breakthroughs in a water treatment system and issues a message when the limit value is exceeded. This message can be used, for example, to trigger regeneration of the water softener.

The TITRASENSE analyser is not a device that prevents hardness breakthroughs.

Conversion for the units of water hardness							
		ppm	°dH	°e	°fH	mval/l	mmol/l
ppm $CaCO_3$	1 ppm =	1	0,056	0,07	0,1	0,02	0,01
German degrees	1 °dH =	17,8	1	1,253	1,78	0,357	0,1783
English degrees	1 °e =	14,3	0,798	1	1,43	0,285	0,142
French degrees	1 °fH =	10	0,56	0,702	1	0,2	0,1
mval/l Alkaline earth ions	1 mval/l =	50	2,8	3,51	5	1	0,5
mmol/l Alkaline earth ions	1 mmol/l =	100	5,6	7,02	10	2	1

The unit 1 ppm is used here contrary to the actual literal sense in the sense of 1 mg/l $CaCO_3$.

2. General

2.1 Brief description

With the TITRASENSE analyser, RLS Wacon offers a compact and very easy-to-use analyser for the automatic online monitoring of water treatment plants.
The measuring device works on the principle of "titration with colour change" and provides all important functionalities for reliable field use.

The TITRASENSE analyser automatically carries out water analyses at regular intervals to determine the total hardness.

If the set limit value is exceeded, the unit outputs a message on a potential-free relay output. This message can be further processed by a softening control. In this way, functions such as automatic regeneration triggering can be realised.

The TITRASENSE analyser is characterised by low maintenance costs. Up to 13500 analyses can be carried out with a 750 ml reagent bottle. The input contact of the device can additionally be used to connect a flow monitor to the device. In this way, the TITRASENSE interrupts the analysis interval during downtimes of the water softener and automatically resumes the analysis when the unit is put back into operation.

To prevent disturbances due to the counter ion effect, a first value suppression is available. If the limit value is exceeded, this first carries out another control measurement before a hard water message is issued.

You will find in-depth and much more information about your new TITRASENSE analyser in this manual.

2.2 Scope of delivery

The scope of delivery for a new unit includes the following items:

- TITRASENSE analyser
- Operating instructions
- Front cover (transparent)

Required accessories:

- Reagent of TSH series suitable for the needed measuring range

Optional accessories:

- TITRASENSE connection set (for water supply)
- Cleaning set
- Shutoff valve

This symbol draws your attention to useful tips that contribute to a better understanding of the unit.

Further information on accessories can be found from page 59.

These operating instructions describe the installation and operation of the TITRASENSE on-line analyser. Installation and commissioning may only be carried out by an authorised specialist.

The unit may only be operated under the conditions described in these operating instructions. The unit may only be used for the specified purpose. When installing and operating the analyser, all locally applicable regulations must be observed.

The analyser is used for the automatic determination of the total water hardness in the process water. Proper operation can only be guaranteed if the reagents and spare parts recommended by us are used.

Changes to the electrical wiring and programming may only be carried out by a designated specialist.

The water connection lines to the unit should be kept as short as possible and should not be laid together with mains lines or in their immediate vicinity. In the vicinity of strong electromagnetic radiators, interference with the analysis may occur; in this case, separate interference suppression measures must be taken, in particular the EMC guidelines must be observed.

It is recommended to always have access to the analyser when familiarising oneself with the help of these operating instructions in order to be able to understand the explained correlations and functions immediately. Since certain areas build on each other, it makes sense to work through the chapters in the given order.

If you have any questions about the use of the analyser, you will receive support from our partners or from us. You can reach us by telephone during normal business hours or by e-mail. The contact details of our technicians and our partners can be found on our website.

2.3 Safety instructions and symbols used

In this operating manual you will find various safety instructions that point out possible risks when handling the analyser. This concerns in detail dangers for

- People,
- this product or associated equipment and installations,
- the working environment.

Various symbols in these operating instructions indicate special dangers to prevent personal injury and damage to the appliance. Please read the entire text completely before starting work.

This symbol draws your attention to useful tips that contribute to a better understanding of the unit.

This symbol is a general warning that indicates circumstances that must be observed.

This symbol is a warning that you must expect pipes under pressure.

This symbol indicates the danger of harmful as well as irritating chemicals. Avoid direct skin contact.

This symbol indicates the danger of electric current and the danger to persons and electronic components and assemblies.

2.4 Transport

Immediately after receipt, check that the unit is complete and has no transport damage. The analyser is delivered in a transport-safe condition. Nevertheless, damage may occur during transport. Immediately inform the delivery person of any transport damage.

Protect the analyser from possible damage during transport. Remove any liquids still in it beforehand. Remove the reagent bottle and close it to prevent the reagent from leaking.

2.5 Storage

Store the analyser in a dry place at temperatures between 0 - 45 °C and out of direct sunlight.

3. Disposal notes

This page informs you about the procedure in the European Union regarding the EU Directives 2002/96/EC and 2008/12/EC for the environmentally friendly disposal of an electrical appliance containing a battery. The analyser is intended as professional electrical equipment for commercial use (B2B). The directives have been transposed into national law in the member states and may differ locally in some respects. In case of doubt, please contact your local waste disposal company before disposal.

3.1 Disposal of the battery

The analysers with display contain a battery type CR2032 for storing date, time and status parameters. When replacing the battery, disposal via municipal waste is prohibited. Furthermore, the battery must also be removed before the device is handed in for recycling. Empty batteries can be handed in at public collection points. Alternatively, the battery can be handed in wherever a battery of the same type can be purchased.

3.2 Disposal of decommissioned analysers

The manufacturer's obligation to dispose of commercially used equipment applies to equipment placed on the market after 13.08.2005.
Electrical equipment marked with this symbol must not be disposed of in municipal waste. Give the appliance to disposal and collection systems for electrical appliances for recycling. Alternatively, you can return decommissioned analysers to us or your dealer for disposal.

Dispose of the device and battery separately. For data protection reasons, remove or delete the microSD card from the device before disposal.

3.3 Procedure for shipping decommissioned analyzers for disposal

1. before sending your decommissioned analysers, please inform us by
- by a short phone call to +49 (0)5121/28126-24
- by sending an e-mail (including the serial number) to support@rls-wacon.de

2. wait for a reply
- If you have a warranty claim, you will receive a free return label.

3. clean the unit before packing it away
- For the safety of transport service personnel and our staff, please roughly clean reagents from hoses, pumps and measuring chambers
- Pack these affected components, if possible, in tear-proof, liquid-tight bags

4. use the original packaging if possible
- If the original packaging is no longer available, please ensure that it is adequately cushioned

5. mark your shipment with the inscription FOR DISPOSAL

6. send the package to the following address
RLS Wacon analytics GmbH
- Disposal Service -
Gropiusstr. 12
D-31137 Hildesheim

4. Specifications

4.1 General specifications

Parameter	Value / Range	
Power supply	**24 V DC (50/60 Hz)**	
Protection class	II	
Power consumption	25 VA (in operation)	
IP protection class	without front cover IP43	with front cover IP54
Storage temperature	0 °C - 45 °C	
Ambient temperature	10 °C – 45 °C	
Measured water temperature	5 °C - 40 °C	
Humidity	20 - 90 % RF (without ice or condensation)	
Inlet water pressure	min: 0.5 bar - max: 5 bar / recommended 1 - 2 bar	
Inlet water in general	clear, colourless, free of solids, without gas bubbles	
Water quality requirements for the measurement of water hardness	pH:	4 - 10
	Iron:	< 3 ppm
	Copper:	< 0.2 ppm
	Aluminium:	< 0.1 ppm
	Manganese:	< 0.2 ppm
	Acid capacity:	KS 4.3 < 5 mmol/l

Note on oxidising agents:
Oxidising agents such as calcium hypochlorite, chlorine, chlorine dioxide, sodium hypochlorite or ozone may attack the dye contained in the reagent and interfere with the measurement. This means that an exact determination of the water hardness is no longer guaranteed. An activated carbon filter connected upstream of the analyser can remove these oxidants from the sample water and thus enable the correct determination of the water hardness.
The capacity of an activated carbon filter is consumed during operation. Therefore, the activated carbon filter must be replaced at regular intervals. The effectiveness of the activated carbon filter can be checked with the help of Caldur® test sets.

4.2 Signal input and outputs

Parameter	Value / Range
Relay outputs	2 Relay 0.3 A / 125 VAC 1 A / 30 VDC as potential-free outputs NC/NO The relays provide the following functions: • Limit value alarm (relay output 1) • Device fault or reagent message BoB (relay output 2)
Input contact (INPUT, start or stop analysis interval) only with TITRASENSE	Galvanically isolated input contact for connection of a potential-free contact • Start analyses (external analysis interval) • Flow monitor (analysis interval interruption during system standstill)

4.3 Technical data

Parameter	Value / Range	
Installation	Wall mounting in closed rooms	
Dimensions	without lid:	250 x 330 x 60 mm (W x H x D)
	with lid:	250 x 330 x 90 mm (W x H x D)
Weight	with lid:	1,8 kg
	one unit package	2,5 kg
Inlet/outlet connection	Plastic hose with 1/4-inch outer diameter	

4.4 Analysis properties

Parameter	Value / Range			
Measuring principle	Colorimetric titration method			
Total hardness reagents:	Lower Limit		Upper Limit	
TSH000	0,2	–	2	ppm
TSH002	0,5	–	5	ppm
TSH005	1,5	–	15	ppm
TSH020	5	–	50	ppm
TSH050	15	–	150	ppm
TSH100	25	–	250	ppm
TSH200	50	–	500	ppm
Reagent consumption	• < 0.10 ml / analysis • Up to 13,000 analyses per 750 ml reagent bottle			
Accuracy	Measurement accuracy: • ± 15 % of the limit value of the respective reagent used			
Durability of the reagents	24 months from date of manufacture			
Water consumption	• Approx. 2 L / analysis • The water consumption varies depending on the inlet pressure and the set flushing time			

4.5 Maintenance intervals

Interval	Maintenance work
every 6 months	Cleaning the measuring chamber
	In case of high ambient and water temperatures or water with a high organic load, the cleaning intervals may have to be shortened.
After 24 months of operation	Installation Maintenance kit: Changing the peristaltic pump cassette and the seals

5. Installation

5.1 Installation requirements

The TITRASENSE analyser may only be used for determining the total hardness in water.

Voltage

Changes to the electrical wiring and parameterisation may only be carried out by an authorised and experienced specialist.

The installation to be monitored must fulfil the following conditions:

- The maximum permissible load capacity of the relay outputs and the total power of the system must not be exceeded by the connected load.
- All inductive loads (valves, motors, contactors, transformers) in the system must be equipped with suitable overvoltage protection (e.g., RC element, varistor, diode, etc.).
- If there are external devices with a high mains interference level in the vicinity of the control unit, these must be reduced with suitable measures, or appropriate external interference suppression measures (mains filters) must be taken at the supply voltage input of the control unit.

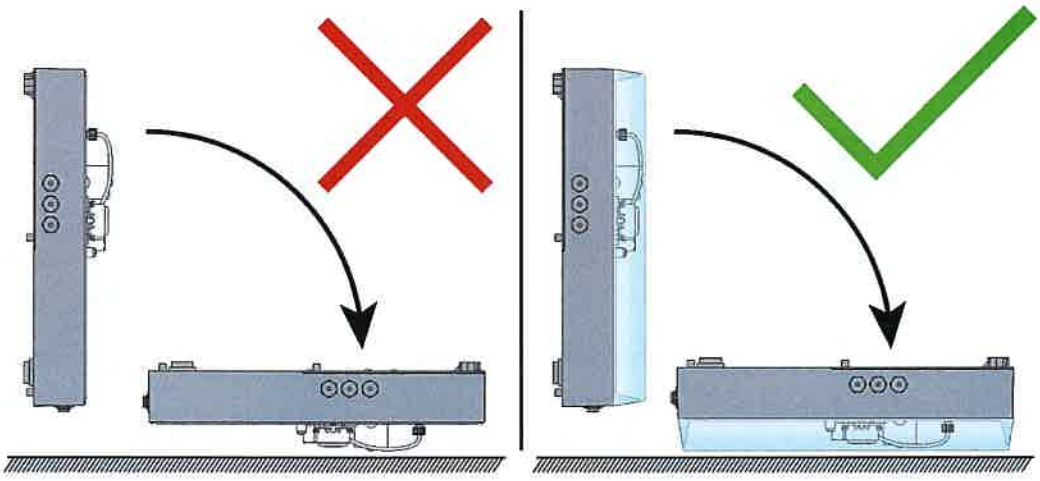


Illustration 1: TITRASENSE - Placement notice

Do not place the analyser on its front without the housing cover. Hoses, connectors and other components could be damaged.
Always use the housing cover when working on the rear of the analyser.

5.2 Wall mounting TITRASENSE

The TITRASENSE analyser can be mounted directly.

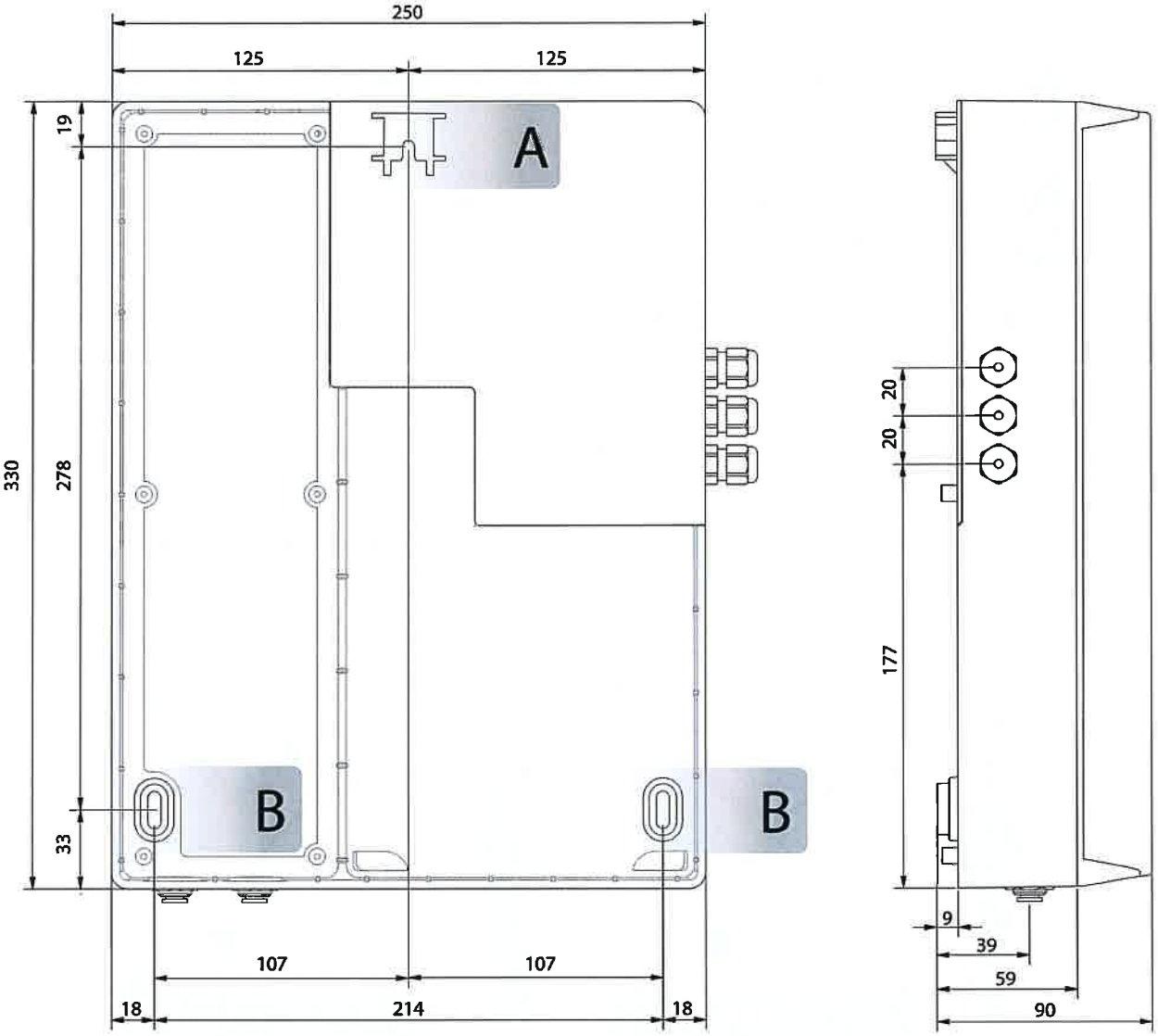


Illustration 2: TITRASENSE - rear and side view (dimensions are in mm)

The unit is attached to a wall or suitable supporting structure using 3 screws (max. Ø 5 mm).

1. Select a suitable mounting location
2. First pre-mount a screw (A) on the wall.
3. Suspend and align the analyser

Connect the TITRASENSE to a power source and connect all other external components. See chapter 6. Electrical installation.

4. Finally, fix to the wall from the front with two screws (B).

Voltage

Do not install the analyser under dripping pipes.

5.3 Establish supply line to the sample water and to the drain

The connections for inlet and outlet are designed for flexible plastic hose with 1/4-inch outer diameter.

A manual shut-off valve must be provided between the preparation unit and the analyser. A suitable valve can be found in the product catalogue or in the spare parts list. When connecting to a drinking water pipe, the installation must take EN 1717 into account. The drain must lead into an open channel via a short connection. The drainpipe must remain depressurised.

Make sure that the inlet and outlet are not interchanged. The inlet is located on the left side of the inlet filter.

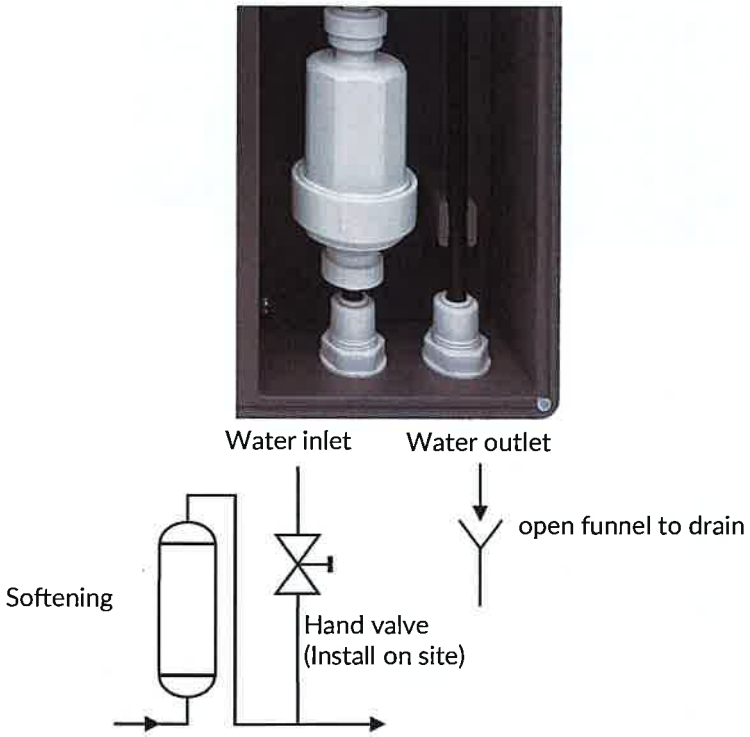


Illustration 3: Connecting the water inlet and outlet

Pressure

The inlet pressure of the water sample must be between 0.5 and 5.0 bar.

The recommended inlet pressure of the water sample should be between 1 and 2 bar.

The hose length of the water drain must not be longer than 2 m and must lead away vertically downwards. The system must be able to relax freely against the atmospheric pressure (no counterpressure). The water drain is pressureless into an open funnel or drain.

6. Electrical installation

6.1 Overview of the electrical connections (mainboard):

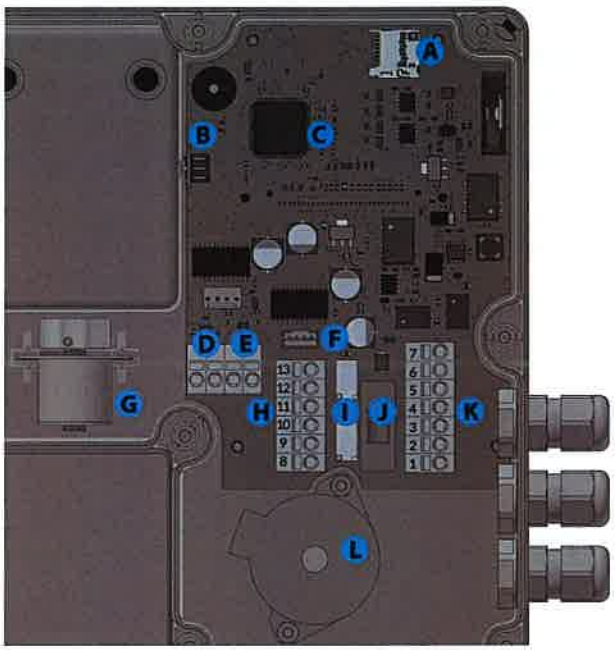


Illustration 4: Electrical connections - mainboard

Position	Description			
A	microSD-card slot			
B	RGB sensor			
C	Controller			
D	Connection LED			
E	Connection Valve			
F	Connection magnetic stirrer (G)			
G	Magnetic stirrer			
H	Relay Outputs:			
	- Output 1 Water	**8:** NO	**9:** COM	**10:** NC
	- Output 2 Alarm	**11:** NO	**12:** COM	**13:** NC
I	2x Relay			
J	Fine-wire fuse (5 x 20 mm) 1 A (inert)			
K	Connections:			
	- Power supply	**1:** + 24V DC	**2:** GND	
	- Input	**3:** V+	**4:** Signal	**5:** GND
	- 4/20 mA-Interface	**6:** +	**7:** -	
L	Dosing pump			

When working on the electrical connections, the following instructions must be observed:

- Screwable and plug-in terminal blocks are suitable for accommodating rigid single-core conductors up to 2.5 mm². Fine-core conductors up to 1.5 mm² can be connected with wire end ferrules, with plastic collars or up to 2.5 mm² without plastic collars. To loosen a terminal, use a slotted screwdriver SL with a maximum blade width of 3 mm.
- The relevant VDE regulations must be observed during all installation work.

Before opening the housing, disconnect the unit from the power supply and secure it against unintentional reconnection.
The installation of a suitable electrical disconnecting device is the responsibility of the system operator.

The maximum connected load of all loads must not exceed 125 VAC / 0.3 A or 30 VDC / 1 A. Provide suitable interference suppression for inductive loads.

Work on the electrical equipment of the system/machine may only be carried out by a trained electrician!

6.2 Connection of the supply voltage

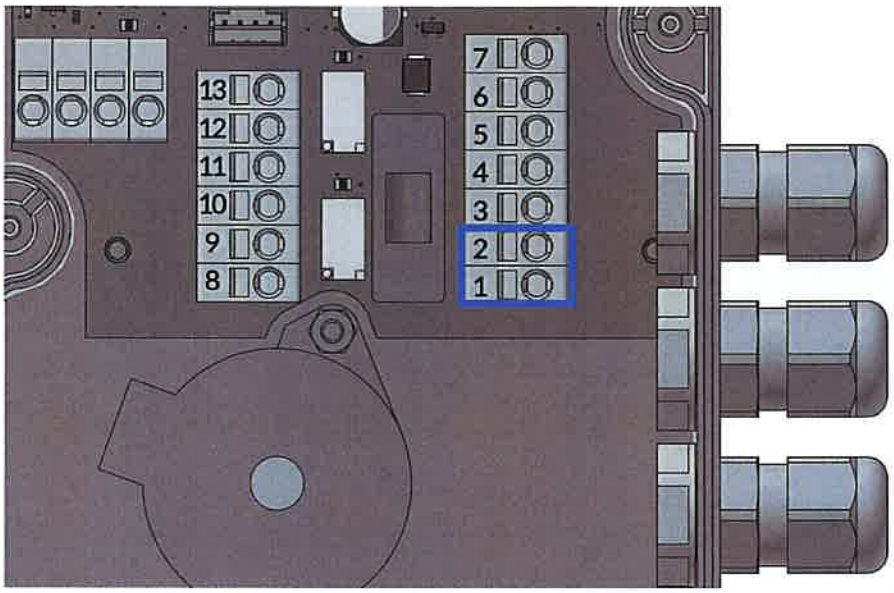


Illustration 5: Terminals for connecting the supply voltage (blue border)

Connection of the supply voltage

Terminal designation	Description
1	+24 V DC
2	GND (Grounding)

6.3 Connection of the relay outputs

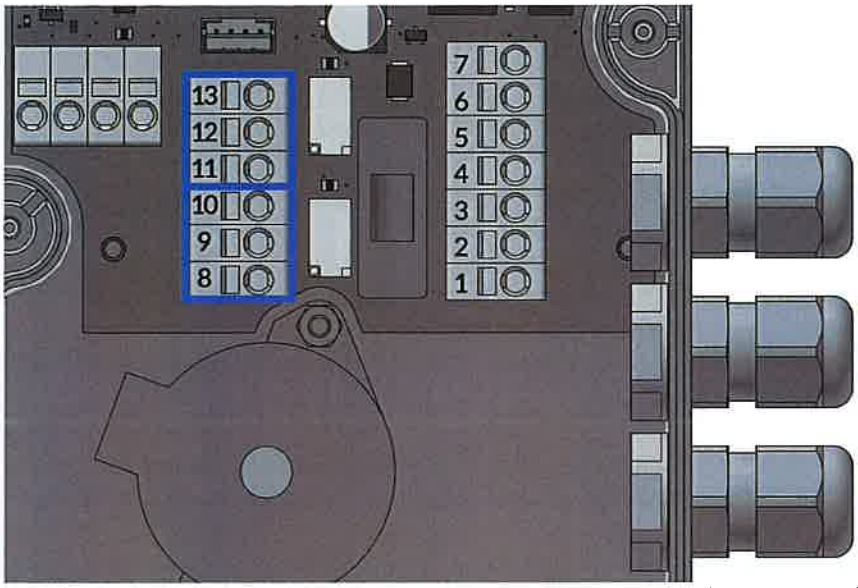


Illustration 6: Terminals for connecting the relay outputs (blue border)

The relays are designed as changeover contacts, with a common connection and the switching outputs NC and NO.

Output 1 water (relay 1): Indication of the water hardness

Terminal designation	Description	
8 NO	Relay 1 NO	normally open
9 COM	Relay 1 COM	common connection
10 NC	Relay 1 NC	normally closed

Output 1 / Relay 1 function (water hardness signal):
If the measured value of the sample falls below the limit value set in TITRASENSE, relay 1 drops out and establishes a connection from COM to NC. In addition, the symbol R1 is not marked in the display.
If the measured value of the sample exceeds the limit value set in TITRASENSE, relay 1 is energized and establishes a connection from COM to NO. In addition, the symbol R1 is marked black in the display.

Output 2 alarm (Relay 2): Signalling of device faults

Terminal designation	Description	
11 NO	Relay 2 NO	normally open
12 COM	Relay 2 COM	common connection
13 NC	Relay 2 NC	normally closed

Output 2 / Relay 2 function (signalling of device faults):
If a device error occurs or the device is switched off, then relay 2 has dropped out (connection from COM to NC). In addition, the symbol R2 is not marked in the display.
Relay 2 is energized in the fault-free device state (connection from COM to NO), this serves to protect against wire breakage. In addition, the symbol R2 is marked in black in the display.

6.4 Connection of the input contact

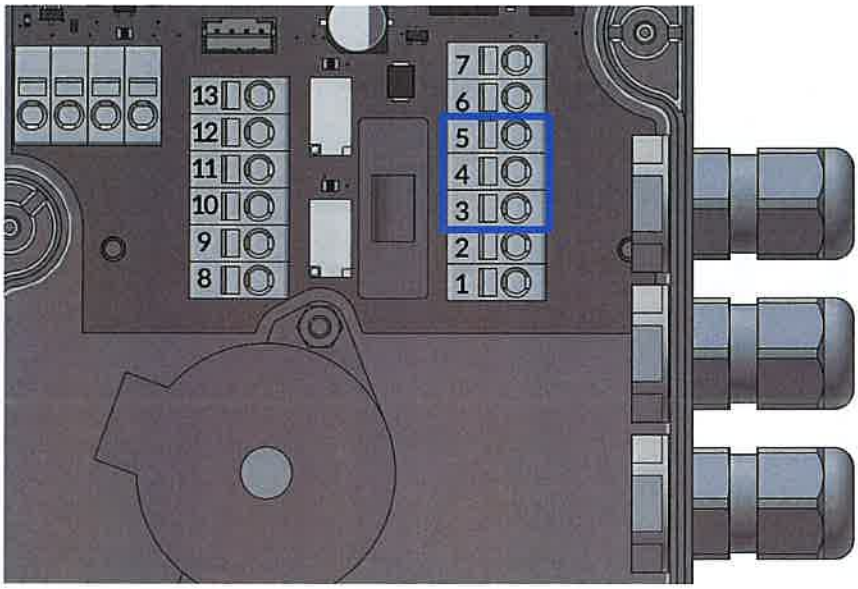


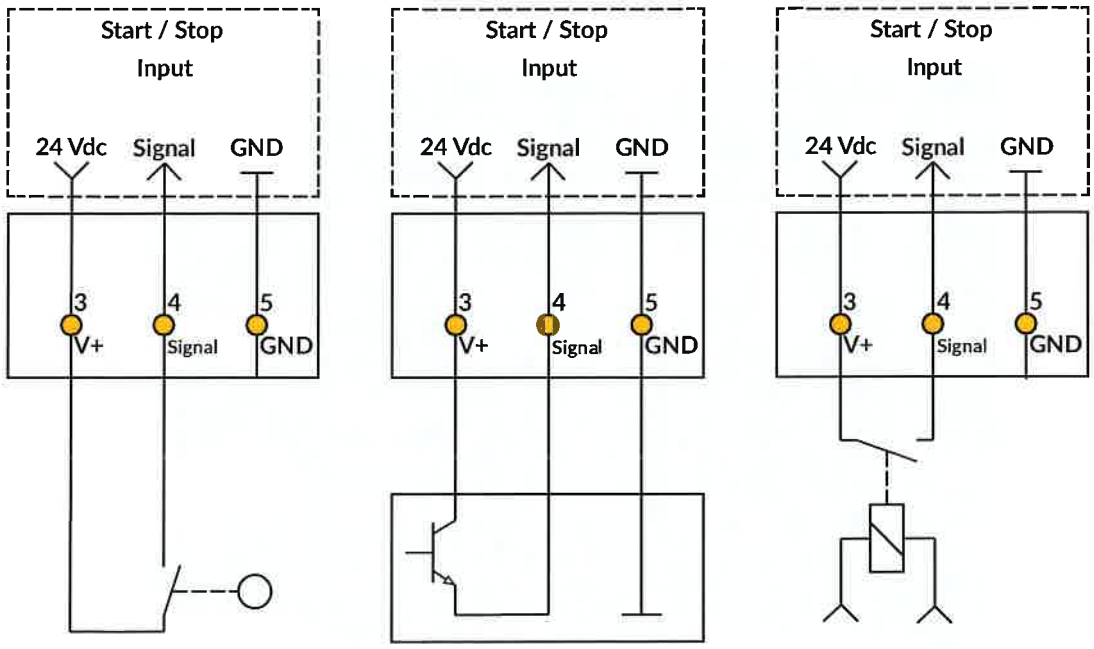
Illustration 7: Terminals for connecting the relay outputs (blue border)

Connection of the input contact

Terminal designation	Description
3	+ 24 V auxiliary voltage to connect potential-free outputs
4	Signal input
5	Ground connection for the + 24 V connection

Input contact Function:
A flow monitor or other potential-free switches can be connected to the input contact. If the input contact is closed, the IN symbol is highlighted in black in the display.

The following pages and chapters 6.5 to 6.7 list the connection options for the input contact.



potential free switch | open collector electric switch | external control voltage

Illustration 8: Three possible variants for connecting the input contact

6.5 Switch for external analysis start

In addition to the possibilities of starting an analysis time-dependently, it is possible to trigger additional analyses via an external button. This can be a potential-free button or the relay output of a PLC control or softening control.
The use of a switch at the input is intended as an addition to the normal time interval. The analyzer works in a set time interval, via the switch a signal can be supplied to the input and thus an additional analysis can be started.

Programming: Menu > Parameters > Input > Start analysis

When using this function, the TITRASENSE must be in automatic mode

An additional analysis can also be triggered by pressing the [OK] button for 3 seconds.

With a permanently connected input contact in Analysis Start mode, analyses are performed permanently.

6.6 Flow monitor / timer

Typically, an ion exchanger is monitored at 10 minute intervals to ensure that hard water does not reach the consumer in the event of a sudden hardness breakthrough. When installed on a system where monitoring is only necessary during operating hours, the input contact can be used for a flow monitor or a timer. This allows the time interval to be paused during a plant shutdown, thus reducing the reagent and power consumption.
A paddle can be used as a flow monitor. The potential-free contact of a timer is also possible. The examples below show different connection possibilities at the input contact.
When using a flow monitor, the analyses are only carried out if a defined signal is present at the input (flow monitor reports flowing water).
Depending on the installed contact, the input can be configured as NC or NO type.

Programming: Menu > Parameters > Input > Flow monitor

[NO] Analysis interval paused: Next analysis start is waiting for a closed input contact.
[NC] Analysis interval paused: Next analysis start waits for an open input contact.

When using this function, the TITRASENSE must be in automatic mode

This function must not be confused with the "Start analysis" function by external control.

6.7 Interval reset

Input IN as interval reset in automatic mode

The Interval reset mode is used when monitoring simple or pendulum softening plants. During operation of the softening plant, the analyses are carried out at the programmed analysis interval. When regeneration is started, the input contact is closed/opened and the analysis and the analysis interval are stopped immediately. The last displayed value is deleted from the display and the analysis interval is paused as long as the input contact is closed/opened.
After completion of the regeneration or after switching over to the second softening system, the input contact is closed/opened again. The first analysis starts after one minute. The following analyses are carried out again at the programmed analysis interval.

Programming: Menu > Parameter > Input > Interval reset

[NO] Analysis interval active: Analysis interval is stopped by a closed input contact.
[NC] Analysis interval active: Analysis interval is stopped by an open input contact.

When using this function, the TITRASENSE must be in automatic mode

6.8 Connecting of current loop

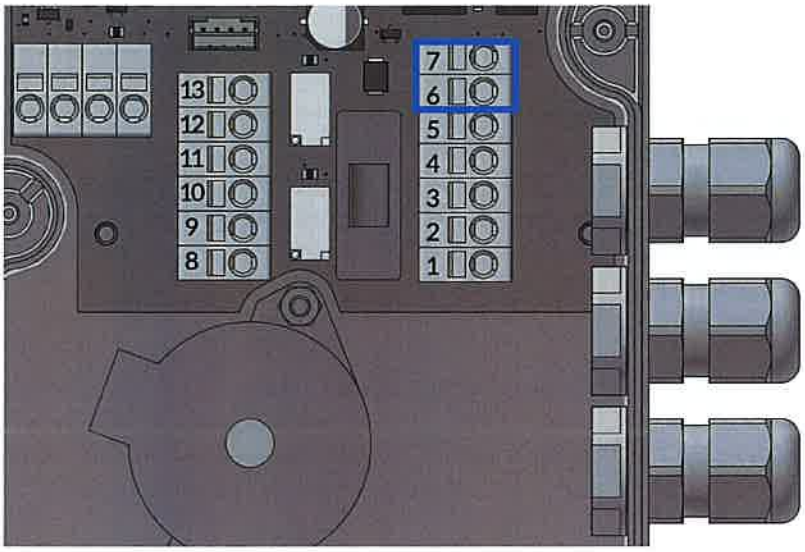


Illustration 9: Terminals for connecting the current loop (blue border)

Output 0/4 - 20 mA: Current loop:

Terminal designation	Description	
6 +	+ output	0 - 20 mA or 4 - 20 mA
7 -	- output	0 - 20 mA or 4 - 20 mA

Current loop Function:
The current water hardness or the device status is output as current via the active current loop. The current range can be selected between the settings 0 - 20 mA or 4 - 20 mA. The maximum load is 750 Ω.

Current loop selection options Type:

- 0 - 20 mA Value
- 4 - 20 mA Value
- 0 - 20 mA Status
- 4 - 20 mA Status

6.9 Analogue measuring device

The current measured value is available as an analog value at terminals 6 and 7. Recorders or external devices can be connected to process the measured value. You can choose between a current output 0 - 20 mA value or 4 - 20 mA value. You must also define which current value of 20 mA corresponds to which total hardness/carbonate hardness.

Programming: Menu > Parameters > Outputs > Current loop type
Programming: Menu > Parameters > Outputs > Calibrate current loop.

(Enter the total hardness/carbonate hardness value to be equal to 20 mA)

The supplied current of the current loop for the displayed measured value is calculated with:

$$I = I_0 + \frac{(20\ mA - I_0) \cdot measured\ value}{upper\ hardness\ level}\ [mA]$$

Depending on the operating mode, 0 or 4 mA must be used for I_0.
The number "*upper hardness level*" corresponds to the entered water hardness value for 20 mA.
Usually the end of the measuring range of the reagent used is used.

We recommend setting the upper hardness level to the end of the reagent measuring range.

Example calculation:
A reagent TSH005 is used for the analysis. Measuring range1.5 ppm to 15 ppm.

Upper hardness level is set to 16 ppm, which corresponds to 20 mA.

For the current loop type "0 - 20 mA", 0 mA corresponds to 0 ppm.
For the current loop type "4 - 20 mA", 4 mA corresponds to 0 ppm.

Calculation for current loops type "0 - 20 mA"

$$I = 0\,mA + \frac{(20\,mA - 0\,mA) \cdot 7{,}48\,ppm}{16\,ppm}[mA]$$
$$I = 9{,}3\,mA$$

9.3 mA corresponds to 7.48 ppm.

Calculation for current loops type "4 - 20 mA"

$$I = 4\,mA + \frac{(20\,mA - 4\,mA) \cdot 7{,}48\,ppm}{16\,ppm}[mA]$$
$$I = 11{,}4\,mA$$

11.4 mA corresponds to 7.48 ppm.

6.10 Operating status via analog current loop

The operating status of the device can be transmitted via the current loops terminals 6 and 7.

Programming: Menu > Parameters > Outputs > Current loop type
Choices:

- 0 - 20 mA Status
- 4 - 20 mA Status

Operating status	Current loop	
	0 - 20 mA Status	4 - 20 mA Status
Malfunction	0 mA	4 mA
Limit value undershot	7.5 mA	10.0 mA
Reagent level < 10 %	16.5 mA	17.2 mA
Operation	3.5 mA	6.8 mA

The specifications listed here may have a deviation of ± 0.3 mA.

7. Device overview

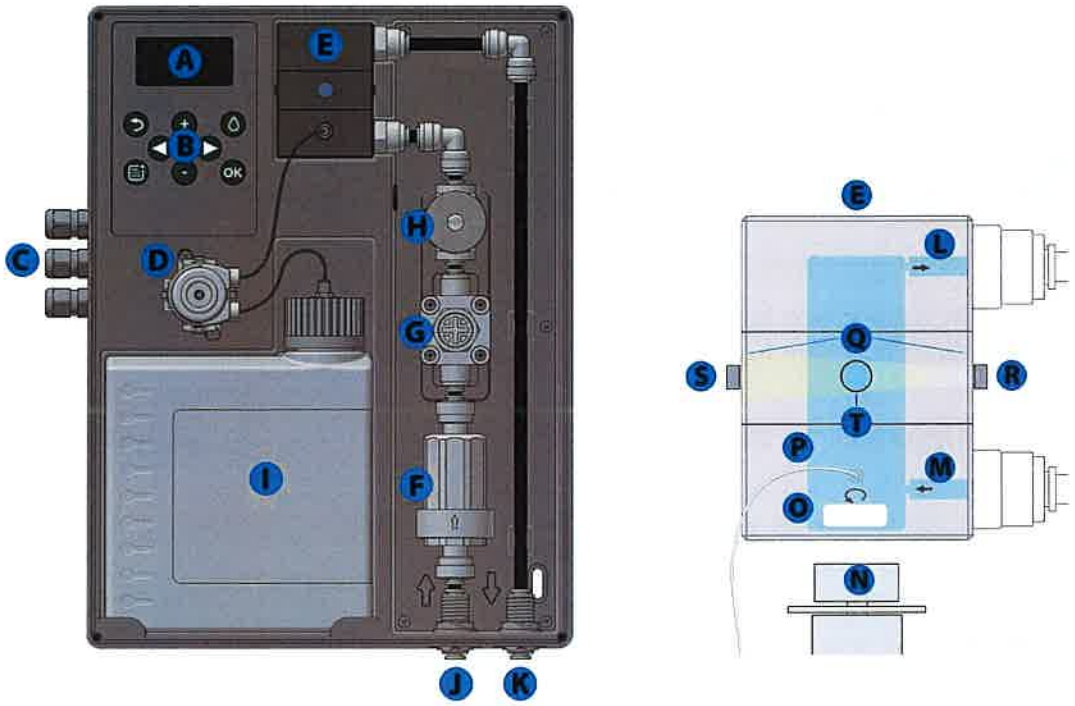


Illustration 10: TITRASENSE analyzer with reagent bottle installed (l.), schematic representation of the measuring chamber (r.)

Position	Description	
A	Display	
B	Operating buttons	
C	Cable gland	
D	Dosing pump (peristaltic pump cassette)	
E	Measuring chamber	
F	Filter	
G	Pressure regulator	
H	Solenoid valve	
I	Reagent bottle 750 ml	
J	Water inlet / sample water	Push-in connection for plastic hoses with 1/4-inch outer diameter
K	Water drainage	
L	Measuring chamber drain	
M	Measuring chamber inlet	
In the housing / not visible		
N	Magnetic stirrer	
O	Stirrer blade	
P	Injector	
Q	Optical measuring path	
R	Actuator board (LED)	
S	RGB sensor	
T	Inspection window	

7.1 Exploded view

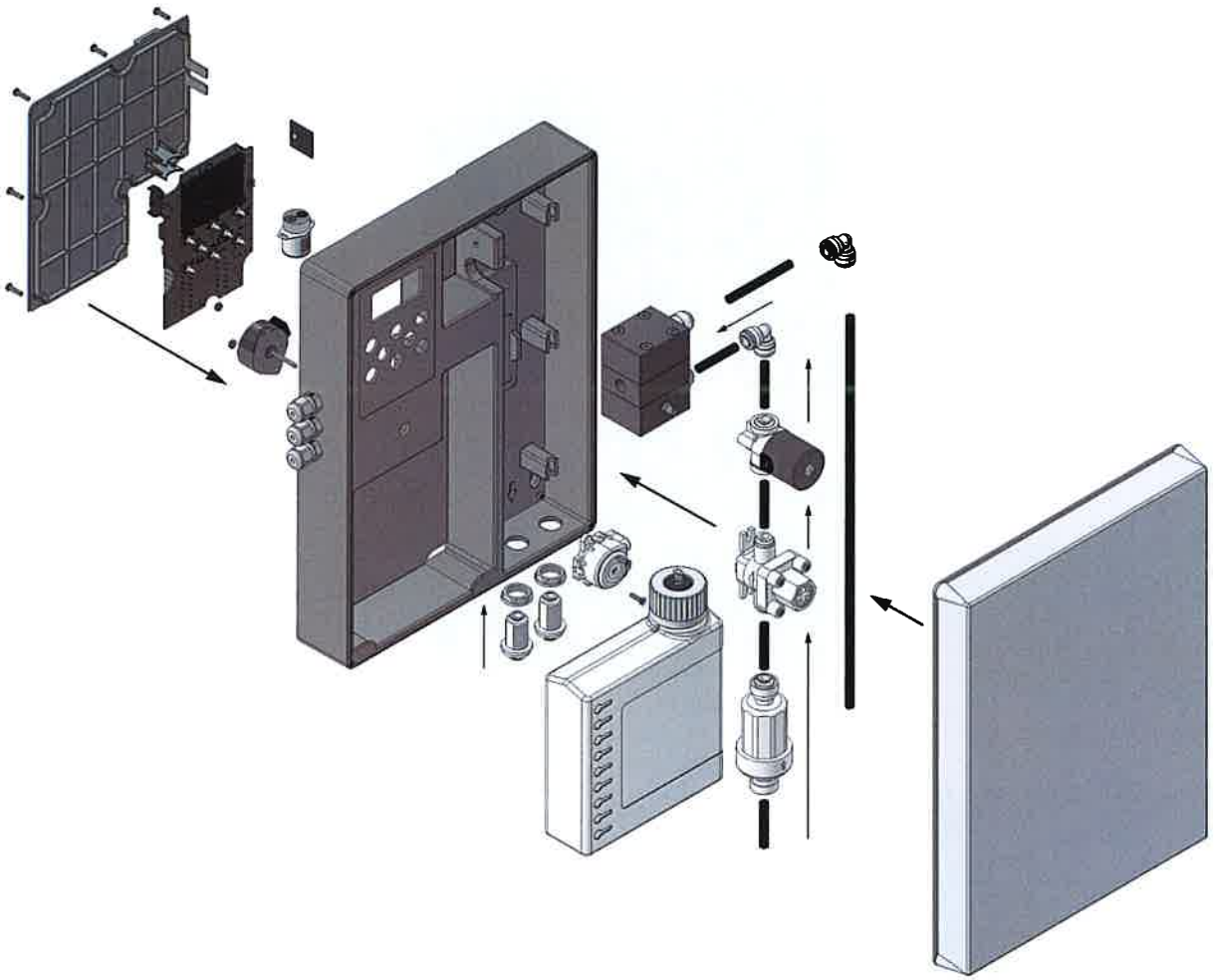


Illustration 11: TITRASENSE exploded view - assembling the components.

Observe the correct placement and flow direction when replacing components or performing other work on the analyser.

7.2 Displays and front panel

On the front of the TITRASENSE analyser there are 8 keys and a graphic display in which both the measured values and the menu for operation can be shown.

Illustration 12: TITRASENSE - Unit overview / front panel

The LED display shows the operating status:

Position	Describtion
A	Display
B	Back / Discard input / Abort a running analysis
C	Inserting a new reagent bottle
D	Main menu / Switching between main menu and analysis display
E	Arrow keys for navigation/value input
F	OK / Confirm

8. Operation

8.1 Manual and automatic operation

The analyser can be started in automatic mode (Menu > Automatic) depending on the time or via an external button or flow monitor. In manual mode (Automatic Off), functions such as starting the analysis, pumping the reagent or rinsing can be controlled manually. In addition, manual mode also includes a diagnostic function to test individual unit components.

In automatic mode, analyses are carried out at the programmed interval or by external start. After switching on, the automatic mode is active. The first analysis is started after 3 minutes after switching on with programmed internal interval. All subsequent analyses are carried out at the programmed interval.

8.2 Main menu

The main menu can be opened by pressing the [Menu] key from the measured value view.

Illustration 13: Menu

Menu item	Description
Automatic	Switch between automatic and manual mode
Parameter	Setting the unit and analysis parameters
Info	Overview of hardware and software version and display of meter readings
Service	Functions for maintenance, diagnosis and reagent change
Assistant	Setup wizard for guided parameterisation of the unit
History	Display of the last 100 measurement results with date and time

8.3 Display indication during a measurement

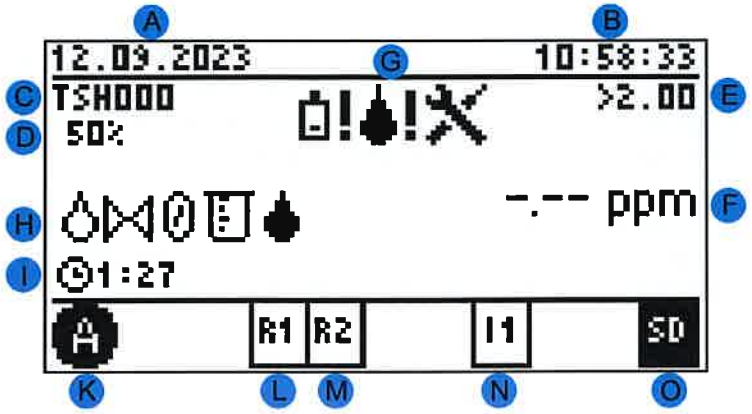


Illustration 14:Info

Position	Description				
A	Date				
B	Time				
C	Selected reagent				
D	Bottle level in %				
E	Set limit value for relay 1				
F	Analysis result				
G	Device status		Reagent empty		
			Cleaning required		
			Maintenance required		
H	Analysis step		Flushing		Measurement
			Taking sample		Rinsing
			Zero sample		
I	Start condition and analysis interval (T - 1:27 min:sec until next analysis)		Time interval		Manual start
			Repetition		Waiting for flowsensor
K	Manual or automatic operation				
L	Relay 1 dropped out				
M	Relay 2 energized (fields with black background are active)				
N	Digital input (IN) inactive				
O	SD card				

Simple analysis start.
Press and hold the [OK] button for 3 seconds to start an analysis.

The analysis start is possible in manual and automatic mode.

8.4 Display of measured value history

Using the arrow keys [◀] and [▶] the last 100 measurements with date and time stamp can be read in the display mode. The set limit value is drawn as a solid bold line in the course.

You can open the history via the Menu > History. Pressing the [Back] button returns you to the measured value display.

When the analyser is disconnected from the mains, the history of the last 100 readings is lost.

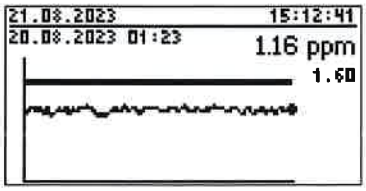


Illustration 15:history

8.5 Display Selection menu

When selecting, you can change the selection with the [◀] and [▶] keys. Confirm the setting with the [OK] button. If you do not want to change the setting, you can exit the selection with the [Back] key.
In the image below, the active selection is the [Yes] button with a black background.

Illustration 16:Example selection (1)

8.6 Display Selection list

In a selection list, you can change the selection with the [▲] and [▼] keys. The setting is confirmed with the [OK] button. If you do not want to change the setting, you can exit the selection with the [Back] key. If the selection list offers more than three options, a scroll bar is displayed on the right edge of the display.
The currently selected option is marked in black.
The black filled circle to the left of the reagent type indicates which reagent is currently programmed for analysis.

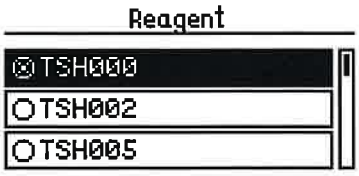


Illustration 17:Example selection (2)

8.7 Display with value input

Numbers are entered using a display keyboard. You can move the cursor with the arrow keys [◀], [▶], [▲] and [▼] of the device. The currently set numerical value and the valid input range are also displayed in the input mask.

You will see an input keyboard. Now use the arrow keys to move the black cursor to the desired digit and press the [OK] button.

The selected digit appears in a frame on the left. Repeat the input until the desired number appears in the frame. Now move the cursor to the OK field on the keyboard and press the [OK] button.

You will see the following information:
Current: currently set value
Minimum: smallest adjustable value
Maximum: largest adjustable value

If the value at "Current" corresponds to your wish, you do not need to enter the number again and can immediately move the cursor to the OK field in the keyboard and confirm with the [OK] button.

In the Flush Time example below, a flush time between 15 and 1800 seconds can be set. The currently programmed flush time is 120 seconds.

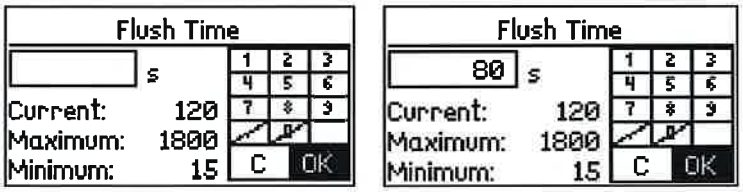


Illustration 18: Display - Flushing time

After entering a flushing time of 80 seconds, confirmation with the [OK] button overwrites the current flushing time with 80 seconds.

8.8 Info display

The menu item Info in the main menu displays additional information about the unit and the measuring point:

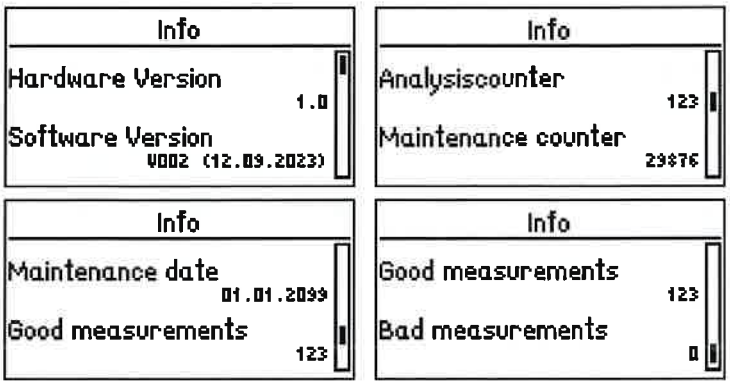


Illustration 19: Info

Information	Description
Hardware version	Version of the hardware used
Software version	Installed software version
Analysis counter	Number of analyses carried out since commissioning
Maintenance counter	Number of analyses remaining - life of the peristaltic pump cassette: is set to 30,000 analyses when the maintenance is acknowledged in the service menu.
Maintenance date	Expiry date of the peristaltic pump cassette used: is set to 2 years when the maintenance is acknowledged in the service menu.
Good counter	Number of analyses without exceeding the limit value: can be reset in the service menu under the item good/bad counter
Bad counter	Number of analyses with limit value exceeded: can be reset in the service menu under the item Good/Bad counter.

8.9 microSD card

The microSD slot is used for software updates of the analyser. In some cases, it may be necessary or helpful to install a software update. Use a microSD card for software updates. The installation file is available on request or by email.

To perform a software update, please proceed as described in 10.7 Software update.

- No microSD card is included in the scope of delivery.
- The user is responsible for providing a microSD card.
- Make sure that your microSD card is formatted as FAT16 or FAT32.
- The analyser is fully functional without a microSD card.

9. Configuration

9.1 Factory settings

The following factory settings are stored in the device:

Menu items		Factory settings
General	Language	Chinese
Analysis	Unit	ppm
	Reagent	TSH002
	Limit value	2 ppm
	Flushing time	120 seconds
	Auto. Interval time	5 minutes
	Analysis Stop	No
	Control measurement	No repetition
	Calibration factor	100 %
Input	Input	Disabled
Outputs	Current loops Type	0 ... 20 mA value
	Current loop Calibrate	2 ppm
	Relay 1	Limit value as permanent
	Relay 2	Inverted

Reset the factory settings with
Programming: Menu > Parameters > General > Factory settings

9.2 Configuration assistant

The configuration wizard is designed for simplified commissioning. The menu-driven device accompanies you step by step through all necessary settings. It also checks whether the device is working properly.

Later, all settings can be changed separately in Menu > Parameters again.

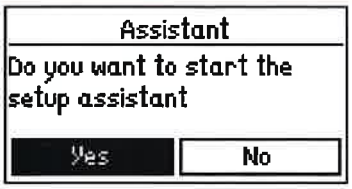
To start the wizard, select:

Programming: Menu > Wizard

Illustration 20: Info

The following steps are executed:

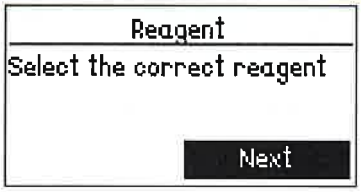
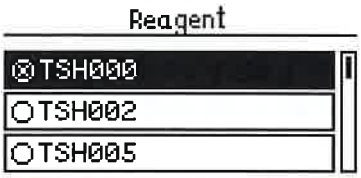
Automatic mode	If the automatic mode is still active, it must now be quit.
	Select [Yes] or [No] with the arrow keys [◀] and [▶] and confirm with [OK] button. [Yes] Terminate the automatic mode. [No] Return to measured value view

Assistant	Would you like to start the configuration wizard?
	Select [Yes] or [No] with [◀] and [▶] and confirm with [OK] button. [Yes] Start the configuration wizard. [No] Go back to the main menu.

Factory settings	Do you want to reset the device to factory settings first?
	Select [Yes] or [No] with [◀] and [▶] and confirm with [OK] button. [Yes] Reset the device to the recommended factory setting. [No] The device retains the settings programmed by the user. The factory settings can be found on page 31.

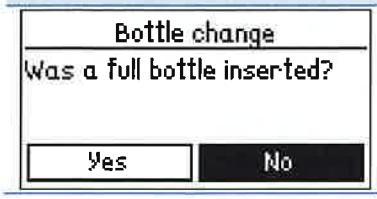
Date	Today is: XX/XX/XX – XX:XX Do you want to set date and time?
	Use the arrow keys [▲] and [▼] to set the date and time. Confirm your entry with the [OK] button or use the arrow keys [◀] and [▶] to move from left to right. The seconds are set to 0 seconds upon completion. Finally confirm your entry with [OK] or skip the date and time entry if it is already set correctly.

Maintenance counter	Is a maintenance / initial installation carried out?
	Select [Yes] or [No] with [◀] and [▶] and confirm with [OK] button. [Yes] Maintenance counter is set to 30,000 analyses and the maintenance date is set to 24 months. (Can be read in the Menu > Info) [No] The device retains the previous data.

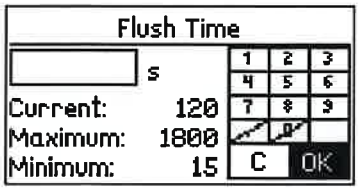
When selecting total hardness	Please select a total hardness reagent.
 	Select the reagent TSH used for total hardness monitoring with [▲] and [▼] from the displayed list. Measuring ranges of the reagents can be found in the table on page 60. After selecting, press the [OK] button.

Reagent	Insert a new reagent bottle and press OK.
	Insert new reagent bottle and press the [OK] button.

Reagent	
 	Reagent is pumped into the measuring chamber. The pumping process can be stopped by pressing the [OK] button before the time has elapsed. Wait for the countdown to ensure that the reagent hose is completely degassed.

Reagent	Has a full reagent bottle been used?
	Select [Yes] or [No] with [◀] and [▶] and confirm with [OK] button. [Yes] The bottle fill level is set to 100%. [No] The previous bottle fill level in % is maintained.
Flushing	**Press OK to flush the supply line and the measuring chamber.**
	Press [OK] button.
Flushing	
	The solenoid valve opens and flushes the measuring chamber. Here, the previous flushing time is shown in the display. This can be used as reference time to set the flushing time before analysis. The flushing process is ended with the [OK] button. The solenoid valve closes.
	Make sure the sample water is clear and free of bubbles.
	When using a sample cooler, check the proper operation of the sample cooler before the next step in order to rule out any danger from hot steam or hot water.
Flushing time	**Set the flushing time in the following mask.**
	Press [OK] button.

Flushing time



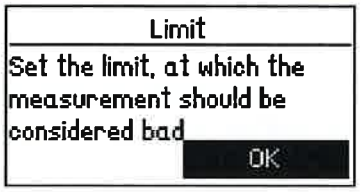
You will see an input keyboard on the right side.
Use the arrow keys ([◀], [▶], [▲] and [▼]) to move the black cursor to the desired digit and press the [OK] button.
The selected digit appears on the left side in a frame.
Repeat the entry until the desired flushing time is within the range.
Now move the cursor to the OK field in the keyboard and press the [OK] button.

You will see the following information on the left:
Current: currently programmed value
Minimum: smallest settable value
Maximum: largest settable value

Should the value at "Current" corresponds to your request, then you do not need to re-enter the digits and you can immediately move the cursor to the OK field in the keyboard and confirm with the [OK] button.

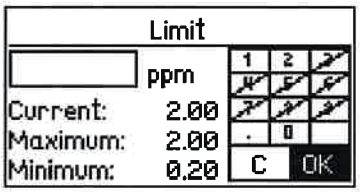
Limit value

Enter the limit, above which relay 1 should be switched.



Press [OK] button.

Limit value

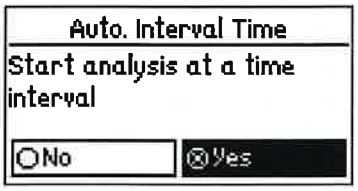


You will see an input keyboard on the right side.
Use the arrow keys ([◀], [▶], [▲] and [▼]) to move the black cursor to the desired digit and press the [OK] button.
The selected digit appears on the left side in a frame.
Repeat the entry until the desired limit is within the range.
Now move the cursor to the OK field in the keyboard and press the [OK] button.

You will see the following information on the left:
Current: currently programmed value
Minimum: smallest settable value
Maximum: largest settable value

Should the value at "Current" corresponds to your request, then you do not need to re-enter the number and you can immediately move the cursor to the OK field in the keyboard and confirm with the [OK] button.

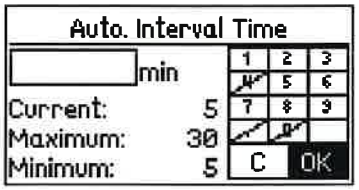
Auto. Time interval	Do you want the analyses to run in a time interval?



Select [Yes] or [No] with [◀] and [▶] and confirm with [OK] button.

[Yes] Analyses are performed in an automatic time interval.
[No] Do not perform any analyses in the automatic time interval.

Auto. Time interval	Set the automatic interval time, in which the analyses are to be carried out.

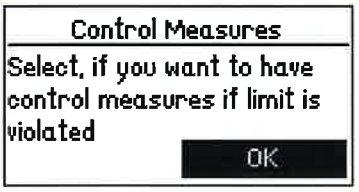


You will see an input keyboard on the right side.
Use the arrow keys ([◀], [▶], [▲] and [▼]) to move the black cursor to the desired digit and press the [OK] button.
The selected digit appears on the left side in a frame.
Repeat the entry until the desired analysis interval time is within the range.
Now move the cursor to the OK field in the keyboard and press the [OK] button.

You will see the following information on the left:
Current: currently programmed value
Minimum: smallest settable value
Maximum: largest settable value

Should the value at "Current" corresponds to your request, then you do not need to re-enter the number and you can immediately move the cursor to the OK field in the keyboard and confirm with the [OK] button.

Control measurement	How often should a limit exceedance be verified before notification?



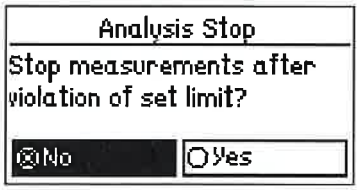
Press [OK] button.

Control measurement

Use [▲] and [▼] to set the number of control measurements that should be performed before any exceedance of limit value should be reported. These are carried out after a limit value exceedance in a 3-minute interval to avoid false alarms due to the counter-ion effect of the water softening system.

Make a selection and confirm with the [OK] button.

Stopping the analysis	Auto. Stop interval after limit exceedance?

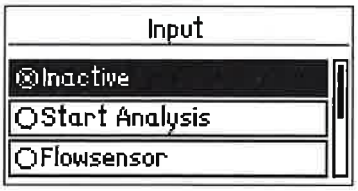


Select [Yes] or [No] with [◀] and [▶] and confirm with [OK] button.

[Yes] Auto. Interval is paused after a limit exceedance. (In order to carry out further analyses, the automatic mode must be reactivated on the device).

[No] Further analyses are also carried out after a limit has been exceeded.

Input	Select the function of the input.

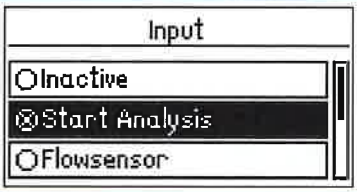


You have the following options at the input:

- Deactivated
- Start analysis
- Flowsensor
- Interval reset

Make a selection and confirm with the [OK] button.

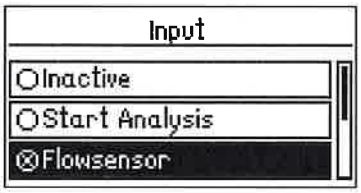
If Start analysis is selected	

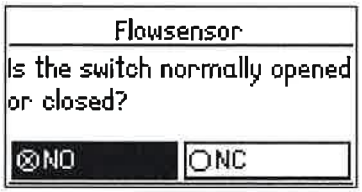


An analysis is started as soon as the "Start/Stop Input: Inlet Contact" terminal 3 is bridged to terminal 4.

(When using this function, the TITRASENSE must be in automatic mode.)

When selecting flowsensor	Is the flowsensor an NC or NO type?





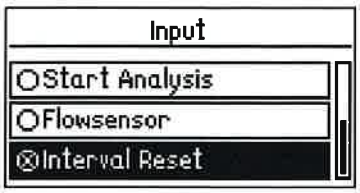
[NO] Analysis interval paused: start of next analysis waits for an open input contact.

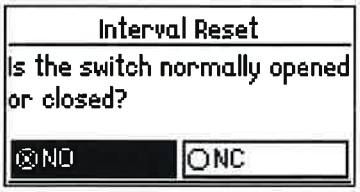
[NC] Analysis interval paused: start of next analysis waits for a closed input contact.

Make a selection and confirm with the [OK] button.

(When using this function, the TITRASENSE must be in automatic mode.)

When selecting interval reset



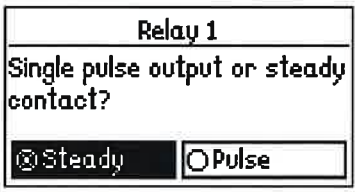


[NO] Analysis interval active: Analysis interval is stopped by a closed input contact.
[NC] Analysis interval active: Analysis interval is stopped by an open input contact.

Make the selection and confirm with the [OK] button.
If the analysis interval is stopped, the analyses are stopped immediately and paused as long as the input contact remains closed/open.

As soon as the input contact is opened/closed, the analysis interval starts. However, since there is no display value in the display yet, the first analysis is carried out after 1 min before the set analysis interval (e.g. 5 min) begins.
(When using this function, the TITRASENSE must be in automatic mode).

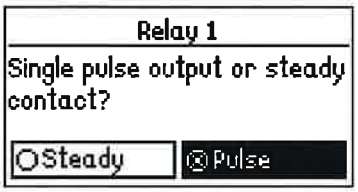
Relay 1 — Do you need a permanent or pulse contact at relay 1 / limit?

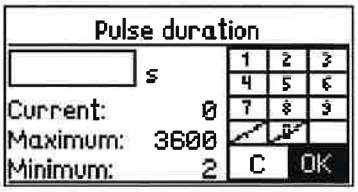


[Steady] or select [Pulse] and press the [OK] button.

[Steady] The relay switches to a permanent contact if the limit value is exceeded until an analysis that falls below the limit value takes place.
[Pulse] The relay switches for a set pulse time.

If pulse contact is selected — Set the pulse duration for relay 1.

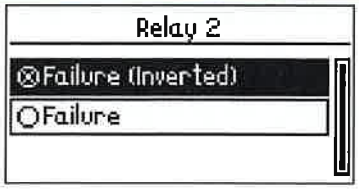


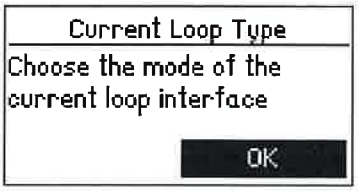


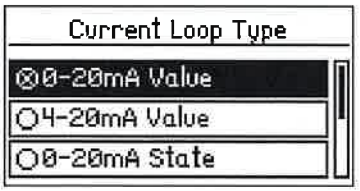
You will see an input keyboard on the right side.
Use the arrow keys ([◀], [▶], [▲] and [▼]) to move the black cursor to the desired digit and press the [OK] button.
The selected digit appears on the left side in a frame.
Repeat the entry until the desired pulse duration is within the range.
Now move the cursor to the OK field in the keyboard and press the [OK] button.

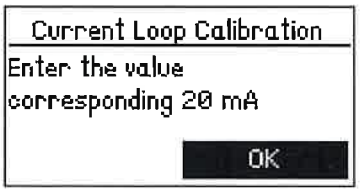
You will see the following information on the left:
Current: currently programmed value
Minimum: smallest settable value
Maximum: largest settable value

Should the value at "Current" corresponds to your request, then you do not need to re-enter the number and you can immediately move the cursor to the OK field in the keyboard and confirm with the [OK] button.

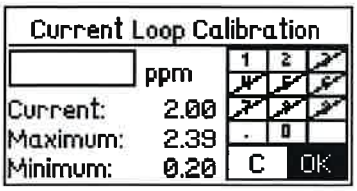
Relay 2	Relay 2 is used to indicate a device error. Press [OK] button
	Relay 2 is used to indicate a device error and can not perform any other functions. Relay 2 is always energised in normal operation, connection from COM to NO (wire break safety). It is possible to invert this function.
	In the event of a device error, relay 2 is de-energised and establishes the connection from COM to NC.

Current loop type.	Select the operating mode of the current loop.
	Press [OK] button.

Current loop type.	
	Use [▲] and [▼] to select the setting of the current loop type from the following options: • 0 bis 20 mA value • 4 bis 20 mA value • 0 to 20 mA status • 4 to 20 mA status (When selecting status, see further information on page 21.) Make a selection and confirm with the [OK] button.

When selecting value	Enter the value corresponding to 20 mA.
	Press [OK] button.

Calibrate current loop	Enter the value corresponding to 20 mA.



Here you can enter the measured value, up to which the current loop should be scaled.
We recommend setting the value for 20 mA at the end of the measurement range of the reagent, but you can also set values below it.

You will see an input keyboard on the right side.
Use the arrow keys ([◀], [▶], [▲] and [▼]) to move the black cursor to the desired digit and press the [OK] button.
The selected digit appears on the left side in a frame.
Repeat the entry until the desired number is in the frame.
Now move the cursor to the OK field in the keyboard and press the [OK] button.

You will see the following information on the left:
Current: currently programmed value
Minimum: smallest settable value
Maximum: largest settable value

Should the value at "Current" corresponds to your request, then you do not need to re-enter the number and you can immediately move the cursor to the OK field in the keyboard and confirm with the [OK] button.

Assistant	The configuration is complete. The wizard is terminated.

Press [OK] button.

This completes the configuration of the device.

If necessary, individual settings can also be set without the wizard.
Programming: Menu > Settings

9.3 Menu structure

The following is an overview of the menu structure to give you an overview of all the functions of the analyzer.

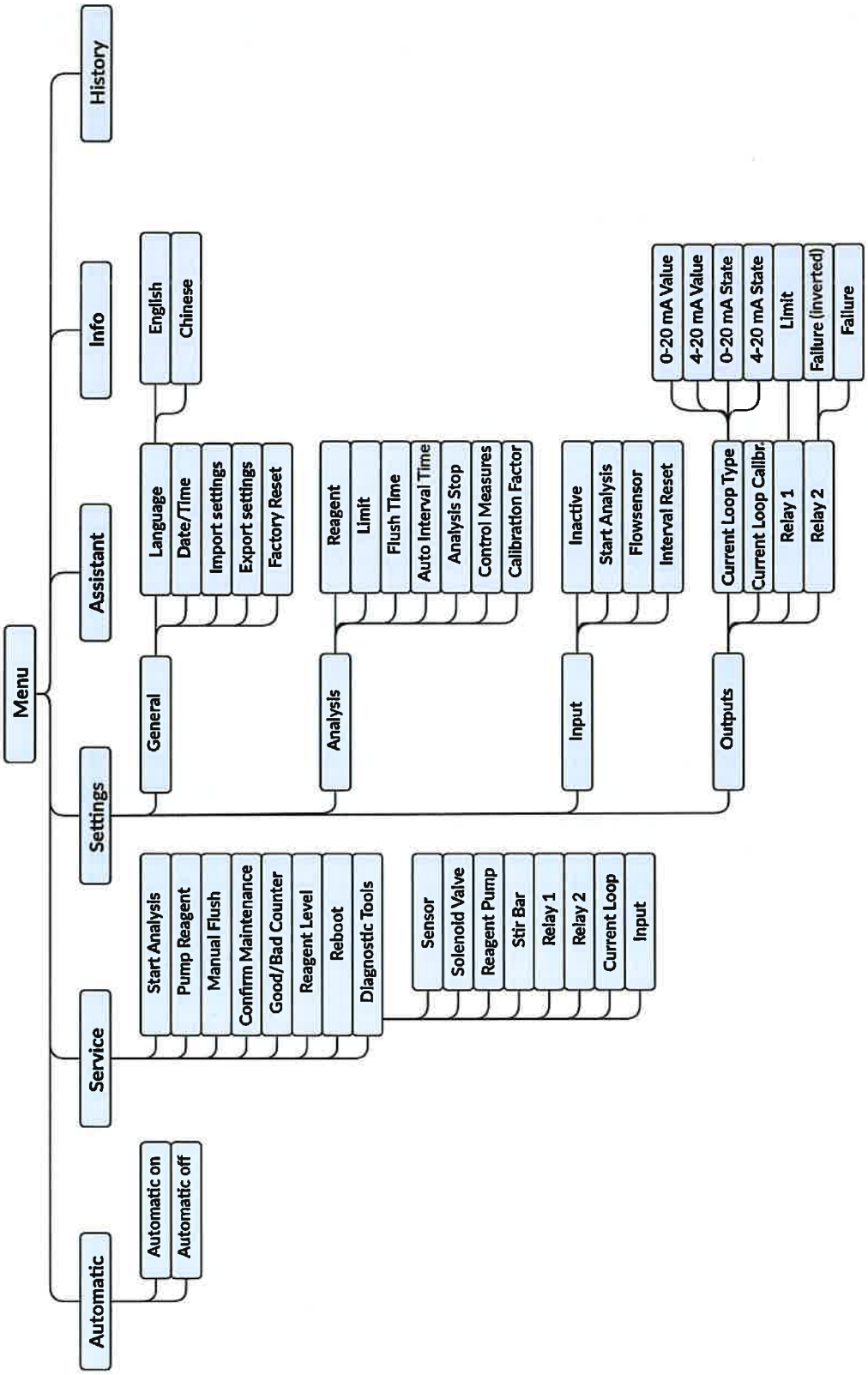


Illustration 21: Menu structure

10. Maintenance and service

To ensure long and trouble-free operation of the analyser, maintenance must be carried out on the unit at regular intervals. Make sure that the unit is switched off before maintenance work is carried out. No analyses are carried out during this time. As a general rule, wear protective goggles and gloves during maintenance to avoid contact with reagent, cleaning fluid or other liquids.

The following maintenance intervals must be observed:

Interval	Maintenance and service
every 6 months	Cleaning the measuring chamber In case of high ambient and water temperatures or water with a high organic load, the cleaning intervals may have to be shortened.
every 30,000 analyses or after 24 months	Maintenance as after 6 months and Install maintenance set

For cleaning, we recommend the "TITRASENSE Clean cleaning set".

Observe the applicable accident prevention regulations.

Voltage

The unit and the supply line to the unit must be disconnected from the power supply and secured against being switched on again.

Pressure

Shut off the water supply before starting work.

Irritant

Ensure that your eyes, skin and clothing do not come into contact with the reagent. Follow the instructions in the safety data sheets. Suitable protective clothing is required during maintenance work:

- Workwear
- Laboratory gloves
- Eye protection

10.1 Changing the reagent bottle

First check the expiry date of the new reagent bottle. Only use reagent whose shelf life has not yet expired.

Always use reagent bottles with a capacity of 750 ml.

- Switch off the unit.
- To change the reagent bottle, loosen the screw cap on the bottle and insert the new reagent bottle. Take up any drips if necessary.
- Switch the unit on again.
- Rinse the measuring chamber (Menu > Service > Manual rinsing).
- Pump reagent into the measuring chamber (Menu > Service > Pump reagent). Wait for the coutdown to ensure that the reagent hose is completely degassed.

Has a full reagent bottle been used?

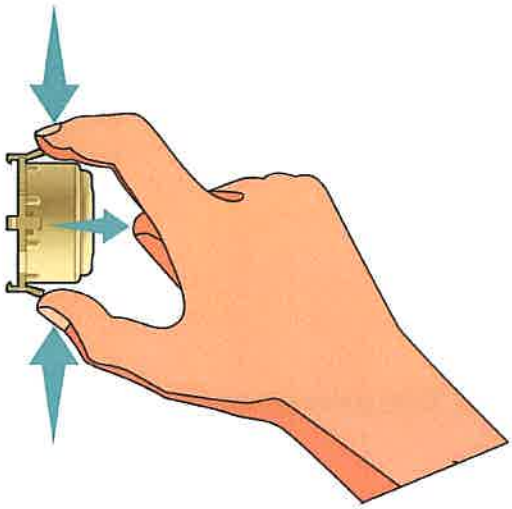
Select [Yes] or [No] and press [OK].
[Yes] The bottle level is set to 100 %.
[No] The previous bottle fill level in % is retained.

- Rinse the measuring chamber again (programming: Menu > Service > Manual rinse) to clean the measuring chamber.
- Test the analysis procedure by starting an analysis. To do this, press and hold the [OK] button for 3 seconds in the measured value view.

The unit is ready for operation again.

10.2 Replacing the pump cassette

To ensure the measuring accuracy of the TITRASENSE analyser, the peristaltic pump cassette should be replaced after 24 months.



- Press the locking tabs together with your thumb and index finger and pull the peristaltic pump cassette off the motor shaft.
- Disconnect the tube connection to the measuring chamber and reagent bottle by turning the Luer connector.
- If reagent liquid leaks out, remove it with a paper towel.
- Put a new peristaltic pump cassette on the motor shaft.
- Make the tube connection to the measuring chamber and reagent bottle by turning the Luer connector.
- Pump reagent into the measuring chamber (Menu > Service > Pump reagent).

You will find a spare parts list from page 56.

10.3 Install maintenance set / clean measuring chamber

Time: approx. 30 minutes
Material: Maintenance set for TITRASENSE
TITRASENSE Clean cleaning set
Paper towels
Tools: Ring spanners 8 and 16mm,
Allen screwdriver with 2.5mm

Irritant

Ensure that your eyes, skin and clothing do not come into contact with the reagent.
Protective clothing required:
Work clothes, laboratory gloves, eye protection

Preparation:

- Ensure a pressureless water inlet. (Close the hand valve)
- Loosen the hose connection to the inlet and outlet on the TITRASENSE
- Switch on the unit briefly.
- Hold a small container under the inlet and outlet.
- Rinse the measuring chamber (Menu > Service > Manual rinsing)by opening the solenoid valve, you relax the supply line,
  and the measuring chamber empties.
- Switch the unit off again.

Dismantle / Clean:

- Loosen the reagent connection on the measuring chamber.
- Remove the measuring chamber to the front from the housing
  (measuring chamber is held in the housing by magnets).
- Disconnect the inlet and outlet hoses from the measuring chamber.

Illustration 22: measuring chamber

- Then dismantle the measuring chamber into its individual parts:
  - 4x screws A2 M4 x 65
  - 3x measuring chamber components
  - 1x plastic tube (transparent)
  - 2x O-rings 24 x 2.5
  - 2x inlet/outlet screw connection
  - 2x O-rings 9 x 1.6
  - 1x injector
  - 1x O-ring 5.28 x 1.78
  - 1x stirrer blade
- Place the three measuring chamber components in the FIT 3000 cleaning liquid for approx. 10 minutes and then clean the parts with the brush.
- Rinse the parts under running water afterwards.

Assembly: *Only insert new parts from the maintenance set.*

- First insert the transparent plastic tube into the middle part of the measuring chamber and slide a greased O-ring onto the top and bottom of the tube.
- Now place the stirring blade in the lower part of the measuring chamber
- Now place the three measuring chamber components on top of each other and tighten them with the 4 screws. *Torque 0.6Nm.*
- Push the O-rings onto the inlet/outlet fitting and grease it, then screw it into the measuring chamber. *Torque 1Nm.*
- Push the O-ring onto the injector and grease it, then screw it into the measuring chamber. *Torque 0.2Nm.*
- Now connect the measuring chamber to the inlet/outlet hose.
- Insert the measuring chamber into the housing.
- Place a new peristaltic pump cassette on the motor shaft and connect the hose to the measuring chamber.
- Unscrew the suction lance from the bottle adapter and insert a new suction lance.
- Connect the suction lance to the peristaltic pump cassette.

Recommissioning:

After a measuring chamber exchange, reagent must be pumped from the bottle into the measuring chamber and the measuring chamber must be rinsed.

- Open the hand valve.
- Switch on the TITRASENSE.
- Rinse the measuring chamber (programming: Menu > Service > Manual rinsing).
- Pump reagent into the measuring chamber (programming: Menu > Service > Pump reagent).

Has a full reagent bottle been used?

Select [Yes] or [No] and press [OK].

[Yes] The bottle level is set to 100 %.

[No] The previous bottle fill level in % is retained.

- Rinse the measuring chamber again (programming: Menu > Service > Manual rinse).

The unit is ready for operation again.

Maintenance is now complete.

10.4 Exchange of the measuring chamber

Preparation:

- Ensure a pressureless water inlet. (Close the hand valve)
- Loosen the hose connection to the inlet and outlet on the TITRASENSE
- Switch on the unit briefly.
- Hold a small container under the inlet and outlet.
- Rinse the measuring chamber (Menu > Service > Manual rinsing). By opening the solenoid valve, you relax the supply line, and the measuring chamber empties.
- Switch the unit off again.

Only when replacing the measuring chamber:

- Loosen the reagent connection on the measuring chamber.
- Remove the measuring chamber to the front from the housing (measuring chamber is held in the housing by magnets).
- Disconnect the inlet and outlet hoses from the measuring chamber.
- Replace the measuring chamber.
-

Recommissioning:

After a measuring chamber exchange, reagent must be pumped from the bottle into the measuring chamber and the measuring chamber must be rinsed.

- Reassemble the unit and put it into operation.
- Now open the hand valve and switch on the TITRASENSE
- Switch on the TITRASENSE
- Pump reagent into the measuring chamber (Menu > Service > Pump reagent).
- Rinse the measuring chamber (Menu > Service > Manual rinsing).

10.5 Replacing the filter / pressure regulator / solenoid valve

Tools required when replacing the solenoid valve:
Screwdriver Torx T10, T20 and a phase tester

Preparation:

- Ensure a pressureless water inlet. (Close the hand valve)
- Loosen the hose connection to the inlet and outlet on the TITRASENSE
- Switch on the unit briefly.
- Hold a small container under the inlet and outlet.
- Rinse the measuring chamber (Menu > Service > Manual rinsing). By opening the solenoid valve, you relax the supply line, and the measuring chamber empties.
- Switch the unit off again.

Only when replacing the filter or pressure regulator:

- Loosen and remove the bulkhead screw connection at the inlet and outlet.
- Remove the component, filter or pressure regulator to be replaced.
- Install the new component (Note the direction of flow, the arrows on the component point in the direction of the measuring chamber).

Note the correct flow direction and placement of the components. *See page 22*

Only when replacing the solenoid valve:

- Disconnect the TITRASENSE and the connection box from the power supply!
- Loosen the reagent connection on the measuring chamber and the reagent bottle.
- Remove the reagent bottle.
- Remove the measuring chamber to the front from the housing.
- Disconnect the inlet and outlet hoses from the measuring chamber.
- Remove the analyser from the wall.
- Remove the electronics cover on the back of the analyser.
- Disconnect the electrical connection of the solenoid valve on the main board.
- Detach the solenoid valve from the plastic plate.
- Attach a new solenoid valve to the plastic plate (Note the direction of flow, the arrow on the component points in the direction of the measuring chamber)
- Guide the electrical connection of the new solenoid valve through the opening provided in the housing.
- Connect the new solenoid valve according to the previous assignment on the main board.

Recommissioning:

- Reassemble the unit and put it into operation.
- Now open the hand valve
- Switch on the TITRASENSE
- Pump reagent into the measuring chamber (Menu > Service > Pump reagent).
- Rinse the measuring chamber (Menu > Service > Manual rinsing).

Observe the electrical connection according to the illustration on page 14

10.6 Replacing the battery / peristaltic pump motor / magnetic stirrer / actuator board (LED)

Required tools: Torx T10 screwdriver and a phase tester.

Do not place the analyser on its front side without a cover.
See note on page 11.

Preparation:

- Ensure a pressureless water inlet. (Close the hand valve)
- Loosen the hose connection to the inlet and outlet on the TITRASENSE
- Switch on the unit briefly.
- Rinse the measuring chamber (Menu > Service > Manual rinsing).
- Hold a small container under the inlet and outlet.
- Switch the unit off again.
- Disconnect the TITRASENSE and the connection box from the power supply.
- Loosen the reagent connection on the measuring chamber and the reagent bottle.
- Remove the reagent bottle.
- Remove the analyser from the wall.
- Remove the electronics cover on the back of the analyser.

Only when replacing the battery:

If the unit does not display the time after it has been switched off and on again, the internal backup battery must be replaced.

- Replace the battery with a new one of type CR2032.
- Dispose of the battery at a collection point for batteries.

Only when replacing the peristaltic pump motor:

- Disconnect the electrical connection on the main board.
- Pull the peristaltic pump cassette off the motor shaft.
- Loosen the two screws on the front of the unit.
- Replace the peristaltic pump motor.
- Connect the new pump motor according to the previous pinout on the main board.

Only when replacing the magnetic stirrer or actuator board (LED)

- Disconnect the electrical connection on the main board.
- Pull or lever out the component.
- Replace the component
  (The cables from the body of the stirrer motor point in the direction of the housing).
- Connect the component according to the previous assignment on the main board.

Recommissioning:

- Reassemble the unit and put it into operation.
- Now open the hand valve
- Switch on the TITRASENSE
- Pump reagent into the measuring chamber (Menu > Service > Pump reagent).
- Rinse the measuring chamber (Menu > Service > Manual rinsing).

Observe the electrical connection according to the illustration on page 14

10.7 Software update

The analyser offers the possibility of a software update. As part of the product improvement, you can receive software updates via your dealer or via our website. Should this be necessary, your dealer will send you a file with the name TISExxx.bin.

Required tools: Torx T10 screwdriver and a phase tester.

Do not place the analyser on its front side without a cover.
See note on page 11.

Preparation:

- Ensure a pressureless water inlet. (Close the hand valve)
- Loosen the hose connection to the inlet and outlet on the TITRASENSE
- Switch on the unit briefly.
- Hold a small container under the inlet and outlet.
- Rinse the measuring chamber (Menu > Service > Manual rinsing).
- Switch the unit off again.
- Loosen the reagent connection on the measuring chamber and the reagent bottle.
- Remove the reagent bottle.
- Remove the analyser from the wall.
- Remove the electronics cover on the back of the analyser.

Installation:

- Transfer the installation file (TISExxx.bin) to the microSD card.
- Insert the microSD card into the slot provided on the mainboard.
- Close the electronics cover.
- Mount the device back on the wall.
- Turn the power back on to the analysis device.
- Click on Menu > Service > Reboot and hold down the [OK] button for a few seconds.
- The software installation will now start automatically.

Recommissioning:

- Now open the hand valve.
- Check the unit configuration of the unit.
- Pump reagent into the measuring chamber (Menu > Service > Pump reagent).
- Rinse the measuring chamber (Menu > Service > Manual rinsing).

10.8 Reboot

The analyzer can be rebooted if necessary. (Programming: Menu > Service > Reboot analyser).

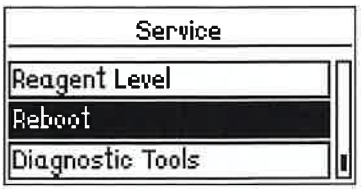


Illustration 23: Reboot

The analyser restarts immediately. If there is a valid software file on the microSD card, a software installation will be initiated, if the ok button is pressed during reboot. If no suitable software can be found on the card, you will be informed and the analyser restarts without an update.

10.9 Reset maintenance counter

After maintenance has been carried out with the "Maintenance set for TITRASENSE" inserted, the maintenance counter in the TITRASENSE must be reset.
The message "Maintenance" disappears from the display and only appears after the 24 months or after 30,000 analyses, in which case maintenance must be carried out again.
(Programming: Menu > Service > Acknowledge Maintenance).

Illustration 24: Maintenance counter

Select [Yes] or [No] with [◀] and [▶] confirm with [OK].
[Yes] Maintenance counter is set to 30,000 analyses and the maintenance date is set to 24 months. (To be read in the menu > Info)
[No] The unit retains the previous data.

10.10 Behaviour in the event of a power failure

Most settings of the device are stored on the SD card or in the internal memory. In the event of a power failure, these settings are available again even after the device is switched on. If the device has been in automatic mode, the analyzer automatically restarts with an analysis according to the set interval times after a short dwell time.

Relay 2 (ready for operation/fault) is energized after the device is switched on (connection COM to NO). In this way, an external control can detect whether the device is ready for operation or whether there is a fault such as device malfunction, power failure or line defect.

If a device failure occurs and it becomes necessary to replace the device, you can export the settings from the old device to the SD card inserted in the device (Menu > Parameters > General > Export settings). After inserting the SD card into the new device, the settings can be imported (Menu > Parameters > General > Import settings). The measurement log on the SD card is continued by the new device.

10.11 Good and bad counters

The good and bad counters are used to count the analysis results. They are displayed in the info screen.
Programming: Menu > Info

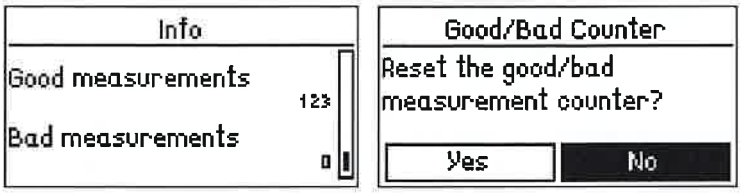


Illustration 25: Good and bad counter

Exceeding the limit value increases the bad meter, and falling below the limit value increases the good meter. This counter can be used to assess the function of a softening system. The number of bad measurements should be significantly smaller than the number of good measurements. The counters can be reset in the menu.
Programming: Menu > Service > Good/Bad counter.

10.12 Calibrating the unit

The unit is calibrated at the factory at a room temperature of 20 °C. When operating in very warm or cold locations, we recommend calibrating the unit during commissioning.

To calibrate the unit, proceed as follows:

- Carry out an analysis with the device. The water hardness of the sample must be within the measuring range of the reagent used. A measured value such as < 0.214 ppm cannot be used.
- Analyse the water in the laboratory in parallel.
- Calculate the correction factor for the analyser using the following formula:

$$correction\ factor = \frac{measured\ value_{laboratory}}{displayed\ value} \cdot 100\ \%$$

- Set the correction factor in the unit under the specified path.
  (Programming: Menu > Parameters > Analysis > Calibration factor)

Example calculation:
Measured value$_{Labor}$ = 9.79 ppm
Display value from the TITRASENSE display = 10.9 ppm

$$correction\ factor = \frac{9.79\ ppm}{10.9\ ppm} \cdot 100\ \%$$

$$correction\ factor = 90{,}1\ \%$$

90.1 % rounded => $correction\ factor = 90\ \%$

The entry is only made with whole numbers, therefore round down/up and enter the correction factor in the input mask on the unit.

11. Diagnostic functions

Pay attention to any connected controls and peripherals.
Observe the valid safety regulations.

To do this, call up the following programme function:
Programming: Menu > Service > Diagnostic programme

11.1 Sensor

The LED in the measuring chamber is switched on and off. If this is not the case, check the electrical connection of the LED at the actuator plug and in the unit. If the plugs are seated properly, the actuator must be replaced. Press the [OK] button to exit.

11.2 Solenoid valve

The solenoid valve in the water inlet can be opened and closed via the [OK] button. If this is not the case, check the electrical connection of the solenoid valve in the unit. If the plugs are seated correctly, measure the voltage between the connections on the valve when the valve is "open". This should be 24 VDC. If this is the case, an error in the electronics can be ruled out and the solenoid valve is defective. To exit, move the cursor to Exit and press the [OK] button.

11.3 Reagent pump

When the reagent pump is started, the peristaltic pump cassette is driven for 2 seconds. The rotation of the rollers in the peristaltic pump cassette is visible and the rotation of the motor can be heard. If this is not the case, check the four-pole connection of the motor on the circuit board. If only the noise is perceptible, the peristaltic pump cassette is defective. In the other case, a fault of the motor or the control board is possible.
To exit, move the cursor to Exit and press the [OK] button.

11.4 Magnetic stirrer

The stirring blade in the measuring chamber is activated and slowly increases its speed to the maximum. If the stirring blade does not rotate, check that the plug connector of the drive motor is correctly seated on the control board (red plug connector).
Remove the measuring chamber and check that the drive pulley (this has two silver magnets) in the magnetic stirrer is not rubbing or resting against the motor housing.
If none of these causes can be determined, the drive motor must be replaced.
Press the [OK] button to exit.

11.5 Relay 1 and 2

When starting the diagnostic function Relay, the selected relay is switched between the two contacts NC and NO via the [OK] button.
Use a continuity tester to check the contact between the connections COM and NC and COM and NO. If the switching operations cannot be measured, replace the control board.
To exit, move the cursor to Exit and press the [OK] button.

11.6 Current loop

A current meter is required to test the current loop. Measurements are taken between terminals 6 (+) and 7 (-).
The current output is shown in the display as I = xx mA. The same value should also be measured at the two terminals. Tolerance ± 0.3 mA. Please observe the accuracy of your current measuring device.
Pressing the [OK] button increases the output current by 2 mA each until the maximum value of 20 mA is reached.
To exit, move the cursor to Exit and press the [OK] button.

11.7 Input

To test the input, you need a conductor or a multimeter set to continuity test.
If no jumper is set between terminals 3 and 4, the display shows "open".
If a jumper is set between terminals 3 and 4, the display shows "closed".
(If you want to establish the bridge with a multimeter, the COM connection of the multimeter must be connected to terminal 3 and the volt connection of the multimeter to terminal 4. Otherwise, no bridge will be established by the multimeter).
Press the [OK] button to exit.

The diagnostic mode is finished.

12. Error messages

12.1 Analysis does not start

- Check whether a flow monitor is configured and connected.
- Check whether an interval time has been entered.
- Check that a water meter is fully configured and connected.
- If necessary, check the connection from an external control to the unit.

12.2 Analysis error: Reagent seems low, please replace

After the first dosing of the analysis, no sufficient discolouration was detected in the sample.

- Check whether there is still enough reagent in the reagent bottle.
- Go to Service>Pump reagent and wait for the countdown to ensure that the reagent hose is completely degassed.
- Check whether there is water in the measuring chamber.
- Check the dosing pump and magnetic stirrer assemblies.
- Check that the water drain is clear and that no foreign bodies have become lodged in the solenoid valve.
- When using a pump for sample delivery, check that the pump is connected correctly.
- Check that the inlet and outlet are connected the right way round.
- Check that the stirring blade is in the measuring chamber.
- 0mA is output at the current output if the type "value" is set at the current loop.

12.3 Analysis error: Cleaning chamber failed, check waterflow

The measuring chamber is not rinsed with clear water after the end of the analysis. The sensor does not detect any lightening of the measuring chamber due to rinsing.

- Check whether there is line pressure at the unit connection.
- Check the function of the solenoid valve.
- Check if the drain is clogged.
- If necessary, check the function of the sample pump, inlet, outlet and also attached stopcocks and valves.
- 0mA is output at the current output if the type "value" is set at the current loop.

12.4 Analysis error: Sensor Error, if problem persists, contact support

No difference in brightness was detected after switching on the actuator LED.

- Check the measuring chamber for dirt.
- Check the electrical connection of the actuator plug.
- Check the correct position of the actuator plug.
- Check the colour sensor in the diagnostic menu.
- 0mA is output at the current output if the type "value" is set at the current loop.

12.5 Analysis error: Chamber dirty, please clean

During titration, the colour change in the measuring chamber is too weak. Too little reagent is dosed.

- Check whether there is still enough reagent in the reagent bottle.
- Go to Service>Pump reagent and wait for the countdown to ensure that the reagent hose is completely degassed.
- Check that the inlet and outlet are connected the right way round.
- Check that the programmed reagent type matches the one used.
- Check that the water drain is clear and that no foreign bodies have become lodged in the solenoid valve.
- Check the function of the dosing pump.
- Check the dosing plug and reagent tubes for foreign objects.
- Check that the blue O-ring on the dosing plug is present and properly seated.
- 0mA is output at the current output if the type "value" is set at the current loop.

13. Spare parts

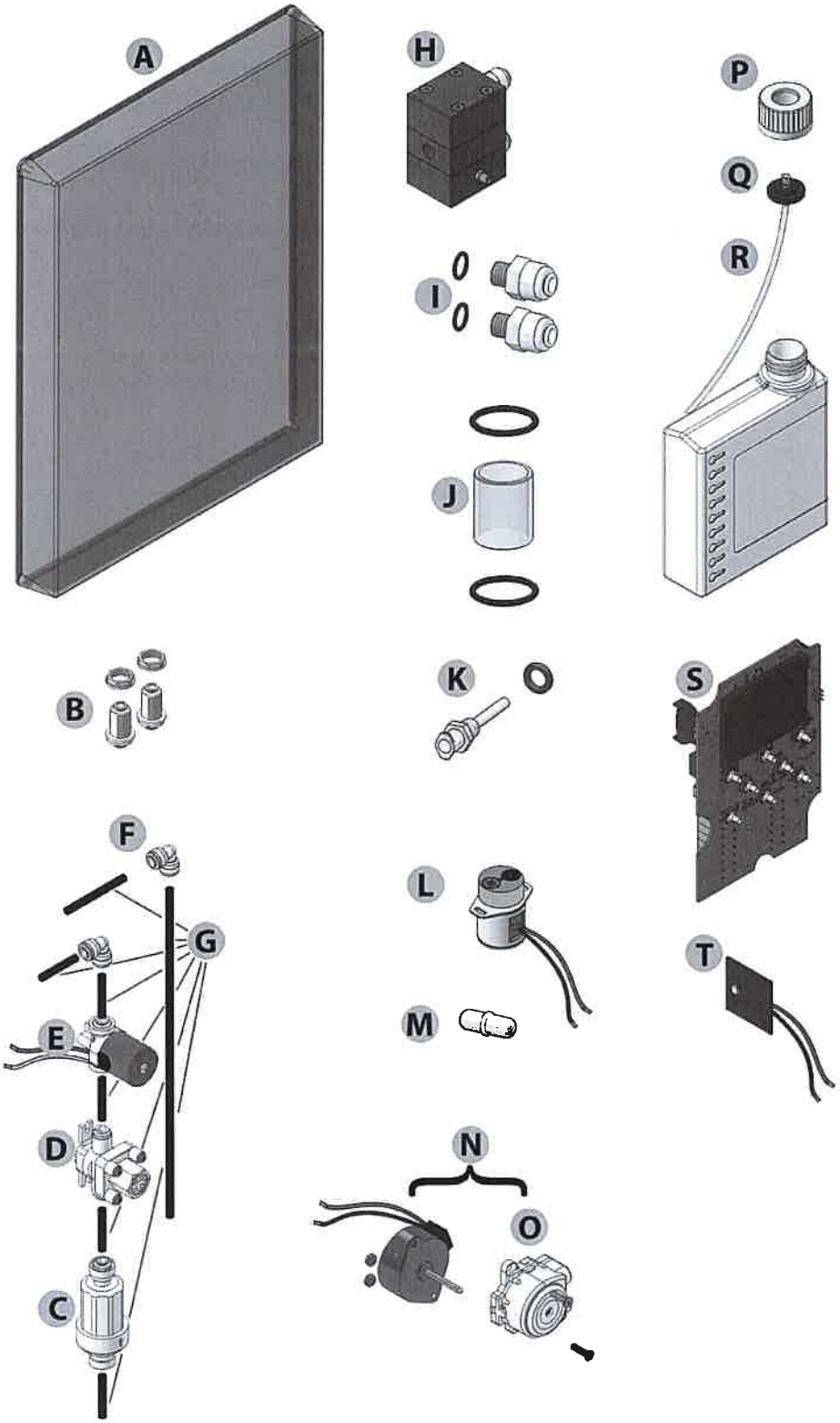


Illustration 26: Spare parts TITRASENSE

Position	Article description	Article number
A	Housing cover transparent TITRASENSE	30-035 109
B	Bulkhead fitting white 1/4 inch (2x)	30-093 202
C	Filter TITRASENSE	30-093 218
D	Pressure regulator	30-093 079
E	Solenoid valve TITRASENSE	30-035 004
F	Angle connection white 1/4 inch (1x)	30-093 216
G	Hose set 1/4 inch	30-035 201
H	Measuring chamber comp. TITRASENSE	33-035 128
I	Screw-in connection 1/4-inch TITRASENSE incl. O-ring (2x)	30-055 203
J	Measuring chamber tube TITRASENSE incl. O-rings	30-055 204
K	TITRASENSE injector including O-ring	30-035 006
L	Stirrer motor with magnet mount comp. TITRASENSE	30-035 108
M	Stirrer blade	33-090 002
N	Peristaltic pump cassette incl. motor TITRASENSE	33-013 101
O	Peristaltic pump cassette TITRASENSE	33-003 101
P	Bottle cap, screw connection GL 32 grey	33-093 060
Q	Bottle adapter	33-090 009
R	Suction lance comp. TITRASENSE	30-035 005
S	TITRASENSE Mainboard	33-050 006
T	Actuator board TITRASENSE (LED)	30-090 182

14. Maintenance sets and accessories

14.1 Maintenance sets

The TITRASENSE operates largely maintenance-free. A **maintenance set is available** for the analyser. It is recommended to install a maintenance set after 24 months.
(Peristaltic pump cassette, hoses and O-rings are changed)

Furthermore, it is recommended to clean the measuring chamber regularly, at least every 6 months. The **TITRASENSE Clean cleaning set is** offered for this purpose. It contains all the tools needed for cleaning as well as the cleaning fluid **FIT 3000.**

Article description	Article number
Maintenance set for TITRASENSE *Contains the following items:* • 1 x TITRASENSE tube measuring chamber • 2 x O-ring 24 x 2.5 NBR 70 • 2 x O-ring 9 x 1.6 • 1 x TITRASENSE injector • 1 x O-ring 5.28 x 1.78 • 1 x stirring blade • 1 x Peristaltic pump cassette comp. TITRASENSE • 1 x suction lance comp. TITRASENSE	33-030 145
TITRASENSE Clean cleaning set *Contains the following items:* • 10 x Lab Gloves • 1 x funnel • 1 x Cleaner FIT 3000 (1000ml) • 1 x pipette brush • 1 x test tube brush wool head • 1 x container with lid	30-010 921
Cleaner FIT 3000 (1000 ml)	32-089 100

14.2 Accessories

Article description		Article number
TITRASENSE connection set *Contains the following items:* • Reducing nipple Stainless steel 1.4408 V4A 1/2 inch to 1/4 inch (Conical external thread) • Socket ball valve stainless steel 1.4408 V4A with 1/4 inch (cylindrical internal thread) • Straight screw-in fitting, nickel-plated brass. 1/4 inch (cylindrical external thread with sealing ring), hose connection external diameter 1/4 inch. • 5 metre plastic hose outer diameter 1/4 inch		33-080 701
Stopcock 1/4-inch TITRASENSE Connection size 1/4 inch		33-000 217

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15. Reagents

15.1 Reagents for monitoring total hardness

Designation Reagent	Measuring range ppm $CaCO_3$			Item no. 750 ml bottle	Item no. 4 x 750 ml bottles
TSH000	0,2	–	2	32-044 115	
TSH002	0,5	–	5	32-044 125	
TSH005	1,5	–	15	32-044 135	
TSH020	5	–	50	32-044 145	
TSH050	15	–	150	32-044 155	
TSH100	25	–	250	32-044 165	
TSH200	50	–	500	32-044 175	

One bottle of reagent is sufficient for approx. 13,000 analyses on a water softener.

15.2 Things to know about the reagents

The meter works with single-component reagents and have a shelf life of 24 months if stored properly (dark and cool).

Sample water with temperatures above 40 °C must be cooled before analysis.

16. Notes

17. Appendix

17.1 Maintenance and service

Model: **Serial number:**

Date	Employees	Comment

17.2 Settings:

Language
☐ Chinese

Reagent:
Total hardness TSH0___

Flushing time:

Limit value:

Time interval
☐ Yes _____ min
☐ No

Control measurement
Repetition(s):

Analysis stop
☐ Yes
☐ No

Entrance
☐ Disabled
☐ Start analysis
☐ Flowsensor
☐ Interval reset

Relay 1
☐ Permanent contact
☐ Pulse contact: s

Current loop
☐ 0..20mA status
☐ 4..20mA status
☐ 0..20mA value
↳ 20mA: ppm
☐ 4..20mA value

17.3 Document changes

Date:	Change:
17.08.2023	Document generation
01.09.2023	Pre-release version generated
24.11.2023	New article numbers for spare parts list
28.11.2023	Notes on work on the rear side added (page 11)