Instructions for Use
FESKS® FOSTCO 5000 SiO$_2$

Analyzer for automatic monitoring of silicate concentration in water

FESKS
INSTRUMENTS

Content

General information

These instructions for use describe the installation, use and management of the FEKSKS® FO STCO 5000 SiO2 on-line analyzer. Installation and commissioning must be carried out exclusively by a specialist, who must be authorized and certified according to the law of March 5, 1990 n. 46 replaced with Ministerial Decree 37/08 containing the rules for systems safety, and any limitations specified below, on the installation, transformation, expansion and maintenance of the systems referred to in Art. 1 of Law no. 46/1990 and subsequent updates.

The device may only be used under the conditions described in these instructions and only for the specified purpose. All local regulations must be observed during installation and operation of the analyzer.

The analyzer is used for automatic determination of the amount of silicate in drinking water. Correct operation can only be guaranteed if are used reagents and spare parts recommended by us.

Changes to electrical wiring and programming can only be done by qualified specialists.

The water connection lines to the device must be kept as short as possible and must not be laid together with the power supply lines or in their immediate proximity. The analysis can be disturbed by strong electromagnetic fields, in this case separate interference suppression measures must be taken (see EMC guidelines).

It is recommended to have access to the following instructions, especially during the first months of use, because they help to understand better how the device works. There are steps that are connected to each other and which have a direct consequence on functioning; therefore it is important to follow the steps as indicated in this manual.

If you have any questions about the analyzer and how to use it, you can get support from our partners or from us directly. You can contact us by phone, e-mail or visit our website www.fesks.com

Intended use

- FESKS® professional analyzer is a colorimetric measurement system with an indicator (not included in delivery)
- Water temperature: max. 45° C
- Checking the hardness (Ca + Mg) of drinking water = see European Standard or residual hardness after the ion exchange softening system (regeneration with brine)
- Not allowed for: electric / electromagnetic field softener, softener that changes the hardness from limestone to calcite (or similar), softening with grouping of hardness (for example: anti-scaling), swimming pool water measurement, direct control of the mixing valve
- Not suitable in explosive and/or radioactive environments
- Not suitable in environments with outside temperatures over 45° C
- Not suitable with demineralized water (risk of corrosion)
- We decline any responsibility for improper or inappropriate use of the instrument

Installation
- Protect from temperatures below 5° C
- Do not expose to direct sun and / or high temperatures over 45° C
- Do not expose to rain and / or direct splashing of water
- Do not install the instrument below any leaks coming from the surrounding pipes
- Do not install in environments with high electromagnetic fields (interferes with operation)
- Do not install in the immediate vicinity of components equipped with inverters and / or inverters themselves
- Do not connect / position the power / signal cables together with the high voltage cables
- Do not install near chemical fumes and / or vapours
- If installed inside an iron container, provide for the use of an air conditioning and / or heating system
- Install a water leakage sensor under the analyzer

Surveillance/Maintenance
- The instrument requires regular maintenance and cleaning (every 6 months)
- If you measure non-softened water, the cleaning interval of the measuring chamber may also be much more frequent
- Check every day: operation, tightness, presence of indicator and its expiration
- Current/Voltage
- Before connecting to the current, make sure that the voltage used is the same as that described on the instrument plate
- Disconnect the power before working on the internal boards of the instrument
- Even if the instrument is turned off using the switch, attention must be paid to the presence of external current (flow to the output relays).

Analysis / chemical
- Accuracy of analysis: +/- 5% of the maximum value of the indicator on the intended use indicated

- Use only the original reagent
- Do not drink /smoke during the use of the reagent
- Keep reagent out of reaching of children, well-sealed, and in the original packaging
- Keep the safety data sheet in proximity of the chemical product
- To replace the reagent: wear safety eyeglasses, gloves and apron
- The reagents stains irreversibly clothes, can colour also marble and porcelain
- Do not dispose the waste reagent in the sink drains especially in marble/porcelain
- The drainage must be backpressure and slope
- The chemical product has an expiry date, do not use it beyond that date.

Export/Import
- The exporter must make sure that the product can be exported (Dual Use, Embargo etc.).
- Internal wiring and connection comply with the European legislation, make sure that there are no different regulations in the country where you want to install the instrument.
- In this case the exporter and the importer must check and ensure that the instrument complies with national reference standard regulations.
- The exporter must also verify that the name of the appliance or its components is not a registered trademark in the country of use of the same, in order not to cause legal problems associated with any other companies with the same trademark.

Further:
- In this operating instruction you'll find registered trademark that may not report the symbol ®. The lack of this symbol does not mean that the product is not a registered trademark
- For controversies of any kind: Italy

Please note:
The information above are for our warranty. The retailer or the builder of the plant can choose other uses on his own responsibility.

Safety indication and symbols used
In these instructions for use there are safety instructions that indicate a potential risk during assembly, start-up, maintenance and management of a water analyzer. There are risks for:

- People
- Systems and equipment interfacing with the device
- Surrounding environment

General Information

In these operating instructions have been used several symbols to indicate special hazards in order to prevent injuries and equipment damage. Please read the entire text completely before using the device.

This symbol draws the attention on useful tips that will help understand the device better.

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

Pression

This symbol warns that you should expect to encounter under pressure lines.

Tension

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

Wear safety glasses

Wear protective gloves

Transport

Immediately after the reception, check that the device is complete and that it has not been damaged during transport. The analyzer is shipped in safe conditions; nevertheless, damage may occur during transport. Notify immediately the delivery person of any transport damage.

Protect the analyzer from possible damage. Remove any liquids that may still be present. Remove the reagent bottle and close it to prevent it from leaking.

Stock

Store the analyzer in a dry place, with temperatures between 0 and 45°C and avoiding direct sunlight.

FESKS® FOSTCO 5000 SiO₂ in detail

Disposal note

The analyzer must not be disposed with residual waste. Take the device to a REEA collection point, please note that the battery must be separately disposed.

Alternatively, the analyzer can be returned to the manufacturer for disposal.

Delivery scope

The FESKS® FOSTCO 5000 SiO2 analyzer is characterized by the following functions:

- Reliable, accurate and fully automatic analyzer with suitable reagents for measuring the silicate concentration in the measuring range from 0.3 to 10 mg / l.
- Monitoring of two programmable limits
- Easy commissioning by the configuration wizard
- Self-calibration and self-monitoring
- Easy maintenance and cleaning
- Housing in a non-corrosive plastic box
- Compact design
- Multicolour and multilingual graphic display
- Relay output for limit 1
- Relay output for fault indication
- Relay output for fuel pump, indicator alarm or cooler control
- 0/4 - 20 mA analogue output for measured value or status message
- 2 programmable digital inputs
- Measurement data storage and measurement data registration on the SD card
- No condensation in the measuring chamber and optical part
- Software updates by SD card

Article desciption	Nr.art.
FESKS® FOSTCO 5000 SiO₂ 85-264V, 50-60Hz, mounted in a box	200191

FESKS® FOSTCO 5000 SiO₂ in detail

Device description

The analyzer consists of the following components: control unit with graphic display and control panel located on the left side of the device, under the control box there are 5 cable glands, the dosing pumps for reagents A, B and C are located in a separate housing at the top right of the control unit.

The head of the metering pumps is inserted into a drive shaft. The correct insertion is indicated by a click. The head can be removed without special tools. The measuring chamber is fixed to the supports by 2 bolts and can be easily removed by pulling out (not completely) the locking pins. Likewise, metering caps, actuator caps, inlet and outlet caps are connected to the measuring chamber and can be removed quickly.

In the center is the measuring chamber, which is always pressureless and filled to avoid contamination. The actuator plug with a high performance white LED is located in the center of the chamber. Under the measuring chamber there is a (magnetic) stirrer which is firmly connected to the electronic board.

The hydraulic connections for pipes with an external diameter of 6 mm are located under the device box: inlet with sample water (under solenoid valve) and outlet. Both are screwed on.

To the left of the bottles is the solenoid valve on the supply line.

Illustration: Front view with open box

Illustration: Bottom view

A more detailed description of the components can be found from page 41 on.

FESKS® FOSTCO 5000 SiO₂ in detail

Functional principle

The DUROMAT® diamond SiO2 is an analyzer for automatic monitoring of the silicate concentration in water using a colorimetric method. A color reaction is generated by adding chemicals to the water sample. DUROMAT® diamond SiO2 calculates the silicate concentration in the water based on the color change of the reagent sample. The device can only monitor one sampling point.

General specifications

Parameter	Value / field	
Power supply	85 - 264 VAC (47...440 Hz)	
Power consumption	30 VA (working)	3,5 VA (standby)
Maximum load	Load capacity of relays with internal power supply 1 A from terminals 1 to 4	
	Load capacity of relays with external 2.5 A power supply	
Protection class	IP56	
Storage temperature	0 °C - 45 °C	
Room temperature	10 °C - 45 °C	
Water temperature	5 °C - 40 °C	
Environmental humidity	20 - 90 % RF (without ice and condensed water)	
Water pression	min: 0,5 bar - max: 5 bar / recommended 1 - 2 bar	
Inlet water in general	clear, free of solids, no gas bubbles, no tobidity	
Water quality requirements for measuring silicate concentration	pH:	9 - 10
	Iron:	< 3 ppm
	Copper:	< 0,2 ppm
	Aluminium:	< 0,1 ppm
	Manganese:	< 0,2 ppm

Indication for oxidizing media and biocides:

Oxidizing agents such as calcium hypochlorite, chlorine, chlorine dioxide, sodium hypochlorite or ozone beyond the limits allowed in the drinking water law (European law) attack the dye contained in the indicator and interfere with the measurement. In this case, the exact determination of the water hardness is no longer guaranteed. An activated carbon filter upstream of the analyzer can remove these oxidizing agents and allow the correct determination of the water hardness. The capacity of an activated carbon filter is consumed during operation. Therefore, the filter must be replaced at regular intervals. The effectiveness of the activated carbon filter can be checked with the help of our test kits.

Any bubbles in the water can disturb the analyzer's functioning. In particular if deposited in the measuring chamber near the reading sensor.

Technical data

Parameter	Value / field
Installation	Wall mounting indoors
Dimensions	600 x 488 x 255 mm (length x height x depth)
Weight	about 8,7 kg

FESKS® FOSTCO 5000 SiO₂ in detail

Analytical properties

Parameter	Value / Range
Method of measurement	Colorimetric
Measuring range	The measuring range with Silicate-A, Silicate-B and Silicate-C reagents goes from 0.3 to 10 mg / l of silicate.
Accuracy	Measurement Accuracy: ± 5% of the maximum measured value of the respective reagent used Please notice: Disturbing variables such as air bubbles or turbidity in the water sample can lead to fluctuating measurement values.
Currently interface	± 0,3 mA
Reagent consumption	Reagent A: approximately 1ml /analysis, Reagent B and C: approximately 0.5ml /analysis
Analysis time	about 15 min, depending on the set washing time
Number of analysis	Reagent A: approximately 500 analyzes / 500 ml reagent Rreagent B and C: each about 1000 analyzes / 500 ml of reagent
Expiration of reagents	2 years when stored properly (<25 ° C, in the dark)
Consumption of water	about 2 l of sample water for one analysis (with 2 bar) The water consumption varies according to the inlet pressure and the set washing time.

Inputs/outputs

Parameter	Value/range
4 relais outputs	max. 250 VAC / VDC 1 A as potential-free NC / NO outputs the relays provide the following functions: • Limit value alarm 1 • Limit value alarm 2 • Device error • Active analysis with switchable delay time • Lack of reagent
2 signal inputs	galvanically isolated contact input • Start the analysis • Water meter • Flow monitoring • Reset the interval • Interruption of fault analysis / recovery
Analog output	0 - 20 mA / 4 - 20 mA Resolution:　　　　< 100 µA Max charge:　　　　750 Ω

Mintentance intervals

Interval	Maintenance
Four times a year	Cleaning of the measuring chamber In the case of high temperatures and water or water with a high organic load, the cleaning intervals may need to be shortened.
every 15,000 analyzes o after 12 months of operation	Cleaning the measuring chamber (as above), Replacing the maintenance set: change the peristaltic pump cassettes, tubes and seals. Resetting the maintenance counter.

FESKS® FOSTCO 5000 SiO$_2$ in detail

Reagents for monitoring the silicate concentration

Reagent	Measuring range	Art. Nr. Bottle of 500 ml
Reagent silicate A		200940
Reagent silicate B	0,3..10 mg/l Silicate	200941
Reagent silicate C		200942

A set of reagents is required for measurement

The reagents are also available in a complete package which contains:

qt 500 ml Bottle	Reagent	Measuring range	Art. No.
2 bottles	Reagent A		
1 bottle	Reagent B	0,3..10 mg/l Silicate	200945
1 bottle	Reagent C		

The contents of the set are sufficient for approximately 1000 analysis.

Installation

Installation must be done through the following steps to avoid errors:
- Install the analyzer in a dry, easily accessible and visible place.
- Fasten the analyzer with the screws according to the instructions.
- Connect the device electrically and pay attention to the correct input voltage. Make
- sure by checking the plate.
- Connect the water inlet and outlet in accordance with the assembly instructions making sure that the inlet pressure is correct and that the flow towards the drain is free.
- Insert the indicator and connect the pipes to the head of the dosing pump. Makesure that the connecting pipes are not twisted.
- Switch on the device only when all the work has been completed and the electricalbox is closed.
- Now run the programming.

The sample water must be clear and free of solids. If not, it is necessary to provide a filter to be mounted on the water inlet. Solids, even suspended, in the water can damage the solenoid valve or prevent it from closing. If the solenoid valve is blocked or does not open or close, the measuring chamber will not work properly. Consequently, the analysis results are incorrect.

The water temperature must be between 5 and 40 °C

Installation

Wall mounting

The analyzer is supplied assembled in a protective box. As an accessory pack, you will receive 4 mounting brackets that attach to the back of the housing.

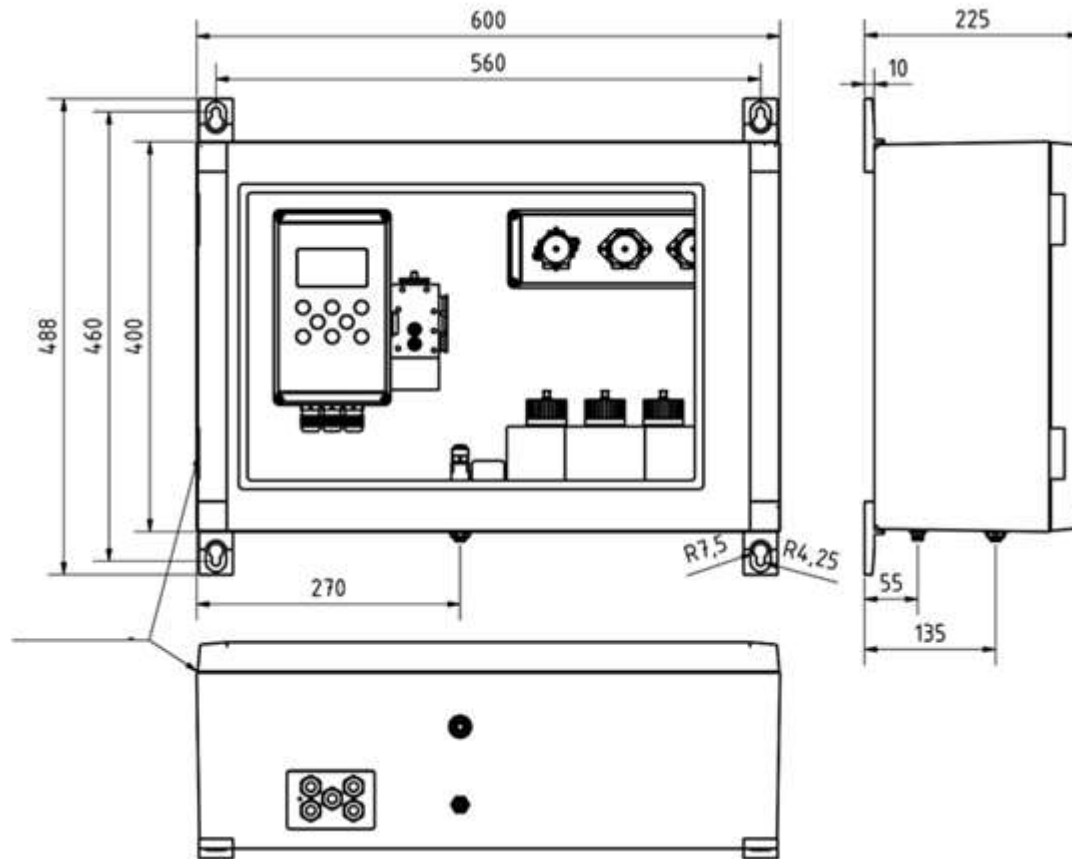To open the unit, the free space available must be at least 650 x 500 mm (length x height).

Figure: Drilling pattern for mounting the analyzer on the wall

Installation

Water connection and drain

Position	Description	
D	Cable glands for electrical connection	
W	Water inlet sample	– Connection for flexible hose with an external diameter of 6 mm
V	Drain	– Connection for flexible hose with an external diameter of 1/4 inch

Connection with water pressure

⚠️ **Pression** Maintenance and repair work can only be carried out by qualified staff.

- Before carrying out any work, make sure there is no pressure.
- The hoses, connections and gaskets must be checked regularly and, if necessary, replaced, even if they do not show visible damage. Maintenance intervals are mandatory.
- Before commissioning and after maintenance, make sure that all connections and seals are installed correctly. Check that all electrical parts are closed and that the filters or other parts connected to the device are installed correctly.
- Remove all tools, spare parts or other materials necessary for maintenance before start up.
- Clean the device, absorb any spilled liquids and leave the device clean.
- Verify that all safety devices are installed and ready for use.

Installation

The analyzer has two quick connections for plastic tubing: one with a 6mm OD for the water inlet (W) and one with a 1/4 inch OD for the water outlet (V). These are simply inserted into the fittings.

Pression

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 length of the water drain hose must not be longer than 2m and must lead away vertically downwards. The exhaust must be free without counter pressure. We recommend a pressureless water drain into an open funnel.

Connection with absence of pression

If the sample water is not pressurized, a self-priming launch pump is required (optional, art.nr. 200025).
This pump is connected in parallel to the inlet solenoid valve, it is self-priming up to 3 meters with a flow rate of 0.6 l / min.

Electrical installation

⚠️ **Tension**

Work on electrical connections can only be carried out by specialized staff in compliance with Currently regulations. All lines must be de-energized. The allowed supply voltage is 85 - 305 V CA (47 - 440 Hz).

Open the cover box by unscrewing the 4 screws.
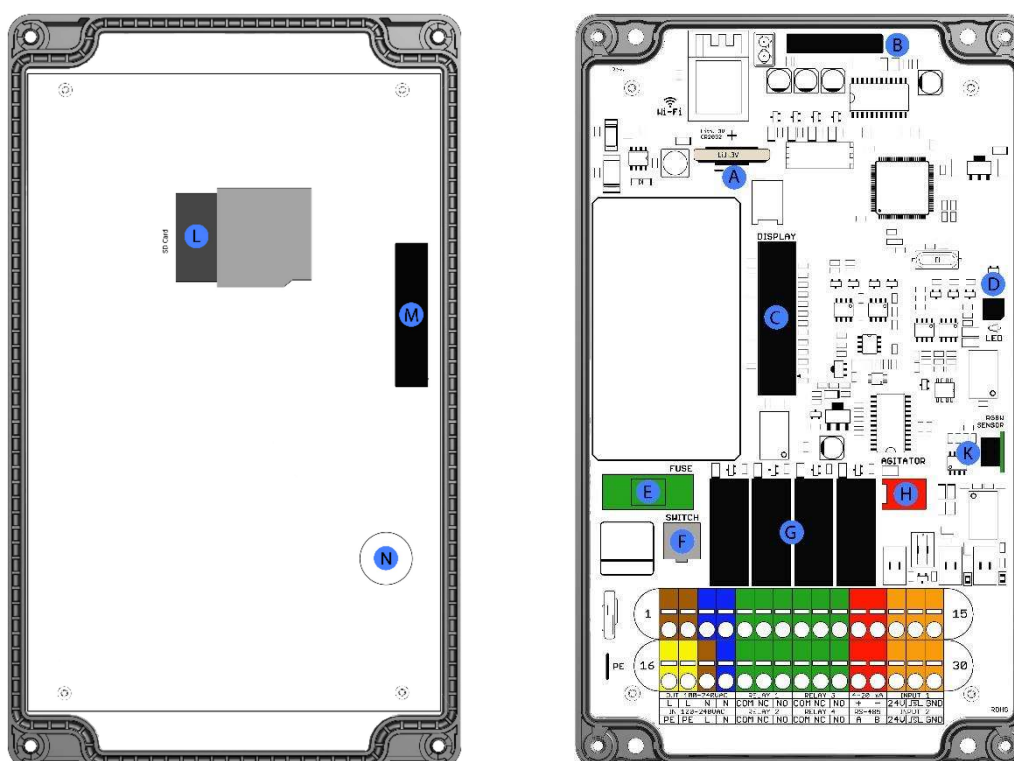
Figure: Back of cover (left side), circuit board (right side)

Position	Description
A	Battery holder
B	Connection to reagent pumps / connection of solenoid valve
C, M	Connecting the display
D	Actuator plug and LED connection
E	Fuse (5 x 20 mm) 1 A slow
F	Connecting the main switch
G	4 relais
H	Connection of the agitator
K	Sensor RGB
L	Socket for SD card
N	Acoustic signal generator

Electrical installation

Power connection
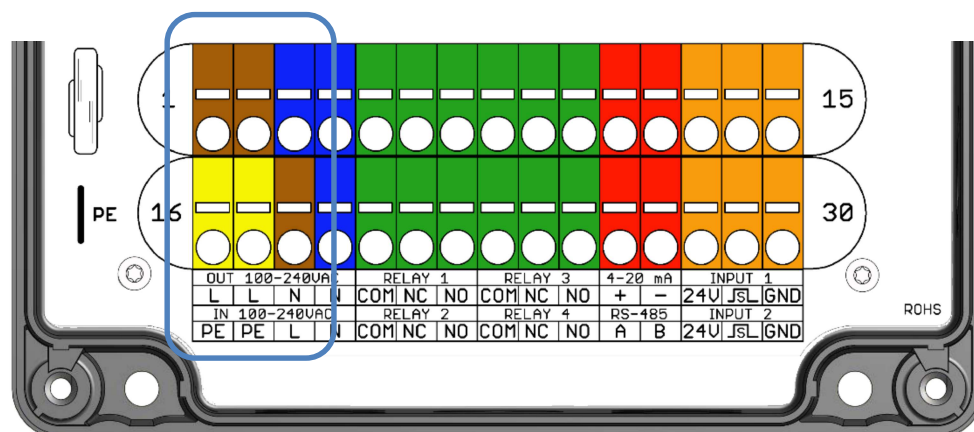
Figure: Terminals for connecting the supply voltage (blue border)

Power supply connection

Nr. terminal	Description
16 PE	ground
17 PE	ground
18 L (power in)	Supply voltage, phase 85 - 305 VAC (47 – 440 Hz)
19 N (power in)	Supply voltage, phase 85 - 305 VAC (47 – 440 Hz)

Output terminals that are switched by the device switch

Nr. terminal	Description
1 L power out	
2 L power out	Supply voltage switched between L and N 85 - 264 VAC (47...440 Hz)
3 N power out	
4 N power out	

⚠️ **Tension**   The maximum connected load of all users must not exceed 250 VA / 1 A.

Electrical installation

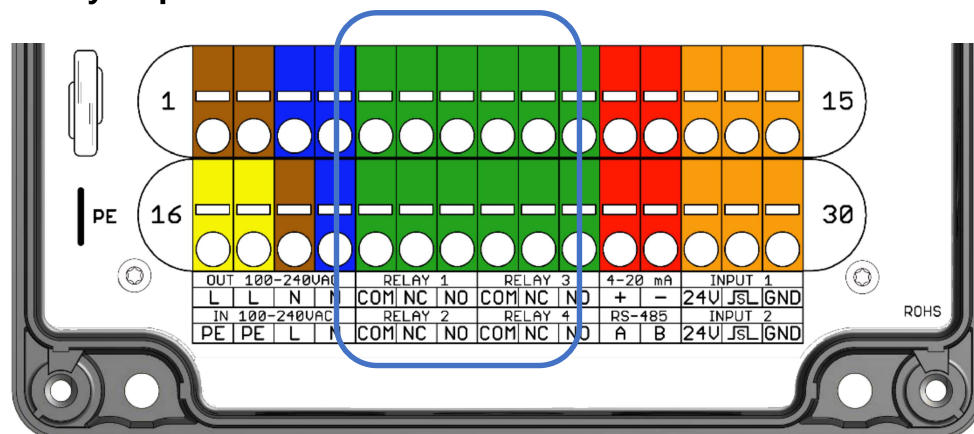**Connection of relay outputs**

Figure: Terminals for connecting the relay outputs (blue border)

The relays are designed as changeover contacts, with a common connection and the n.c. switching outputs. and n.o.

RELAY 1 (relè 1): limit value exceeded (limit value alarm 1)

Terminal	Description	Connection
5	COM	COM common
6	n.c.	n.c. closed in the event of a power failure
7	n.o.	n.o. open in the event of a power failure

REL 1: Upper limit alarm (upper limit 1)

If the measured value of the sample is below the maximum value 1 programmed in the FESKS®
FOSTCO 5000 SiO2, relay 1 is deactivated and establishes a connection from COM to n.c. In addition,
the R1 symbol is not marked on the display.If the measured value of the sample exceeds the maximum
 value 1 programmed in the FESKS® FOSTCO 5000 SiO2(upper limit value 1), relay 1 activates a connec
tion
from COM to n.o. The R1 symbol is also marked in black on the display.
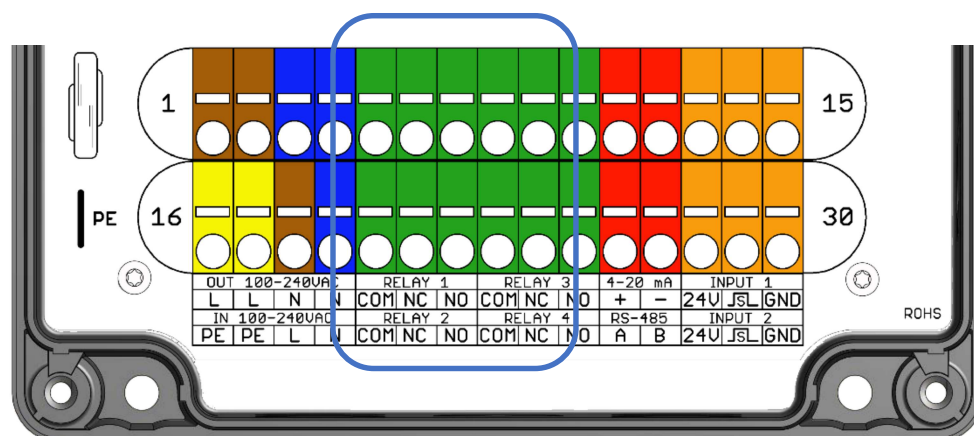
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Electrical installation

Figure: Terminals for connecting the relay outputs (blue border)

RELAY 2 (relè 2): limit value 2 - value measured below the detection threshold

Terminal	Description	Connection
20	COM	COM common
21	n.c.	n.c. closed in the event of a power failure
22	n.o.	n.o. open in the event of a power failure

Relè 2 Function Maximum value alarm 2:
The limit value alarm 2 indicates that the value has fallen below the start of the measuring range.
In this case it may be that
- there is no silicate in the water either
- there is no reagent (or a reagent is missing).
The relay can also be connected to relay 4 in low reagent mode.

If the measured value of the sample is within the nominal range set in the device, relay 2 turns off and establishes a COM to NC connection. Also, the R2 symbol is not highlighted on the display.
If the measured value of the sample exceeds the limit value 2 set in the device, relay 2 is energized and establishes a connection from COM to NO. In addition, the R2 symbol is highlighted in black on the display.
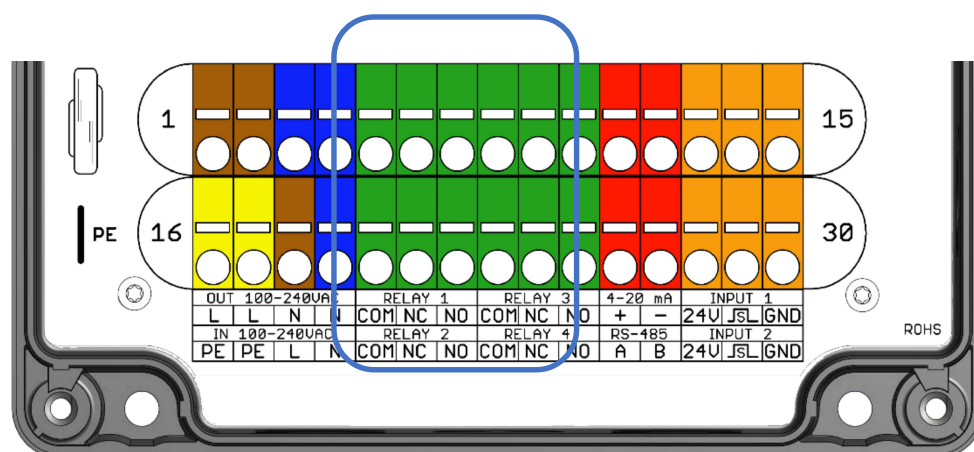
Electrical installation

Figure: Terminals for connecting the relay outputs (blue border)

RELAY 3 (Relè 3): Analyzer failure

Terminal	Description	Connection
8	COM	COM common
9	n.c.	n.c. closed in the event of a power failure
8	COM	COM common

Relay 3 function Notification of device errors:
If a device error occurs or the device is turned off, relay 3 is not operated. Closed contact between COM and n.c. The R3 symbol in the display is not marked in black.
Relay 3 energizes when the device is in a fault-free condition (connection from COM to n.a.), this is to prevent wire breakage. In addition, the R3 symbol is marked in black on the display.

> The switching behaviour of relay 3 is reversed. This means that a switched off device and a broken wire can be detected.

RELAY 4 (Relè 4): notice of lack of reagent or analysis report in force (also analysis delay)

Terminal	Description	Connection
23	COM	COM common
24	n.c.	n.c. closed in the event of a power failure
25	n.o.	n.o. open in the event of a power failure

Relè 4 Reagent level function:
If the reagent level in any of the three bottles falls below 10%, the "warning lack of reagent" signal is activated.

Programming: Menu> Parameters> Outputs> Relay 4> Reagent

If the bottle level is above 10%, relay 4 is de-energized and establishes a COM to NC connection. Also, the R4 symbol is not highlighted on the display.
If the level of one or more bottles drops below 10%, relay 4 energizes and establishes a COM to NO connection. In addition, the R4 symbol is highlighted in black on the display.

Relè 4 analysis signal (also delay):
If no analysis is in progress, relay 4 is switched off (connection from COM to NC). Also, the R4 symbol is not highlighted on the display.
Relay 4 is energized during an operational analysis (COM to NO link). In addition, the R4 symbol is highlighted in black on the display.

Alternatively, relay 4 can be programmed for the optional delay analysis function to control the cooling water valve, the sample cooler or a bypass valve. The switching status of the relay is shown on the display as R4.

(*) Attention: not necessary for the optional pump 200028.

Note on the analysis delay
An analysis delay can be programmed. It means that relay 4 is activated for the time programmed before the analysis. With the start of the analysis, the relay remains active until the end. The relay switches from COM to n.a. for the set delay time + analysis time.

Electrical installation

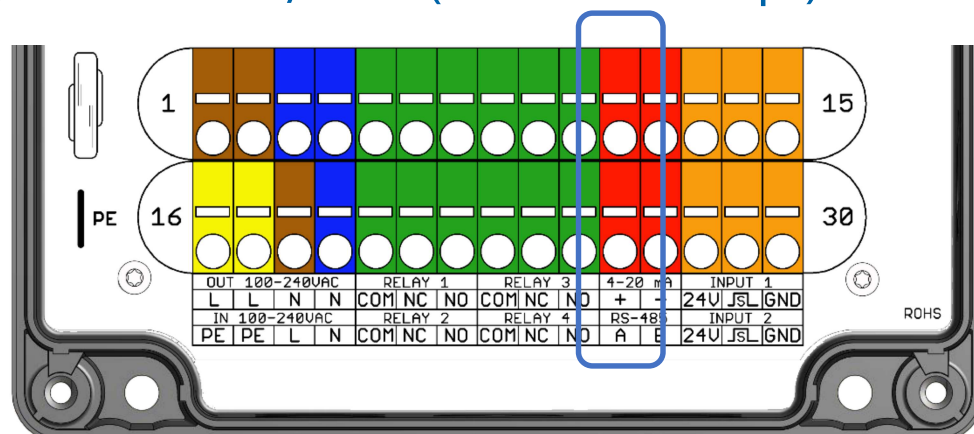**Output 0 (4) - 20mA and RS-485 / Modbus (ATTENTION: active output)**

Figure: Terminals for connecting the Currently interface and RS-485 (blue border)

Terminal	Description	Connection
11	+	Positive 0-20mA or 4-20mA output
12	-	Negative 0-20mA or 4-20mA output

Interface output 0 (4) - 20mA:

The Currently silica or device status is output as electricity to the Currently interface. The Currently range can be selected between the 0 - 20 mA or 4 - 20 mA settings. The maximum load is 750 Ω.

Programming possibility:
- output off
- 0 - 20 mA Measured value
- 4 - 20 mA Measured value
- 0 - 20 mA State of operation
- 4 - 20 mA State of operation

RS-485 Interface: Modbus

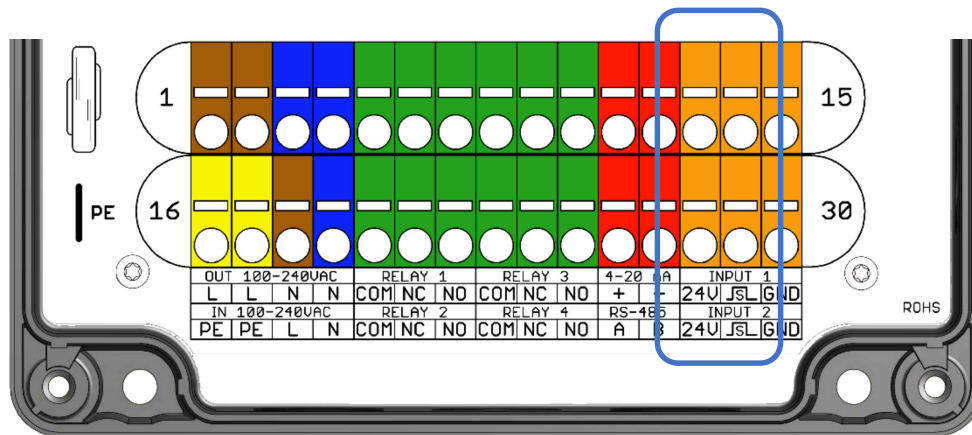| Terminal	Description	Connection
26	A	RS-485 output
27	B	RS-485 output

Figure: Terminals for connecting the input contacts (blue border)

INPUT 1: start the input contact start the analysis / flow meter (= block the beginning of the analysis)/water meter/reset interval

Terminal	Description	Connection
13	24V	+24V Currently to power the output
14	S	Signal entry
15	GND	Ground contact for + 24V 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 1 symbol is highlighted in black on the display.

INPUT 2: input for stop analysis with result reset

Terminal	Description	Connection
28	24V	+24V Currently to power the output
29	S	Signal entry
30	GND	Ground contact for + 24V connection

Input 2 function:
A programmer (or switch) can stop the analysis and perform a reset of the analyzer.

External component connections

To connect additional components, the device is equipped with two inputs, 4 output relays and an analog output (0/4 - 20 mA Currently interface) and ModBus (RS-485 interface).
A flow meter (analysis stop contact), a potential-free switch or an electronic switch can be connected to the inputs. For a volumetric range (in relation to water consumption) it is possible to connect meters with on / off contact (Reed) or Hall contact (0 (4) -20mA meters, those that give output Currently cannot be connected.
For Hall-type meters only: An auxiliary voltage of 24 V DC is available on terminal 13 and GND on terminal 15 for the connection of electronic meters. For signal recognition, the 24 V DC terminal block must be connected to terminal 14.
No external voltage sources can be connected to the input. If necessary, the isolation potential must be done with a relay or an optocoupler (optocoupler).

The relay connections are all potential-free. For switching external devices, the internal mains voltage or alternatively an external supply voltage can be used. Connection to external controls is usually done via the potential-free contacts of the relays.
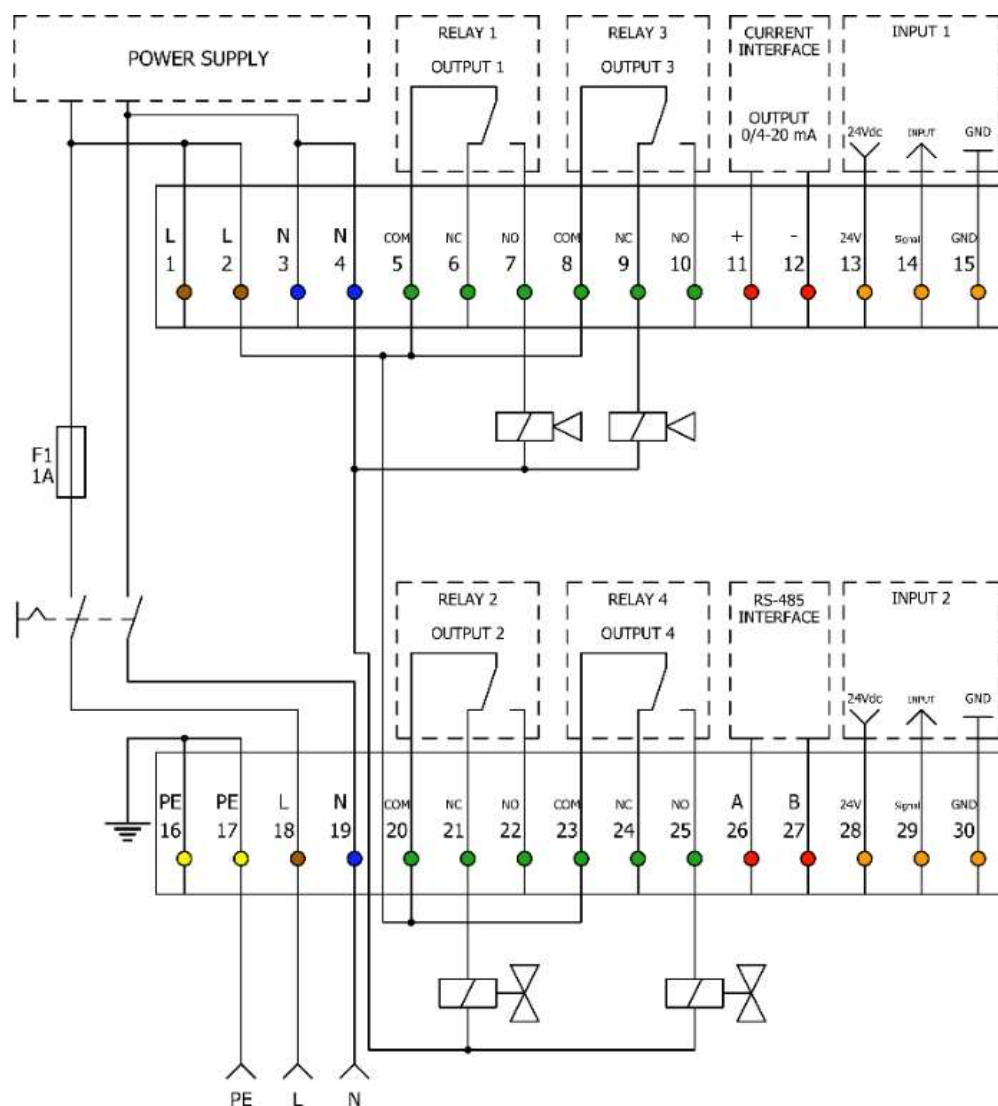
Figure: schematic view of the connection terminals

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External component connections

Relay 3 is always energized during normal operation: COM connection to n.o. (wire break safety).

Tension

The supply voltage passes through the analyzer switch. Terminal blocks 1 to 4 can be used to have output Currently (or to pass the relay output Currently). The maximum input Currently is 250V. The maximum output load must not exceed 250VA. The output terminals are switched with the analyzer power switch and protected by an internal micro-fuse.

External component connections

Analysis start switch

In addition to the options for starting an analysis depending on the time, there is the possibility to activate further analysis using an external button. It may be a potential-free button or the relay output of a PLC control or programmer of a softening system.The use of a switch on the input is intended as an addition to the normal time interval. The analyzer operates in a predetermined time interval, a signal can be sent to the input by the switch and an additional analysis can be started.
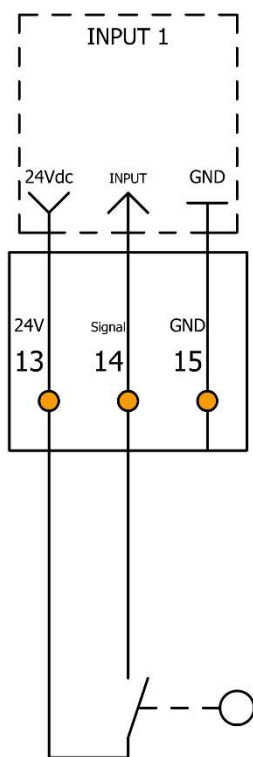
(The analyzer must be in "automatic" operation)

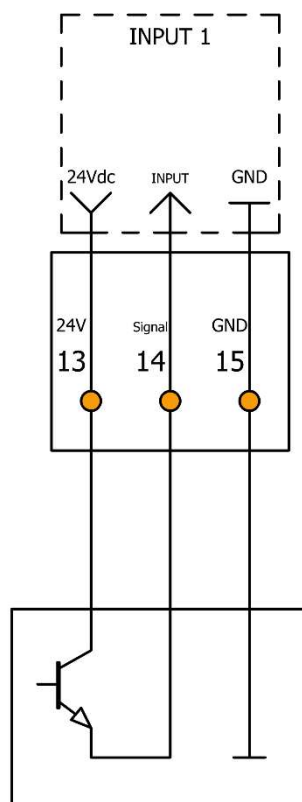Further analysis can also be performed by pressing the OK button for 3 seconds.

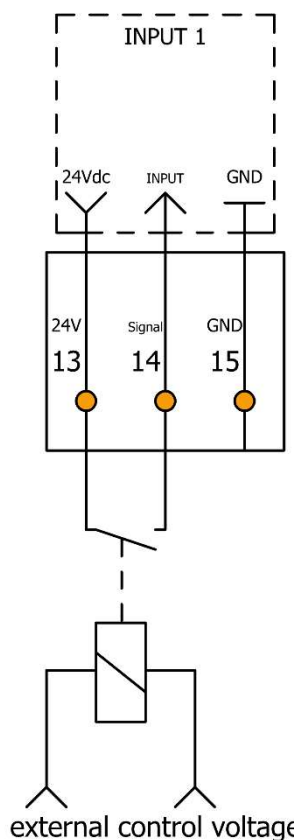Bridging the contact, we will have continuous analysis.

Programming: Menu> Parameters> Inputs> Input IN1> Start analysis

Figure: Three possibilities to connect an external switch to start analysis

External component connections

Connection of a water meter (volumetric analysis interval)

In addition to timed analysis, there is also the possibility of having volumetric analysis. For this purpose, a water meter with reed contact (potential-free) or a Hall type water meter (with an electric turbine) is used. (The analyzer must be in "automatic" operation)

Programming: Menu> Parameters> Inputs> Input 1> Water meter

1. Enter the characteristics of the water meter used in the liter/pulse unit.
2. Enter the type of Hall or Reed water meter. In Reed mode, the input is not monitored to avoidincorrect counts.

Programming: Menu> Parameters> Analysis> Automatic interval quantity

3. Activate the analysis in the quantity range.
4. Select the unit of measurement to be shown on the display.
5. Enter the quantity by which an analysis is to be performed.

> After turning on the device, the first analysis starts after 3 minutes. The amount of water is already active during this period.
> The operation of the contact water meters (reed) in the input mode for electronic water meters (hall) can lead to incorrect intervals due to the contact bounce.

Programming: Menu> Parameters> Inputs> Input 1> Water meter
Programming: Menu> Parameters> Analysis> Interval quantity
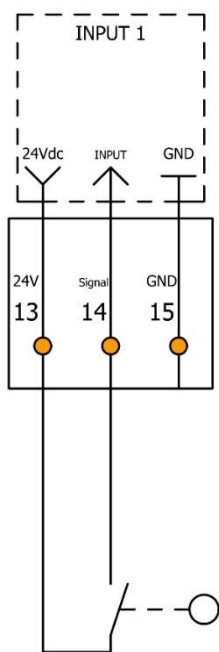
potential free switch
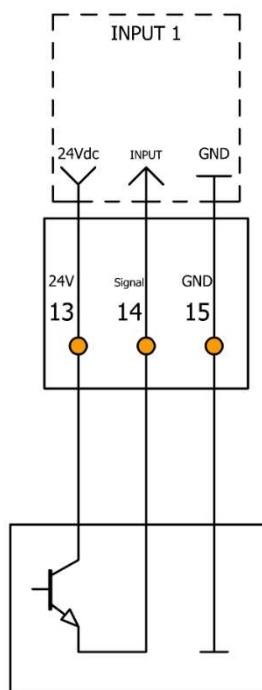
open collector electric switch

external control voltage

30
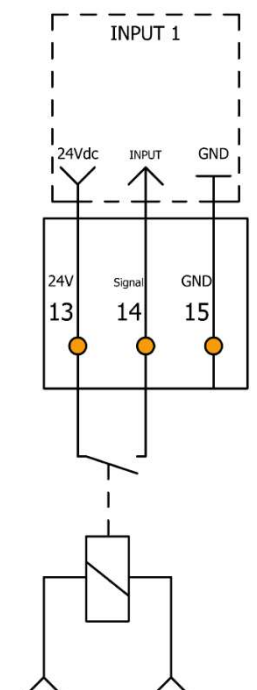
External component connections

Flow meter

If installed on a system where monitoring is only necessary during operating hours, the input contact (INPUT 1) can be used in combination with a flow meter. This allows the analyzer to be paused during a plant shutdown, thus reducing the consumption of reagents and energy.

For example, a level (e.g. full tank = no analysis), an external on / off switch or a timer can be used as a flow meter. The following examples show different connection options on the input contact.

When using a flow meter, the analyzes are performed only if a defined signal is present at the inlet (the flow meter signals a flow of water). Depending on the contact installed, the input can be configured as n.c. or n.o.

[NO] Analysis interval paused: The start of the next analysis waits for a closed input contact.

NC]   Analysis interval paused: The start of the next analysis is waiting for an open input contact.

(For this function, the analyzer must be in "automatic" operation)

Programming: Menu> Parameters> Inputs> Input 1> Flow meter

⚠ This function is not the "Start analysis" function.
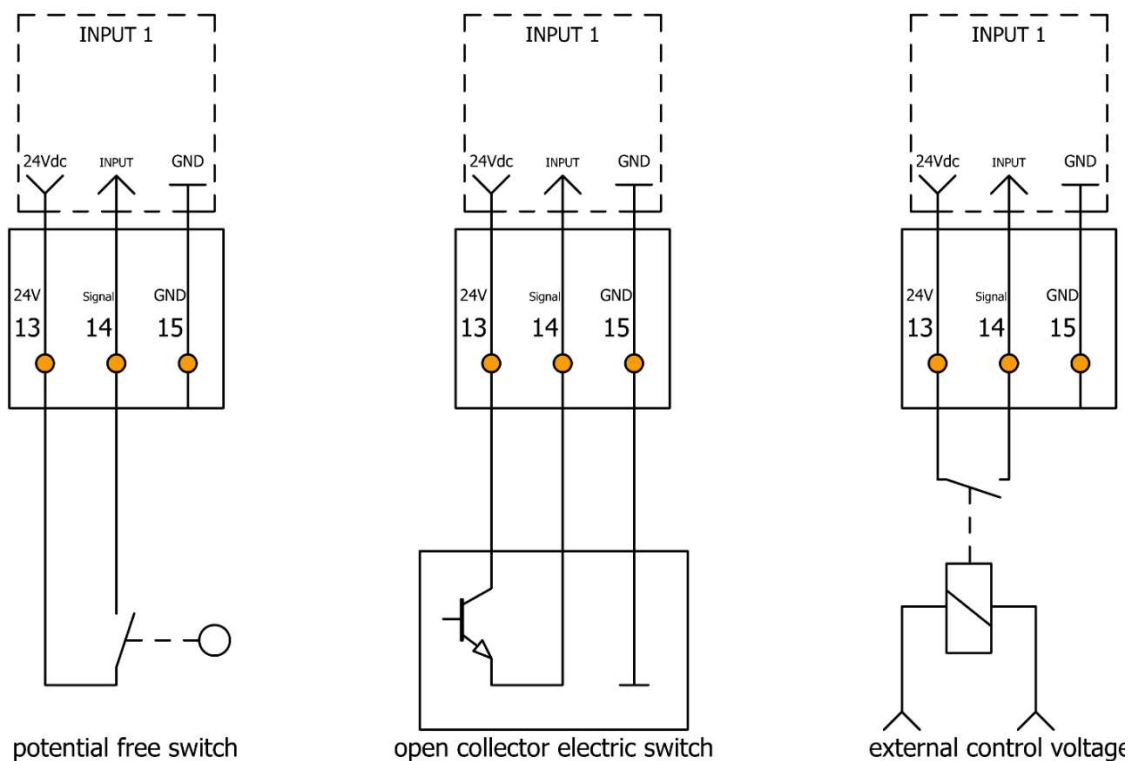
Figure: Three possibilities for connecting a Stop signal

External component connections

Analysis stop reset with result reset

Input IN as reset of the interval during automatic mode.
The interval recovery mode is used for monitoring a single filter softening system.

During the operation of the softening system, the analysis are carried out in the programmed interval. When regeneration starts, the input contact is closed to interrupt the analysis interval. The last displayed value is cleared from the display. The analysis interval is paused until the input contact is closed. After the end of the regeneration, the input contact is opened again. The first analysis starts after a minute. The following analysis are performed again in the scheduled analysis interval.

This prevents the output of an incorrectly assigned measured value.

NO] Active analysis interval: the analysis interval is stopped by a closed input contact.
NC] Active analysis interval: the analysis interval is stopped by an open input contact.

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

⚠️ No analysis is performed if the IN 1 contact is permanently closed.

Programming: Menu> Parameters> Inputs> Input 1> Reset interval

potential free switch   open collector electric switch   external control voltage

32
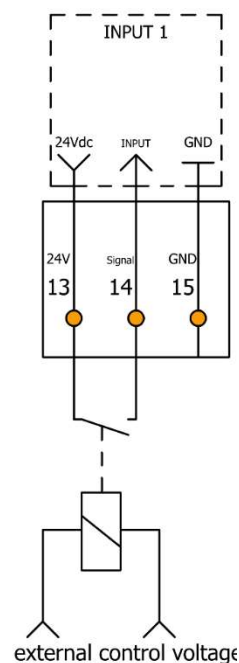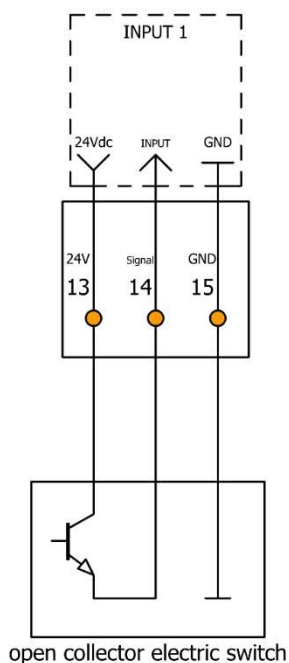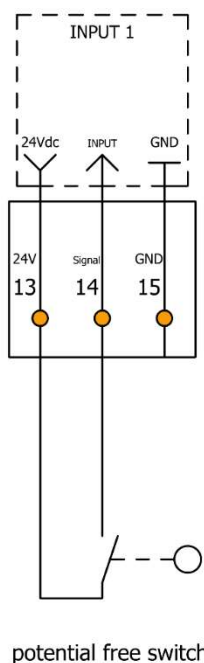
External component connections

Input 2: Connection of a switch for fault/error reset

An error message can be removed from an external switch.

It can be a physical switch or a relay output contact of a PLC, from a control room or something similar.

For a transistor switch only: an auxiliary voltage of 24 V DC on terminal 28 and GND on terminal 30 is available for electronics. 24 VDC must be connected to terminal 29 for signal detection. No external voltage source can be connected to the input. If necessary, the potential must be isolated with a relay or photocopier.
Programming: no programming required for input 2.

External component connections

Optical or acoustic signal

An optical or acoustic signal can be connected to relay 1 to sign that a limit value has been exceeded.

Relay 3 is used to report detected errors (e.g. optical errors, dirty measuring chamber (zero test error / water transparency), missing supply voltage on the analyzer). If the analyzer works normally and no errors occur, relay 3 is activated and the connection is switched from COM to n.o. If an error is detected, relay 3 switches off and establishes the connection from COM to n.c.

Relay 1 is activated when the (upper limit 1) is exceeded and switches the connection from COM to n.o. This position can be programmed as a permanent contact or as a pulse contact

Permanent contact on relay 1/output 1:

If the limit value is exceeded (upper limit value 1), relay 1 remains in position (connection from COM to n.o.) until the measured water hardness is again lower than the limit value (upper limit value 1). Subsequently, the limit is exceeded and relay 1 returns (connection from COM to n.c.).

Pulse contact on relay 1/output 1:

If the limit value is exceeded (upper limit value 1), relay 1 remains in position only for a programmed pulse duration (connection switched from COM to n.o.). As soon as the programmed pulse duration has expired, relay 1 returns (connection from COM to n.c.). The next time the limit value (upper limit value 1) is exceeded, relay 1 is switched again as an impulse. This function is often used in combination with pilot distributors with internal programmer (for example TUYA digit) or with programmers (for example Marzio type).

External component connections

Programming: Menu> Parameters> Outputs> Relay 1
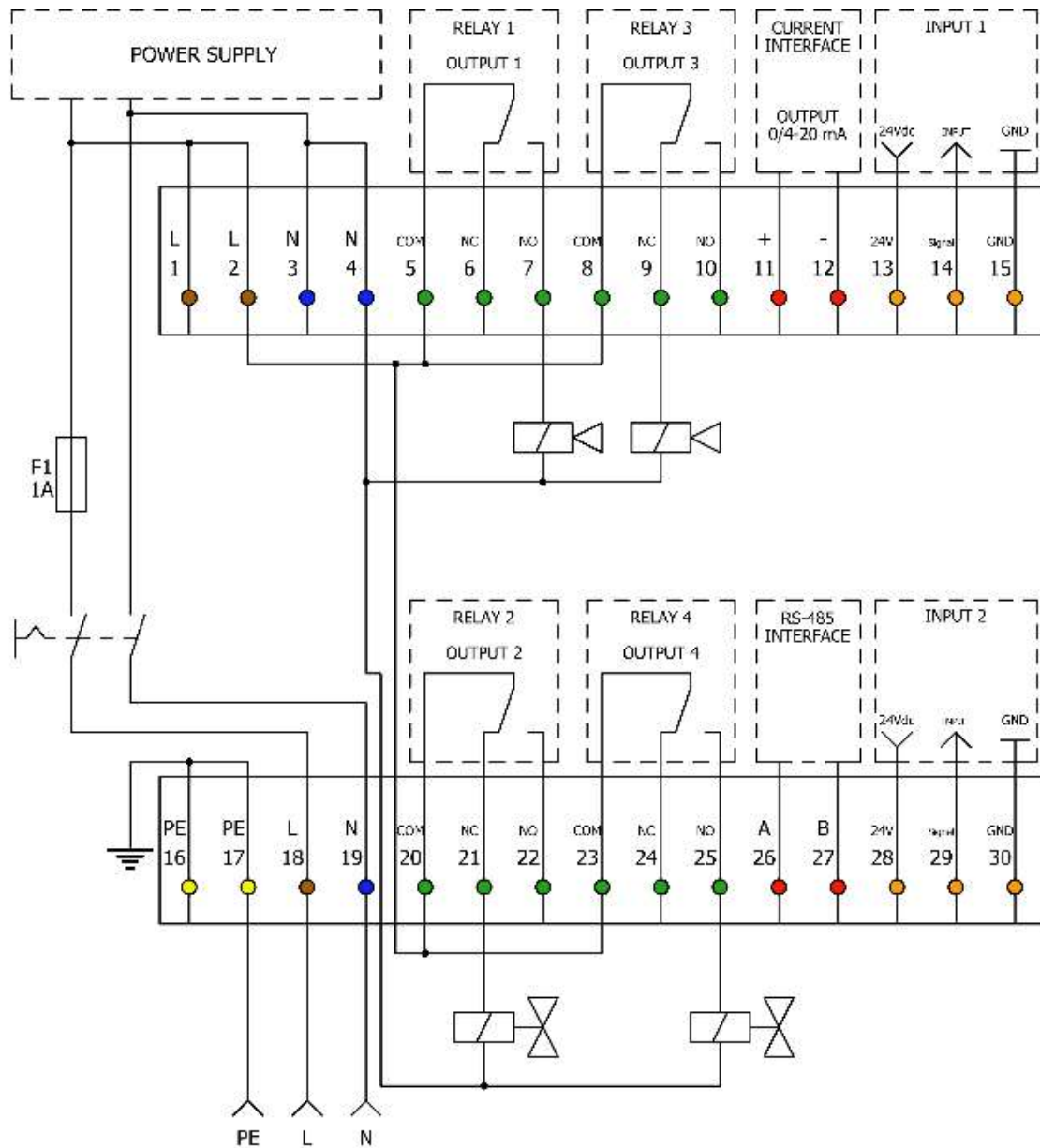
Illustration: Terminal assignment when a lamp / audible alarm is connected

External component connections

Active analysis signal

Relay 4 can be used to signal the start of an analysis. It is possible to connect signaling devices, pumps or valves. A connection to a control room is also possible.

You can choose between:
Relay 4 activation only during analysis:
Programming: Menu> Parameters> Outputs> Relay 4> Analysis
In this mode, you can connect a remote signal that indicates that it is an analysis in effect.

Relay 4 activation before and during the analysis:
Programming: Menu> Parameters> Outputs> Relay 4> Analysis> Analysis delay

The analysis delay must be programmed to activate, for example, a cooler (so that the sample water is below 40 ° C) or to connect a purge solenoid valve to have cold and softened water (in case that the sampling point is in a "dead" point).

Use of the cooler: when controlling a cooling valve (cold water) and/or hot water valve, dangers for people and material must be avoided during maintenance or testing operations. Design, integration in the safety chain and installation must be carried out considering the applicable standards and laws. You need to speak to the steam boiler manufacturer.

External component connections

Analog output

The Currently measured value is available as an analog value at terminals 11 and 12. External devices can be connected for measured value processing and a Currently output of 0 - 20 mA or 4 - 20 mA can be selected. The value remains constant until the next analysis result. Even during the STOP analysis, the value remains constant. Only with the RESET contact is the output value also reset (= 0 mA).

It is also necessary to define which Currently value of 20mA corresponds to which silicate concentration "higher concentration".

Programming: Menu> Parameters> Outputs> Type of Currently interfaces
Programming: Menu> Parameters> Outputs> Calibrate Currently interfaces.

(Enter the value of the silicate content which corresponds to 20mA. By default, the value is 10mg / l, but you can also choose a lower concentration (for example 5 mg / l), so the 20mA corresponds to 5 mg /L.

The Currently supplied by the Currently loop for the displayed measured value is calculated with:

$$I = I_0 + \frac{(20\,mA - I_0) \cdot measured\ value}{higher\ concentration}\,[mA]$$

Depending on the type of Currently interface, 0 or 4 mA must be used for I0.
For 0 - 20 mA type Currently interface, use 0 mA for I0.
For the 4 - 20 mA type Currently interface, use 4 mA for I0.

The "higher concentration" number corresponds to the silicate content value entered for 20 mA. Usually the end of the measuring range of the reagents used is used.

It is recommended to set the concentration above the end of the reagent measuring range.

External component connections

Calculation example: The silicate reagents A, B and C are used for the analysis. Measuring range up to 10 mg / l of silicate. The displayed "measured value" is 8 mg / l.

"Higher concentration "is set to 10 mg / L, which corresponds to 20 mA.

For the Currently interface type "0 - 20 mA", 0 mA corresponds to 0 mg / l.
For the Currently interface type "4 - 20 mA", 4 mA corresponds to 0 mg / l.

Calculation for Currently interfaces type "0 - 20 mA

$$I = 0\ mA + \frac{(20\ mA - 0\ mA) \cdot 8\ mg/l}{10\ mg/l}\ [mA]$$
$$I = 16,0\ mA$$

16,0 mA corresponds to 8 mg / l of silicate.

Calculation for Currently interfaces type "4 - 20 mA

$$I = 4\ mA + \frac{(20\ mA - 4\ mA) \cdot 8\ mg/l}{10\ mg/l}\ [mA]$$
$$I = 16,8\ mA$$

16,8 mA corresponds to 8 mg / l of silicate..

Operating status via analog Currently interface
The operating status of the device can be transmitted through the Currently interface terminals 11 and 12.

Programming: Menu> Parameters> Outputs> Currently interface type
Choices:
- 0 - 20 mA Status
- 4 - 20 mA Status

Operating status	Currently interface	
	0 - 20 mA Status	4 - 20 mA Status
Operation	3,5 mA	6,8 mA
Limit value not reached	7,5 mA	10,0 mA
limit value exceeded	12,5 mA	13,6 mA
Reagents level < 10	16,5 mA	16,8 mA
Malfunction	0 mA	4 mA

The values listed here may vary by ± 0.3 mA.

Management

Illustration: DUROMAT® diamond SiO2 analyzer with installed reagents.

Illustration: DUROMAT® diamond SiO2 analyzer Bottom view

Position	Description
A	Control unit
B	Graphic display
C	Bottons
D	Cable glands
E	On / Off switch
F	Reagent cap Dosing pump A
G	Measurement chamber / optical measurement section (The locking pins can only be pulled upwards and not outwards).
H	Reagent cap Dosing pump B
I	Reagent cap Dosing pump C
J	Agitator
K	Discharge tube from the measurement chamber
L	LED actuator plug
M	Water inlet to the measuring chamber

N	Pump housing
O	Dosing pump A
P	Dosing pump B
Q	Solenoid valve
R	Dosing pump C
S	Reagent bottle A 500 ml
T	Reagent bottle B 500 ml
U	Reagent bottle C 500 ml
V	Water drain (plug connection for plastic pipes with 1/4 inch outside diameter)
W	Water inlet (push-in connection for plastic pipes with an outside diameter of 6 mm)

Management

Display and keyboard

The analyzer has a graphic display where it is possible to view both the measured values and the menu for operation. The background colour of the display changes according to the condition of the device:

Colour	Status
White	the analyzer works properly
Red	exceeded the maximum value or device failure

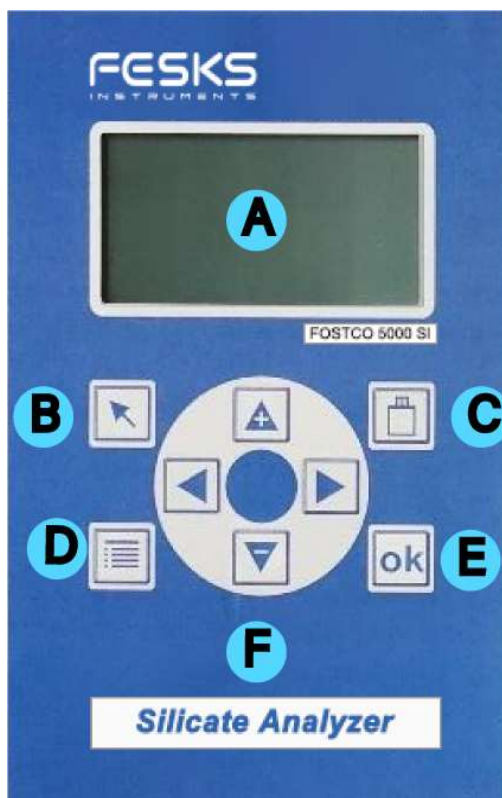*Figure: Front cover structure of the controller*

The programming and control of the appliance takes place through 8 buttons.

Position	Description
A	Display
B	Return / do not save / stop analysis
C	Confirmation of supply indicator
D	Basic menu / Return to the basic display
E	OK / confirmation
F	buttons for navigation / entry of values

Management

The following options are available in the menu window:

```
            Menu
┌──────────────┬──────────────┐
│ Automatic    │ Service      │
├──────────────┼──────────────┤
│ Settings     │ Wizard       │
├──────────────┼──────────────┤
│ Info         │ History      │
└──────────────┴──────────────┘
```

Menu items	Description
Automatic	for the activation and deactivation of the "analysis"
Parameters	to access programming
Info	Info for: software version, hardware version, analysis and maintenance counts, good and bad analyses.
Manual	Start analysis (manual starting), Indicator pump activation (confirmation of new bottle insertion), manual washing, maintenance confirmation, reset of good/bad analysis counter, diagnostic program)
Assistited	Wizard for basic programming.
Function	Indication of the last 100 results

Management

Display during the analysis
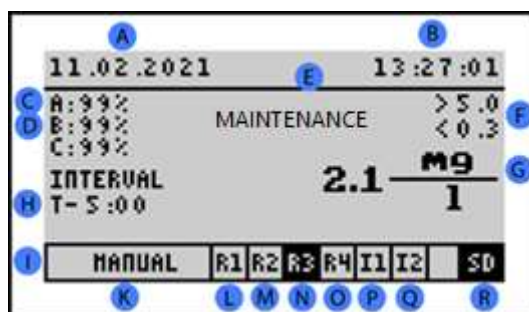
Position	Description
A	Date
B	Hour
C, D	Bottle level %
E	device status ("Maintenance" is displayed: Maintenance counter expired, can also be "Cleaning" = Dirty chamber)
F	Limit values programmed
G	Result of the analysis
H	Analysis phase (T - 5:00 time remaining in minutes until next analysis)
I	Status bar
K	Manual or automatic operation
L	Relay 1 is not operated
M	Relay 1 is not operated
N	Relay 3 operated (fields with black background are active)
O	Relay 4 is not operated
P	INPUT1 (I1) inactive
Q	INPUT2 (I2) inactive
R	SD card available

ℹ Simple analysis start.
Press the [OK] button for 3 seconds to start the analysis.

ℹ An analysis can be started both in manual and automatic mode.

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History display of measured values

With the help of the [◄] and [►] keys it is possible to read the last 100 measurements with date and time. The set limit is drawn with a line.

🛈　　A trend.csv file is available on the SD card. With this you can transfer the measured values to a PC.

It's possible to open the history using the keys Menu> History. By pressing the key [Back] it's possible to return to the measured value display.
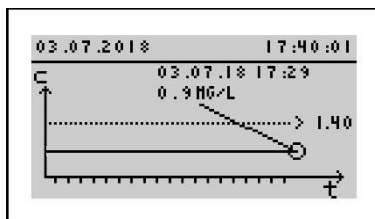
Display indication Selection menu

The selection can be changed with the [◄] and [►] keys. Confirm the setting with the [OK] key. If you do not wish to change the setting, you can leave the selection with the [Back] key.
In the image below, the active selection is the [Yes] key with a black background.

Display with list

You can change the selection with the [▲] and [▼] keys. The setting is confirmed with the [OK] key. If you do not want to change the setting, you can leave the selection with the [Back] key. If the picked list offers more than three options, a scroll bar appears on the right edge of the display.
The Currently selected function is marked in black (start of analysis).
The filled black circle to the left of the input function indicates which function is Currently programmed for input 1.
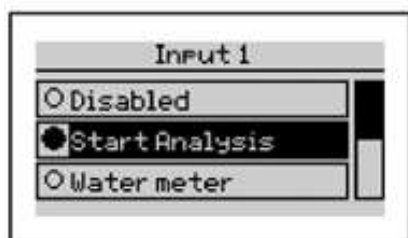
Management

Display

Numbers are entered using the buttons below the display. You can move the cursor with the arrows [◄]; [►]; [▲] and [▼]. The numeric value Currently set is displayed together with the possible programming fields.

You see a list of numbers for insertion. Now use the arrow keys to move the black cursor to the desired number and press the [OK] key.

The selected digit appear in a frame on the left. Repeat the entry until the desired number appears in the box. Now move the cursor to the OK field on the display and press the key.

You see the following information:
Currently: Currently set value
Minimum: minimum programmable value
Maximum: maximum programmable value

If the value in "Currently" matches the desired value, it is not necessary to re-enter the number. Just put the cursor on OK and confirm.

In the following example, the analysis delay time can be set between 0 and 1800 seconds. The Currently programmed delay time is 30 seconds.

After entering the new delay time, pressing OK confirms.

Configuration

Factory programming

The factory programming is as follow (you can go back to restore it at any time):

Step		Factory programming
Base	Language	English
Analysis	Unit	mg/l
	Reagent	Silicate-A, Silicate-B, Silicate-C
	Max value 1	< 5 mg/l
	Max value 2	> 0,3 mg/l
	Washing time	120 secondi
	Timed analysis interval	5 minuti
	Volumetric analysis interval	No
	Stop analysis	No
	Analysis repetition	No
	Calibration factor	100%
Inputs	Input 1	Start analysis
	Input 2	Stop analysis
Outputs	Analog output type	4 – 20 mA
	Value 20mA	10 mg/l
	Relay 1	Maximum value 1, continuous contact
	Relay 2	Maximum value 2, continuous contact
	Relay 3	Errors / failure
	Relay 4	Lack of reagent

Restore factory settings with:
Programming: Menu> Parameters> General> Factory

Wizard - first start

Wizard

The configuration wizard is used for simplified initial commissioning. Menu-based, the device takes you step-by-step through all the necessary settings. It also checks whether the device is working properly.

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

Italiano, Español, Français, English, Deutsch, Русский, Dutch, Polish and Danish

To start the wizard, select:
Programming: Menu> Wizard

Wizard - first start

If the automatic mode is still active, it must be terminated:

Choose [Yes] or [No] with the [◄] and [►]
buttons, confirm with the [OK] button.

[Yes] Ends the automatic processing.

Premere [OK] per confermare

Choose of the language:
Press [OK] to confirm.

Italiano, Espanol, Francais, English, Deutsch,
Russian, Dutch, Polish and Danish.
Select the language with the arrows [▲] and [▼]
and confirm in the [OK] button.

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Wizard - first start

Wizard	Would you like to start the wizard?
Start Would you like to start the configuration wizard? **Yes** No	Choose with the [◄] and [►] buttons whether to go ahead or not, choose [Yes] or [No], confirm the [OK] button. [Yes] Wizard starts. [No] Return to the main menu.

Factory programming	Would you like to reset the unit to the factory settings?
Factory setting Would you like to reset the unit to the factory settings? Yes **No**	Use the [◄] and [►] button to select [Yes] or [No] to confirm the [OK] button. [Yes] Programming returns to programming of the factory. [No] the appliance keeps the programmed values. Factory settings can be found at page 48.
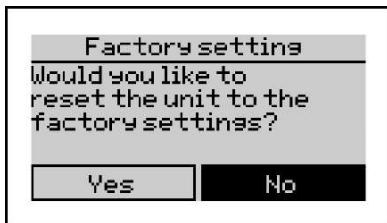
Date	Today is: XX.XX.XX - XX:XX Do you want to set the date and time?
Date Today is: 24.09.18 - 10:36 Would you like to change time and date? Yes **No**	Use the [◄] and [►] button to select [Yes] or [No] to confirm the [OK] button. [No] Date and time are not changed. [Yes] You can change the date / time.
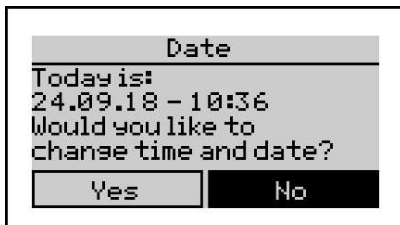
Wizard - first start

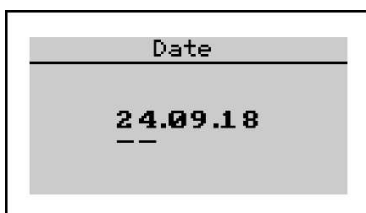| Set date	
Date 24.09.18 --	You can lower or increase the date with the [▲] and [▼] buttons. Confirm with the [OK] button. Then we move from day to month and year. Press [OK] to go to the next step.
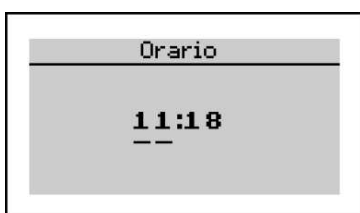
Time programming	
Orario 11:18 --	You can increase or decrease the time with the [▲] and [▼] buttons. Press [OK] to go from hours to minutes. The seconds are set to 0 after programming two minutes. Press [OK] to go to the next step.

Maintenance counter	Is it a new installation or has a Maintenance been carried out?
Maintenance counter Has a maintenance / initial installation been performed? Yes No	Choose [Yes] or [No] with [◄] and [►] buttons, confirm with [OK]. [Yes] The time until the next maintenance request is set after 15,000 analyzes and after 12 months. (See: Menu> Info) [No] The device keeps previous data.

Reagent A	Insert a new bottle of indicator
Reagent Insert the reagent bottle and press OK. OK	Insert a new bottle of indictor A and press [OK].

Wizard - first start

Pump reagent

Confirm with [OK].
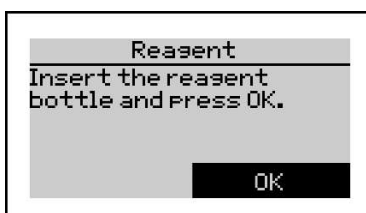The indicator is aspirated and sent to the measuring chamber. Pumping can be stopped by pressing the [OK] button.

⚠️

Check that the reagent is without air bubbles

Reagent — Has a new indicator bottle been inserted?

Use the [◄] and [►] buttons to choose [Yes] or [No], confirm with [OK].

[Yes] The quantity is reset to 100%.

[No] The residual quantity remains as it was.

Reagent B — Insert a new bottle of indicator

Insert a new bottle of indictor B and press [OK].

Pump reagent

Confirm with [OK].
The indicator is aspirated and sent to the measuring chamber. Pumping can be stopped by pressing the [OK] button.
⚠️

Check that the reagent arrives without air bubbles

Wizard - first start

Reagent	Has a new indicator bottle been inserted?
Reagent Reagent bottle renewed? Yes / No	Use the [◄] and [►] buttons to choose [Yes] or [No], confirm with [OK]. [Yes] The quantity is reset to 100%. [No] The residual quantity remains as it was.

Reagent C	Insert a new bottle of indicator
Reagent Insert the reagent bottle and press OK. OK	Insert a new bottle of indictor and press [OK].

Pump reagent	
Pump reagent 8 s OK	Confirm with [OK]. The indicator is aspirated and sent to the measuring chamber. Pumping can be stopped by pressing the [OK] button. ⚠️ Check that the reagent arrives without air bubbles

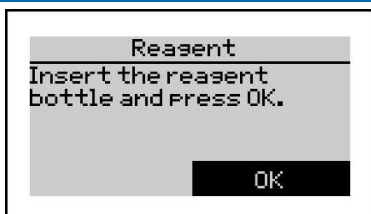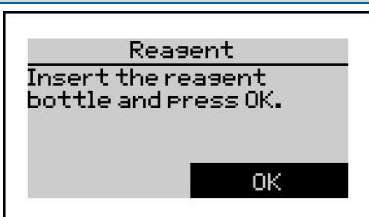| Reagent	Has a new indicator bottle been inserted?
Reagent Reagent bottle renewed? Yes / No	Use the [◄] and [►] buttons to choose [Yes] or [No], confirm with [OK]. [Yes] The quantity is resetted to 100%. [No] The residual quantity remains as it was

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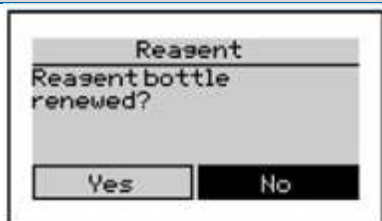
Wizard - first start

Flush time	Press OK to flush the feed line and the measuring chamber.
Flush time Insert your desired flush time in the following mask. OK	Press OK.

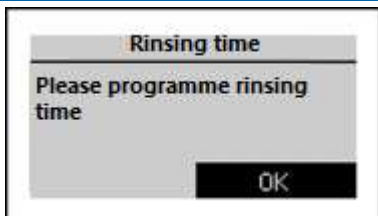| Flush	
Rinsing 19 s Cancel	The inlet solenoid valve opens and the measuring chamber is flushed. The washing time is indicated on the display. The elapsed washing time can be considered as programming the washing time. To finish washing, press [OK]. ⚠️ Make sure that the sample water is clear and without air bubbles.

Rinsing time	Programme rinsing time.
Rinsing time Please programme rinsing time OK	Press the [OK] key.

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Rinsing time

You see an input keyboard on the right of the display with the arrows [◄]; [►]; [▲] and [▼]. Move the black cursor to the desired digit and press the [OK] key.
The selected digit appears in a frame on the left.
Repeat the entry until the desired rinsing time appears in the box.
Now move the cursor to the OK field on the keyboard and press the [OK] key.

On the left you can see the indications:
Currently: Currently programmed value
Minimum: minimum programmable value
Maximum: maximum programmable value

If the value in "Currently" matches the desired value, you do not need to re-enter the digits. You can immediately move the cursor to the OK field in the display and confirm with the [OK] key.

Advice:
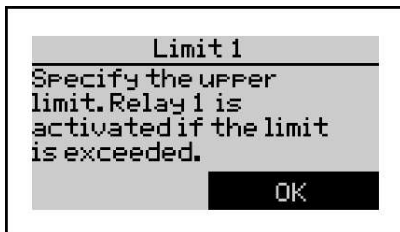6mm external supply pipe, 4 mm internal, water pressure 3bar:
tube with length 2 meters: 10 seconds
tube with a length of 5 meters: 30 seconds

Wizard - first start

| Limit 1 | Enter the higher limit value 1 which, if exceeded, should switch to relay 1. |

Press [OK].

| Limit value 1 | |
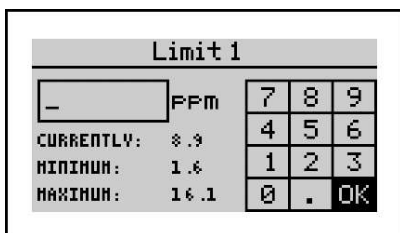
You will see an input keyboard on the right of the display. Now move with the arrow keys [◄]; [►]; [▲] and [▼] the black cursor on the desired digit and press the [OK] key. The selected digit appears in a frame on the left. Repeat the entry until until the desired limit is in the box. Now move the cursor to the OK field on the keyboard and press the [OK].

On the left you can see the indications:
Currently: Currently programmed value
Minimum: minimum programmable value
Maximum: maximum programmable value

If the value in "Currently" matches the desired value, you do not need to re-enter the digits. You can immediately move the cursor to the OK field in the display and confirm with the [OK] key.

Wizard - first start

Timed interval	Do you want a timed analysis interval?
 Auto. interval time Do you want the analyses performed at a time interval? ● Yes ○ No	Choose [Yes] or [No] with the [◄] and [►] buttons, press the [OK] button. [Yes] We will have timed analyses. [No] We will not have timed analyses.

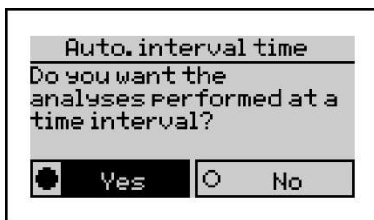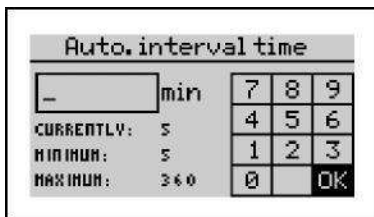| Timed interval	Program the analysis interval.
 Auto. interval time _ min 7 8 9 CURRENTLY: 5 4 5 6 MINIMUM: 5 1 2 3 MAXIMUM: 360 0 OK	You will see an input keyboard on the right of the display. Now move with the arrow keys [◄]; [►]; [▲] and [▼] the black cursor on the desired digit and press the [OK] key. The selected digit appears in a frame on the left. Repeat the entry until the desired limit is in the box. Now move the cursor to the OK field on the keyboard and press the [OK] key. 🛈 On the left you can see the indications: Currently: Currently programmed value Minimum: minimum programmable value Maximum: maximum programmable value 🛈 If the value in "Currently" matches the desired value, you do not need to re-enter the digits. You can immediately move the cursor to the OK field in the display and confirm with the [OK] key.

Repetition analysis	When the maximum value is exceeded, how many times must the analysis be repeated before giving an alarm?
 Control measure Adjust the amount of verification loops taking place after a bad measurement. OK	Press [OK].

Repetition analysis	
 Control measure ● Off ○ 1 measurement ○ 2 measurements	Choose with the [▲] and [▼] buttons the quantity of measurement before an alarm signal is given. The true repetition analysis performed within 3 minutes. Choose and confirm by pressing the [OK] button.

Stop analysis	Stop the analysis after a bad water result?

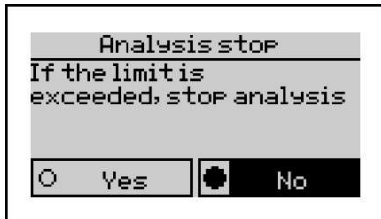|	Confirm [Yes] or [No] using the [◄] and [►] buttons. Press [OK]. [Yes] After passing the silicate we will have a firm analysis. The alarm remains active. To reactivate the analysis, the device must be set in automatic mode. [No] The analysis continues. The alarm is removed when the silicate returns.

Input 1	Choose the function of input 1

	Press [OK].

Input 1	
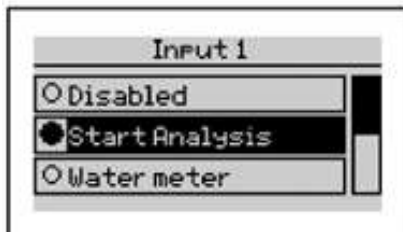
	You can choose one of the following functions: • Disabled • Start analysis • Water meter • Flowmeter for analysis during water consumption • Memory reset Confirm your choice by pressing the [OK] button

Choice 'start analysis'	
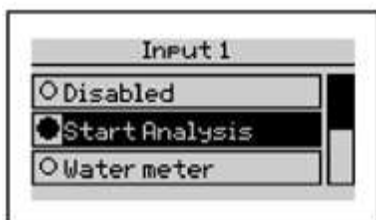
	The analysis will start when the contact of the terminal board 13 "INPUT 1: Input contact" and terminal board 14 is closed. (For this function, the analyzer must be in automatic mode)

Wizard - first start
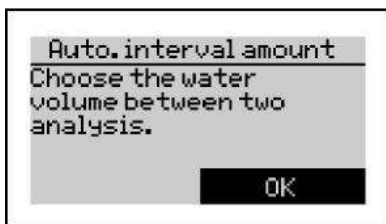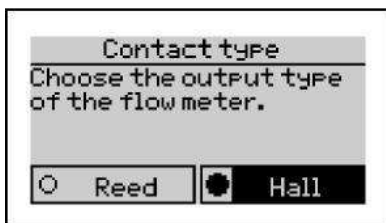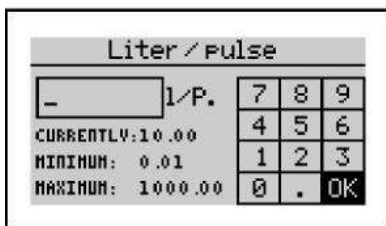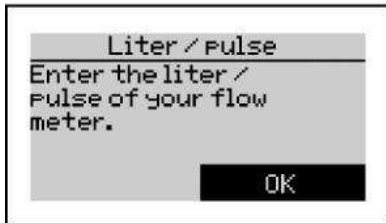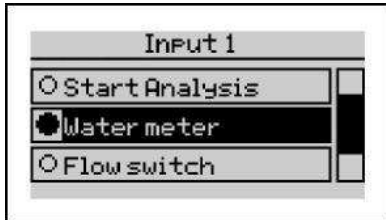
| Insert the meter impulse

You will see an input keyboard on the right.
Now move with the black cursor on the desired digit and press the [OK] key.
The selected digit appears in a frame on the left. Repeat the entry until the desired limit is in the box. Now move the cursor to the OK field and press the [OK] key.
(For this function, the analyzer must be in automatic mode)

🛈

On the left you can see the indications:
Currently: Currently programmed value
Minimum: minimum programmable value
Maximum: maximum programmable value
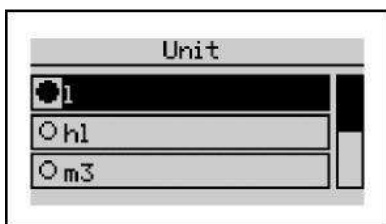
🛈

If the value in "Currently" corresponds to the desired one, it is not necessary to re-enter the digits; you can immediately move the cursor to the OK field in the display and confirm with the [OK] key.

Program the type of counter. If it is a REED (on / off) or Hall contact (with auxiliary voltage):
Reed for on / off contact
Hall for electronic counter

Press the [OK] button.

Set the measurement unit using the arrows.

Confirm with [OK].

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Program the amount of water that must be consumed between two analysis.

On the left you can see the indications:
Currently: Currently programmed value
Minimum: minimum programmable value
Maximum: maximum programmable value

If the "Currently" value is the required value, it is not necessary to re-enter the digits. You can immediately move the cursor to the OK field in the display and confirm.

With choice of flow meter | It is a flow meter n.c. or n.o.?

[n.o.] Opened contact = no analysis
Closed contact = analysis in the programmed time/volume.
[n.c.] Opened contact = analysis in the programmed time/volume.
Closed contact = no analysis

Choose the type of contact and confirm with [OK].

(For this function, the analyzer must be in automatic)

Wizard - first start
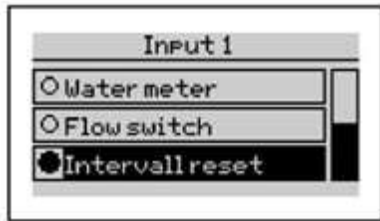
[n.o.] Opened contact = analysis in its scheduled interval
      Closed contact = analysis interruption and memory reset
[n.c.] Opened contact = analysis interruption and memory reset
      Closed contact = analysis in its scheduled interval
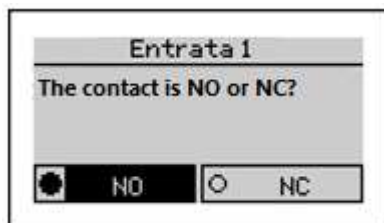
If the input contact is closed, the analyses are
immediately interrupted and the device is stopped
as long as the input contact remains closed.
The output signals are deactivated, the 0 (4) -20mA output
goes to 0 or 4 mA.

Select and confirm with the [OK] key.

As soon as the input contact is opened, the evaluation
interval begins. However, as there is still no display
value on the display, the first analysis is performed
after 1 minute, before the start of the set analysis
interval (e.g. 5 minutes).
(When using this function, the DUROMAT must be in
automatic mode)

Input 2	Remote fault reset.

Input 2 can be used to reset a fault signal.

Confirm with [OK].

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Wizard - first start

REL 1 output contact	Do you want a continuous or an impulse contact with the exceeding maximum value 1?
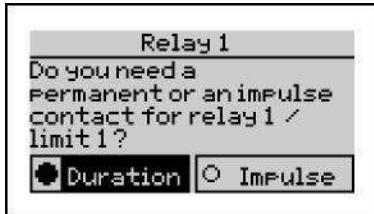
Choose the contact type [Duration] or [Pulse] and confirm with [OK].
[Duration] after the hard water signal, the relais stays active until the hardness stays below the programmed maximum value 1.
[Impulse] The relais gives only an xx s impiulse (to be programmed)

If a pulse contact is selected	Set the pulse duration for relay 1.
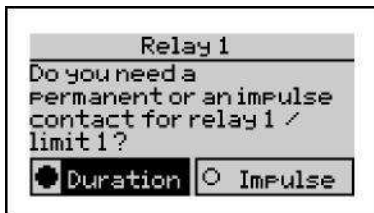
You will see an input keyboard on the right.
Now move with the arrow keys [◄]; [►]; [▲] and [▼]. the black cursor on the desired digit and press the [OK] key.
The selected digit appears in a frame on the left. Repeat the entry until the desired limit is in the box. Now move the cursor to the OK field on the keyboard and press the [OK] key.

🛈

On the left you see the indications:
Currently: Currently programmed value
Minimum: minimum programmable value
Maximum: maximum programmable value

🛈
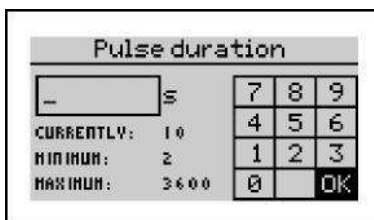
If the "Currently" value is the desired value, you don't need to re-enter the digits. You can immediately move the cursor to the OK field in the display and confirm.

Wizard - first start

REL 2	REL 2 indicates a result below the measurement range
Relais 2 Cannot be programmed: value alarm<measuring range OK	When the analysis result is below the reagent measurement range, relay 2 is activated. Press the [OK] key. ⚠️ Values below the lower value show no staining of the sample. This can mean: absence of silicate, lack of reagent or malfunction.
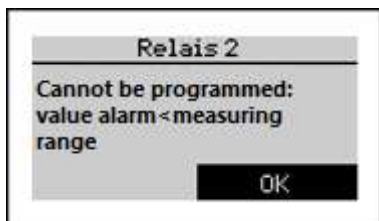
REL 3	Relay 3 is used to indicate a device error.
Relay 3 Relay 3 is used for reporting errors / standby. OK	Relay 3 is used to indicate a device error. The device goes in "standby". Press the [OK] key. ⚠️ Relay 3 is always activated (COM and n.a.) to indicate even if the connection cable is disconnected. In the event of a device failure, relay 3 switches off and establishes the COM-to-NC connection.

REL 4	Select the switching function for relay 4
Relay 4 Choose the switching function for relay 4. ○ Analysis ● Reagent	Choose between [Analysis] or [Reagent], confirm with the [OK] button. [Analysis] Relay activated during analysis. [Reagent] Active relay with reagent level <10%.
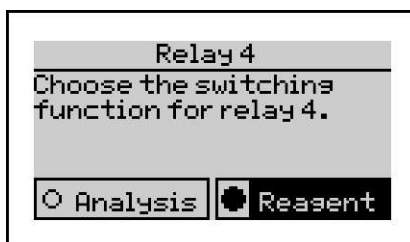
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With choice analysis	Analysis deceleration (cooler connection)?
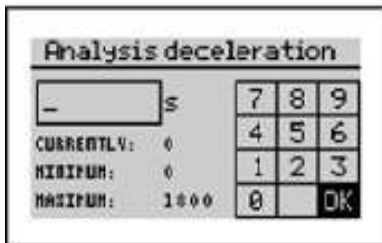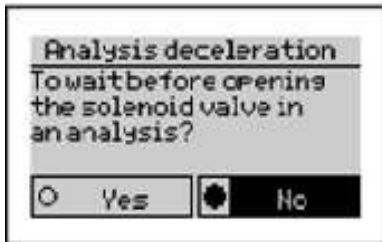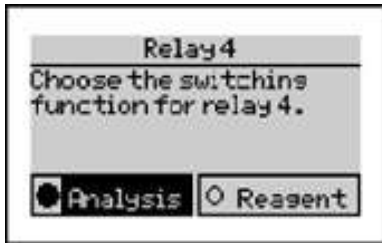
Choose [Yes] or [No] and press the [OK] button.

[Yes] The analysis start is delayed. It is used to operate a cooling system first and after a programmed delay to start the analysis.

The relay remains active during the delay time and during the analysis.

[No] The relay is activated only during the analysis (contact between COM and n.o.).

Enter the delay time (it can also be 0 seconds).
Confirm with [OK].
(For further information: see page 34)

Output 0(4) – 20mA	Choose the type of output.
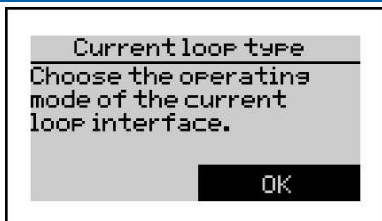
Press [OK].

Output 0(4) – 20mA	
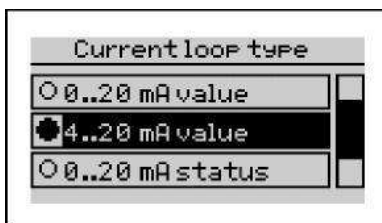
Choose with the [▲] and [▼] buttons one of the following options:

-Output disabled (off)
- 0 - 20 mA measured value
- 4 - 20 mA measured value
- 0 - 20 mA device situation
- 4 - 20 mA device situation

Confirm with the [OK] button. (For the choice of situation (status) see page 36)

Wizard - first start

With choice: measured value	Enter the value corresponding to 20 mA.
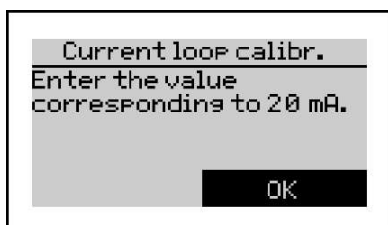
Press [OK].

With choice: measured value	Enter the value corresponding to 20 mA..
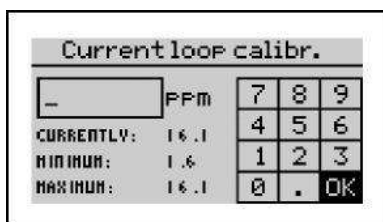
Here you can enter the measured value up to which the Currently interface is to be scaled.

It is recommended to set the value for 20 mA at the end of the measuring range of the indicator, but it is also possible to select lower values.
(See page 39 for more info).

You will see an input keyboard on the right.
Now move with the arrow keys [◄]; [►]; [▲] and [▼] the black cursor on the desired digit and press the [OK] key.
The selected digit appears in a frame on the left. Repeat the entry until the desired limit is in the box. Now move the cursor to the OK field on the keyboard and press the [OK] key.

On the left you see the indications:
Currently: Currently programmed value
Minimum: minimum programmable value
Maximum: maximum programmable value

If the "Currently" value is the required value, you don't need to re-enter the digits. You can immediately move the cursor to the OK field in the display and confirm with the key.

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Wizard - first start

Wizard	Programming has been completed.
	Press [OK].

The device has been programmed with all the necessary steps.

If necessary, the individual parameters can be changed by entering programming:
Programming: Menu> Parameters

Programming

To enter programming, press the Menu button

Then press 'First start':
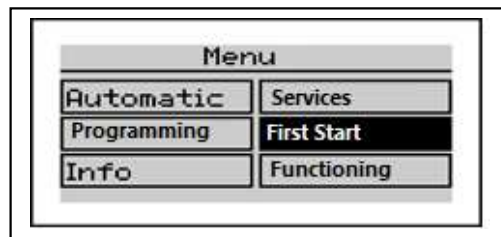
Put the device in "manual", re-enter the Menu and go to Programming.

ATTENTION: for the purpose of programming, put the analyzer back on automatic!

Below is the structure of the programming.

Programming

The menu structure is listed below to provide an overview of all analyzer functions:

```
            Menu
  Automatic    Services
  Programming  First Start
  Info         Functioning
```

Automatic on
Automatic off

Basic display:
Automatic
Manual

First start programming

General
*Language
*Time
*Import programming
*Export programming
*Return to factory programming

Analysis
* Reagent
* Max value
* Washing time
* Timed analysis time
* Quantity of water between 2 analysis
* Stop analisi
* Stop analysis
* Device calibration

Inputs
* Input IN1
* Input IN2

Outputs
*0(4) – 20mA
*value 20mA
*Relay 1
*Relay 2
*Relay 3
*Relay 4

* Start analysis
* Dosing reagent A
* Dosing reagent B
* Dosing reagent C
* Chamber washing
* Maintenance confirmation
* Counts good / bad analyzes
* Diagnostics (manual control)

Manual control:
*Display
*sensors
*Electromagnetic valve
* Reagent A pump
* Reagent B pump
* Reagent C pump
* Magnet
* Relay 1
* Relay 2
* Relay 3
* Relay 4
* Output 0 (4) -20mA
* Input 1
* Input 2

* Deactivate (off)
* Start analysis
* Water meter
* Flow meter
* Reorganization of
analysisand memory

*Analysis
*lack of indicator

Analysis delay

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Operation

Manual and automatic operation

The analyzer can be started in automatic mode (Menu> Automatic) based on the time or by an external button (e.g. flow meter). In manual mode (automatic switch-off) it is possible to start functions such as analysis, activate the indicators or manually control the rinsing. In addition, a manual function is also included to test the individual components of the device.

In automatic mode, analysis are performed at the scheduled interval or by an external start. Automatic mode is active after power on. The first analysis is started after 3 minutes, all subsequent analysis are performed at programmed intervals.

Main menu

The main menu can be opened by pressing the [Menu] button.

Menu	Description
Automatic	Change between automatic and manual mode
Parameters	Device setting and analysis parameters
Info	Overview of hardware and software version information and display of meter readings
Service	Service functions for maintenance, diagnosis and indicator change
Assistance	for the guided programming of the device
Chronology	Display of the last 100 measurement results with date and time

Operation

Info

The Information menu item in the main menu shows additional information about the device and the measuring point:

Info	Description
Hardware version	Version of the hardware used
Software version	Software version installed
Analysis counter	Number of analysis performed since commissioning
Maintenance counter	Number of remaining analysis – Service life of the peristaltic pump cassette: it is set to 30,000 analysis (after confirmation of "maintenance")
Maintenance date	Expiry date of the peristaltic pump cassette used: it is set to 2 years when maintenance is confirmed in the service menu.
Good analysis	Number of analysis without exceeding the limit value: can be reset in the service menu under 'Good / bad meter'
Bad analysis	Number of analysis exceeding the limit value: can be reset in the service menu under 'Good / bad meter'.

Behaviour in case of power failure

All device settings are stored in a SD card or an internal memory. In the event of a power failure, all settings are available even after the device is turned on. If the device is in automatic mode, the analyzer automatically starts an analysis based on the set time intervals.

Relay 2 (ready/operational error) is activated after switching on the device (connection from COM to NO). An external control unit can detect if the device is ready for operation or if an error has occurred, for example a device error, a power outage or a line fault.

In case of device failure and replacement of the same, it is possible to export the settings from the old device to the SD card inserted in the new one (Menu> Parameters> General> Export settings). After inserting the SD card into the new device, you can import the settings (Menu> Parameters> General> Import settings), the programming is transferred to the new device which continues the work as the old one. The memory of the old data remains, and new ones are added.

Operation

Micro SD

The analyzer contains an SD (Micro SD) card. The following information is stored in this memory card: measured values, error messages, device configuration, device firmware.
The data is stored as a .csv file. These files can be opened with an editor or a spreadsheet program (e.g. MS Excel, OO Calc) and further processed data. There are also system files (.bin).

The analyzer works perfectly even without an SD card, but only the last 100 measured values are saved internally.

The level of the indicator is saved on the SD card. If the device is turned off and on again without a card, it is unable to read a bottle filling level and therefore emits an indicator missing message (bottle filling level less than 10%).

If you want to use another SD card than the one provided, make sure it is formatted as follows:

Memory capacity: max. 4,0 GB / 32,0 GB
File system: FAT16 / FAT32

The following files are located on the SD card:

File name:	Type	Content
trend.csv	Data	Measurement results in tabular form with date, time and measured value. Data are stored in the following format: : AAAA.MM.DD [tab] hh.mm [tab] x.xxx [tab] unit [LF]. The measured values (x.xxx) are stored in the unit displayed on the device.
error.csv	Data	Error messages in tabular form with time, date and error. Data are stored in the following format: YYYY.MM.DD [Tab] hh.mm [Tab] Error code [LF].
history.dat	System	analysis results of the history.dat system with date and time. The device loads them into the internal memory on start-up.
setting.dat	System	Full setup of the analyzer device (optional file). Before replacing the analyzer, you can transfer the saved device configuration directly to the new device. The export is in the menu in Parameters> General> Settings. Export. The device configuration is accepted in the menu below: Parameters> General> Settings. Import.
logfile.dat	System	System date, date, time and device start-up. This file is required for internal purposes
TA28xxx.bin	Operative	This file is not present on the SD card by default. If there are software updates for your analyzer, these will be provided by our sales partners or can be downloaded from our homepage. You can copy this file to the SD card and perform a software update.

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Operation

File name	Type	Content
INDICE.HTM	Data	Configuring the device as an HTML page. It can be printed and saved for system documentation. It is generated when the device configuration is exported.
MAIN.CSS	Data	Style file associated with INDEX.HTM for display as A4 page. It is generated when exporting the device configuration.

Maintenance and service

Periodic maintenance of the device is required to allow the analyzer to function properly and for a long time. Make sure that the device is turned off before maintenance work and no analysis is performed during this period. Always wear safety glasses and gloves to avoid contact with the indicator, cleaning liquid or other liquids.

 Observe the safety regulations when handling chemicals and use the necessary protective equipment.

 Wear safety glasses

 Wear protective gloves

The following maintenance intervals must be observed:

Interval	Maintenance and service
Every 2 weeks	Check the measuring chamber for contamination and clean it if necessary. In the case of high room temperatures and water or water with a high organic load, the cleaning intervals may need to be shortened.
after 15,000 analyzes or after 12 months	Install the cleaning and maintenance kit

Maintenance and service

Cleaning the measuring chamber (recommended: cleaning set FESKS® art.nr. 200013)

Observe the safety regulations when handling chemicals and use the necessary protective equipment.

Wear safety glasses

Wear protective gloves

Cleaning of the measuring chamber takes approximately 20 minutes. Proceed as follows for cleaning:

- Switch off the device.
- Remove the head of the peristaltic pump from the support by releasing it with the clips in the superior and inferior part.
- Disconnect the tube from the reagent cap and the reagent bottle.
- Remove the two metering caps.
- Pull the locking pins slightly forward. (They can only be pulled up and not pulled out).
- Remove the three fittings on the right and the cap on the top.
- Pull the measuring chamber to the right from the fixing bolts on the control box.
- Remove the magnet.
- Use a flat-blade screwdriver to lift the indicator plug upward.
  (Make sure the locking pins are raised before levering)
- Clean the measuring chamber and caps using the FESKS cleaning set. Clean as described on the package in the set.

In the event of an incrustation (often hard water measurement) it is necessary to leave the measuring chamber (only the block of plexiglass) overnight in the basin of the cleaning set (bath with phosphoric acid as described in the cleaning set).

For trouble-free operations, it is important to clean not only the measuring chamber but also the lens of the transmitter LED. Take a damp cloth and clean with the two solutions found in the DUROMAT® cleaning set.

For reassembly, respect the frequency:
- Lubricate the O-rings (5 x J e 1 x C) with professional vaseline. See spare parts photos on page 87.

The blue dosing O-ring (D) on the reagent caps must not be lubricated with technical vaselin.

On the other hand, the O-rings (5 x J e 1 x C) must be lubricated with technical vaseline before insertion into the measuring chamber.

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Maintenance and service

- Screw the two metering caps into the front of the measuring chamber.
- Pull up the locking pins, insert the reagent plug and lock it.
- Place the cleaned measuring chamber on the fixing bolts and lock it in place.
- Insert the magnet.
- Pull up the locking pins, insert the inlet plug, actuator plug and drain plug into the measuring chamber and lock them.
- (Make sure that all plugs are inserted into the measuring chamber up to the stop and lock them, otherwise the plugs can be damaged)

- Connect the connectors to the reagent plug and to the two dosing plugs in a screwable manner.
- Turn the device on again.
- Wash the measuring chamber (programming: Menu> Service> Manual wash).
- Insert reagents A, B and C into the measuring chamber
  Programming: Menu> Service> Reagent Change A
  Programming: Menu> Service> Reagent Change B
  Programming: Menu> Service> Reagent change C

⚠️ It is important that all three reagents A, B and C are pumped until no more air bubbles escape from the reagent cap and dosing caps.
Air bubbles in tubes or plugs lead to measurement errors.

Has a full reagent bottle been used?
Select [Yes] or [No] and press the [OK] button.
   [Yes] The bottle level is set to 100%.
   [No] The previous bottle level in % is kept.

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

The device is ready for use again.

Maintenance and service

They must be replaced at regular intervals (every 12 months or 15.00 analysis): the head of the peristaltic pumps, the flexible hoses and the O-rings.
The necessary spare parts are included in the "Maintenance set for FESKS® diamond SiO2".See page 90.

Observe the safety regulations when handling chemicals and use the necessary protective equipment.

Wear safety glasses

Wear protective gloves

Replacement takes about 25 minutes.

Proceed as follows:
- Switch off the device.
- Remove the peristaltic pump head from the support by unlocking it with the clips at the top and bottom.
- Disconnect all hose connections.
- Loosen the suction lances from the bottle adapters and remove them.
- Pull the locking pins slightly forward (they can only be pulled up and not pulled out).
- Remove the drain plug, actuator plug and inlet plug from the measuring chamber.
- Pull the measuring chamber on the right side from the mounting bolts on the control housing.
- Remove the stirrer blade from the measuring chamber.
- Use a flat head screwdriver to lever the reagent plug upward. (When levering, make sure the locking pins are pulled up).
- Screw the two metering caps from the front of the measuring chamber.
- Pull up the locking pin of the light rod plug.
  Take a non-metallic object such as a plastic or wooden rod, insert it into the actuator pin hole and use it to push the light rod pin out.
  (The plug of the light rod belongs to the optical measurement section and should not be scratched.)
- Remove the O-rings (6 x J, 1 x C and 3 x D) from the caps. See spare parts illustration on page 87.

Maintenance and service

- Clean the measuring chamber and the caps using the Cleaning Set (Art. 200013) as described in the instruction sheet.

⚠️ For a trouble-free operation, it is important that the actuator plug with the white LED is also clean. Take a cloth and moisten it with ethyl alcohol (included in the cleaning set) and clean.

During assembly, observe the following sequence:
- Slide the O-rings onto the caps (6 x J, 1 x C e 3 x D). See spare parts photo on page 87

⚠️ The blue dosing O-ring (D) on the reagent cap must not be lubricated with vaseline.

On the other hand, the O-rings (6 x J and 1 x C) must be lubricated before being inserted into the measuring chamber.

- Pull the locking pin up, insert and lock the light rod plug.
- Screw the two metering caps into the front of the measuring chamber.
- Pull up the locking pins, insert the reagent plug and lock it.
- Place the cleaned measuring chamber on the fixing bolts and lock it in place.
- Insert the new stirring blade into the measuring chamber.
- Pull up the locking pins, insert the inlet plug, actuator plug and drain plug into the measuring chamber and lock them.
- (Make sure that all plugs are inserted into the measuring chamber up to the stop and only then locked, otherwise the plugs can be damaged)
- Place the new peristaltic pump cassettes on the brackets so that they snap into place. (Note that these are 2 types of peristaltic pump cassettes)
- One tube pump cassette has white rollers and the other two have black rollers.
- Insert the new suction lances into the bottle adapters.
- Connect the new pipes. See the illustration on page 41

⚠️ The hoses must not be kinked.

- Turn on the device again.
- Wash the measuring chamber (programming: Menu> Service> Manual wash).
- Insert reagents A, B and C into the measuring chamber
  Programming: Menu> Service> Reagent Change A
  Programming: Menu> Service> Reagent Change B
  Programming: Menu> Service> Reagent change C

> ⚠️ It is imperative that all three reagents A, B and C are pumped until no more air bubbles escape from the cap and the two dose caps.
> Air bubbles in tubes or plugs lead to measurement errors.

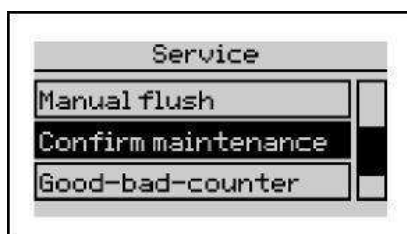*Has a full reagent bottle been used?*
  Select [Yes] or [No] and press the [OK] button
  [Yes] The bottle level is set to 100%.
  [No] The previous bottle level in % is kept.

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

The "Maintenance" message is hidden on the display and only appears after 12 months or after 15,000 analyzes, so you need to perform maintenance again. (Programming: Menu> Service> Confirm maintenance).

```
            Service
 Manual flush
 Confirm maintenance
 Good-bad-counter
```

```
      Maintenance counter
 Has a maintenance /
 initial installation
 been performed?
      Yes          No
```

Choose [Yes] or [No] with the arrows [◄] and [►] and confirm with the [OK] button. [Yes] The maintenance deadline is reset and appears after 30,000 analyses.
(See in the Menu> Info)
[No] The maintenance deadline is not reset.

Maintenance and service

Change the reagent bottles

First check the expiration date of the new reagent bottles. Use only reagents that are not expired.

Proceed as follows:
- Switch off the device.
- To replace the indicator bottle, loosen the screw cap off the bottle and insert the new one. If necessary, collect the drops.

> ⚠️ Make sure that bottles A, B and C are connected to the correct peristaltic pump cassettes.

- Switch on the device again.
- Rinse the measuring chamber (programming: Menu> Service> Manual rinse).
- Insert reagents A, B and C in the measuring chamber
  Programming: Menu > Service> Replace reagent A
  Programming: Menu > Service> Replace reagent B
  Programming: Menu > Service> Replace reagent C

> ⚠️ It is important that the 3 reagents A, B and C are pumped untill no air bubbles come out from the cap and the two dosing caps.
> Air bubbles in the pipes and caps can lead to measuring mistakes.

Was a full reagent bottle used?
Choose [Yes] or [No] with the arrows [◄] and [►] and confirm with the [OK] button.
[Yes] The indicator level is set to 100%.
[No] The Currently level remains stored.

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

The device is ready for use again.

Maintenance - reset of good/bad analysis counts

Good/bad analysis counter

The analysis results are counted through the good / bad analysis counter.
You will see the screen:
Programming: Menu> Information

Exceeding the maximum hardness limit increases the "bad analysis" counter. A result with good water increases the "good analysis" counter. This list can be used to evaluate the function of a water softening system. The number of incorrect measurements should be significantly less than the number of valid measurements

The counters can be reset in the menu.
Programming: Menu> Service> Good-bad counter
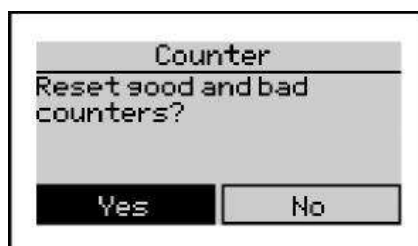
Device calibration

The device is factory calibrated in an ambient temperature of 20 ° C. When operating in very hot or cold places, it is recommended to calibrate the device during commissioning.

To do the calibration we will have two possibilities:
a)   Calibration on the local water
b)   Calibration on known hardness solutions (for example: pharmaceutical sector)

**Calibration on the local water (you need a water analysis from a laboratory):**
It produces 1 liter of water with a hardness that is around the alarm set point (mix softened water with hard water). Have it analyzed by the laboratory to be sure of its hardness.

> ⚠️ Do not use a drop testkit to determine the hardness of the water. The FESKS® professional analyzer is always more precise than a manual testkit.

•Close the inlet water and install a bypass system
(see drawing)
•Close the inlet valve
•Open the bottle valve
•Start an analysis and press the bottle to bring water into the chamber
•Wait for the result
•Repeat the procedure 2 more times
•Calculate the correction factor for the analyzer using the following formula:

$$\text{correction factor} = \frac{\text{hardness measured in laboratory}}{\text{hardness measured by analyser}} \times 100\%$$
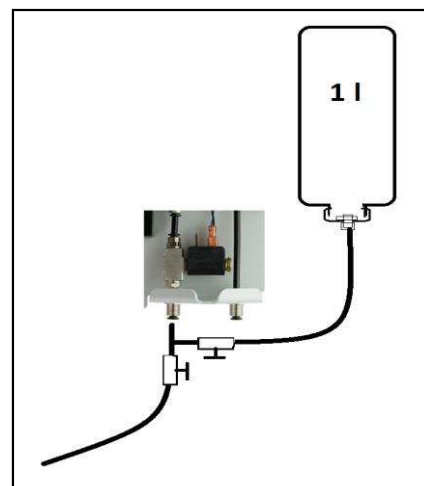
Program the factor in the step:
(Programming: Menu> Parameters> Analysis> Calibration factor)

Calculation example:
Value measured in laboratory = 7,5 mg/l Silica
Value measured by the analyzer: = 8 mg/l silica

$$Correction\ factor = \frac{7,5\ mg/l}{8,0\ mg/l} \cdot 100\ \%$$
$$Correction\ factor\ 93,75\ \%$$

93,75 % roundend up => *correction factor = 94 %*

The correction factor can only have whole numbers, so round up and enter the correction factor in the input mask on the device.

Maintenance - battery change

Battery change

If the device does not show the time after switching off and on again, the internal backup battery must be replaced. The life of the factory-installed-battery is several years. The watch is powered by device power; therefore, the battery life is longer if the device is turned on.

Proceed as follow:
•Turn off the device and turn off the power.
•Open the cover of the electronic box with the 4 screws (battery holder inside).
•Replace the battery with a new CR2032.
•Close again. Make sure that the connection cable between the display board and the controller isn't lose.
•Reschedule the current time and date.
•Dispose the battery in a suitable collection point.

Maintenance - software update

Software update

The analyzer offers the possibility of a software update. As part of the product improvement, you will receive software updates from your reseller or from our website. If necessary, the reseller will send you a file with the name SI32xxx.bin.

To perform a software update, proceed as follows:
- Save the current programming (Menu> General> Export programming)
- Turn off the device and turn off the power.
- Open the cover of the amplifier box with the 4 screws and remove the SD card.
- Copy the SI32xxx.bin file to the SD card using a computer and insert it again.
- Close again. Make sure that the connection cable between the display board and the controller isn't loose.
- Hold down the [OK] button and turn on the device. As soon as 'Software update' appears on the display, release the [OK] button. The device updates the software and then starts measuring again.
- Turn off the device, remove the SD card and delete the SI32xxx.bin file.
- Reinsert the card into the device.
- Check the device configuration. In case of data loss, import the schedule (Menu> General>Schedule import).

Diagnostic

It is used to check the operation of the various components (including connected external components).

⚠️ Only authorized and qualified people can perform the diagnosis. Various alarm signals that directly affect the operation of the water treatment plant are created.
Respect the safety rules in force.

To do this, follow the following program function:

Programming: Menu> Service> Diagnostic program

Display
The display changes the colour between red, green and blue.

To finish press [OK].

Sensor

The transmitter LED in the measuring chamber switches on and off continuously. In the case of a defective sensor, an error message appears. If the LED in the measuring chamber does not light up, check the electrical connection on the transmitter plug and the socket on the device; if the plugs are inserted correctly, but the transmitter does not turn on, the latter must be replaced. During tests, intensity bars for red, green and blue are displayed. Press the [OK] button to finish.

Electromagnetic valve (inlet water to the measuring chamber)

The solenoid valve in the water inlet can be opened and closed using the [OK] button. If not, check the electrical connection of the solenoid valve in the device. If the sockets are inserted correctly, measure the voltage when the valve is open; the voltage should be 24 VDC. In this case, it is possible to exclude a failure in the electronics and it means that the solenoid valve is defective. Check if the solenoid valve contacts are oxidized.

To exit, place the cursor on Exit and press the [OK] key.

Pump reagent A
When starting the reagent A pump, the peristaltic pump head spins for 2 seconds. You can see the rotation of the rollers in the peristaltic pump cassette and hear the rotation of the motor. If not, check the four-pole connection of the motor on the circuit; if only the noise is audible, the peristaltic pump cassette is defective. Otherwise, the motor or control board may not work properly.

To exit, place the cursor on Exit and press the [OK] key.

Diagnostic functions

Pump reagent B

When starting the reagent B pump, the peristaltic pump head spins for 2 seconds. You can see the rotation of the rollers in the peristaltic pump cassette and hear the rotation of the motor. If not, check the four-pole connection of the motor on the circuit; if only the noise is audible, the peristaltic pump cassette is defective. Otherwise, the motor or control board may not work properly.

To exit, place the cursor on Exit and press [OK].

Pump reagent C

When starting the reagent C pump, the peristaltic pump head spins for 2 seconds. You can see the rotation of the rollers in the peristaltic pump cassette and hear the rotation of the motor. If not, check the four-pole connection of the motor on the circuit; if only the noise is audible, the peristaltic pump cassette is defective. Otherwise, the motor or control board may not work properly.

To exit, place the cursor on Exit and press [OK].

Magnet

The magnet in the measuring chamber is activated and slowly increases its speed until maximum. If the magnet does not turn, check that the drive motor connector is correctly inserted on the control board (red connector).
Remove the measuring chamber and check whether the drive disc (which has two silver magnets) in the agitator does not rub or stick to the motor housing. The two magnets are located under the measuring chamber in the black block.
If none of these causes can be determined, the drive motor must be replaced.
Press the [OK] button to finish.

The positioning of the connectors is shown at page 19.

Relais 1 to 4

When the relay diagnostic function starts, the selected relay is switched between the contacts n.c. and n.o. using the [OK] button.
Use a continuity tester to check the contact between the COM and n.c. connections and COM and n.o. If the switching processes are not measurable, the base board must be replaced. To exit, place the cursor on Exit and press the [OK] key.

0(4)-20mA Output

An amperometer is required to test the current interface. Measurements are made between terminals 11 (+) and terminal 12 (-).
The current output is shown on the display as I = xx mA, the same value should also be measured on the two terminals. Tolerance ± 0.3 mA, please note the accuracy of the current measuring device.
By pressing the [OK] key, the output current is increased by 2 mA until the maximum value of 20 mA is reached.
To exit, place the cursor on Exit and press the [OK] key.

Diagnostic functions

Entry IN 1 and 2

To test the inputs, you need a multimeter set to continuity test.

(INPUT 1) no link is set between terminal 13 and 14, then the display shows "open".
If a link is set, the display shows "closed"
(INPUT 2) no link is set between terminal 28 and 29, then the display shows "open".
If a link is set, the display shows "closed".

If you want to link with a multimeter, note the following:
For INPUT 1, connect the multimeter's COM connector to terminal 13 and the multimeter's Volt connector to terminal 14.
For INPUT 2, connect the multimeter's COM terminal to terminal 28 and the multimeter's Volt terminal to terminal 29.

Press the [OK] key to exit.

Diagnostic mode has ended.

Errors and signals

The analysis doesn't start
- The display must be in "automatic" and not "manual"
- Check if a flow meter is configured and connected.
- Check if a time interval has been entered.
- Check if a water meter is fully configured and connected.
- If necessary, check the connection from an external controller.

Test zero error
- Check that there is water in the measuring chamber and that the water supply and drain are connected correctly.
- Check that the measuring chamber is not contaminated (gas bubbles or foreign bodies).
- Check the water inlet and pressure function (1-2 bar recommended).
- Check that the water drain is free and that there are no foreign bodies in the solenoid valve.
- When using a pump to dispense the sample, check that the pump is connected correctly.
- Check the sensor and solenoid valve via the diagnostics menu.

Error message E11 reagent
- Check that there is still enough regent in the bottle.
- Check the suction pipe, it must be free of air bubbles. Deaerate.
- Check if there is water in the measuring chamber
- Check the dosage and that the magnet turns in the chamber
- Check if the drain is free
- Using a launch pump: check the operation of the pump
- Check whether the inlet and outlet are connected the right way round. Inlet=under solenoid valve
- Check the inlet prefilter.
- If the 0-20 mA output has been programmed as a "value", the output gives 0 mA

Error message E12 water flow
- Check for pressure
- Check the function of the solenoid valve
- Check whether the drain is blocked
- Check the launch pump, shut-off valves or external solenoid valves (if present).
- If the 0-20 mA output has been programmed as a "value", the output gives 0 mA

Error message E13 optics
- Check that the measuring chamber is not dirty.
- Check the electrical connection of the actuator plug.
- Check the correct position of the actuator pin.
- Check the color sensor in the diagnostic menu.
- 0 mA is output on the current output if the "Value" type is set on the Currently interface.

Errors and signals

Titration is not performed correctly

- Check if the rotor is in the measuring chamber.
- Check if there is no water going to the drain during the metering (defective solenoid valves)
- Check if there is still enough indicator in the bottle.
- Check for air bubbles in the connection tube between the indicator bottle and the peristaltic pump.
- Check that the blue O-Ring is at the end of the metering cap pin.
- Check if there is water in the measuring chamber.
- Check the delivery of the indicator, the sensor and the impeller in the diagnostics menu

Differences in the analysis result

- Check if there is no water going to the drain during the indicator dosage (faulty solenoid valves)
- Check if the type of indicator programmed corresponds to the one used.
- Check for air bubbles in the indicator tube.
- Check the discolouration of the sample water due to foreign substances and turbidity due to air bubbles during the zero test.
- Check that the water connection and drain are not reversed.
- Check for the presence of the magnet.
- Check if the blue O-Ring is present on the metering cap and is inserted correctly.
- Check that the solenoid valve closes correctly.
- Replace the hose pump box.
- Check that a water sample complies with the limit values for additives, foreign substances and pH.

The analysis doesn't start, everything is turned off and the analysis starts again

- Check the electrical contacts of the solenoid valve, they are most likely oxidized, therefore, replace the solenoid valves and possibly the socket. Do not use a different solenoid valve.
- Disconnect all the outgoing and incoming RELAY contacts. Do an analysis again. If solved, connect one relay after another until a defect occurs. In this case, the last connected component is defective.

Spare parts
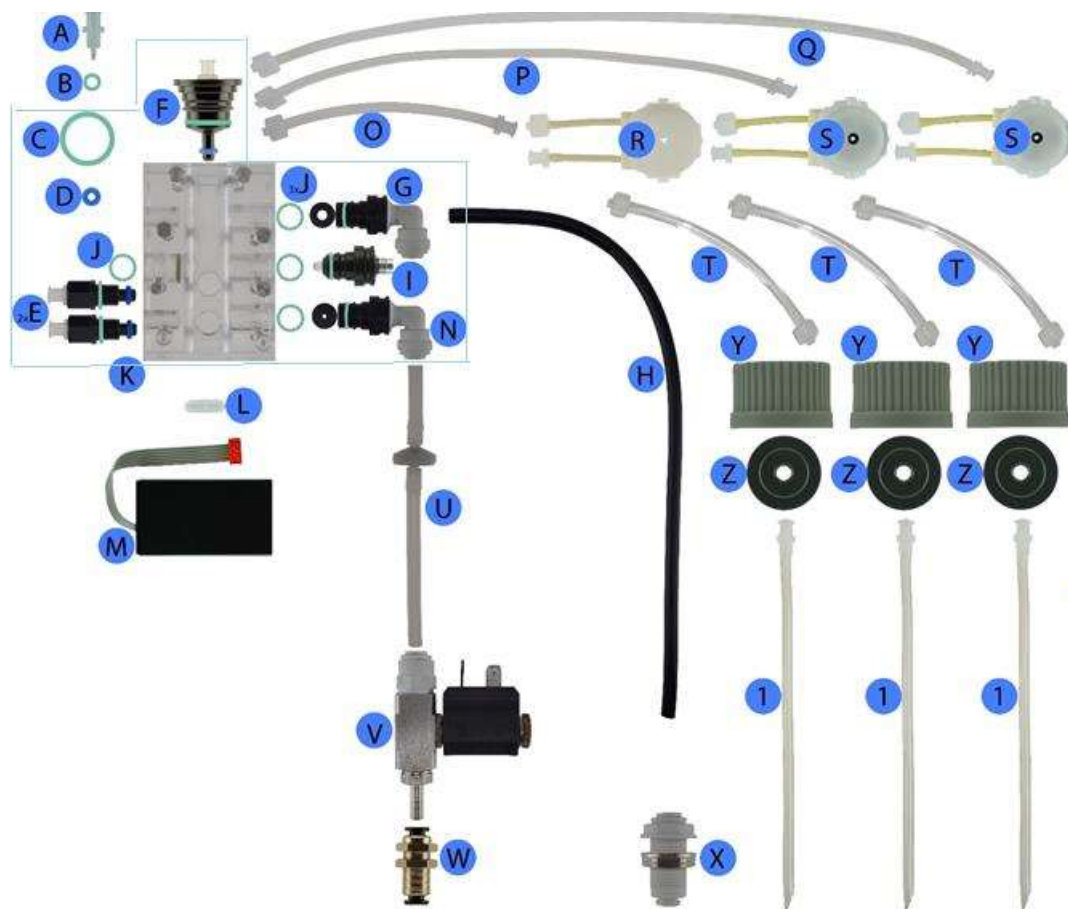
Maintenance set

B, C, D, 4xJ, R, 2xS	Set di manutenzione DUROMAT diamond Maintenance set for DUROMAT diamond	111907

Spare parts for 2 – 3 years

M	Motorino del magnete Magnetic stirrer actuator	1 px 111727
V	Valvola elettromagnetica 24V Solenoid valve 24V complete	2 px 111770
	Camera di misura completa Complete measuring chamber	1 px 111695
F	Iniettore indicatore in alto (compreso pos. A, B, C, D) Dosing plug high (complete with Pos. A, B, C, D)	1 px 111717
E	Iniettore indicatore completo (compreso pos. J, E) Dosing plug (complete with Pos. J, E)	2 px 111718
B, C, D, 4xJ, R, 2xS	Set di manutenzione DUROMAT diamond SiO2 Maintenance set for DUROMAT diamond SiO2	6 px 111907

Appendix

Position	Item description	Nr. art.
A	Luer connection	111719
B	O-Ring 5,28 x 1,78 green	111219
C	O-Ring 16 x 2 green	111225
D	Dosage O-Ring 3,2 x 2,5 blue	111218
E	Screw-on dosing cap complete with position A, B, J and D	111718
F	Top dosing cap complete with position A, B, C and D	111717
G	Drain plug with 1/4 inch connection and 5mm hole with Pos. J	111715
H	Drainpipe ¼"	111735
I	Complete actuator LED including J position	111740
J	O-Ring 9 x 1,5 green	111220
K	Measurement chamber body	111696
L	Magnet	111002
M	Magnet motor	111727
N	Elbow for water inlet to the measuring chamber, ¼ ", 2 mm hole, with Pos. J	111738
O	Pump delivery pipe A, length 130mm	111750
P	Pump delivery pipe B, length 250mm	111751
Q	Pump delivery pipe C, length 300mm	111752
R	Pump head A complete with tube (white rollers)	111760
S	Pump head C and B complete with tube (black rollers)	111761
T	Connection to reagent bottles	111734
U	Water inlet pipe to the measuring chamber with non-return valve	111765
V	Complete solenoid valve DUROMAT® diamond SiO2	111770
W	Complete connector for water inlet to the analyzer, metal, 6mm	111075
X	Complete connection for water outlet from the analyzer, plastic, ¼ "	111076
Y	Bottle cap	111060
Z	Inner cap of the reagent bottle screw	111038
1	Suction lance FESKS® FOSTCO 5000 SiO2	111010

Spare parts without illustration

Item description	Nr. art.
Measuring chamber with all green caps and O-rings including positions K, F, 2x E, G, I, N, L	111695
Electronic card with display	111970
Complete motherboard, FESKS® FOSTCO 5000 SiO2	111975
Complete pump A (motor, head and dosing tube)	111762
Complete pump B and C (motor, head and dosing tube)	111763
FESKS® diamond solenoid valve connection cable	111775
FESKS® diamond pump unit connection cable	111780
Optical sensor connection cable	111785

Appendix

Maintenance set

FESKS® FOSTCO 5000 SiO2 is mostly maintenance-free. We do supply a maintenance set is available for the analyzer. It is recommended to change peristaltic pump cassettes, tubing and O-rings after 15,000 runs or every year. The analyzer will show a maintenance notice on the display after the maintenance interval has expired. This counter must be resetted on the device when changing the peristaltic pump cassettes.

Furthermore, it is recommended to clean the measuring chamber regularly, we suggest every 2 months.

Item description	Nr. art.
Maintenance set F E S K S ® FOSTCO 5000 SiO$_2$	111907

Includes the following items:
- 3 x 111734 Connection to reagent, lenght 85mm
- 1 x 111750 Pump connector A 130mm
- 1 x 111751 Pump connector B 250mm
- 1 x 111752 Pump connector C 300mm
- 3 x 111010 Reagent suction lance
- 1 x 111225 O-ring 16 x 2 green
- 6 x 111220 O-ring 9 x 1,5 green
- 3 x 111218 O-ring blue
- 1 x 111760 Reagent A pump head
- 2 x 111761 Reagent B and C pump head

Cleaning set FESKS®

Road transport 200013

Air transport 200013S

Accessories

CanBus connection

	CanBus connecton ATTENTION: CanBus and WiFi cannot be used together. Choose only one additional card.	200157

ProfiBus connection

	ProfiBus connection (external). ATTENTION: it is connected to the ModBus output which cannot be used together with the ProfiBus.	200145

WiFi connection

	WiFi connection (in developement) ATTENTION: WiFi and CanBus cannot be used together. Choose only one additional card.	200158

Prefilter

	prefilter 6mm, 100 micron, plug-in	200175

Pressure reducer

	Pressure reducer (water inlet to be analyzed) • Max. Pressure inlet 8 bar • Regulation 0,8 - 3,9 bar	200022

Launch pump
Application: for example, sampling suction from a water tank

	Launch pump, self-priming up to 3 meters, 0.6 ltr / min 1 bar, 24V DC mounted in a box, complete with everything	200028

Coolers

The maximum sample water inlet temperature is 40 ° C. If the sample water is at a higher temperature, a pre-cooler must be used. Depending on the water and cooling water temperature, pre-coolers are available for flow cooling. PED certificates. .

	Cooler for water analyzers, certified PED, max. 80 ° C / 16bar, cold water max. 8bar	200030
	Cooler for water analyzers "big", 1/2 ", certified PED, max. 120 ° C / 16bar, cold water max. 8bar	200031
		200045
	High pressure automatic cooler, certified PED, max. 200 ° C / 40bar, cold water max. 8bar	

Dilution unit

To dilute a water with values higher than the measurement range. Dilution from 1: 1 to 1:10.

	Product in development.	2001600

CE Declaration of conformity

(Low voltage and electromagnetic compatibility directive)

I, the undersigned, representing the following manufacturer:

manufacturer: Fesks Instruments
address: Unit 1804 South BankTower 55 Upper Ground, London England SE1 9EY

hereby declares that the product

Identification of the product: "FESKS"

results in compliance with the provisions of the following EU directives (including all applicable changes)

Refer to n°	title
2014/30/UE 2014/35/UE	EMC (ELECTROMAGNETIC COMPATIBILITY) LVD (LOW VOLTAGE)

and that all the standards and/or technical specifications indicated on the back have been applied.

Last two digits of the year in which the CE marking was affixed...........19.........

Gargnano, 11/01/2019

CE Declaration of conformity

Reference to the standards and / or technical specifications, or parts of them, used for this declaration of conformity:

- harmonized standards: :

nr	title
CEI EN 55014-1/2008 +A1/2002+A2/2010	Electromagnetic compatibility. Requirements for household appliances, electric tools and similar appliances. Part 1: Issue.
CEI EN 55014-2/2015	Electromagnetic compatibility. Immunity requirements for household appliances, power tools and similar appliances. Part 2: Immunity.
CEI EN 61000-3-3/2014	Electromagnetic compatibility. Part 3: Limits - Section 3: Limitation of voltage fluctuations and flicker in low voltage power supply systems for equipment with rated Currently less than 16A and not subject to connection on condition.
CEI EN 61000-3-2/2015	Electromagnetic compatibility. Part 3: Limits - Section 2: Limits for harmonic Currently emissions (devices with input Currently less than 16A per phase).
CEI EN 60335-1 /2013-01	Safety of electrical appliances for domestic and similar use. Part 1: General rules.
CEI EN 30335-2-89/2011	Safety of electrical appliances for domestic and similar use. Part 2: Particular rules for commercial refrigeration appliances including a condensing unit of the refrigerating fluid or compressor, incorporated or remote.
CEI EN 50106/2010	Safety of electrical appliances for domestic and similar use Special rules for routine tests for appliances falling within the scope of EN 60335-1 and EN 60967
CEI EN 62233	Measurement methods for electromagnetic fields of electrical household appliances and similar with reference to human exposure.