USER MANUAL

3S-UVFL
Fluorescence Analyzer

3S Analyzers S.r.l. Italy www.3s-analyzers.eu May 2021

Electrical equipment marked with this symbol can not be disposed of through home or public waste disposal systems after 12 August 2005. In accordance with local and national European regulations (EU Directive 2002/96 / EC), users must return the equipment which is unsuccessful or can no longer be used to the manufacturer, which have to provide free of charge disposal.
Note: To return devices at the end of their useful life, accessories supplied by the manufacturer and all auxiliary items for recycling, contact the manufacturer or the vendor of the device to arrange proper disposal.

INDEX

1 - SAFETY INFORMATION

Before installing and operating the analyser, read this manual thoroughly. Please pay particular attention to all the labels applied to the analyser and to all the hazard information indicators in this manual.

This symbol indicates that you must refer to this manual for proper use of the equipment. Only qualified operators, properly trained on the use and maintenance of the analyser can carry out service activities on the equipment.

This symbol indicates the existence of a risk of electric shock and/or electrocution.
Only operators qualified for these activities can perform maintenance and control operations on the equipment bearing this label, always after unplugging it.

Parts involved:
- input terminal block in the upper box

This symbol indicates the risk of burns and physical damage caused by the presence of hazardous chemical compounds.
Only operators qualified for these activities can handle and perform service operations that may involve the risk of contact with such compounds. Before carrying out any type of service activities on the analyser, please read the safety data sheets of the different chemicals used and take all precautions specified therein.

Parts involved:
- cleaning reagent bottle and the pipes connected to it

The instrument operates with low power UV radiation. Do not look directly at the light source and do not disassemble the light source enclosure.

Parts involved:
- UV source

The manufacturer shall not be held responsible under any circumstances for improper use of the equipment.
The head of department and the machine operator must comply with the following rules and with the provisions of current legislation on the safety and health of workers.
The use, maintenance, and repair of the analyser are permitted only to persons authorised for such operations. These operators must be physically and mentally capable to perform such activities, which can not be performed under the influence of alcohol and drugs.
When the analyser is not being used it must be protected from voluntary or involuntary activation, after disconnecting the power supply.
Failure to follow the instructions given and/or failure to pay attention to the hazard indicators may cause serious risks of physical damage to operators and breaks or malfunctioning of the analyser.
All the components of the analyser are placed within a panel closed by a door with a special key, supplied only to maintenance operators.
The analyzer must, then, be used under operating conditions with both lower and upper doors closed.

2 - GENERAL INFORMATION

2.1 Technical specification

Measured parameter	Oil-in-water, BTEX, aromatic hydrocarbons, PAH
Measuring principle	Fluorescence photometry
Range	PAH 0 - 1 ppm equivalent NDSA PAH 0 - 5 ppm equivalent NDSA PAH 0 - 10 ppm equivalent NDSA OIW 0 - 5 ppm equivalent phenol OIW 0 - 10 ppm equivalent phenol OIW 0 - 30 ppm equivalent phenol
Reproducibility	± 3 % of full scale
Limit of detection	0.1 ppm
Sampling Mode	Batch, with freely settable frequency.
Analysis Duration	2 minutes, including conditioning before analysis cycle and rinsing after measuring.
Cell material	Optically pure quartz
Sample	Pressure: atmosferic Temperature: 5 - 50 °C (41 - 122 °F) Flow: 80 - 500 mL/min Connection: 6 mm (¼-in.)
Drain	Pressure-free, atmospheric drain Connection: 12 mm (½-in.)
N° of streams	Up to 2, with integrated switching valve
Dimensions (H x L x D)	300 x 380 x 210 mm (11.8 x 14.8 x 8.3 in)
Weight	Approx. 10 Kg (22 lbs)
Power Supply	Voltage: 100 - 240 VAC 50/60 Hz standard or 24 VDC (optional) Consumption: max. 80 VA
Outputs	2 x 4-20 mA outputs for measured data Modbus RTU RS485
Alarms	2 SPDT programmable potential free relays
Input Digitale	Remote start/stop, start extra cycle, skip idle time, emergency stop
Operating Temperature	5 - 45 °C (41 - 113 °F)
Humidity	10 - 90% RH (indoor use only)
Installation	Wall mount (standard), bench top support or panel mount (options).
Protection Grade	IP54

2.2 Analyzer description

The 3S-UVFL is an online analyzer for continuous determination of fluorescent organic compounds in acqueous samples by means of fluorescence spectroscopy. The analyzer consists of two enclosures with lockable doors. The upper enclosure includes the main power supply, the controller PCB assembly and the touchscreen interface. The bottom part contains the hydraulic components involved in the fluids movement and the optical part for the measurement acquisition. The separation of the two enclosures guarantees that the electric part does not come in contact with the wet part, sample vapors or cleaning solution.

2.3 Applications

The 3S-UVFL is an online analyzer for continuous determination of fluorescent organic compounds in acqueous samples by means of fluorescence spectroscopy. The analyzer can be used to monitor the concentration of aromatic hydrocarbons, BTEX and polycyclic aromatic hydrocarbons (PAH) in acqueous samples. It finds application in industrial wastewater control, oil industry, hydrocarbons transport and storage and every other application that requires a fast and sensitive determination of fluorescent organic compounds in acqueous streams.

2.4 Method description

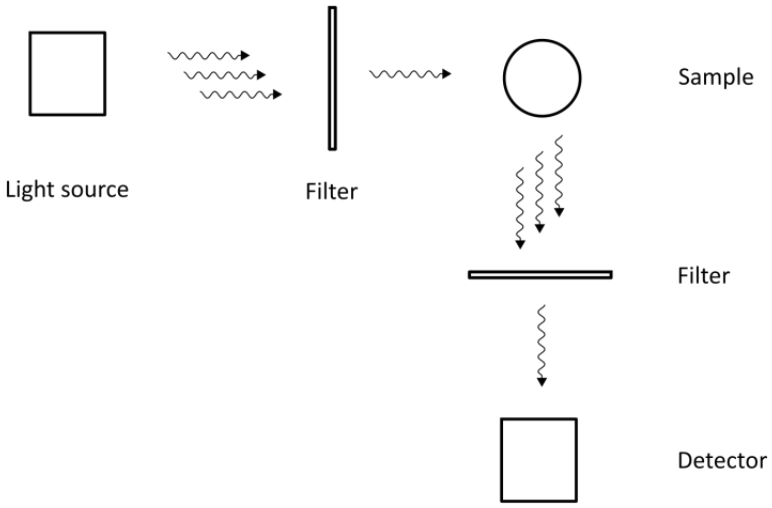
Fluorescence spectroscopy, or fluorimetry, is a technique that measures the amount of light emitted by a fluorescent sample when excited with an incoming radiation of appropriate wavelength. Fluorescence is a property of some substances that are able to absorb energy from the incoming light and then release it as a radiation with a lower energy (longer wavelength) and partially as heat.

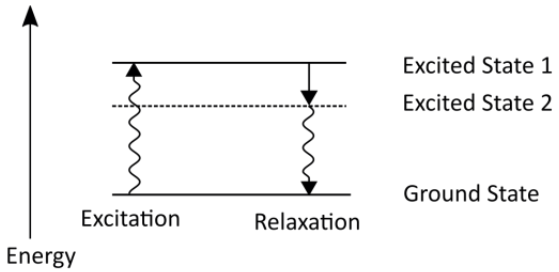
It's strictly related to absorption spectroscopy where a sample absorbs part of the incoming radiation and releases it exclusively as heat.

In fluorescence spectroscopy we can measure the intensity of the emitted radiation and correlate it to the concentration of the analyte.

Compared to the absorbance spectroscopy the technique presents a greater selectivity and sensitivity, since only fluorescent compounds are detected.

A simplified scheme of fluorescence spectroscopy is depicted in the next page. The light beam from a polychromatic source (in the UV region) passes through a filter (monochromator) to select a specific wavelength. The now monochromatic photons get absorbd by the substances in the sample and re-emitted as a polychromatic radiation (photons with different wavelengths). A second filter selects a target wavelength and its intensity is measured by a detector. The light emitted by the sample is diffused in every direction therefore the detector is placed at an angle to avoid interference with the incident light.


Light source
Filter
Sample
Filter
Detector


Excited State 1
Excited State 2
Ground State
Excitation
Relaxation
Energy

3 - INSTALLATION

3.1 Opening the package

Caution:
Please take all the precautions required for handling and lifting the box containing the analyser.
The instrument weight is about 20 Kg.

For safety reasons, when removing the packaging of the equipment, please check for any visible defects and, if necessary, inform the supplier.

Parts inside the package apart from the user manual:

A	3S-UVFL Fluorescence Analyzer	UVFL-X.....see code format
B	Liquid reservoir with level switch for sample	A46ERLS000
C	Startup kit	A46KIT0001
D	Cleanng reagent bottle (empty)	A460110BR*1

These are the material present in the start up kit:

Silicone tubing 2 m for drain connection	N° 1
Norprene tubing size 1/8" OD with 30 cm straw for the cleaning reagent	N° 1
Norprene tuning size 1/4" OD for ports 1 - 2 - 3	N° 3
Key for the instrument's door	N° 1

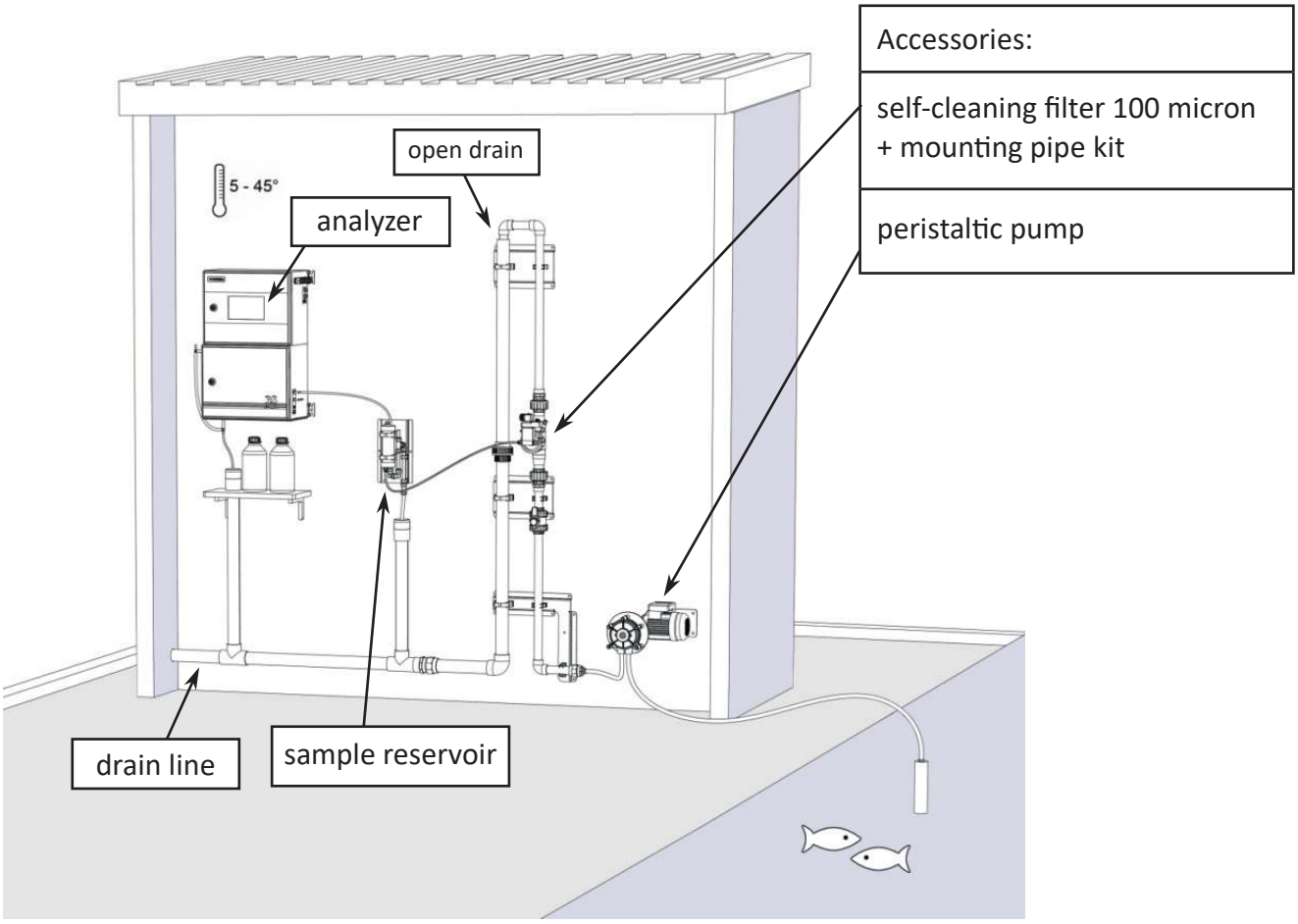
These are the codes to identify the different configurations:

UVFL-0	Single stream analyzer, with no dilution nor autocal
UVFL-2	Two valves analyzer (dual stream or autocal o dilution)
UVFL-3	Three valves analyzer (dual stream + autocal or dilution)

Other optional accessories may be included in the package.

Optional accessories		
for Dual Stream option	Fast loop reservoir with level switch for the second sample	A46ERLS000
for Dilution option	Fast loop reservoir with level switch for the dilution water	A46DWLS000
for Autocal option	Bottle for standard solution	A46KHPB1

3.2 Example of sample suction installation



In the example, a large sample quantity is sucked by a peristaltic pump from a reservoir and sent to a self-cleaning filter.

Part of the sample flow passes through the filter (10 - 500 microns) and recirculates inside the sample cylinder before being drained. The unfiltered sample portion is drained as well.

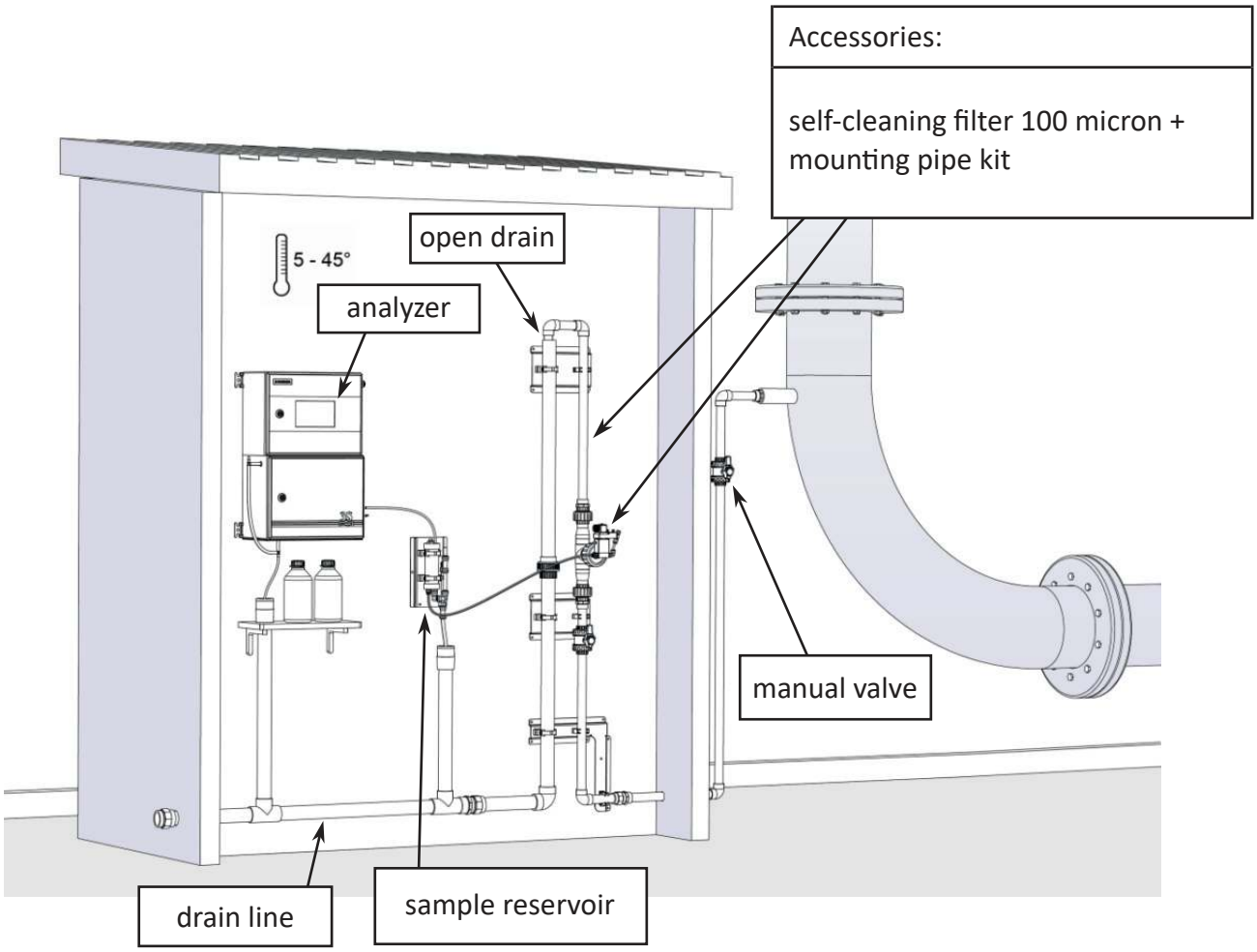
To perform the analysis the instrument collects the sample from the sample reservoir at predefined, regular intervals. If the level of the sample in the cylinder is not enough, the level sensor prevents the analysis to continue. When the sample level in the reservoir is restored, the analyzer restart the online operations autonomously.

The sampling peristaltic pump can run continuously or only for a short period of time before the analysis, in that case one of the analyzer's driven in this case by the analyser itself (control panel operated by the installer) through one of its potential free relay contacts.

The suction line from the tank may need heat tracing to prevent occlusion due to negative temperatures.

The installer shall implement a drain line, which, however, shall not create a backpressure to the free drain of the analyser and recirculation tank.

3.3 Example of sample from pressurized piping



In this example, the sample is taken from a pressurized process pipe and a flow of 500-1000 l/h (adjusted by the sampling valve) crosses the self-cleaning filter to reach the drain line.
The conformation of the pipe where the filter is inserted produces a positive suction head (the drain is in the upper position compared to the height of the filter) which allows the fraction of filtered liquid to escape and reach the recirculation tank.
A filter must be mounted if there are any suspended solids greater than 500 microns.
If the filter is not needed, a sampling needle valve to adjust the maximum flow rate of 500 ml/min must be mounted, from the pipe to directly send liquid to the recirculation reservoir.

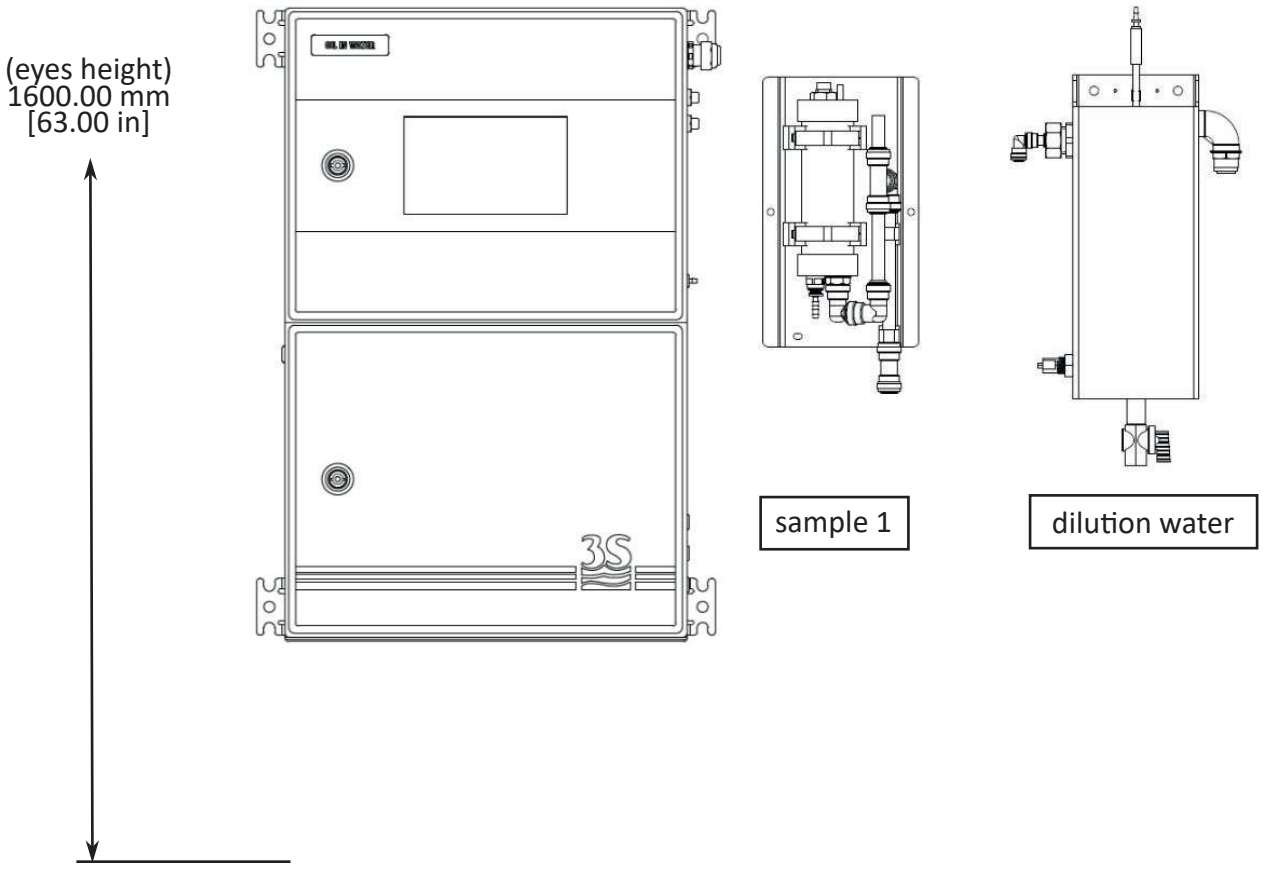
Also in this example, the installer shall implement a drain line, which, however, shall not create a backpressure to the free drain of the analyser and recirculation tank.

3.4 Mounting the instruments

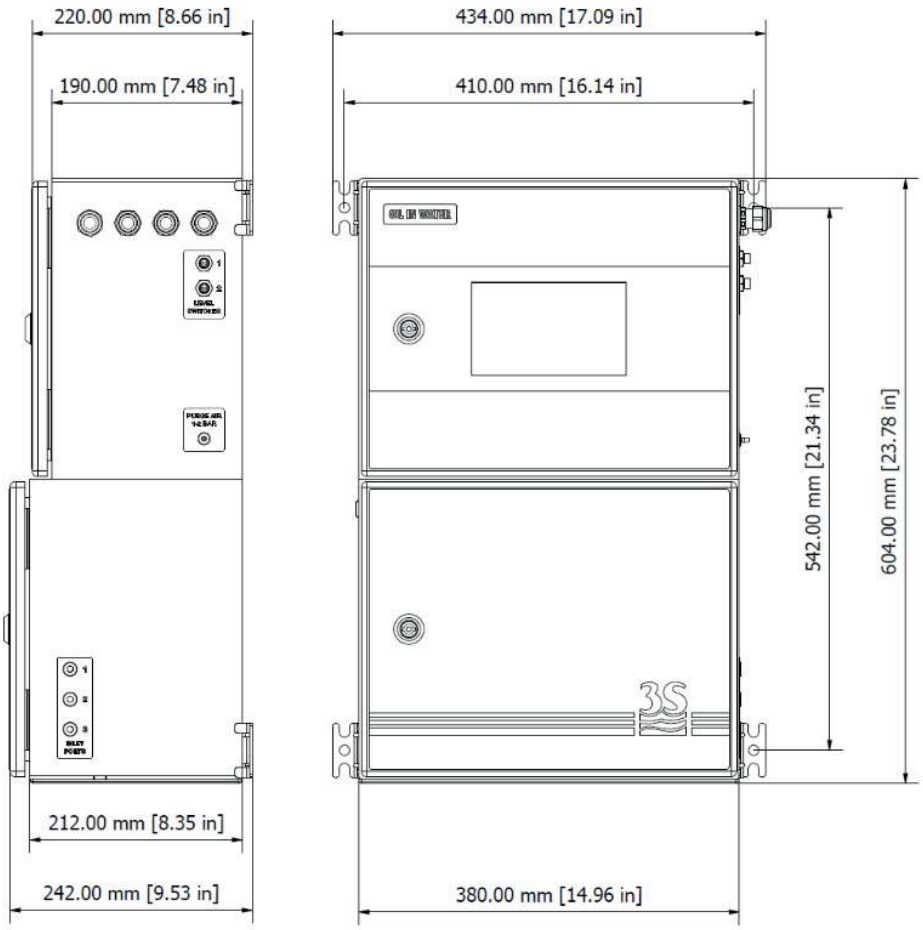
The analyzer and the sampling cylinder must be mounted vertically on a wall or support suitable for their weight and not subject to vibrations. Use suitable screws (not included in the supply) to fasten them only on the side brackets (ear clips) of the instrument and in the holes of the tank metal plate. Mount them so as to get the display at eye height (160 cm).
Since the sampling connections and level contact connectors are on the right side of the analyser, install sample reservoir and dilution water sampling to the right of the instrument.
Please consider that the surrounding space must allow easy opening of the doors (upper and lower). The sampling reservoir can be monted below the analyzer also, if necessary.
A minimum distance of 10 cm is required between the wall to the right of the instrument and the cylinder.

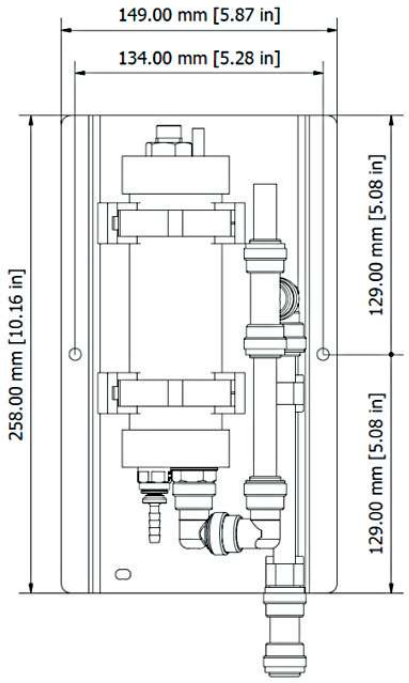
Instrument configuration	Liquid reservoir to install
Standard single stream	1 x A46ERLS000
Dual stream	2 x A46ERLS000
Single stream with dilution	1 x A46ERLS000 + 1 x A46DWLS000
Dual stream with dlution	2 x A46ERLS000 + 1 x A46DWLS000

Example: single stream with dilution

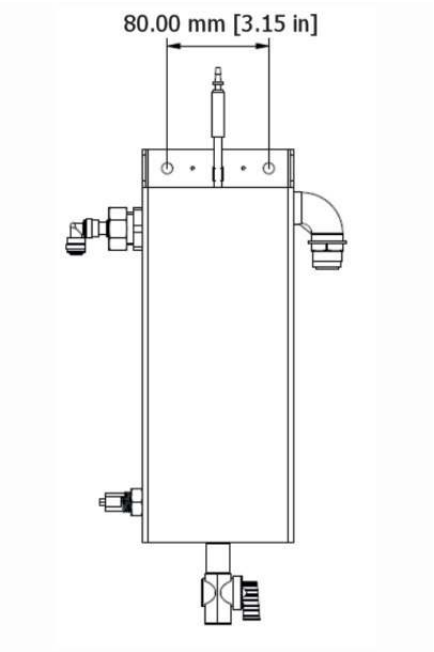


3.5 Wall mounting dimension





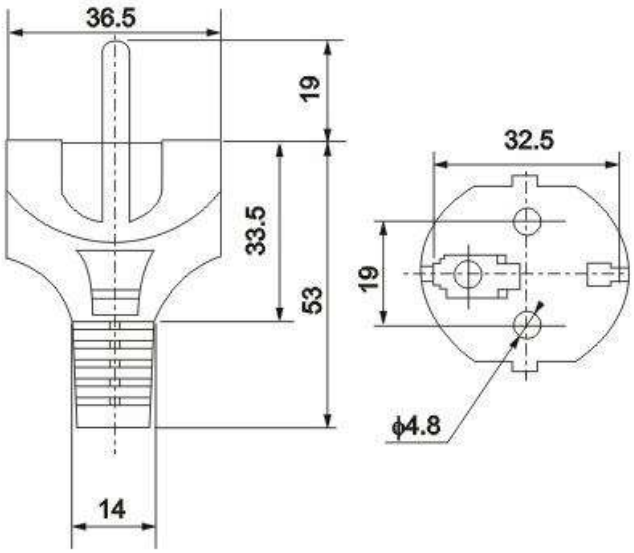
liquid reservoir with level switch
p/n A46ERLS000



dilution water reservoir
p/n A46DWLS000

3.6 Power supply connection

The electrical power is supplied by the analyser's cable , 2,5 mt.llenght with a CEE7/7 SCHUKO Europe plug.



The analyzer, in accordance with CEI EN 61010-1 standard on electrical safety, has passed the following factory safety tests:

-continuity test
-protective earth test
-insulation resist test
-high voltage test AC
-leakage current test

In addition to the tests carried out by the manufacturer, the installer shall:

- make sure that the power cord is not damaged when unboxing the package

- check the condition of the earth conductor of the power cord

- provide adequate over current and over voltage protection on the power supply line

- check for compliance of the power line with any applicable safety standards

3.7 Signal connection to the data acquisition system

To connect the signals and the contacts to the acquisition system, proceed as follows:

- use up to 2 cables with a maximum diameter (insulation included) of 12 mm

- pass the cables into the two free PG13.5 cable glands on the top right side of the instrument

- remove the electrical insulator from each wire and place it into the terminal making up the terminal block on the top of the instrument. Use a screwdriver with a 3 mm cutting width and make sure that the wire is secured inside the terminal

- make sure that the cable glands are perfectly sealed to prevent dust and moisture infiltration

Please refer to the connection diagram below.

TERMINAL	CONNECTION	NOTES
1 2	N.C. N.C.	Not connected
3 4	- INPUT + INPUT	Connect to a SPDT contact
5 6	- 4-20 mA analog signal channel 2 + 4-20 mA analog signal channel 2	max impedence 500 ohm protected by 50 mA fuse
7 8	- 4-20 mA analog signal channel 1 + 4-20 mA analog signal channel 1	
9 10 11 12	NC Relay 2 COM Relay 2 NC Relay 1 COM Relay 1	Load max 5 A, 250 VAC Relay logic can be inverted in software

3.8 Modbus serial protocol

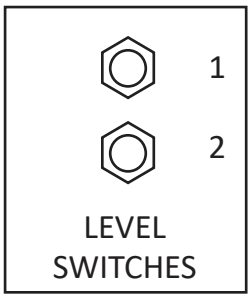
The analyzer can be connected to a Modbus network via Ethernet TCP/IP.
The Ethernet interface can be used by plugging in an Ethernet cable to the RJ45 connector on the back of the display.
The analyser exchanges information over the serial line via the Modbus protocol in Slave mode. The connection parameters are totally configurable (see 6.7) and default to the following values:

IP	user defined
Port	502

Address	Format	Alias
900	32 bit float (CD-AB)	Result A
902	32 bit float (CD-AB)	Result B
904	32 bit float (CD-AB)	Validation %
908	32 bit float (CD-AB)	Calibration Factor
800	bit	ONLINE flag
801	bit	SINGLE CYCLE flag
802	bit	STOPPED flag
803	bit	EXTRA CYCLE flag
804	bit	LOSS OF SAMPLE 1 flag
805	bit	LOSS OF SAMPLE 2 flag
806	bit	Calibration A error
809	bit	Probe error
950	ASCII (6 words)	Unit
960	ASCII (12 words)	Parameter name A
970	ASCII (12 words)	Parameter name B

3.9 Connecting sample level sensor

The sample recirculation tanks, positioned to the right of the device, have a level contact to show the presence or absence of the sample. The signal reaches the device through the connector-terminated cable plugged into the socket on the right side of the analyzer.
A label helps to identify the correct connection.



Below the contact logic :

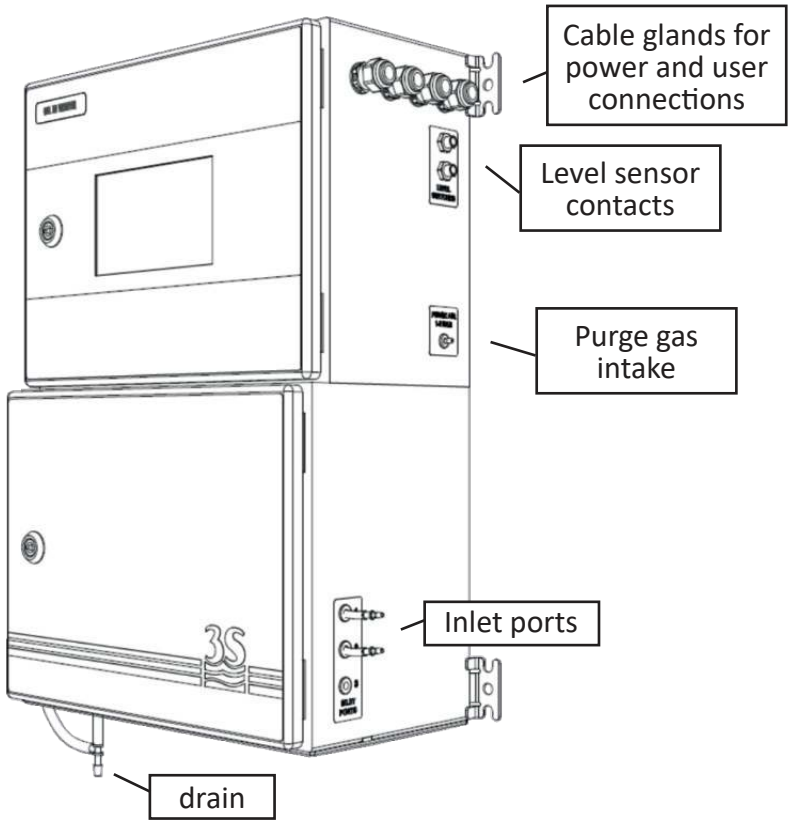
SAMPLE PRESENT	floating element UP	Contact OPEN
SAMPLE NOT PRESENT	floating element DOWN	Contact CLOSED

3.10 Sample/Dilution/Standard solution connection

The analyzer takes samples or standard solutions through a peristaltic pump.
The same pump can pick up to 3 different liquids through 3 clamp valves located in the hydraulic power unit.
The possible configurations are shown below:

CONFIGURATION	VALVES	CONNECTIONS
single channel without autocalibration or dilution	0	port 1: sample
single channel with autocal/val or dilution	2	port 1: sample port 2: autocal/val or dilution
dual channel without autocal/val or dilution	2	port 1: sample 1 port 2: sample 2

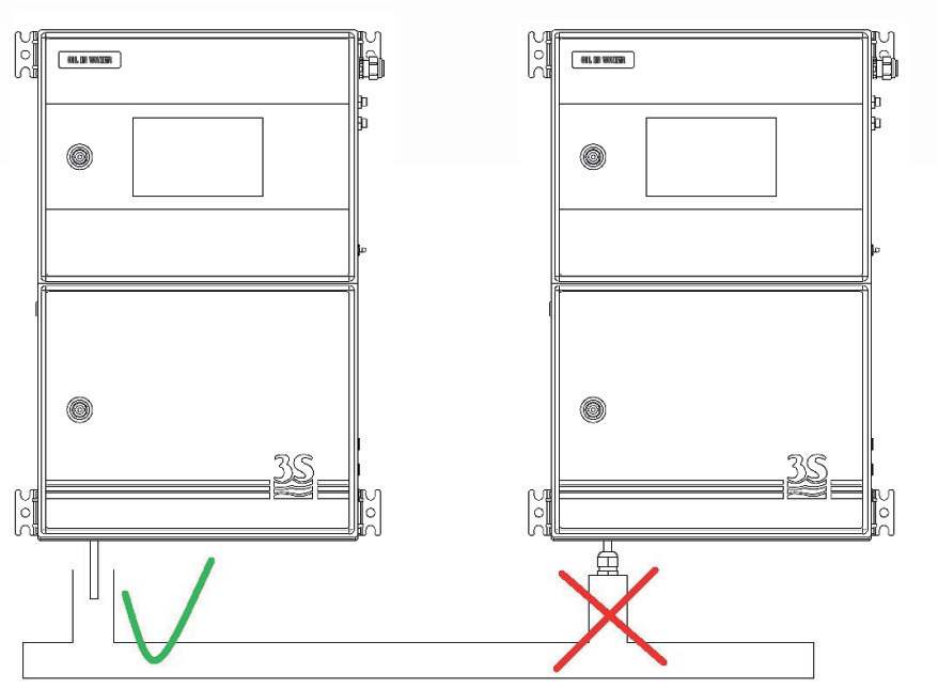
For the connections, identify the defined configuration and connect the pipes supplied with the start-up kit (norprene 1/4" OD) to their straight fittings coming out of the 3 inputs on the right side of the hydraulic unit. See the following image for reference.



The pump is designed to suck the sample from the sample container and the calibration solution from a bottle placed at the lower level.
The tanks can be placed both above or below the suction port, while direct connection to pressurized lines must be avoided to ensure dosage precision and to prevent any undesired liquid spills inside the hydraulic unit (max pressure 0.1 bar, 1 meter of water column).

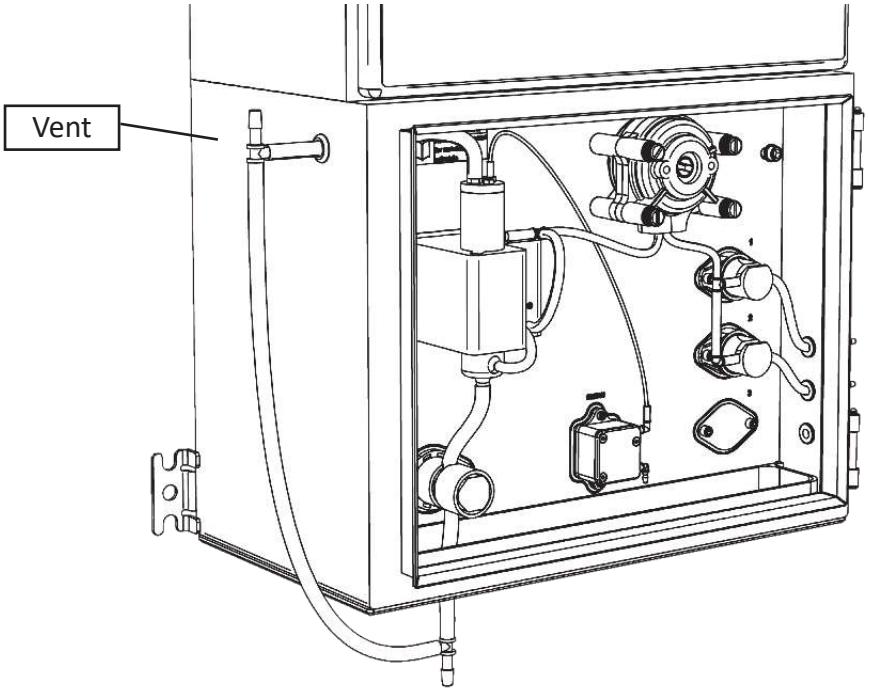
3.11 Measuring cell - waste connection

Connection to the drain line is provided by the flexible tube included in the start-up kit to be connected to the 9 mm hose connector located below the analyzer.
Please note that the liquid must be drained by allowing its free fall, therefore any backpressure has to be avoided.



3.12 Reading cell - VENT connection

To ensure the free fall of the liquid contained in the reading cell at the end of the analysis or during all rinsing operations, a hose connector is placed on the cell cap and, through a norprene tube 7/16" OD conveys any vapours outside the lower cabinet (left side).



This vent port can may be conveyed out through an extension tubing, preventing corrosion from gas coming from sample or cleaning solution, especially when the analyzer is mounted in a small cabinet

Be aware to avoid counter pression or condensation in the extension tube.

3.13 Cleaning reagent connection

To connect the bottle containing the cleaning reagent, use the sampling pipe with straw included in the start-up kit.
The bottle should be placed below or next to the analyzer at the maximum distance equal to the length of the pipe.
No extension should be made to the pipe as the small head of the peristaltic pumps may not be able to suck the fluid if it's too low.

Please pay close attention when handling the pipe and the reagent bottle after their first use, as some reagents can be corrosive. Use protective gloves and goggles to prevent any spilled liquid from coming in contact with the eyes and skin.

3.14 Purge gas connection

The analyzer stainless steel enclosure is rated IP54. This makes the analyzer suitable for most industrial conditions. For extreme environments however, where metal corrosion is a real issue, a purge gas line can be connected to the instrument to prevent corrosive gases to enter the analyzer.
The user must provide a purge gas line (nitrogen or clean air, 1 - 2 bar) and connect it to intake on the right side of the analyzer with a 6 mm OD pipe (see picture at page 20 for the exact location).
An internal flow regulator will provide a positive pressure inside the analyzer preventing ambient air to reach sensitive components.
The purge gas line does not replace a proper flushed cabinet required for ATEX areas.

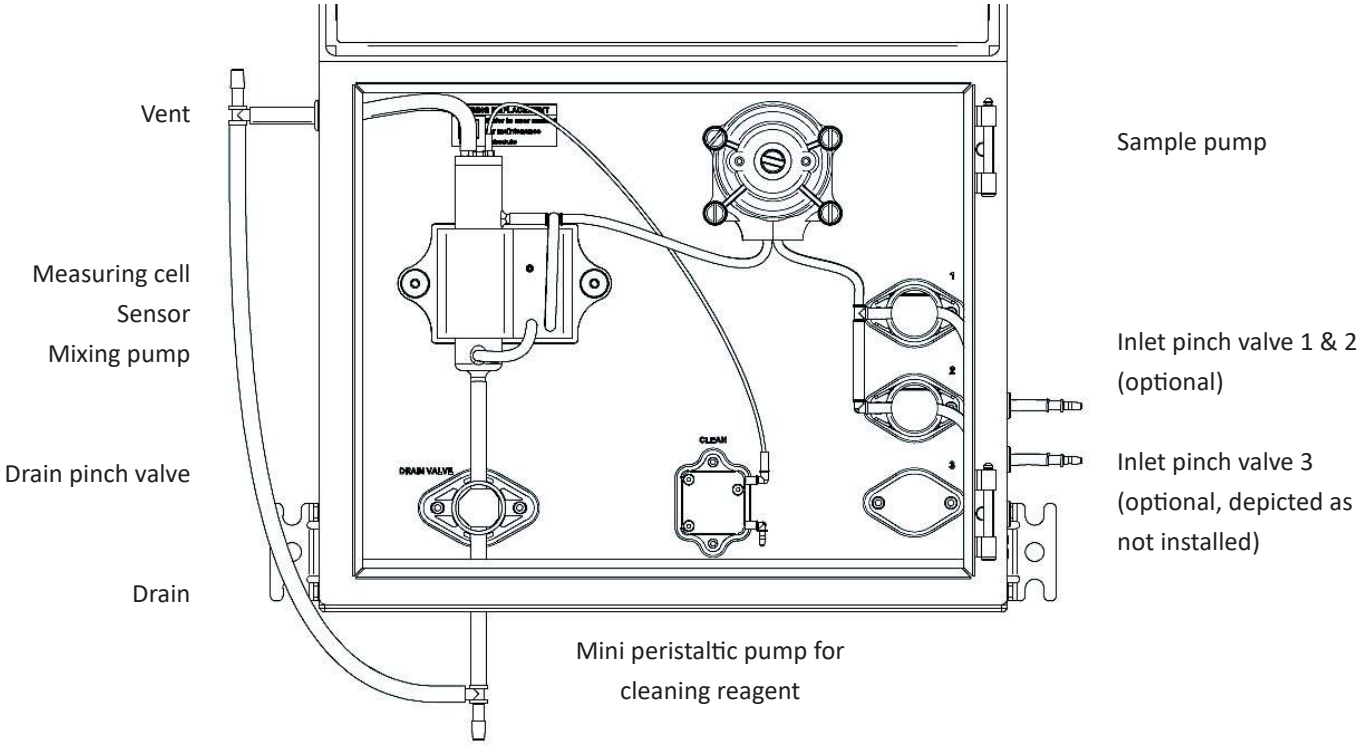
3.15 Power on

After checking the power supply, you can turn the device on through the switch located inside the upper compartment.
The analyzer display takes a few seconds to turn on, during which a splash screen appears followed by the main screen. Proceed to Section 6 for details on how to operate the instrument through the graphical user interface.

4 - COMPONENTS

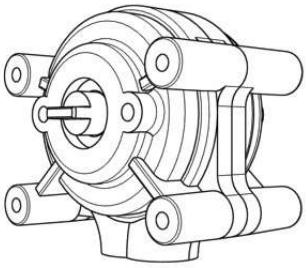
4.1 Knowledge of the standard components

Before using the analyzer, you should identify its standard components. To do this, open the lower compartment.
Here is what you will see:



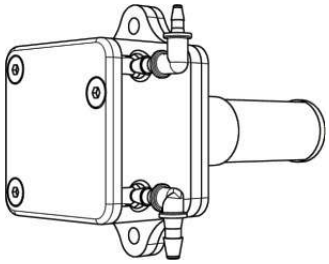
Depending on the number of inlet streams (1 or 2), the presence of dilution or autofunction the number of inlet valves can vary from 0 to 2 (see 3.11).

4.2 Components description



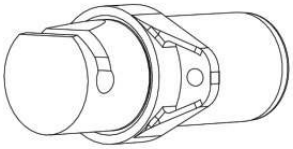
Sampling pump

The 3S UVFL mounts a Masterflex® peristaltic pump for sampling. The pump is positioned in the liquid enclosure. The code of the pump is printed on it and the tubing used must have the correct diameter (internal and external) suitable for the pump. The diameters and the material of the tubing is very important, use only 3S spares.



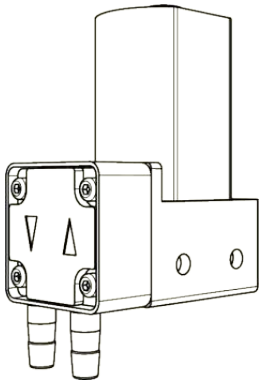
Miniature peristaltic pump

The reagents are dosed with “Miniature Peristaltic Pumps “; up to 4 pumps could be installed in the analyzer, allowing to dose up to 4 different reagents. The pumps are positioned in the liquid enclosure.



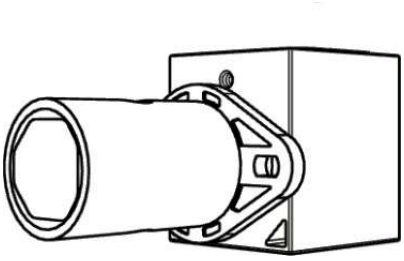
Inlet valves

The inlet valves are responsible to regulate the inlet flows for the sample(s), or optionally, dilution water and standard solution. If the analyzer is single stream without autocalibration or dilution the valves are not necessary and will not be present. Single stream + dilution or autofunction will have 2 valves, dual stream + dilution or autofunction will have 3 valves (see 3.10).



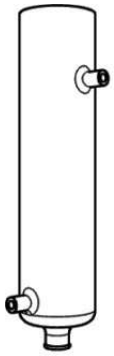
Mixing pump

The sample is mixed with a membrane mixing pump. This helps keeping a stable oil-water emulsion. The liquid is pumped from the lower part to the upper part of the measuring cell. Flow direction (inlet / outlet) of the pump is indicated on it with the symbols Λ and V . The mixing pump is positioned inside the cell mounting block in the liquid enclosure.



Drain pinch valve

Normally-closed pinch valve is used to close/pinch or open a silicon / norprene tube section in order to close or open the drain of the measuring cell. The size (ID and OD) and the material of the tubing is very important, use only 3S spares.
The pinch valve is positioned in the liquid enclosure.



Measuring cell

The measuring cell is made of glass, the diameter is 26 mm. The cell is positioned inside a metal block and can be easily removed for manual cleaning.
The side arms are used to as inlet/outlet for filling and mixing the sample in the cell. The cell is closed with a cap, secured with a rubber o-ring.

Microprocessor

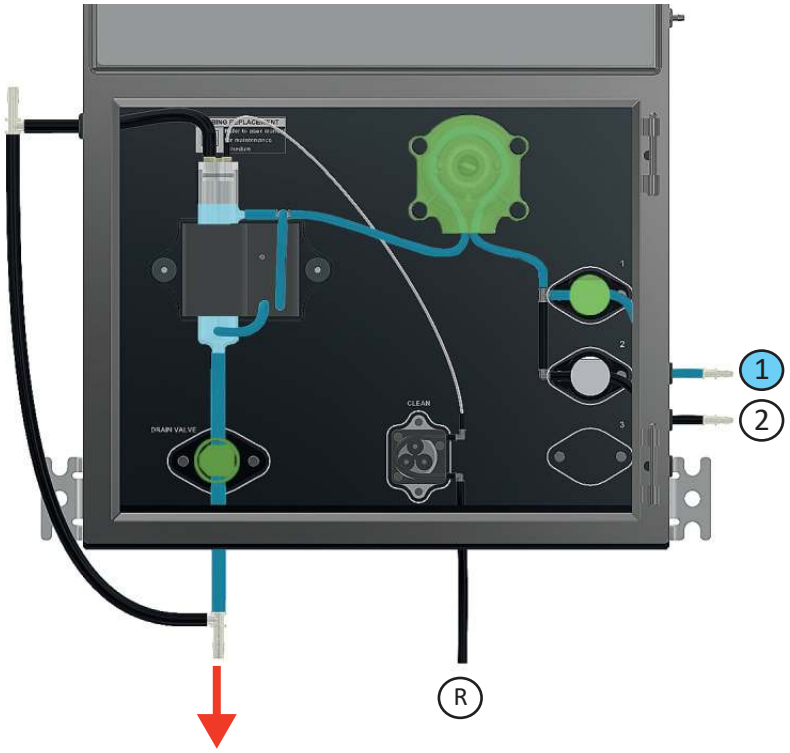
The microprocessor and its PCB assembly are located in the electronic section. It provides full control of the entire analyzing system. It handles the analyzer operations, it collects all the information and data coming from the different analyzer devices and it controls all the I/O apparatus to communicate with the user touchscreen interface and transfer of data.

4.3 Description of the analyzer functions

The instrument can execute various functions to perform the analysis cycle. Some of these functions drive hardware components, others are responsible for calculations or data managing. Listed below you can find the description of all the available functions.

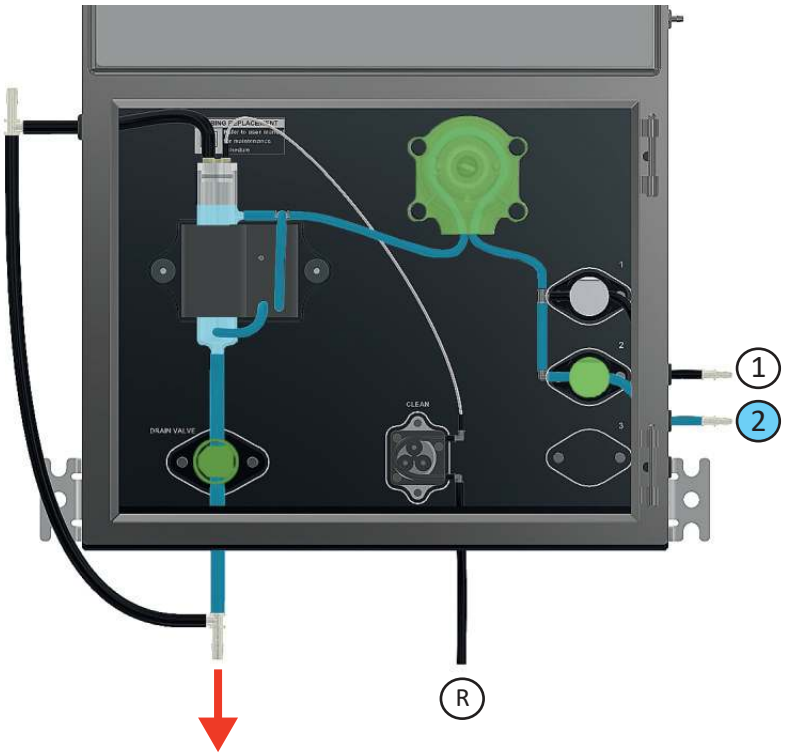
Rinse 1

During this operation the drain pinch valve is open, sample 1 is pulled from the sample reservoir and passes through the cell, but it is discarded immediately since the cell drain is open. The mixer pump is also activated, this helps conditioning all parts of the sample line.



Rinse 2

Similarly to Rinse 1, the drain pinch valve is open, sample 2 is pulled from the sample reservoir and passes through the cell, but it is discarded immediately.

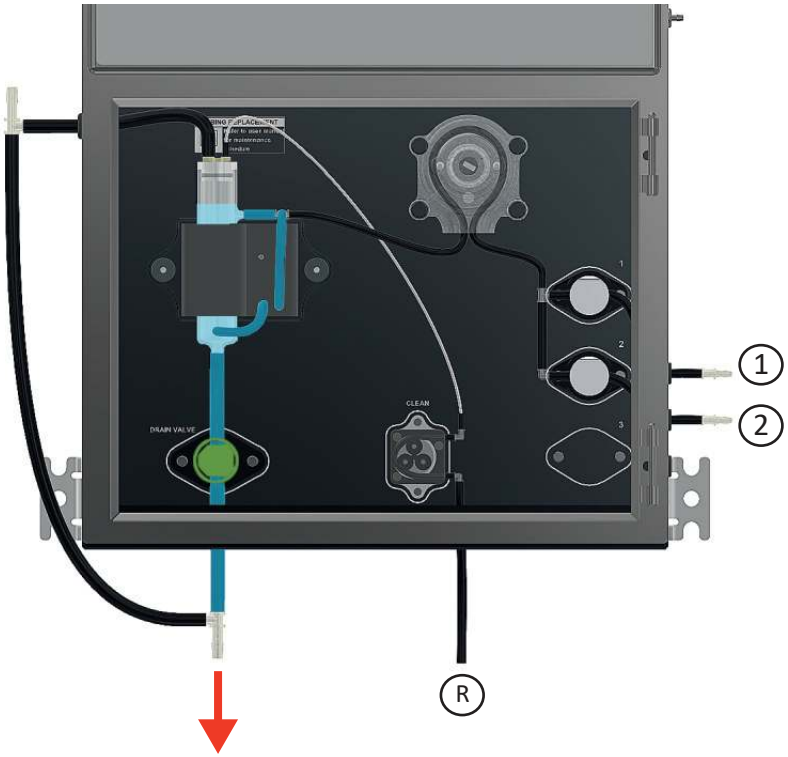


Rinse 3

This function is only available for the dual channel option (additional valve and inlet 3).

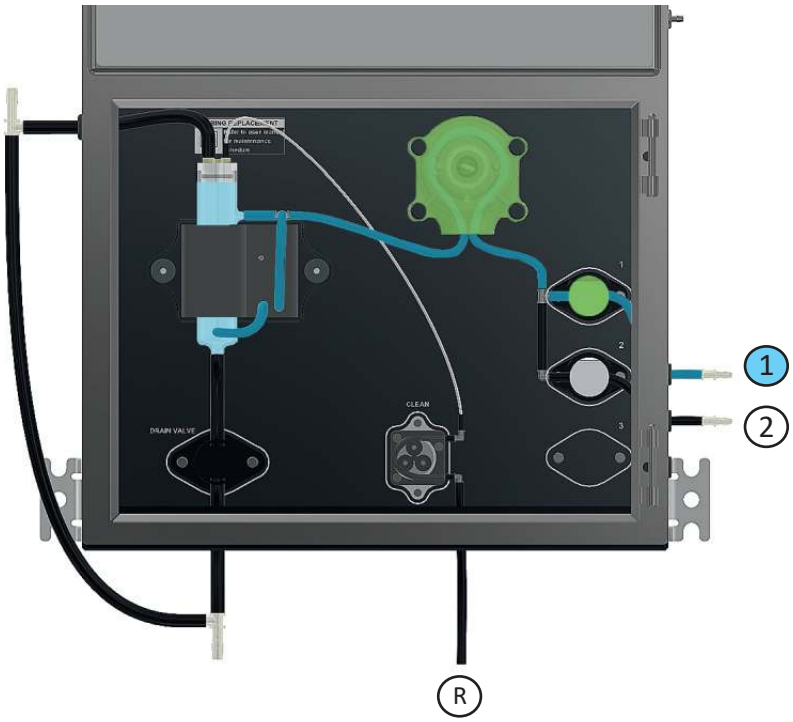
Drain

Open the drain pinch valve and discard the liquid in the cell.



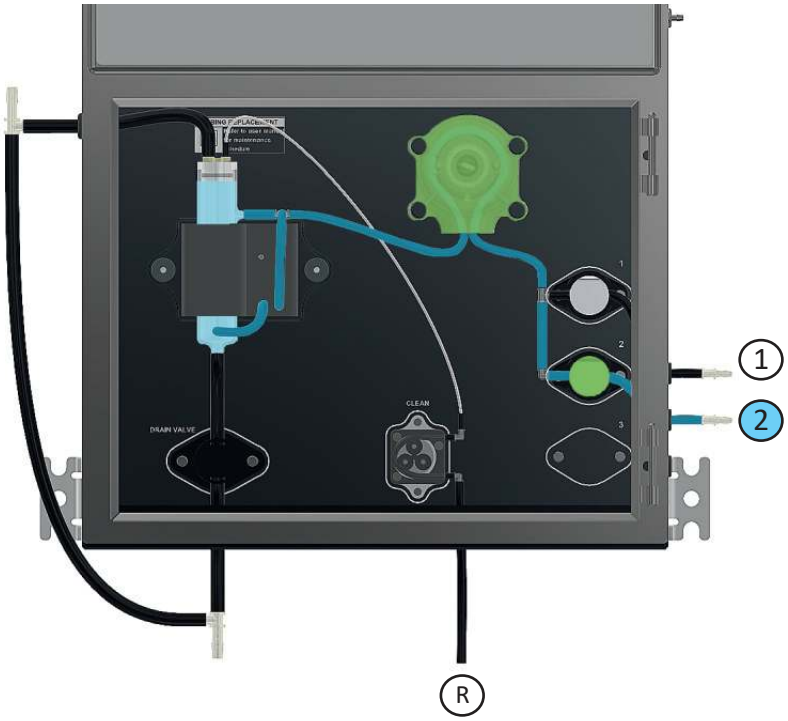
Sample 1

During this function the sample peristaltic pump is activated, the bottom pinch valve is closed and the sample 1 fills the measuring cell.



Sample 2

During this function the sample peristaltic pump is activated, the bottom pinch valve is closed and the sample 2 fills the measuring cell. Sample 2 is used for the extra cycle operation (i.e. calibration) in case of single channel analyzer or for a second sample stream in case of dual channels analyzer.

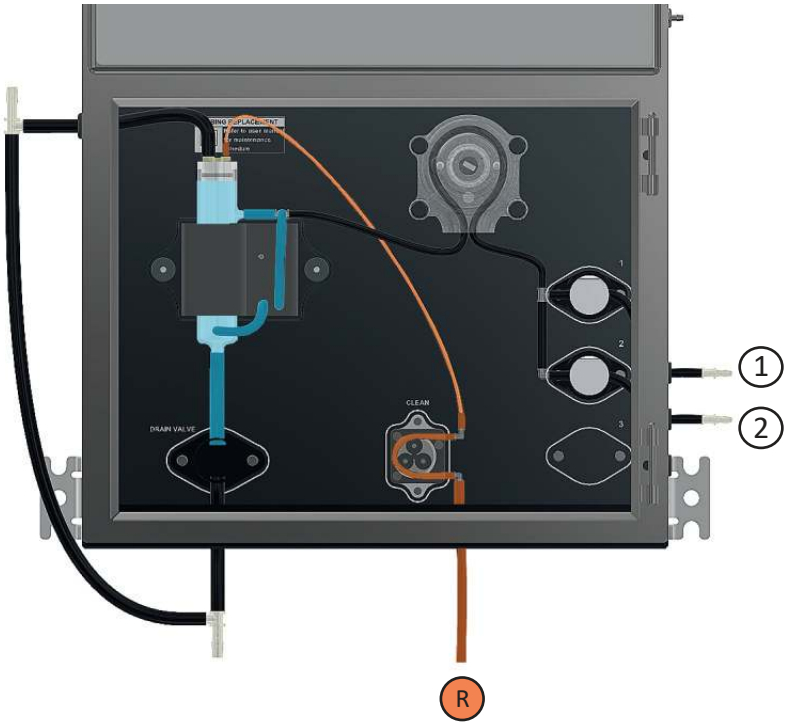


Sample 3

Dual channel option (additional valve and three inlets). The selection valve switches on, the bottom pinch valve is closed and the sample 3 fills the measuring cell. Sample 3 is usually dilution water, cleaning solution or standard solution for autocalibration.

Add Reag

The cleaning reagent is pulled from its container by the corresponding miniature peristaltic pump and poured into the measuring cell.



Wait

The analyzer waits and do nothing.

Mix

The mixing pump is activated and the liquid in the measuring cell is mixed.

Measure A

Convert the sensor reading into a concentration reading, taking into account the blank absorbance and the stored calibration factor for channel A.

Measure B

Convert the sensor reading into a concentration reading, taking into account the blank absorbance and the stored calibration factor for channel B.

Calibration
Perform a calibration using the most recent absorbance value measured by the instrument.

Validation
Perform a validation using the most recent absorbance value measured by the instrument.

Relay 1
Activate relay #1. The relay settings can be modified in the CONFIGURATION page of the user interface.

Relay 2
Activate relay #2.Activate relay #1. The relay settings can be modified in the CONFIGURATION page of the user interface.

Level jump 1, 2, 3, 4
Check the sample presence and jump to a predefined step in the cycle. The user can configure the rules for the level jump in the CONFIGURATION > LEVEL JUMP section, see 6.6.

4.4 Manual activation of functions

After opening the lower door, it is possible to observe and distinguish the various operations by activating them manually.
This may help when turning on the analyzer for the first time or even later, during maintenance operations.

For example, it is advisable to use this procedure to verify the correct arrival of the sample, after connecting the different parts, or check the correct operation of the drain.

See section 6.4 for instructions to activate manual function through the graphical user interface.

5 - ANALYSIS CYCLE

5.1 Single cycle, online cycles and extra cycle

The instrument executes its analysis cycle by performing a sequence of operations listed in the analysis program. The program can be accessed from the graphical user interface and can be modified at any time to meet the requirements of the applications. Users are strongly encouraged to contact the 3S Analyzers technical service prior to commit any modification to the program. A program consists of a maximum of 20 individually configurable steps, every step defines a function, identified by a unique name (see 4.3), and an associated duration.

Using the graphical interface the user can arbitrarily call any function manually for testing or servicing (see 6.4).

The instrument can perform a single analysis cycle or continuous (online) measurements. In the first case the analyzer will put itself in standby after the analysis cycle is completed while in the second case it will start another analysis after waiting for a predefined amount of time (cycle wait). The wait time between each analysis cycle can be set in the menu of the graphical user interface (see 6.6).

In any case, at the end of the cycle a new result value is calculated, shown and transferred out by mean of an analog output or by serial communication (Modbus RTU protocol).

During online operation an EXTRA cycle can be performed in between the standard analysis cycles, at a predefined frequency. The EXTRA cycle follows a different program and can be used for autocalibration, autovalidation or cleaning. The frequency of the EXTRA cycle can be set in the menu of the graphical user interface (see 6.6).

An analysis sequence in the 3S-UVFL would typically have the following structure.

After rinsing and conditioning the reading cell, a constant amount of sample is grabbed. Then the measurement takes place and a concentration value is calculated. The cell is finally cleaned by adding a cleaning reagent. A new analysis will then start according to the analysis frequency.

A more detailed description of the analysis cycle is shown in the following table.

Drain, conditioning, rinsing and sampling *Drain, rinse and sample functions*	First the cuvette is drained and rinsed (this can also be programmed at the end of the run). In this way the hydraulic line and the reading cell are well rinsed prior to the actual sample taking. Next, a sample is taken.
Mixing and wait *Mix and wait functions*	The mixing pump is activated and the liquid is pumped from the lower part to the upper part of the cell. This will keep organic substances dispersed in water. The waiting time is programmed in order to eliminate bubbles or suspended solids.
Measure *Measure A or B function*	The sample is irradiated by the UV light source and the light emitted by fluorescence is measured. The corresponding concentration value is calculated and shown on the display. If the datalogger is enabled the data is also stored on the USB support.
Add cleaning reagent, mix *Add cleaning reagent and mix functions*	The cleaning reagent is added to the reaction cell and mixed to clean the reading cell and the mixing pump tubings.
Waiting time (analysis frequency) *Wait function*	The analyzer will wait until the end of the defined analysis duration before starting a new analysis cycle.

5.2 Dilution

The 3S Analyzers' UVFL does not usually need a diluted sample. However, in order to meet our customer requirements the instrument can be provided with the dilution option, in this way the maximum range can be increased to values that would be not possible without dilution. It is necessary to provide a dilution water line and connect it to the supplied external reservoir, the water must be pure and free from contaminants, preferably deionized/demineralized. See section 3.10 for the instruction to connect the analyzer to the dilution water line.

5.3 Dual stream analysis

If you have purchased the 3S-UVFL analyzer with the dual stream option you can run analyses on two different sample streams. In that case you have to connect the sample inlets to the respective external reservoirs.
The analysis cycle will contain the necessary step to sequencially run the two analyses. The two results will be displayed on the display at the end of the analysis.
The samples level sensors will operate independently and in the case one of the two sample is missing the analysis can still proceed on the available one.
The analyzer will come already configured to run dual stream analyses. A single stream analyzer can be converted in a dual stream one by purchasing the conversion kit, contact the 3S Analyzers customer service to request the kit and the related procedure.

5.4 Example of measuring and extra cycle programming

The measurement cycle is a sequence of 20 steps, a function as well as a duration in seconds is assigned to each of them in the cycle programming (ANALYSIS SETUP TABLE). The same happens for an extra cycle which has a different programming (EXTRA).

As an example, the analysis cycle for a single channel analyzer is shown in the following table.

STEP	OPERATION	DURATION (sec)
1	DRAIN	5
2	RINSE 1	10
3	SAMPLE 1	16
4	DRAIN	5
5	LEVEL JUMP 1	2
6	SAMPLE 1	16
7	MIX	30
8	WAIT	10
9	MEASURE A	2
10	WAIT	0
11	WAIT	0
12	WAIT	0
13	WAIT	0
14	WAIT	0
15	WAIT	0
16	WAIT	0
17	WAIT	0
18	WAIT	0
19	WAIT	0
20	WAIT	0

As you can see the cycle only uses 9 out of the 20 total possible steps, the remaining one are left blank.

In the following table you can see how the cycle continues in case of a double stream analyzer.

STEP	OPERATION	DURATION (sec)
1	DRAIN	5
2	RINSE 1	10
3	SAMPLE 1	16
4	DRAIN	5
5	LEVEL JUMP 1	2
6	SAMPLE 1	16
7	MIX	30
8	WAIT	10
9	MEASURE A	2
10	WAIT	0
11	DRAIN	5
12	RINSE 2	10
13	SAMPLE 2	16
14	DRAIN	5
15	LEVEL JUMP 2	2
16	SAMPLE 2	16
17	MIX	30
18	WAIT	10
19	MEASURE B	2
20	WAIT	0

In the table below you can find an example of an analysis cycle that uses dilution. Inlet 1 is connected to the sample while inlet 2 is connected to the dilution water.

STEP	OPERATION	DURATION (sec)
1	DRAIN	5
2	RINSE 2	10
3	SAMPLE 2	16
4	DRAIN	5
5	LEVEL JUMP 1	2
6	LEVEL JUMP 2	2
7	SAMPLE 2	10
8	SAMPLE 1	6
9	MIX	30
10	WAIT	10
11	MEASURE A	2
12	WAIT	0
13	WAIT	0
14	WAIT	0
15	WAIT	0
16	WAIT	0
17	WAIT	0
18	WAIT	0
19	WAIT	0
20	WAIT	0

The program stored as EXTRA cycle can be used to perform one of the following operation: CLEAN, CALIBRATION, VALIDATION.
The CLEAN cycle is usually characterized on the basis of the sample and the cleaning agent used while CALIBRATION and VALIDATION depend on the parameter.
An example of a cleaning cycle is reported in the table below.

STEP	OPERATION	DURATION (sec)
1	DRAIN	5
2	SAMPLE 1	17
3	ADD REAG	20
4	MIX	300
5	DRAIN	5
6	SAMPLE 1	17
7	DRAIN	5
8	SAMPLE 1	16
9	WAIT	0
10	WAIT	0
11	WAIT	0
12	WAIT	0
13	WAIT	0
14	WAIT	0
15	WAIT	0
16	WAIT	0
17	WAIT	0
18	WAIT	0
19	WAIT	0
20	WAIT	0

5.5 Emergency stop

Any running cycle can be halted by the user by pressing the STOP! key on the COMMANDS page of the user interface, any operation will be immediately stopped. A physical emergency stop button can also be connected to the digital input to provide a way to externally stop the analyzer.
The analyzer operation must be then restored manually by pressing STOP RESET within the COMMANDS menu.

5.6 Loss of sample

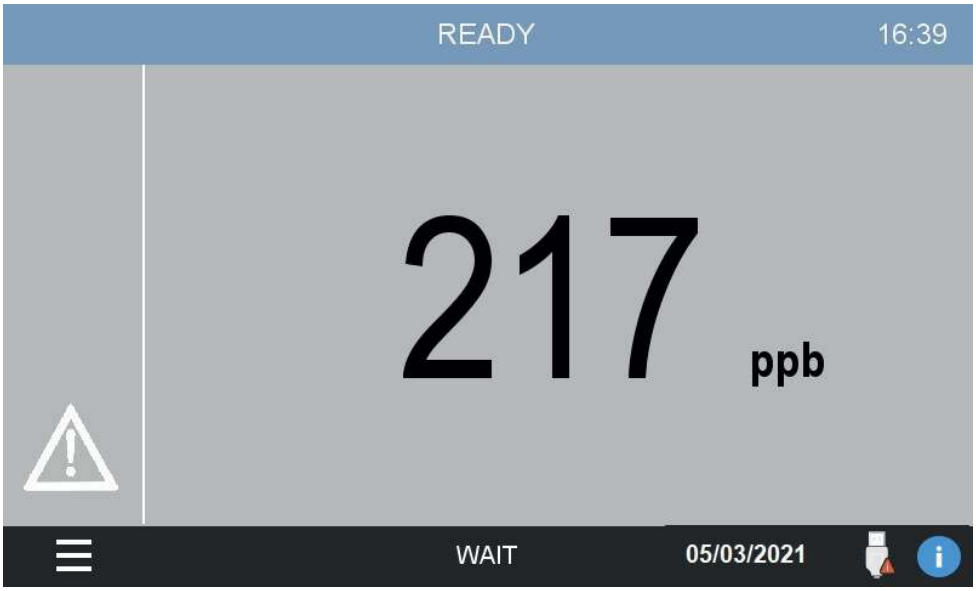
The analyzer uses two level contacts to verify the presence of the sample (see 3.8) by means of level sensors.
In this way if the sample or dilution water needed for the analysis is missing, the analysis will not proceed and the analyzer will put itself in standby. When the sample fills the external reservoir again the level sensor floater will rise up and the analyzer will start online analyses again, without needing any external intervention.

Sometimes a small quantity of sample can be present in the external reservoir thus giving consent to start the analysis even though the sample flow is interrupted. If this happens frequently due to a non-constant sample flow we can force the analyzer to check again for the presence of the sample when te cycle is already running. To do so the LEVEL JUMP operation can be inserted in the analysis cycle at an appropriate place (usually just before the last sampling is performed). In case the sample is missing when the analysis cycle reaches the LEVEL JUMP step, the analyzer automatically proceed to the target step. Usually this means that all the steps in the analysis cycle requiring the sample are not executed and the cycle jumps to the final steps, usually washing and reconditionng the reaction cell with dilution water (if present) or just waiting for the next cycle.
It's important to check this before key points of the analysis, up to 4 Level Jump commands can be inserted in the analysis cycle to make the verification when required.

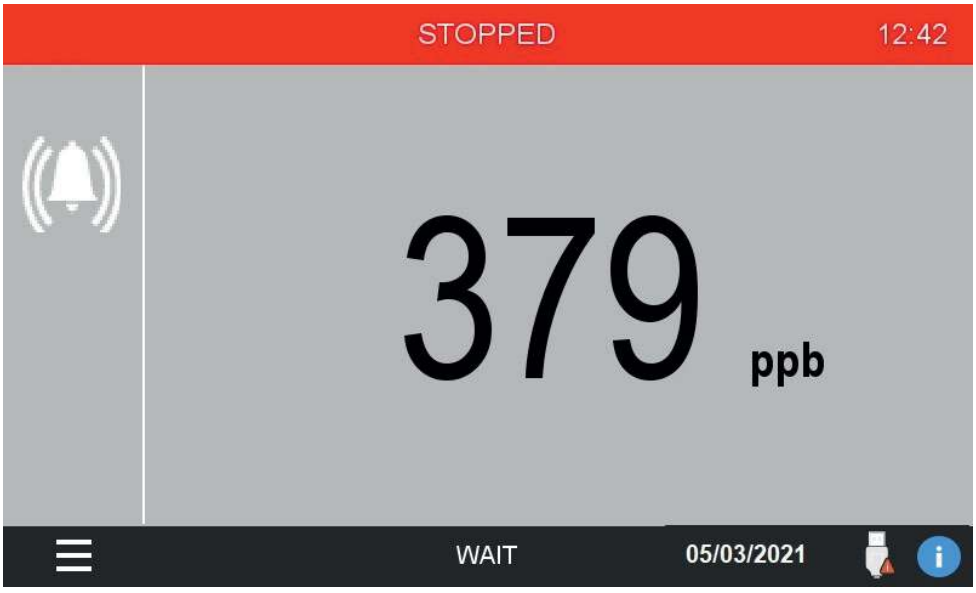
5.7 Warnings and Faults

The analyzer has a Warnings and Faults system to signal anomalies, fault conditions or measurement overpassing the preset threshold.
A warning is considered a condition with low priority that may or may not require user attention to be properly solved. After raising a warning the analyzer proceeds with its normal operations and the analysis cycle is not interrupted.
A fault indicates a more serious condition and always requires user intervention to restore the regular operation of the analyzer.
The user can decide to bound various events to warnings and faults through the graphical user interface. See section 6.6 for instruction on how to do so.
Additionally warning and faults can also have a relay assigned, when the analyzer raises a warning or fault condition the corresponding relay will be activated so that the user can be informed remotely of anomalies in the instrument operation.

The graphical user interface informs the user about the presence of warnings or faults. In case of a warning a triangle with an exclamation mark appears on the bottom left corner. The warning condition will stay on until the souce of the error is removed but the analyzer continues its operation normally.



A fault indicates an unrecoverable condition. The analyzer will stop any operation and will require user intervention to restore the normal analysis routine. The top bar will become red and changes its label to STOPPED. The icon of a ringing bell signals the alarm condition and if the analyzer beep functionality has been turned on you will also hear a beep sound.
After resolving the condition that lead the analyzer to a fault the user must manually restart by tapping on COMMANDS > STOP RESET in the main menu of the graphical user interface (see next chapter).



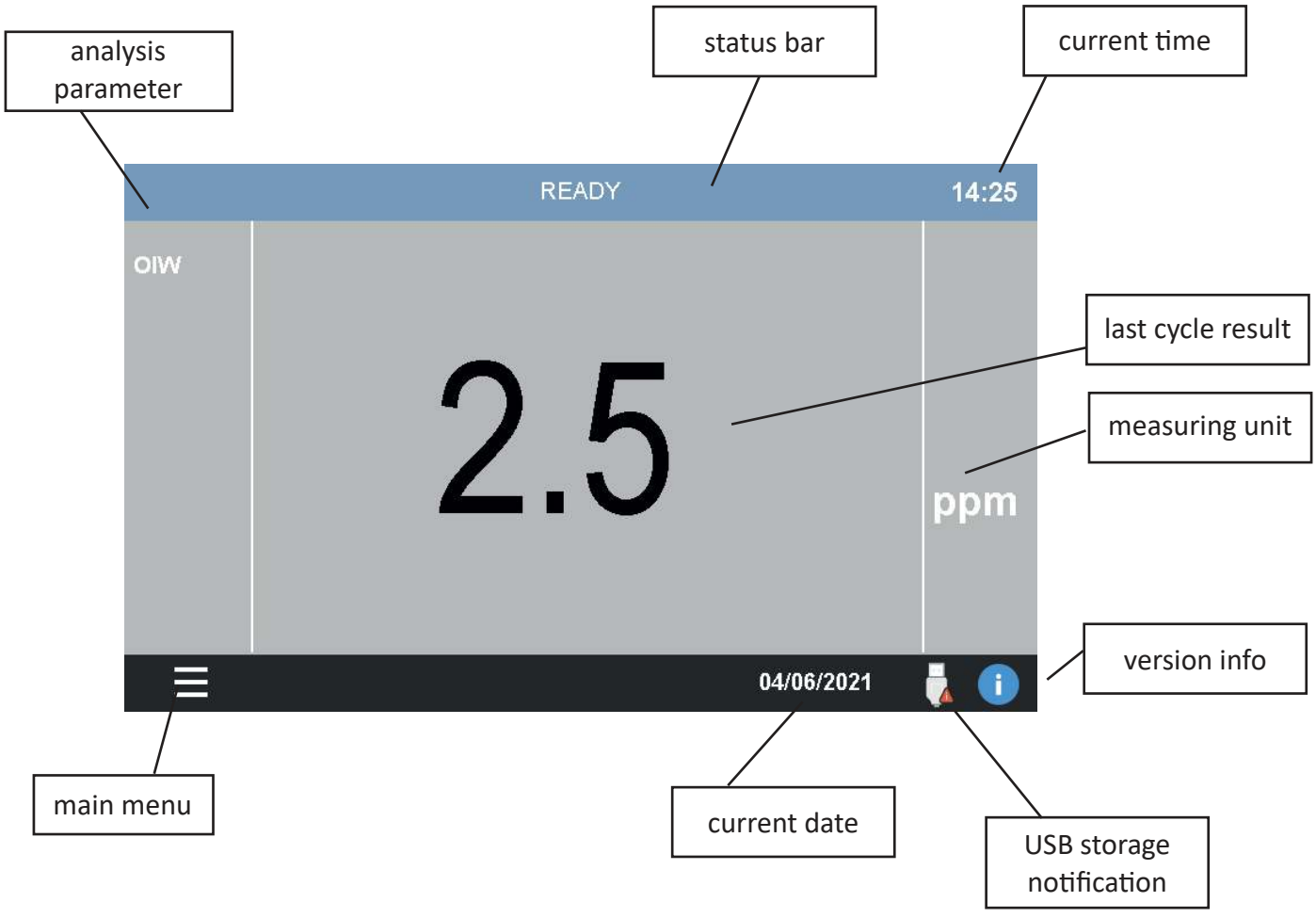
6 - USER INTERFACE

6.1 Power on

After checking for a proper power supply connection, you can turn the device on through the switch located inside the upper compartment.
The analyzer display takes a few seconds to turn on, during which a splash screen appears followed by the main screen.

Please note that the device will restart continuing the same operation that was in course when it was turn off. If the previous shutdown had been caused by a power loss, and the analyzer was set to ONLINE (continuous consecutive analysis cycles), when restarting the machine, the analysis cycles will continue from the same point.
If, on the other hand, the analyzer was set to Stand-by before being turned off, it will stay in stand-by.

You will se the following main page:



If the device was set to analyze 2 channels, you see an additional result value for channel B.

result A

result B

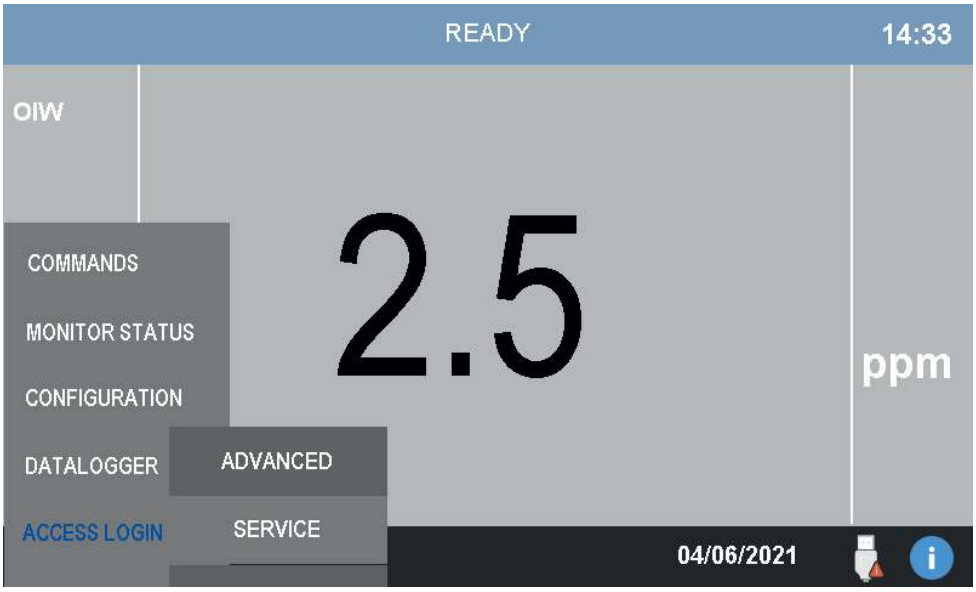
After some minutes of inactivity the screen will go black to save power.

6.2 Main menu

By tapping on the bottom left corner you will access the main menu. All the commands, options and configurations can be accessed from here.

6.3 Gaining access

To prevent undesired modifications to important configuration parameters, the access to the user interface is restricted on a login-based access menu. The user can log himself in by tapping on the ACCESS LOGIN entry of the main menu.



The analyzer has two levels of security, each level allows the user to access more advanced functions. The two levels are:

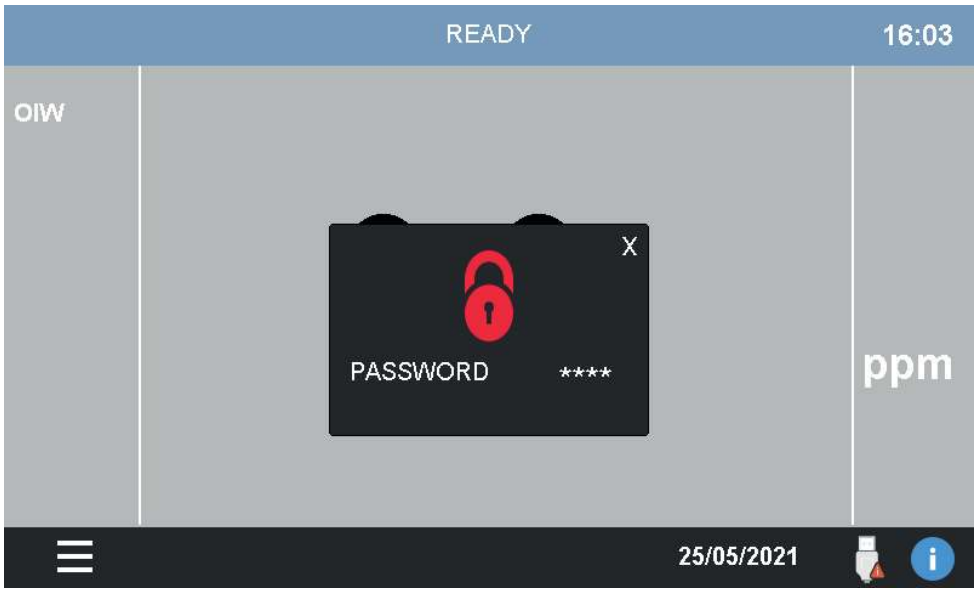
ADVANCED	This level allows the user to perform calibrations and modify basic settings. The password for this level is **1111**
SERVICE	This level allows the user to perform calibrations and modify any settings. Operate cautiously when logged in with this password.

Contact the 3S Analyzers technical service or your local supplier to receive the password for your analyzer. You can write it down below.

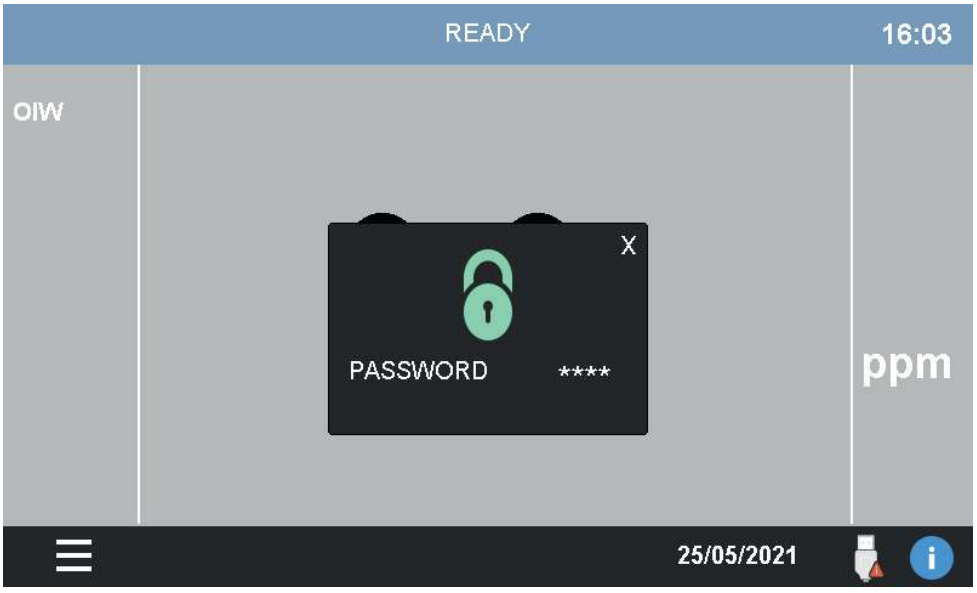
SERVICE PASSWORD _____

To access the analyzer menu with the required security level tap on ACCESS LOGIN in the main menu.

Press on **** to display the numerical pad and enter your password.

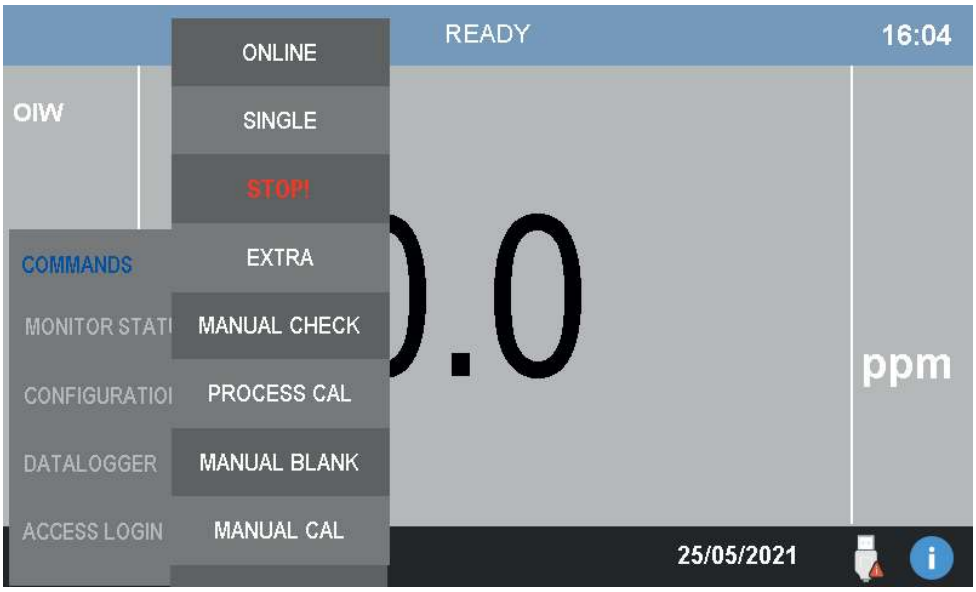


If the password for the selected access level is correct, the lock symbol becomes green.



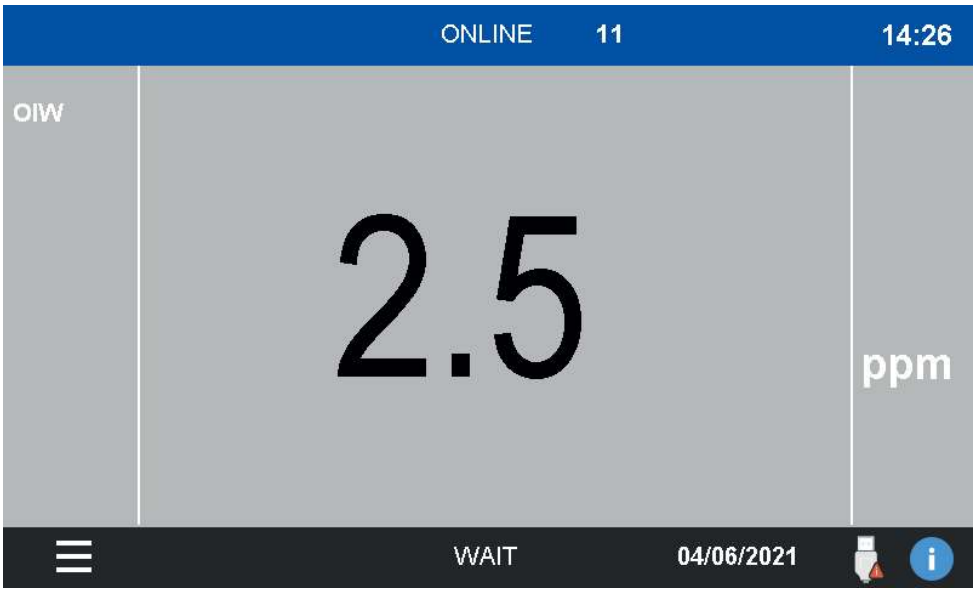
6.4 Commands

In the COMMANDS menu the user can give orders to the analyzer, such as starting a new analysis or perform calibrations.

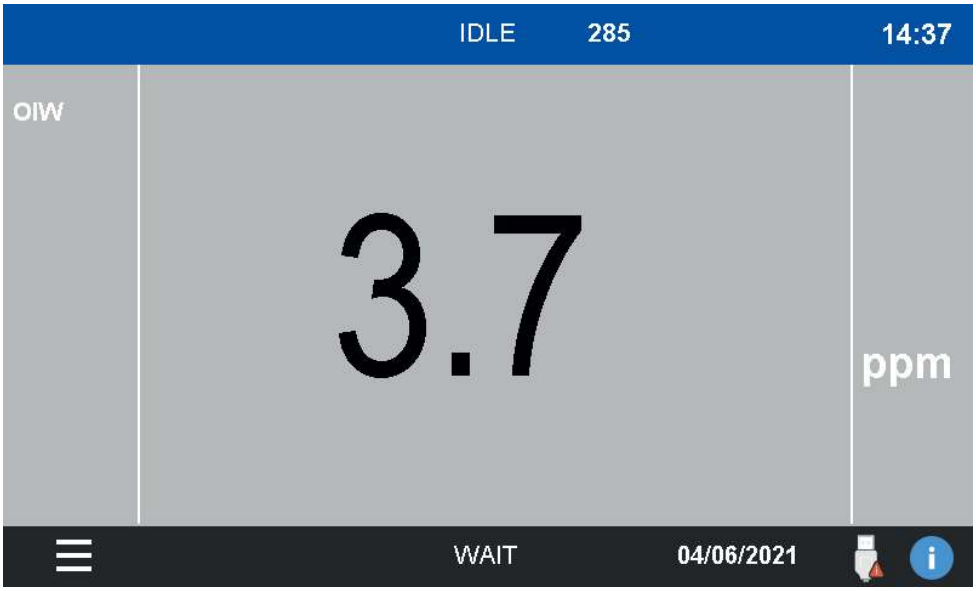


Start Online

By pressing this button the analyzer will start online analyses.
The ONLINE status is characterized by a dark blue top bar replacing the light blue one present when the analyzer is in standby mode. In the top bar the word ANALYSIS also indicates that the instrument is currently in the middle of an analysis run. A countdown timer shows the time remaining after the end of the analysis cycle.



After the analysis cycle is completed the instrument will wait a predefined wait time before starting a new one. The top bar is still dark blue, the countdown timer indicate the time remaining before the next analysis.

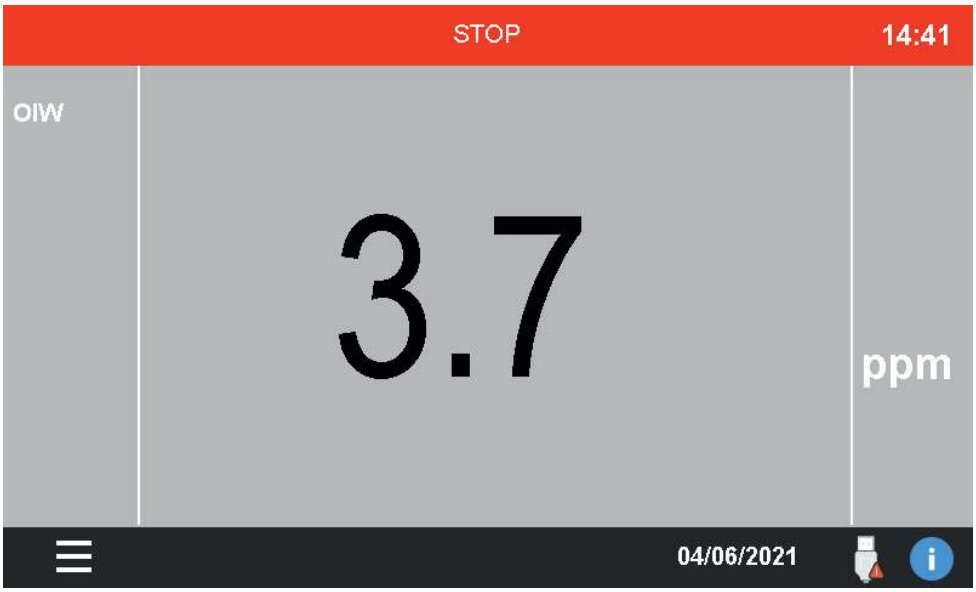


Single Start

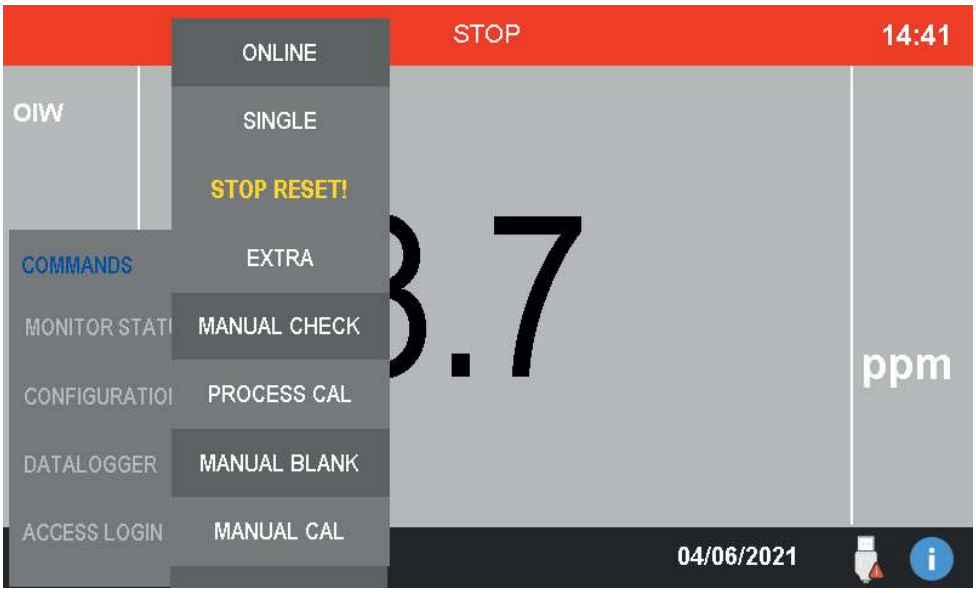
A single analysis cycle can be started by pressing this button. After the measurement is completed the analyzer will stay in standby, ready to receive new orders. The top bar is now green and the timer still indicates the time remaining untile the end of the run.

Stop!

Stop any operation and put the analyzer in the STOPPED status. This command is considered an emergency stop thus an alarm condition is raised.
In any alarm condition the top bar becomes red and an icon of a bell appears on the left side of the screen. If the beep option is active an acustic indicator



To restore the normal operation condition enter the COMMANDS menu and press STOP RESET.

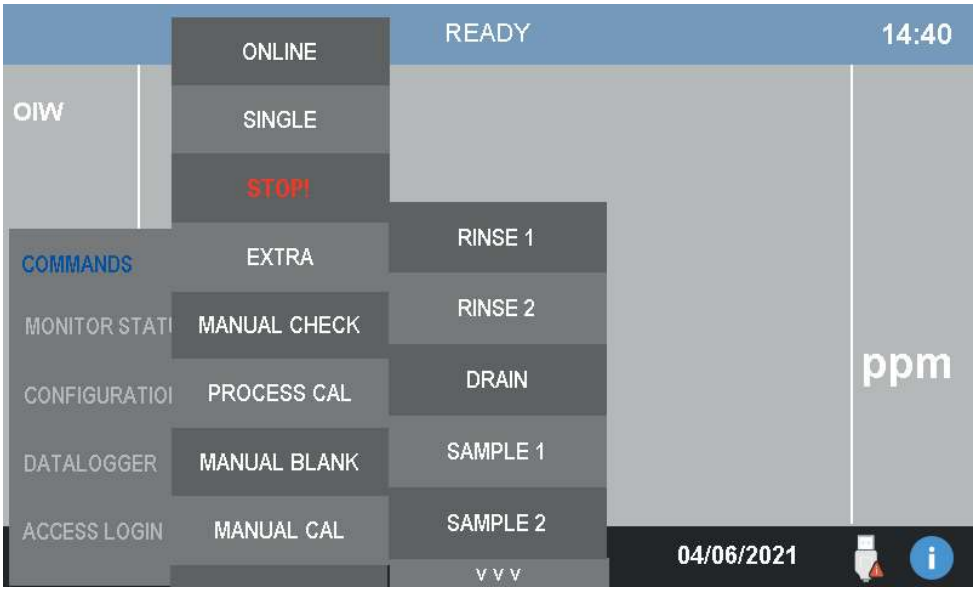


Extra cycle

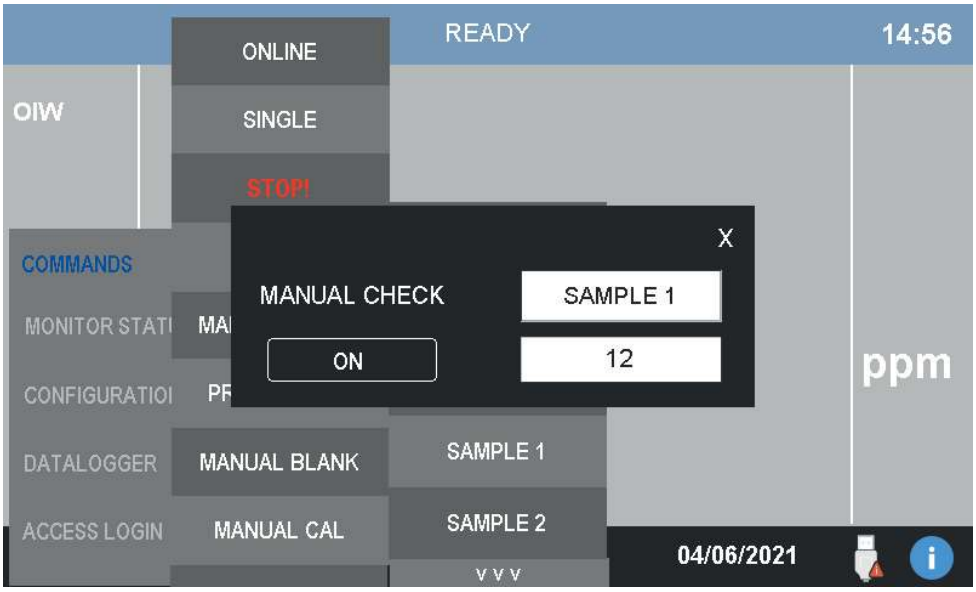
Run an extra cycle immediately. The analyzer will run the program saved as Extra Cycle, usually an autocalibration, autovalidation or cleaning operation. The extra cycle execution can also be scheduled at a given frequency, see section 6.6 to configure the Extra Cycle settings.

Manual checks

Press this button to access a submenu with the list of every function available to the analyzer. The user can then manually run any function/operation for a specified amount of time. This is usefule for testing or servicing purporses. See Section 4.3 for the list of the operations and their description.



After selecting the desired operation you will be asked for the amount of seconds you want the function to stay on. Enter the value in the field and confirm with OK to run the function.



Process Cal

In this page the user can perform a process calibration to align the calibration curve obtained with standard solutions to the actual sample. See paragraph 7.6 for more information about process calibration.

The value obtained by a laboratory analysis of the sample can be inserted in the PROCESS CONC field, by pressing the PROCESS CAL A (or PROCESS CAL B for the optional second channel) a new calibration factor can be calculated.

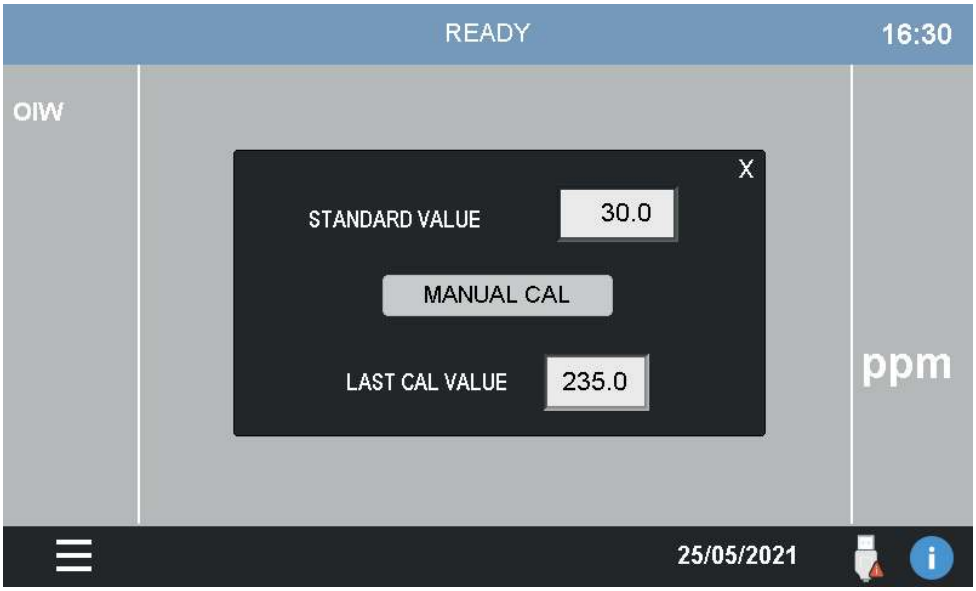
Alternatively, if the factor is already know, it can be directly supplied by pressing on the PROCESS CAL FACTOR FIELD.

Manual blank

Store the last measurement value as blank calibration. See Section 8 for more info on how to calibrate the instrument.

Manual cal

Perform the calibration of the instrument. If the calibration mV value falls out of the predefined boundaries, a calibration error will be raised.
See Section 7 for the correct procedure to perform a calibration.

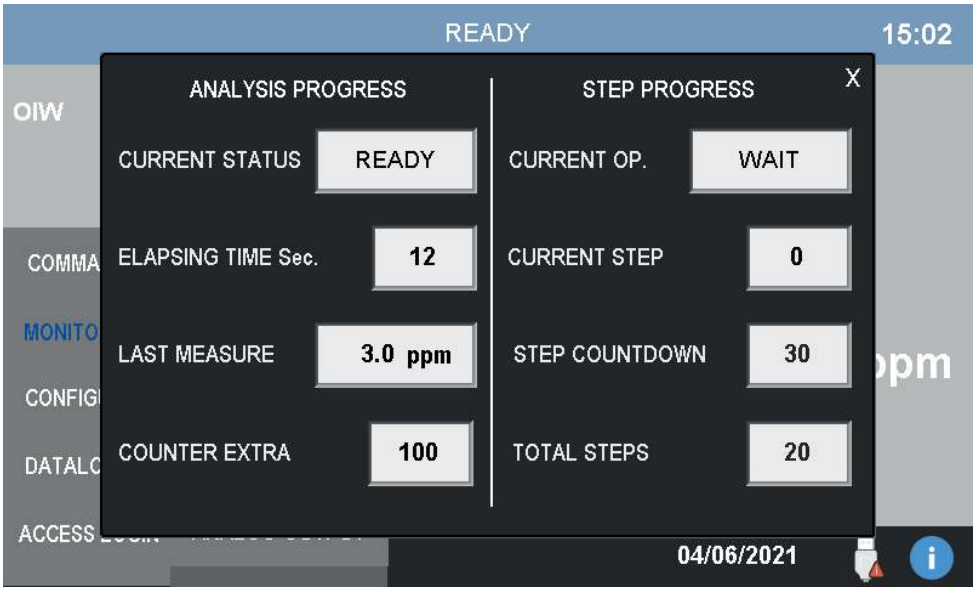


6.5 Monitor status

This menu contains the data representation in grafical form as well as important diagnostic information on the analyzer status.

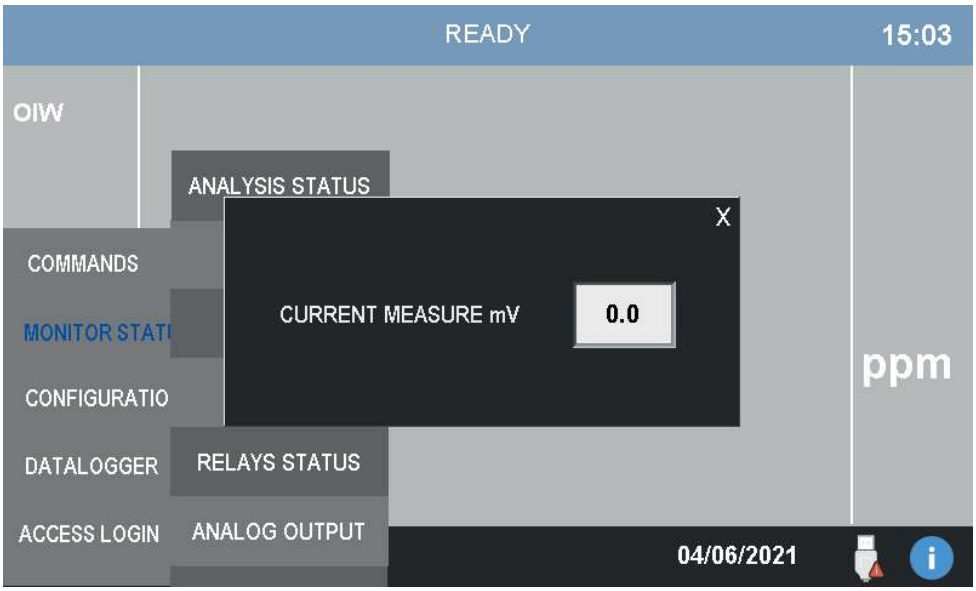
Analysis Status

This window will report data on the current analyzer status.
In the left column the user can find the status of the analyzer (READY, ANALYSIS, IDLE TIME, STOPPED), the elapsing time of the current analysis, the last measured value, cycles remaining before an EXTRA cycle is executed (COUNTER EXTRA).
On the right colum there is the current operation, the step number and the time reamining to complete it, and the total number of steps in the cycle.



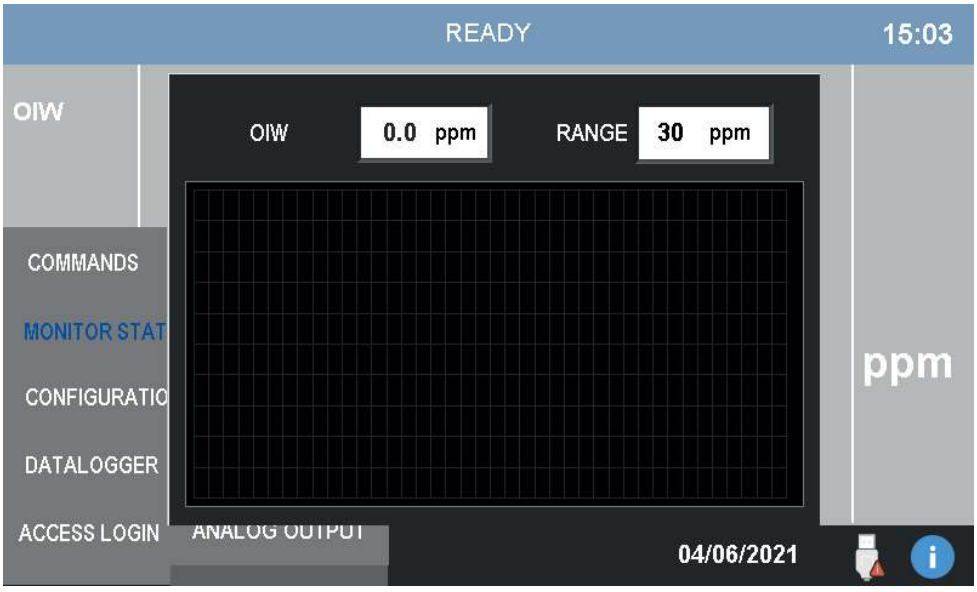
Sensor

This window shows the current value of the signal in mV as read by the analyzer sensor.



Result trend

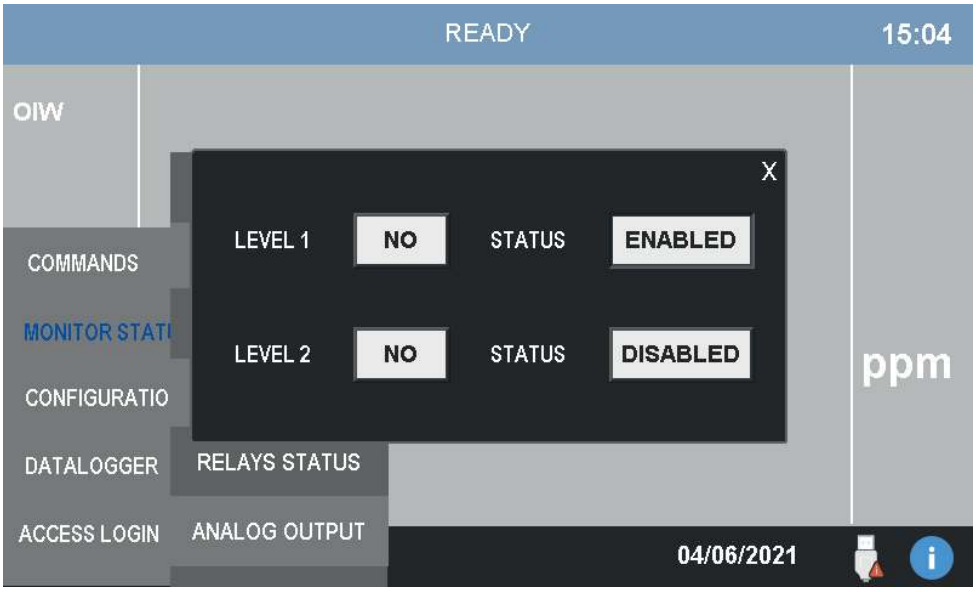
This window shows the plot of the most recent analysis results.



Levels

In this window the user can check the presence of the samples.

The level switches detect the presence of the sample in the inlet streams (1 or 2 depending on the configuration). They must be connected to the level sensors of the external reservoirs in order to operate correctly, see Section 3.9.



Relays status

The analyzer is provided with two output relays to signal anomalies in the analyzer behavior.

In this page the current status of the two relays is shown.

Analog output

The analyzer is provided with two 4-20 mA analog outputs, one for each channel (up to two). The current output value can be monitored in this window.

From the same window is also possible to simulate the output, this is useful to test a new installation or for servicing purposes.

To start the simulation press SIMULATE OUTPUT, a numerical pad will appear allowing the user to enter the value as a percentage of the full scale.

Remember to disable the simulation when you have done with it!

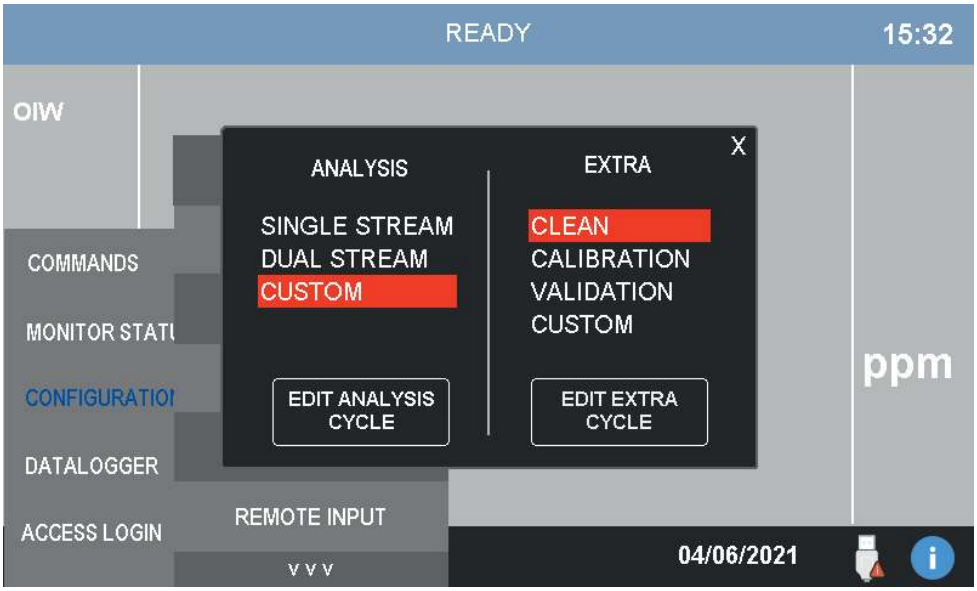
6.6 Configuration

This menu contains the configuration parameters of the analyzer.

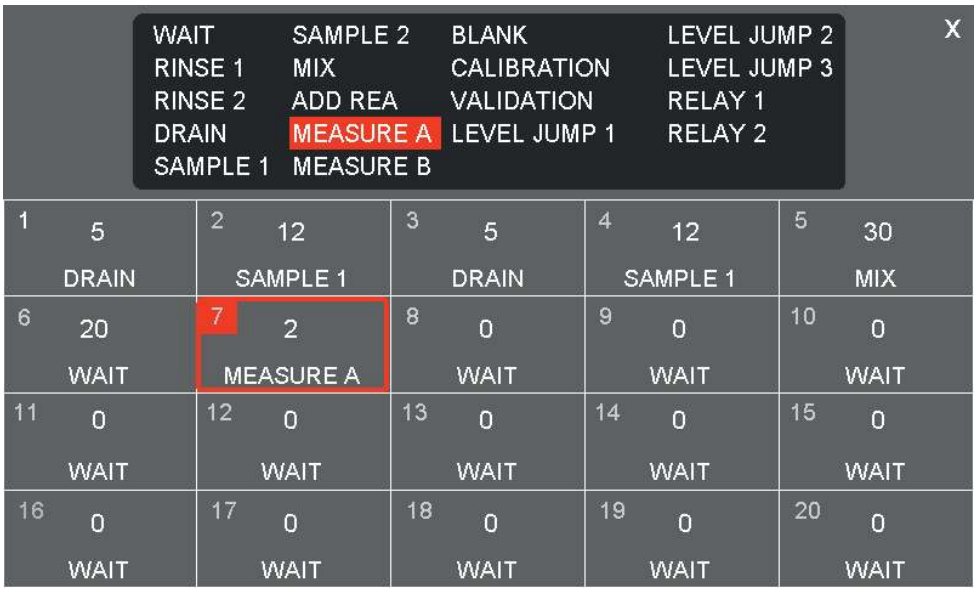
Cycle setup

The instrument perform the analysis as a sequence of (up to) 20 individual steps. Another sequence of 20 steps defines the EXTRA cycle. The user can choose among a handful of preset analysis and EXTRA cycles. Both cycles can be also customized, for applications where a finer control on the cycle is needed,

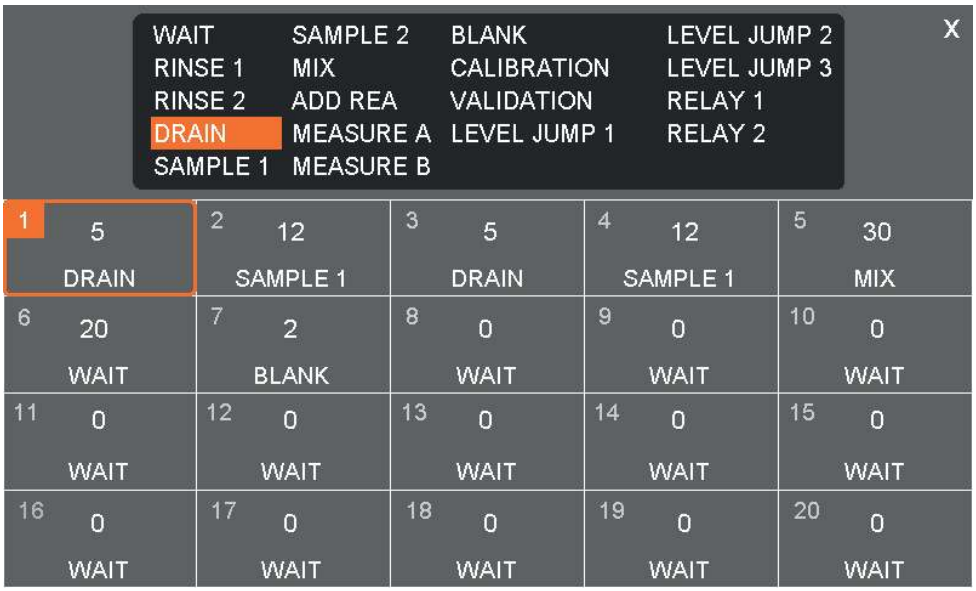
After accessing the menu button the following window appears:



The analysis cycle is present in the single or dual stream versions. The EXTRA cycle can be selected for cleaning, calibration or validation. The correct cycle for the analyzer configuration will be already set before shipping, however the user is free to change configuration and therefore the analysis or EXTRA cycles. It is advised to contact the 3S Analyzers technical assistance before doing any modifications to the cycles.
By selecting the CUSTOM option, the corresponding edit button will be activated. The CUSTOM analysis cycle can be modified step by step by tapping on the edit button.
The following window appears:

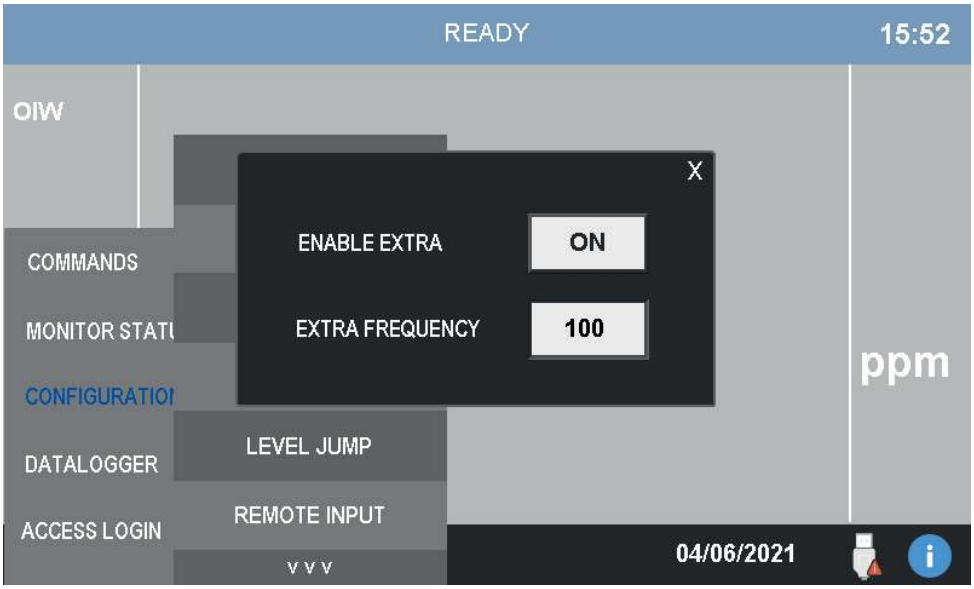


Any step can be reprogrammed individually by pressing the corresponding square. After selecting the desired function, press on the number to set the duration time.
Analogously, by selecting the CUSTOM EXTRA cycle and pressing the edit button, the user will be directed to its configuration page.



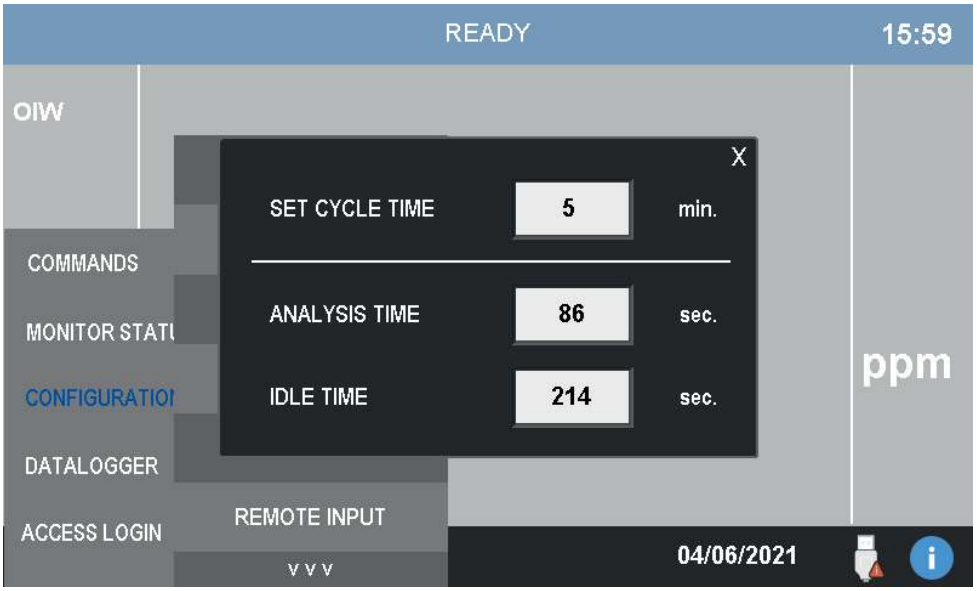
Extra cycle frequency

In this window the user can set up the extra cycle frequency. In the following example the instrument will perform an extra cycle every 100 analysis cycles. The automatic execution of the extra cycle can be turned on and off.



Cycle time

The instrument is able to run batch analysis continuously but it is also possible to set up an arbitrary analysis frequency. In this window the user can set a cycle time that comprises the analysis time and an idle time that the instrument waits before continue to the next analysis. In this way the analysis frequency can be controlled precisely.



Level jump

When the sample is missing the analyzer has to decide how to behave. The analysis cycle can poll the status of the level sensors to check the presence of the sample, it does this through the Level Jump cycle function. In the analysis table you can insert a Level Jump step, when the step is encountered the analyzer will check the presence of the sample and if this is missing will jump to a step that does not require the sample, usually the final cleaning steps or directly to the end of the cycle.

Up to 3 different level jump events can be programmed in this window. By calling the corresponding event in the analysis cycle the jump is then executed.

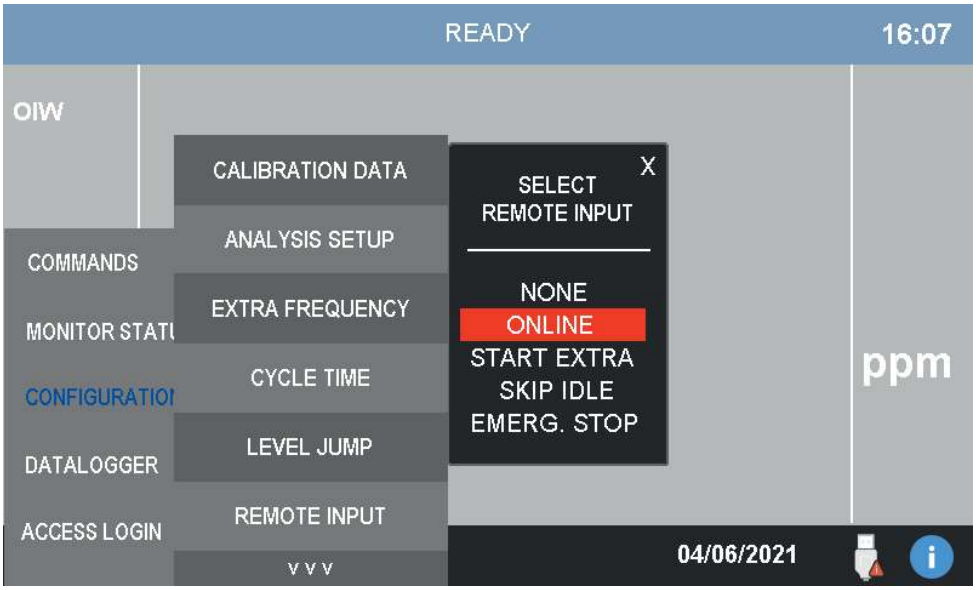
Remote input

Some operations of the instrument can be controlled remotely through a digital input, physically located in the screw terminals inside the electrical compartment of the analyzer.

To select the operation controlled by the remote input open the window REMOTE INPUT of the CONFIGURATION menu.

Four operations are possible:

NONE	Remote input disabled.
ONLINE	The analyzer will start continuous analysis.
START EXTRA	An extra cycle is started.
SKIP IDLE	The idle time is bypassed and the following cycle will start.
EMERG. STOP	All operations are halted and the instrument is stopped, the FAULT sytem event will be activated



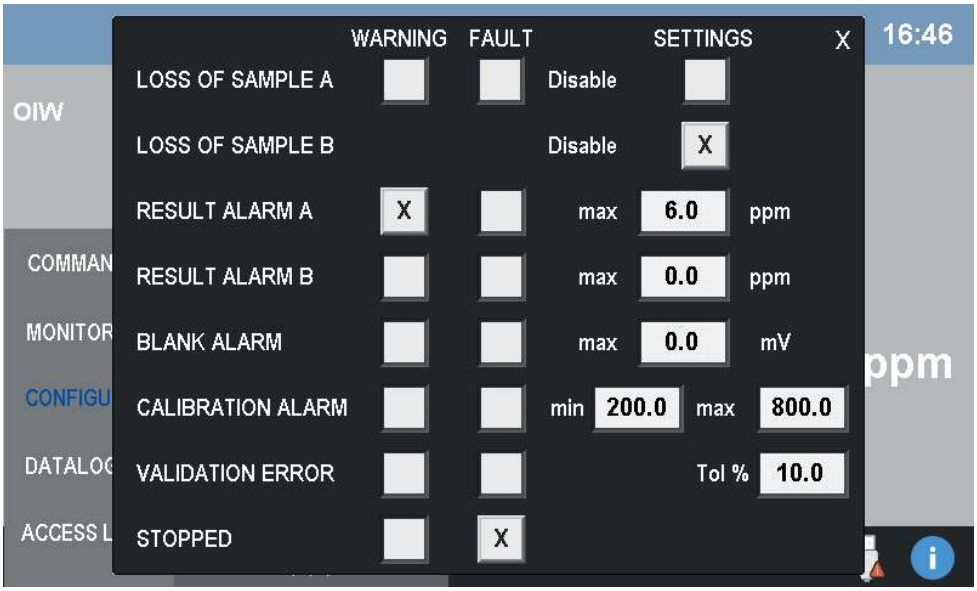
Press on the arrows in the bottom of the configurations menu to show more options.

Alarms

The analyzer can incour into events that require user attention or user intervention. In this window the user can bind an event either to a warning or to a fault, or even disable the event completely. The warning or fault will be displayed on the screen and communicated externally through one of the two relays. In the case of fault, the analyzer will completely stop every operation until user intervention.

The following events are available:

LOSS OF SAMPLE A, B	The relay is activated when the level sensor of the recirculating tank indicates the absence of a sample (A or B). They can be disabled although is not advised.
RESULT ALARM A, B	The relay is activated when the last measured value exceeds the preset limits. Once the value returns within the limits, the alarm is reset.
BLANK ALARM	The relay is activated when the BLANK calibration exceeds a preset threshold.
CALIBRATION ALARM	The relay is activated when a calibration falls outside of the limits in mV units.
VALIDATION ERROR	The relay is activated when a validation falls outside of the given limits.
STOPPED	The relay is activated in case of forced stop of the analyzer when an user press emergency stop (STOP! command).



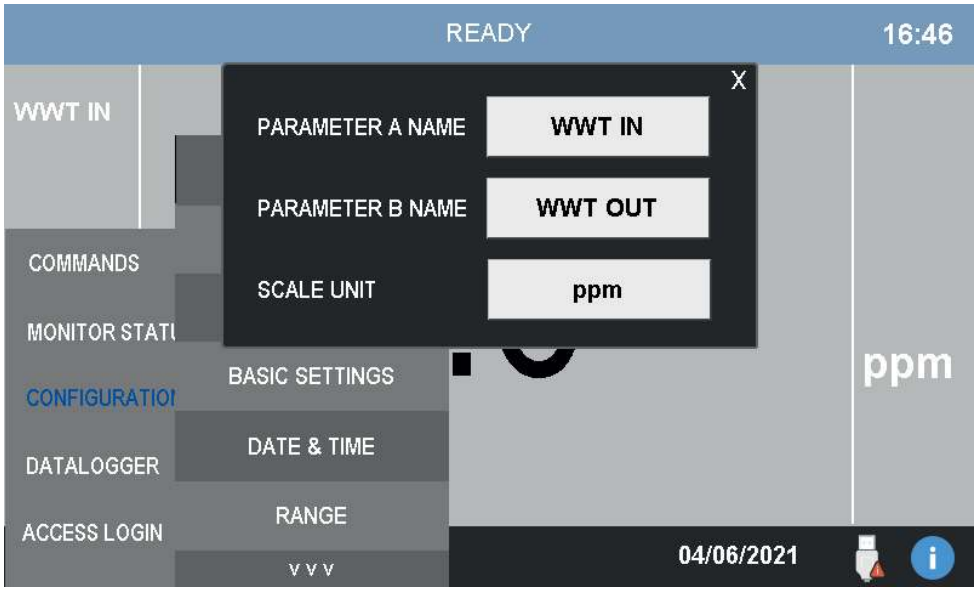
Relays

The user can configure the two relays arbitrarily. Both relay can be set either as a warning or as a fault (hard error, analysis will stop). Additionally the relays can be activated by the steps in the analysis cycle table (or extra cycle table). The latter option is useful to operate external equipment (valves, pumps etc.) during the cycle.

By activating the "failsafe" mode, the relays will be normally closed and normally powered, in case of power losses the relays will open thus simulating an alarm condition.

Unit & parameter

This window allows the user to change the labels for the analysis parameter(s) and the measure unit. Tap on the fields to open the interactive keyboard.



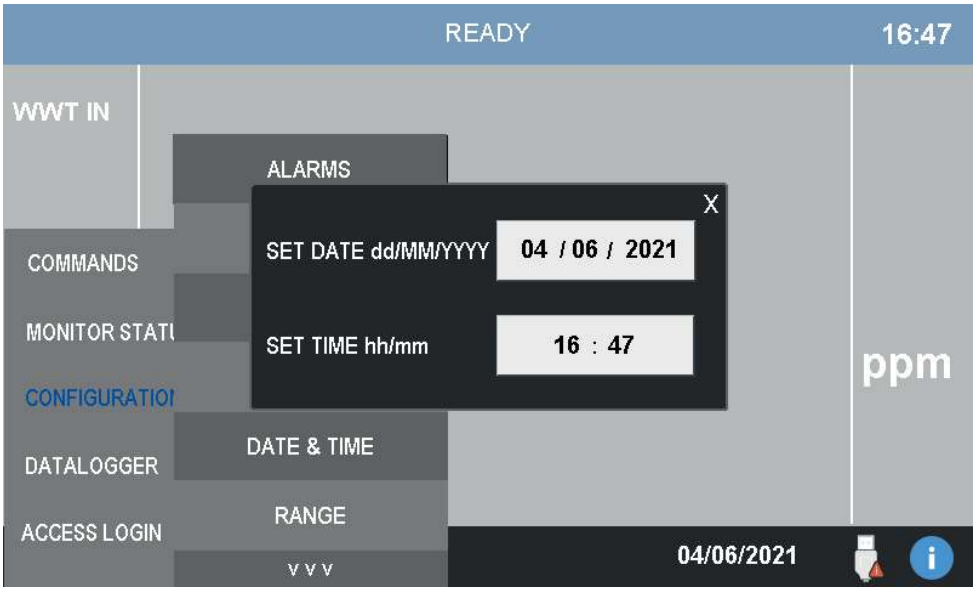
Basic Settings

Some generic options are collected in this page.

LOG OFF	Time before the user is logged off.
BACKLIGHT OFF DELAY	Time before display shut off for energy saving.
DUAL STREAM	This option is required if the analyzer is configured as dual channel.
UPDATE PROGRAM	Must be turned on in order to be able to update the HMI panel software, otherwise the update window is not show when a USB drive is plugged in..
ENABLE DATALOG	Enable/disable the integrated datalogger.
BEEP	Turn beep on/off.

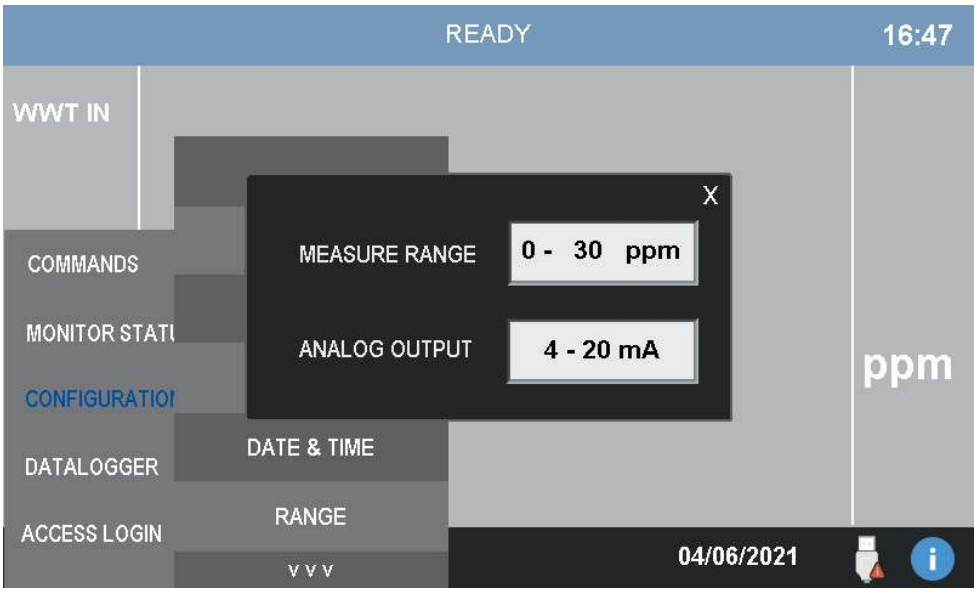
Date & time

The current date and time can be set in this window. Press on the fields to activate the numerical pad and enter the new values.



Range

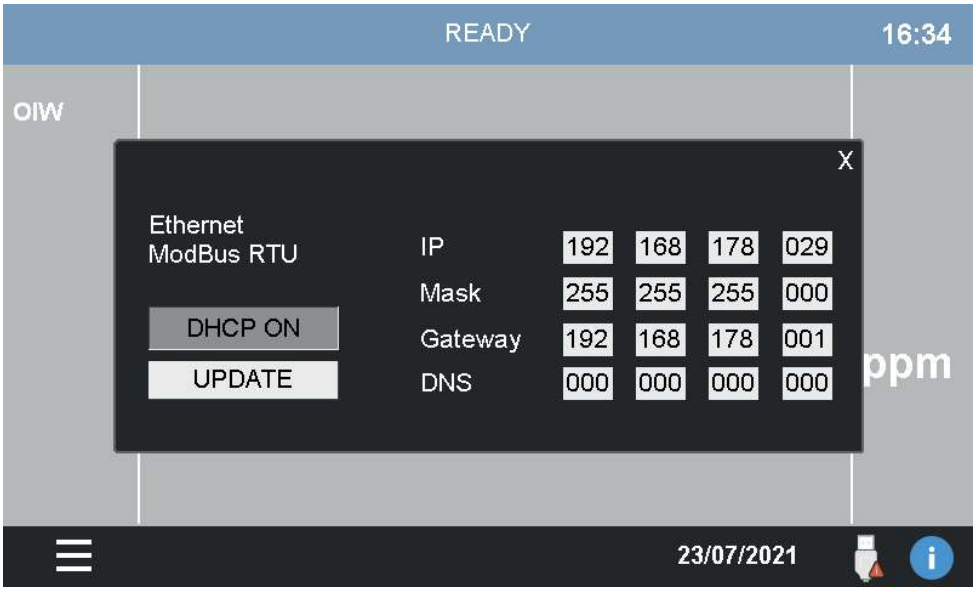
In this page the user can set the range of the analyzer. This range will be applied to the analog output, that can also be switched from 0 - 20 mA to 4 - 20 mA from the same window.



6.7 Version Info and Connection Parameters

By pressing the ? symbol on the bottom right corner you can access a windows containing some informations about the analyzer software version. By scanning the QR code is also possible to download the user manual for your analyzer version.

By pressing ETHERNET SETTINGS the following window appears.



From here you can change the configuration parameter for the Ethernet Modbus connection. You are free to set a static IP address or let DHCP decide, in any case remember to press UPDATE after any changes are made.
The commands available for the serial communication are listed in the table in section 3.8.

7 - CALIBRATION

7.1 About the method

Fluorescence spectroscopy is an analytical method that requires calibration before quantitative measurements can be performed. This is done using standard solutions which are analyzed in the same way as the sample.

In order to ensure correct measurement performance, the analyzer should be calibrated periodically, best results are obtained if the analyzer has been recently cleaned and serviced.

Due to the nature of fluorescence spectroscopy the concentration/signal plot is not linear in the whole range of our interest. Therefore the analyzer uses a multi-point calibration curve. The first point is the blank (zero), which is usually done by analyzing demineralized water. If the analyzer requires dilution it is advisable to calibrate the blank using the same dilution water used for the analysis. A part from the blank, other four points are needed for the calibration curve at concentration equal to 25%, 50%, 75% and 100% of the full scale of the analyzer.

The multi-point calibration curve will be already calculated in the factory, we then provide a method to automatically recalibrate the whole curve using only a single point.

7.2 Autocalibration

The analyzer can be programmed to execute a calibration operation automatically. The calibration must be programmed as an EXTRA cycle. The EXTRA cycle must be switched on and its frequency defined, you can do this in the CONFIGURATION > EXTRA FREQUENCY menu of the user interface. The calibration will then run automatically after the defined amount of analysis cycle. Both the zero and the span calibration can be executed automatically via the EXTRA cycle.

The user can also trigger a calibration cycle at any time by pressing COMMANDS > EXTRA CYCLE.

Of course an appropriate standard solution must be connected to the secondary inlet port of the analyzer (see 3.11) and the EXTRA cycle must be set to CALIBRATION (see 6.4). Also see section 5.5 for an example of a calibration cycle.

7.3 Blank calibration

The blank calibration is simply performed by analyzing demineralized water (or dilution water in the case of an analyzer that requires dilution). The blank calibration is particularly sensitive to impurities so is advisable to thoroughly clean the analyzer tubing and the reaction cell before starting the calibration.

To perform a blank calibration, run at least three analyses using pure water. If the results are stable go to COMMANDS > BLANK CALIBRATION and press and hold the MANUAL BLANK button for three seconds.

In case of a dual channel analyzer, both channel share the same calibration curve, blank included. Therefore you don't have to calibrate the second channel.
If the analyzer requires dilution, the steps are the same, make sure to connect demineralized water to the sample inlet and leave the dilution water attached. In this way any discrepancies due to matrix effect of the dilution water can be leveled out.

7.4 Span calibration

Due to the nature of fluorescence spectroscopy, the analyzer has a method with a non-linear response. Therefore a 5-point calibration curve will be used. The calibration curve will be already calculated during our factory testing specifically for your unit. Users are not required to modify the original calibration curve manually (even if they are free to do so, see the following paragraphs) as we provide a method to rescale the whole curve using only a single value.
Only a standard solution with a concentration equal to the full scale value of the analyzer is needed.

Proceed as follows:

1. Prepare a standard solution of a concentration equal to the full scale of the analyzer. If in doubt you can check the full scale value by pressing COMMANDS > MANUAL CAL. It's not possible to change the value of the full scale.

2. Run at least three analyses using such standard solution. If the results are stable go to COMMANDS > MANUAL CALIBRATION then press and hold the MANUAL CAL button for three seconds.

After the calibration is completed you can see the new curve in the page CONFIGURATION > CALIBRATIONCURVE.

7.5 Modifying the calibration curve

The calibration curve of the analyzer has been already calculated during the factory testing right before shipping. The end user does not have to recalculate all the five points each time: by performing a calibration at the full scale value, the curve can be recalculated automatically.
Anyway it is possible to recalculate the curve to maximize the analyzer accuracy or to compensate matrix deviations after on-site installation.

To do so, follow these steps:

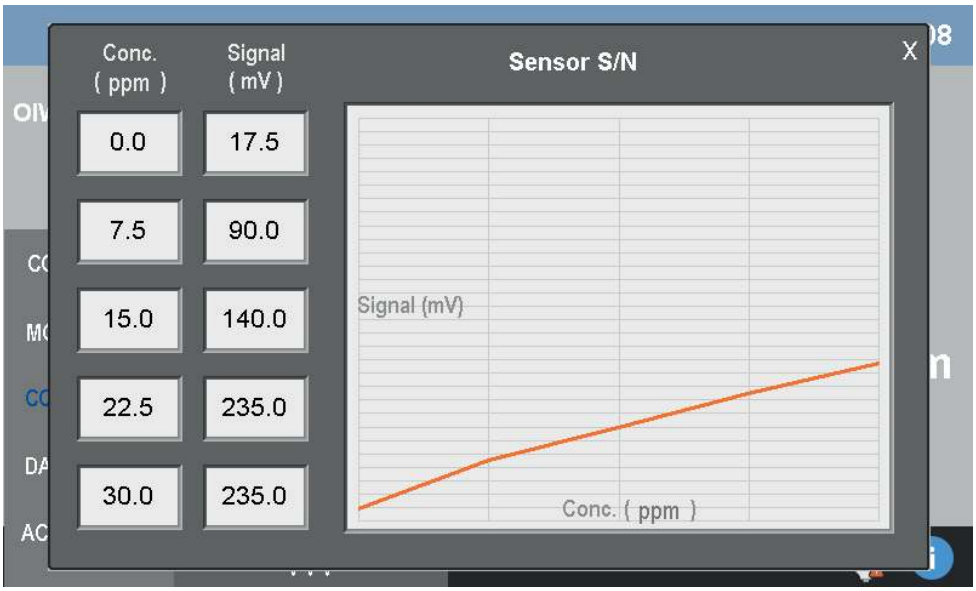
1. Prepare a set of standard solutions at the following concentrations:

- 25 % of full scale
- 50 % of full scale
- 75 % of full scale
- Full scale

2. Perform blank calibration as describe in section 7.3

3. Make an analysis for each one of the standard solutions. You can proceed as in the two-point calibration but do not press the calibrate button at the end of the analysis, instead After each analysis go to MONITOR STATUS > ANALYSIS STATUS and take note of the mV value. Do this for every point to be measured. Repeating and averaging the analysis is not mandatory but advised.

4. Go to CONFIGURATION > CALIBRATION DATA. You will see the following page:



5. Replace the old calibration data with the new one.
When all the points are insterted the calibration is completed. Further calibrations can be carried out just by calibrating at the full scale concentration, see 7.5.

7.6 Process calibration

The analyzer is calibrated using a standard solution of a stable substance of known concentration. This gives the analyzer reliability in the calibration process.
However, different substances have different emission coefficient and the calibration curve obtained with standard solutions may require to be adjusted to be fully representative of the sample.
The process calibration applies a scale factor to the measurement to align it to the value of the actual sample.
The process calibration can be performed through the following steps:

1. Take a sample representative of the water stream to be analyzed, at least 1 liter. Follow good sampling techniques to have reliable results.
2. Determine the concentration of the oil/analite of interest using a reference instrument or a laboratory analysis of the sample .
3. Attach the same sample to the inlet of the analyzer and perform at least 3 analyses.
4. Go to COMMANDS > PROCESS CAL (see section 6.7) and press the PROCESS CAL A or B button, depending on the origin of the sample taken.
5. The calibration is now over, the following measurements will be calculated with the new process factor.

7.7 Validation

A validation operation follows more or less the same steps of a calibration, a standard solution is feeded to the instrument and an analysis is performed. The main difference is that with the validation the result of the analysis is not used to calculated a calibration factor but it is compared to the stored calibration value instead. The result of the validation is a percentage with the 100 % corresponding to a perfect replication of the last calibration factor.
The validation needs a standard solution of the same value of the last calibration stored in the anlyzer.
Like the calibration, the validation can be programmed as the EXTRA cycle and can be run at the necessary intervals. It can be also started manually with COMMANDS > EXTRA CYCLE.
The validation is useful in those cases where the user wants to verify the calibration or more generally the correct function of the analyzer without risking to compromise the current calibration factor.

8 - DATA STORAGE

8.1 Datalogger Page

The instrument has an integrated datalogger functionality. At the end of each analysis cycle the results are logged together to the time and date of the analysis.
The data is stored on a removable USB device that must be plugged in on the the back of the HMI display. To reach it, open the electronics compartment and look at the bottom of the display. If the storage unit is removed the data is not saved and the datalogger functionality will not be available. A warning will be displayed on the screen the first time the instrument tries to log a result and the device is not present. The presence of the USB storage is also notified in the bottom right corner.
To access the datalogger press DATALOGGER on the main menu of the graphic interface.

Result Log

This is the main datalogger page where the analysis results are shown.

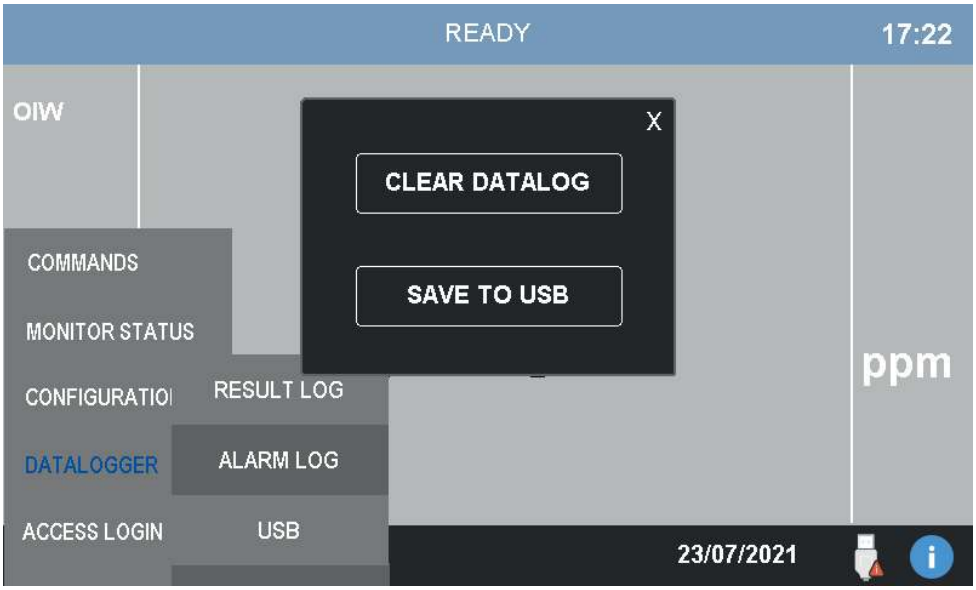
In the leftmost column there are the dates the data has been recorded on. By selecting a day the corresponding lists of measures will be displayed. The time column indicates the analysis time whiile the other two columns contains the data for both channels. In the picture the last column is empty because the analyzer has not recorded any data on the second channel. This is the case of a single channels analyzer.

Alarm Data

In this page the analyzer alarm conditions are collected. The column on the left shows the date, the START column show the time the alarm condition started, the EVENT column describe the alarm. When the alarm condition is resolved the corresponding line will be grayed out and the time will be recorded on the END column.
The data present in the Alarm Data page are stored on the analyzer internal memory and wll be recorded even if the exteral storage is removed.

USB

In this page you can clear the data on the external USB device. Is it possible to completely erase the logged data or to selectively erase the data for the oldest day. By pressing the SAVE TO USB button the database is converted to the CSV format in the external USB storage.
After the conversion the USB storage can be unplugged and the data viewed on a personal computer with any spreadsheet software.



9 - MAINTENANCE

9.1 Maintenance operation

Here below the list of the preventive maintenace operations:

COMPONENT	OPERATION	FREQUENCY
DRAIN VALVE	tubing replacement	every 4 months
INLET VALVES 1 - 2 - 3	tubing replacement	every 4 months
REAGENT PUMP	tubing replacement	every 8-12 months depending on duty
SAMPLE PUMP	tubing replacement	every 4 months
MEASURE CELL	cleaning	depending on duty

The frequency of the listed maintenance operations is heavily dependent on the nature of the sample. Samples that contain a high concentration of organic solvents or solid particles such as sand grains may require more frequent cleaning and mantainance.

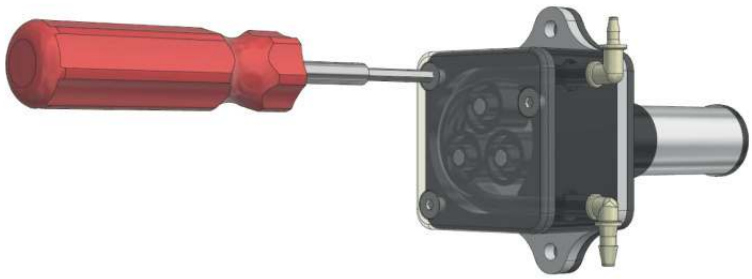
Important: replace pinch and peristaltic valve tubing using only spare parts provided by the manufacturer to ensure proper sealing.

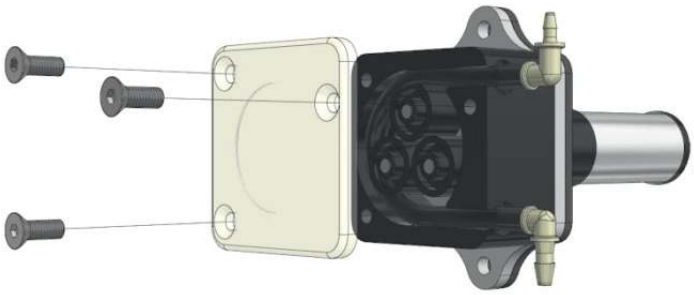
9.2 Reagent pump maintenance

This operation is necessary for the replacement of the cleaning reagent pump tube and rollers.
Although the tube ensures at least 70 hours of operation (it is possible to calculate the operating time considering the frequency of analysis and the operation intervals required by the cycle program), therefore it must be maintained and/or replaced at least every 8-12 months.
Use only the tube provided with the REAGENT PUMP KIT, the kit includes 3 spare tubes and one spare roller.

Proceed as follows:

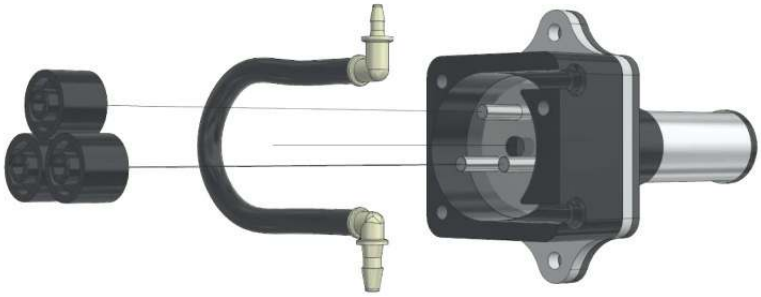
1. Remove the transparent cover by unscrewing the 3 fixing screws with an hexagonal screwdriver



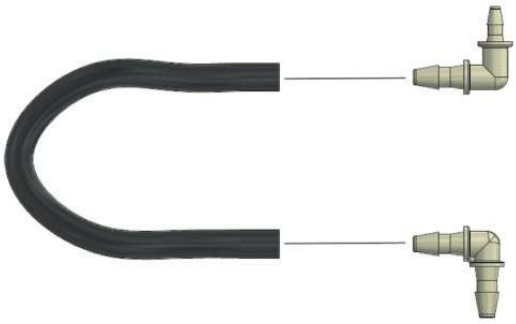


PAY ATTENTION TO THE LIQUID CONTAINED IN THE TUBE WHILE REMOVING THE CONNECTIONS

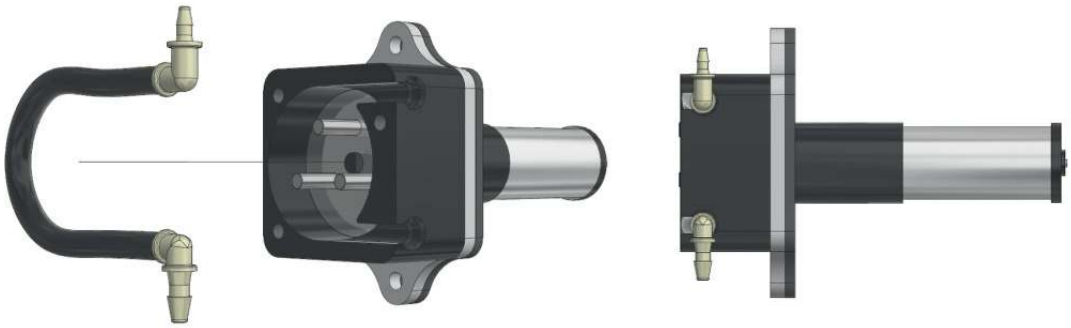
2. Remove the rollers and the tube to be replaced.



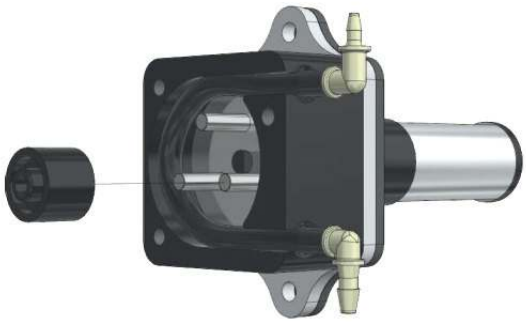
3. Disconnect the fittings and, if necessary, clean or replace them with those provided with the maintenance kit.

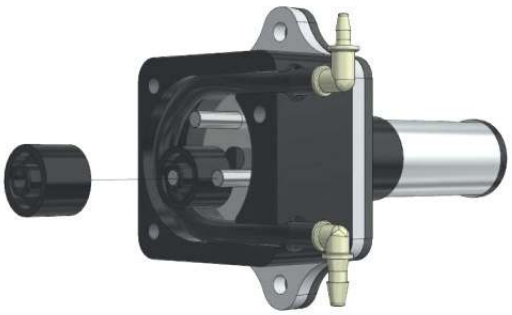


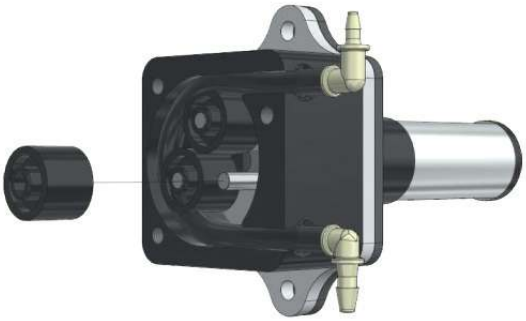
4. Insert the new tube using the fitting (pay attention to the size and direction)



5. Insert the first roller, then operate the pump in manual mode for 1 second (COMMANDS > MANUAL CHECKS, see paragraph 6.4) and insert the second roller. Repeat the same operation for the third roller

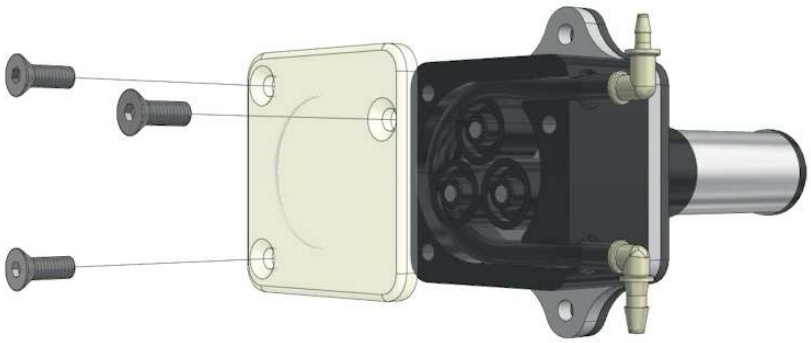


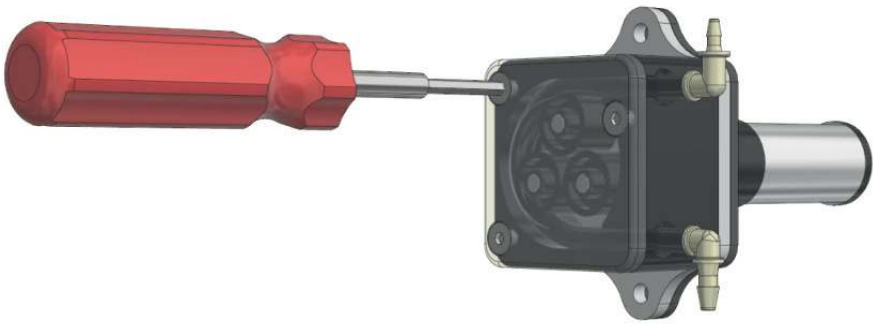




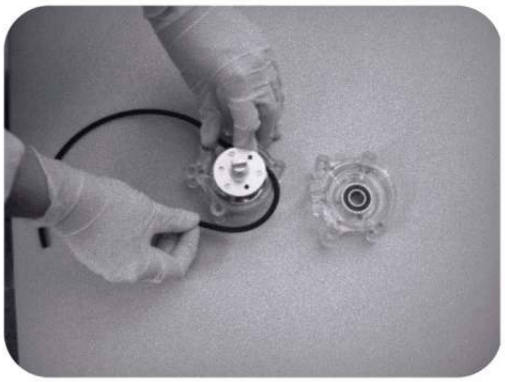
6. Close the transparent cover with the screws.

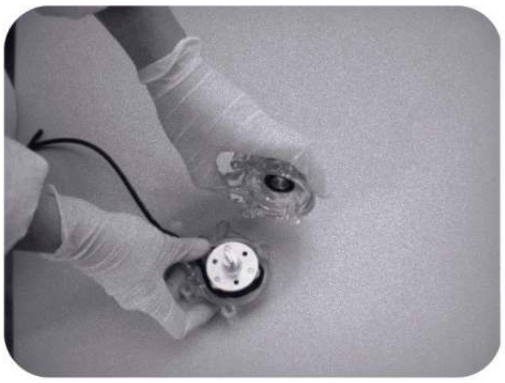
Reconnect the tubes and operate the pump in manual mode to fill the tube with the cleaning liquid coming from the bottle. Make sure that the liquid reaches the cell, this usually needs 45 seconds.





9.3 Replacing the sample pump tubing





- Stop the analyzer

- Remove the four screws holding the pump head

- Disconnect the pump tubing from its inlet and outlet fittings,
  taking extreme caution of liquid spills

- Remove the pump head

- Separate the two halves taking care of rotor and remove the used tubing taking caution for spills

- Clean the two halves and the rotor with towel paper if necessary

- Place the pump half containing the rotor in one hand and place the rollers in the 2, 6 and 10 o' clock positions. Place tubing in the outer port and against the two rollers as shown, keeping your thumb on the tubing to hold it in place, insert tubing key on the back of the rotor shaft and push in as far as possible. Tubing is now positioned deep into the pump head body. With the key firmly pressed against the rotor, turn counterclockwise and push down while turning until tubing has surrounded the rotor.

- The tubing is now in place. Remove key and position other pump half into the rotor shaft and snap shaft. Be careful not to pinch tubing between plastic pump halves.

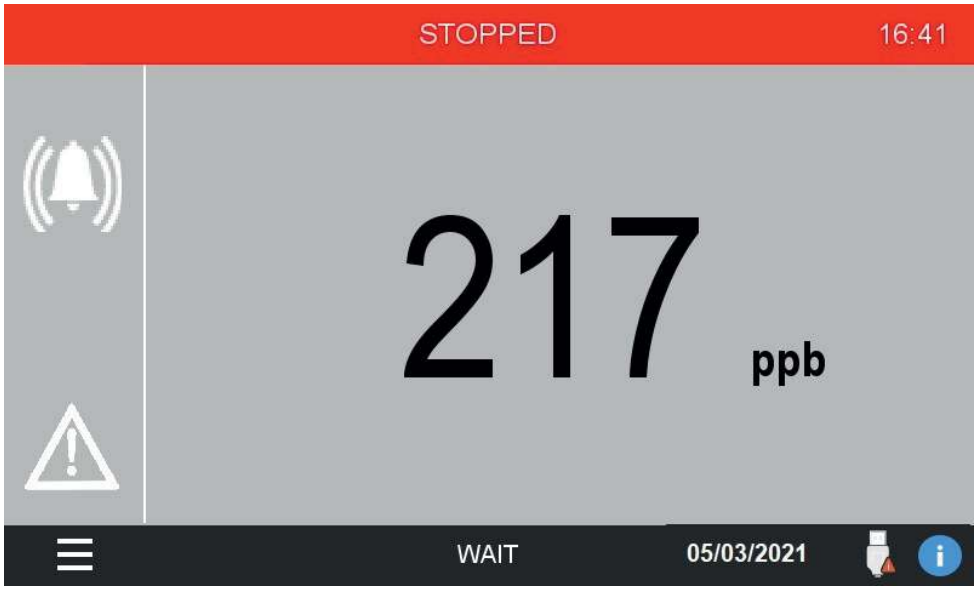
- Check if the pump turns correctly using the key - tightening with fingers the pump head slide it into the mounting screws moving the roller block with the key or with a screwdriver until the shaft aligns with the motor drive

- Put the pump head in place and secure it with the four screws

- Reconnect inlet and outlet to the analyzer tubings

9.4 Alarms and troubleshooting

The analyzer warnings and faults are shown as icons on the main screen when the condition occurs. See section 5.8 for an example of warning and fault conditions. Additionally, the warning and fault messages are stored in the alarm datalogger (see 8.1). When the warning or the fault icons appear the user can check what is going on by opening the alarm datalogger. Alarms that are not active anymore are grayed out and the END column shows the when the error has been resolved. If this is not the case the error is still active and the operator has to intervene to resolve it. In section 6.6, under "Alarms" the user can configure which event is associated with a warning and which events are associated with a fault. A fault is an hard error that requires user intervention to be solved.
Warnings and faults are not mutually exclusive, here is an example of what you will see when a warning and a fault are present at the same time. The red top bar and the bell indicate a fault, the triangle indicates a warning.



The events that can be associated either with a warning or a fault (see 6.6) are:

- Loss of Sample A
- Loss of Sample B
- Result Alarm A
- Result Alarm B
- Blank alarm
- Calibration alarm
- Validation Error
- Stopped

In the following table the user can find a possible solution for the events.

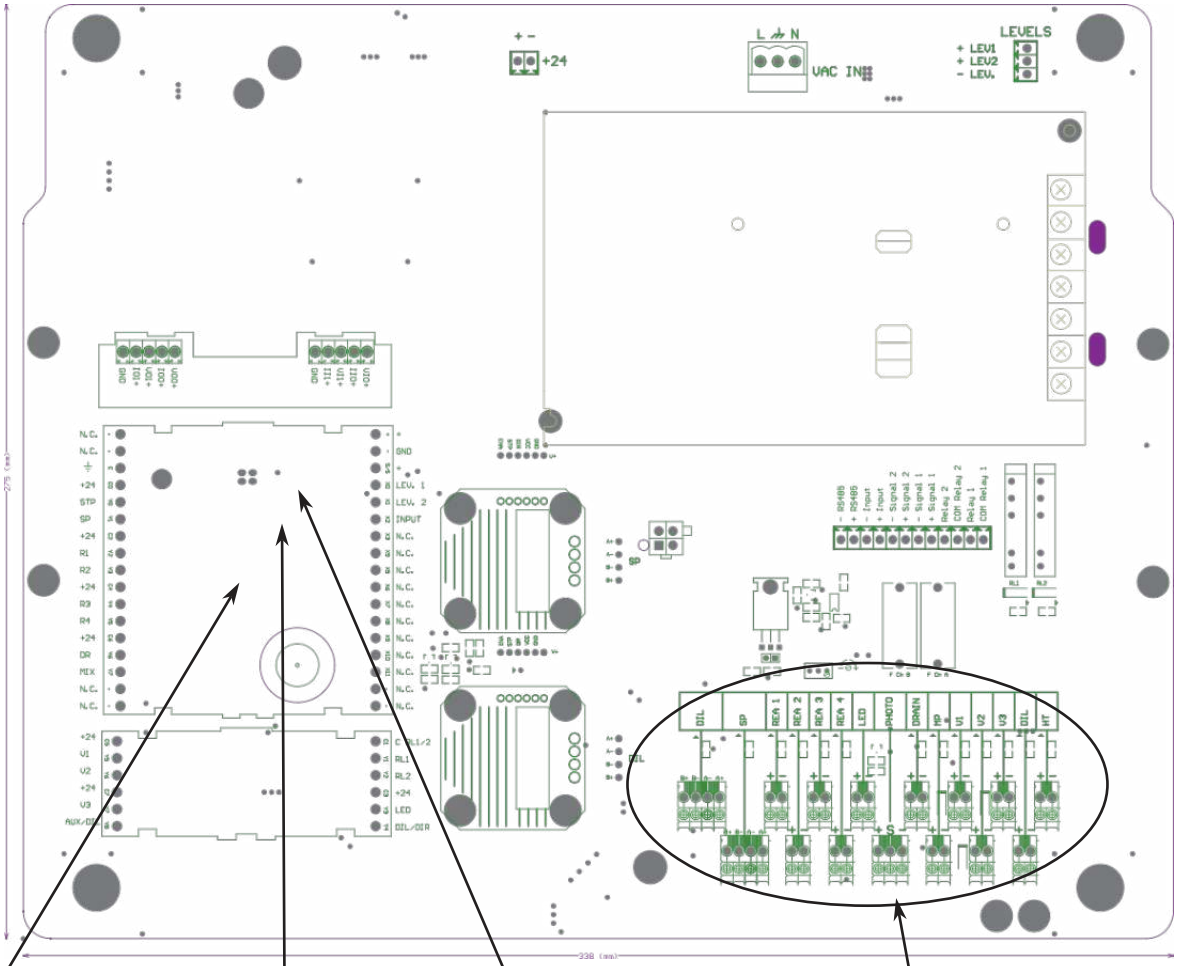
EVENT	CAUSE	SOLUTION
Loss of Sample A, B	The sample is missing	Check the sample line and the sample reservoir
Result Alarm A, B	The value of the result exceeded the preset threshold	User must take action to decrease the amount of analyte in the sample, if it's a cause of concerns
Calibration Alarm	The calibration of the instrument failed	Check wether the analyzer is in good working conditions, the cell is clean and the calibration solution is correctly grabbed by the instrument. Eventually check if your calibration solution is at the expected concentration and has been prepared correctly
Validation error	The validation of the instrument failed	Check wether the analyzer is in good working conditions, the cell is clean and the validation solution is correctly grabbed by the instrument. Eventually check if your validation solution is at the expected concentration and has been prepared correctly
Stopped	The analyzer has been stopped manually	If there aren't other errors or reasons for the analyzer to be offline, you can restart the online operations.

9.5 Electronics checks

When the metal cover is opened by removing the five fixing screws, then it's possible to check a few indicator LEDs, as indicated below

After removing the cover, do not touch the device with your hands or tools without removing the power supply! Switching on without the cover is only allowed for visual inspection.

LED CHECKS - NORMAL CONDITION



Red LED POWER always lit

green LED blinking rapidly means RUN

function LED area, lit when the labeled component is active

green LED and red LED alternate and fast blinking showing the serial communication with the touchscreen panel