s::can
Intelligent. Optical. Online.

Manual

Spectrometer Probe V3

August 2020 Release

Table of Contents

1 General

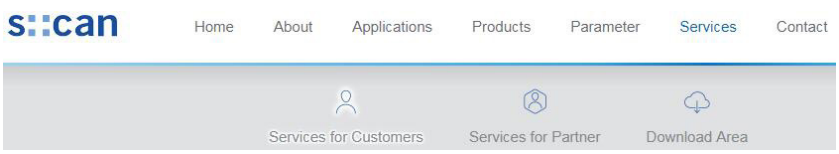
This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the s::can product itself as well as information regarding transport and storage of the product. In further chapters the installation (chapter 4) and the initial startup (chapter 5) are explained. Furthermore information regarding calibration of the device (chapter 6), data management (chapter 7), how to perform a functional check (chapter 8) and maintenance (chapter 9) can be found in this manual. Information regarding troubleshooting (chapter 10), the available accessories (chapter 11) and the technical specifications (chapter 12) complete the document.

Each term in this document that is marked *italic and underlined*, can be found on the display of your controller for operation or as lettering on your s::can product.

In spite of careful elaboration this manual may contain errors or incompletion. s::can does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by s::can. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into third languages.

This manual, at the time of its publication (see release date printed on the top of this document), concerns the s::can products listed in chapter 3. Information and technical specifications regarding these items in s::can manuals from earlier release dates are herewith replaced by this manual.

The electronic version (pdf-document) of this manual is available on the s::can Customer Portal (Services for Customer) of the s::can website (www.s-can.at).



2 Safety Guidelines

Installation, electrical connection, initial startup, operation and maintenance of any s::can product as well as complete s::can measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or by s::can for these activities. The qualified personnel must have read and understood this manual and have to follow the instructions contained in this manual.

For proper initial startup of complete s::can measuring systems, the manuals for the controller and software used for operation (e.g. con::lyte, con::cube, con::nect, moni::tool), the connected probes and sensors as well as the used additional devices (e.g. compressor) have to be consulted.

The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial startup – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

All s::can products are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the product, however, can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Any kind of manipulation of the instrument is strictly prohibited - except for the activities described in this document. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business.

2.1 Declaration of Conformity

This s::can product has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity.

CE-marks are applied on the device. The declaration of conformity related to this marking can be requested from s::can or your local s::can sales partner or can be downloaded from the s::can Customer Portal.

2.2 Special Hazard Warning

Because the s::can measuring systems are frequently installed in industrial and communal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one’s health during work with the measuring device.

The light source of the s::can spectrometer probe emits visible light as well as UV-light, which is extremely dangerous for human eyes (health hazard!). Do not look into the pulsed light beam (e.g. directly or by using mirrors)!

As internal parts of the s::can spectrometer probe are under high voltage, the opening of the probe‘s housing can cause injury, is strictly forbidden and will cancel all guarantee / warranty.

3 Technical Description

3.1 Intended Use

All s::can spectrometer probes are compact spectrometer probes, designed for continuous online measurements of absorption spectra (UV-Vis and derived parameters) with high quality. The spectrometer probes are available with three different optical path lengths (OPL).

These probes can be operated either directly submersed in liquid media (in-situ) or in by-pass via flow cell setup. Furthermore small samples of the medium can be measured with help of the multifunctional slide. Applications range from ultra pure water (DOC > 0,01 mg/l) up to industrial waste water with COD concentrations of several 1000 mg/l, and from single substance detection in sub-ppm concentrations up to surrogate and sum parameters in highest concentrations. The possibility to use the measured absorption spectrum (fingerprint) for spectral alarms complete the application field.

In all types of applications, the respective acceptable limits, which are provided in the technical specifications in the respective s::can manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by s::can Messtechnik GmbH in written form, do not fall under the manufacturer's liability.

The device must only be used for the purpose described in this manual. Use in applications not described in this manual, or modification of the device without written agreement from s::can, is not allowed. s::can is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

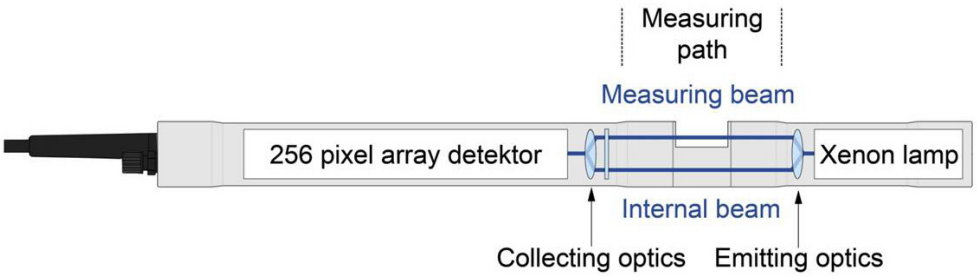
3.2 Functional Principle

Spectrometer probes work according to the principle of UV-Vis spectrometry. Substances contained in the medium to be measured weaken a light beam that moves through this medium. The light beam is emitted by a lamp, and after contact with the medium its intensity is measured by a detector over a range of wavelengths. Each molecule of a dissolved substance absorbs radiation at a certain and known wavelength. The concentration of substances contained determines the size of the absorption of the sample – the higher the concentration of a certain substance, the more it will weaken the light beam.

Extinction or absorbance stands for a ratio of two light intensities: The intensity of light after the beam passed through the medium to be measured and the intensity of light determined after the beam passed through a so-called reference medium (distilled water). There is a linear increase in absorption with higher concentrations.

Every s::can spectrometer probe consists of three main components: the emitter unit, the measuring section and the receiving unit.

The central element of the emitter is a light source – a xenon flash lamp. This is complemented by an optical system to guide the light beam and an electronic control system to operate the lamp.



In the measuring section the light passes through the space between the two measuring windows which is filled with the measuring medium and interacts with it. A second light beam within the probe – called compensation beam - is guided across an internal comparison section. Every probe is a dual-beam measuring instrument, allowing the automatic compensation of disturbances in the measuring process (e.g. ageing of the flash lamp).

The receiving unit is located on the side of the spectrometer probe where the probe cable is attached, and it consists of two major components: the detector and the operating electronics. An optical system focuses the measuring and compensation beams on the entrance port of the detector. The light received by the detector is split up into its wavelengths and guided to the 256 fixed photodiodes, making the use of sensitive moving components unnecessary. The operating electronics contained in this part of the probe are responsible for controlling the entire measuring process and all the various processing steps required to edit and check the measuring signal and to calculate fingerprints and parameters values.

3.3 Product

The s::can spectrometer probes are offered in two different device variants (spectro::lyser and G-series) and three optical path lengths. The needed parameters can be configured individually for the different applications. Regarding detailed information of the device please refer to the technical specifications located at the end of this manual.

Part-no.	Type / specification
SP3-1-01-NO-xxx	UV-Vis spectro::lyser for waste water with 1 mm optical path length
SP3-1-05-NO-xxx	UV-Vis spectro::lyser for surface water with 5 mm optical path length
SP3-1-35-NO-xxx	UV-Vis spectro::lyser for drinking water with 35 mm optical path length
SP3-1-xx-NO-010	UV-Vis spectro::lyser with 1 m fixed sensor cable, for by-pass installation
SP3-1-xx-NO-075	UV-Vis spectro::lyser with 7.5 m fixed sensor cable, for submersed installation
SP3-1-xx-NO-150	UV-Vis spectro::lyser with 15 m fixed sensor cable, none standard, longer lead time
N2-1-xx-NO-xxx	nitro::lyser (Turbidity or TSS and Nitrate)
U5-1-xx-NO-xxx	uv::lyser (Turbidity or TSS and four specified wavelengths)
O2-1-xx-NO-xxx	ozo::lyser (Turbidity or TSS and ozone)
C2-1-xx-NO-xxx	carbo::lyser (Trubidity or TSS and one organic parameter)
C3-1-xx-NO-xxx	carbo::lyser (Trubidity or TSS and two organic parameters)
M4-1-xx-NO-xxx	multi::lyser (Turbidity or TSS and Nitrate and two organic parameters)
Additional features	
V3-LOGGER	License fee for integrated data logger

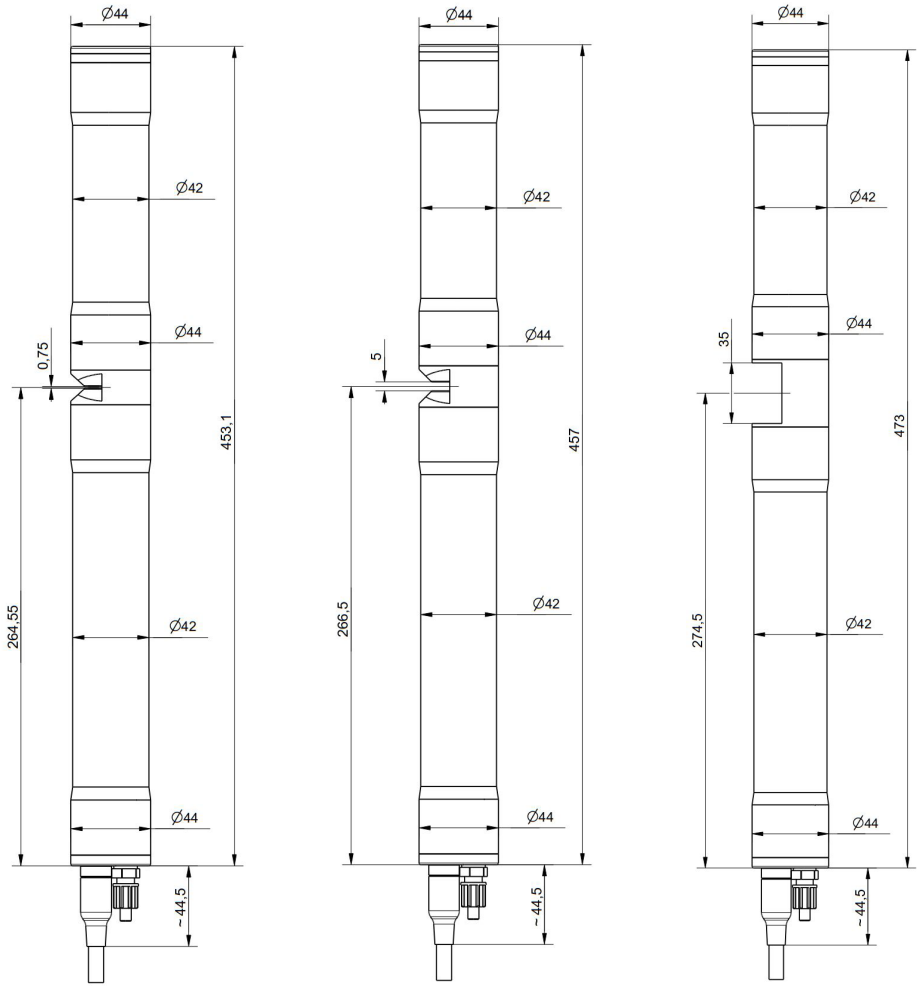
Part-no.	Type of application	SP3	G.ser
I	municipal waste water influent / sewage	x	x
A	municipal waste water aeration basin	x	x
E	municipal waste water effluent	x	x
R	river water / surface water	x	x
G	ground water	x	x
O	sea water	x	
D	drinking water	x	x
M	diary industry	x	
P	paper industry influent	x	
Q	paper industry effluent	x	
B	brewery industry	x	
X	industrial water	x	

Regarding detailed information of the measured parameters please refer to section 5.4.

The device is typified by a type label, as shown below, that contains the following information:

- Manufacturer‘s name and country of origin
- Several certification marks
- Device name
- QR code to s::can Support
- Part number (Type)
- Bar code
- Device serial number (S/N)
- Information on power supply
- Acceptable temperature limits
- Environment rating (IP)
- Maximal power consumption

1	Probe housing (lamp side)
2	Measuring section (optical measuring path)
3	Probe housing (detector side)
4	Connection for automatic cleaning
5	Cable gland
6	Probe cable



Dimension of probe in mm:

- OPL 1 mm left figure
- OPL 5 mm middle fig.
- OPL 35 mm right fig.

3.4 Storage and Transport

The temperature limits for device storage and transport, which are described in the section technical specifications, have to be observed at all times. The device shall not be exposed to strong impacts, mechanical loads or vibrations. The device should be kept free of corrosive or organic solvent vapours, nuclear radiation as well as electromagnetic radiation.

Damage to the device caused by wrong storage will not be covered by warranty.

Transport should be done in a packaging that protects the device (original packaging or protective covering if possible).

This product is marked with the WEEE symbol to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EC. The symbol indicates that this product should not be treated as household waste. It must be disposed and recycled as electronic waste. Please assist to keep our environment clean.

3.5 Scope of Delivery

Immediately upon receipt, please check the received consignment for completeness on the basis of the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and s::can immediately in case of any damages in transit.

The following parts should be included in the delivery:

- s::can spectrometer probe (part-no. according to section 3.3)
- Connection set for automatic cleaning (part-no. B-41-SENSOR)
- Cleaning brushes - 2 pieces (part-no. B-60-1 for OPL 1 mm or B-60-2 for OPL 5 and 35 mm)
- Multifunctional slide (part-no. E-421-V3 for all OPL)
- s::can manual spectrometer probe (part-no. S-30-M)

The following parts could be included in the delivery if ordered as an option:

- Adapter cable (part-no. C-32-V3, C-32-MIL)
- Extension cable (part-no. C-210-V3 or C-220-V3)
- con::ncet box (part-no. B-33-012)
- Probe carrier (part-no. F-110-V3 for 45 degree installation or F-120-V3 for vertical installation)
- Fixing adapter - stainless steel (part-no. F-15)
- Flow cell waste water (part-no. F-48-V3 for all OPL)
- Flow cell clean water (part-no. F-445-V3 for all OPL)
- Flow cell - autobrush (part-no. F-446-V3 for OPL 35 mm or F-446-V3-TI for OPL 35 mm titanium)
- Cleaning valve (part-no. B-44 or B-44-2)
- s::can compressor (item-no. B-32-230, B-32-110 or B-32-012)

In case of incompleteness please contact your s::can sales partner immediately!

3.6 Product Updates, Other

The manufacturer reserves the rights to implement, without prior notice, technical developments and modifications in the light of continuous product care.

4 Installation

4.1 Environment

The correct installation of measuring instruments is an important prerequisite for satisfactory operation. Therefore the following checklist for the installation can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during the installation, allowing the monitoring system to operate properly.

- Favourable flow conditions (little turbulence, acceptable flow rate, pressure, etc.)
- Unadulterated, representative measuring medium
- Measuring medium is in equilibrium state (no gas release, no precipitation, etc.)
- No external interferences (no electric and electro-magnetic interferences by leakage current, earth fault of pumps, electric motors, electric power lines, etc.)
- Easy accessibility (mounting, sampling, functional check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller, etc.)
- Adherence to limit values (see technical specifications located at the end of this manual)

- Power supply for controller (operational reliability, voltage, power, peak free)
- Oil- and particle free compressed-air supply (optional for automatic probe / sensor cleaning)
- Best possible weather and splash water proof conditions
- Shortest possible distances between system components (probe / sensor – controller – compressed-air supply – energy supply)
- Correct dimensioning, mounting and protection of all cables and lines (non-buckling, no risk of stumbling, no damage etc.)

4.2 Mounting

When mounting the s::can spectrometer probe, please ensure that it is not possible that the measuring section (optical path) becomes blocked accidentally or by build-up of large particles present in the medium.

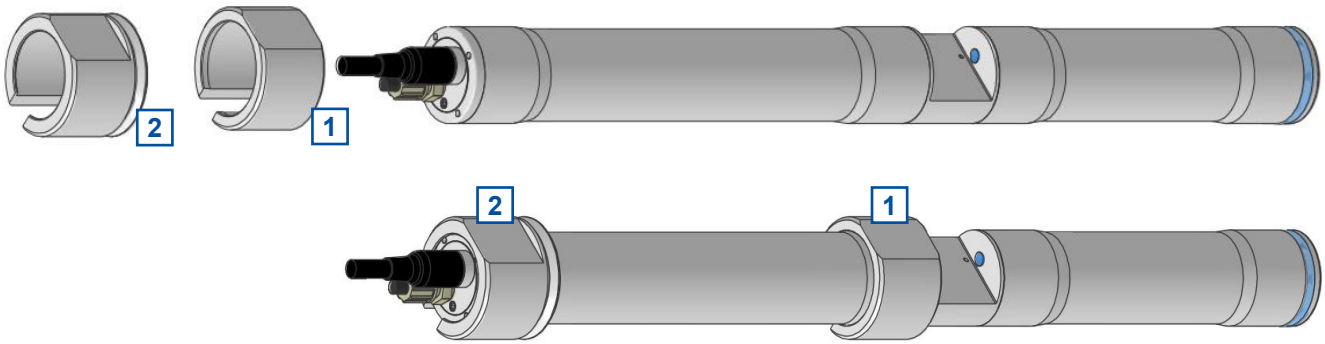
- Horizontal orientation (i.e. with measuring windows in vertical position) with plane face of the measuring section in vertical position. This will ensure no sedimentation of particles in the measuring section will take place and no gas bubbles will adhere to the measuring windows. The proper usage of an s::can probe carrier or s::can flow cell setup will ensure the correct position.
- Vertical orientation (i.e. with measuring windows in horizontal position) is only possible in applications with sufficient medium flow or automatic cleaning to ensure that no particles can sediment on the lower measuring window and no gas bubble might be captured within the measuring section. The proper usage of an s::can probe carrier will ensure the correct position.
- Flow velocity: < 3 m/s to avoid cavitations and therefore deterioration of measuring quality
> 1 m/s when vertically mounted
- Abrasive solids (sand): < 1 g/l
- Recommended water level: > 10 cm at horizontal installation
- The housing must not be in direct contact with other metals, to prevent the possibility of contact corrosion.

- The probe cable has to be protected appropriately against cuts or damage induced by foreign objects in the water.
- In case of shallow water and / or low flow velocities the compressed-air cleaning system may swirl up sediments surrounding the measuring site (e.g. at the sewerage bottom). As a result the state of the measuring medium will not be representative of the normal water quality directly after cleaning. To avoid this from happening, the probe should be installed in such a way that the openings of the cleaning nozzles point towards the surface. This orientation is ensured when the cable gland is oriented above the connection for the automatic cleaning.

Even though the cable entry of the spectrometer probes is equipped with a protective mechanism against forces along the axis of the probe, the probe cable must never bear the weight of the spectrometer probe!

4.2.1 Mounting with Probe Carrier for submersed Installation

The submersed installation of a spectrometer probe using the specific probe carrier (part-no. F-110-V3 or F-120-V3) is performed by the following steps:



1 The shorter spacer ring has to be placed on the cable side of the probe housing close to the measuring section.

2 The longer spacer ring has to be placed on the cable side of the probe housing close to the probe cable with the groove towards the optical path.

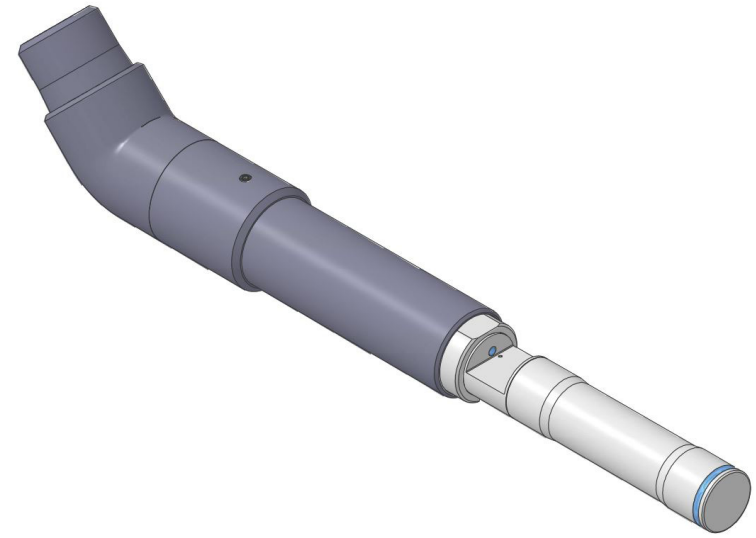
3 After mounting the spacer rings, the compressed-air cleaning must be connection to the probe (see section 4.3).

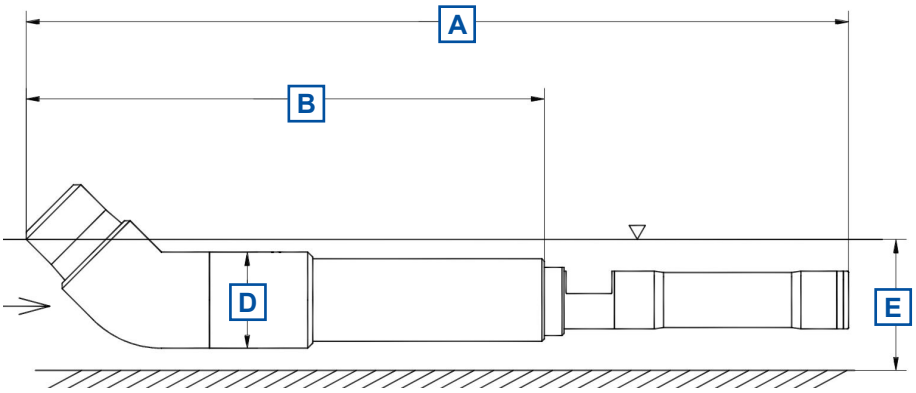
4 Subsequently, the probe cable and the compressed-air hose are inserted into the probe carrier (e.g. with the help of a cable pulling device); when doing so, the cable plug and cleaning hose end must be protected against contamination.

5 The delivered M5 hexagon socket screw has to be placed in the provided tap hole, but should not be tightened yet.

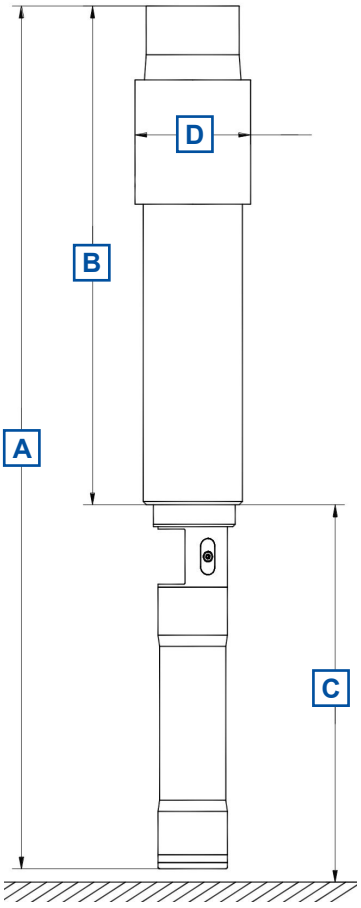
6 Now slide the spectrometer probe into the probe carrier, so that the spacer ring close to the measuring section juts out 1.5 cm of the edge of the carrier (see marking on the spacer). When using probe carrier for horizontal installation the probe has to be placed in such a way that the plane face of the measuring section has a perpendicular orientation so that there can be no sedimentation in the measuring section and so that air bubbles can escape upwards.

7 The probe can now be fixed in this position by means of the hexagon socket screw [3], which will fall into the V-shaped groove of the spacer ring sitting on the end of the probe where the cable is located.





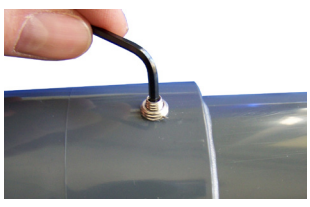
Probe Carrier F-110-V3



Probe Carrier F-120-V3

Device / OPL	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]
F-110-V3 / 1 mm	608.6	396	---	73.4	> 100
F-110-V3 / 5 mm	612.5	396	---	73.4	> 100
F-110-V3 / 35 mm	628.5	396	---	73.4	> 100
F-120-V3 / 1 mm	528.6	317	240	73.4	---
F-120-V3 / 5 mm	532.5	317	240	73.4	---
F-120-V3 / 35 mm	548.5	317	240	73.4	---

When necessary the probe carrier can be supplied with a tube extension that can simply be fixed to a railing by means of the fixing adapter (part-no. F-15). Appropriate measures must be taken to protect the probe cable and the compressed-air hose from damage due to buckling, abrasion etc. at the point where they exit the extension pipe.

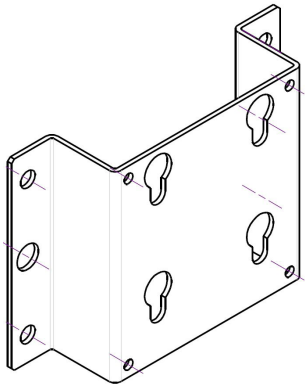


For cleaning or checking the reference measurement (functional check) using the multifunctional slide, the spectrometer probe can be slid out of the probe carrier slightly after loosening of the hexagon socket.

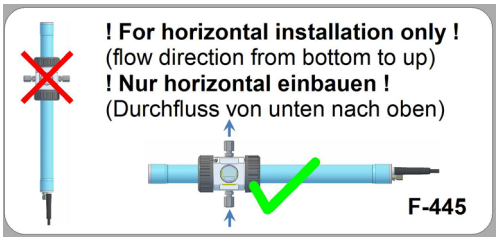
Probe Carrier V-120-V3

4.2.2 Mounting in Flow Cell Tap Water

The flow cell can be mounted directly on a solid and flat surface (wall, mounting panel, etc.) using the mounting bracket (included in delivery). Once the mounting bracket is fixed the complete flow cell can easily be removed by unscrewing the safety screw (M4x45).

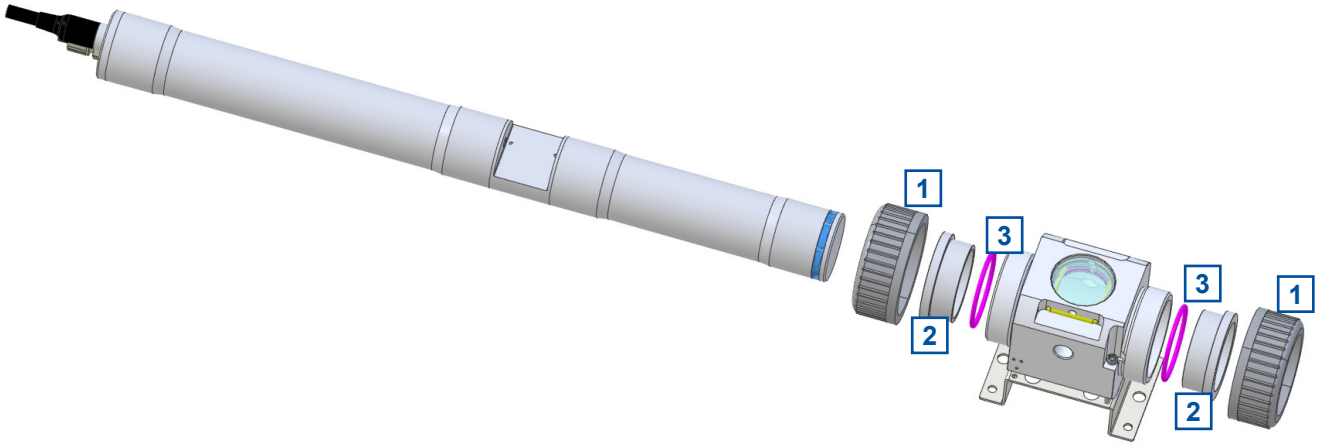


Please note, that the spectrometer probe should be mounted horizontal with water flow from bottom to top. This ensures the flow cell is always filled completely and no air bubbles will be captured.

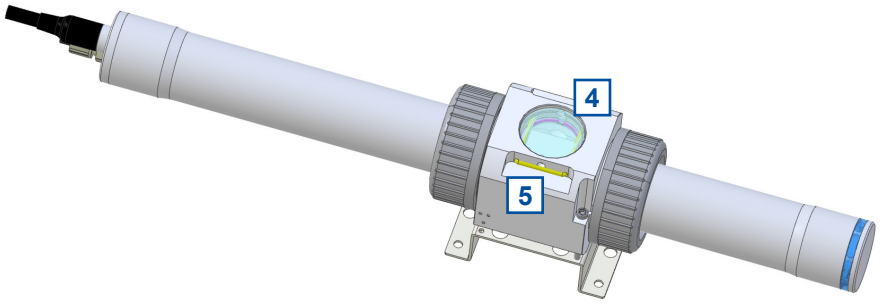


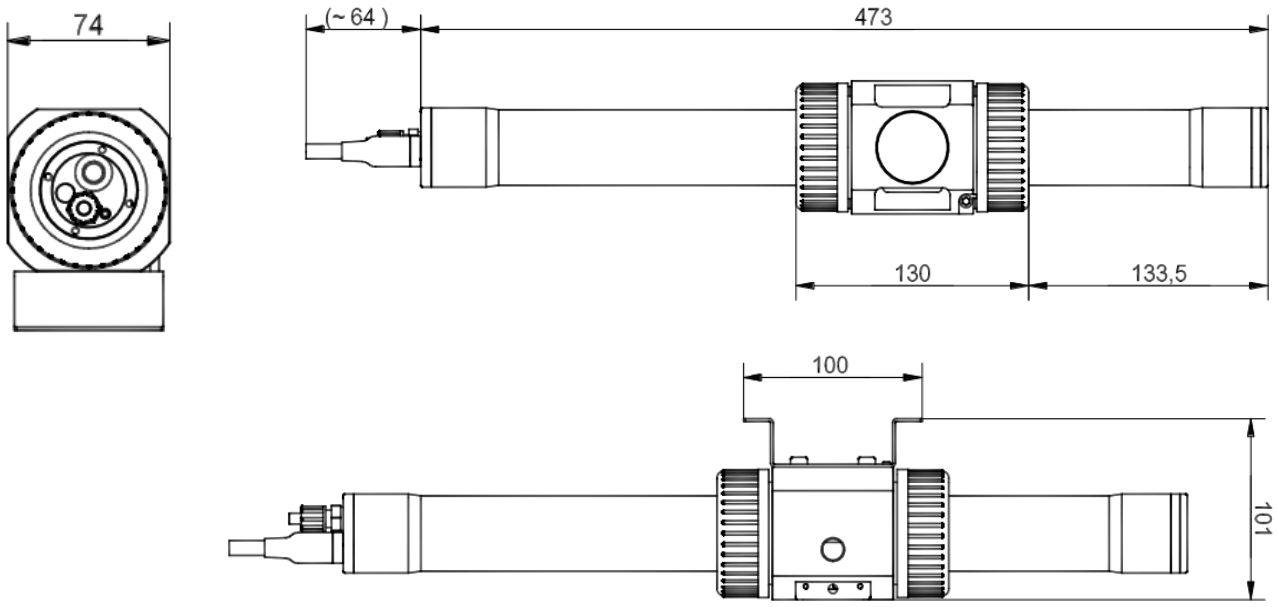
The installation of a spectrometer probe using the flow cell setup (part-no. F-445-V3) is performed by the following steps (see figures below also):

- Loosen both union nuts [1], which compress the O-rings of the flow cell. Do not unscrew completely – the compression inserts [2] and O-rings [3] must stay in place.
- Insert the spectrometer probe so that the cable points to the marked side (red marking dot and label) and align, so that the optical path appears level and centred in the flow cell.
- Fasten both union nuts [1] while holding the spectrometer probe firmly in place.



- Check the correct assembly by peering into the glass window [4] on top of the flow cell.
- For cleaning purposes the glass window [4] can be opened by removing the metal bracket [5] with a flat screw driver.





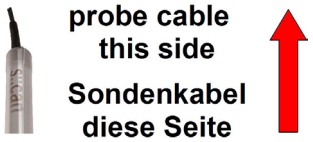
Dimension of flow cell (F-445-V3) and required space in [mm]

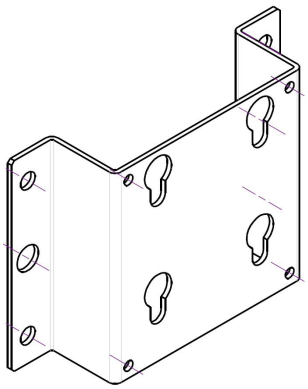
For connection of the water supply use any fittings with $^{1}/_{4}$ inch outside thread. To ensure that flow cell is always completely filled with water the medium supply has to be done vertically from bottom to top.

4.2.3 Mounting in Flow Cell Tap Water with Autobrush

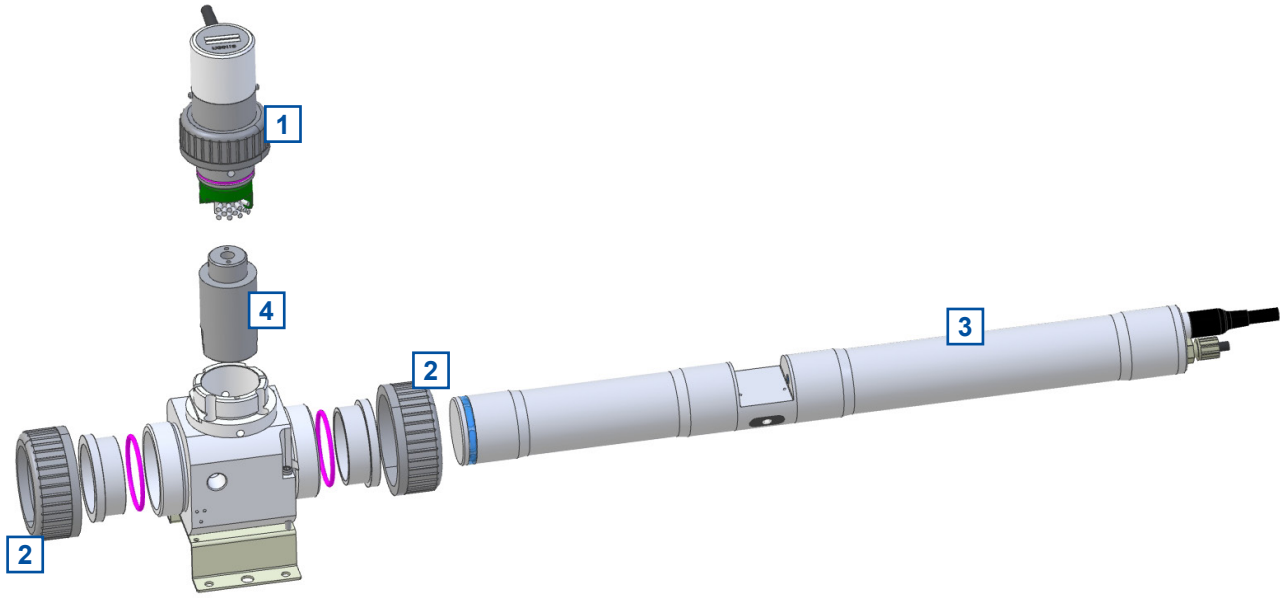
The flow cell can be mounted directly on a solid and flat surface (wall, mounting panel, etc.) using the mounting bracket (included in delivery). Once the mounting bracket is fixed the complete flow cell can easily be removed by unscrewing the safety screw (M4x45).

Please note, that the spectrometer probe can only be mounted in one way, because the measurement cell as well as the inside of the flow cell are not symmetrical. A red marking dot and a label on the flow cell indicate the position of the spectrometer probe in respect of the probe cable.





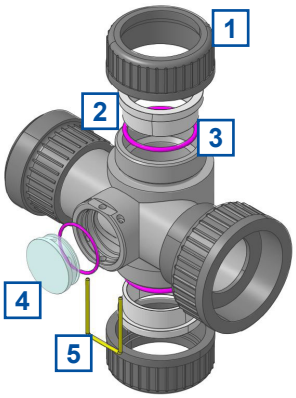
The installation of a spectrometer probe using the flow cell setup autobrush (part-no. F-446-V3) is performed by the following steps (see figures below also):



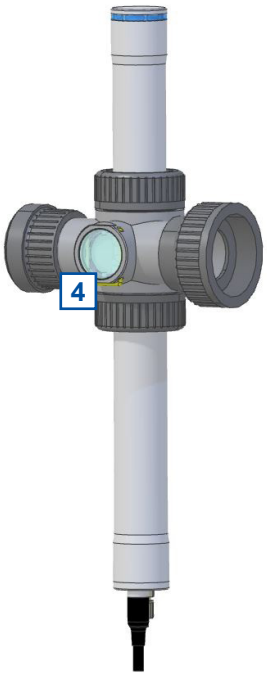
- Unscrew the union nut for fastening of the brush unit [1] and lift it out of the unit carefully. The brush unit is sealed with an O Ring and will need some force to take it out of the flow cell.
- Loosen both union nuts [2], which compress the O-rings of the flow cell. Do not unscrew completely – the compression inserts and O rings must stay in place.
- Insert the spectrometer probe [3] so that the cable points to the marked side (red marking dot and label) and align, so that the optical path appears approximately level and centred in the brush opening. Observe that the optical path of the spectrometer probe is properly positioned in the brush unit.
- Insert the provided alignment tool [4] – the cross hole lined with the spectrometer axis - to find the exact position. Rotate and shift the spectrometer probe slightly, until the tool sits flush with the rim of the flow cell. The tool should not bend, while at the same time, the spectrometer cannot rotate.
- Fasten both union nuts while holding the alignment tool firmly in place.
- Remove the alignment tool. It is now assured, that the brush will rotate freely and will clean both windows properly.
- Insert the brush unit. Make sure that the alignment key on the brush unit fits in one of the notches on the armature. This ensures, that the brush will not obstruct the optical path, when in rest position. The unit may be rotated 180° so that the cable exits at a convenient position.
- Note during insertion that approximately 4 mm short of the final position, you will notice a significant resistance from the O ring seat.
- You may want to check the correct assembly by peering into the water inlets.

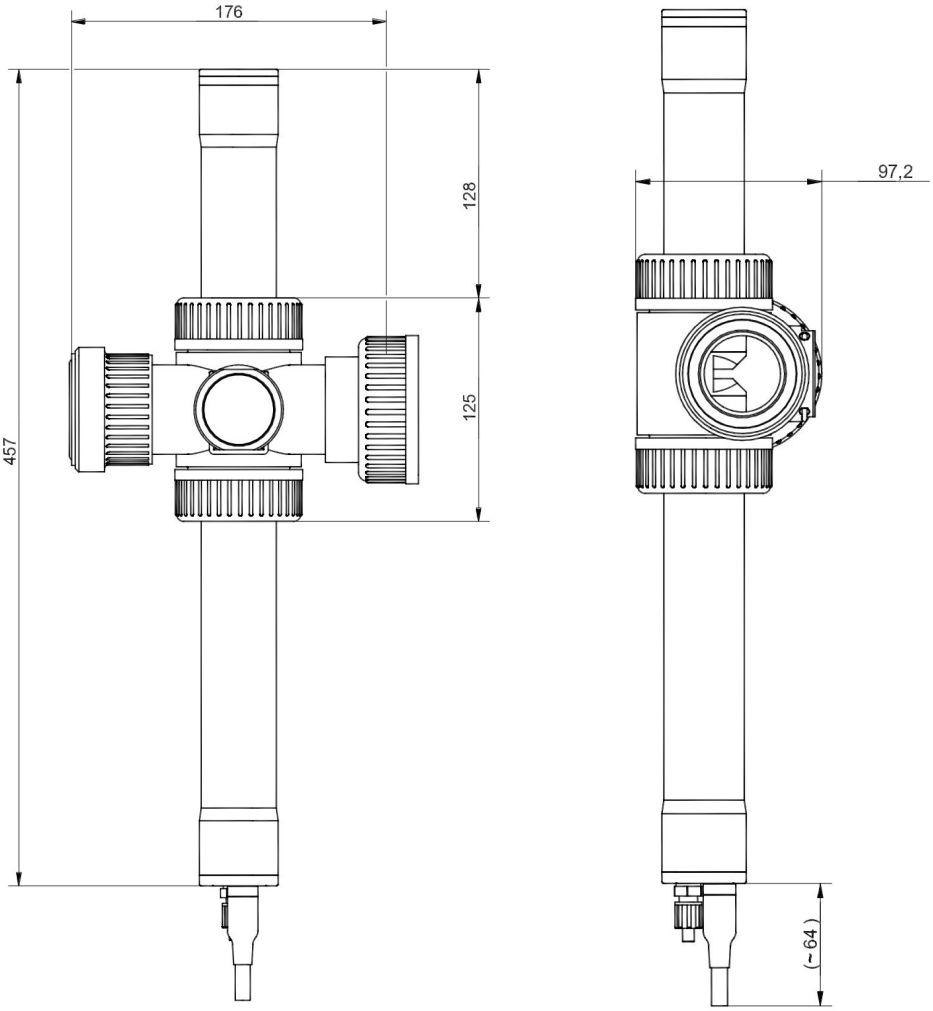
4.2.4 Mounting in Flow Cell Waste Water

The installation of a spectrometer probe using the flow cell setup waste water (part-no. F-48-V3) is performed by the following steps (see figures below also):



- Loosen both union nuts [1], which compress the O-rings of the flow cell. Do not unscrew completely – the compression inserts [2] and O-rings [3] must stay in place.
- Insert the spectrometer probe so that the optical path appears level and centred in the flow cell.
- Fasten both union nuts [1] while holding the spectrometer probe firmly in place.
- Check the correct assembly by peering into the glass window [4].
- For cleaning purposes the glass window [4] can be opened by removing the metal bracket [5] with a flat screw driver.





Dimension of flow cell (F-48-V3) and required space in [mm]

4.3 Automatic Probe Cleaning

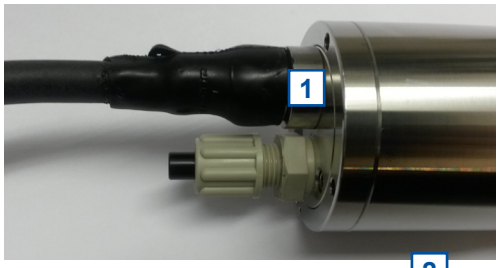
The automatic cleaning of optical windows is needed to ensure a correct and stable measurement. For automatic probe cleaning either cleaning devices with a rotating brush (ruck::sack or auto::brush) or compressed air is needed.

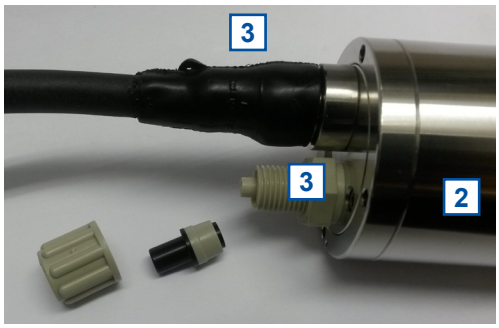
For mounting of the cleaning devices please see the manuals and installation notes of the specific devices. The connection of the pressurized air cleaning is explained in the following section.

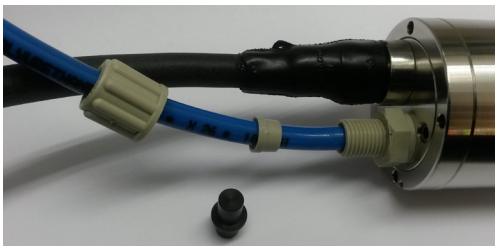
4.3.1 Connection of compressed Air Cleaning

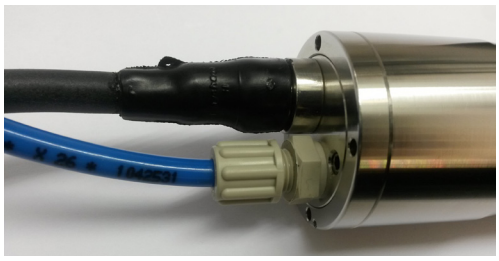
The pressure connection set (B-41) supplied with the system contains components necessary to connect the spectrometer probe to the cleaning valve. The connection to the probe is performed by the following steps (see pictures on the right hand side also):

- Remove black dummy insert [1] from pressure connection on top of probe be unscrewing the connecting nut [2] and removing the conical part [3].
- Put the connecting nut [2] and the conical part [3] over the blue cleaning hose.
- Push the cleaning hose over the pressure connection on top of the probe (warm up cleaning hose in hot water if necessary).
- Fasten connecting nut [2] by hand.







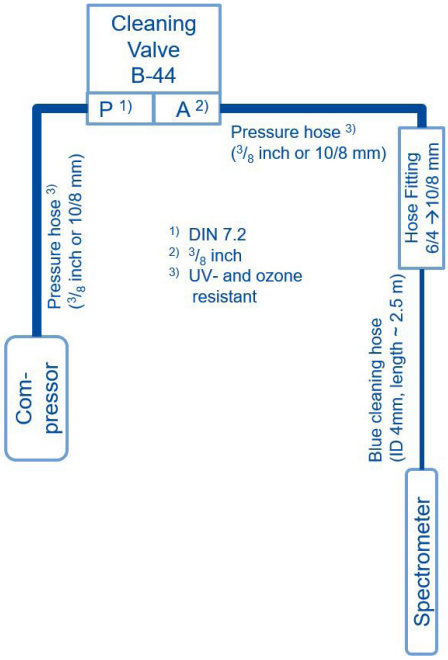


The connection to the cleaning valve depends on the used type of cleaning valve.

- Cleaning valve B-44

A compressed air hose (to be provided by customer, ID 8 to 9 mm, UV- / ozone resistant) must be used to connect the adapter fitting of the pressure connection set to the output side of the cleaning valve (marked with *A*). Fasten the air hose with hose clamps.

Another air hose and DIN 7.2 compressed air coupling are required to hook up the compressed air supply to the input side of the cleaning valve (marked with *P*).

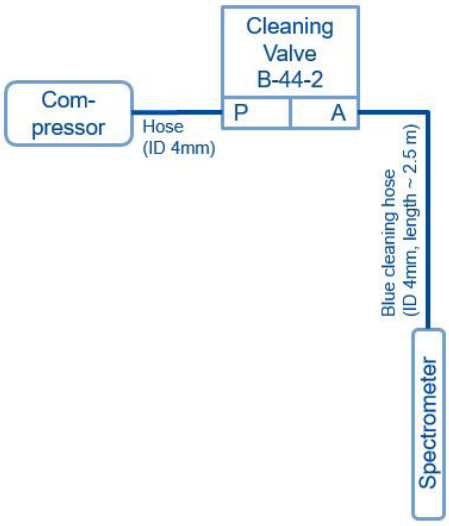


- Cleaning valve B-44-2

The adapter fitting of the pressure connection set can be removed to connect the blue tube directly to the push-pull fitting of the cleaning valve. The same type of tube can be used to connect the cleaning valve to the s::can compressor.

The cleaning valve should never be connected to the compressed air coupling of your compressor directly, i.e. without a pressure hose in between. The total length of hoses should be as short as possible to avoid unnecessary pressure loss. In special occasions, drinking water may be used to operate the hydraulic-pneumatic cleaning appliance instead or compressed air – for more information please contact your local s::can sales partner.

Any foreign matter in the compressed air supply may impair the hydraulic-pneumatic cleaning process. If you have any doubts about the purity of the air used (contamination by particles, oil, etc.), please install an appropriate filter upstream from the solenoid valve.



In areas with extremely low outside air temperature, s::can recommends laying the compressed air hoses such that they remain frost-free to prevent freezing of condensed water in the compressed air hose.

Please note that depending on the s::can probe and sensor type you are using, different maximum allowed pressures may be specified. In case a central pressurised air supply is used in such a case the lowest maximum allowed pressure amongst those specified for the individual instruments is to be used to supply all instruments or the use of pressure reducing valves to supply each instrument with the correct pressure is necessary.

In order to ensure proper operation of automatic cleaning s::can highly recommends to use s::can compressor optimized for compressed air supply of all probes and sensors.

5 Initial Startup

Once the mounting and installation of the s::can spectrometer probe have been completed and checked (see chapter 4) the initial startup of the s::can monitoring system will require the following actions, in the order presented below:

- Connect the spectrometer probe to the controller used for operation (see section 5.1 and 5.2).
- Connect the cleaning devices to the proper terminal connections in the cable terminal compartment of the used controller (please refer to the manual of the cleaning device and the controller).
- Establish main power supply to the controller (please refer to the manual of the controller) and wait until the operation software has started up.
- Perform probe initialisation of the spectrometer probe. Refer to section 5.3.1 in case of using a con::lyte D-320, refer to section 5.3.2 in case of using con::cube with moni::tool and refer to section 5.3.3 in case of using con::nect B-33-012 with Io::Tool.
- Perform parameterisation of the spectrometer probe. Refer to section 5.4.9 in case of using a con::lyte D-320, refer to section 5.4.10 in case of using con::cube with moni::tool and refer to section 5.4.11 in case of using con::nect B-33-012 with Io::Tool.
- Configure the measurement and automatic cleaning settings (see sction 12 regarding cleaning settings).
- Check whether the cleaning system works properly.
- Connection and parameterisation of data transfer when desired (please refer to the manual of the controller).
- Check the readings obtained for plausibility after sufficient running-in time (at least 15 minutes).
- If necessary calibrate the readings of the spectrometer probe to the local water matrix when the readings are stable (see chapter 6).

5.1 Controller for Operation

The s::can spectrometer probe is equipped with an Web application for direct operation (Io::Tool). Therefore the spectrometer can be operated directly via mobile device or can be connected to a s::can controller for operation. Depending on the used configuration, different features are available. The table below provides a general overview of possible configurations.

Controller	con::cube D-330	con::cube D-315	con::lyte D-320	con::nect B-33-012
Connection	via M-12 plug	via B-33-012	via C-32-V3 cable	via M-12 plug
Communication	ReST-API [1)]	ReST-API [1)]	Modbus RTU	ReST-API / Modbus RTU
Operating software	moni::tool V4	moni::tool V4	con::lyte V7.11	Io::Tool / Io::Tool, SCADA
Parameter transfer	yes	yes	yes	yes
Fingerprint transfer	yes	yes	via Io::Tool	
Trigger cleaning	via D-330	via D-315	via D-320	spectrometer / SCADA
Function Check	yes	yes	yes	Io::Tool
Local Calibration	yes	yes	yes	Io::Tool

[1)] Representional State Transfer Application Programming Interface

5.2 Connection to the Controller

The s::can spectrometer will be delivered with a fixed cable including a plug that can be used to connect the sensor to a compatible socket provided on the controller used for operation. Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.

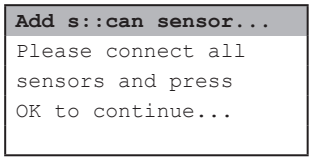
Some of the s::can controller do not supply the specific M12 plug. When using a con::lyte D-320 a specific connection cable (part-no. C-32-V3) has to be used (see section 11.1.2). For initialisation on a D-315 con::cube the con::nect B-33-012 must be used. Connect the spectrometer to the con::nect via M12 plug and use a network cable to connect the con::nect to the con::cube. In addition the IP settings of D-315 and spectrometer have to be configured to the same address range (please refer to manual con::nect B-33-012).

5.3 Probe Initialisation

For operating one or several probes / sensors with one operation controller, it is necessary to allocate an individual address to every probe / sensor. This will be done during probe initialisation process, at which the connected measuring device has to be recognized by the controller for operation first, and then a modification of the actual (preset) probe / sensor address might be performed. The corresponding address will be stored on the respective measuring device. For s::can probes and sensors of the same type, the same address is preset ex factory.

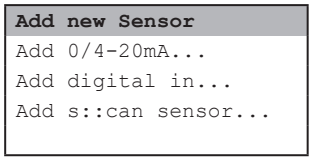
5.3.1 Probe Initialisation using con::lyte D-320

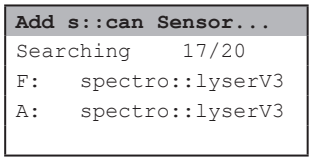
At the initial start-up the con::lyte D-320 provides an automatic probe and sensor initialisation procedure (see screen on the right). After connecting all probes and sensors to the appropriate plugs of the con::lyte (see section 5.2) and pushing the *OK* button, the probe and sensor initialisation starts.



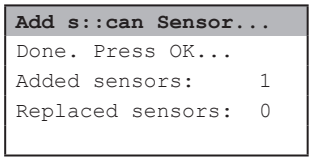
If sensor will be initialized at a later date, the following steps are needed:

- Switch to Status display by using the *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select menu *Add sensor ...* and confirm with *OK*.
- Connect sensor to the D-320 (see section 5.2).
- Select menu *Add s::can sensor ...* and confirm with *OK*.





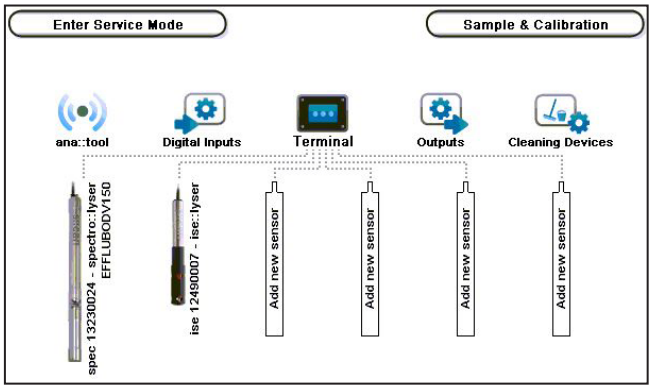
As soon as the entry is confirmed by pushing the *OK* button, the con::lyte will automatically search the Modbus port for a new sensor and will add the new sensor to the sensor list.



After adding a new probe or sensor, the parameters will be displayed in the parameter screen. Furthermore single parameter can be added manually (see section 5.4.2 and menu *Add parameters...*). In case the installation failed, the message *Error adding!* will be displayed.

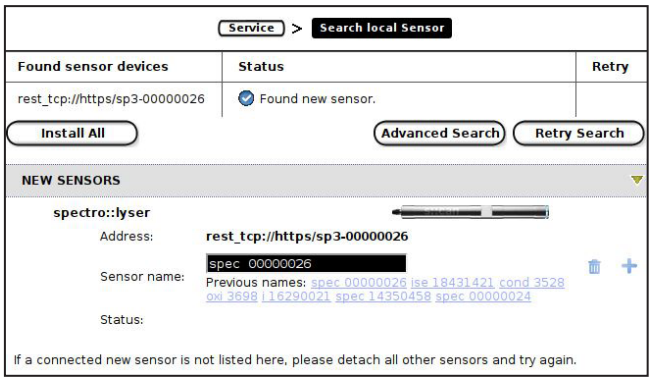
5.3.2 Probe Initialisation using moni::tool

- Click the *Service* tab of the moni::tool screen and logon as *Administrator*.
- Click on an empty sensor icon (*Add new Sensor*) to initiate the initialisation process.



- An automatic search procedure will start, searching for the connected sensor.

- When the automatic search prodedure is finished, moni::tool will display all connected probes and sensors. Those sensors that are connected for the first time will have the Status *Found new sensor* (also listed as *New Sensors* below).
- If needed *Sensor name* can be modified now, which can be any descriptive name you desire or select one of the previous names listed below this entry field.
- To install the new sensor click on the blue + sign on the right side of the sensor or push the button *Install All*.



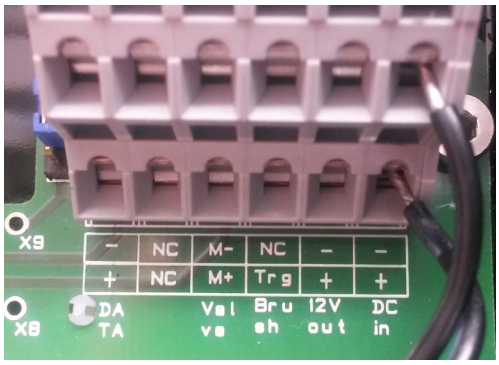
- moni::tool will install the sensor and switch to the *Service* tab showing the new sensor in the system overview. Now pushing the button *Leave Service Mode* located on the upper left side to start the measuring process.

5.3.3 Probe Initialisation using con::nect and Io::Tool

In case the s::can spectrometer probe will be operated as stand alone measuring device without an s::can terminal, the probe initialisation and the start-up of Io::Tool is performed by the following steps:

- Connect the spectrometer probe to the compatible socket of the con::nect. Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.
- Wire the cleaning device for automatic cleaning of the spectrometer probe to the con::nect directly. The table below displays the different possibilities for connection.

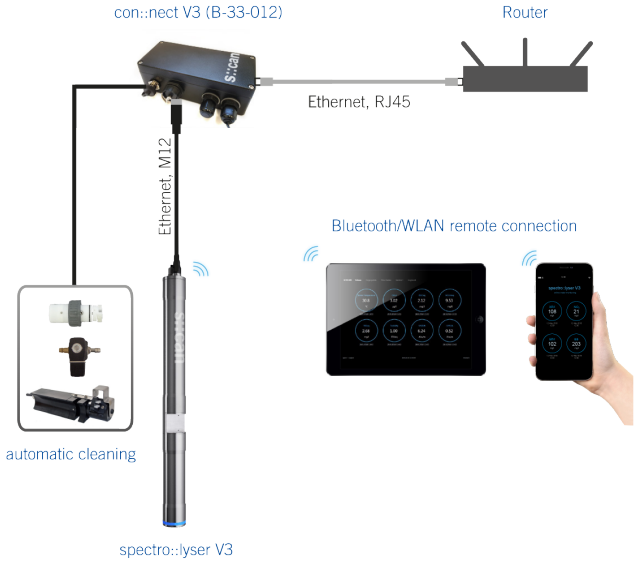
Cleaning Device	Color of wire	Labelling
Cleaning valve	Blue	M+ Valve
	Brown	M- Valve
Autobrush	Purple (yellow [1])	Trg Brush
	Black (brown [1])	- 12V out
	Red (white [1])	+ 12V out
ruck::sack	Purple	Trg Brush
	Black	- 12V out
	Red	+ 12V out



[1] previous used cable version

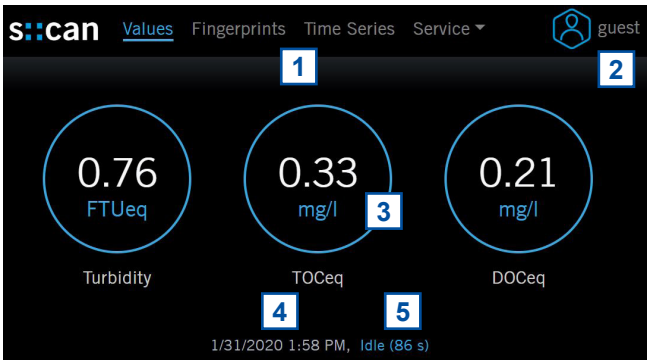
Once the cleaning device has been electrically connected, the device needs to be parameterised within the operating software (please refer to according manual).

- Connect the con::nect to the main power supply (DC in).
- Several seconds after the con::nect box was connected to power supply, the LED ring of the probe will flash blue.
- Within one minute the LED ring will change from flashing to continuous color. The spectro::lyser is online now and measurements will start automatically according to user settings.
- Enter the IP address of the spectro::lyser into your Web-Browser to start Io::Tool. The table below displays the different possibilities to get the correct IP address.



Connection methode	IP address of spectrometer	Remark
via WLAN	192.168.43.1	default address; password = *spectrolyser*
via Bluetooth	192.168.44.1	default address
via LAN	to be checked on DHCP Server	DHCP active on spectrometer probe per default
via LAN	192.168.42.10	fall back (static) if network without DHCP Server (e.g. when connecting directly with notebook)

As soon as the connection is established, Io::Tool will pop up in the Web-Browser showing the actual readings of the spectrometer probe (see figure on the right).



1 Main tabs to change the displyed information

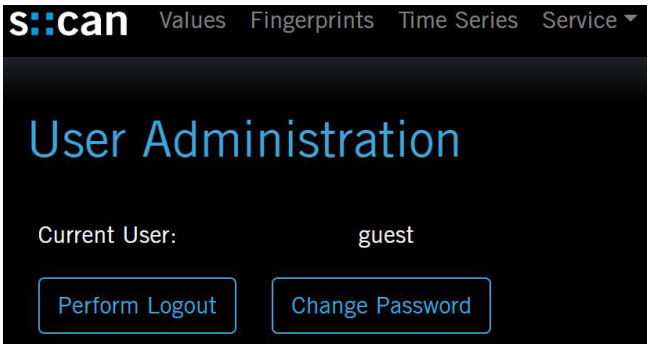
2 User logged in actually. For operation of Io::Tool there are three users available. Per default the user is logged in as *guest* automatically (no password required). For the normal operator the level *user* (with password *scan*) and for service personal the user *expert* (with password *scan*) is available.

3 Actual parameter readings and unit

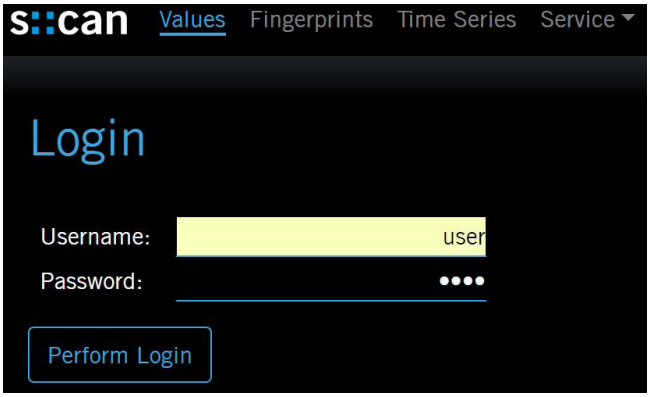
4 Actual system date and time

5 Activity (e.g. *Idle*, *Measuring*, *Offline*). In case the probe is operated with an s::can terminal (e.g. con::lyte) the displayed activity is *con::lyte Operation*.

A change of the user is performed by the following steps:



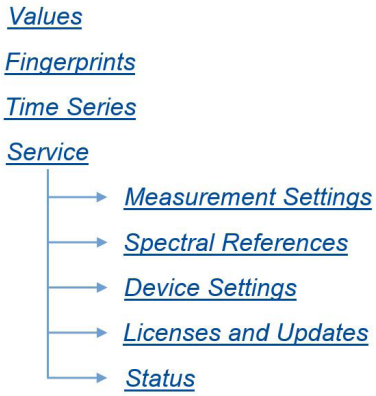
- Click on the user icon in the upper right corner of Io::Tool.
- Click on button *Perform Logout* to logout the actual user.
- Enter the new *Username* (e.g. user).
- Enter the *Password* (e.g. scan).
- Click on button *Perform Login* to login as new user.

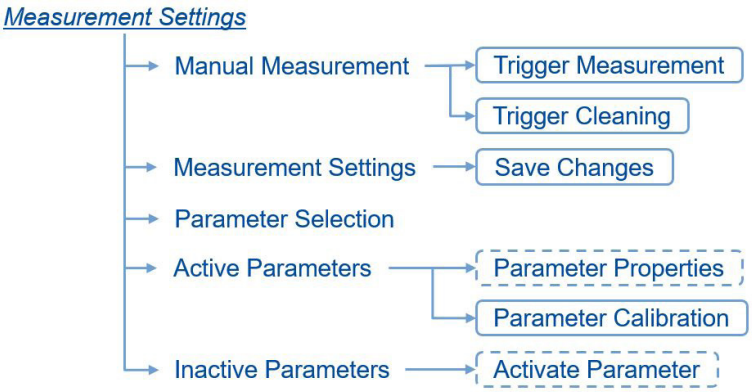


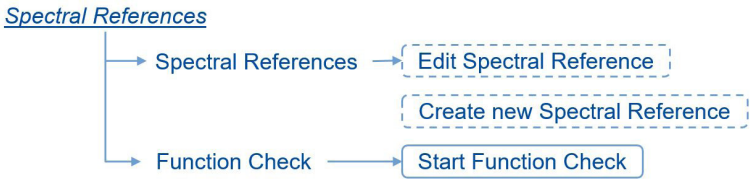
The table below displays which operator functions are allocated to the different user types and which information are visible on the different user displays of Io::Tool.

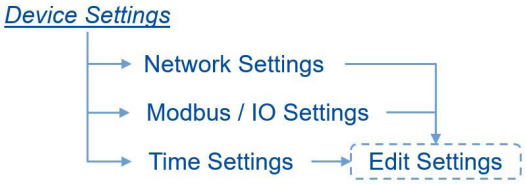
Fuctionality	Guest		User		Expert		
	View	Edit	View	Edit	View	Edit	Remark
Service mode	X		X	X	X	X	
Reboot probe			X	X	X	X	
Trigger measurement				X		X	
Measurement settings	X		X	X	X	X	
Local calibration	X		X	X	X	X	
Activate / modify parameters	X		X		X	X	
Create or edit zero reference	X		X	X	X	X	
Upload config file						X	License, updates
Probe name	X		X		X	X	
GPIO mode	X		X		X	X	Modbus, air, bush
System time	X		X		X	X	
IP configuration			X		X	X	
Modbus configuration	X		X		X	X	
Sensor maintenance	X		X	X	X	X	

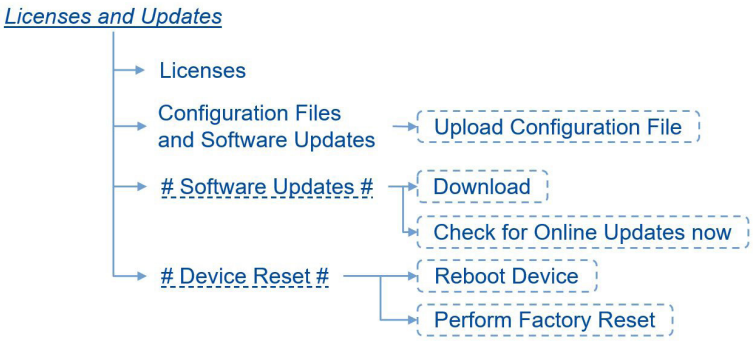
The figures below provide a general overview of the Io::Tool features to display the fingerprint and parameter readings and to check / configure the spectrometer settings. A detailed description can be found in the individual sections of this manual.











Legend:

5.4 Probe Parameterisation

Number and type of measured parameters can be configured individually on the spectrometer probe. For each parameter a Global Calibration will be uploaded to the probe. Therefore later upgrade is possible.

The G-Series (e.g. nitro::lyser) will be delivered with a fix set of parameter.

In the following sections all available parameters and the possible measuring ranges for the different types of applications are shown. These measuring ranges are the same for spectro::lyser and G-Series.

5.4.1 Parameter Measuring Ranges in Clean Water

Below the s::can part no. of the specific parameter (e.g. GC-G-TURB, which is Turbidity for ground water) the measurable concentration ranges, which may vary due to water matrix, are displayed for all three optical path lengths (1 mm, 5 mm and 35 mm).

Parameter	Ground water	Surface water	Drinking water
Turbidity [FTU/NTU]	GC-G-TURB	GC-R-TURB	GC-D-TURB
OPL = 1 mm [1]	0 - 8000	0 - 9300	0 - 8000
OPL = 5 mm	0 - 1200	0 - 1400	0 - 1200
OPL = 35 mm	0 - 170	0 - 200	0 - 170
TSS [mg/l]	not available	GC-R-TSS	not available
OPL = 1 mm [1]		0 - 8000	
OPL = 5 mm		0 - 1200	
OPL = 35 mm		0 - 170	
COLORapp / COLORtru [Hazen]	GC-G-COL	GC-R-COL	GC-D-COL
OPL = 1 mm [1]	0 - 23000 / 14000	0 - 23000 / 14000	0 - 23000 / 14000
OPL = 5 mm	0 - 3500 / 2100	0 - 3500 / 2100	0 - 3500 / 2100
OPL = 35 mm	0 - 500 / 300	0 - 500 / 300	0 - 500 / 300
TOC / DOC [mg/l]	GC-G-TOC	GC-R-TOC	GC-D-TOC
OPL = 1 mm [1]	0 - 930 / 700	0 - 1400 / 1200	0 - 1000 / 800
OPL = 5 mm	0 - 140 / 100	0 - 210 / 180	0 - 160 / 120
OPL = 35 mm	0 - 20 / 15	0 - 30 / 25	0 - 22 / 17
BOD [mg/l]	not available	GC-R-BOD	not available
OPL = 1 mm [1]		0 - 2000	
OPL = 5 mm		0 - 300	
OPL = 35 mm		0 - 42	
COD / CODf [mg/l]	not available	GC-R-COD	not available
OPL = 1 mm [1]		0 - 3300 / 2000	
OPL = 5 mm		0 - 500 / 300	
OPL = 35 mm		0 - 71 / 42	
NO_3-N / NO_3 [mg/l]	GC-G-NO3-N	GC-R-NO3-N	GC-D-NO3-N
OPL = 1 mm [1]	0 - 930 / 4100	0 - 700 / 3100	0 - 930 / 4100
OPL = 5 mm	0 - 140 / 620	0 - 100 / 460	0 - 140 / 620
OPL = 35 mm	0 - 20 / 88	0 - 15 / 66	0 - 20 / 88
Chl-a [µg/l]	not available	GC-R-CHL-A	not available
OPL = 1 mm [1]		0 - 4600	
OPL = 5 mm		0 - 700	
OPL = 35 mm		0 - 100	
HS^- [mg/l]	GC-G-HS	GC-R-HS	not available
OPL = 1 mm [1]	0 - 240	0 - 240	
OPL = 5 mm	0 - 35	0 - 35	
OPL = 35 mm	0 - 5	0 - 5	

[1] real OPL is approx. 0.75 mm

Parameter	Ground water	Surface water	Drinking water
BTX [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	GC-G-BTX 0 - 2400 0 - 360 0 - 51	GC-R-BTX 0 - 2400 0 - 360 0 - 51	not available
Chloramine [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	not available	not available	GC-D-CHLORAMINE 0 - 2000 0 - 300 0 - 42
Ozone O_3 [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	not available	not available	GC-D-O3 0 - 1200 0 - 180 0 - 25
Chlorine demand CLD [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	not available	not available	GC-D-CLD 0 - 1000 0 - 160 0 - 22
UV254t / UV254f [Abs/m] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	GC-G-UV254 0 - 3300 / 2800 0 - 500 / 420 0 - 71 / 60	GC-R-UV254 0 - 3300 / 2800 0 - 500 / 420 0 - 71 / 60	GC-D-UV254 0 - 3300 / 2800 0 - 500 / 420 0 - 71 / 60

[1] real OPL is approx. 0.75 mm

5.4.2 Parameter Measuring Ranges in Municipal Waste Water

Parameter	Influent & sewer	Aeration	Effluent
TSS [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	GC-I-TSS 0 - 8000 0 - 1200 0 - 170	not available	GC-E-TSS 0 - 4000 0 - 600 0 - 85
TS [g/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	not available	GC-A-TS 0 - 20 0 - 3 0 - 0.42	not available
Turbidity [FTU/NTU] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	not available	not available	GC-E-TURB 0 - 8000 0 - 1200 0 - 170
COLORapp / COLORtru [Hazen] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	GC-I-COL 0 - 23000 / 14000 0 - 3500 / 2100 0 - 500 / 300	not available	GC-E-COL 0 - 23000 / 14000 0 - 3500 / 2100 0 - 500 / 300
TOC / DOC [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	GC-I-TOC 0 - 3300 / 2600 0 - 500 / 400 0 - 71 / 57	not available	GC-E-TOC 0 - 2600 / 2000 0 - 400 / 300 0 - 57 / 42
BOD [mg/l] OPL = 1 mm [1] OPL = 5 mm OPL = 35 mm	GC-I-BOD 0 - 5300 0 - 800 0 - 110	not available	GC-E-BOD 0 - 2000 0 - 300 0 - 42

[1] real OPL is approx. 0.75 mm

Parameter	Influent & sewer	Aeration	Effluent
COD / CODf [mg/l]	GC-I-COD	GC-A-COD	GC-E-COD
OPL = 1 mm [1]	0 - 10000 / 5300	0 - 530 (CODf only)	0 - 3300 / 2000
OPL = 5 mm	0 - 1500 / 800	0 - 80 (CODf only)	0 - 500 / 300
OPL = 35 mm	0 - 210 / 110	0 - 11 (CODf only)	0 - 71 / 42
NO_3-N / NO_3 [mg/l]	GC-I-NO3-N	GC-A-NO3-N	GC-E-NO3-N
OPL = 1 mm [1]	0 - 100 / 460	0 - 26 / 110	0 - 300 / 1300
OPL = 5 mm	0 - 16 / 70	0 - 4 / 17	0 - 45 / 190
OPL = 35 mm	0 - 2.2 / 10	0 - 0.6 / 2.5	0 - 6.4 / 28
HS^- [mg/l]	GC-I-HS	not available	not available
OPL = 1 mm [1]	0 - 80		
OPL = 5 mm	0 - 12		
OPL = 35 mm	0 - 1.7		
Ozone O_3 [mg/l]	not available	not available	GC-E-O3
OPL = 1 mm [1]			0 - 1200
OPL = 5 mm			0 - 180
OPL = 35 mm			0 - 25
UV254t / UV254f [Abs/m]	GC-I-UV254	GC-A-UV254	GC-E-UV254
OPL = 1 mm [1]	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800
OPL = 5 mm	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420
OPL = 35 mm	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60

[1] real OPL is approx. 0.75 mm

5.4.3 Parameter Measuring Ranges in Industrial Waste Water

Parameter	Brewery	Paper mill influent	Paper mill Effluent	Dairy
TSS [mg/l]	GC-B-TSS	GC-P-TSS	GC-Q-TSS	GC-M-TSS
OPL = 1 mm [1]	0 - 13000	0 - 8000	0 - 4000	0 - 8000
OPL = 5 mm	0 - 2000	0 - 1200	0 - 600	0 - 1200
OPL = 35 mm	0 - 280	0 - 170	0 - 85	0 - 170
COD / CODf [mg/l]	GC-B-COD	GC-P-COD	GC-Q-COD	GC-M-COD
OPL = 1 mm [1]	0 - 60000 / 53000	0 - 13000 / 11000	0 - 5300 / 3300	0 - 33000 / 16000
OPL = 5 mm	0 - 9000 / 7900	0 - 2000 / 1700	0 - 790 / 490	0 - 5000 / 2400
OPL = 35 mm	0 - 1200 / 1100	0 - 280 / 240	0 - 110 / 70	0 - 710 / 340
NO_3-N / NO_3 [mg/l]	GC-B-NO3-N	GC-P-NO3-N	GC-Q-NO3-N	GC-M-NO3-N
OPL = 1 mm [1]	0 - 100 / 470	0 - 100 / 470	0 - 100 / 470	0 - 210 / 940
OPL = 5 mm	0 - 16 / 70	0 - 16 / 70	0 - 16 / 70	0 - 140 / 32
OPL = 35 mm	0 - 2.2 / 10	0 - 2.2 / 10	0 - 2.2 / 10	0 - 4.5 / 20
UV254t / UV254f [Abs/m]	GC-B-UV254	GC-P-UV254	GC-Q-UV254	GC-Q-UV254
OPL = 1 mm [1]	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800	0 - 3300 / 2800
OPL = 5 mm	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420	0 - 500 / 420
OPL = 35 mm	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60	0 - 71 / 60

[1] real OPL is approx. 0.75 mm

5.4.4 Available Parameters for nitro::lyser

Part no. / Application	FTU	NTU	TSS	TS	NO_3-N	NO_3
N2-D / Drinking water	[X]	X			X	[X]
N2-G / Ground water	[X]	X			X	[X]
N2-R / Surface - / River water	[X]	X			X	[X]
N2-E / Effluent			[X]		[X]	X
N2-A / Aeration				[X]	[X]	X
N2-I / Influent & sewer			[X]		[X]	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.4.5 Available Parameters for ozo::lyser

Part no. / Application	FTU	NTU	TSS	OZONE
O2-D / Drinking water	[X]	X		[X]
O2-E / Effluent			[X]	[X]

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.4.6 Available Parameters for carbo::lyser

Part no. / Application	FTU	NTU	TSS	TS	NO_3-N	NO_3	COD	CODf	BOD	TOC	DOC	UV254t	UV254f
C2-D / Drinking water	[X]	X								[X]	X	X	X
C3-D / Drinking water	[X]	X								[X]	[X]	X	X
C2-R / Surface - / River water	[X]	X	X				X	X	X	[X]	X	X	X
C3-R / Surface - / River water	[X]	X	X				X	X	[X]	[X]	X	X	X
C2-E / Effluent			[X]				[X]	X	X	X	X	X	X
C3-E / Effluent			[X]				[X]	X	[X]	X	X	X	X
C2-A / Aeration				[X]				[X]					
C2-I / Influent			[X]				[X]	X	X	X	X	X	X
C3-I / Influent			[X]				[X]	X	[X]	X	X	X	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.4.7 Available Parameters for multi::lyser

Part no. / Application	FTU	NTU	TSS	TS	NO_3-N	NO_3	COD	CODf	BOD	TOC	DOC	UV254t	UV254f
M4-D / Drinking water	[X]	X			X	[X]				[X]	[X]	X	X
M4-R / Surface - / River water	[X]	X	X		X	[X]	X	X	[X]	[X]	X	X	X
M4-E / Effluent			[X]		[X]	X	[X]	X	[X]	X	X	X	X
M4-A / Aeration				[X]	[X]	X		[X]					
M4-I / Influent			[X]		[X]	X	[X]	X	[X]	X	X	X	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.4.8 Available Parameters for uv::lyser

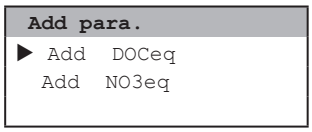
Besides Turbidity, TSS or TS the uv::lyser provides the absorbance value (UV) of up to 4 individual wavelengths.

Part no. / Application	FTU	NTU	TSS	TS	UV254t	UV254f
U5-D / Drinking water	[X]	X			X	X
U5-R / Surface - / River water	[X]	X			X	X
U5-E / Effluent			[X]		X	X
U5-A / Aeration				[X]	X	X
U5-I / Influent			[X]		X	X

X Parameter available and can be activated instead of another
[X] Parameter available and activated per default

5.4.9 Probe Parameterisation using con::lyte D-320

After successful probe initialisation (see section 5.3.1) the needed measuring parameters of the spectrometer probe have to be added to the parameter display. This is performed by the following steps:

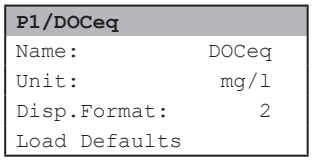


- Switch to status display with *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select *spectro::lyserV3/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

The selected parameter will be displayed now on the next free position of the parameter display. The default display configuration is used. Changing the display format is performed by the following steps:

- Select the parameter in the parameter display using *Up-* or *Down* button.
- Push *Function* button, select menu *Display settings...* and confirm with *OK*.

In the displayed parameter configuration the following settings can be modified.



- *Name* Displays the actual name of the paramter.
- *Unit* Displays the actual unit of the paramter.

A change of the name or unit of the parameter is performed by the following steps:

- Select the entry with *Up-* and *Down* buttons and confirm by pushing the *OK* button.
- Change the name with *Up-*, *Down-*, *Left-* and *Right* buttons.
- Push the *OK* button to confirm the new name.

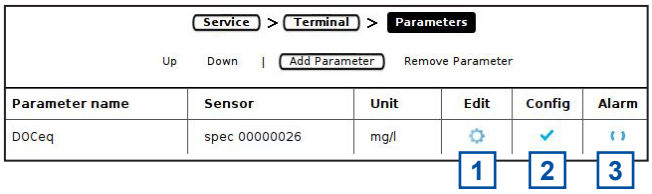
Please note that change of parameter name or unit will not change the parameter configuration itself (e.g. if you change the parameter name NO_3-N to NO_3 the reading will still be NO_3-N).

- *Disp.Format* Within this line the number of displayed decimal places (between 0 and 5) can be set. Please note that in case of too many digits high values can not be displayed and the parameter reading will switch to plus signs (++.+++++).
- *Load Defaults* Confirming this entry by pushing the *Ok* button will restore the default display settings from the sensor.

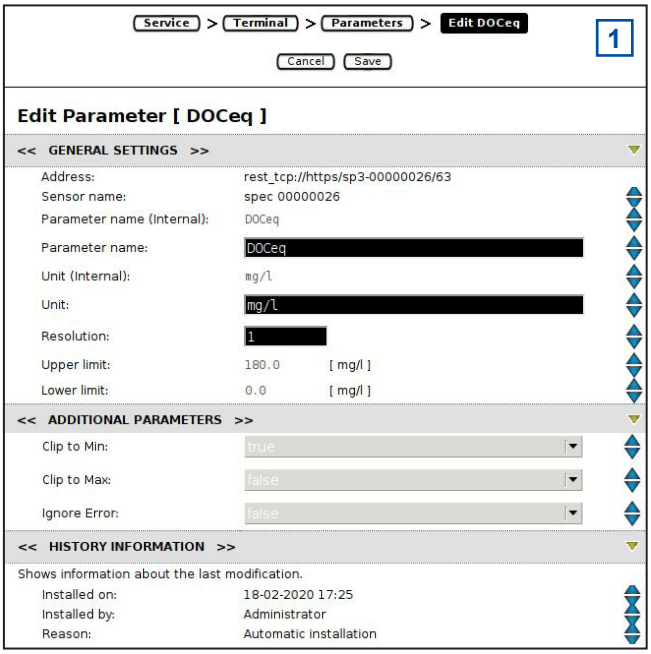
All modifications performed by the operator within these settings menu will be documented in the config file of the con::lyte (see manual con::lyte D-320).

5.4.10 Probe Parameterisation using moni::tool

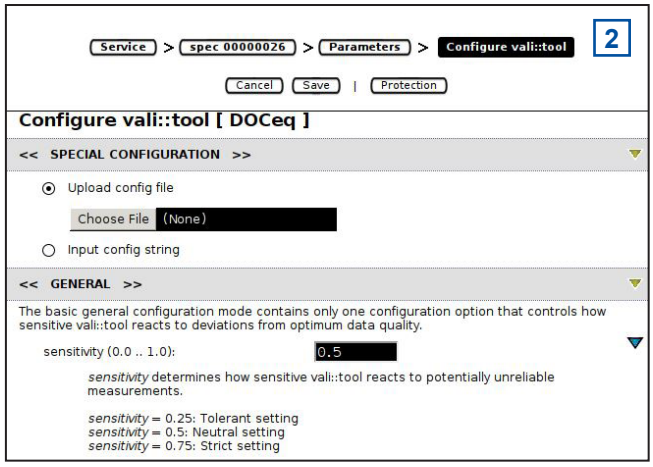
After successful probe initialisation (see section 5.3.2) all parameters of the spectrometer probe will be installed and the active parameters will be displayed on the *Values* screen of moni::tool. If you want to configure the measuring parameters individually, this can be done using the menu item *Service / Terminal / Parameters*.

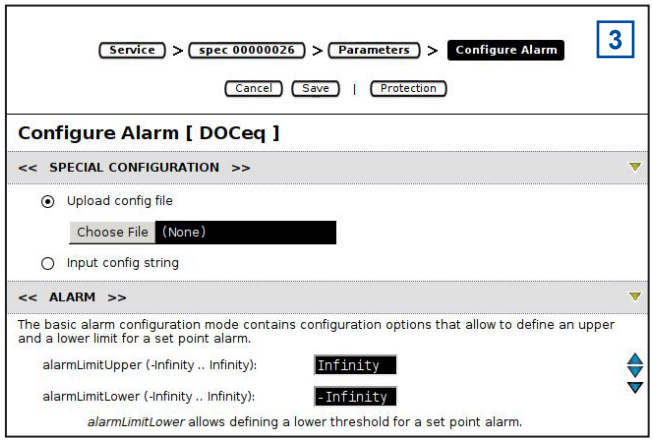


After selecting that menu item a list of all installed parameters is displayed. After selecting one or several parameters by clicking on them, the following activities can be performed:



- Moving the selected parameter to a higher position in the *Values* display by pushing the entry *Up*.
- Moving the selected parameter to a lower position in the *Values* display by pushing the entry *Down*.
- Deleting the selected parameter from *Values* display by pushing the entry *Remove Parameter*. This action has to be confirmed in a new screen by pushing the button *Delete all*.
- A new parameter can be added to the *Value* display by pushing the entry *Add Parameter*. A table of all parameters that are available will be displayed.
- Click on the blue plus sign (+) on the right hand side of the parameter you want to add to the *Values* display.
- Click on the blue wheel (*Edit*) on the right hand side of the parameter will display the actual parameter settings.
- Depending on the used *Service Level* different settings are displayed and can be edited. *Parametername*, *Unit* and *Resolution* can be modified in the *Basic* level. On a higher *Service Level* (*Advanced*, *Expert*) the *Additional Parameters* can be configured.
- Click on the blue check mark (*Config*) on the right hand side of the parameter to check or modify the settings for vali::tool of this parameter. The *Basic* screen is displayed on the right. Please refer to the manual moni::tool for further information.
- Click on the next blue sign (*Alarm*) on the right hand side of the parameter to check or modify the alarm settings for this parameter. The basic screen is displayed on the right. Please refer to the manual moni::tool for further information.

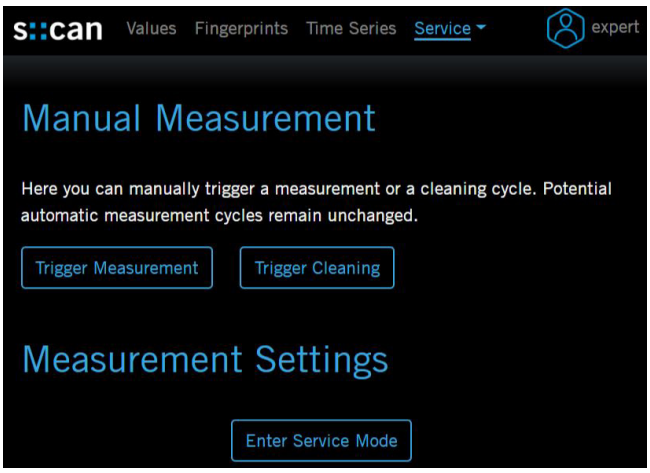


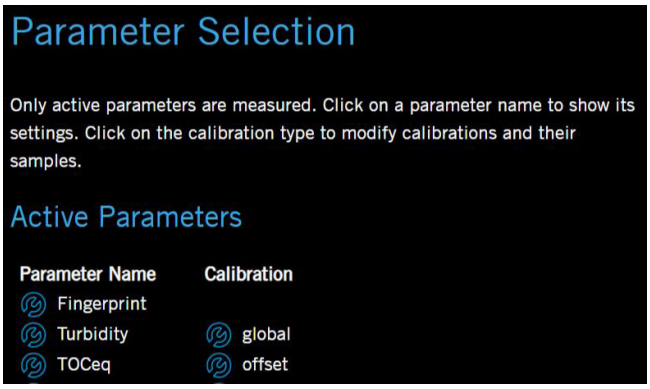


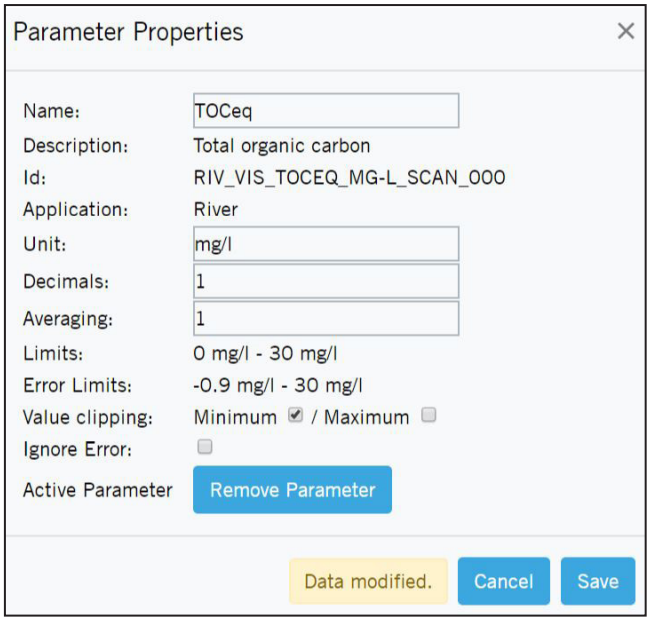
5.4.11 Probe Parameterisation using con::nect and lo::Tool

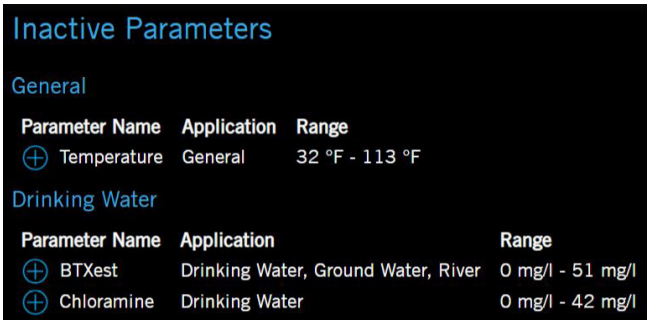
After successful probe initialisation (see section 5.3.3) all active parameters of the spectrometer probe will be displayed on the *Values* screen of moni::tool. If you want to configure the measuring parameters individually, this can be done using the menu item *Measurement Settings*.

- Logon as user *user* or *expert* (see section 5.3.3).
- Select menu *Service \ Measurement Settings*.
- Activate the *Servicemode* by pushing the button.
- Below the *Parameter Selection* all active parameters are displayed. Push the blue icon on the left side of the *Parameter Name* to open the configuration window of the *Parameter Properties* for this parameter.
- *Name* displays the used parameter name. This can be changed if needed.
- *Description* is the exact description of the parameter.
- *Id* and *Application* are the identification of the calcultation algorithm (Global Calibration).
- *Unit* displays the used parameter unit. This can be chaged if needed.
- *Decimals* is the number of displayed decimal places of the parameter. This can be changed if needed.
- *Averaging* displays the number of used readings to calculate the average. The number 1 (factory setting) deactivates the averaging.
- *Limits* displays the defined measuring range for the used optical path length.
- *Error Limits* displays the range outside of that an error message for this parameter will be displayed.
- The following check boxes define if the reading display will be limited to the measuring range (*Value clipping*) and if the exceed of the measuring range will cause an error (*Ignore Error*).
- Pushing the button *Remove Parameter* will not display readings of this parameter anymore and move the parameter to the inactive parameters.
- Any changes made will be confirmed by pushing the button *Save*.
- By pushing the blue ± sign on the left hand side of the *Parameter Name* an *inactive Parameter* will be added to the readings display again.









6 Calibration

At each measurement the s::can spectrometer probe detects the absorbance at different wave lengths caused by the measured medium. This so called fingerprint is used to calculate different parameters (e.g. NO3-N, COD) based on the global calibration the spectrometer probe is equipped with. Global calibrations are standard spectral algorithms available for specific conditions of typical applications (e.g. municipal waste water, river water, drinking water) in such a way, that the spectrometer probe can be used immediately after delivery.

With a local calibration the respective parameters can be adapted to the actual concentrations if required. A local calibration can be performed directly on site without demounting the spectrometer probe or using standard solutions.

Once the spectrometer probe is local calibrated to the specific medium, there is no need to recalibrate the spectrometer probe any more. Only the measuring windows have to be kept clean.

Data base for each local calibration are results of conventional laboratory analysis on one hand and the absorbance spectra measured with the spectrometer probe on the other hand. Because comparison analyses are made in the laboratory, it is necessary to take random samples. The measurement of the fingerprints takes place directly in the process (on-line and in-situ). Caused by this fact not only the deviation of the different methods influences the quality of the calibration but also the total sampling failure (homogeneity of medium, biochemical reactions from sampling to analysing).

Samples have to be chosen in such a way, that they enable you to cover the whole measuring range with only a few samples. Therefore, s::can recommends to take one sample at low and one at high concentration. Under normal circumstances a two-point calibration based on these samples will be satisfactory.

When using calibration standards you have to keep in mind that these standards will always present a different background matrix compared to the real measuring medium.

- Before performing any kind of sample measurement the cleanliness of the measuring windows should be ensured (please refer to section 9.1).
- Before performing the sample measurement in-situ, the probe has to be submersed into the medium (at least 15 min.).
- When performing the sample measurement with the multifunctional slide, spill the slide serveral times with the calibration medium (sample) before measuring the sample. Perform the sample measurement immediately after filling the slide, to avoid any inffluences due to sedimentation.
- A sample measurement has to be triggered at the same time the sample for laboratory analysis is taken.
- The result of the laboratory analysis can be entered later.
- The calibration will not be executed and used till the menu item *Calibrate!* is confirmed.
- When performing a parameter calibration the result will be checked for plausibility. In case of faulty calibration an error message will be displayed to the operator.
- On the spectrometer probe itself sample readings and coresponding laboratory results can be stored for each parmeter using Io::Tool. Furthermore the coefficients of the local calibration (offset and slope) are stored onto the probe.
- In case of a spectro::lyser the complete fingerprint of the sample measurement is stored in the calibration database. Therefore this sample can be used for local calibration of several parameters calculated from this fingerprint. This calibration database is stored on the controller (moni::tool) and not on the probe itself.

6.1 Types of Calibration

Depending on the type of the spectrometer probe (G-Serie or spectro::lyser) and the used controller for operation different types of calibration can be performed.

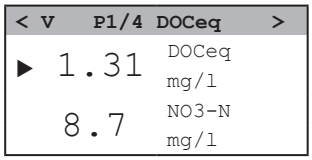
	Offset	Linear	Multi
Number of samples	1 sample	2 samples	3 or more samples
Modified coefficients	offset	offset and slope	offset and slope
con::lyte D-320	possible	possible	not possible
moni::tool V4	possible	possible	possible using samples stored on con::cube
lo::Tool	possible	possible	possible using samples stored on the spectrometer probe

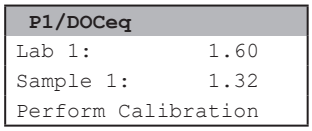
6.2 Performing a Calibration

6.2.1 Calibration using con::lyte D-320

This operating controller provides, beside normal calibration procedure (see further down), the possibility for a quick calibration call directly from the parameter view. This is performed by following steps:

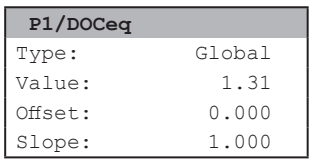
- Select the parameter in the parameter display with *Up-* or *Down* button.
- Push *OK* button, which directly displays the calibration screen.
- Select *Sample 1* and confirm with *OK* to store the global (raw) signal of the actual reading.
- Take a water sample to analyse real parameter concentration.
- Enter the result from laboratory analyse into the field *Lab 1*.
- Select entry *Perform Calibration* and confirm with *OK*.
- Leave the calibration screen with *Back* button.

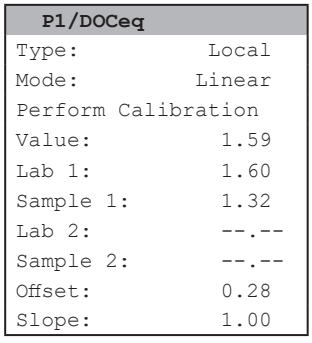




The advanced local calibration provides extensive possibilities for calibration of measurement parameter. After selecting the parameter in the parameter display, pushing the *Function* button, selecting the menu *Calibrate expert...* and pushing the *OK* button, the calibration screen is displayed.

- *Type* Two different types of calibration are available: *Local* or *Global*. By default *Local* is selected. This is the normal calibration performed by the operator. As soon as *Global* is selected an confirmed with *OK* a reset of this parameter to factory calibration (global) is performed and the actual reading (*Value*), the default offset (*Offset*) and the default slope (*Slope*) will be displayed.
- *Mode* As available local calibration variants either *Offset* or *Linear* can be selected.
- *Perform Calibration* Confirming this entry by pushing the *Ok* button will execute the local calibration, using the *Lab* and *Sample* values displayed on the calibration screen.





- *Value* Displays the measured value of the sensor like on the parameter screen (i.e. using the actual calibration). The value will be updated permanently.
- *Lab 1* Within this line the correct value for the measured *Sample 1* (laboratory result) has to be entered. The unit of the lab value has to be in accordance with the measuring parameter.
  An entered *Lab* value can be deleted by selecting it and pushing the *Function* button so that it will not be used in the calibration.
- *Sample 1* When confirming this entry by pushing the *Ok* button, a measurement will be performed and stored as sample 1 for the local calibration. The sample for the laboratory should be taken at the same time.
  Existing readings (*Sample 1* or *Sample 2*) are overwritten whenever a new measurement is performed by pushing *OK*. If no sample measurement was performed or the measurement was invalid, the message *Measure!* will be displayed instead of a numerical value.
- *Offset* Displays the used offset of the actual calibration. It is not possible to edit this value.
- *Slope* Displays the used slope of the actual calibration. It is not possible to edit this value.

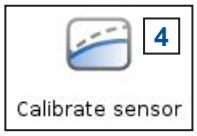
6.2.2 Calibration using moni::tool

1 Click the *Service* tab of the moni::tool screen.

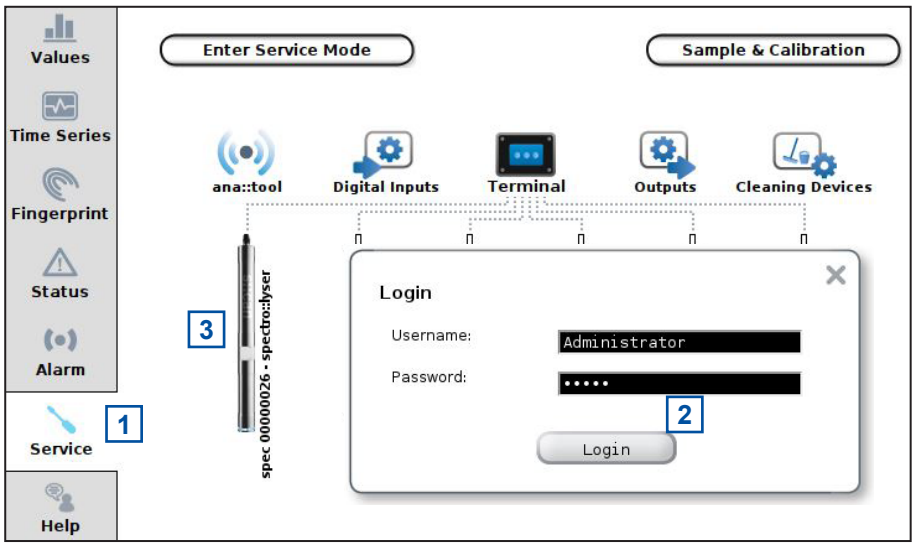
2 Logon as *Administrator* with password *admin1* or your individual username.

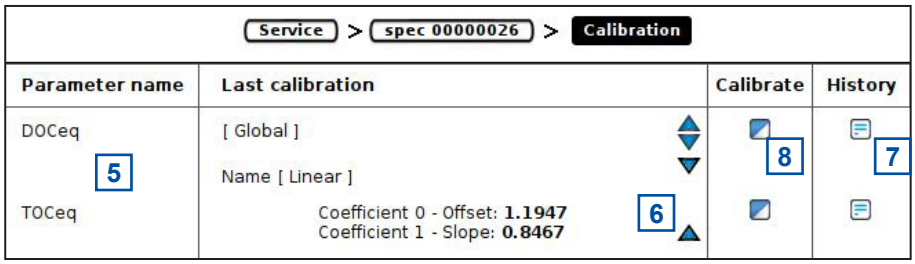
3 Click the icon of the sensor you want to calibrate in the displayed system overview.

4 Click the icon *Calibrate sensor* in the next screen.



5 Now the screen shows a list of all parameters being measured by this sensor (Parameter name).





6 Clicking on the blue triangles will display more information about actual used calibration for this parameter.

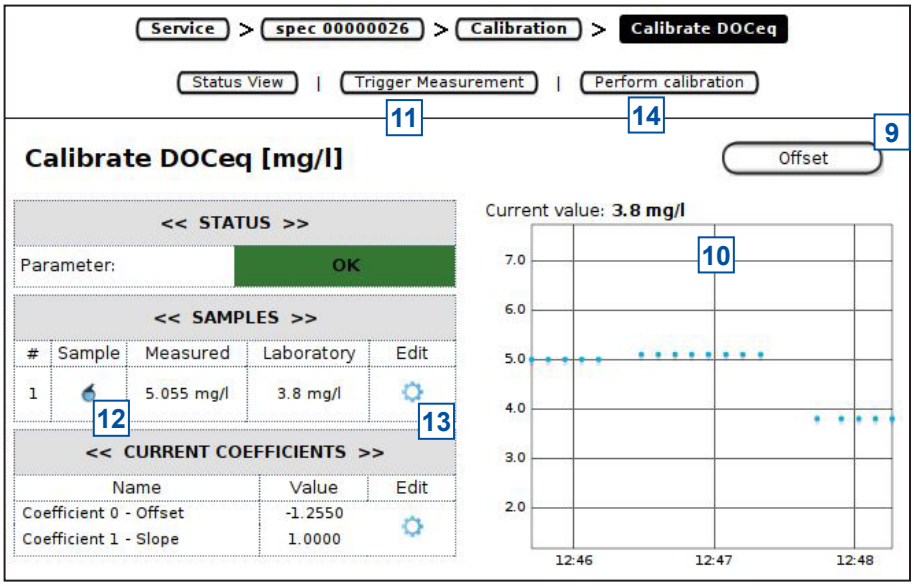
7 Furthermore a click on the *History* icon rightmost opens a logbook showing all up to now with this con::cube performed calibration procedures.

8 Open the calibration screen by clicking on the *Calibrate* icon on the right side of the paramter you want to calibrate.

9 This button displays the actual used calibration (*Global*, *Offset*, *Linear* or *Multi*). Push this button to select the type of calibration you want to perform.

10 The current readings of the parameter will be displayed numerically and graphically.

11 A new measurement of the spectrometer probe will be performed whenever you push the button *Trigger measurement*.



12 Push the *Sample* icon to perform a new measurement and store the reading on the probe. Please note that the displayed value is the *Raw* value, based on the global calibration.

13 Push the *Edit* icon to enter the result of the laboratory analysis and store it on the probe.

14 Push the button *Perform Calibration* to start the calibration procedure.

After the calibration procedure is finished a user message will inform you, if the local *calibration of parameter* was *successful*. In case of an error the reason will be displayed to the user in red letters (e.g. *Please enter at least lab values for 2 samples*).

The coefficients of the new local calibration will be displayed in the column *Value*. It is also possible to write coefficients directly onto the probe by pushing the button *Edit*.

6.2.3 Calibration using con::nect and Io::Tool

1 Enter the IP of the spectrometer probe into your webbrowser (see section 5.3.3) to start Io::Tool. Logout user *guest* and logon as *user* or *expert*.

2 Select menu *Service \ Measurement Settings*.

3 Push the button *Enter Service Mode*.

4 Push the blue calibration icon on the left side of the parameter you want to calibrate.

5 Within the *Samples* screen all stored samples for this parameter up to now are displayed.

6 Results of laboratory analysis can be entered in the row *Lab Values*.

7 Date and time when the sample was taken are displayed in the row *Timestamp*.

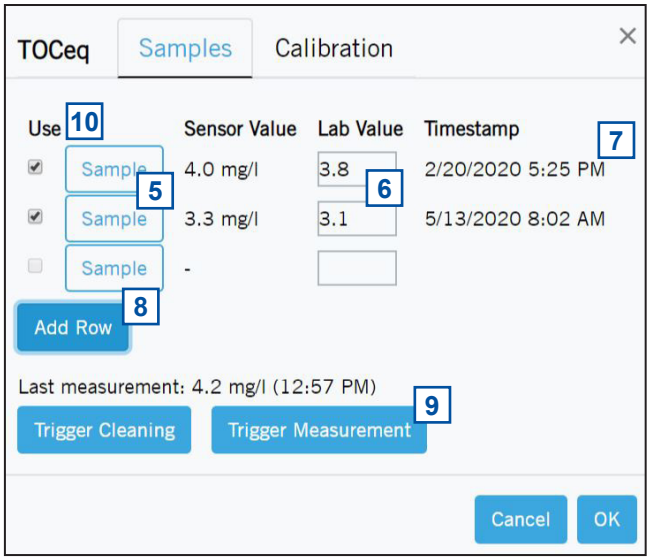
8 If a further sample is needed push the button *Add Row*.

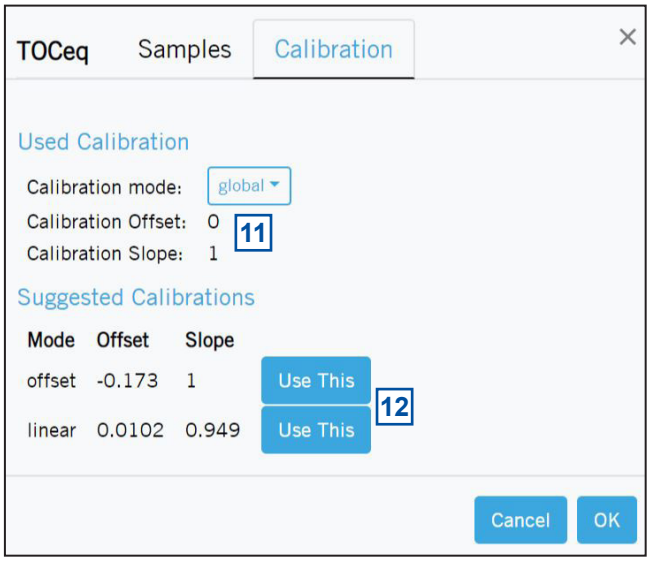
9 When pushing the button *Trigger Measurement* a new measurement is performed and the readings are displayed above as *Last measurement*. Push the *Sample* button to add this measurement to the sample row.

10 The checkbox on the left side (*Use*) defines which samples will be used for local calibration.

11 Within the *Calibration* screen the actual used calibration is displayed. Below the *Calibration mode* (*global*, *offset* or *linear*) the actual used *calibration offset* and *calibration slope* are displayed.

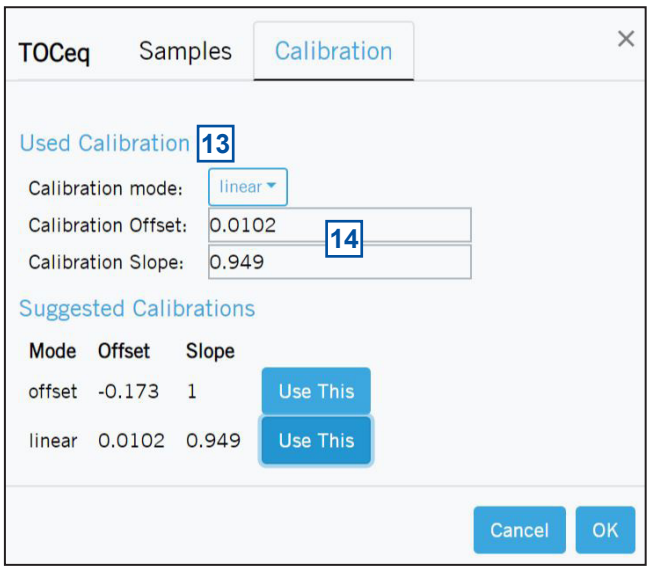
12 Below the information about the *Used Calibration* the *Suggested Calibrations* are displayed. Depending on the number of used samples only *offset* or *linear* calibration also is displayed. Simply push the button *Use This* on the right side of the local calibration that shall be used.





13 As soon as the button *Use This* has been pushed, the new calibration mode with used offset and slope is displayed in the upper part of the calibration screen.

14 The used calibration coefficients can be modified manually in the entry field.



7 Data Management

7.1 Data Storage

The following information are stored directly on the spectrometer probe:

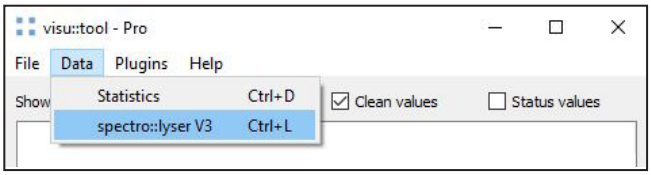
- Global calibration for all uploaded parameters
- Actual used local calibration for each parameter
- Readings of sample measurements for each spectral parameter
- Laboratory results of samples for each spectral parameter
- Reference measurements (air, water)
- Device information (e.g. type, serialnumber, address, please refer to section 10.3)
- Service information in the internal probe logfile

The spectro::lyser is equipped with an 8 GB onboard memory (please refer to the technical specifications located at the end of this manual). A fixed part of this memory is resered to store the measured fingerprints and another part is reserved to store the measured parameter readings. Within the table below there are two examples how many data can be stored maximal.

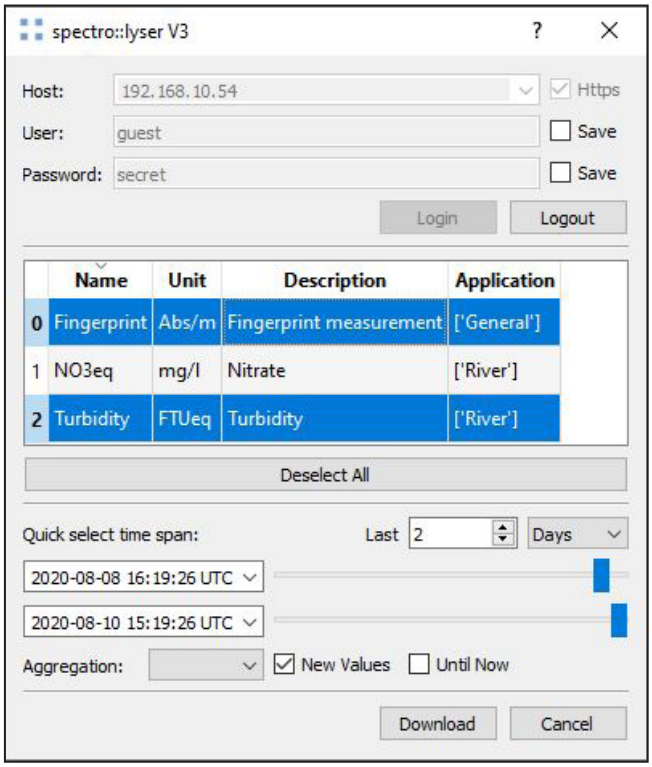
Measuring Interval	No. of Fingerprints	No. of optical Parameters	Storage capacity of Fingerprints	Storage capacity of Parameters
2 minutes	1	2	555 days	730 days
2 minutes	2	6	277 days	603 days

The storage capacity is direct related to the measuring interval. The number of parameters is not directly correlated to storage capacity of parameters. There are several internal parameters logged additionally. Activating temperature in °C does not decrease storage capacity as it is always logged as internal parameter, but activating temperature in °K counts as additional parameter.

7.2 Data Transfer



Stored fingerprint and parameter results can be downloaded from the probe with visu::tool. Please refer to manual visu::tool for further details.



7.3 Data Visualisation

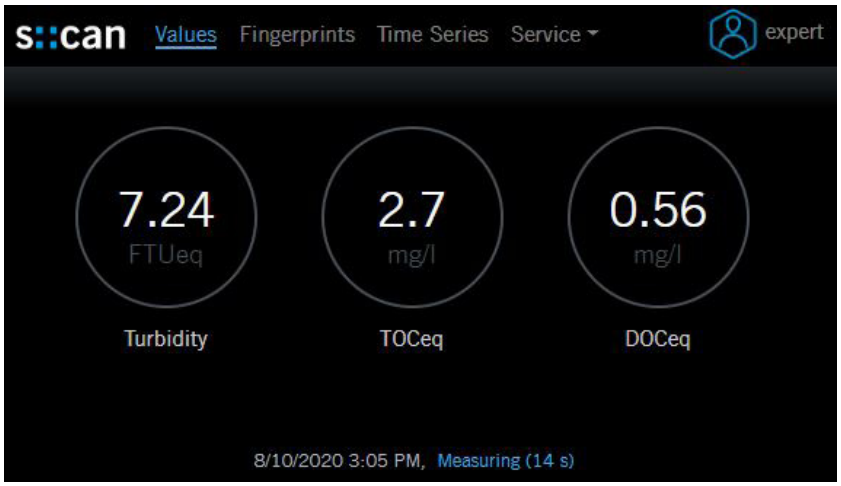
For visualisation of the spectrometer probe readings one of the following s::can controller can be used:

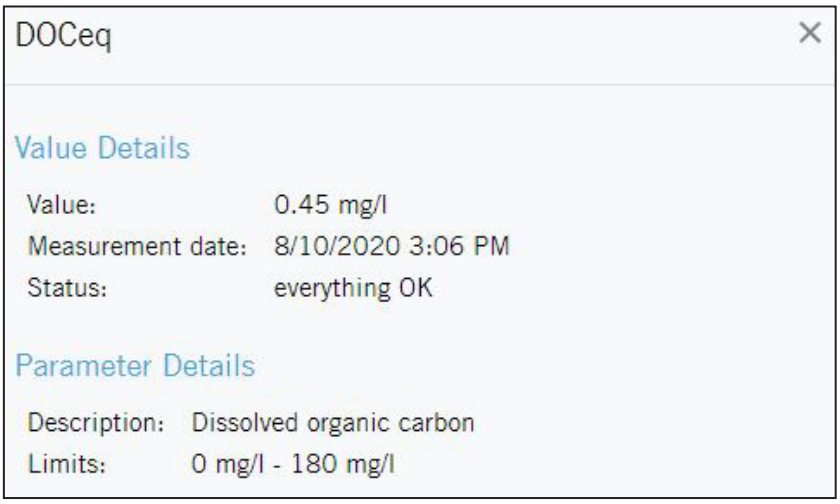
- con::lyte (parameter readings)
- con::cube (parameter readings, time series and fingerprints when using of spectro::lyser)
- con::nect with PC using Io::Tool (parameter readings, time series and fingerprints when using spectro::lyser)

7.3.1 Data Visualisation using Io::Tool

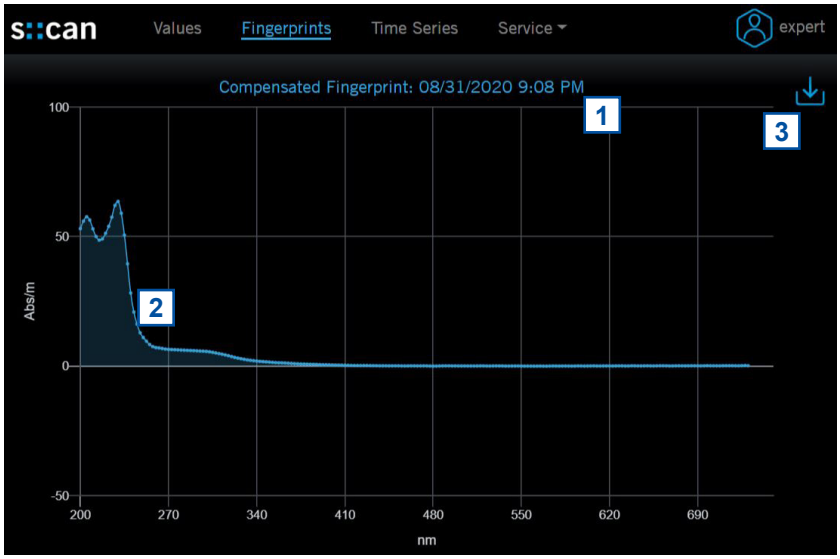
On the Values screen the most actual readings of all active parameters are displayed. When clicking on the parameter reading a window pops up which contains all parameter details.

- Value
- Measurement date
- Status
- Description of the parameter
- Limits of the measuring range





For each measured or calculated fingerprint one diagram is displayed

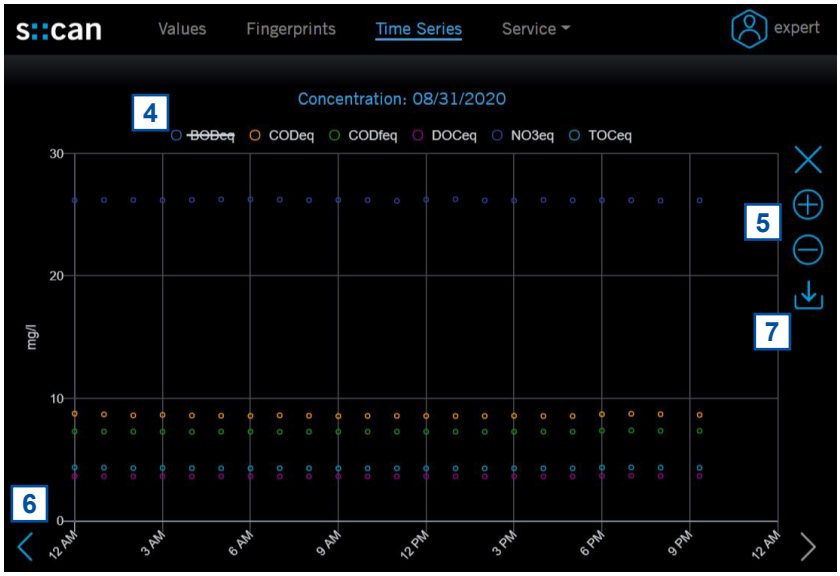


1 Description of the fingeprint and date and time of measurement.

2 Measured fingerprint displayed as Absorption per meter over the wavelengths.

3 Pushing this icon will copy the fingerprint data to the clipboard. So the data can be copied to any other program easily.

Depending on the number and type of parameters one or more diagrams are displayed. Within one diagram all parameters using the same unit are summarized.



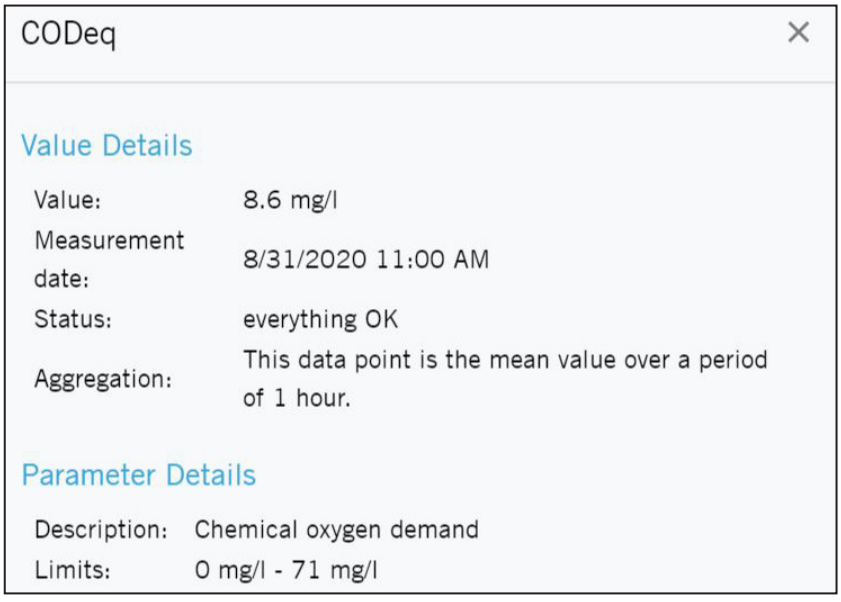
4 Legend of displayed parameter. A parameter can be removed from the digram by clicking on the parameter name (~~*BODeq*~~).

5 Zoom icons to diplay one hour, one day, one week or one month.

6 Arrow icons to move timeseries back or forward.

7 Copy icons to copy all displayed parameter readings into the clipboard. So the data can be copied to any other program easily.

When clicking on a displayed reading, a window pops up, which displays the parameter details.



8 Functional Check

A functional check might be required for one of the following reasons:

- Initial startup
- Routine functional check
- Suspicion of monitoring system malfunction
- Modification of monitoring system (e.g. integration of additional sensor or device)
- Change of measuring location

Depending on the application (water composition), the probes and sensors connected and the environmental conditions a regular functional check (weekly to monthly) is recommended. The following sections provide an overview of all the actions that have to be performed to check the monitoring system quickly (see section 8.1), to check the plausibility of the collected readings (see section 8.2) and to check the integrity of a single probe or sensor (see section 8.3).

8.1 Check of System

Check	con::lyte	moni::tool / con::cube
Power supply controller	Green LED is on? Text is visible on the display?	LED on housing cover is on? moni::tool screen is displayed after touching the screen?
System running (up-to-date)	Displayed system time is current and is updated every second? Use arrow buttons.	Click on system clock at the bottom of the screen shows current time and time of last measurement. Both are current?
System status	No error messages or error symbol displayed?	LED of con::cube is blue and *Status* icon of moni::tool is not blinking yellow?
Reason for bad system status	Check logbook entries since last functional check.	Open *Status* tab and select symbol of affected sensor for more information.

Check	Remark
Function of automatic cleaning	Use function *Clean now* or wait for next cleaning cycle. Watch for air bubbles when cleaning is activated or listen if cleaning brush is rotating.
Compressed air supply for automatic cleaning	All tubes and fittings are tight?
Function of compressor and storage tank	Drain condensed water from storage tank of compressor (not necessary for s::can compressor B-32). Check pressure.
Monitoring station (by-pass)	All tubes and fittings are tight and all probes and sensors are supplied with medium? No air bubbles within the tubes?
Submersed Installation (in-situ)	Mounting equipment of all devices is ok and all probes and sensors are submersed?
Data transfer	Check if displayed readings on local controller are equal with displayed readings on customer display system.

8.2 Check of Readings

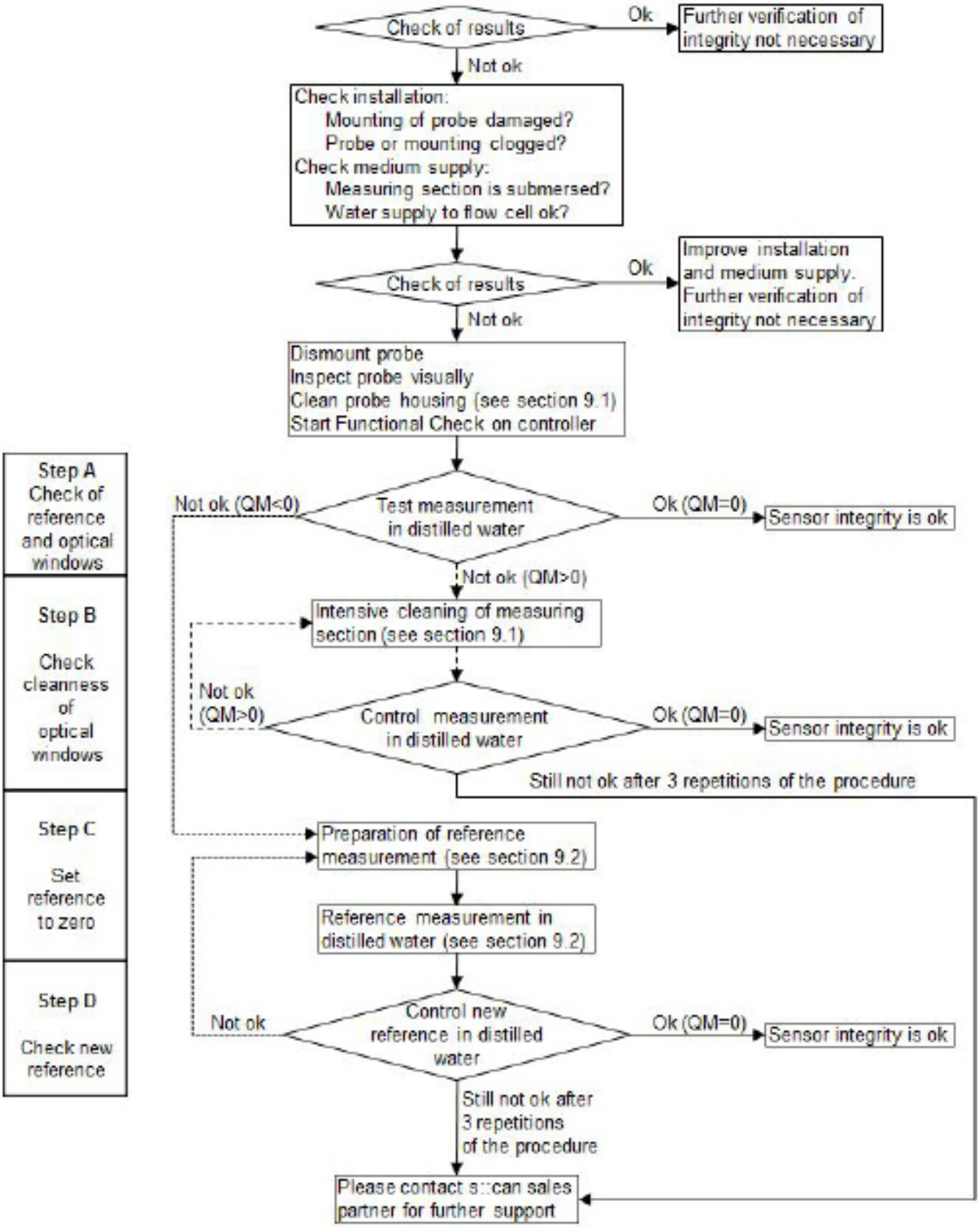
Check	con::lyte	moni::tool / con::cube
Current readings displayed completely	No *NaN* and no dashes (- - - -,- -) or plus sign (++++,++) displayed. Use arrow buttons to scroll through all displayed parameters.	No *NaN* displayed.
Current parameter status of displayed readings	Check logbook entries since last functional check.	Red background for parameter indicates an error or alarm. Grey background indicates reading is not current.

Check	Reason	Remark
Up-to-date: Readings actualised on regulary base?	- Measuring interval is too long - Automatic measurement has been stopped manually	Consider measuring interval and smoothing.
Continuity: Check historical data (timeseries) for interruptions or discontinuities	- Change of medium - Local calibration - Maintenance of probe / sensor (cleaning, etc.) - Readings out of range - System failure (loss of power, communication error, etc.)	Only possible if timeseries are availbale.
Plausibility: Timeseries look plausible with daily or seasonal fluctuation	- Drift of readings (can be caused by fouling) - Increasing noise (can be caused by flow conditions or fouling) - Fixed readings / no fluctuation	Check logbook of plant operator if possible.
Measuring range: Readings are within the specified and calibrated measuring range?		Quality of results might be reduced outside the specified range.
Accuracy: Difference between laboratory values and readings of the spectrometer probe	In case of significant difference during initial operation a local calibration has to be performed (please refer to section 6). In case of significant difference during normal operation a functional check has to be performed to ensure cleanness of measuring section (optical path).	To verify the accuracy of the displayed readings only a reliable and validated comparison method has to be used.

8.3 Check of Probe - Sensor Integrity

During a functional check the actual reference and the cleanness of the measuring windows as well as the internal optical system will be checked. The operation software of con::cube, con::lyte and Io::Tool, will guide the user through all necessary steps.

The diagram above gives an overview of the procedure of the software supported functional check, which can be divided into four steps (A to D). Depending on the results of the test measurements that have to be performed in distilled water or on air, these steps will be executed or not.



The software supported functional check is executed as follows:

A1 Take the spectrometer probe out of the measuring medium.

A2 General cleaning of the probe and careful cleaning of the measuring section. The measuring windows themselves must not be cleaned at this point. Finish the cleaning procedure by rinsing with distilled water. Start the functional check in the operating software or on the controller (see manual of operating software).

A3 Place the carefully cleaned multifunctional slide over the cleaned measuring section of the spectrometer probe. This step can be skipped when performing functional check on air.

A4 Fill the multifunctional slide with distilled water and pour it out. Rinse the multifunctional slide several times (at least 3 times) in this way. This step can be skipped when performing functional check on air.

A5 Fill the multifunctional slide once again with distilled water. This step can be skipped when performing functional check on air.

A6 Start execution of functional check (entry *Functional Check*, *Execute Check* or *Check*).

Test measurement: The probe now executes a measurement. Once the measurement has been finished a quality number (Indicator = -2 to +2) will be displayed. According to this the following actions are necessary:

Q=0 The probe is fully operative and can be mounted again without any modification (sensor integrity is ok).

Q<0 A new reference measurement is necessary (see section 9.2).

Q>0 Suspicion of window fouling.

B1 Thoroughly clean the measuring section again.

B2 Thoroughly clean measuring windows.

B3 see A3

B4 see A4

B5 see A5

B6 see A6

If the quality number is still > 0 after the 3rd repetition of this procedure please continue as follows:

Q=1 Perform a new reference measurement (see section 9.2).

Q=2 Inform your local s::can sales partner.

Alternatively, for experienced users it is also possible to assess the status of the measuring windows and reference measurement by looking at the spectra recorded when distilled water is measured and comparing these with the zero / background line. When using of the software controlled functional check this evaluation is done fully automatic.

9 Maintenance

9.1 Cleaning

During routine operation the cleaning of the spectrometer probe, i.e. the optical measuring windows of the instrument, is performed automatically either via compressed air system or via rotating brush (autobrush or ruck::sack) in the flow cell. To clean the probe manually the following is recommended:

Before demounting the probe be sure that automatic air cleaning is deactivated via operating software and air supply line is depressurised to avoid dirt and / or injury by suddenly escaping pressurized air.

- Rinse sensor with hand-hot (lukewarm) drinking water to remove course deposits.
- Put the probe in a bucket of hand-hot (lukewarm) drinking water for several minutes to remove deposits on and in between the measuring gap.
- To clean the sensor housing a soft cleaning agent (e.g. dish-washing detergent) can be used.

When cleaning the measuring windows, care has to be taken that the windows are not damaged (do not use abrasive materials such as scouring sponges or stiff brushes).

The cleaning of the measuring windows is performed using a soft cloth (one that does not leave behind fibres), cotton swabs or paper tissues that are moistened with cleaning liquid before they are applied. Furthermore, cleaning tissues for eye glasses, e.g. available in supermarkets, are suited. For the removal of strongly adhering fouling, s::can cleaning brushes are available.

The use of the following liquids is allowed for cleaning of the windows. The liquids are listed in the order in which they are to be used in case fouling is persistent.

- Water (can be mixed with a commercial liquid dishwashing agent)
- Pure alcohol (Ethanol)
- s::can cleaning agent
- 3% Hydrochloric acid (HCl) in case of mineral film on the windows

All cleaning liquid must only be applied on the windows using cleaning cloth or tissue. Rinse with distilled water directly after the cleaning. Otherwise the residue of cleaning agents may change the optical characteristics of the windows under UV light and thus lead to a distortion of measurements.

After every step undertaken in the cleaning process, the measuring compartment must be rinsed with sufficient amounts of distilled water.

Sometimes it is possible that the air introducd by the automatic cleaning causes oxidation reactions to take place in the water. As a result, thin films of Fe / Mn / Ca can be formed. When the risk exists that such deposits are formed, it is recommended to use a very brief cleaning time only (1 – 2 seconds) and to reduce cleaning frequency (one cleaning cycle per hour) or to use drinking water instead of air for the automatic cleaning. The rotatings brushes of the autobrush flow cell (F-446-V3) or the ruck::sack will avoid such coatings of oxidized Fe / Mn / Ca also.

9.2 Reference Measurement

All s::can spectrometer probes will be delivered with a high quality reference measurement and therefore can be used at once. The reference measurement serves to define the zero point of all wavelengths that are measured by the spectrometer probe.

A new reference measurement shall only be performed due to result of a performed functional check (see section 8.3) or if recommended from your s::can sales partner. As faulty reference measurement will lead to falsification of all subsequent readings, replacing a reference measurement has to be done with great care.

- Thoroughly clean the measuring section, the measuring windows (see section 9.1) as well as the multi-functional slide.
- Place the carefully cleaned multifunctional slide over the cleaned measuring section of the spectrometer probe.
- Fill the multifunctional slide with distilled water and pour it out. Rinse the multifunctional slide several times (at least 3 times) in that way.
- Fill the multifunctional slide once again with controlled distilled water.
- Start the reference measurement (see manual moni::tool or con::lyte). The measurement ends automatically and replaces the last reference measurement. With Io::Tool the reference measurement can be started via *Service \ Spectral References*.
- Check the new reference measurement by means of the functional check (quality number Q = 0) or manual measurement in the reference medium (Fingerprint = zero).

High quality distilled water must be used for the reference measurement. In this context, please ensure that it contains no foreign matter (e.g. air bubbles, contamination) whatsoever! There is no way to check the quality of the distilled water used automatically.

For the highest possible accuracy of measurements, it is recommended to perform the reference measurement at the temperature and with the probe in the same orientation as it will be used when the probe is installed.

Poor referencing (e.g. when the measuring windows have not been properly cleaned or there are traces of cleaning agents on the measuring windows) may reduce the quality of the readings provided by your spectrometer probe.

10 Troubleshooting

10.1 LED Ring

The spectrometer V3 is equipped with a LED ring on the bottom end of the probe. The color of the LED ring informs about the actual status of the spectrometer V3. The table below explains the meaning of the different LED codes.

Color	Ilumination	Status	Comment
blue	continuous	Normal operation	
red	continuous	Device error	Check error message on terminal or in Io::Tool
red	continuous	Parameter error	Check parameter status on terminal or in Io::Tool
yellow	continuous	Service mode	End service mode for normal operation
blue	flashing with 0.5 Hz	Booting sequence	Wait for 2 minutes
blue	flashing with 0.5 Hz and 200 ms pulse width	Sleep mode	
blue	flashing with 0.2 Hz and 200 ms pulse width	Deep sleep mode	
yellow	flashing with 0.5 Hz	Update in progress	Wait for 2 minutes
green	continuous	Reed contact activated	

10.2 Error Messages / Status Messages

No	API name	Message / Reason	Removal
1	VOLT_HIGH	Supply voltage too high	Check power supply
2	VOLT_LOW	Supply voltage too low	Check power supply
3	MED_TEMP_HIGH	Water temperature too high	Take sensor out of medium
4	MED_TEMP_LOW	Water temperature too low	Take sensor out of medium
5	DEV_TEMP_HIGH	Device temperature too high	Remove sensor from hot environment
6	DEV_TEMP_LOW	Device temperature too low	Remove sensor from cold environment
7	NO_MEDIUM	No medium detected	Check medium supply
8	VAL_BELOW	Value below minimum	Check medium and calibration
9	VAL_ABOVE	Value above maximum	Check medium and calibration
10	MED_BELOW	Signal below sensor range	Check medium and OPL
11	MED_ABOVE	Signal above sensor range	Check medium and OPL
12	COMP_BELOW	Compensation signal below range	
13	COMP_ABOVE	Compansation signal above range	
14	CHECK_BELOW	Check signal below range	
15	CHECK_ABOVE	Check signal above range	
16	DARK_NOISE	Dark noise above limit	
17	DARK_MAX	Maximum dark noise above limit	
18	MEAS_RETRY	Retry needed	
19	HIGH_STD_DEV_ DARK	High variance dark measurement	
20	HIGH_STD_DEV_ME-DIUM	High variance of measurement signal	
21	HIGH_STD_DEV_ COMP	High variance compensation path	
22	HIGH_STD_DEV_ CHECK	High variance check signal	
23	MAINT_NEEDED	Maintenance needed	Perform functional check
24	SERV_NEEDED	Service needed	
25	HW_DEFECT	Hardware error	
26	HIGH_UNCERT	High signal uncertainty	
27	NEG_MED	Negative medium signal	
28	NEG_COMP	Negative compensation signal	
29	NEG_CHECK	Negative check signal	
30	NEG_FP	Negative fingerprint	Perform functional check
31	NEG_LIMIT_EXT	Extinction limit reached	
32	COMP_ABOVE_REF	Compensation above reference	
33	COMP_BELOW_REF	Compensation below reference	
34	CHECK_ABOVE_REF	Check signal above reference	
35	CHECK_BELOW_REF	Check signal below reference	
36	INV_REF_ENER	Invalid spectral reference	
37	MATH_UNCERT	High mathematical uncertainty	
38	MATH_ERR	Calculation error	

10.3 Device Settings

In case detailed sensor information or configuration settings have to be checked, the following sections will explain how to find these information when operating the sensor with a s::can controller.

10.3.1 Check of Device Settings using con::lyte D-320

Select the entry *Manage sensors...* in the main menu of the status screen. Select the name *spectro::lyserV3/0/4* in the list of installed sensors, in which the second number (*4*) indicates the address assigned to the sensor. After confirming the entry *Configure...* as well as the entry *Probesettings* in the next view, the following information of the sensor will be displayed:

- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*spectro::lyser*)
- Serialnumber of the sensor (*S/N*)
- Hardware version of the sensor (*H/W-Version*)
- Software version of the sensor (*S/W-Version*)
- Information about probe type (*UV-VIS*)
- Information about optical pathlength (*Path length*)
- Information about actual used reference (*Name*, *Date*)
- Information about maintenance (*xx %*)

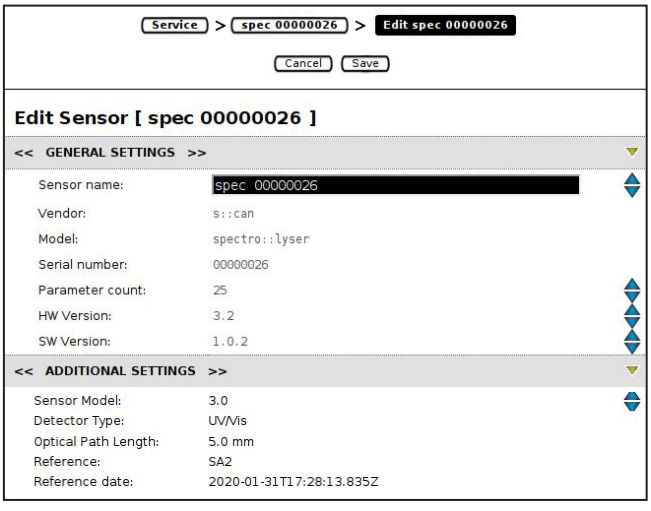
P1/DOC	
Sen.:	spectro::lyse
Name:	DOCeq
Unit:	mg/l
Disp. Format:	2
P. lower:	0
P. upper:	180
Al. lower:	----,---
Al. upper:	----,---

Information of the single measuring parameter can be retrieved via the entry *Parameter info...* from the main menu of the parameter display. In addition to the parameter name (*Name*), the unit of measurement (*Unit*) the number of decimal places (*Disp. Format*), also the lower and upper limit of the parameter range (*P. lower* / *P. upper*) and the adjusted alarm range (*Al. lower* / *Al. upper*) are displayed.

10.3.2 Check of Device Settings using moni::tool

For checking the sensor settings click on the spectrometer icon within the system overview of the *Service* tab and select *Sensor Settings*. Depending on the *Service Level* (figure below is *Service Level Advanced*) some or all of the following information will be displayed:

- Interface of the sensor (*Address*)
- Sensor name used internal (*internal*). Should not be changed by the operator.
- *Sensor Name* allocated to the device by the operator
- Manufacturer name of the sensor (*Vendor*)
- Type of the sensor (*Model*)
- Serial number of the sensor (*Serial Number*)
- Number of available parameters (*Parameter count*)
- Information regarding the purchase (*Purchase date*, *Warranty expiry date*). Can be entered by the operator at initial startup.



- Actual hardware and software version of the sensor (*HW Version*, *SW Version*)
- Cleaning device allocated to the sensor (*Cleaning device*)
- *Sensor Model* of the spectrometer probe
- Type of the spectrometer probe (*Detector Type*)
- *Optical Path Length* of the spectrometer probe in mm
- Name of the actual used zero reference (*Reference*)
- Internal number of the actual used zero reference (*Reference index*)
- Date of the actual used zero reference (*Reference date*)
- Actual used operation mode of the spectrometer probe (*Measurement mode*)
- Actual used measuring interval of the spectrometer probe (*Measurement interval*)
- *Logging interval* for Datalogger of the spectrometer probe
- Actual used mode of allocated *cleaning* device (e.g. automatic, manual off)
- Actual used cleaning interval (*Time between cleaning*) in sec.
- Actual used cleaning duration (*Cleaning duration*) in sec.
- Actual used waiting time (*Delay after cleaning*) in sec.
- History information about installation (*Installed on*, *Installed by*)

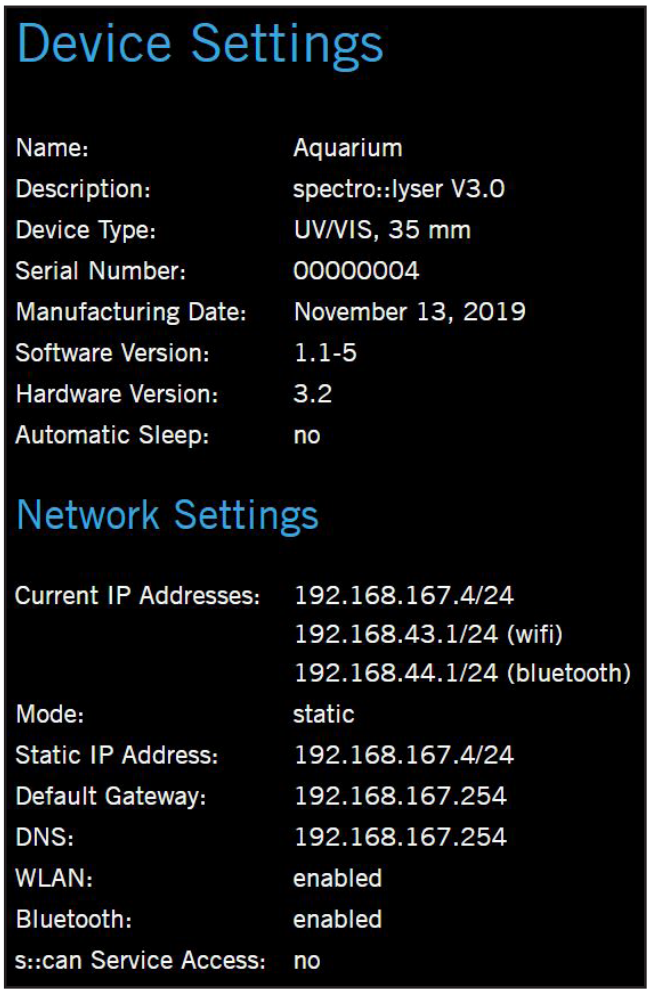
10.3.3 Check of Device Settings using con::nect and Io::Tool

Enter the IP address of the spectrometer probe into your webbrowser to start Io::Tool (see section 5.3.3). Now select menu *Service \ Device Settings* to display the following information:

- User specific *Name* of the location
- *Description* of the measuring device
- Detector type (e.g. UV/Vis) and optical path length of the spectrometer probe (*Device Type*)
- Serial number of the sensor (*Serial Number*)
- Production date of the sensor (*Manufacturing Date*)
- Actual software version of the sensor (*Software Version*)
- Actual hardware version of the sensor (*Hardware Version*)
- Information if *Automatic Sleep* mode is activated or not

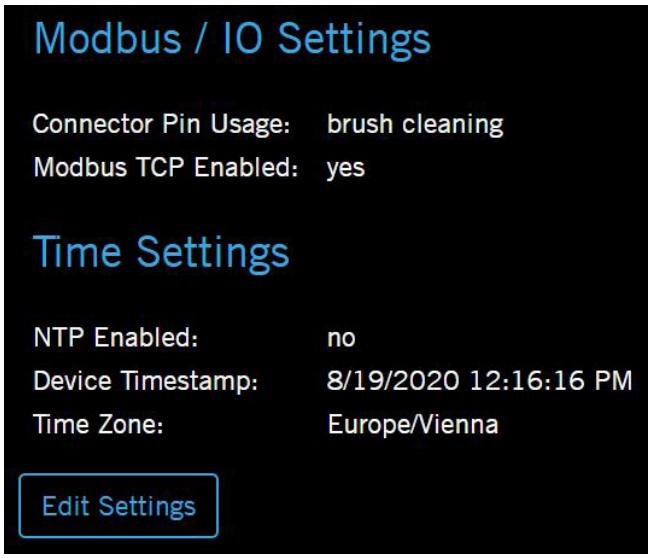
Within the *Network Settings* all *Current IP Addresses* for static IP, *Wifi* and Bluetooth are displayed. The *Mode* can be *static* or *DHCP*.

- Actual network settings of *WLAN*. The following options are possible: *enabled*, *disabled* or *at startup only* (i.e. WLAN is enabled for approx. 10 minutes after a power reset of the spectrometer probe).
- Actual network settings of *Bluetooth*. The following options are possible: *enabled*, *disabled* or *at startup only* (i.e. Bluetooth is enabled for approx. 10 minutes after a power reset of the spectrometer probe).



For best measurement performance s::can recommends to use configuration *disabled* or *at startup only* for Bluetooth and WLAN

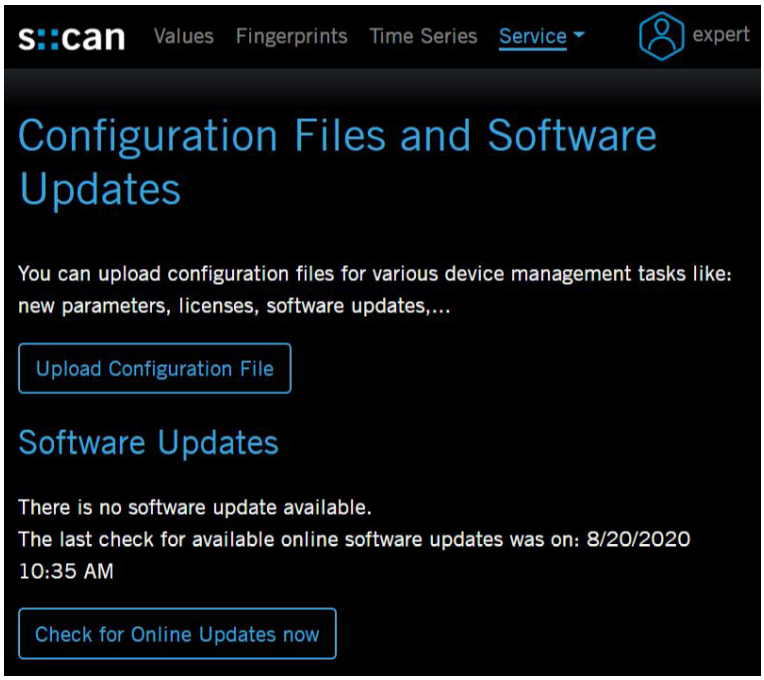
- Information if *s::can Service Access* is activated or not.
- Status of actual *Connector Pin Usage*. The following options are possible: *Modbus*, *air cleaning* or *brush cleaning*.
- Information if *Modbus TCP* is enabled or disabled.
- Actual status of *NTP* server (enabled or disabled)
- Actual date and time of the internal clock (*Device Timestamp*)
- Actual used time zone (*Time Zone*)



To modify the device properties logon as user *expert* is needed. Then push the button *Edit Settings* which is visible below the *Time Settings*. Now properties can be modified. After all changes are finished push the button *Save Changes* to change the configuration permanently.

10.4 Software Update

- Enter the IP of the spectrometer probe into your webbrowser (see section 5.3.3) to start Io::Tool.
- Logout user *guest* and logon as *expert*.
- Select menu *Service \ Licenses and Updates*.
- Below the header line *Software Updates* all available download files are displayed. You can also push the button *Check for Online Updates now* to search for actual updates.
- Select the most actual version and push the button *Download*.
- If the spectrometer probe is not connected to the Internet the update file can be uploaded from a connected mobile device. Push the button *Upload Configuration File* to select the file on the mobile device.
- After the download is finished push the button *Install* to start the update procedure.



10.5 Return Consignment (RMA - Return Material Authorization)

Return consignments of the s::can monitoring system, or parts of the system, shall be done in a packaging that protects the device (original packaging or protective covering if possible). Before returning a consignment, you have to contact your s::can sales partner or s::can customer support (support@s-can.at). A RMA number will be assigned for each device, independent if the reason of the return consignment is service, repair or demo equipment.

RMA numbers can be requested from the s::can Costomer Portal available on the s::can webpage directly. Return consignments without an RMA number will not be accepted. The customer always has to bear the costs for return consignment.

11 Accessories

11.1 Installation

11.1.1 Extension Cable

The cable of the spectrometer probe can be elongated when necessary with an extension cable (10 m or 20 m length). The extension cable is attached using the probe cable connector plug.

Name	Specification	Remark
Part-no.	C-210-V3 C-220-V3	
Cable lenght	10 m 20 m	C-210-V3 C-220-V3
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can probe cable and controller

11.1.2 Connection Cable for spectrometer probe V3 to MIL-Plug

For connection of the spectrometer probe V3 to a con::lyte with MIL-plug connection a specific adapter cable is available.

Name	Specification	Remark
Part-no.	C-32-V3	
Cable lenght	0.3 m	
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can controller with MIL-plug

Please note that for connection to s::can terminal con::cube D-315 this cable cannot be used. In this case the con::nect box B-33-012 has to be used.

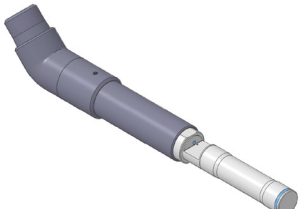
11.1.3 Connection Cable for spectrometer probe V2 to M12-Plug

For connection of the spectrometer probe V2 to a con::cube D-330 with M12-plug connection a specific adapter cable is available.

Name	Specification	Remark
Part-no.	C-32-MIL	
Cable lenght	0.3 m	
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can controller with MIL-plug

11.1.4 Spectrometer Probe Mounting (horizontal)

For proper, horizontal submersed installation of the spectrometer probe a seperate probe carrier is available. This part can be extended by a pipe (to be provided by the customer), if necessary. For lenght > 1 m stainless steel pipes are prefered.



Name	Specification	Remark
Part-no.	F-110-V3	
Scope of delivery	1 mounting pipe 2 spacer rings 3 fixing screws (M5x10)	
Material	PVC POM stainless steel	mounting pipe spacer rings fixing screw
Dimensions	73 / 396 mm	diameter / lenght
Weight	approx. 0.9 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1

11.1.5 Spectrometer Probe Mounting (vertical)

For proper, vertical submersed installation of the spectrometer probe a seperate probe carrier is available. This part can be extended by a pipe (to be provided by the customer), if necessary. For lenght > 1 m stainless steel pipes are prefered.

Name	Specification	Remark
Part-no.	F-120-V3	
Scope of delivery	1 mounting pipe 2 spacer rings 3 fixing screws (M5x10)	
Material	PVC POM stainless steel	mounting pipe spacer rings fixing screw
Dimensions	73 / 317 mm	diameter / length
Weight	approx. 0.6 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1

11.1.6 Fixing Adapter

For proper and easy mounting of installation pipes onto the railing a seperate fixing adapter carries is available.

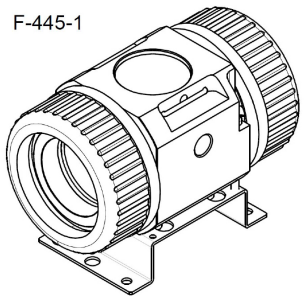
Name	Specification	Remark
Part-no.	F-15	
Material	Stainless steel	
Dimensions	158 / 267 / 73 mm	W / H / D
Weight	approx. 2.6 kg	
Process connection	ID 50 mm	OD installation pipe
Installation / mounting	OD up to 64 mm	on rail

11.1.7 Flow Cell Setup Tap Water

For measurement of sample stream outside the medium with a spectrometer probe a separate flow-through installation is available.

Name	Specification	Remark
Part-no.	F-445-V3	
Material	POM-C stainless steel	flow cell mounting
Dimensions	132 / 101 / 74 mm	W / H / D
Weight	approx. 0.45 kg	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 60 °C (32 to 140 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose nozzle $^1/_4$ inch (ID 6 mm)	F-45-PROCESS

F-445-1



11.1.8 Flow Cell Setup Autobrush

For measurement of sample stream outside the medium with a spectrometer probe in such applications, where fouling of the measuring windows may occur and automatic cleaning with compressed air is not sufficient or not applicable, a separate flow-through installation with an automatic brush is available.

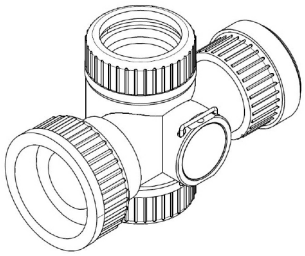
Name	Specification	Remark
Part-no.	F-446-V3	for 35 mm OPL
Material	POM-C stainless steel	flow cell mounting
Dimensions	132 / 155 / 74 mm	W / H / D
Weight	approx . 0.9 kg	
Power supply	10.5 to 13.5 VDC	
Power consumption	1.2 W (typ.)	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 40 °C (32 to 104 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose nozzle $^1/_4$ inch (ID 6 mm)	F-45-PROCESS

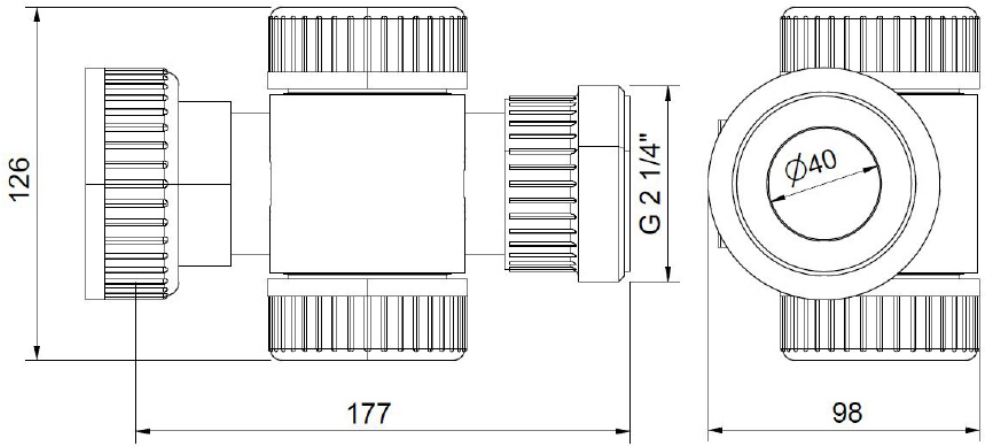
For this s::can product a seperate manual is available.

11.1.9 Flow Cell Setup Waste Water

For measurement of waste water sample stream outside the medium with a spectrometer probe a separate flow-through installation is available.

Name	Specification	Remark
Part-no.	F-48-V3	
Material	PVC	
Dimensions	126 / 98 / 177	W / H / D
Weight	approx. 0.65 kg	
Process connection	ID 40 mm	
Installation / mounting	flow-through (by pass)	
Operating pressure	0 to 3 bar (0 to 43.5 psi)	





11.1.10 System Panel micro::station

For easy attachment of a complete s::can monitoring system (s::can controller, flow cell autobrush and two other flow cells) a separate system panel with holes for mounting of different devices is available.

Name	Specification	Remark
Part-no.	F-501-ECO-EU F-501-ECO-US	
Material	PP	
Dimensions	450 / 750 / 10 mm 450 / 750 / 190 mm	W / H / D (panel itself) W / H / D (required depth)
Process connection	G $^1/_4$ inch $^1/_4$ inch NPT	F-501-ECO-EU F-501-ECO-US

11.2 Automatic Cleaning

11.2.1 Pressure Connection Set

For connection of the automatic air cleaning system of the spectrometer probe a specific pressure connection set is available.

Name	Specification	Remark
Part-no.	B-41-sensor	
Pressure hose	3 m	ID 4mm / AD 6mm
Assembling	ex works	
Material	PU Nickel-plated brass	tube connection fitting
Process connection	$^{3}/_{8}$ inch	
Operating pressure	1 to 6 bar (14.5 to 87 psi)	

11.3 Maintenance

11.3.1 Cleaning Brushes

For easy and proper manual cleaning of the measuring windows of the spectrometer probes specific brushes are available. They are especially suited for mechanical removal of persistent window fouling.

Name	Specification	Remark
Part-no.	B-60-1 B-60-2	for OPL 1 mm for OPL 5 and 35 mm
Dimensions	200 mm	length

11.3.2 Cleaning Agent

For easy and proper manual cleaning of the measuring windows of the spectrometer probes a specific cleaning agent is available. It is especially suited for chemical removal of grease and persistent organic window fouling.

Name	Specification	Remark
Part-no.	B-61-1	
Weight	approx. 1.3 kg	
Volumne	1 000 ml	

11.3.3 Multifunctional Slide

For easy and proper functional check and reference measurements of the spectrometer probe a multifunctional slide is available.

This slide can also be used for measuring individual samples outside the process flow (e.g. spot samples in a laboratory). To place the multifunctional slide without requiring excessive force and risk of damaging the O-rings, the contacting surfaces on the probe, as well as the O-rings of the multifunctional slide can be moistened with water.

After fitting, the multifunctional slide must always be rinsed first using distilled water. This is done to avoid influence of subsequent measurements by traces of O-ring material left on the probe during fitting.

Name	Specification	Remark
Part-no.	B-421-V3	
Material	POM-H FPM	housing sealing
Dimensions	100 / 44 / 60 mm 26 mm	W / H / D circular opening
Volumne	30 ml 40 ml	for 5 mm OPL for 35 mm OPL
Weight	approx. 0.17 kg	

12 Technical Specifications

Name	Specification	Remark
Part-no.	SP3-1-xx-NO-yyy xx-1-xx-NO-xxx	spectro::lyser G-Serie (no access to fingerprint), see section 3.3 for further details
Measuring parameter	depending on type and used global calibration	see section 5.4
Measuring principle	UV-Vis spectrometry with xenon flash lamp (190 - 750 nm)	256 photo diodes, two beam instrument, automatic compensation
Automatic compensation flash lamp	dual beam measurement	for detailed diagnostics
Measuring range	depending on optical pathlegth (OPL)	
Resolution	2.5 nm	
Measurement interval	10 sec (min.) 120 sec (typical)	min. depending on number of parameters and application
Response time	> 10 sec	depending on number of parameters and application
Accuracy spectro::lyser	NO3-STD: +/- 2% + 1/OPL [mg/l] COD-KHP: +/- 2% + 10/OPL [mg/l]	in standard solution (>1 mg/l) OPL ... optical pathlength
Accuracy G-Serie	NO3-STD: +/- 3% + 1/OPL [mg/l] COD-KHP: +/- 3% + 10/OPL [mg/l]	in standard solution (>1 mg/l) OPL ... optical pathlength
Repeatability (in air at 20°C)	+/- 0.004 ext. - spectro::lyser +/- 0.010 ext. - G-Serie	in air at 20°C with 10 flashes per measurement without averaging of measurements
Drift (peak to peak)	< +/- 0.005 ext./day - spectro::lyser < +/- 0.010 ext./day - G-Serie	in air at 20°C with 10 flashes per measurement without averaging of measurements
Calibration ex-works	all parameter precalibrated ex-works	depending on application
Local calibration	offset or linear	to real (local) water matrix
Reference	distilled water	e.g. dist. water for analysis by Merck
Automatic spectral compensation	Turbidity, solids, organic substances, etc.	compensation of cross sensitivities
Temperature sensor internal	0 to 45 °C (32 to 113 °F) 0.1 °C resolution	readings displayed license free
Additional sensors internal	Supply voltage, tilt and rotation	readings display for s::can service
Power supply	10 to 18 VDC, 350 mA < 1.5 A 5 mA	full activity during flashing (measuring process) in sleep modus (logger mode)
Power consumption	3.0 W (typical) 20 W (max) 60 mW (during sleep mode)	

Name	Specification	Remark
Electrical potential	max. 1 Ohm < 0.5 Ohm	max. resistance between (power supply) earth (=PE) and the real site ground resistance between the medium to be measured and the ground of the probe‘s power supply (e.g. con::lyte, con::cube)
Electrical isolation	galvanic isolation	between electronic and housing
Sensor cable length	1.0 m fixed cable 7.5 m fixed cable 15 m fixed cable	-010 -075 -150
Sensor cable specification	OD 8 mm +/- 0.5 mm, polyurethane jacket with double screening	min. bending radius 5 cm, no buckling allowed at probe connection
Status information	RGB LED ring on bottom	see section 10.1
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to s::can controller
Interface connection to third party terminals	con::nect V3 incl. Modbus RTU, REST API	
Digital interface for cleaning device	1 digital in/out ; 1 digital out	
Network connection	100Base-T Ethernet, Bluetooth, WLAN	Bluetooth and WLAN only works if sensor is not submersed completely
Sensor materials (in contact with measuring medium)	stainless steel 1.4404 X2 Cr Ni Mo 17-12-2 fused silica (UV-grade) sapphire (Al2O3)	housing (ISO) (DIN material number) measuring windows (OPL 35 mm) measuring windows (OPL 1 and 5 mm)
Weight	3.4 kg	incl. cable
Dimension (without cable gland)	44 / 473 mm 44 / 457 mm 44 / 453 mm	diameter / length (OPL 35 mm) diameter / length (OPL 5 mm) diameter / length (OPL 1 mm)
Operating limits temperature	0 to 45 °C (32 to 113 °F) up to 50 °C (122 °F) < 3 minutes	temperature, min. freezing, max. 45°C submerged
Operating limits pressure	0 to 3 bar (0 to 43.5 psi)	up to 10 bar as optional specification
Operating limits others	max. 3 m/s max. 30 Nm	flowrate mechanical stability, centric load, adequate for most known application conditions and all s::can installation / mounting parts
Storage limits temperature	-10 to 65 °C (14 to 149 °F)	probe has to be acclimatised to medium temperature before initial operation
Installation / mounting	submersed or in flow cell	
Environment rating (IP)	IP 68	
Internal storage	8 GB on board memory	see section 7.1
Back-up battery	5 years life duration without external power supply (e.g. storage)	exchange by s::can service only
Interface to external terminals	Gateway Modbus RTU	via con::nect

Name	Specification	Remark
Automatic cleaning - probe connection	G $^{1}/_{8}$ inch for air hose OD 6 mm	
Automatic cleaning - specification	compressed air, free of oil & particles min. 3 bar (43.5 psi) max. 6 bar (87 psi)	medium (drinking water alternative) allowed pressure at probe cleaning connection
Automatic cleaning - settings	duration: 1 to 10 sec. interval: 1 min. to 6 hours delay: >10 sec.	valve open or brush rotating depending on application delay until start of next measurement, (consider that flow cell has to be filled up with new medium)
Mechanical tests	deviation, shock, temperature 3 bar (43.5 psi)	acc. internal quality criteria leak test
Quality tests	99% within tolerance over 24 hours NO_3 standard solution 8 fingerprints within specification	precision / stability linearity absorbance in distilled water
Light source	xenon gas discharge lamp	
Stability light source	> 99 % > 99.5 % (typical)	UV-Vis (230 - 650 nm) standard deviation in air at 20°C with 10 flashes
Life time light source	> 1 x 10^9 flashes	Life time = 50 % of output energy; corresponds to about 85% of absorbance / concentration.
Protection light source	shielded, encapsulated	
Regulation light energy	between 60 and 100%	by s::can service only
Flashes per measurement	20 - 60 flashes / measurement	depending on application
Warranty standard	2 years	
Warranty extended (optional)	3 years	
Conformity - environmental testing	EN 60721-3	
Conformity - EMC	EN 61326-1	
Conformity - RoHS2	EN 50581	

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