s::can
A Badger Meter® Brand

Manual

i::scan

December 2022 Release

Table of Contents

1 General

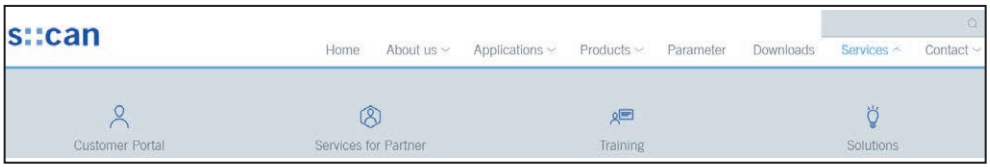
This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the s::can product itself as well as information regarding transport and storage of the product. In further chapters the installation (chapter 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 function 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.

A CE-mark is 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 municipal 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 i::scan 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)!

3 Technical Description

3.1 Intended Use

All i::scan probes are compact multi-wavelegth probes, designed for continuous online measurement of absorption spectra (UV, UV-Vis, NIR and derived parameters) with high quality. The i::scan 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.

The i::scan is available with 5 mm or 35 mm optical path length (OPL). The i::scan with 35 mm OPL has an additional 90 degree detector for scattered light measurements including suitable light sources. This allows measurements of turbidity according to ISO 7027 and similar to EPA 180.1.

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 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

The i::scan is a multi-wavelength photometer with narrow band light sources. The light beam of a specific wavelength is emitted by the light source and after contact with the medium its intensity is measured by a detector.

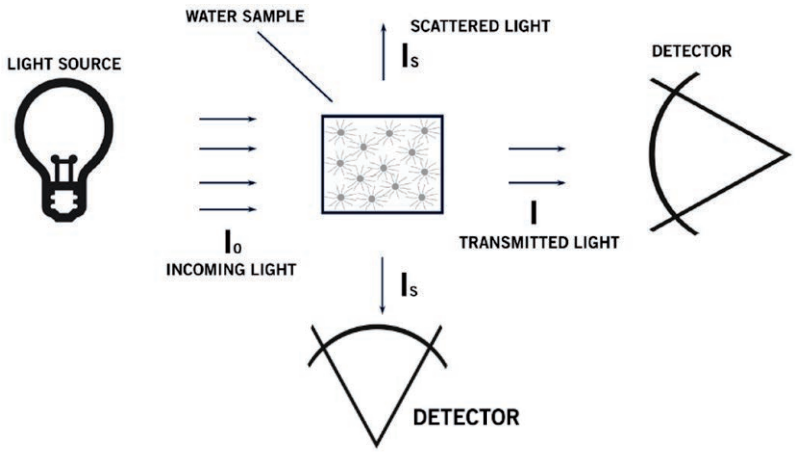
The wavelengths used in the i::scan have been carefully selected to best fit the intended applications. For organic parameters multiple wavelengths in the UV-A, UV-B and UV-C range are used. For colour, solids and turbidity measurements light sources in the visible and near infrared range are used.

Each molecule of a dissolved substance absorbs radiation at a certain and known wavelength. The concentration of substances contained in the medium determines the size of the absorption. The higher the concentration of a certain substance, the more it will weaken the light beam.

Extinction or absorbance is defined as ratio of two light intensities: The intensity of light after passing through the medium to be measured and the intensity of light after passing through a so-called reference medium (distilled water).

The i::scan is equipped with an internal compensation detector, which is used to compensate for influences on the measurement quality caused by temperature and aging of the integrated light sources.

The absorption measurement for turbidity according to ISO 7027 is performed with a narrow band near infrared light source and a 90 degree detector for scattered light. The measurement comparable to EPA 180.1 is performed using a light source with a similar colour temperature as a tungsten lamp.



3.3 Product

The i::scan probes are available with two different optical path length (OPL) depending on the application. i::scan for measurement of rather clean water (i.e. lower concentration range) with 35 mm OPL and i::scan for measurement of waste water (i.e. higher concentration range) with 5 mm OPL.

Furthermore the i::scan can be equipped either with a plug connector (Yxx-x-x-000) for installation in flow cell or with a fixed cable 7.5 m (Yxx-x-x-075) or 15 m (Yxx-x-x-150) for submersed installation.

The following device variants of the i::scan are available. Regarding detailed information of the device please refer to the technical specifications located at the end of the manual.

Part-no.	Application
d	drinking water
r	river water and surface water
e	municipal water effluent
i	municipal water influent / sewage
Part-no.	**Cable length xxx**
000	only sensor plug (1.0 m connection cable C-010 needed)
075	7.5 m fxed cable
150	15.0 m fixed cable

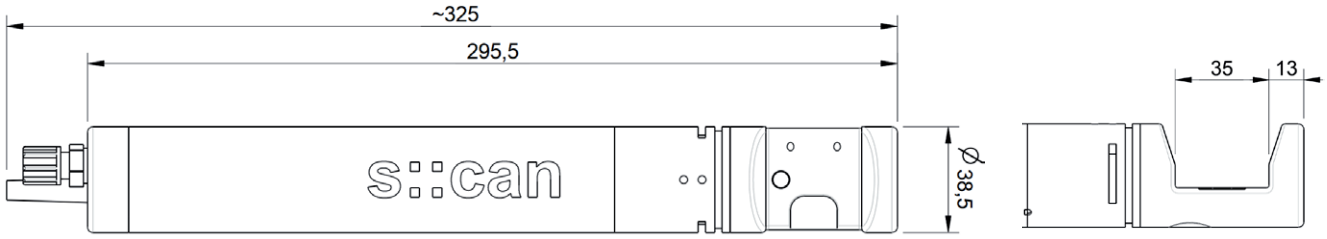
Part-no.	Type / specification
Y01-1-d-xxx or Y01-1-r-xxx	i::scan for drinking or river water (35 mm OPL) with Turbidity (NTU / FTU)
Y02-1-d-xxx or Y02-1-r-xxx	i::scan for drinking or river water (35 mm OPL) with Turbidity (NTU / FTU), Colour
Y03-2-d-xxx or Y03-2-r-xxx	i::scan for drinking or river water (35 mm OPL) with Turbidity (NTU / FTU), UV254 / UVT
Y04-2-d-xxx or Y04-2-r-xxx	i::scan for drinking or river water (35 mm OPL) with Turbidity (NTU / FTU), UV254 / UVT, Colour
Y05-3-d-xxx or Y05-3-r-xxx	i::scan for drinking or river water (35 mm OPL) with Turbidity (NTU / FTU), UV254 / UVT, TOCeq
Y06-3-d-xxx or Y06-3-r-xxx	i::scan for drinking or river water (35 mm OPL) with Turbidity (NTU / FTU), UV254 / UVT, TOCeq, Colour
Y08-1-e-xxx or Y08-1-i-xxx	i::scan for waste water effluent or influent (5 mm OPL) with TSS, Colour
Y09-2-e-xxx or Y09-2-i-xxx	i::scan for waste water effluent or influent (5 mm OPL) with TSS, UV254 / UVT
Y10-2-e-xxx or Y10-2-i-xxx	i::scan for waste water effluent or influent (5 mm OPL) with TSS, UV254 / UVT, Colour
Y11-3-e-xxx or Y11-3-i-xxx	i::scan for waste water effluent or influent (5 mm OPL) with TSS, CODeq
Y12-3-e-xxx or Y12-3-i-xxx	i::scan for waste water effluent or influent (5 mm OPL) with TSS, CODeq, Colour

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

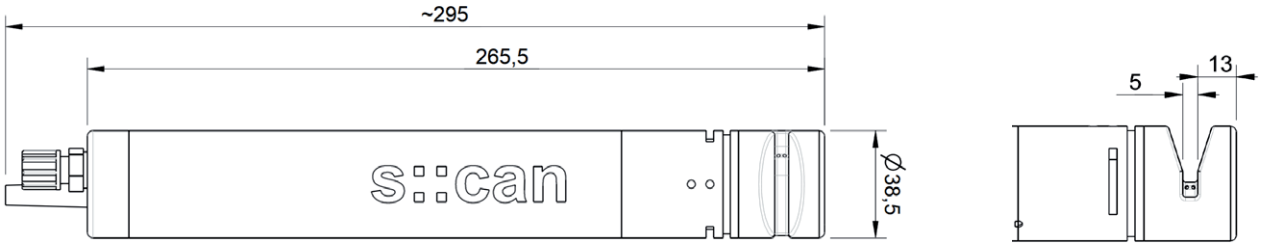
The device is typified by a type label, as shown below, that contains the following information:

- 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	Sensor housing
2	Sensor plug
3	Sensor cable
4	Connection for automatic compressed air cleaning
5	Fastening groove for metal clamp for fixing in flow cell
6	Hole or pin as positioning guide for flow cell, pipe::scan or ruck::sack
7	O-ring (33x2) for flow cell and multifunctional slide
8	Measuring section (OPL - optical path length)
9	Parking position for automatic cleaning brush
10	Mounting threads of nozzles for automatic compressed air cleaning
11	90° scattered light detector
12	180° detector



Dimensions of i::scan with 35 mm OPL



Dimensions of i::scan with 5 mm OPL

3.4 Storage and Transport

The limiting values 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 guarantee / 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:

- i::scan probe (part-no. according to section 3.3)
- Connection cable (part-no. C-1-010-SENSOR) in case of plug version (-000)
- Connection set for automatic cleaning (part-no. B-41-SENSOR) in case of cable version
- Multifunctional slide (part-no. E-431-1-ISCAN for 35 mm OPL and E-431-2-ISCAN for 5 mm)
- s::can manual i::scan (part-no. S-297-M)

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

- Extension cable (part-no. C-210-SENSOR, C-220-SENSOR or C-230-SENSOR)
- Probe carrier (part-no. F-110-ISCAN for horizontal installation, F-120-ISCAN for vertical installation or F-130-ISCAN for 45° installation)
- Fixing adapter for railing (part-no. F-15)
- ruck::sack (part-no. F-146-RS-ISCAN-35 for 35 mm OPL or F-146-RS-ISCAN-05 for 5 mm OPL)
- Flow cell waste water (part-no. F-48-ISCAN for all OPL)
- Flow cell clean water (part-no. F-46-ISCAN for 35 mm OPL)
- Flow cell clean water (part-no. F-46-FOUR-ISCAN for 35 mm OPL)
- Flow cell - autobrush (part-no. F-446-ISCAN for 35 mm OPL)
- In-pipe i::scan fixture (part-no. F-160-ISCAN)
- Cleaning brush (part-no. B-60-2 for 5 mm and 35 mm OPL)
- 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.

For information on environmental limitations (e.g. temperature), also refer to the Technical Specifications at the end of the manual.

- Favourable flow conditions (little turbulence, acceptable flow rate, 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, function check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller, etc.)
- Adherence to limit values (see technical specifications located at the end of the 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 of the controller for operation
- Shortest possible distances between system components (probe / sensor – controller for operation – 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 i::scan, 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.

- Inclined or 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.
- Flow velocity: < 3 m/s to avoid cavitations and therefore reduced measuring quality
  > 1 m/s when vertically mounted
- Abrasive solids (sand): < 1 g/l
- Recommended water level: > 10 cm at horizontal installation

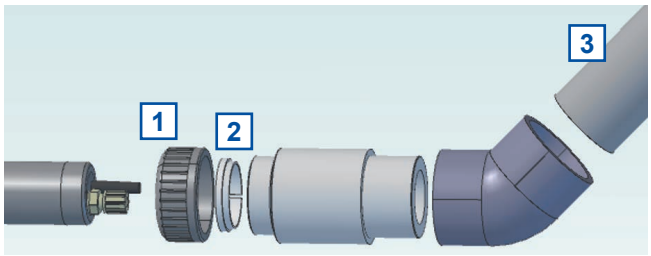
- The probe cable has to be protected appropriately against cuts or damage induced by foreign objects in the water.
- In case of shallow water and / or low flow velocities the compressed-air cleaning system may swirl up sediments surrounding the measuring site (e.g. at the sewerage bottom). As a result the state of the measuring medium will not be representative of the normal water quality directly after cleaning. To avoid this, the openings of the cleaning nozzles shall point upwards.

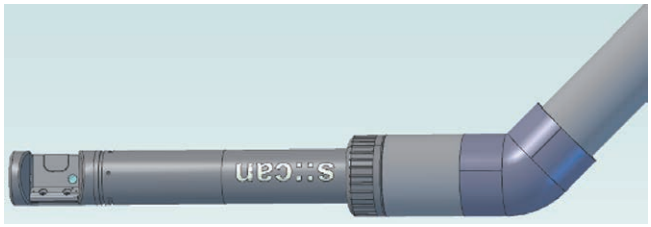
Even though the cable entry of the i::scan is equipped with a protective mechanism against forces along the axis of the probe, the probe cable must never bear the weight of the probe!

When installing the i::scan in flow cells, the O-rings can be lightly greased. In the case of applications in drinking water, the drinking water approval of the greases used must be ensured.

4.2.1 Mounting with Probe Carrier for submersed Installation (F-110-ISCAN / F-120-ISCAN / F-130-ISCAN)

The submersed installation of an i::scan using the specific probe carrier (part-no. F-110-ISCAN, F-120-ISCAN or F-130-ISCAN) is performed by the following steps (see figures below also):





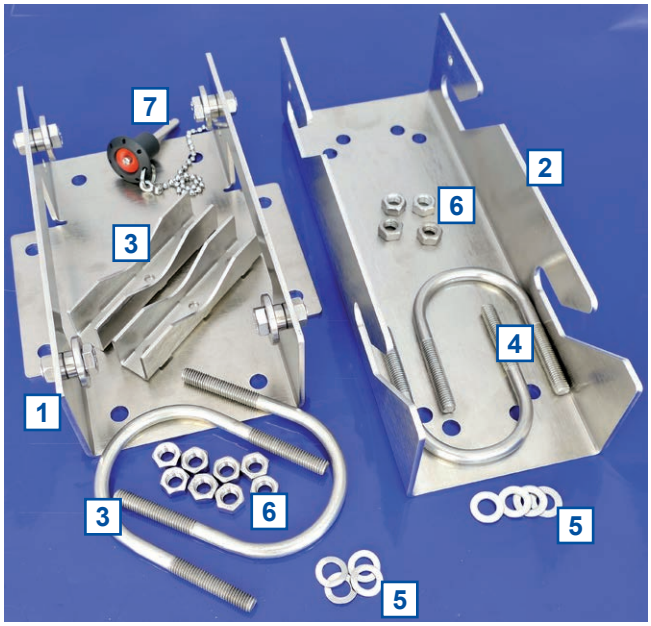
- Unscrew the grey union nut [1] to disable the probe carrier into the single parts (see figure on the right).
- The spacer ring [2] has to be placed on the probe housing.
- If necessary, connect the compressed-air cleaning to the probe (see section 4.3).
- Subsequently, the probe cable and the compressed-air 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.
- Now slide the i::scan into the probe carrier as far as possible and fix it with the grey union nut. Ensure that the spacer ring is aligned correctly. 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.

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). The probe cable and the compressed air hose must be protected at the upper end of the mounting tube against damage by kinking, abrasion, etc. by suitable measures.

4.2.2 Monting of Railing Bracket / Fixing Adapter (F-15)

This section explains the mounting of the railing bracket (fixing adapter) with the extension pipe on the railing in case of a submersed installation.

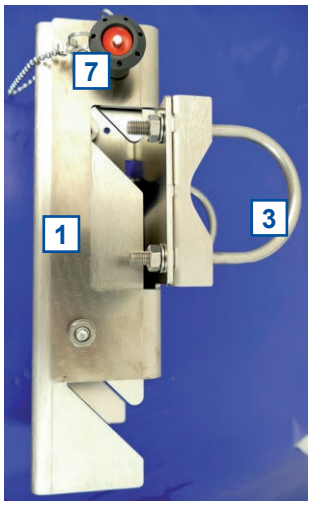
The following parts are included in the delivery of the railing bracket F-15:

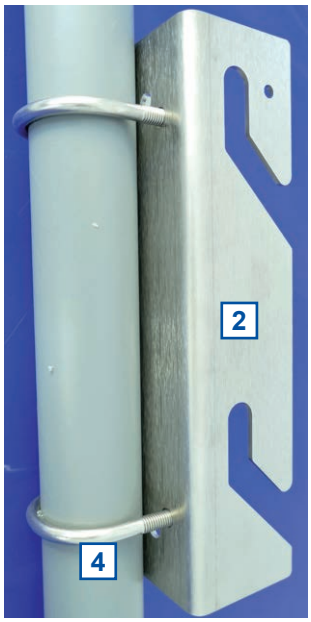


- **1** Fixing adapter for railing
- **2** Fixing adapter for extension pipe of sensor carrier
- **3** Fixing clamp for railing ($2^1/_2$ inch)
- **4** Fixing clamp for extension pipe of sensor carrier (50 mm)
- **5** Washers for fixing clamp
- **6** Screw nuts for fixing clamp
- **7** Safety pin for railing bracket

Once the sensor is installed in the sensor carrier with the extension pipe (see section 4.2.1) the mounting of the railing bracket is performed by the following steps:

- Fasten the fixing adapter for the railing [1] with the fixing clamp [3], the screw nuts and the washers, included in delivery, onto the railing.
- Fasten the other part of the fixing adapter [2] with the fixing clamp [4], the screw nuts and the washers, included in delivery, onto the extension pipe of the sensor carrier.
- Now insert the sensor with the extension pipe into the railing bracket from top.
- Secure the railing bracket with the locking pin [7] to prevent it from being pulled out unintenionally.
- If necessary, adjust the inclination of the extension pipe and the immersion depth of the sensor. To do this, loosen the corresponding screw nuts of the fixing clamps.

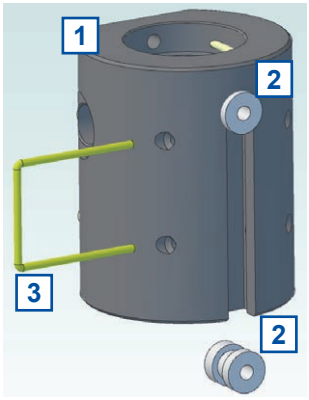




4.2.3 Mounting in Flow Cell for Clean Water (F-46-ISCAN or F-46-FOUR-ISCAN)

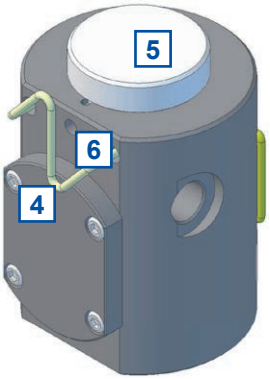
This section explains how the i::scan can be installed in the flow cell for clean water. There are two types of flow cells available, a single sensor flow cell (F-46-ISCAN) and a flow cell for an i::scan and up to three additional s::can sensors (F-46-FOUR-ISCAN).

Both types of flow cells can be equipped with an autobrush optionally for automatic cleaning of the i::scan with 35 mm OPL (see section 4.2.4).

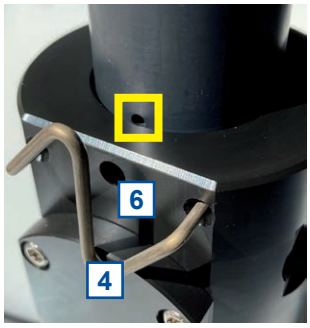


The flow cell itself [1] can be mounted directly on a solid and flat surface (wall, mounting panel, etc.) with the two fixing holders [2]. The position of the flow cell is secured by the mounting bracket [3] (see figure on the right).

The installation of an i::scan using the flow cell for clean water is performed by the following steps (see figures below also):



- Pull out the z-shaped metal bracket [4] from the flow cell that fixes the blanking plug [5]. A flat screw driver can be used to do this, if needed.
- Remove the blanking plug [5] from the flow cell. To remove the plug insert a flat screw driver or the metal bracket into the small hole [6] on the side of the flow cell and move the plug out by moving the screw driver downwards.
- Insert the i::scan in the opening of the flow cell and push sensor down carefully until O-ring [7] snaps into the correct sensor position. Correct position in ensured when upper hole of i::scan is still visible from outside (see yellow marking on the picture on the right) and lower positioning hole of i::scan is aligned with hole in flow cell [6].
- Push the metal bracket [4] back into the flow cell to secure the i::scan in place. The metal bracket can only be inserted if the i::scan is in the correct position.
- Ensure that all other openings of the flow cell are covered with blanking plugs [5] before putting the monitoring station into operation.



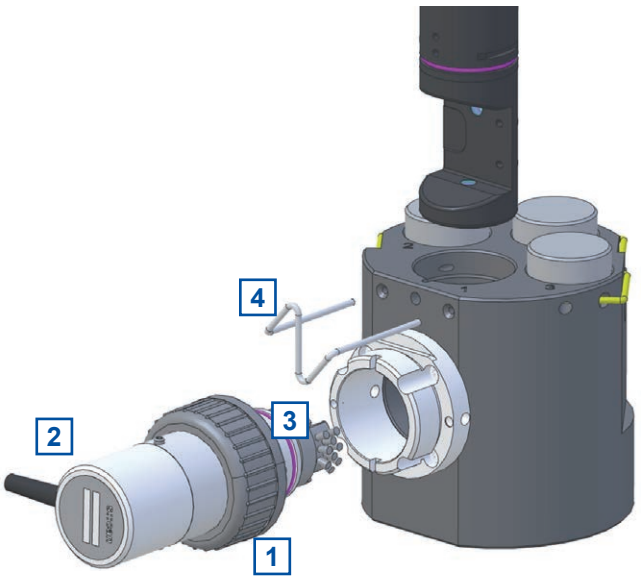
⚠ To demount the i::scan use a flat screw driver to remove the z-shaped metal bracket [4] first and pull the sensor out. If an autobrush is used, the brush unit has to be demounted first (see section 4.2.4).

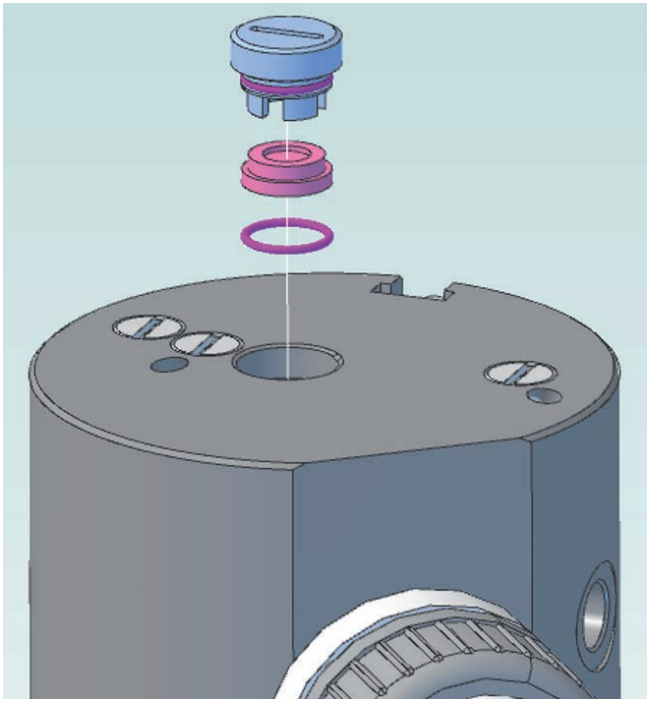
4.2.4 Mounting of autobrush in Flow Cell for Clean Water (F-446-ISCAN or F-46-FOUR-ISCAN)

This section explains how the autobrush for the i::scan with 35 mm OPL can be installed in the flow cell for clean water. There are two types of flow cells available, a single sensor flow cell (F-446-ISCAN) and a flow cell for an i::scan and up to three additional s::can sensors (F-46-FOUR-ISCAN).

The installation of the autobrush using the flow cell for clean water is performed by the following steps (see figure on the right also):

- Unscrew the union nut [1] for fastening of the brush unit [2] and lift it out of the flow cell carefully. The brush unit is sealed with an O-ring [3] and will need some force to take it out of the flow cell.
- Now install the i::scan in the flow chamber marked with 1 as expained in section 4.2.3.
- After the i::scan is installed and secured by the the z-shaped metal bracket [4] (see section 4.2.3) the brush unit [2] can be installed again.
- Before inserting the brush unit, ensure the correct orientation (see figure on the right). The brush for cleaning of 180° detector window on the right and the brush for cleaning of 90° detector window on the left. The connection cable is located on the left side. The correct position is ensured by the two pins of the autobrush additionally.
- Note during insertion that approximately 4 mm short of the final position, you will notice a significant resistance from the O-ring seat.
- Finally fasten the union nut [1] for fixing of the brush unit.





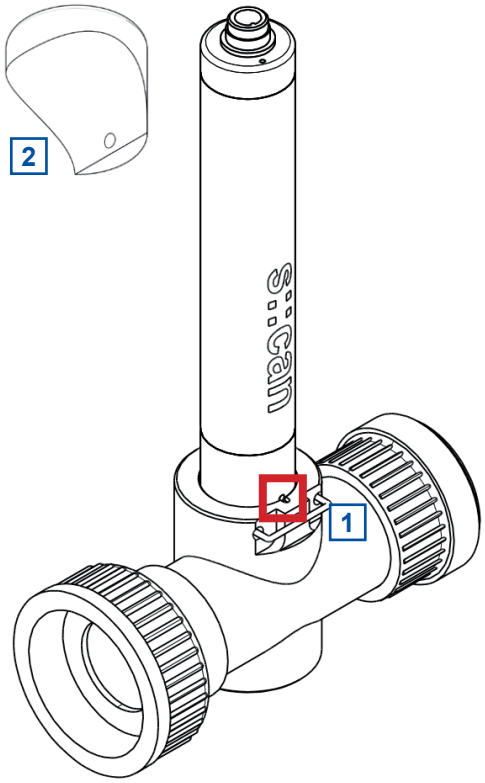
To limit the flow and at the same time to protect the sensors (e.g. disinfection sensors) from excessive pressure, a flow limiter is installed in the flow cell after the second measuring chamber (see figure on the right).

At the same time, the flow limiter reduces the risk of air bubbles forming due to outgassing caused by a drop in pressure in the first two measuring chambers.

4.2.5 Mounting in Flow Cell for Waste Water (F-48-ISCAN)

The installation of an i::scan using the flow cell setup for waste water (part-no. F-48-ISCAN) is performed by the following steps (see figure on the right also):

- Pull out the U-shaped metal bracket [1] from the flow cell. A flat screw driver can be used to do this, if needed.
- If an i::scan with 5 mm OPL is used, install the small spacer [2] on the bottom of the flow cell.
- Insert the i::scan in the opening of the flow cell and push sensor down carefully until O-ring snaps into the correct sensor position. Correct position in ensured when upper hole of i::scan is aligned with the small nut in the flow cell (see red marking on the picture on the right).
- Push the metal bracket [1] back into the flow cell to secure the i::scan in place. The metal bracket can only be inserted if the i::scan is in the correct position.



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 compressed air or cleaning devices with a rotating brush (autobrush in the flow cell or ruck::sack when installed submersed) are needed. In special occasions drinking water may be used to operate the automatic pressure cleaning instead of compressed air.

The compressed air cleaning can be used for i::scan with fixed cable only.

Sometimes it is possible that the air introduced 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 rotating brushes of the autobrush flow cell (F-446-ISCAN and F-46-FOUR-ISCAN) or the ruck::sack (F-146-RS-ISCAN) will avoid such coatings of oxidized Fe / Mn / Ca also.

Information on the configuration of the cleaning settings (frequency, duration, waiting time) is given in the Technical Specifications at the end of the manual.

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

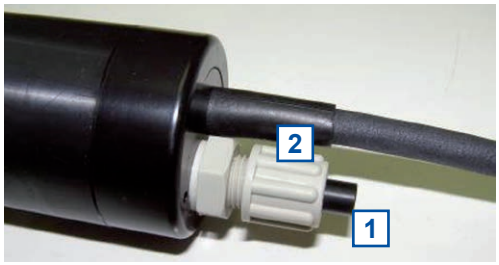
- The cleaning valve should never be connected to the compressed air coupling of your compressor directly, i.e. without a pressure hose in between.
- The total length of hoses should be as short as possible to avoid unnecessary pressure loss (especially between cleaning valve and sensor).
- Any foreign 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.
- When using rotating brushes ensure the correct positioning of the cleaning unit on the probe to clean all optical windows equally.
- When using autobrush or ruck::sack consider the rotating brushes as consumables and replace them on a regular base (recommended at least once per year) to ensure best cleaning performance.

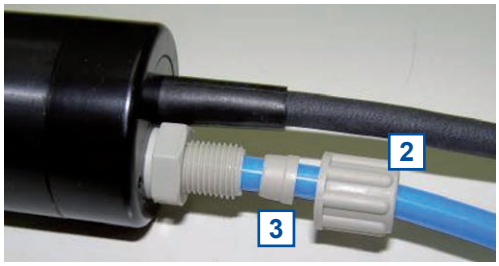
For mounting of the cleaning devices please see the manuals and installation notes of the specific devices. The connection of the compressed air cleaning and the mounting of the ruck::sack are explained in the following sections.

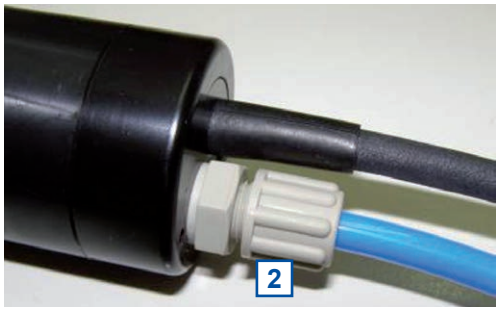
4.3.1 Connection of compressed Air Cleaning

The pressure connection set (B-41) supplied with the system contains components necessary to connect the i::scan 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.
- To do this, unscrew 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. Ensure the correct orientation of the conical part [3].
- 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.





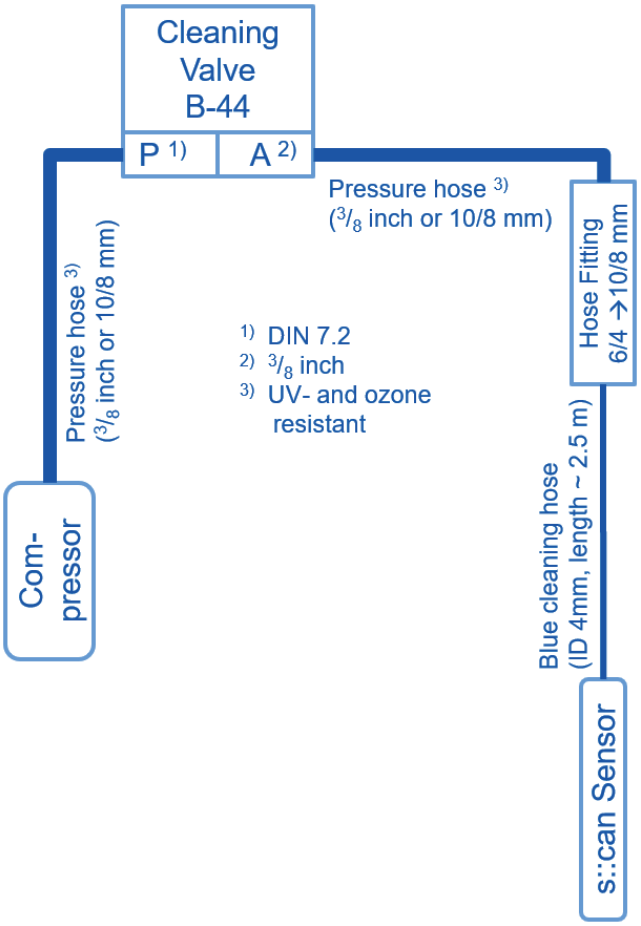


The connection of the compressed air hose to the cleaning valve depends on the used type of the valve (B-44 or B-44-2).

- Cleaning valve B-44

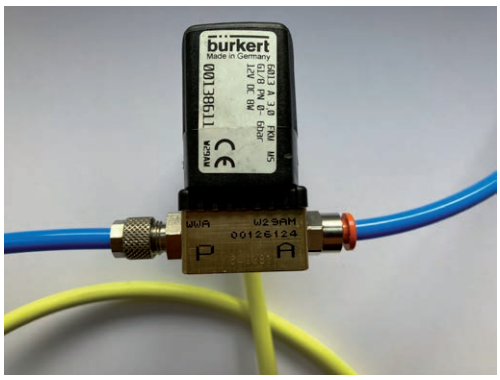
A compressed air hose (to be provided by customer, ID 8 to 9 mm, UV- / ozone resistant) must be used to connect the adapter fitting of the pressure connection set to the output side of the cleaning valve (marked with *A*). Fasten the air hose with hose clamps.

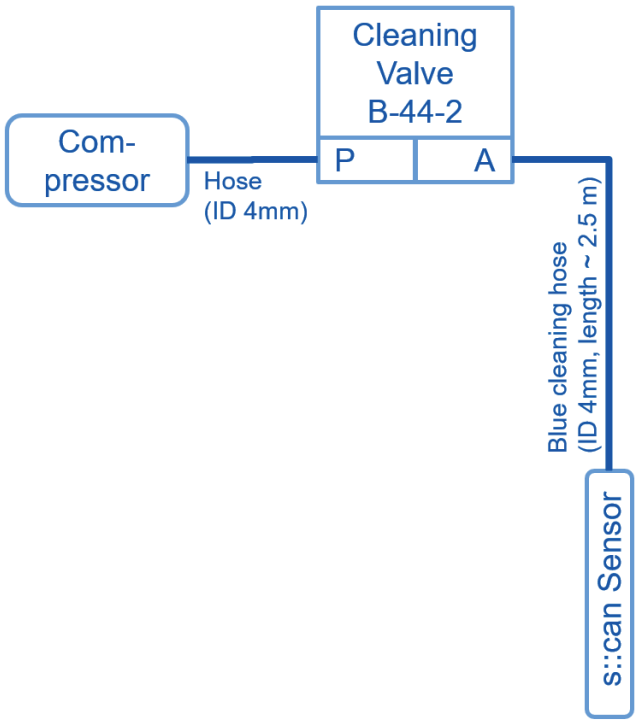
Another compressed air hose with DIN 7.2 compressed air coupling (to be provided by customer) are required to hook up the compressed air supply to the input side of the cleaning valve (marked with *P*).



- Cleaning valve B-44-2

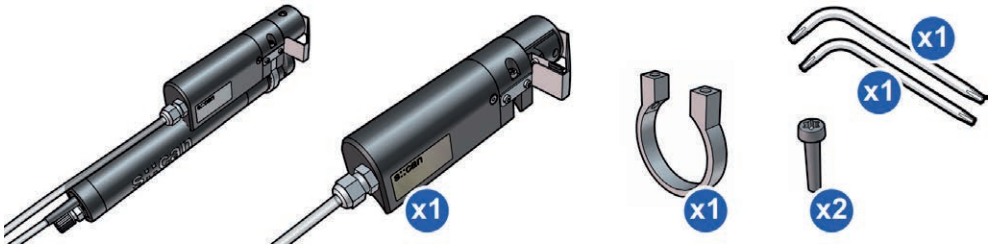
The adapter fitting of the pressure connection set can be removed to connect the blue tube directly to the push-pull fitting of the cleaning valve. The same type of tube can be used to connect the cleaning valve to the s::can compressor.



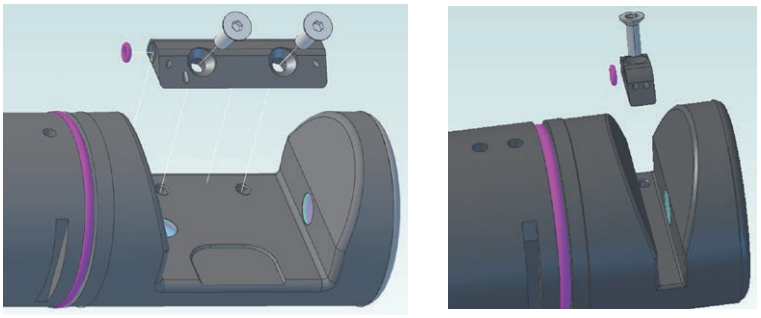


4.3.2 Mounting of ruck::sack (F-146-RS-ISCAN)

All needed tools for mounting of the ruck::sack are included in the scope of delivery (see figure on the right).

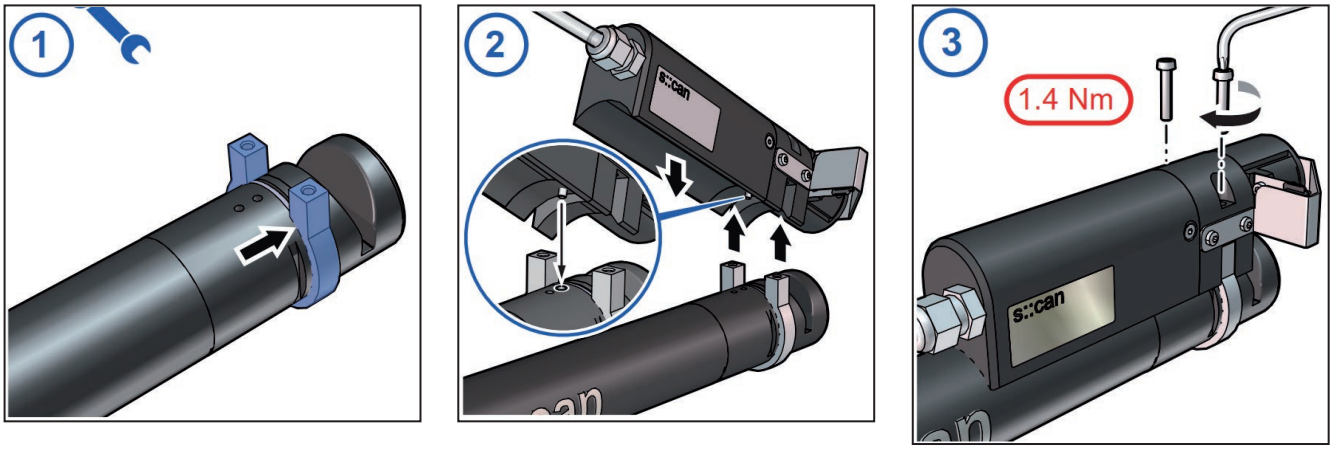


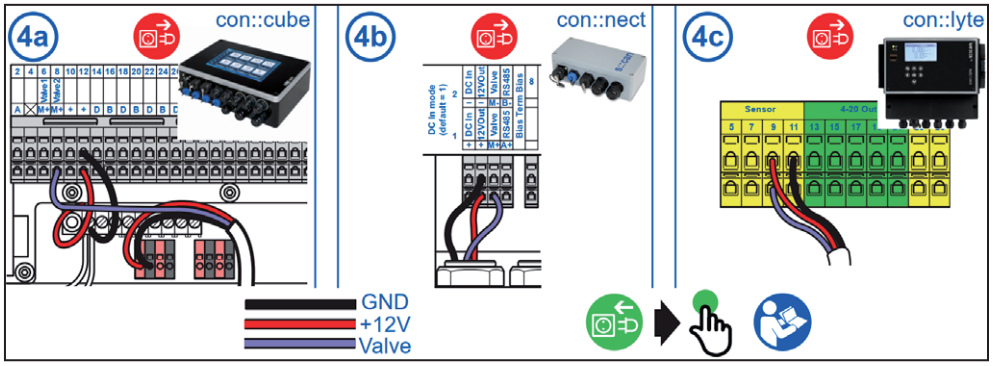
Before mounting the ruck::sack ensure that cleaning nozzles for compressed air cleaning are removed from the optical measuring section (see figure on the right).

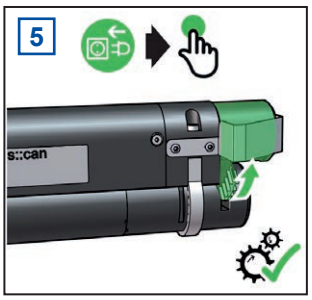


The mounting is performed by the following steps (see figures below also):

1. Place the fixing ring over the probe housing.
2. Position the ruck::sack in that way the metal pin on the ruck::sack fits into the hole of the i::scan housing.
3. Screw the ruck::sack onto the fixing ring with the two screws included in delivery.
4. Connect the ruck::sack to the controller for operation (see manual of controller for operation).
5. Check the correct position of the brush and the function of the ruck::sack.







5 Initial Startup

Once the mounting and installation of the i::scan 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 i::scan 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 initialisation of the i::scan. Refer to section 5.3.1 in case of using a con::lyte D-320 and refer to section 5.3.2 in case of using con::cube with moni::tool.
- Perform parameterisation of the i::scan. Refer to section 5.4.5 in case of using a con::lyte D-320 and refer to section 5.4.6 in case of using con::cube with moni::tool.
- Configure the measurement and automatic cleaning settings (please refer to the manual of the controller and see section 12 regarding cleaning settings).
- Check the proper functioning of the cleaning system.
- Connection and parameterisation of data transfer when desired (please refer to the manual of the controller for operation).
- Check the plausibility of the readings obtained after sufficient running-in time (at least 15 minutes).
- If necessary calibrate the readings of the i::scan to the local water matrix when the readings are stable (see chapter 6).

5.1 Controller for Operation

For proper operation of the sensor you will need one of the following controller and operating software respectively.

Controller	Type	Software
con::lyte	D-320	V7 or higher
con::cube	D-315	moni::tool V2 or V3
con::cube	D-330	moni::tool V4

s::can recommends to use the most current version of the operating software on the controller.

5.2 Connection to the Controller for Operation

The sensor will be delivered either with fixed cable or with a plug connection on the sensor itself. In case of plug connection the connection cable C-1-010 has to be used to connect the sensor to a compatible socket provided on the controller. Ensure that the sensor plug and the connector are dry and clean. Otherwise communication errors and / or device damage might occur.

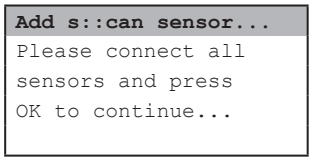
In case the controller does not supply enough sockets, the distribution box for sensors C-41-HUB can be used.

5.3 Probe Initialisation

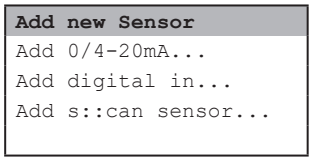
To enable the operator terminal to operate several probes / sensors simultaneously, it is necessary to assign each probe / sensor its own address. This is done automatically during probe initialization. The connected measuring device is first recognized by the operator terminal via the preset address. If this address is already in use, the operator terminal assigns a new, still free, address for the measuring device and stores this address on the measuring device.

The exact procedure of the probe initialization for the different operator terminals is described in the following sections.

5.3.1 Probe Initialisation using con::lyte

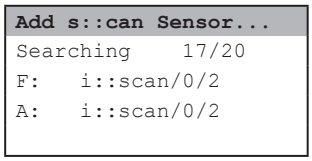


At the initial start-up the con::lyte D-320 provides an automatic probe and sensor initialisation procedure (see screen on the right). After connecting all probes and sensors to the appropriate plugs of the con::lyte (see section 5.2) and pushing the *OK* button, the probe and sensor initialisation starts.

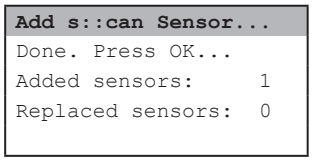


If sensor will be initialized at a later date, the following steps are needed:

- 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 a new probe or sensor has been added, the parameters can be added in the parameter screen 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

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

2 Login as *Administrator* with Password *admin1* or your individual username.

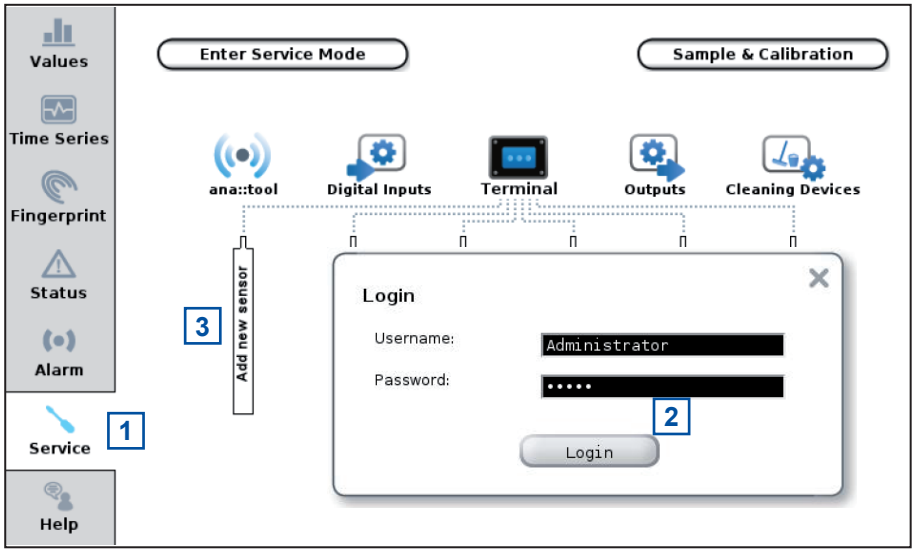
3 Click on an empty sensor icon (*Add new Sensor*) to initiate the initialisation process.

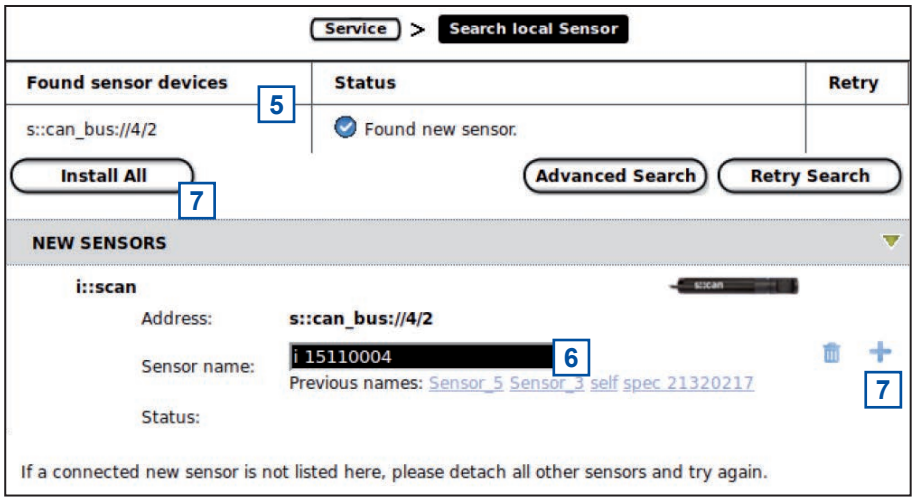
4 An automatic search procedure will start, searching for the connected sensor.

5 When the automatic search prodedure is finished, all connected probes and sensors will be displayed. Those sensors that are connected for the first time and not installed will have the Status *Found new sensor*. These sensors are listed as *New Sensors* below also.

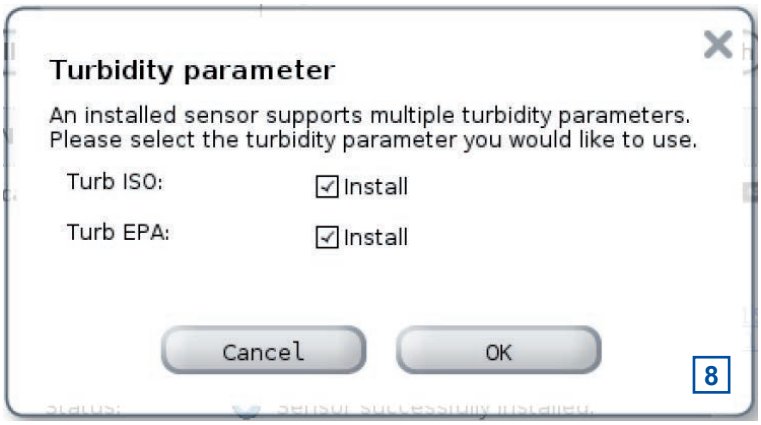
6 If needed the suggested *Sensor name* can be modified. This name will be used in the system overview of the *Status* and *Service* display also.

7 To install the new sensor click either on the blue + sign on the right side of the sensor or push the button *Install All*.



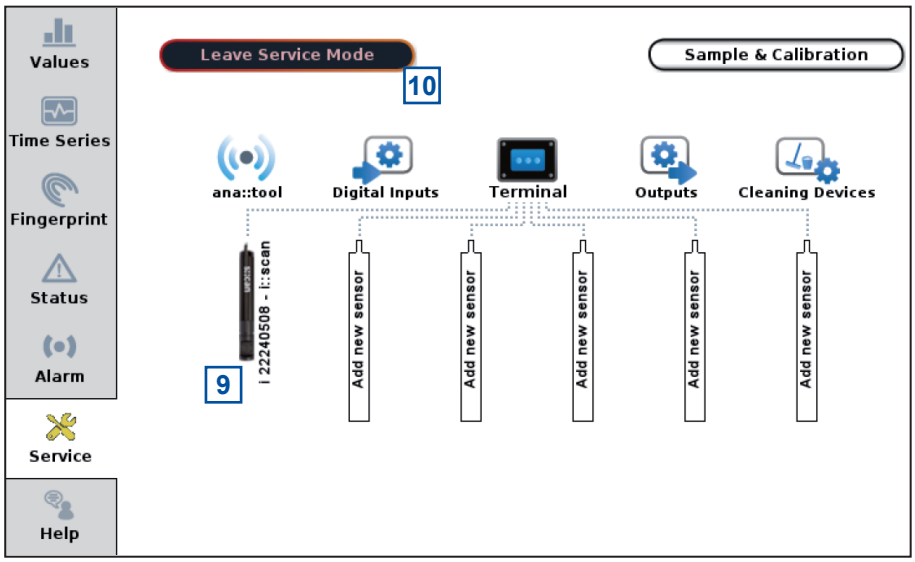


8 During installation the type of the used Turbidity measurement can be selected (*Turb ISO* or *Turb EPA*). The selection is confirmed with *Ok*.

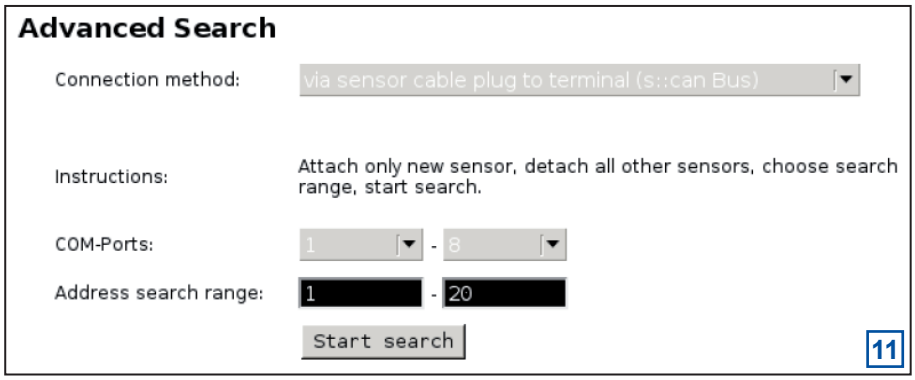


9 moni::tool will install the sensor and switch to the *Service* display. The new sensor is displayed in the system overview.

10 Push the button *Leave Service Mode* located on the upper left side to start the measuring process.



11 When pushing the button *Advanced Search* the method how the sensor is connected (*Connection methode)*, the used *COM-Port* and the *Address* can be defined exactly. This option shall be used by advanced users only.



5.4 Probe Parameterisation

The number, type and measuring range of the parameters measured by the i::scan are defined by the probe type and cannot be extended or changed. In the following sections all available parameters and the possible measuring ranges for the applications clean water (see section 5.4.1), surface water (see section 5.4.2), waste water effluent (see section 5.4.3) and waste water influent (see section 5.4.4) are shown.

Which parameter will be displayed on the operator terminal and how they can be configured will be explained in the subsequently sections (see section 5.4.5 and 5.4.6).

5.4.1 Parameter and Measuring Ranges in Clean Water (Y01-x-D to Y06-x-D)

The table below provides an overview of the available parameters and their measuring range for the i::scan with 35 mm OPL for the application drinking water.

Parameter	Unit	Measuring range	Y01-D	Y02-D	Y03-D	Y04-D	Y05-D	Y06-D
Turbidity ISO	[FTU]	0.008 - 800	X	X	X	X	X	X
Turbidity EPA	[NTU]	0.02 - 800	X	X	X	X	X	X
COLORapp	[Hazen]	0 - 500		X		X		X
COLORtru	[Hazen]	0 - 500		X		X		X
UV254	[Abs/m]	-0.15 - 70			X	X	X	X
UV254f	[Abs/m]	-0.15 - 70			X	X		
UVT10	[%]	0 - 100			X			
UVT10f	[%]	0 - 100			X	X		
UVT100f	[%]	0 - 100			X			
TOCeq	[mg/l]	0 - 25					X	X
DOCeq	[mg/l]	0 - 25					X	X
Temp	[°C]	-20 - 80	X	X	X	X	X	X

5.4.2 Parameter and Measuring Ranges in Surface Water (Y01-x-R to Y06-x-R)

The table below provides an overview of the available parameters and their measuring range for the i::scan with 35 mm OPL for the application surface water.

Parameter	Unit	Measuring range	Y01-R	Y02-R	Y03-R	Y04-R	Y05-R	Y06-R
Turbidity ISO	[FTU]	0.008 - 800	X	X	X	X	X	X
Turbidity EPA	[NTU]	0.02 - 800	X	X	X	X	X	X
COLORapp	[Hazen]	0 - 500		X		X		X
COLORtru	[Hazen]	0 - 500		X		X		X
UV254	[Abs/m]	-0.15 - 70			X	X	X	X
UV254f	[Abs/m]	-0.15 - 70			X	X		
UVT10	[%]	0 - 100			X	X		
UVT10f	[%]	0 - 100			X			
TOCeq	[mg/l]	0 - 25					X	X
DOCeq	[mg/l]	0 - 25					X	X
Temp	[°C]	-20 - 80	X	X	X	X	X	X

5.4.3 Parameter and Measuring Ranges in Waste Water Effluent (Y08-x-E to Y12-x-E)

The table below provides an overview of the available parameters and their measuring range for the i::scan with 5 mm OPL for the application waste water treatment plant effluent.

Parameter	Unit	Measuring range	Y08-E	Y09-E	Y10-E	Y11-E	Y12-E
TSS	[mg/l]	0.008 - 500	X	X	X	X	X
COLORapp	[Hazen]	0 - 3500	X		X		X
COLORtru	[Hazen]	0 - 3500	X		X		X
UV254	[Abs/m]	-1 - 500		X	X	X	X
UV254f	[Abs/m]	-1 - 500		X	X	X	X
UVT10	[%]	0 - 100		X	X		
UVT10f	[%]	0 - 100		X	X		
CODeq	[mg/l]	0 - 500				X	X
CODfeq	[mg/l]	0 - 300				X	X
Temp	[°C]	-20 - 80	X	X	X	X	X

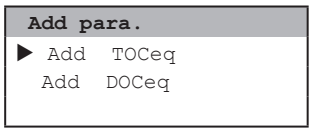
5.4.4 Parameter and Measuring Ranges in Waste Water Influent (Y08-x-I to Y12-x-I)

The table below provides an overview of the available parameters and their measuring range for the i::scan with 5 mm OPL for the application waste water treatment plant influent.

Parameter	Unit	Measuring range	Y08-I	Y09-I	Y10-I	Y11-I	Y12-I
TSS	[mg/l]	0.008 - 1000	X	X	X	X	X
COLORapp	[Hazen]	0 - 3500	X		X		X
COLORtru	[Hazen]	0 - 3500	X		X		X
UV254	[Abs/m]	-1 - 500		X	X	X	X
UV254f	[Abs/m]	-1 - 500		X	X	X	X
CODeq	[mg/l]	0 - 1500				X	X
CODfeq	[mg/l]	0 - 500				X	X
Temp	[°C]	-20 - 80	X	X	X	X	X

5.4.5 Probe Parameterisation using con::lyte

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

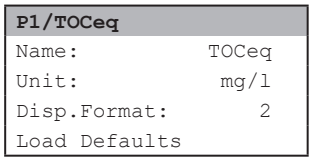


- Switch to status display with *Left-* or *Right* button.
- Push *Function* button, select menu *Manage sensors...* and confirm with *OK*.
- Select *i::scan/0/x* and confirm with *OK*.
- Select menu *Add parameters...* and confirm with *OK*.
- Select needed parameter and confirm with *OK*.

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 parameter.
- *Unit* Displays the actual unit of the parameter.

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.

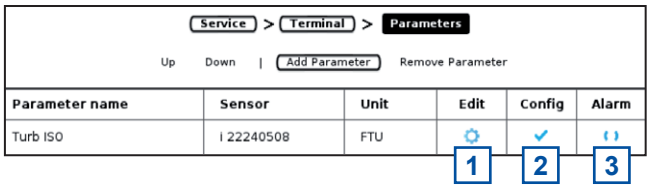
All modifications performed by the operator within these settings menu will be documented in the config file of the con::lyte (see manual con::lyte D-320).

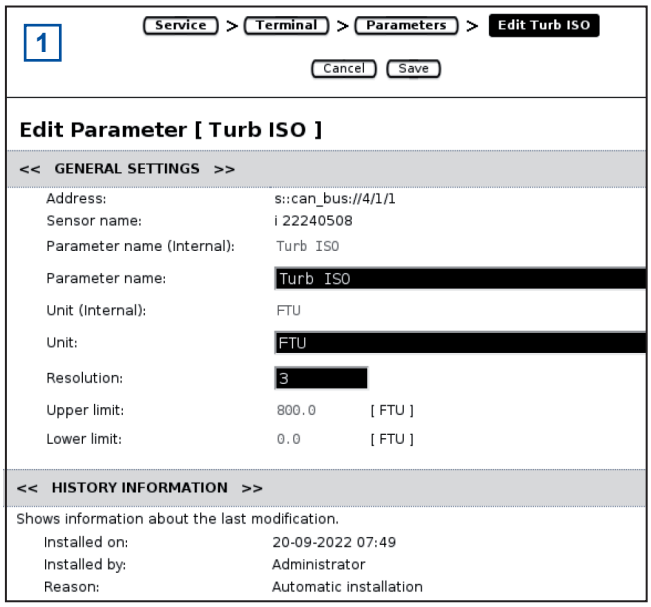
5.4.6 Probe Parameterisation using moni::tool

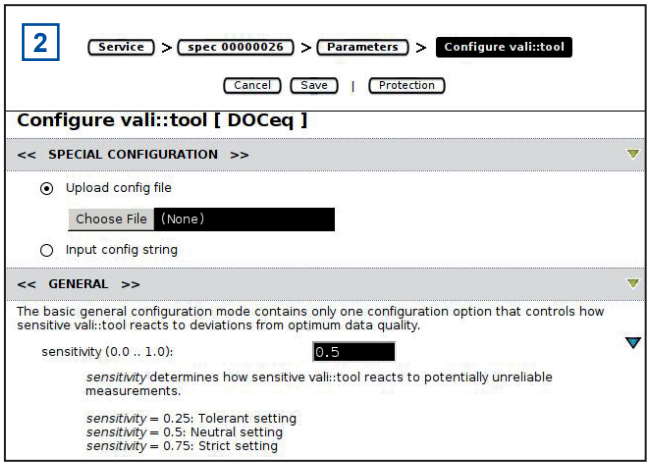
After successful probe initialisation (see section 5.3.2) all parameters available on the probe will be installed and displayed on the probe will be installed and displayed on the *Values* screen of moni::tool. If not all new parameters are displayed, please check the maximum number of parameters of your monit::tool license. If you want to configure the measuring parameters individually, this can be done using the menu item *Service / Terminal / Parameters*.

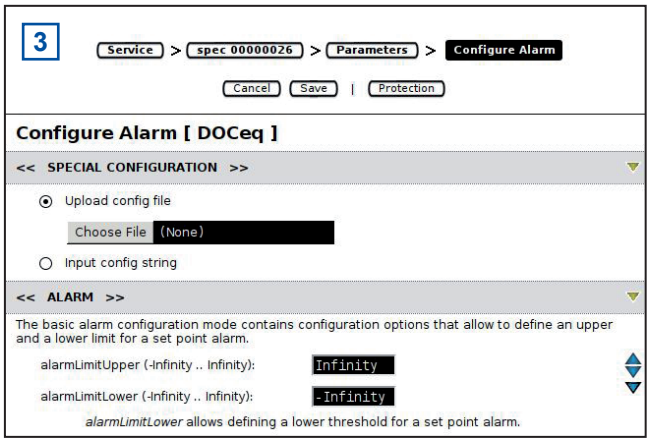
After selecting this menu item a list of all installed parameters is displayed. After selecting one or several parameters by clicking on them (the lines of parameters selected will be highlighted), the following activities can be performed:

- 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 [1].
- 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 [2]. 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 [3]. The basic screen is displayed on the right. Please refer to the manual moni::tool for further information.









6 Calibration

At each measurement the i::scan detects the absorbance at different wavelengths caused by the measured medium. This information is used to calculate different parameters (e.g. TOC, COD) based on the global calibration the i::scan 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 i::scan can be used immediately after delivery.

With a local calibration the respective parameters can be adapted to the actual concentrations of the local water matrix, if necessary. A local calibration can be performed directly on site without demounting the i::scan or using standard solutions.

Data base for each local calibration are results of conventional laboratory analysis on the one hand and the absorbance measured with the i::scan on the other hand. Because comparison analyses are made in the laboratory, it is necessary to take random samples. The measurement of the absorbance 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. Therefore only real samples should be used to adapt the parameter to the local water matrix. The only exeption are the turbidity readings acc. to EPA or ISO.

- 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, rinse the slide serveral times with the calibration medium (sample) before measuring the sample.
- Perform the sample measurement immediately after filling the multifunctional slide, to avoid any influences 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 i::scan itself sample readings and corresponding laboratory results of two samples can be stored for each parameter. Furthermore the coefficients of the local calibration (offset and slope) are stored on the probe.

Once the parameter is adapted to the specific water matrix by performing a local calibration, there is no need to recalibrate this parameter on a regular base. The design of the i::scan ensures instrumental changes (e.g. ageing of light source) cannot affect the parameter readings. Instead of recalibration, it is most important to keep the measuring windows clean.

6.1 Types of Calibration

Depending on the type of the used controller for operation different types of calibration can be performed.

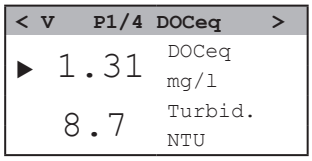
	Offset	Linear	Multi
Number of samples	1 sample	2 samples	3 or more samples
Modified coefficients	offset	offset and slope	offset and slope
con::lyte	possible	possible	not possible
con::cube / moni::tool	possible	possible	possible using samples stored on con::cube

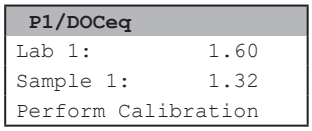
6.2 Performing a Calibration

6.2.1 Calibration using con::lyte

This controller for operation 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:

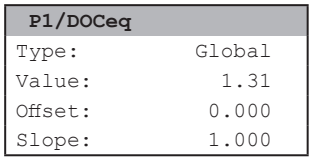
- Select the parameter in the parameter display with *Up-* or *Down* button.
- Push *OK* button, which directly displays the calibration screen.
- Select *Sample 1* and confirm with *OK* to store the global (raw) signal of the actual reading.
- Simultaneously take a water sample to analyse real parameter 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.



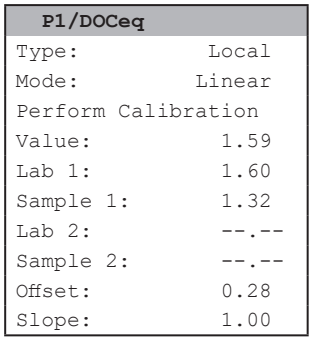


Now the selected parameter is offset calibrated. The advanced local calibration provides extensive possibilities for calibration of selected parameter.

- Select the parameter in the parameter display with *Up-* or *Down* button.
- Push the *Function* button.
- Select the menu *Calibrate expert...* and pushing the *OK* button.



Now the complete calibration screen is displayed and provides the following options:



- *Type* — Two different types of calibration are available: *Local* (custom calibration) or *Global* (factory calibration). By default *Local* is selected. This is the normal calibration performed by the operator. As soon as *Global* is selected and confirmed with *OK* a reset of this parameter to factory calibration (global) is performed and the current 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.

⚠ A local calibration can be performed either starting from type Global or Local. Depending on this either the global slope or the local slope will be used after perfoming an offset calibration.

- *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 current calibration).
- *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 possible to edit this value by pushing the *OK* button. The offset of the global calibration is 0, except turbidity.
- *Slope* Displays the used slope of the actual calibration. It is possible to edit this value by pushing the *OK* button. The slope of the global calibration is 1, except turbidity.

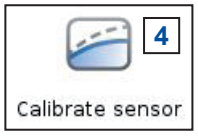
6.2.2 Calibration using moni::tool

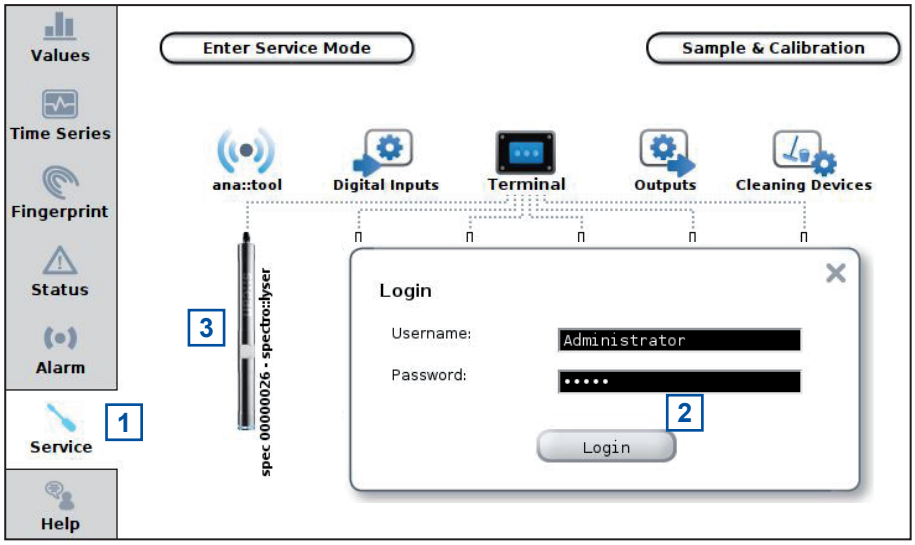
1 Click the *Service* tab of the moni::tool screen.

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

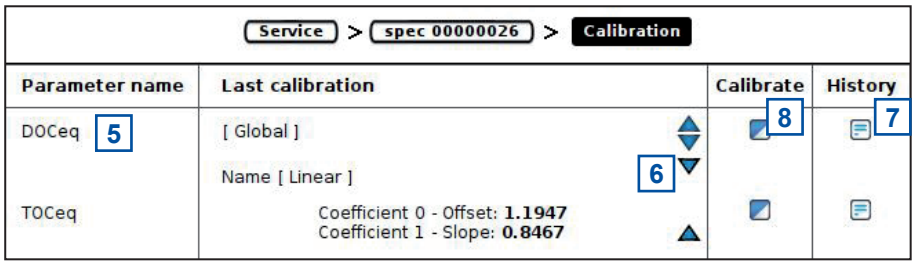
3 Click the icon of the sensor you want to calibrate in the displayed system overview.

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. The global calibration uses offset=0 and slope=1 (except turbidity).

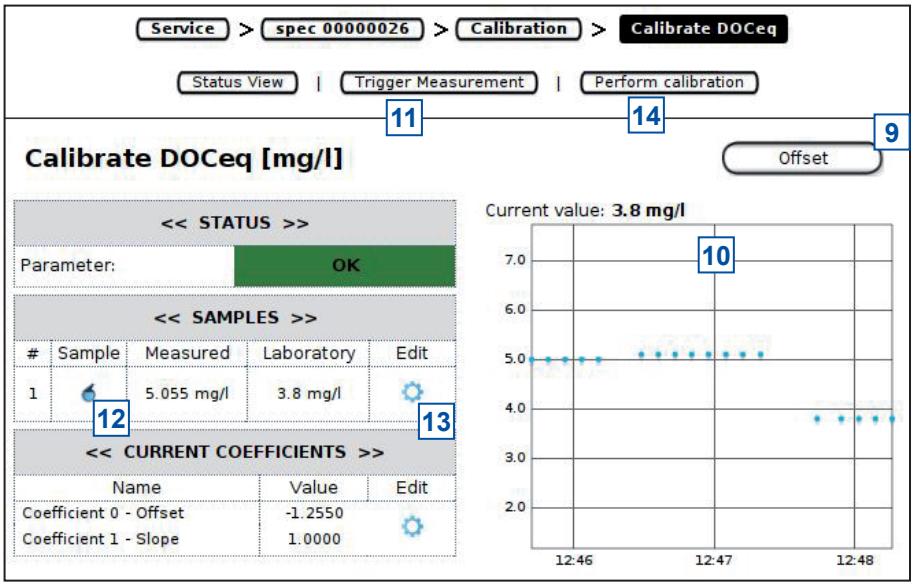
7 Furthermore a click on the *History* icon rightmost opens a logbook showing all calibration procedures performed with this con::cube up to now.

8 Open the calibration screen by clicking on the *Calibrate* icon on the right side of the parameter 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 i::scan 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 value (*Measured*) displayed below *SAMPLES* is the raw value, based on the global calibration. The *Sample #1* will be used for offset and linear 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*.

7 Data Management

7.1 Data Storage

The following information is stored directly on the sensor:

- Global calibration for all installed parameters
- Actual used local calibration for each parameter
- Readings of sample measurements for each parameter
- Laboratory results of samples for each parameter
- Reference measurement
- Device information (e.g. type, serialnumber, address, please refer to section 10.4)

The sensor readings can be stored on the controller used for operation. There is no possibility to store the readings on the sensor itself.

7.2 Data Transfer

The measurements are performed on the sensor and the readings are transfered to the controller used for operation via the sensor cable using RS 485.

7.3 Data Visualisation

For visualisation of the i::scan readings one of the following s::can controller for operation or s::can tools can be used:

- con::lyte (parameter readings)
- con::cube (parameter readings and time series)
- visu::tool for offline visualisation of parameter readings and status messages

8 Function Check

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

- Initial startup
- Routine function 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 function 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 / Monitoring Station

Check if Monitoring System is operational and Status is OK		
con::lyte	moni::tool / con::cube	Remark
■ Green LED is on? ■ Readings are visible on the display after touching one key? ■ Displayed system time is current and is updated every second?	■ 4 LEDs on housing cover are on or at least flashing? ■ moni::tool screen is displayed after touching the screen? ■ Click on system clock at the bottom of the screen will shows current time and last measurement. Both are current?	■ Check if Service mode is activated or automatic measurement is paused. ■ Check power supply of controller. ■ Power off controller for 2 minutes and power on again.
■ No error messages or error symbols are displayed? ■ Check logbook entries since last function check.	■ LED of con::cube is blue and *Status* icon of moni::tool is not blinking yellow? ■ Open *Status* tab and select symbol of affected sensor for more information.	■ Check for displayed error messages. ■ See section 10 for Troubleshooting. ■ See section 10 for Status- and Errorcodes.

Check Installation and Cleaning	Remark
■ Automatic cleaning is operational	■ Use function *Clean now* or wait for next cleaning cycle. ■ Watch for air bubbles when cleaning is activated or listen / watch 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?

8.2 Check of Readings

Check	Reason	Remark
■ Current readings: Completely displayed. No *NaN* and no dashes (- - - -,- -) or plus signs (++++,++) are displayed.	■ No communication to sensor ■ Parameter error ■ Reading is too long to be displayed ■ vali::tool error	■ Use arrow buttons / scroll bar to scroll through all displayed parameters. ■ Check status and configuration of parameter.
■ Status of displayed readings:	■ Red background for parameter indicates an error or alarm. ■ Grey background indicates reading is not current. ■ Flashing background indicates an error.	■ Check parameter status ■ Check sensor integrity ■ Check logbook entries since last function check.
■ Up-to-date: Readings are updated on regulary base?	■ Measuring interval is too long ■ Automatic measurement has been stopped manually	■ Consider measuring interval and smoothing.
■ Continuity: Check historical readings (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.) ■ Unsteady flow through flow cell installation	■ 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 (comparison) values and readings of the i::scan	■ 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 function 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.
■ Data transfer		■ Check if displayed readings on local controller are equal with displayed readings on customer display system.

8.3 Check of Probe / Sensor Integrity (Function Check)

During the software supported function check of the i::scan the operating software of con::cube or con::lyte will guide the user through all necessary steps, where the following is checked:

- Effectiveness of the automatic and / or manual cleaning
- Cleanness of the optical measuring windows
- Quality of the zero reference used currently
- Status of the internal optic

The software supported function check is executed as follows:

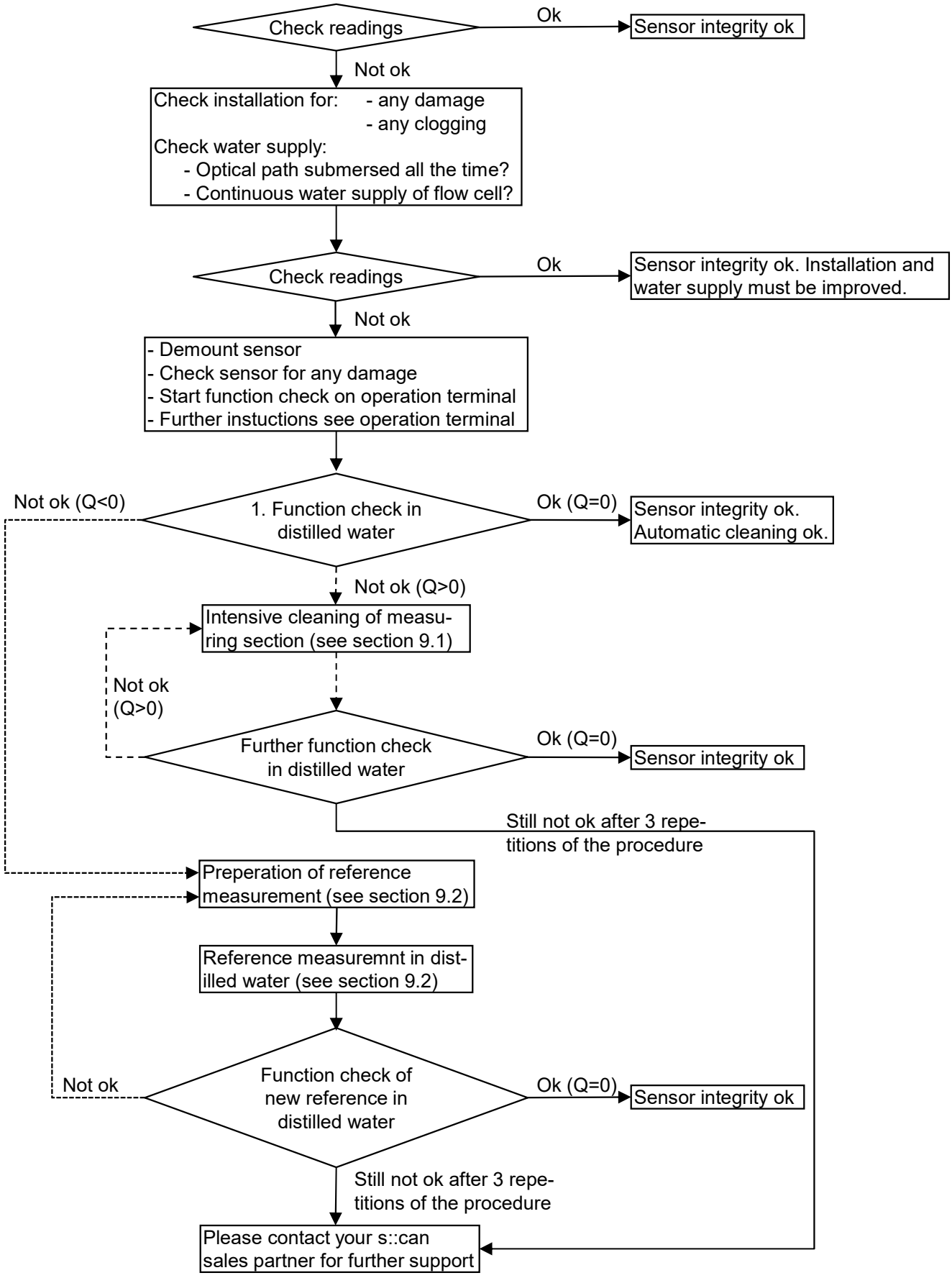
- Take the i::scan out of the measuring medium.
- General cleaning of the probe and careful cleaning of the measuring section. The measuring windows themselves must not be cleaned at this point. Finish the cleaning procedure by rinsing with distilled water. Start the function check in the operating software or on the controller (see manual of operating software).
- Place the carefully cleaned multifunctional slide over the cleaned measuring section of the i::scan.
- Fill the multifunctional slide with distilled water and pour it out. Rinse the multifunctional slide several times (at least 3 times) in this way.
- Fill the multifunctional slide once again with distilled water.
- Start execution of function check on the controller used for operation:
  con::cube: *Service \ iscan \ Function Check*
  con::lyte: *Status / Manage sensors / Configure... / Execute check!*

The probe now executes a measurement. Once the measurement has been finished, a quality number Q between -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: Due to fouling of the measuring windows a manual cleaning is required (see section 9.1). If the quality number is still > 0 after three repetitions, proceed as follows:
  Q = 1: Perform a new reference measurement (see section 9.2).
  Q = 2: Inform your s::can sales partner or request a RMA.

The s::can website provides a support video, showing the complete prodedure of the function check (link: www.s-can.at/support-video-iscan).

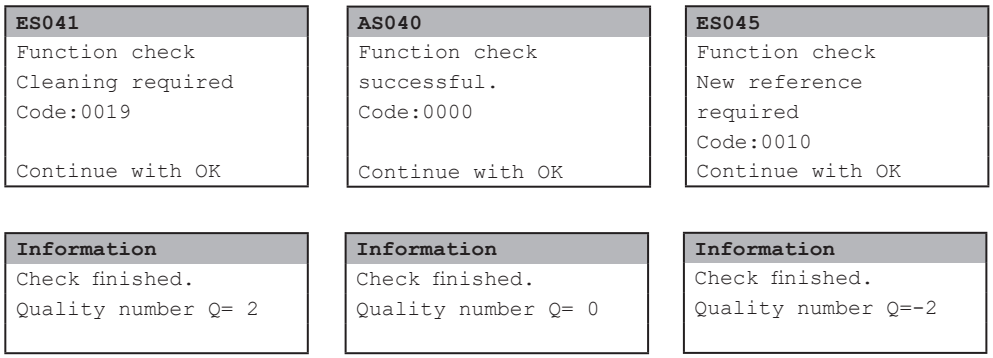
The flow chart below gives an overview of the procedure of the function check, which can be divided into several steps. Depending on the results of the test measurements that have to be performed in distilled water, these steps will be executed or not.



8.3.1 Performing a Function Check using con::lyte

When using the con::lyte for operation, the result of the function check will be displayed as follow. The quality number defines the next step necessary (see section 8.3).

Q > 0	Q = 0	Q < 0
Suspect of strong (Q=2) or small (Q=1) window fouling.	The probe is fully opereative (sensor integrity is ok).	A new reference measurement is necessary.
Perform cleaning until measuring windows are clean (Q=0). At least 3 times.	Probe can be installed again without modification.	Perform a new reference measurement (see section 9.2).

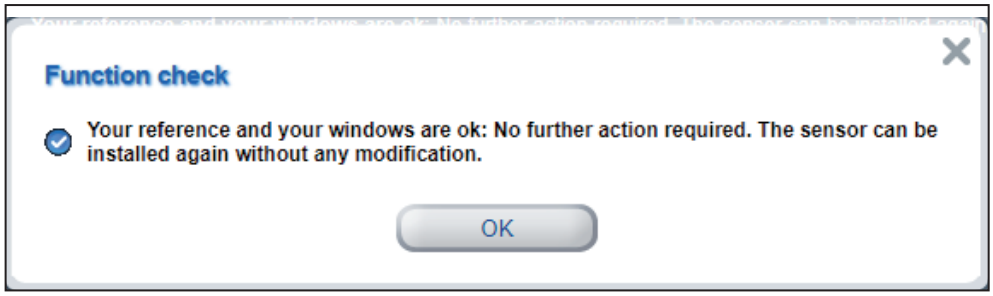


8.3.2 Performing a Function Check using moni::tool

When using the con::cube for operation, the result of the function check will be displayed as follow. The quality number defines the next step necessary (see section 8.3).

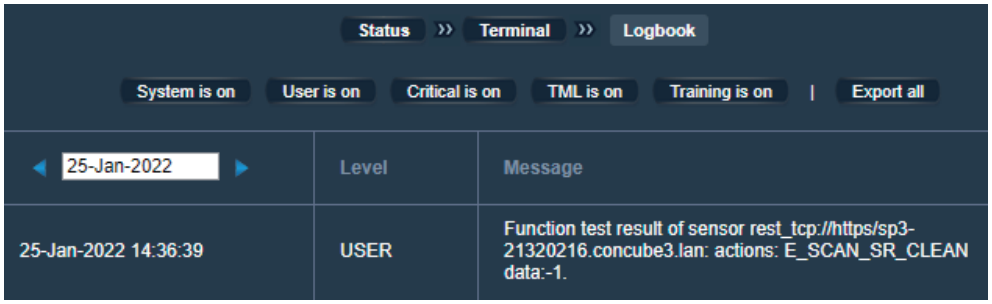
- Q > 0:
- Suspect of strong (Q=2) or small (Q=1) window fouling.
- Perform cleaning until measuring windows are clean (Q=0). At least 3 times.

- Q = 0
- The probe is fully opereative (sensor integrity is ok).
- Probe can be installed again without modification.



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

The result of the function check is displayed in the moni::tool logbook also (see figure on the right).



9 Maintenance

9.1 Cleaning

During routine operation the cleaning of the i::scan, i.e. the optical measuring windows of the instrument, is performed automatically (see section 4.3). To clean the probe manually the following is recommended:

Before demounting the probe be sure that automatic cleaning is deactivated via operating software (e.g. by entering the Service Mode). In addition ensure the air supply line is depressurised. This is to avoid dirt and / or injury by suddenly escaping compressed air or rotating brushes.

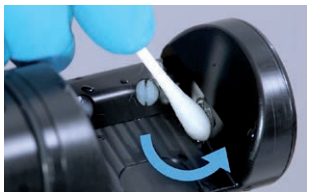
- Rinse sensor with hand-hot (lukewarm) drinking water to remove course deposits.
- Put the probe in a bucket of hand-hot (lukewarm) drinking water for several minutes to remove deposits on and in between the measuring gap.
- To clean the sensor housing a soft cleaning agent (e.g. dish-washing detergent)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

- 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 falsification of measurements.

After every step undertaken in the cleaning process, the measuring section must be rinsed with sufficient amounts of distilled water. After finishing the cleaning the internal cleaning tube of the probe shall be spilled with distilled water. This can be done with a disposable syringe as shown in the figure on the right.

9.2 Reference Measurement

All i::scan 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 i::scan.

A new reference measurement shall only be performed due to result of a performed function 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 and the internal cleaning tube (see section 9.1) as well as the multifunctional slide.
- Place the carefully cleaned multifunctional slide over the cleaned measuring section of the i::scan.
- 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.
- Hold the slide and rotate the i::scan slowly by 180° so that the measuring section is covered.
- Turn the measuring section upwards again and check that no air bubbles are visible.
- When the measuring section is free of air bubbles, rotate again by 180° so that the measuring section is covered. This prevents water surface reflections.

- Start the reference measurement (see moni::tool manual or con::lyte manual). The measurement ends automatically and replaces the last reference measurement.
- Check the new reference measurement by means of the function check (quality number Q = 0).

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). There is no way to check the quality of the used distilled water automatically.

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

10 Troubleshooting

10.1 Typical Error Pattern

Error	Reason	Removal
■ Turbidity = 0.008 FTU ■ Turbidity = 0.02 NTU	■ Reading is below the lower detection limit but still higher than - 0.5 FTU / NTU	■ Check if reading is fixed for longer time ■ Perform function check ■ Check local calibration of turbidity
■ Turbidity = NaN 	■ Reading is below - 0.5 FTU / NTU	■ Perform function check ■ Check local calibration of turbidity
■ i::scan is leaking in flow cell or multi-functional slide	■ O-ring on sensor housing is missing or broken (see figure in section 3)	■ Replace O-ring (size 33x2) or order replacement from s::can Service (part-no. A000884).

10.2 Error Messages and Status Messages

During execution of a measurement the monitoring system (system status), the measuring device itself (device status) and the result (parameter status) will be checked for possible errors and for plausibility. In case of an error (status bit will be set from 0 to 1) a user message will be displayed to the operator.

Depending on the controller used for operation these messages will be shown on the display (function *Monitor...* in case of con::lyte D-320, *Status* tab in case of moni::tool) and also stored within the result files or logfiles. Additional to the user message (general error reason and recommendations for removal) the detailled status code will be displayed either in binary form (0000, 0001, 0010, 0011, 0100, etc.) or as a hex number (0x0001, 0x0002, 0x0004, 0x0008, 0x0010, etc).

Up to 16 status bits are used for different errors. If several errors occur at the same time, the con::lyte and moni::tool will add up all the status bits. This detailed information might be important if you request s::can support. Below you will find examples how to translate these combined hex codes:

Hex	Bin	Bits
0x8000	1000 0000 0000 0000	b15
0x8001	1000 0000 0000 0001	b0, b15
0x4011	0100 0000 0001 0001	b0, b4, b14

Within moni::tool the complete status code of a simple parameter has the following format:

0xTTTT.SSSS.PPPP.pppp.VVVV.vvvv.

Code	Status Type	Remark
0xTTTT	System status sensor	visible in the second column of all moni::tool parameter result files (e.g. Error 0x0010 or Ok 0x0000)
0xSSSS	Sensor status general	valid for all sensors
0xssss	Sensor status private	valid for respective sensor
0xPPPP	Parameter status general	valid for all parameters
0xpppp	Parameter status private	valid for respective parameter
0xVVVV	vali::tool status general	valid for all clean values of vali::tool software
0xvvvv	vali::tool status private	valid for respective clean values of vali::tool software

1 Within the moni::tool *Status* tab of the sensor you will see the system status sensor and the sensor status as clear text and as status code (0xTTTT.SSSS.ssss).

2 Within the moni::tool *Status* tab of the parameter you will see the parameter status and in case of activated vali::tool the vali::tool status also (0xPPPP.pppp.VVVV.vvvv).

Timestamp Measurement interval	Station 1 Status	ammo::lyser NH4-N - Measured value [ppm]	3 ammo::lyser Status [NH4-N - Measured value]	ammo::lyser NH4-N - Clean value [ppm]	4 ammo::lyser Status [NH4-N - Clean value]
31.05.2019 12:32	Ok 0x0000	4.25	Ok 0x0000.0000.0000.0000	3.33	Ok 0x0000.0000
31.05.2019 12:34	Ok 0x0000	4.78	Ok 0x0000.0000.0000.0000	3.43	Ok 0x0000.0000
31.05.2019 12:36	Ok 0x0000	6.05	Ok 0x0000.0000.0000.0000	3.61	Ok 0x0000.0000
31.05.2019 12:38	Ok 0x0000	58.24	Ok 0x0000.0000.0000.0000	3.84	Ok 0x1001.0010
31.05.2019 12:40	Ok 0x0000	123.67	Ok 0x0000.0000.0000.0000	8.64	Ok 0x0000.0000
31.05.2019 12:42	Ok 0x0000	139.51	Ok 0x0000.0000.0000.0000	18.57	Ok 0x0000.0000
31.05.2019 12:44	Ok 0x0000	136.43	Ok 0x0000.0000.0000.0000	28.85	Ok 0x0000.0000

3 Within the moni::tool results file of the sensor parameter the status (0xTTTT.SSSS.PPPP.pppp) will be stored in the column beside the measured value.

4 If vali::tool is active, the result file contains also the vali::tool status (0xVVVV.vvvv) in the column beside the cleaned value.

10.2.1 System Status

The table below shows all errors regarding the operation terminal (system status) the user message, the reason of the error and notes for troubleshooting. If the error can't be removed although the suggested procedure was executed several times, please contact your s::can sales partner.

System Status Error 0xTTTT	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	ES007 / COMM! Probe not detected. Check power supply and connection cable.	No communication between sensor and terminal.	No communication between sensor and operation terminal. Replacement sensor was not installed correctly.	Check sensor cable and connector. Disconnect and reconnect sensor.
0x0002 - b1	0002	Invalid sensor	Sensor serial number has changed.	Connect the previously installed sensor or perform sensor replacement (moni::tool) or new sensor installation (con::lyte).

10.2.2 Sensor Status

The table below shows all errors regarding the used sensor incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Sensor Status Error 0xSSSS	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	ES100 / 0001 Probe reports an error. Call service! Param.Status error. Status Code:	General sensor error	Sensor reports error during internal check. At least one internal sensor check failed.	For details see additional status message below. In case no further messages are shown, note the error code and contact your s::can sales partner.

Sensor Status Error 0xSSSS	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0002 - b1	ES101 / 0002 MISUSE Medium temperature. Take probe out of medium, immediately!	SENSOR MISUSE	Operation outside the specification (e.g. temperature too high). This can damage the device permanently.	Take the sensor out of the medium immediately and check environmental conditions.
0x8000 - b15	ES115 / 8000 Device maintenance required Code 8000 0000	Sensor mainentance required	At least one internal sensor check reports a warning.	Perform function check of the sensor according the manual.

10.2.3 Parameter Status

The table below shows all errors regarding the measured parameters incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Parameter Status Error 0xPPPP	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0001 - b0	EP 100 / 0001 Status error. Code: 0001.0000 Details in following log messages.	General parameter error	At least one internal parameter check failed.	Note additional status message below. If no further message is displayed, note the error code and contact your local s::can sales partner.
0x0002 - b1	EP 100 / 0002 Parameter failure, hardware failure	Parameter error, Hardware error	Electrode signal not ok. An electrode is missing, too old or defective.	Check the electrode or replace the electrode.
0x0004 - b2		Parameter error, configuration error	Parameter error, configuration error	Change the local calibration or switch back to global calibration.
0x0008 - b3		Parameter error, Wrong medium	Sensor outside of the medium or in incorrect medium.	Check supply of medium and medium itself.
0x0010 - b4	EP 100 / 0010 Parameter failure, calibration failure	Parameter error, Incorrect calibration	Invalid sensor configuration. At least one calibration coefficient is invalid.	Check readings and lab values. Restart sensor by un- and replugging. Set back to factory settings. Repeat local calibration.

Parameter Status Error 0xPPPP	Display con::lyte (D-31x / D-320)	Message moni::tool	Reason	Removal
0x0020 - b5	EP 100 / 0020	Parameter not ready	Parameter not activated on the sensor or sensor still warming up.	Activate parameter or wait until sensor is fully operational.
0x8000 - b15	EP 115 / 8000 Out of range Code 8000 0000 The parameter is out of measure-ment range	Reading out of measuring range	Measured parame-ter is outside the defined measuring range.	Check if sensor is in the medium. Perform functional check.

10.2.4 Status Messages vali::tool

The table below shows all errors regarding clean parameters of the vali::tool software incl. the user message, the reason of the error and notes for trouble shooting. If the error can't be removed although the suggested procedure was executed several times please contact your s::can sales partner.

Parameter Status Error 0xVVVV	Message moni::tool	Reason	Removal
0x0001 - b0	vali::tool reports an error	At least one internal check reports a warning.	Check further status messages.
0x0800 - b11	Maintenance recommen-ded	Parameter check reports a warning.	Check system and sen-sor, perform functional check.
0x1000 - b12	Marked as not trustable	Parameter check reports a warning.	Do not use this value for calibration.

10.3 Device Settings

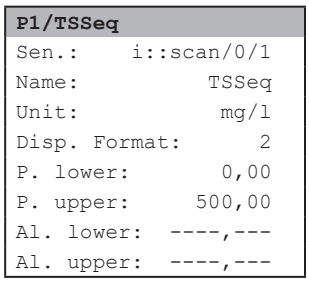
In case detailed sensor information or configuration settings have to be checked, the following sections will explain how to find these information when operating the sensor with a s::can operator terminal.

10.3.1 Check of Device Settings using con::lyte

Select the entry *Manage sensors...* in the main menu of the status screen. Select the name *i::scan/0/1* in the list of installed sensors, in which the second number (*1*) 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:

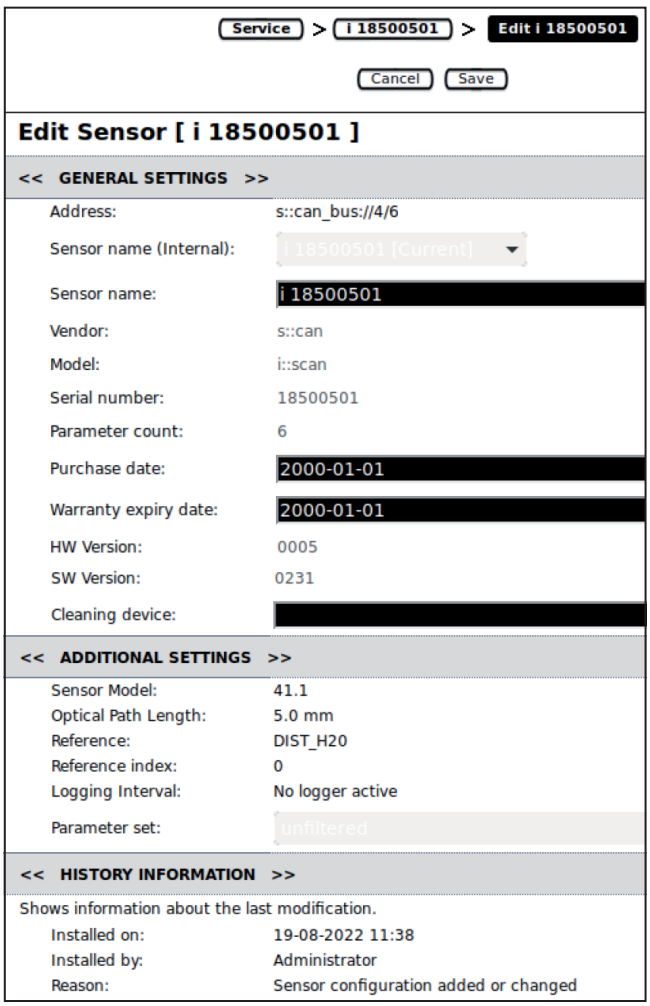
- Internal sensor identifier (*M-Version* and *Model*)
- Sensor name (*i::scan*)
- Serialnumber of the sensor (*S/N*)
- Hardware version of the sensor (*H/W-Version*)
- Software version of the sensor (*S/W-Version*)

Information of the single measuring parameter can be retrieved via the entry *Parameter info...* from the main menu of the parameter display (see figure on the right). 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 i::scan 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 (COM-port, *Address*)
- Sensor name used internal (*internal*). Should not be changed by the operator.
- *Sensor Name* for the display, 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 connected sensor
- *Optical Path Length* of the i::scan in mm
- Name of the actual used zero reference (*Reference*)
- Internal number of the actual used zero reference (*Reference index*)
- *Logging interval* for Datalogger (not available for i::scan)
- *Parameter set* (not available for i::scan)
- History information about installation and last modification of the sensor (*Installed on*, *Installed by* and *Reason*)

10.4 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 Customer Portal available on the s::can website 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 Connection Cable

For operation of i::scan with plug a connection cable is necessary. This is included in the standard order.

Name	Specification	Remark
Part-no.	C-1-010-SENSOR	
Cable lenght	1 m	
Assembling	ex works	
Dimensions plug	20 mm	outer diameter
Material	PU	Cable sheathing
Environment rating (IP)	IP 68	
Interface connection	IP 67, RS 485, 12 VDC	to s::can sensors

11.1.2 Extension Cable

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

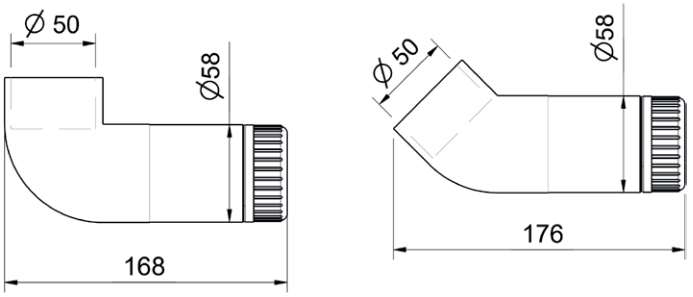
⚠ A direct connetion of the extension cable to i::scan with sensor plug (Yxx-x-x-000) is not possible. A connection cable (see section 11.1.1) is also needed.

Name	Specification	Remark
Part-no.	C-210-SENSOR C-220-SENSOR	
Cable lenght	10 m 20 m	C-210-SENSOR C-220-SENSOR
Assembling	ex works	
Dimensions plug	20 mm	outer diameter
Material	PU	Cable sheathing
Environment rating (IP)	IP 68	
Interface connection	IP 67, RS 485, 12 VDC	to s::can sensors

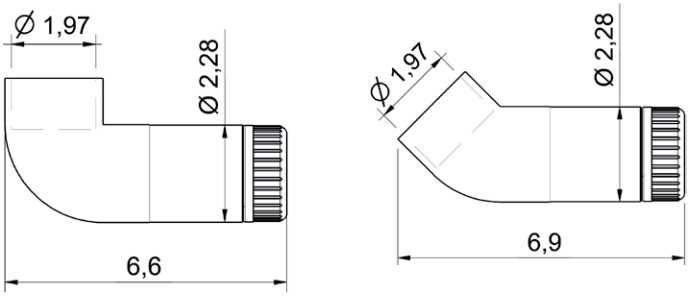
11.1.3 Probe Mounting

For proper horizontal, vertical or inclined submersed installation of the i::scan probe three seperate probe carriers are available. This part can be extended by a pipe (to be provided by the customer) if necessary. For length > 1 m stainless steel pipes or plastic pipes with higher wall thickness are recommended.

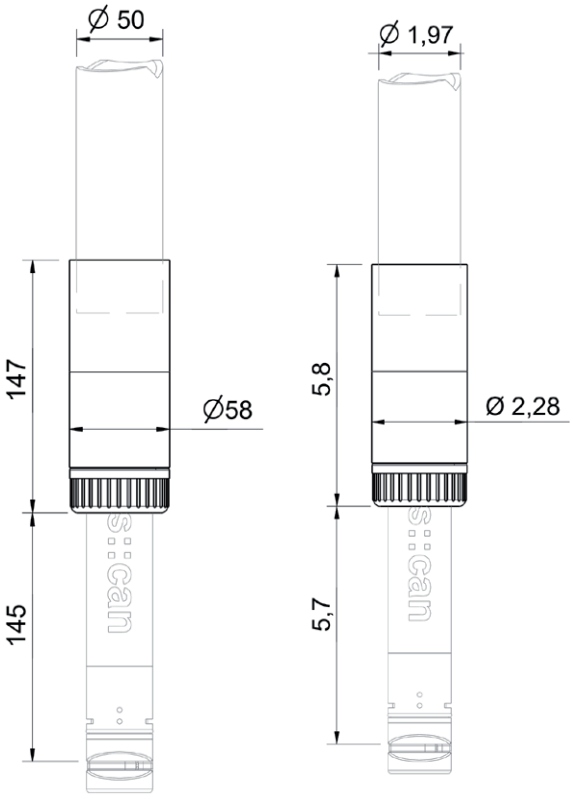
Name	Specification	Remark
Part-no.	F-110-ISCAN F-120-ISCAN F-130-ISCAN	horizontal installation vertical installation 45° inclined installation
Material	PVC grey POM-C white	carrier clamp ring
Dimensions (diameter / length)	58 / 168 mm 2.28 / 6.6 Inch 58 / 147 mm 2.28 / 5.8 Inch 58 / 176 mm 2.28 / 6.9 Inch	F-110-ISCAN F-120-ISCAN F-130-ISCAN
Weight	approx. 0.4 kg	
Process connection	ID 50 mm	to mounting pipe OD 50 mm
Installation / mounting	submersed (in situ)	see section 4.2.1



Dimension of F-110-ISCAN and F-130-ISCAN in mm



Dimension of F-110-ISCAN and F-130-ISCAN in inch



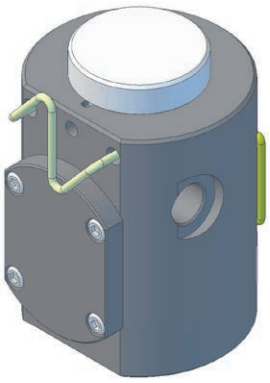
Dimension of F-120-ISCAN in mm and inch

11.1.4 Railing Bracket / Fixing Adapter

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

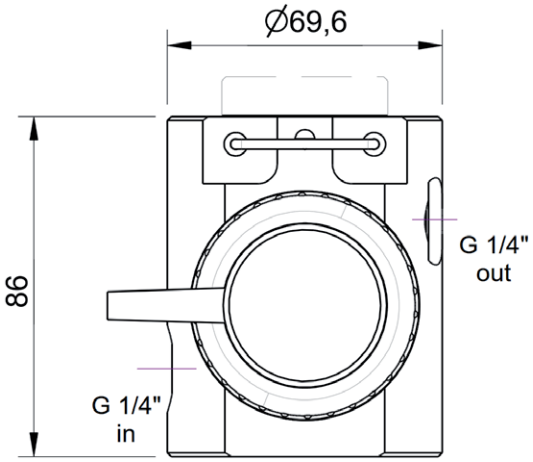
Name	Specification	Remark
Part-no.	F-15	
Material	Stainless steel	
Dimensions	158 / 267 / 73 mm 6.22 / 10.51 / 2.87 inch	W / H / D
Weight	approx. 2.8 kg	
Process connection	50 mm 1.97 inch	OD extension pipe of i::scan carrier
Installation / mounting	up to 64 mm (2.5 inch)	OD of railing

11.1.5 Flow Cell Setup Clean Water



For measurement of sample stream outside the medium with an i::scan probe a separate flow-through installation is available.

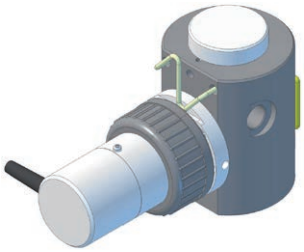
Name	Specification	Remark
Part-no.	F-46-ISCAN	suitable for all OPL
Material	POM-C black POM-C white stainless steel	flow cell blanking plug fixing bracket
Dimensions	70 / 86 mm 2.76 / 3.39 inch	diameter / H
Weight	0.4 kg	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose connection $^1/_4$ inch (ID 6 mm)	F-45-PROCESS

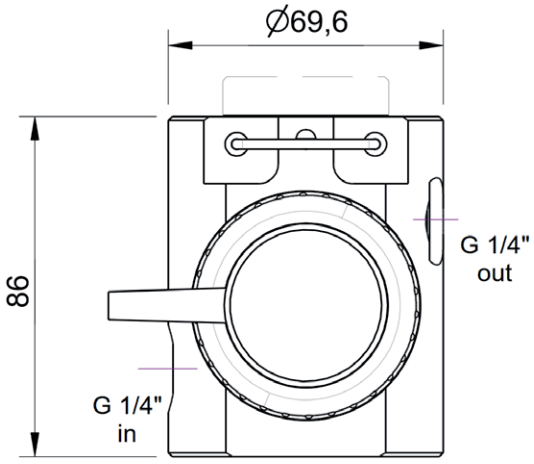


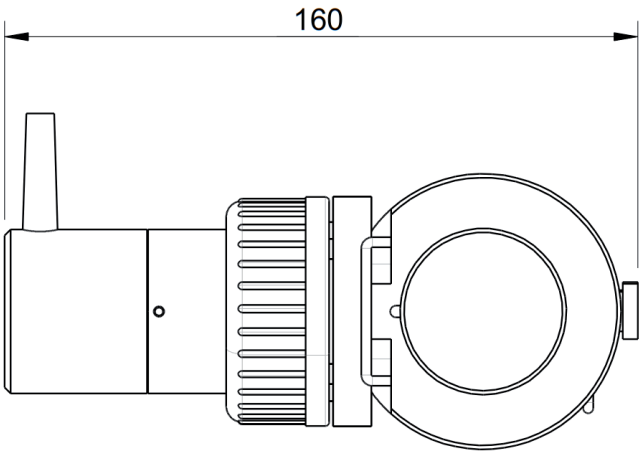
11.1.6 Flow Cell Setup Clean Water autobrush

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-ISCAN	for 35 mm OPL
Material	POM-C black POM-C white stainless steel	flow cell blanking plug fixing bracket
Dimensions	70 / 86 / 160 mm 2.76 / 3.39 / 6.30 inch	W / H / D
Weight	approx . 0.9 kg	
Power supply	10.5 to 14.5 VDC	
Power consumption	1.2 W (typ.) 150 mA (typ.) 30 mA (permanent)	 when 3-pin connected
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose nozzle $^1/_4$ inch (ID 6 mm)	F-45-PROCESS



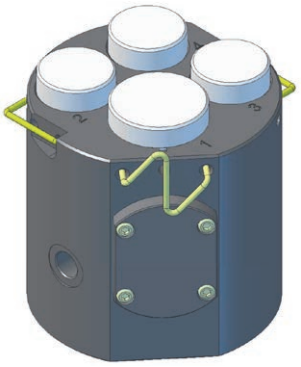




11.1.7 Multi Flow Cell Setup Clean Water

For measurement of sample stream outside the medium with an i::scan and up to 3 additional s::can sensors a separate flow-through installation is available.

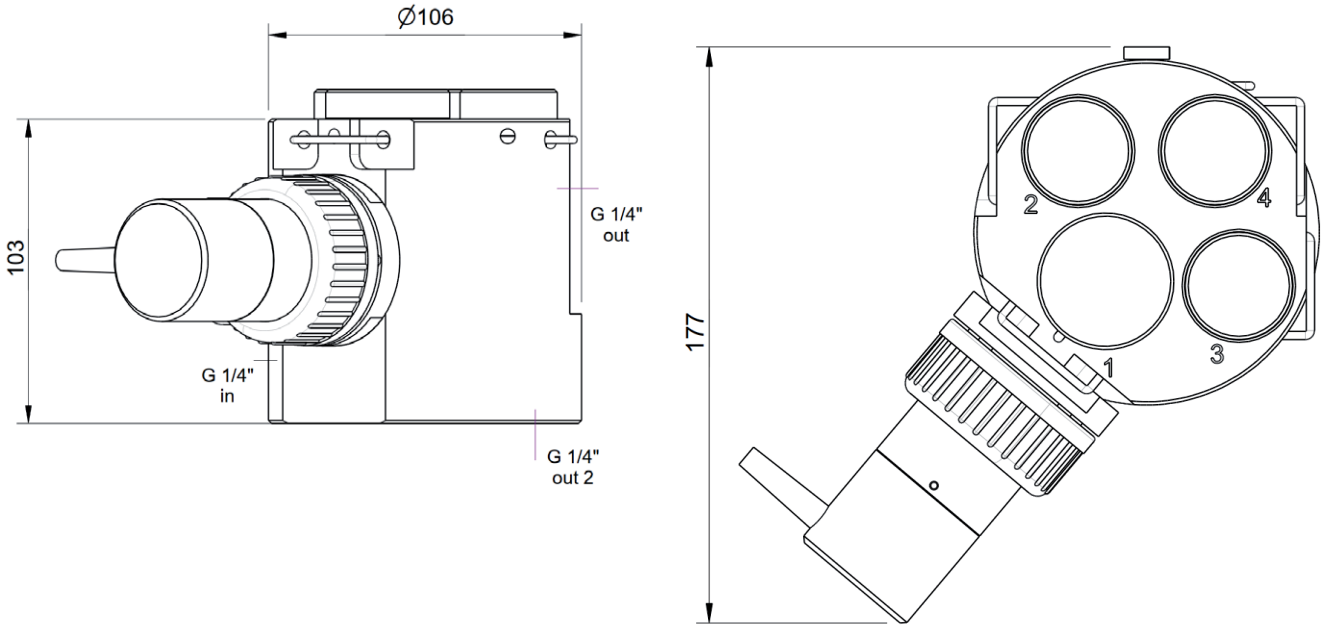
Name	Specification	Remark
Part-no.	F-46-FOUR-ISCAN	for 5 or 35 mm OPL
Material	POM-C black POM-C white stainless steel	flow cell blanking plug fixing bracket
Dimensions	106 / 103 mm 4.17 / 4.06 inch	diameter / H
Weight	approx. 1 kg	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose connection $^1/_4$ inch (ID 6 mm)	F-45-PROCESS



11.1.8 Multi Flow Cell Setup Clean Water autobrush

For measurement of sample stream outside the medium with an i::scan with 35 mm OPL and up to 3 additional s::can sensors in such applications, where fouling of the measuring windows may occur, a separate flow-through installation with an automatic brush is available.

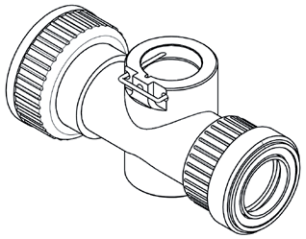
Name	Specification	Remark
Part-no.	F-46-FOUR-ISCAN	for 35 mm OPL
Material	POM-C black POM-C white stainless steel	flow cell blanking plug fixing bracket
Dimensions	106 / 103 / 177 mm 4.17 / 4.06 / 6.97 inch	diameter / H / D
Weight	approx. 1.3 kg	
Process connection	$^1/_4$ inch inside	
Installation / mounting	flow-through (by pass)	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 6 bar (0 to 87 psi)	
Accessories	Hose connection $^1/_4$ inch (ID 6 mm)	F-45-PROCESS

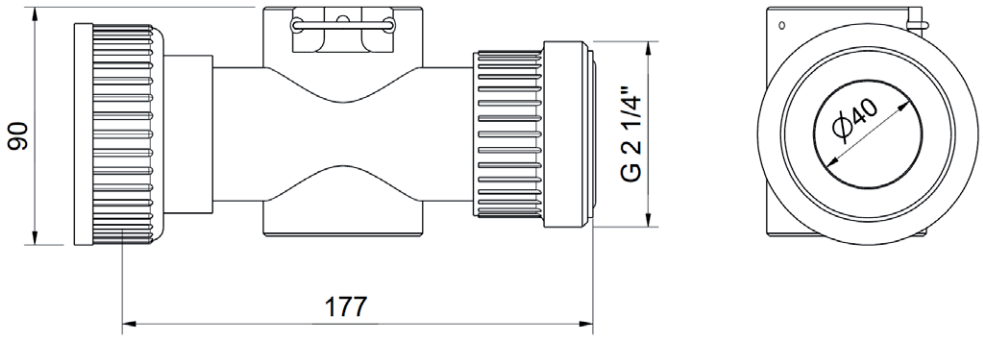


11.1.9 Flow Cell Setup Waste Water

For measurement of waste water sample stream outside the medium with an i::scan a separate flow-through installation is available.

Name	Specification	Remark
Part-no.	F-48-ISCAN	suitable for all OPL
Material	PVC	
Dimensions	90 / 177 mm 3.54 / 6.97 inch	H / D
Weight	approx. 0.65 kg	
Process connection	ID 40 mm (1.57 inch)	
Installation / mounting	flow-through (by pass)	
Operating pressure	0 to 3 bar (0 to 43.5 psi)	





11.2 Automatic Cleaning

11.2.1 Pressure Connection Set

For connection of the automatic air cleaning system of the i::scan a specific pressure connection set is available.

Name	Specification	Remark
Part-no.	B-41-SENSOR	
Pressure hose	3 m	ID 4 mm / OD 6 mm
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)	

11.2.2 autobrush

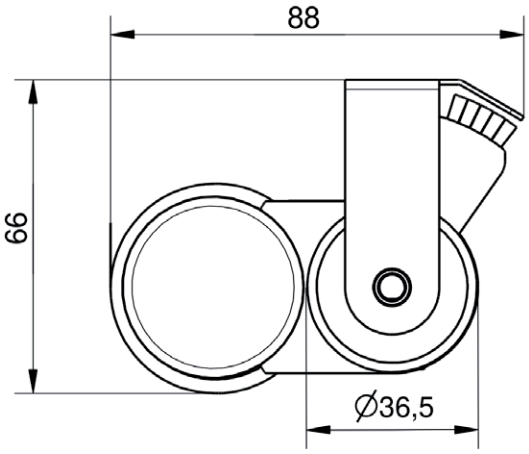
For automatic cleaning of the i::scan with 35 mm OPL a rotating brush unit is available. This auto::brush will be mounted into the matching flow cell.

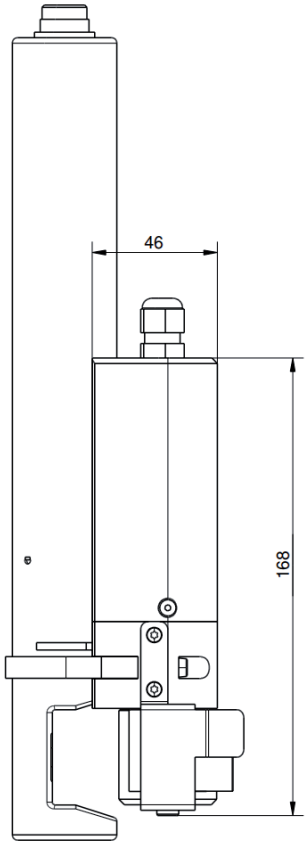
Name	Specification	Remark
Part-no.	F-446-M-ISCAN-DW F-446-M-ISCAN-TI F-446-M-ISCAN-PS	stainless steel version titanium version pipe::scan
Power supply	10.5 to 14.5 VDC	
Power consumption	1.2 W (typ.) 150 mA (typ.) 30 mA (permanent)	 when 3-pin connected
Material	POM-C Polyamide, Polyester stainless steel / titanium EPDM / FKM	 brush axis (DW / TI) O-ring (DW / TI)
Dimensions	58 x 126 mm	diameter / length
Cable length	1.5 m 0.35 m with plug	flow cell pipe::scan
Cable assignment	Purple = Trigger signal Black = -12 VDC (GND) Red = +12 VDC	yellow (previous cable) brown (previous cable) white (previous cable)
Weight	300 g	
Environment rating (IP)	IP 66	
Operating temperature	0 to 45 °C (32 to 113 °F)	
Operating pressure	6 bar 10 bar	flow cell pipe::scan
Conformity - EMC	EN 61326-1: 2013 S.I. 2016/1091	EU UK
Conformity - RoHS2	EN IEC 63000: 2018 S.I. 2012/3032	EU UK
Spare parts	F-446-BRUSH-ISCAN-DW F-446-BRUSH-ISCAN-TI	

11.2.3 ruck::sack

For automatic cleaning of the i::scan installed submersed with brushes a cleaning device is available. This ruck::sack will be mounted on the probe housing. Regarding mounting please refer to section 4.3.2.

Name	Specification	Remark
Part-no.	F-146-RS-ISCAN-35 F-146-RS-ISCAN-05	for 35 mm OPL for 5 mm OPL
Power supply	10.5 to 14.5 VDC	
Power consumption	150 mA (typ.) 300 mA (max.) 30 mA (permanent)	
Material	POM-C Polyamide, Polyester stainless steel NBR / FKM	housing brush fixing, shelter O-ring
Dimensions	168 x 46 x 36,5 mm 6,6 x 1,81 x 1,42 inch	W / H / D
Cable length	8 m	
Cable type	d 7 mm PUR	
Cable assignment	Purple = Trigger signal Black = -12 VDC (GND) Red = +12 VDC	yellow (previous cable) brown (previous cable) white (previous cable)
Weight	750 g	incl. cable
Environment rating (IP)	IP 68	
Operating temperature	0 to 50 °C (32 to 122 °F)	
Operating pressure	0 to 0.5 bar	5 m immersions depth
Storage temperature	-20 to +80 °C (-4 to +176 °F)	
Conformity - EMC	EN 61326-1: 2013 S.I. 2016/1091	EU UK
Conformity - RoHS2	EN IEC 63000: 2018 S.I. 2012/3032	EU UK
Spare parts	F-146-BRUSH-ISCAN-35 F-146-BRUSH-ISCAN-05	





11.3 Maintenance

11.3.1 Cleaning Brush

For easy and proper manual cleaning of the measuring windows of the i::scan a specific brush is available. This is especially suited for mechanical removal of persistent window fouling.

Name	Specification	Remark
Part-no.	B-60-2	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 i::scan a specific cleaning agent is available. It is especially suited for chemical removal of grease and persistent organic window fouling.

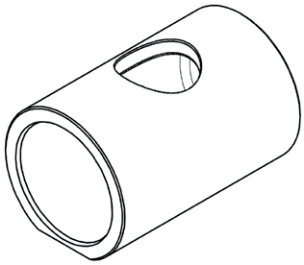
Name	Specification	Remark
Part-no.	B-61-1	
Weight	approx. 1.3 kg	
Volume	1 000 ml	

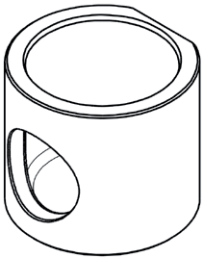
11.3.3 Multifunctional Slide

For easy and proper function check and reference measurements of the i::scan 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.	E-431-1-ISCAN E-431-2-ISCAN	für 35 mm OPL für 5 mm OPL
Material	POM-C black FPM	housing sealing
Dimensions	49 / 73 mm 1.93 / 2.87 Zoll 49 / 43 mm 1.93 / 1.69 Zoll	diameter / length 35 mm diameter / length 5 mm
Volume	approx. 10 ml approx. 30 ml	for 5 mm OPL for 35 mm OPL
Weight	45 g 70 g	for 5 mm OPL for 35 mm OPL

12 Technical Specifications

Name	Specification	Remark
Part-no.	Y01-x-x-xxx to Y06-x-x-xxx Y08-x-x-xxx to Y12-x-x-xxx	i::scan with 35 mm OPL i::scan with 5 mm OPL see section 3.3 for further details
Measuring parameter	depending on type	see section 5.4
Measuring principle	multi-wavelegth spectrometry with narrow band light sources	automatic compensation of lamp aging
Automatic spectral compensation	Turbidity, solids, organic substances, etc.	compensation of cross sensitivities
Automatic turbidity compensation	using 180° detector	independent which turbidity measurement (ISO or EPA) is used
Measuring range	depending on optical pathlegth (OPL)	see section 5.4
Measurement interval	35 sec (min.) 120 sec (typical)	min. interval depending on number of measured parameters
Resolution 35 mm OPL	Turbidity: 0.001 NTU / FTU Color: 0.01 Hazen UV254: 0.015 Abs/m TOC: 0.01 mg/l	
Resolution 5 mm OPL	Color: 0.07 Hazen UV254: 0.105 Abs/m COD: 0.035 mg/l	
Precision 35 mm OPL	Turbidity: +/- 0.02 NTU / FTU Color: +/- 0.3 Hazen UV254: +/-0.05 Abs/m TOC: +/- 0.025 mg/l DOC: +/- 0.025 mg/l	< 2 NTU / FTU app and true total and filtrated
Precision 5 mm OPL	TSS: +/- 2 mg/l +/- 4 mg/l Color: +/- 2.5 Hazen UV254: +/- 0.4 Abs/m COD: +/- 1 mg/l +/- 2.5 mg/l	Effluent Influent app and true total and filtrated Effluent total and filtrated Influent total and filtrated
Global calibration	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
Temperature sensor	-20 to 70 °C (-4 to 158 °F) 0.06 °C resolution	
UVT10 [%]	$= 100 * 10^{(-UV254\ [Abs/m] * 0.01)}$	
UVT100 [%]	$= 100 * 10^{(-UV254\ [Abs/m] * 0.1)}$	
Power supply	10 to 18 VDC	
Power consumption	0.3 A (max) 20 mA at 12 VDC (typical) 200 mA at 12 VDC (max) 9 mA at 12 VDC (min)	
Sensor materials	PEEK, POM-C PVC, PA fused silica sapphire (Al_2O_3)	housing (ISO) other measuring windows (35 mm OPL) measuring windows (5 mm OPL)

Name	Specification	Remark
Sensor cable length	1.0 m connection cable 7.5 m fixed cable 15.0 m fixed cable	-000, to be ordered seperately -075 -150
Sensor cable specification	PUR (polyurethane jacket), 22 AWG, 6.3 mm (outside diameter), -30 to 80 °C (-22 to 176 °F)	min. bending radius 5 cm, no buckling allowed at probe connection
Sensor cable assignment	Pin 1: Data - (green cable strand) Pin 2: Data + (pink cable strand) Pin 3: +12 VDC (red cable strand) Pin 4: Ground (black cable strand) Pin 5: not used Pin 6: Shielding (blank cable strand)	green (previous cable version) yellow (previous cable version) white (previous cable version) brown (previous cable version) black (previous cable version)
Interface connection	RS 485, Modbus	to s::can operator terminal
Weight	approx. 330 g	without cable
Dimension	38.5 / 325 mm 38.5 / 295 mm	diameter / length (35 mm OPL) diameter / length (5 mm OPL)
Operating limits temperature	0 to 45 °C (32 to 113 °F)	min. freezing, max. 45°C submersed
Operating limits pressure	0 to 8 bar (0 to 116.0 psi)	
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	-20 to 60 °C (-4 to 140 °F)	probe has to be acclimatised to medium temperature before initial operation
Installation / mounting	submersed or in flow cell	
Environment rating (IP)	IP 67 (plug version -000) IP 68 (cable version -075, -150)	due to connection plug on sensor
Internal storage	512 MB on board memory	
Automatic compressed air cleaning - probe connection	G $^{1}/_{8}$ inch for air hose OD 6 mm	only for i::scan with fixed cable possible
Automatic compressed air 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. (typical)	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)
Warranty	2 years	
Guarantee	1 year	
Guarantee extended (optional)	3 years	Guarantee card must be filled in
Conformity - EMC	EN 61326-1: 2013 S.I. 2016/1091	EU UK
Conformity - RoHS2	EN IEC 63000: 2018 S.I. 2012/3032	EU UK

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