

ION Director®

Instruction Manual



Valid from Firmware-Version 1.00

As of 2022-09-09

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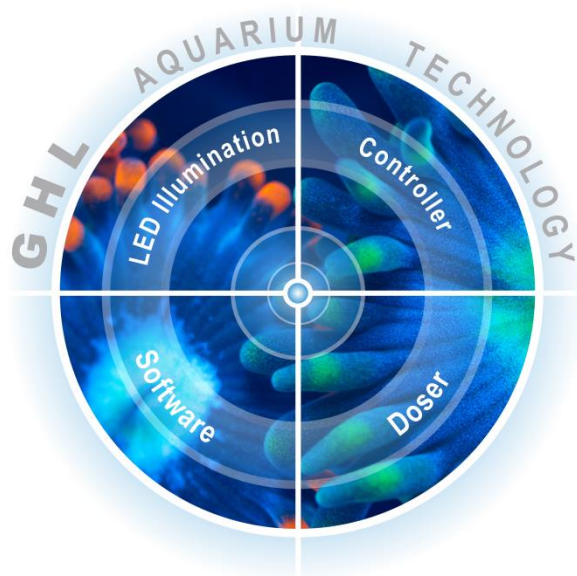
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Read and follow these instructions as well as the instructions of the ION Director multi-ion sensor completely!

Failure to follow these instructions may cause damage or premature wear to the IOND device and/or sensor, which is not covered by any warranty and/or guarantee!



- ✓ Maximum Quality
- ✓ Maximum Performance
- ✓ Maximum Safety

FOCUSSED ON SUCCESSFUL FISHKEEPING

Congratulations on your Purchase

Thank you for purchasing our product and allowing us to help support your path to successful fishkeeping! With an *ION Director®* you now own a highly professional piece of equipment that is more than capable of assisting you in your daily monitoring and maintenance routines.

Please note that the *ION Director®* does not have an internal controller and therefore requires for operation a *ProfiLux 3* Aquarium controller with latest firmware (6.44 or newer), a *ProfiLux 4* (7.25 or newer), a *GHL Doser 2/2.1/2.2 Stand Alone* or *GHL Doser Maxi Stand Alone* both with firmware 1.37 or higher. GHL products and their firmware and software are subject to continuous development, so please ensure that you always use the latest version.

For transporting liquids to the *ION Director®* a *GHL Doser 2/2.1/2.2* (Stand Alone or Slave) with at least 3 free pumps is required.

We are confident that our product will help make your hobby more efficient, safe, and ultimately help you spend more time enjoying your aquarium.

Enjoy Your Passion!

GHL Takes Care of the Rest

Get the Most out of your GHL Product

GHL products are well-equipped with simple and intuitive features. In order to get the most out of our products, we recommend you read this Instruction Manual and the Instruction Manual of the respective Controller (*ProfiLux*, *GHL Doser 2/2.1/2.2 Stand Alone* or *GHL Doser Maxi Stand Alone*) carefully. Doing so will provide you with the most profound details for using our product. These and other helpful documents can be downloaded from our website's download area (*Support->Downloads*). Visit our website at www.aquariumcomputer.com, our Support Forum or meet us on Facebook to become a GHL-Product expert and fully utilize the full range of functions offered from your device!

1 Safety Instructions

Please read these instructions carefully before operating the *ION Director®*.

GHL products are built with maximum security and safety in mind. However, product safety for this device can only be guaranteed if you follow these guidelines.

Anyone who uses this device must become familiar with the following safety instructions and the operation of the device.

Failure to follow these instructions will void any warranty claims.

Be sure to read also over the safety instructions provided by ProfiLux/Doser manual; including the respective manuals of other equipment manufacturers.

In this manual, the following symbols are used:



TIP

General note, tip or advice.



WARNING

Important note for operation, to avoid damage to the equipment, and for your safety.

**DANGER**

Warning that non-compliance can result in injury or damage to the device.

1.1 Safety of Children and Vulnerable Persons

**WARNING**

This equipment must not be used:

- By small children and vulnerable persons with limited physical, sensory or mental capabilities.
- By people who are unfamiliar with the functions of this product.

1.2 Intended Use

The *ION Director®* is intended exclusively for use in the domestic area. *ION Director®* may only be operated with GHL accessories.

The *ION Director®* may only be used to determine the respective ion concentrations of aquarium water.

Make sure to place the device away from splashing water, moisture or other liquids.

**WARNING**

To ensure safe operation, the following guidelines must be followed.

Disregarding these safety guidelines, will result in voiding your warranty. In which case, the manufacturer rejects any responsibility or liability for damage!

**WARNING**

Moisture indicators are placed inside the unit and will change color when exposed to excessive moisture.

Removing these indicators will void all warranty claims



DANGER

Make sure that the power cord is plugged into a grounded outlet; otherwise you could get an electric shock or cause a fire.

- Protect the power cable from damage (For example, twisting, kinking, clamping). Please also pay attention to the joints and connections to the device.
- Disconnect the power plug by pulling the plug, not the cable.
- Never attempt to disassemble, repair or alter the equipment by yourself.
- Do not insert sharp objects into the electrical contacts and ports.



DANGER

- If the unit falls into the aquarium or has been exposed to moisture or humidity, first turn off the power to the device via the fuse or circuit breaker, then pull the power cord.
- Never touch the power plug with wet hands.
- If the device has become wet or dirty, thoroughly clean and dry it with a dry cloth.



DANGER

- The device may not be operated if it has been damaged in any way (e.g. damaged power cord or plug, liquids or objects have gotten into the interior, device has been exposed to excessive moisture, the normal operation is disturbed, or the device has been dropped.)



DANGER

- Never leave your aquarium unsupervised for an extended amount of time.
- The maximum amount of time without personal view depends on how long your aquarium can survive without significant damage, even when errors occur.
- Always remember that technology can fail and therefore malfunctions can never be ruled out!
Power failures, incorrect settings, damage (For example, by water or overvoltage) or simply an unexpected operating situation can lead to fatal damage.
- The manufacturer declines any liability for (consequential) damage or loss arising in connection with the use of the *ION Director®*, as far as permitted by law

For your own safety, please look at the hazard prevention and safety instructions in the chapters that follow.

2 General

2.1 About this Manual

These instructions apply to the operation of the *ION Director®*.

Settings are explained in this manual using the *GHL Control Center* PC software as an example. Of course, all settings can just as well be made via the *GHL Connect* app, via the GHL cloud service *myGHL* or via the web interface of the device, depending on personal preference.

2.2 Features

- 1 x *Multi Ion Sensor (MUI-Sensor port)*, BNC-connector
- 2 x *ProfiLux Aquatic Bus* (PAB Western sockets)
- 1 x AUX port
- 5 x Tube connectors (Water sample, References A and B, Waste water, Vent connector)
- 1 x Power supply input (24 VDC)

2.3 Scope of Delivery

Please check the contents of this box. The following items should be included:

- *ION Director®*

- Power supply splitter-cable
- IOND MUI Sensor
- Reference solutions A and B
- Flex PVC tube 8 m (315")
- 2x pre-drilled screw caps
- Inline water-filter
- Insert

PAB connection cables are not included with the *ION Director®*, they are also available in our onlineshops. The *IOND-Sets* do however, include a *PAB-Cable* for connecting the *IOND* to the included Doser.

Please check to make sure all items are in perfect condition. In case of damage, immediately contact the dealer from whom you purchased the *ION Director®*.



WARNING

A damaged *ION Director®* or components may not be put into operation under any circumstances.

3 Connections of the *ION Director®*

3.1 General

Applies to all connections:



WARNING

- Connect only original accessories from GHL.
- Do not use force when plugging-in connectors. If a plug contact does not fit check that you have chosen the correct socket and that the orientation is correct.

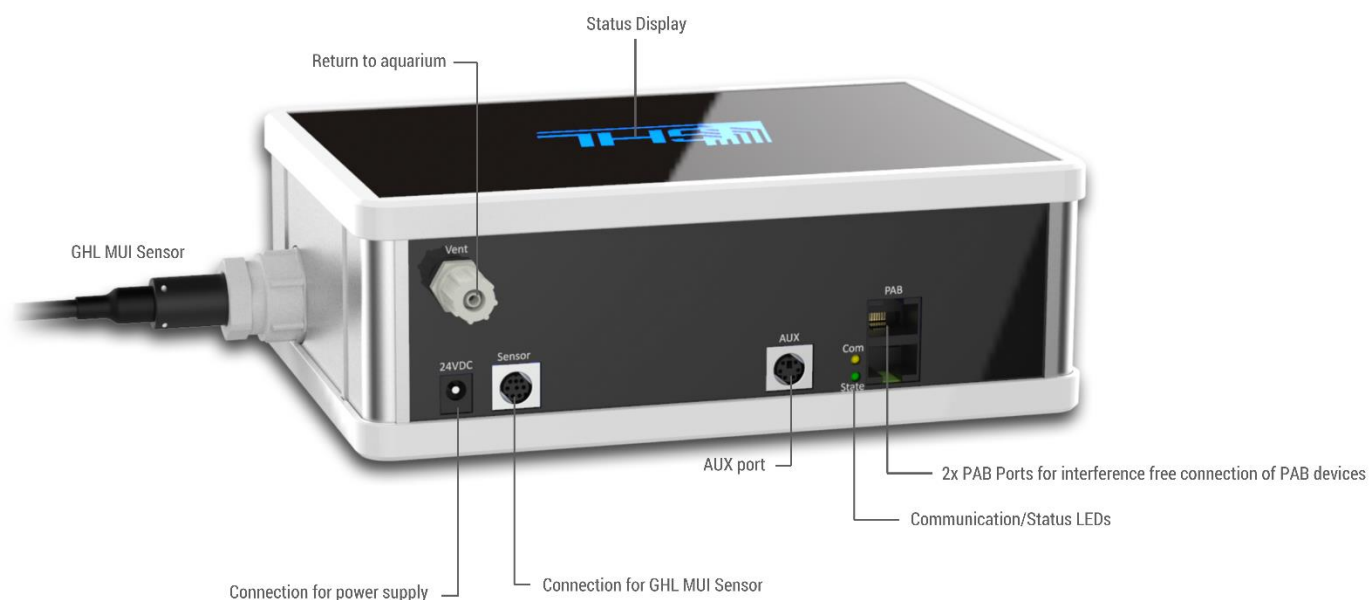


DANGER

- Incorrect connection (For example inserting a USB connector into a *PAB* connector) can lead to damaging the *ION Director®*.
- A repair caused by this, is not covered under warranty and will therefore incur repair charges.

3.2 Connection Overview

The *ION Director®* includes the following connection ports and displays:



3.2.1 MUI Sensor Connection

The supplied MUI sensor is connected to this eight-pin Mini-DIN socket.



DANGER

- The eight-pole Mini-DIN socket (MUI sensor input at IOND) as well as the eight-pole Mini-DIN plug (at MUI sensor) can easily be damaged permanently if not handled properly, e.g. when contacts are bent!
- Therefore, when plugging in the connector, make sure that the polarity respectively the orientation is correct (arrow on connector must be directed upwards)!
- The plug must be easy to insert, NEVER use force, insert with care!
- Mechanical damage to the plug and/or socket can lead to the destruction of the *ION Director®*!
- A repair caused by this, is not covered under warranty and will therefore incur repair charges.

**TIP**

- The sensor is sensitive to interference due to the low signal level. To obtain the best measurement results, it is therefore necessary to ensure sufficient distance between the sensor and its cable and sources of interference (e.g. ballasts, power lines, pumps, entertainment electronics, etc.).

3.2.2 PAB-Ports

PAB devices are connected to the black RJ45 Western sockets. These are on the one hand the control unit (*ProfiLux 3/4/4e* or *GHL Doser Standalone*), on the other hand possibly existing further slave devices. Please also refer to the instructions in the operating manual of the corresponding control unit.

3.2.3 AUX Port

This Mini-DIN socket can be used to connect devices with AUX plugs.

3.2.4 Return Vent

Return to the aquarium and ventilation.

3.2.5 Power Supply

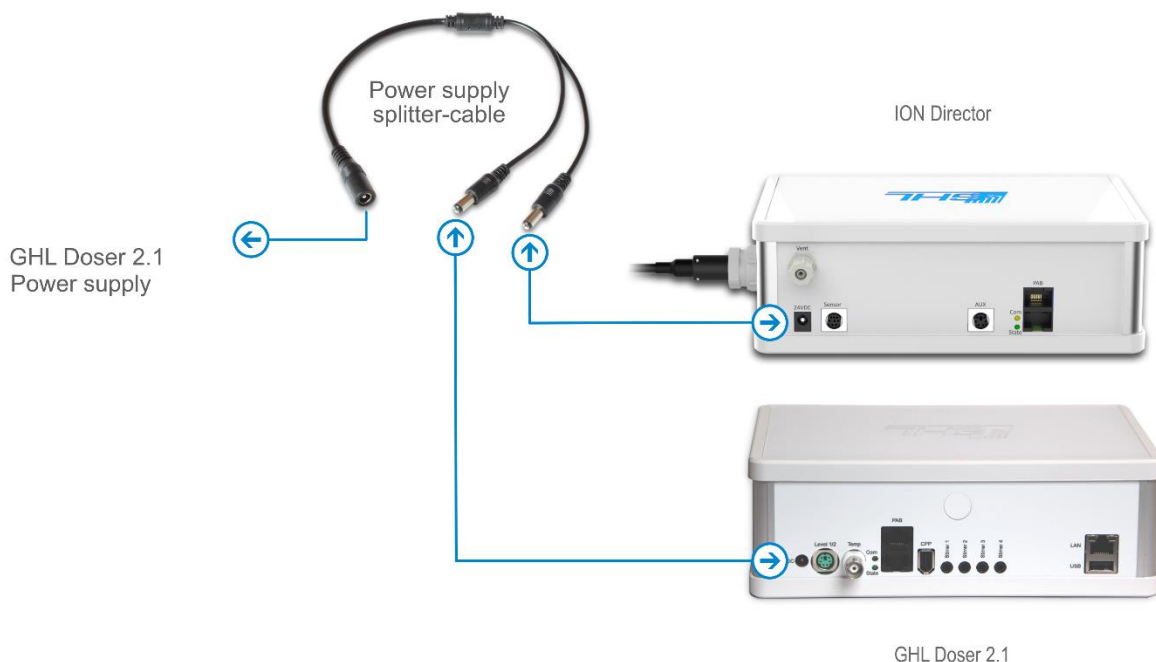
24 VDC hollow socket. The *ION Director®* does not have its own power supply. The device needs to be connected to the power supply of the *GHL Doser 2/2.1/2.2* via the power supply splitter-cable.

To install, first connect each Y-ends of the splitter cable to the DC-connector of the *ION Director®* (24 VDC, polarity: Inside +, outside -) and *GHL Doser 2/2.1/2.2*. Connect then the other end of the splitter to the main power supply of the Doser.

Please note that the *ION Director®* and the *GHL Doser* are operated with **24 V**, *ProfiLux* on the other hand runs with **12 V**. It is therefore not possible to tap the supply voltage for the *ION Director®* from the *ProfiLux*.

Never connect 12 V consumers to 24 V power supplies (or vice versa), this will inevitably lead to malfunction or destruction!

Use only the supplied original cables and power supplies for supplying power to the *ION Director®* device.



DANGER



- To establish the power supply, the supplied *Power supply splitter-cable* may only be connected to the *ION Director®* and to the *GHL Doser 2.1* (24 V consumer) and its power supply unit.
- Under no circumstances connect 12 V consumers (e.g. *ProfiLux*) to 24 V power supply units (or vice versa), this will inevitably lead to malfunction or destruction!
- A repair caused by this is not covered by warranty and is therefore subject to a charge.

4 Activation

4.1 Configuration Options

DANGER



For conveying the liquids (sample water and referenced) to the *ION Director®* only pumps of a *GHL Doser 2/2.1 Slave* or *Stand Alone* must be used!

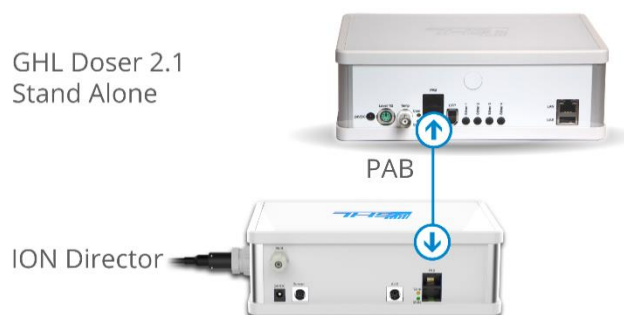
Never use other pumps for this purpose (also don't use pumps of the *GHL Doser Maxi*) – this may cause destruction of the *ION Director®*!

To operate the device, an additional control unit (*ProfiLux* from model 3, *GHL Doser Stand Alone* from model 2 or a *GHL Maxi Doser Stand Alone*) is required

4.1.1 Operation with GHL Doser 2/2.1/2.2 Stand Alone

The *ION Director®* is connected to the *GHL Doser 2/2.1/2.2 Stand Alone* via the ProfiLux Aquatic Bus (PAB).

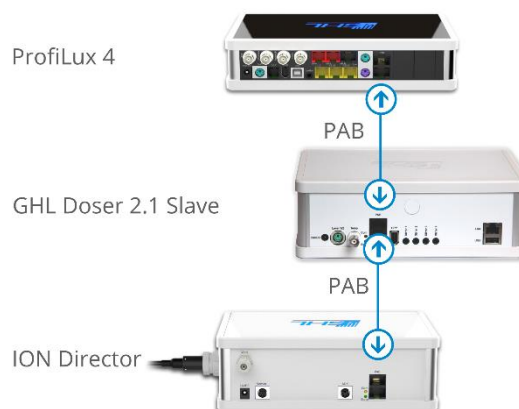
In this configuration, the *GHL Doser* has control over the measurement process: It controls its dosing pumps and the valve in the *ION Director®*, evaluates the measurement results, and calculates the measurement values.



4.1.2 Operation with ProfiLux Aquarium Controller and GHL Doser Maxi Stand Alone

The *ION Director®* is connected to the *ProfiLux 3/4* or a *GHL Doser Maxi Stand Alone* and a *GHL Doser 2/2.1/2.2 Slave* via the ProfiLux Aquatic Bus (PAB).

With this option, the *ProfiLux* or the *GHL Doser Maxi Stand Alone* has full control over the measuring process and behavior of both the *GHL Doser* and *ION Director®*. The *ProfiLux* or the *GHL Doser Maxi Stand Alone* will control the dosing pumps in the *Slave Doser* and the valve in the *ION Director®*. This will allow the controller to evaluate the measurement results and calculate the measurement values.



4.2 Establishing the PAB connection

As a PAB device, the *ION Director®* is connected via the PAB connection to the controller (*ProfiLux*, *GHL Doser 2/2.1/2.2 Stand-Alone* or *GHL Doser Maxi Stand Alone*).

PAB is an interference free CAN-Bus-System which allows for extremely secure data transfer between all *PAB* devices such as for example *ION Director®* and *GHL Doser 2/2.1/2.2*. The range can be up to 100 m (300 FT).

The required *PAB* cables are available in different lengths and are not included and must be purchased. The *IOND-Sets* do include a *PAB cable* for connecting the *IOND* to the included *Doser*.



TIP

- Be sure to obtain suitable *PAB* cables in the appropriate lengths to meet your needs.
- *PAB*-cables are available online at *GHL Store (EU)* and *GHL USA Shop (US)* in different lengths from 0.5 m up to 50 m.

To enable the operation of the *ION Director®*, the device needs to be assigned to the respective controller. For thorough information on how to assign *PAB* devices please refer to the corresponding Instruction manuals and our Knowledge Base on our website www.aquariumcomputer.com.

4.3 Status Indicators of the *ION Director®*

The *ION Director®* includes two status indicator lights which are located on the housing cover and the back of the device. These lights provide system status information at a glance.

4.3.1 System-Status- LED on the housing cover

The various colors can show you at a glance, the condition of your aquarium.

The color and blink codes shown depend on the particular Firmware.

For the meaning of the blink codes, please refer to the Knowledge Base at our website www.aquariumcomputer.com.

4.3.2 PAB Status LEDs on the Back Panel



Located on the back panel of the *ION Director®* are another two LEDs that provide information about PAB connection status and PAB communication status.

The upper yellow LED indicates proper communication within the *PAB* connection. The lower green LED provides information about the status of the *PAB* communication.

Status	Meaning
Yellow LED flashes	<i>ION Director®</i> receives <i>PAB</i> commands
Green LED is ON	<i>ION Director®</i> is ready for operation
Green LED flashes quickly	<i>ION Director®</i> is started, firmware update
Green LED flashes every second, yellow LED is OFF	<i>ION Director®</i> has not received <i>PAB</i> commands from <i>ProfiLux</i> , <i>GHL Doser SA</i> or <i>GHL Doser Maxi SA</i> for more than 30 seconds
Both LEDs are OFF	<i>ION Director®</i> has no supply voltage

4.4 Placing the ION Director®

To ensure safe and hazard-free operation, the following regulations must be followed! Failure to follow the safety guidelines will result in VOIDING your warranty. The manufacturer rejects any responsibility or liability for damages resulting from misuse!

Make sure that the IOND cannot be affected by electromagnetic interference sources!

The *ION Director®* is a highly sensitive electronic measuring device. To accurately determine ion concentration, it measures extremely low voltages with an accuracy of 10µV (that's a ten-thousandth of a volt). Although the IOND electronics is designed to be as interference

resistant as possible, electromagnetic interference can significantly disturb the measurements.

We therefore recommend placing the ION Director® as far as possible from potential sources of interference. Sources of interference are:

- Power supplies, ballasts, drivers
- Fluorescent and gas discharge lamps
- LED lights
- Pumps and other motors
- Other electrical and electronic devices
- Electrical cables to above mentioned sources of interference

In particular, third-party devices of non-optimal quality that do not comply with the permitted maximum emission limits can cause problems. If you detect interference, you can take these measures:

- Increase the distance to the interfering device (approx. 1 - 1.5m distance will usually be sufficient).
- If this is not possible, shielding may help (simple shielding plate or aluminum foil) ...
- ... or the exchange of the strong disturbing device.

GHL products such as ProfiLux, Doser, Expansion-Box as well as cables connected to them such as PAB cables and cables from the associated power supplies are not critical sources of interference due to their high-quality design and they comply with all emission standards, the ION Director® may be placed in their proximity. However, the power supplies belonging to these GHL products should also be placed at a distance. This also applies to all other sensors in general.

Use only the original supplied grounded power supplies for the operation of all GHL products. These meet all requirements regarding electromagnetic interference and are grounded so that external interference can be discharged against the ground potential of the wall outlet.

Place the device in a vibration-free location!

Vibrations can cause pressure changes in the measuring cell during the measurement, which in turn can cause voltage fluctuations at the sensor in the μV range and thus lead to impaired measurements. Vibrations are mainly generated by pumps. If vibrations or shocks during the measurement cannot be ruled out at the installation location, the ION Director® must be placed on a vibration-absorbing pad, e.g. on foam.

The device must be protected from water at all times!

The *ION Director®* as well as its accessories are destroyed by excess moisture or excess humidity - Please observe the technical data and notes below!

Mains voltage operated devices and water can become a dangerous combination. Therefore, it is essential to supply all mains voltage operated devices that are operated in or near the aquarium with mains voltage via an GFCI breaker!

In order to avoid any danger, all mains-operated devices must be disconnected from the mains; all plugs must be disconnected! When working in the aquarium, it can never be ruled out that a heating element, a pump, or a luminaire is defective.

If the device is placed inside an aquarium cabinet, make sure that it is placed in an area free from splashing water; moisture or liquids that can penetrate.

Please also note:



TIP

- Please ensure good access to the connections of the device
- Please consider the maximum cable lengths of the connected *PAB* cables, sensors etc. when selecting the installation site



WARNING

- To ensure proper operation, the connection cables should never be kinked, crimped, or positioned in an unsuitable way.

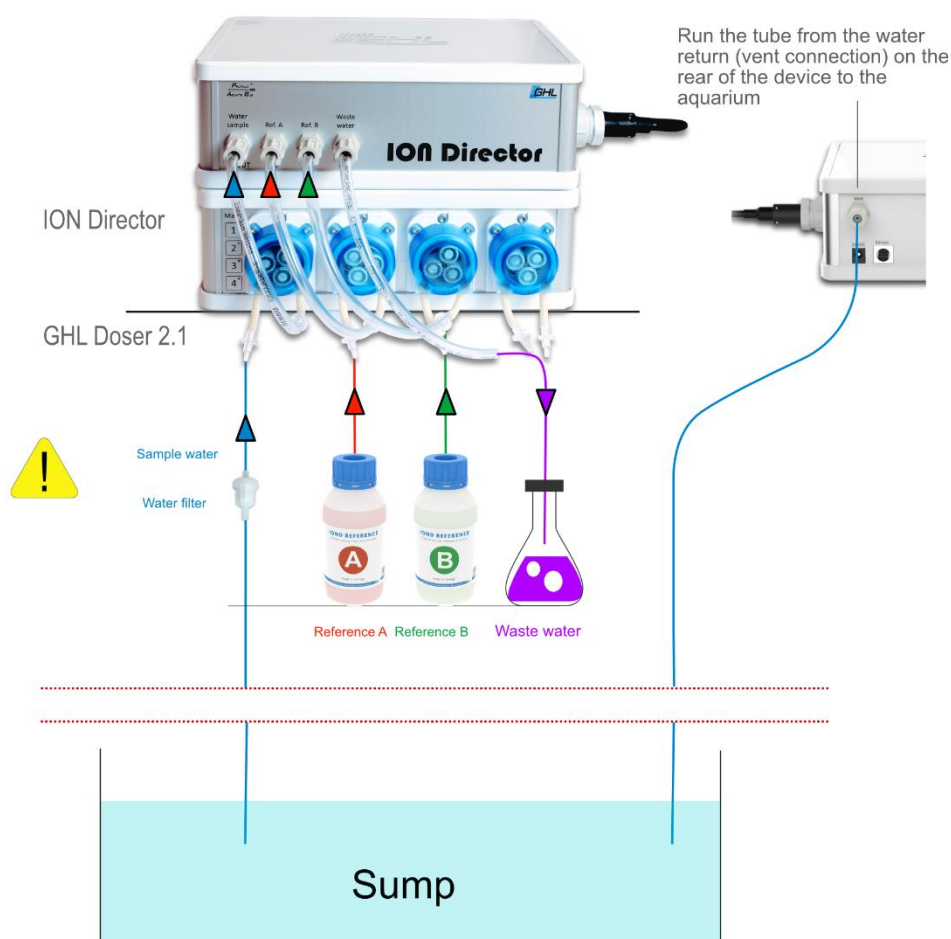


DANGER

- The *ION Director®* **must** be installed horizontally, with illuminated GHL logo facing upwards.
- The maximum deviation from the horizontal must not exceed $\pm 3^\circ$.
- **Only when installed correctly** an adequate measurement can be carried out.
- **The *ION Director®* may NEVER be used without a built-in MUI sensor!**

4.5 How it works

The figure to the side shows a schematic representation of the operating principle.



The 3 tube inlets on the front of the *ION Director®* are connected to 3 dosing pumps of a *GHF Doser 2/2.1/2.2*. The precise dosing pumps handle the conveying of the liquids.

After starting the measuring process, first the sample tube is completely refilled, the water previously present in the sample tube is returned to the aquarium (or the sump) through the connection on the back (*Vent*). This ensures that a fresh sample is always used for the measurement - and not older water that has been in the sample hose for a longer period of time - and that the measurement result actually reflects the current situation in the tank; in addition, no water is wasted during this flushing.

Afterwards, the sensor is calibrated and the measurement is carried out by slowly adding reference liquids and the sample water.

The sample water required for the measurement as well as the reference liquids are drained off as wastewater (through wastewater outlet on the front of the device), this wastewater must be collected in a separate container for later disposal.

Please note the following when installing the devices:

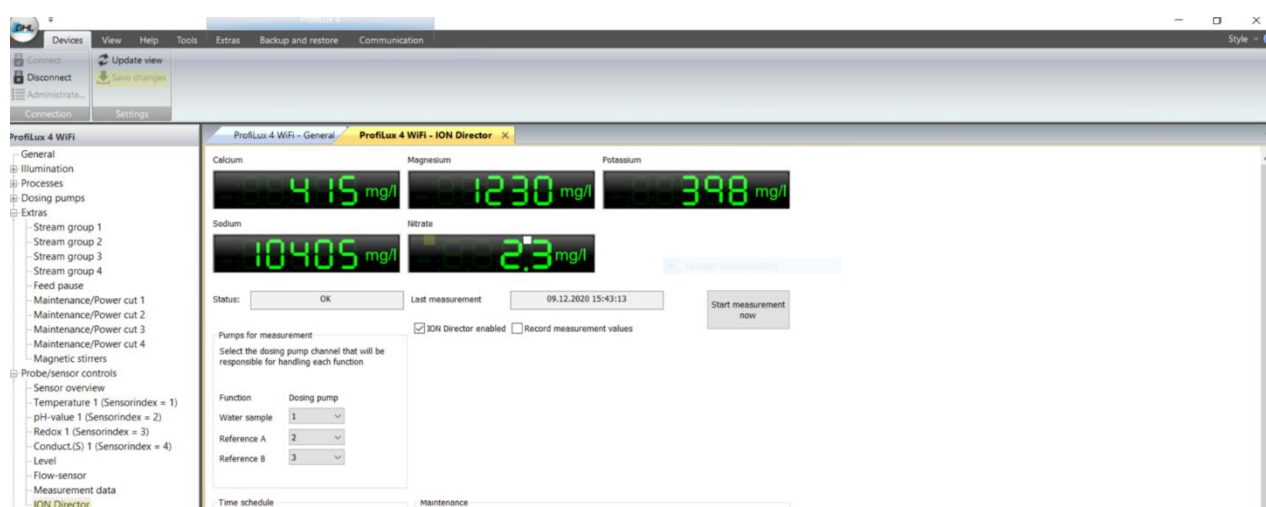


WARNING

- *ION Director®* and *GHL Doser* (as well as *ProfiLux* if present) must be positioned away and protected from splashing water and excess humidity!
- Splashing water/saltwater and or condensing humidity (e.g. occurring nearby the sump) will destroy the devices – this voids all warranty claims!
- **The waste water should generally be collected and disposed of. However, it may be returned into the tank if the quantities of reference liquids do not lead to significant or disturbing changes of salinity or filling level.**
- **You may lead the return of the sample water back into the tank.**

4.6 Selection and Assignment of the Pumps

In the *GCC* under *Probe/sensor controls*, select the category *ION Director*, check *ION Director enabled*. **Save the changes.**

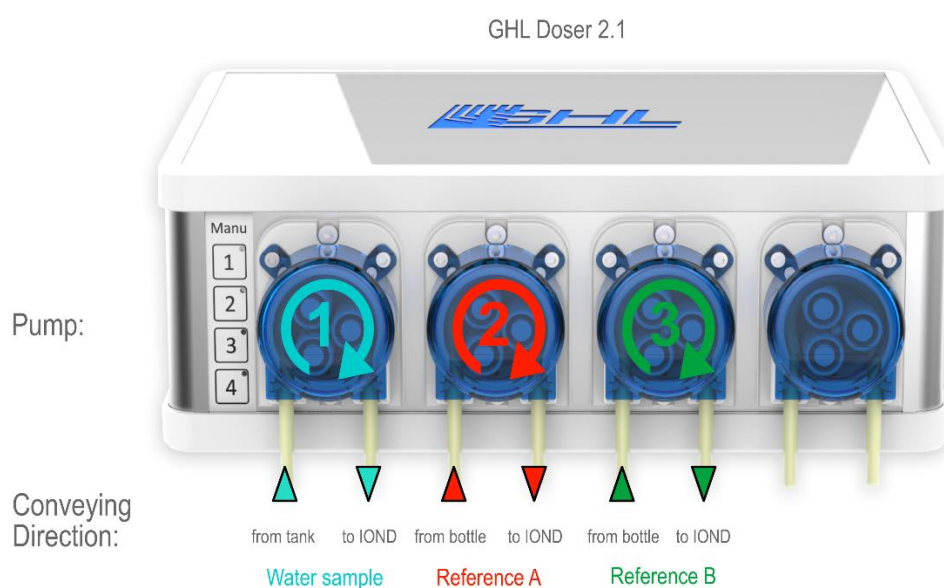




WARNING

When you changed settings for your device via the GCC, you must **always** save them using the "Save changes" button.

For the measurement, three pumps of the *GHL Doser 2/2.1/2.2* are required. As default, pumps 1-3 are preselected for the functions *Water sample*, *Reference A* and *Reference B*.



You can change that pump assignment. If you already have several Dosers in your system, then take care when numbering the pumps that one number is not assigned more than once.

4.7 Activation of the Pumps

1. Set the pump speeds required for the measurement, for all 3 pumps (water sample and references) to speed 3

Dosing -> Dose overview -> Dosing pump x (the pump you chose for the IOND) -> Pump settings -> Maximum Speed (3).

DANGER



- Please carry out the calibration carefully.
- The pump calibration has a direct influence on the precision of the measurement and control.
- The more precisely you perform the calibration, the more accurate the ION measurement can be.

2. Calibrate the selected pumps

3. Activate the fill level

For safety reasons, ION measurements are only started if it is ensured that there is at least 30 ml of each Reference solution for the measurement in the respective dosing container.

Enter the container capacity. For the pumps that deliver the reference fluids (here 2 and 3), the example shown here is 500 ml. You can also enter a minimum below which an alarm should be triggered. The container is emptied by dosing, therefore choose *Container is emptied*.

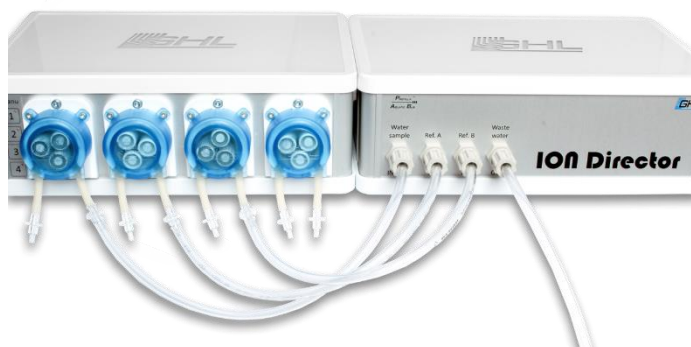
-> Save the changes.

The Doser calculates the fill level indicator according to the specified capacity of 500 ml and the filling level. If you choose a larger fluid container (for example, 1000 ml) at a later time, then you need to save that again, so that this capacity change can be taken into account in the level indicator.

To activate the level indicator, press the Refill container button and confirm with **OK**.

4.8 Installing the Tubes

You can place the *ION Director®* and the *GHL Doser 2/2.1/2.2* side by side or stack the devices.



Assembly stacked and next to each other

Please note that depending on the chosen mounting method you need different tube lengths between *IOND* and *Doser*. For orientation, you will find below a tabular overview of the recommended tube lengths.

Assembly	Water sample	Reference A	Reference B
stacked	16 cm (6.3")	17 cm (6.7")	18 cm (7.08")
side by side	26 cm (10.2")	23,5 cm (9.3")	21 cm (8.3")

TIP



Make a note of the lengths of the 2 water sample tubes (here: sump/tank to pump 1 and pump 1 to *ION Director®*) and add the two lengths. You will need this total tube length later when determining the *Sample tube volume*.

In order to achieve maximum measuring accuracy, it is necessary to keep the tube to the reference liquids as short as possible (in total max. 100 cm / 40").

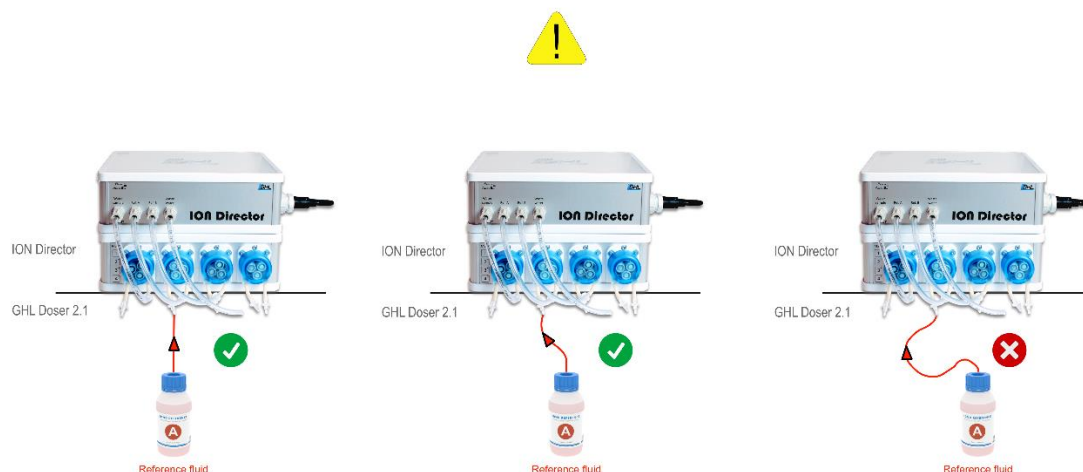
Insert the reference tubes through the pre-drilled screw caps provided and screw them onto the reference liquid bottles. The tube ends should just touch the bottom of the bottles. These screw caps must be used to avoid evaporation and excessive exchange with the ambient air, use of the reference bottles without caps as well as filling into other containers is not permitted, otherwise the measurement results will be impaired.

The bottles with the reference liquids must be protected from strong light, otherwise the chemical composition could change, which would affect the measurement accuracy. This applies to both operation and storage.

Replace the reference liquids before they are too empty and air is drawn in. The level indicators and the alarm functions of the corresponding pumps help you not to miss this moment.

Make sure that bubbles cannot collect anywhere in the tube, for example because the tube sags. The tube must therefore be routed steadily from the reference bottles to the corresponding dosing pump.

The sample tube must suck in clean water (i.e. after filtration) and must not suck in any air and must safely be sufficiently deep below the water surface at all times. Even small bubbles can lead to inaccurate measurement results or even premature sensor wear. The water sample must therefore not be drawn in in areas with a strong flow, e.g. near pumps, returns, skimmers. However, the water sample must also not be taken in "dead" corners where it may not be possible to collect a representative sample. Lightly flowed areas without visible turbulence and bubbles are ideal.



After connecting the tubes, the tubes of the pumps (here pumps 2 and 3), which feed the reference liquids, must be primed. This can be done manually using the buttons on the *GHl Doser 2/2.1/2.2*, via the app or via the *GCC* under *Manual dosing*. Pump until tubes are entirely primed.

ATTENTION



- Only the enclosed Flex PVC tubes may be used for all tube connections to and from the ION Director, this also applies to all tubes to and from the dosing pumps involved. If other tubes are used, too large air bubbles will develop, these will impair the measuring result and wear out the sensor prematurely.
- The sample tube must not suck in any air.
- Air bubbles in the measuring cell can lead to inaccurate measurement results or even premature sensor wear.

- Premature sensor wear due to above mentioned air in tubes or the measuring cell is not covered by the limited manufacturer's warranty for the sensor.
- Before activation, the connected reference tubes must be completely primed.
- Carefully perform the priming, otherwise accurate measurement results cannot be achieved.
- Guide the reference tubes in a way that no air bubbles can form during operation.
- The priming of the internal tubes will be done later (see *5 Carrying out the Measurement*).

4.8.1 Installing and maintain the water filter

Impurities in the sample water can damage the pump and the *ION-Director®*. Therefore, the use of our inline water filter (Art. No. PL-1610, 1x in scope of delivery) in the sample tubing between aquarium and sample water pump is mandatory. Please note the marking of the flow direction, it must point to the pump. A dirty filter will lead to poor or no measurement results, the filter must therefore be replaced in time. It is available as a spare part.

4.8.2 Installing the return tube

Connect a tube to the return outlet on the back of the *ION Director®*, which leads into the aquarium (or sump).



4.9 Preparation of the MUI Sensor

For optimal sensor performance, the active sensor tip (the front, slotted area) must be watered before mounting and using the sensor in the IOND.

Place the sensor in a suitable container and slowly fill it with tap water or deionized water (no salty water!) until the front sensor slot is completely submerged (marked below as **Min**), do not fill much more water than necessary for this (marked below as **Max**).

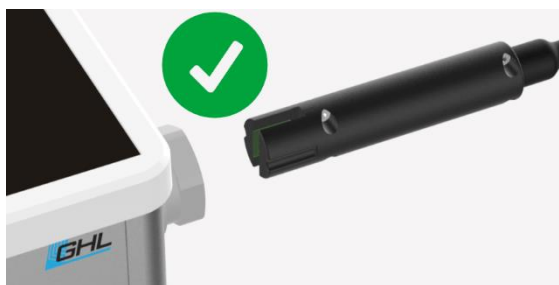
Allow the sensor to soak for at least 30 Minutes before proceeding to the next step.



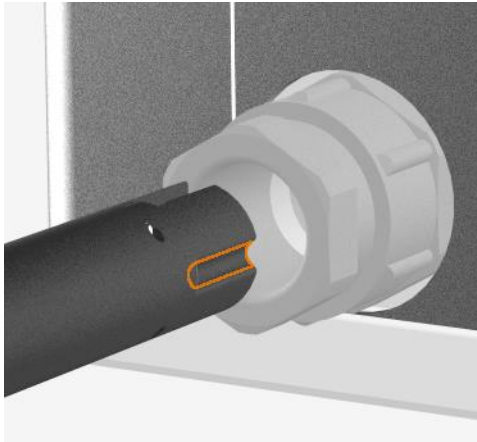
4.10 Installing the MUI Sensor

To install the sensor, the sensor shaft must be pushed into the measuring cell of the IOND. To do this, loosen the locking nut on the side of the device without unscrewing it completely.

Hold the sensor so that its front slot is aligned vertically and carefully slide it into the measuring cell.

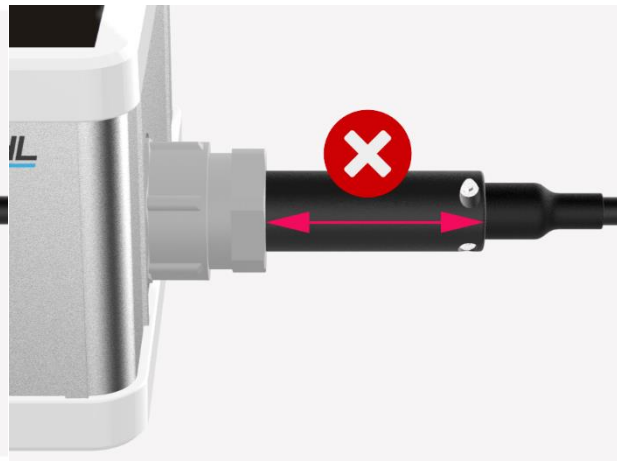


Note the guide grooves on the right and left of the sensor shaft, which ensure precise positioning.



Only if these

are met correctly the sensor can be pushed to the stop and thus sufficiently deep into the measuring cell. Be careful and do not use force.



Then tighten the nut again firmly.

Tighten the nut around the sensor as tight as possible to prevent water from escaping and air from entering the measuring cell, use a suitable tool for this (e.g. a 24 mm wrench).

- Escaping water due to insufficiently tightened nut will cause damage!
- Air entering due to insufficiently tightened nut leads to poor measurement results or even to early sensor aging!



TIP

To keep the rubber seal in the screw connection flexible and watertight, we recommend rubbing the inside of the seal thinly with Vaseline before installing the sensor, e.g. using a Q-tip. Do NOT remove the seal and do

NOT loosen the nut completely. Vaseline must not touch active sensor surfaces within the front slot.

DANGER



- Incorrect installation of the MUI sensor can destroy the *ION Director®*, the sensor and surrounding items!
- The *ION Director®* must NEVER be used without the installed MUI sensor!
- A defect caused by this - e.g. due to water leakage at the sensor - is not covered by warranty, repair or replacement is therefore subject to a charge

4.11 Connecting the Multi Ion Sensor

Plug the sensor plug into the socket *Sensor*.

DANGER



- Sensor plugs (as well as all plugs) must not be moist when connecting to the socket.
- The eight-pole Mini-DIN socket (MUI sensor input at IOND) as well as the eight-pole Mini-DIN plug (at MUI sensor) can easily be damaged irreparably if not handled properly, e.g. by bending contacts!
- Therefore, when plugging in the connector, make sure that the polarity is correct (arrow on connector must point upwards)!
- The plug must be easy to insert, NEVER use force, insert with care!
- Mechanical damage to the plug and/or socket can lead to the destruction of the *ION Director®*!
- A repair caused by this is not covered by warranty and is therefore subject to a repair charge.

4.12 Removing the Multi Ion Sensor

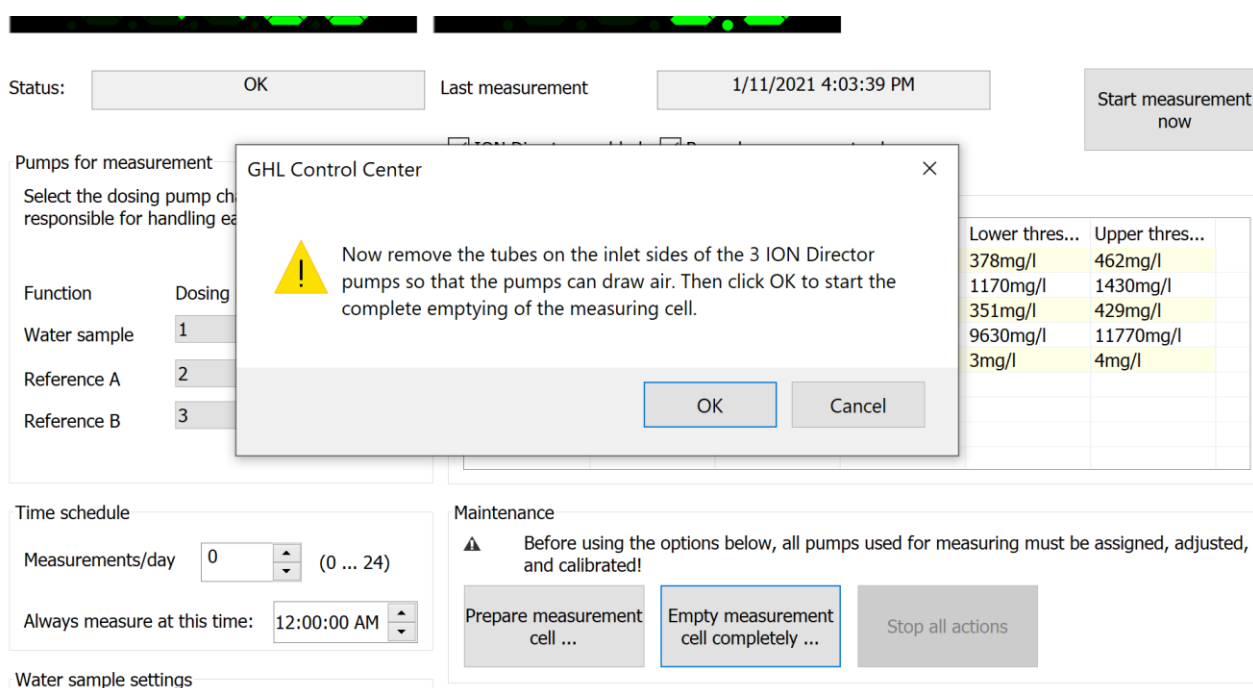
The measuring cell is normally always filled with liquid, therefore it is absolutely necessary to empty the measuring cell before the MUI sensor can be removed.

The IOND has the function *Empty measuring cell completely* for this purpose. Execute this function and follow the instructions (removing the tubes), then the sensor can be removed.

If you want to store the sensor for later use, the remaining salt water from the active sensor tip (the front, slotted area) must first be rinsed off with tap water or deionized water. This will prevent salt crusts from forming and damaging the sensor during storage. The active sensor tip should be kept dry during storage.

Please note that each wet-dry cycle will age the sensor faster, the sensor performance will degrade and the ideal lifetime may no longer be reached. Therefore, remove and store the sensor only in special cases.

When using a previously stored sensor again, prepare the sensor again as described in 4.9 *Preparation of the MUI Sensor*.



The screenshot shows the ION Director software interface. A warning dialog box titled "GHL Control Center" is displayed in the center. The dialog contains a yellow warning triangle icon and the following text: "Now remove the tubes on the inlet sides of the 3 ION Director pumps so that the pumps can draw air. Then click OK to start the complete emptying of the measuring cell." Below the text are "OK" and "Cancel" buttons. The background interface shows various settings sections: "Status" (OK), "Last measurement" (1/11/2021 4:03:39 PM), "Start measurement now" button, "Pumps for measurement" section with a table for dosing pumps, "Time schedule" section with "Measurements/day" (0) and "Always measure at this time" (12:00:00 AM), and "Maintenance" section with buttons for "Prepare measurement cell ...", "Empty measurement cell completely ...", and "Stop all actions".

Lower thres...	Upper thres...
378mg/l	462mg/l
1170mg/l	1430mg/l
351mg/l	429mg/l
9630mg/l	11770mg/l
3mg/l	4mg/l

Place a cloth under the sensor and the screw connection to catch any residual liquid. You can then loosen the nut (do not unscrew it completely) and remove the sensor.

DANGER



- The sensor must not be removed until the measuring cell has been emptied!
- If the sensor has been removed without emptying the measuring cell, the liquid in the measuring cell will leak out and may damage the IOND and any equipment underneath!
- A repair caused by this is not covered by warranty and is therefore subject to a repair charge.

5 Carrying out the Measurement

A measurement can be started *manually* or *automatically* every day at certain times. For details on the duration and accuracy of the measurement as well as the consumption of references and sample water, please refer to *11 Technical Data*.

Carry out manual and automatic measurements only when the MUI sensor is installed and the screw connection is screwed tight and watertight.

Also, to note before you start the measurements:

- Involved pumps must be correctly selected and calibrated.
- Sample tube volume must have been entered and measurement must have been prepared, both explained below.



HINT

The measurement is only started if at least 30 ml of each reference liquid is present!

5.1 Enter sample tube volume

The sample tube is automatically filled with fresh water and primed before a measurement. This ensures that an up-to-date reading is always determined.

Therefore, the *ION Director®* requires the exact *Sample tube volume*. When calculating the volume, you are supported by a built-in tool. Just click on the calculator next to the input field for the *Sample tube volume*. Enter the total tube length (including the sample tube between the *ION Director®* and the dosing pump and including the tube length of the dosing pump which is 12 cm / 4.2") that you have connected and confirm with **OK**.



HINT

The inline filter volume must be added. The GHL inline filter has a volume of 7 ml.

Example: The tube had a volume of 10 ml - then a sample tube volume of 17 ml has to be entered.

Calculate tube volume

Inner diameter: mm

Length: ☒ cm ☐ inch

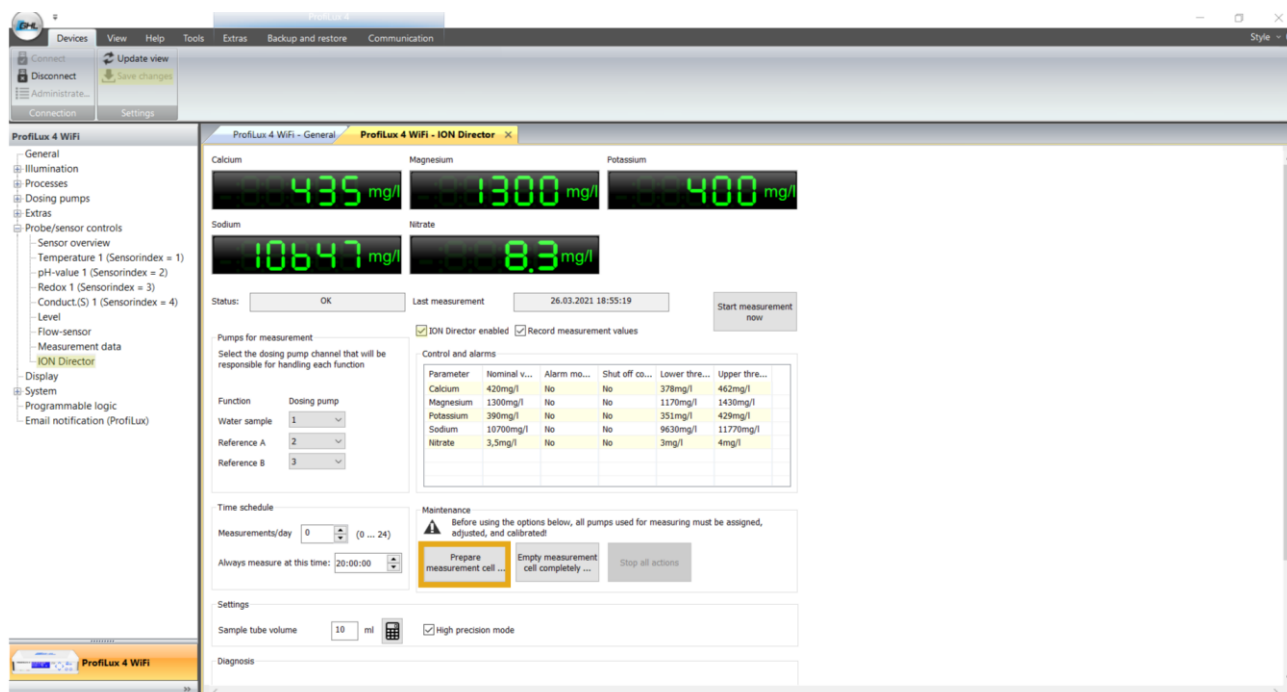
Calculated volume: ml

5.2 Prepare measurement

Before the initial measurement, the Measurement cell needs to be prepared. Click *Prepare Measurement cell*, subsequently IOND does this:

- ➔ The measuring cell and the internal tubes are primed
- ➔ The measuring cell is prepared for the measurement

After this step you have to wait at least **12 hours** for the **FIRST** measurement; the sensor needs this time for stabilization to be able to deliver precise results. After that, measurements can be performed at any time.



The screenshot displays the ION Director software interface. The top menu bar includes 'Devices', 'View', 'Help', 'Tools', 'Extras', 'Backup and restore', and 'Communication'. The left sidebar shows a tree view with categories like 'General', 'Illumination', 'Processes', 'Dosing pumps', 'Extras', 'Probe/sensor controls', 'Sensor overview', 'Measurement data', 'Display', 'System', 'Programmable logic', and 'Email notification (Profilux)'. The main window is titled 'Profilux 4 WiFi - General' and 'Profilux 4 WiFi - ION Director'. It shows real-time measurement data for Calcium (435 mg/l), Magnesium (1300 mg/l), Potassium (400 mg/l), Sodium (10647 mg/l), and Nitrate (8.3 mg/l). Below the data, there are sections for 'Status' (OK), 'Last measurement' (26.03.2021 18:55:19), and 'Start measurement now'. A 'Pumps for measurement' section allows selecting a dosing pump channel. A 'Control and alarms' table lists parameters and their status. A 'Time schedule' section shows measurements per day and a time to always measure. A 'Maintenance' section includes a warning and buttons for 'Prepare measurement cell', 'Empty measurement cell completely', and 'Stop all actions'. A 'Settings' section shows 'Sample tube volume' (10 ml) and 'High precision mode' (checked). A 'Diagnosis' section is at the bottom.

Parameter	Nominal v...	Alarm mo...	Shut off co...	Lower thre...	Upper thre...
Calcium	420mg/l	No	No	378mg/l	462mg/l
Magnesium	1300mg/l	No	No	1170mg/l	1430mg/l
Potassium	390mg/l	No	No	351mg/l	429mg/l
Sodium	10700mg/l	No	No	9630mg/l	11770mg/l
Nitrate	3,5mg/l	No	No	3mg/l	4mg/l



WARNING

The **FIRST** measurement can only be performed after at least **12 hours** after preparation of the measuring cell!

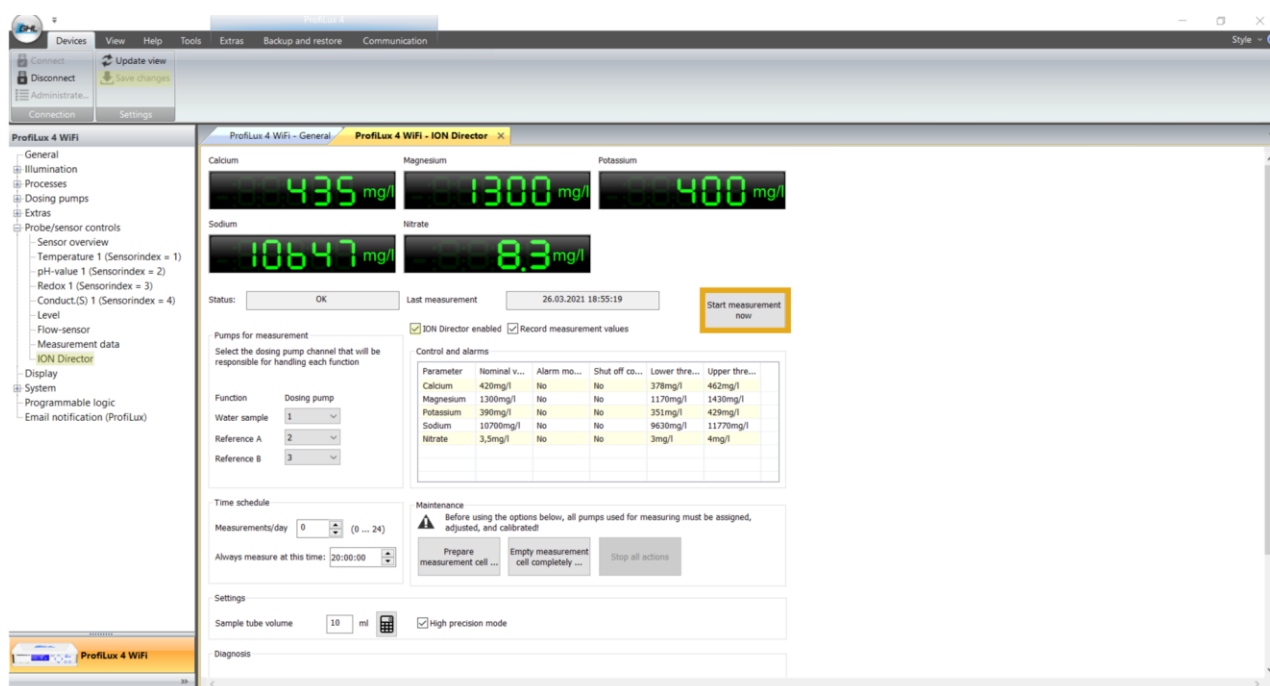


DANGER

- The sample water tube must always take water from an area free of sediment, dirt and air bubbles! Dirt and/or sediment will damage BOTH the dosing pumps and the IOND! In these cases, the IOND will no longer provide a correct measurement. The water sample tube must be positioned carefully so that only clean water is pumped into the IOND.
- A filter must be installed before the water sample pump!
- **Damages, caused by dirty sample water, are not covered by warranty.**
- It must always be ensured that there are no air bubbles in the sample tubes, as these falsify the measurement result.
- Make sure that the tubes cannot draw air during operation.
- If you detect air in the hoses, prime them and then perform 5.2 *Prepare measurement again*.

5.3 Manual measurement

The measurement can be started via the button *Start measurement now*.



5.4 Daily automated measurement

If you want to carry out automatic measurements daily, you can define a *Time schedule*.

Measurements/day

As often (1 to 24) is measured daily at equal intervals

Always measure at this time

This allows you to select a time to always be measured. The other times are adjusted accordingly.



EXAMPLE

- You want to measure twice a day at 07:00 and 19:00.
 1. Set for *Measurements per day* = 2
 2. For *Always measure at this time*, set 07:00 (the second time is automatically: $07:00 + 24\text{h} / 2 = 19:00$)



NOTE

- In most cases, it will not be necessary to measure more than once or twice a day. If the dosing pumps regulating the parameters are used correctly and the control procedure explained below is followed, sufficiently stable parameters can be reached.
- The more often you measure, the more reference fluids will be consumed.

5.5 Alarm

The *ION Director®* can monitor the measured parameters and, if necessary, display alarms. To do this, activate the alarm monitoring and specify the *Lower* and the *Upper limit* for the permissible values. If measured values are outside these thresholds an alarm is triggered.

If, for safety reasons, you wish to switch off the corresponding control in the event of an alarm, then check *Deactivate control during alarm*.

6 Control

Depending on the differences between the desired *Nominal values* and the measured actual values (= control differences), measures can be taken that raise or lower these values.

The control is either via the influence of one or more dosing pumps and/or via switching of sockets. Set the desired nominal values and chose one or more control methods.

6.1 Simple control: Switching sockets

This option is only available if switchable sockets (controlled via ProfiLux 3 or 4) are present in the system.

This control method is explained in more detail in the corresponding Knowledge Base article, which you can find on our website www.aquariumcomputer.com.

6.2 Control via dosing pumps

This control method is explained in more detail in the corresponding Knowledge Base article, which you can find on our website www.aquariumcomputer.com.

7 Measurement accuracy

The *ION Director®* gives you the best possible accuracy for a measuring device of this class.

In many trials, the measurement process, the measurement electronics and the mechanical design have been optimized to such an extent that the *ION Director®* can supply very precise measurement results. Nevertheless, small measuring tolerances, as they occur in all measuring devices, cannot be completely avoided.

You as a user can make a significant contribution to achieving the maximum measurement accuracy the *ION Director®* can offer by ensuring the following optimal starting conditions:

- Accurate calibration of the dosing pumps involved in the measurement
- Shortest possible tubes between dosing pumps and *ION Director®* as well as between reference containers and dosing pumps
- Careful priming of reference liquid tubes

For details on the duration and accuracy of the measurement as well as the consumption of references and sample water, please refer to *11 Technical Data*.

7.1 What does the measuring tolerance mean in practice?

On closer consideration, one comes to the conclusion that the relatively low measurement tolerance (potential deviation from the real value) of the *ION Director®* does not play a significant role for the application. Why is this so?

- A slight deviation of the measurement result from the real value has no harmful effects, provided that the target values are in the ideal range.
- Daily visible fluctuations of the individual parameters are normal and unproblematic, whereas longer significant overshoots or undershoots of the optimal range may well be harmful.

- Many commonly used measuring methods, e.g. test kits, offer at best a reproducibility of 5% under real conditions, an actual tolerance of 10% or more is not uncommon.
- When regulating the individual parameters, it is not important that a specific value is permanently maintained to the ppm level; rather, it is important that the parameters are within an optimal range.

7.2 Comparison with other measurements

Our investigations have shown that different measuring methods (droplet tests or measuring devices from various manufacturers) do not provide consistent results.

In most cases, even several successive measurements with the same equipment show more or less deviating results. It is therefore difficult to judge which result is the "correct" one.

This is where the *ION Director®* shows another strength: The measurement process is always exactly the same, the results are calculated exactly according to scientific principles and are more reproducible than with most other methods.

7.3 Conclusion

Every measurement is subject to tolerances, yet the *ION Director®* delivers a high degree of precision when used with care.

For effective measurement and control (if used), we recommend the following:

1. ensure that the measurement achieves reasonable accuracy with appropriate effort.
2. adjust the control for each parameter (or manually dose in such a way) that the desired optimum ranges are maintained.
3. do not select these ranges too narrowly.

8 Maintenance

The *ION Director®* is largely maintenance-free. It is recommended to clean the device from dust and other contaminants.

Check filters and tubes regularly. Replace them if they are dirty or covered with algae or bacteria. Use only our Flex PVC tubes for all tubes to and from the IOND and its pumps.

Tubes, pumps and motors are wearing parts, the service life depends on the frequency of use, the flow rates and the ambient conditions.

In the event of malfunction (for example, inadequate fluid delivery, loss of suction, leakage, increased operating noise) or mechanical failure, these must be replaced.

Due to the maintenance-friendly design, all wear parts can be easily replaced by yourself, all wearing parts are available as accessories.

9 Warranty/Liability

You have a 2-year warranty beginning from invoice date. This applies to material and manufacturing defects (normal wear and tear, such as occurs with sensors, is not subject to the warranty). Wear parts may be covered by a different limited warranty, which can be found in the instructions for the corresponding item.

We guarantee that the supplied products correspond to the specifications and that the products do not have material resp. manufacturing defects. For the accuracy of the manuals, we do not guarantee damages of any kind which result from improper operation or from an unsuitable environment. Furthermore, we do not take over warranty for damages that are caused by a false connection or excessive humidity. We assume no liability for direct damages, indirect damages, consequential damages and third-party damages as far as it is legally permitted. We do not take over guarantee that our product package corresponds to the requirements of the buyer. Our warranty expires if the delivered original product is damaged or modified.

10 Additional Information

10.1 Help and Information

Help and further information can be found on our website www.aquariumcomputer.com (where you can use our Knowledge Base, our Download Area and our Support Forum, among other things, free of charge), or from the dealer from whom you purchased the device.

10.2 Firmware-Update



DANGER

- Be sure to back up your data **before** updating!
- You can use the menu item "Backup and Restore" -> "Transmit all settings from GHL Device to file" and load them again after the successful update via "Transmit from file to GHL Device".

The firmware of your *GHL Devices* is constantly being further developed. If you want to use new features that are not supported by your current firmware, you can update your device.

For the update, you need the PC program *GHL Control Center*, which can be downloaded free of charge from our website www.aquariumcomputer.com.

Instructions for updating firmware can be found from our website.

10.3 Troubleshooting

If no or only poor measurement results are achieved:

The IOND determines a so-called sensor performance for each measurement. If this becomes too low, no more measurement results can be acquired.

Often it is not the sensor that is responsible for decreasing performance, but other conditions. Before replacing the sensor, first check the following possibilities:

- Tubes and/or filter dirty – Replace
- Reference liquids no longer ideal, e.g. due to temperature and light influences, contamination – Replace
- Dosing quantities for references and sample too low due to too high pump calibration - Correct calibration
- Measurements too infrequent, tubes too long, thus too much air can collect - Measure at least 1x day, tubes as short as possible, see chapter Tubes
- Air penetrates at sensor into measuring cell - Thinly apply petroleum jelly to sensor shaft at sealing position, tighten sensor screw connection sufficiently
- Sensor dirty - Remove, carefully rinse sensor tip with fresh water, leave sensor tip in fresh water overnight, then prepare measuring cell again (as for initial start-up)
- Follow sensor operating instructions
- Concentrations of the ions to be measured are far outside the optimal range for seawater - bring aquarium water into normal range

You can find more help on problem solving on our website.

11 Technical Data

Input voltage	24 VDC
Environmental conditions	Operating temperature: 0°C - 40°C / 32°F - 104°F Humidity: Max 80% rel. Humidity <u>non-condensing</u>
Current consumption	200 mA max.
Dimensions	220 mm (8.7") x 150 mm (5.9") x 75 mm (3.0") (without MUI sensor) 290 mm (11.5") x 150 mm (5.9") x 75 mm (3.0") (with MUI sensor)

Measuring range

The ION Director has been designed to provide optimum results in the relevant measuring range. The total measuring range is larger than the optimum range in order to be able to detect fluctuations beyond it, at least in tendency. If the total measuring range is exceeded or under-run, the displayed value is frozen at the corresponding limit, which means that changes outside the total measuring range cannot be detected.

Parameter	Optimal measurement range min. [ppm]	Optimal measurement range max. [ppm]	Total measurement range min. [ppm]	Total measurement range max. [ppm]
Ca	378	462	315	525
Mg	1170	1430	975	1625
K	351	429	293	488
Na	9630	11770	8025	13375
NO3	3	15	0	50

	Normal mode	High-precision mode
Consumption of each reference per measurement	9 ml	13 ml
Consumption of sample water per measurement	14 ml	21 ml
Measurement duration	24 min	30 min
Typ. measurement accuracy (repeatability) rel. to meas. value *)	±3% resp. ±3 ppm (largest value)	±2% resp. ±2 ppm (largest value)

*) Specification for measurement in the optimized measuring range, higher deviations possible if actual values are outside the optimized measuring range

