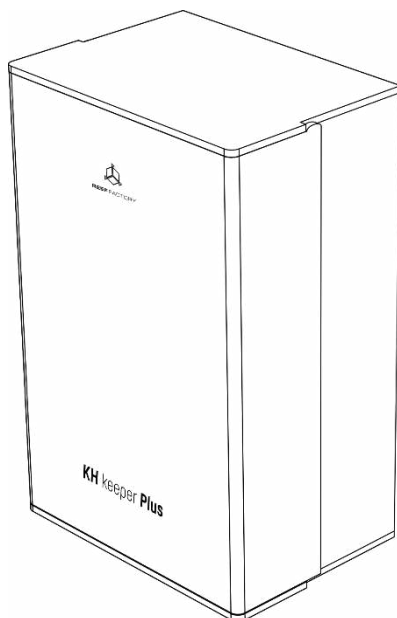




User manual

version 1.3.1



KH keeper

KH keeper Plus

Dear Customer, **thank you** for your purchase.



ENGLISH

www.reeffactory.com



Table of contents

I. Contents of the KH keeper device kit	4
II. Assembly and disassembly of the glass beaker (applicable to KH keeper device)	6
III. Assembly and disassembly of the glass beaker (applicable to KH keeper Plus device).....	7
IV. Preparation of the reagent.....	8
V. Installation of the KH keeper device.....	10
VI. Initial configuration of KH keeper device	13
VII. Configuration of the KH keeper operation.....	14
VIII. KH keeper functions.....	22
IX. Calibration procedure.....	24
X. Error signals	37
XI. Resetting the device	38
XII. Smart Reef system.....	39
XIII. Technical problems and their possible causes	40
XIV. Dedicated power adapter - user guide.....	42



IMPORTANT INFORMATION: Please read the entire manual very carefully before setting up and using the device. There may be some slight differences between the information displayed on the screen of the device and the descriptions in the manual. This manual contains information about the functions of the device with the latest firmware version installed. The firmware version is always displayed in the bottom right corner of the screen, below the product serial number. If your firmware version is older, update your device firmware to access the latest features.



Do you need our help? Write to support@reeffactory.com

**IMPORTANT INFORMATION: RECOMMENDATION FOR THE pH PROBE**

When starting the device for the first time, or after a prolonged period of inactivity, place the pH probe in aquarium water (brine) for 30 minutes and then take several test measurements.

**IMPORTANT INFORMATION: RECOMMENDATION FOR THE REAGENT**

Remember to stir the reagent used to measure the KH value at least once a week. Otherwise, its concentration may be unstable.

**IMPORTANT INFORMATION: DEVICE INFORMATION**

The KH keeper Plus device is a newer version of the device used to measure the KH value. Its functionality range and measurement accuracy are the same as the KH keeper device. Therefore, further on in this manual we will refer to both these devices as KH keeper.

**ATTENTION: UNPACKING**

During transportation, protective packaging was used to protect the appliance against any damage. After unpacking, please dispose of all elements of packaging in a way that will not cause damage to the environment. All materials used for packaging the appliance are environmentally friendly; they are 100% recyclable and are marked with the appropriate symbol. Caution! During unpacking, the packaging materials (polythene bags, polystyrene pieces, etc.) should be kept out of reach of children.

**ATTENTION: DISPOSAL OF THE APPLIANCE**

Old appliances should not simply be disposed of with normal household waste, but should be delivered to a collection and recycling centre for electric and electronic equipment. A symbol shown on the product, the instruction manual or the packaging shows that it is suitable for recycling. Materials used inside the appliance are recyclable and are labelled with information concerning this. By recycling materials or other parts from used devices you are making a significant contribution to the protection of our environment. Information on appropriate disposal centres for used devices can be provided by your local authority

I. Contents of the KH keeper device kit

The following items are included with your KH keeper device [see graphic below]:

- condensed reagent designed for the KH keeper device (to be mixed with RO water at a ratio of 1:9 [1]);
- two calibration solutions - pH4 and pH7 [2 and 3];
- glass beaker installed on the device to measure the KH value;
- magnetic stirrer [packed in a bag];
- spare connection tubes in a bag [4];
- scale [5];
- magnet used to reset the device [6];
- set of two tubes [7 and 8] 2/5 mm in diameter: the first one with a water filter should be used to connect the pump which draws water from the aquarium [it should be connected to the connector marked 4 in the graphic below] and the second one without a water filter should be used to connect the pump which removes water after the measurement is completed [it should be connected to the connector marked 6 in the graphic below];
- 1/3 mm tube [9] used for drawing the reagent, together with a separate plastic tube [both of these elements should be connected to the connector marked 5 in the graphic below];
- 12 V power adapter [10].



IMPORTANT INFORMATION: DEVICE INFORMATION

We recommend using the shortest tube length possible. Tubes with a diameter of 2/5 mm should not be longer than 150 cm, while the tube used for drawing the reagent should not be longer than 75 cm. Remember that any change in the tube length affects the amount of fluid dispensed and requires recalibration of the device. Remember to cut the tubes to the correct length before calibrating the device.



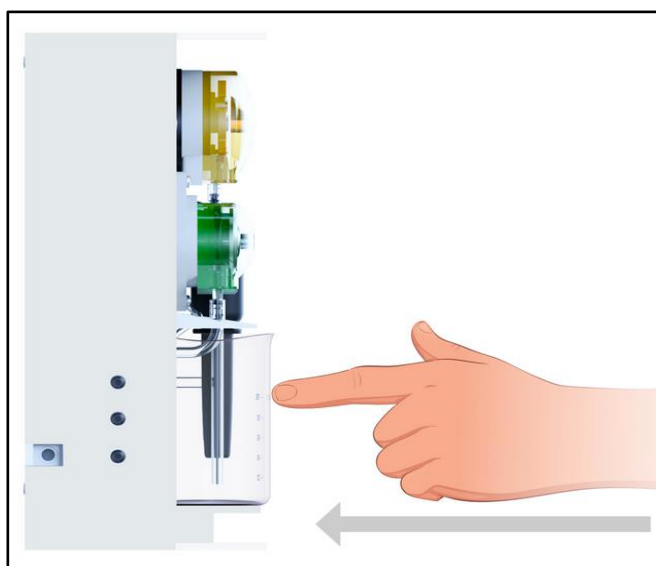
II. Assembly and disassembly of the glass beaker (applicable to KH keeper device)

1. If there is a need to clean the device or to disassemble the glass beaker please follow the steps below:
 - Gently push the pH probe [A] out of the plastic holder.
 - Gently push the pump's connector out of the plastic holder on the right side of the beaker - this pump is used to draw water out of the aquarium. Be careful not to damage the tube [B].
 - Gently push the pump's connector out of the plastic holder on the left side of the beaker - this pump is used to remove water from the beaker after the measurement. Be careful not to damage the tube [C].
 - Gently push out the glass beaker [D], being careful not to lose the magnetic stirrer [E] located in the glass beaker.
 - Remember to leave the piece of plastic that is under the glass beaker. It keeps the beaker in place and it gives the plastic tubes adequate reach.
2. When reassembling the glass beaker, follow the instructions given above but in reverse order. When attaching the probe, insert it into the slot in the holder, lower it as far as possible and press it from below with a rubber cap. Try to keep the probe mounted as close to the vertical position as possible.



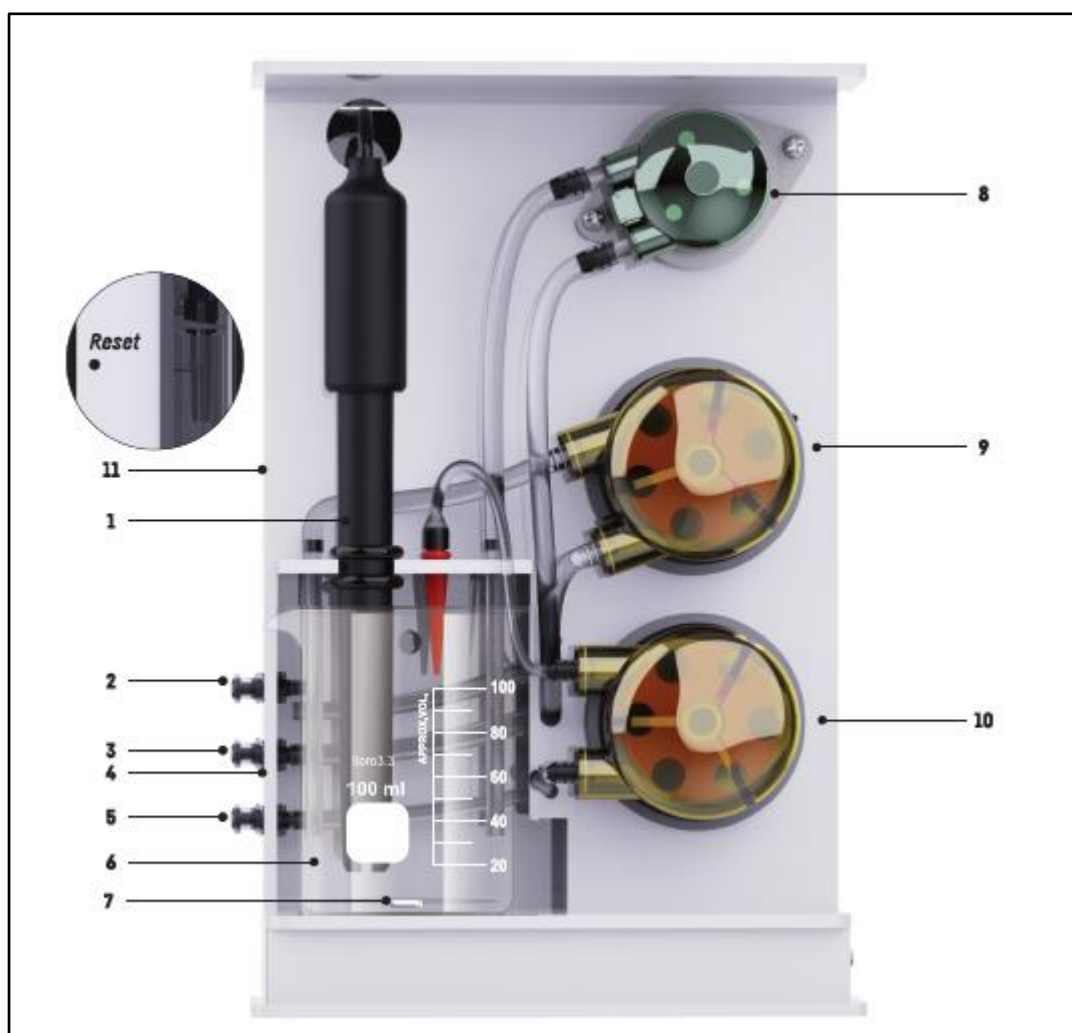
IMPORTANT INFORMATION: DEVICE INFORMATION

It is very important to properly (maximally) align the beaker with the back wall of the device. Incorrect positioning of the beaker may prevent the magnetic stirrer from moving and cause an incorrect measurement of the KH value. After each installation of the glass beaker in the device, test the magnetic stirrer operation by selecting its rotation speed in the device functions (by selecting the stirring function).



III. Assembly and disassembly of the glass beaker (applicable to KH keeper Plus device)

1. If there is a need to clean the device or to disassemble the glass beaker please follow the steps below:
 - Slide the tubes installed in the beaker and the reagent dispenser (red plastic dispensing needle) upward.
 - Gently push the pH probe [1] out of the holder.
 - Gently push the glass beaker [6] out. Be careful not to lose the magnetic stirrer [7] that is in the glass beaker.



IV. Preparation of the reagent

Make sure that you have purchased a dedicated Reef Factory reagent for taking measurements with the device. It must be purchased separately because it is not included with the device. If you do not have a dedicated reagent, measurement will not be possible [the result will be incorrect]. Our reagent is condensed and needs to be diluted at a ratio of 1:9 in RO water. This means that the preparation of 1 liter of reagent solution for measurements requires 100 ml of the condensed reagent to be mixed with 900 ml of RO water. The following table contains the values needed to help you correctly prepare your reagent.



IMPORTANT INFORMATION: RECOMMENDATION FOR THE REAGENT

Remember to stir the reagent used to measure the KH value at least once a week. Otherwise, its concentration may be unstable.

Table for easy preparation of the reagent		
Container capacity (liters)	Condensed reagent amount (liters)	RO water amount (liters)
1	0.1	0.9
2	0.2	1.8
2.5	0.25	2.25
5	0.5	4.5
10	1	9
25	2.5	22.5

You can use KH/Alk Profi Test from Salifert to verify the reagent solution you've prepared. To do this, first, take a measure using Salifert kit for the KH measurement and then repeat the manual KH measure using Salifert kit, but instead of using a Salifert reagent use the Reef Factory reagent solution you've prepared. You can then verify the result comparing the amount of Salifert and Reef Factory reagent that was left in the syringe. Please use the table below.

Reagent RF	Reagent Salifert	Result dKH	Reagent RF	Reagent Salifert	Result dKH	Reagent RF	Reagent Salifert	Result dKH	Reagent RF	Reagent Salifert	Result dKH
0,10	0,22	12,1	0,31	0,38	9,6	0,52	0,54	7,0	0,73	0,70	4,5
0,12	0,24	11,8	0,33	0,40	9,3	0,55	0,56	6,7	0,76	0,72	4,1
0,15	0,26	11,5	0,36	0,42	8,9	0,57	0,58	6,4	0,79	0,74	3,8
0,17	0,28	11,2	0,39	0,44	8,6	0,60	0,60	6,1	0,81	0,76	3,5
0,20	0,30	10,9	0,41	0,46	8,3	0,63	0,62	5,7	0,84	0,78	3,2
0,23	0,32	10,5	0,44	0,48	8,0	0,65	0,64	5,4	0,87	0,80	2,8
0,26	0,34	10,2	0,46	0,50	7,7	0,68	0,66	5,1	0,89	0,82	2,5
0,28	0,36	9,9	0,50	0,52	7,3	0,70	0,68	4,8	0,92	0,84	2,2

Remember that the measure taken with the syringe and dropper is not accurate. Because of that, the results of the measurements may be slightly different than the values listed in the table.

Example: I took the measurement using Salifert kit. The amount of Salifert reagent that was left in the syringe is 0,42 ml, which means that the measured KH value is 8,9 dKH. Then, I take this same measure using Salifert kit, but instead I use the Reef Factory reagent. With the Reef Factory the amount left should be around 0,36 ml. It means that the reagent was prepared and mixed in correct proportions. Remember, that the values listed in the table are indicative and the dropper method is not very accurate.

Reagent RF	Reagent Salifert	Wynik dKH
0,31	0,38	9,6
0,33	0,40	9,3
0,36	0,42	8,9
0,39	0,44	8,6
0,41	0,46	8,3
0,44	0,48	8,0
0,46	0,50	7,7
0,50	0,52	7,3

V. Installation of the KH keeper device

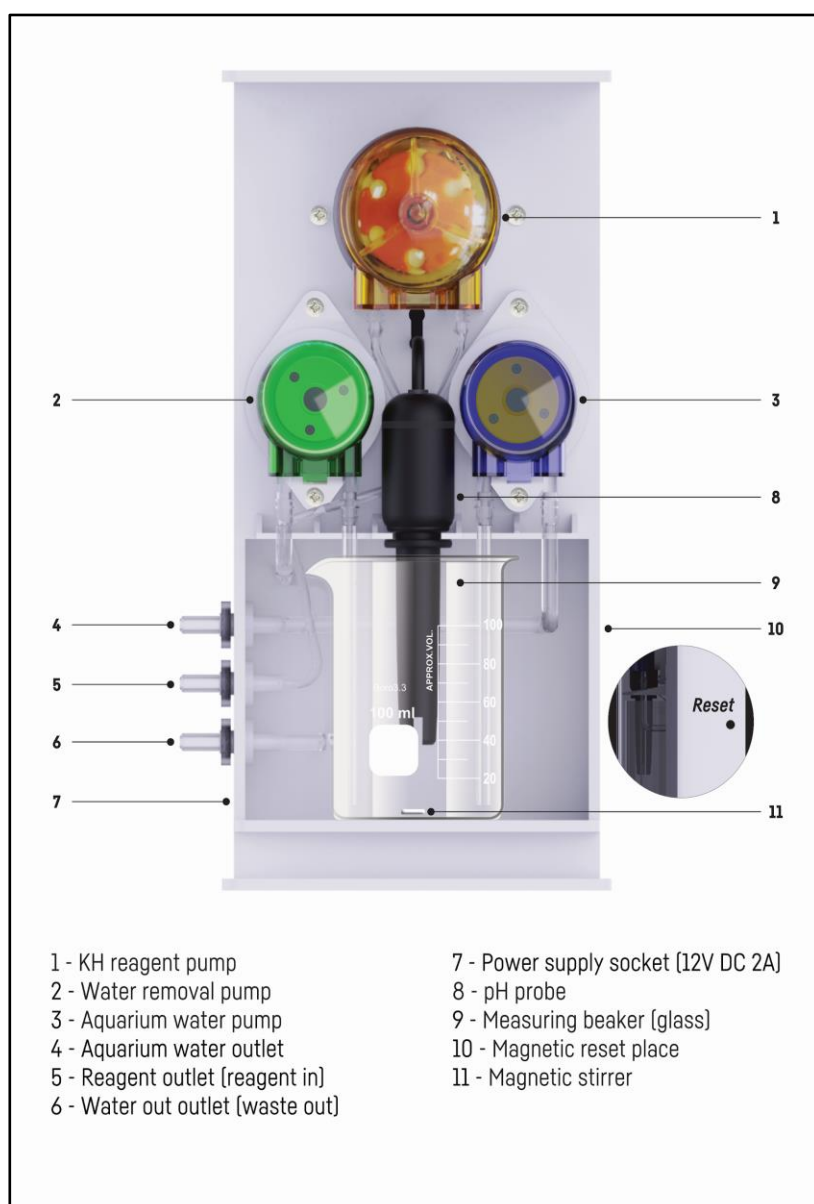
Make sure that the device is installed in a place that allows easy regular maintenance.

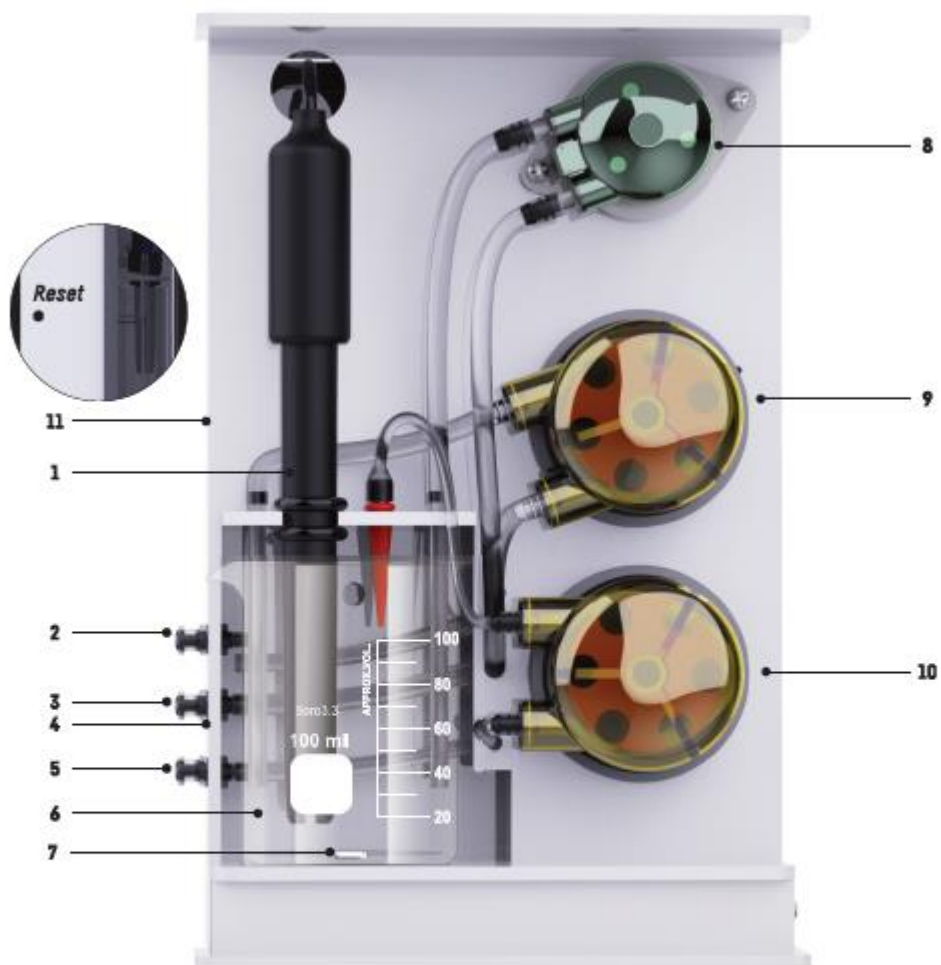


IMPORTANT INFORMATION: DEVICE INFORMATION

The device must be installed vertically. It is also wall-mountable. The water filter must be fully immersed in water and its elements must not protrude above the water level.

1. See the graphic below to learn how to connect the peripherals to the **KH keeper** device correctly. Notice the designations of individual elements, so as not to confuse them while connecting.





- 1 - pH probe
- 2 - Aquarium water outlet
- 3 - Water out outlet (waste out)
- 4 - Power supply socket (12V DC 2A)
- 5 - Reagent outlet (reagent in)

- 6 - Measuring beaker (glass)
- 7 - Magnetic stirrer
- 8 - Water removal pump
- 9 - Aquarium water pump
- 10 - KH reagent pump
- 11 - Magnetic reset place

2. Pay particular attention to the proper connection of the tubes, liquids [aquarium water, reagent] and the water outlet to the waste container.



3. There is a magnetic stirrer in the glass beaker. Be careful not to lose it.
4. Try to place the reagent container as close as possible to the **KH keeper** device, preferably at the same height or not lower than 20 cm below it.
5. After the installation, the device should be calibrated. This process will be described in the following sections of this manual.



IMPORTANT INFORMATION: DEVICE INFORMATION

Any change in the device installation place, shortening or lengthening of the tubes, connection of additional accessories (e.g. filters or check valves in the water supply circuit) causes a change in the method of reagent dosing and requires recalibration of KH keeper. In order to ensure the highest possible accuracy of measurements, it is necessary to use only the dedicated Reef Factory reagent. The use of a reagent other than the dedicated one will result in an incorrect measurement.

VI. Initial configuration of KH keeper device

1. After the installation, connect to the power supply using the dedicated power adapter included in the set.
2. The device can be set up via a browser on a computer, laptop, tablet or smartphone. To do so, you'll first need to view the list of Wi-Fi networks available on the device. Then connect to the network with a name corresponding to the serial number of your device, in accordance with the following pattern: **RFKHXXXXXXXXXXXXX**. Our device is compatible with 2.4 GHz networks. To log in, enter the following password: **reeffactory**
3. Open an Internet browser on the device and type the following address in the "website address" field: www.khkeeper.io

If you entered the address correctly and you still see the following message, it means that a connection with the device couldn't be established, so the connection with your home Internet network (wired or wireless) is still active.

This domain is used to configure **Smart Reef** device.
If you see this text it means that you are not logged properly into device Wi-Fi.
Please connect to the Wi-Fi device only (Wi-Fi password is **reeffactory**) and refresh this page.

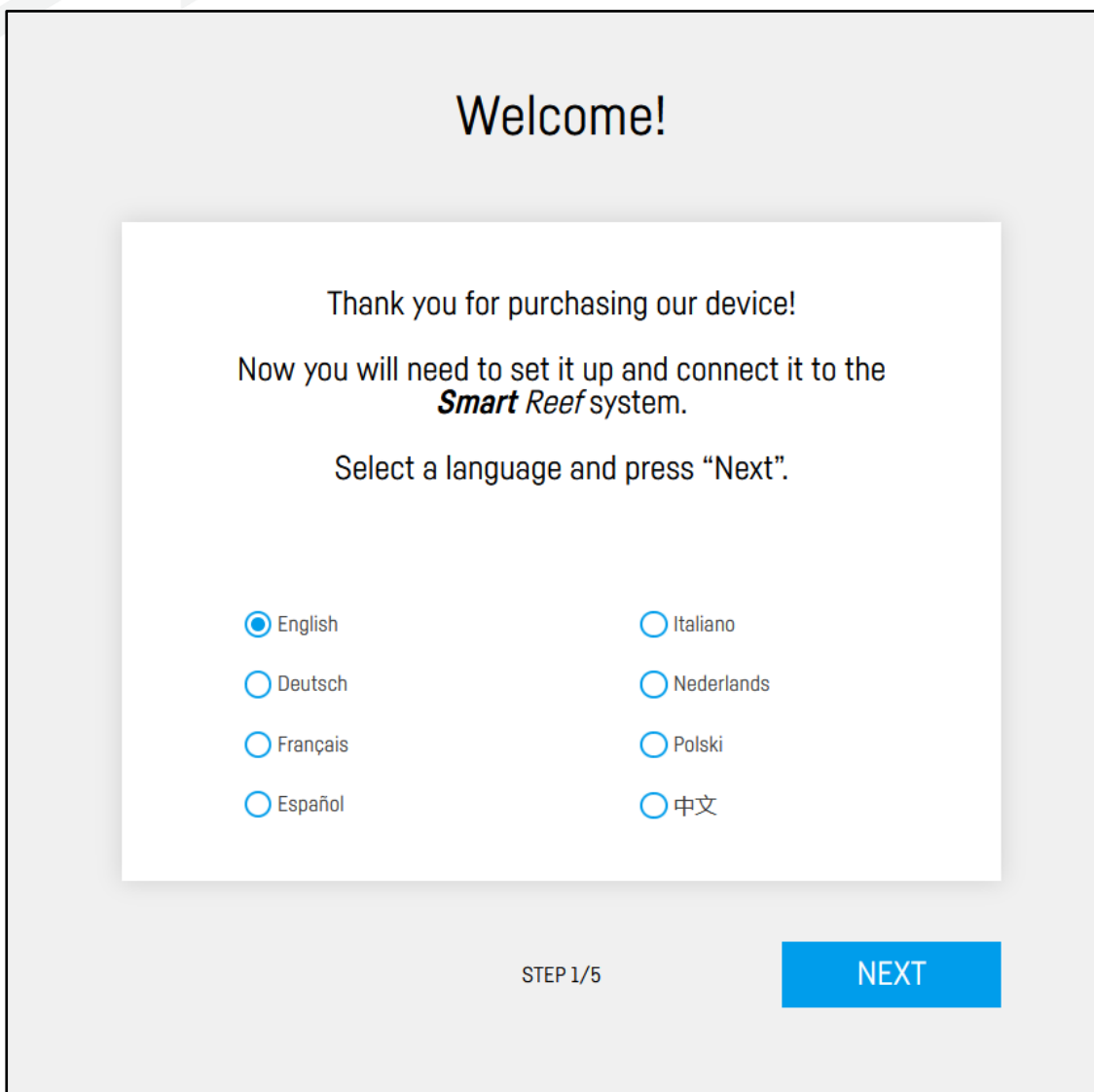


Try to reconnect to the device and repeat the steps described above.

VII. Configuration of the KH keeper operation

Set up your device in five simple steps.

Step one - choose the language you want to use when operating the device.



The screenshot shows a digital display with a light gray background. At the top, the word "Welcome!" is displayed in a large, black, sans-serif font. Below this, a white rectangular box contains the following text: "Thank you for purchasing our device!", "Now you will need to set it up and connect it to the **Smart Reef** system.", and "Select a language and press 'Next'.". Underneath the text, there are two columns of radio button options. The left column includes "English" (selected with a blue dot), "Deutsch", "Français", and "Español". The right column includes "Italiano", "Nederlands", "Polski", and "中文". At the bottom of the screen, the text "STEP 1/5" is centered, and a blue rectangular button with the word "NEXT" in white capital letters is positioned on the right.

Welcome!

Thank you for purchasing our device!

Now you will need to set it up and connect it to the **Smart Reef** system.

Select a language and press "Next".

☒ English ☐ Italiano

☐ Deutsch ☐ Nederlands

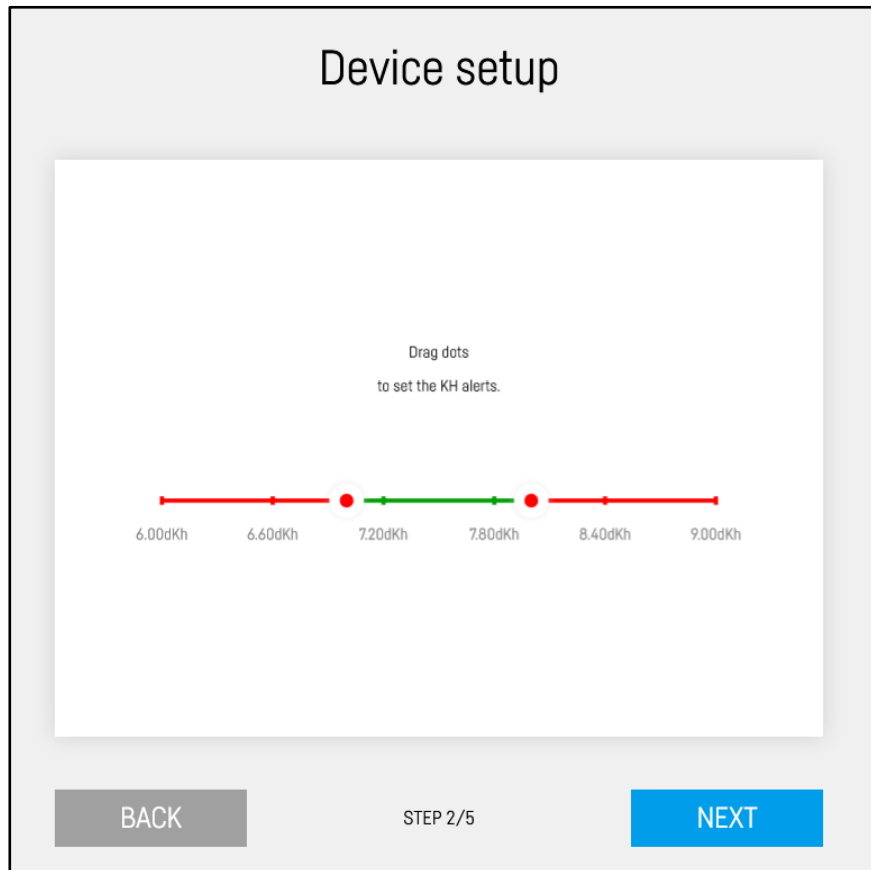
☐ Français ☐ Polski

☐ Español ☐ 中文

STEP 1/5

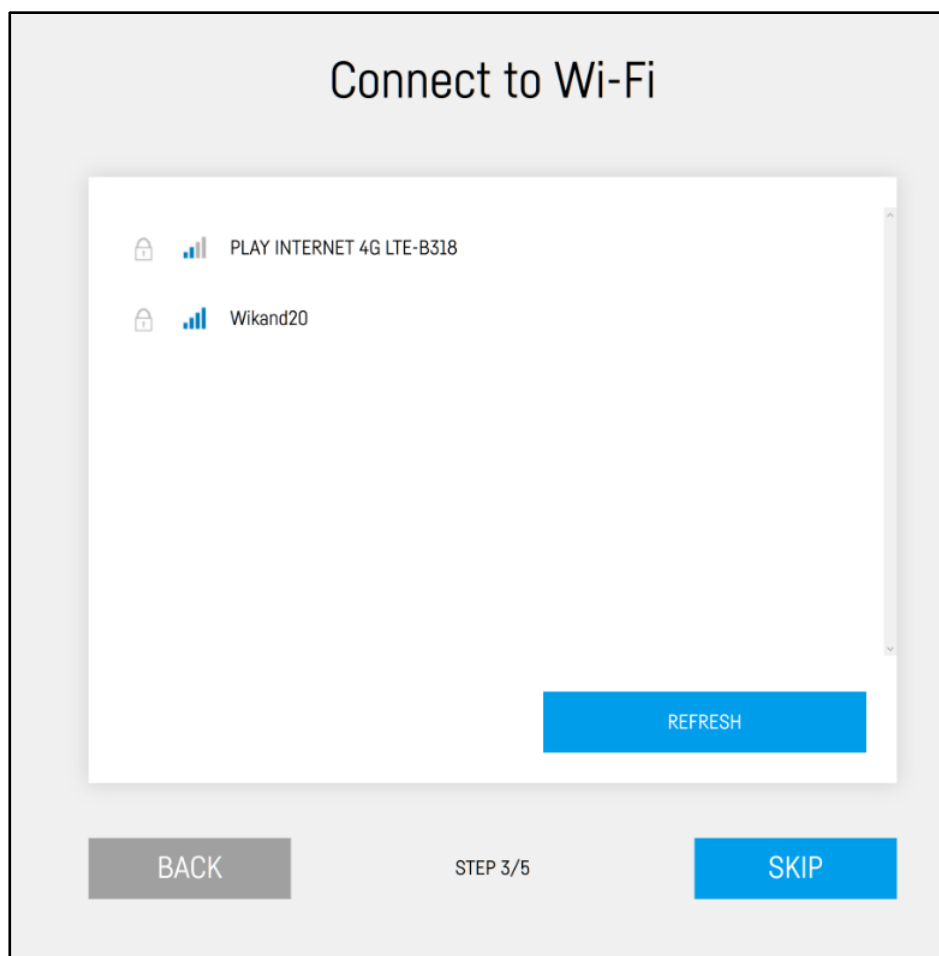
NEXT

Step two - set the KH value range appropriate for your tank [default value range is 7.00 to 8.00].



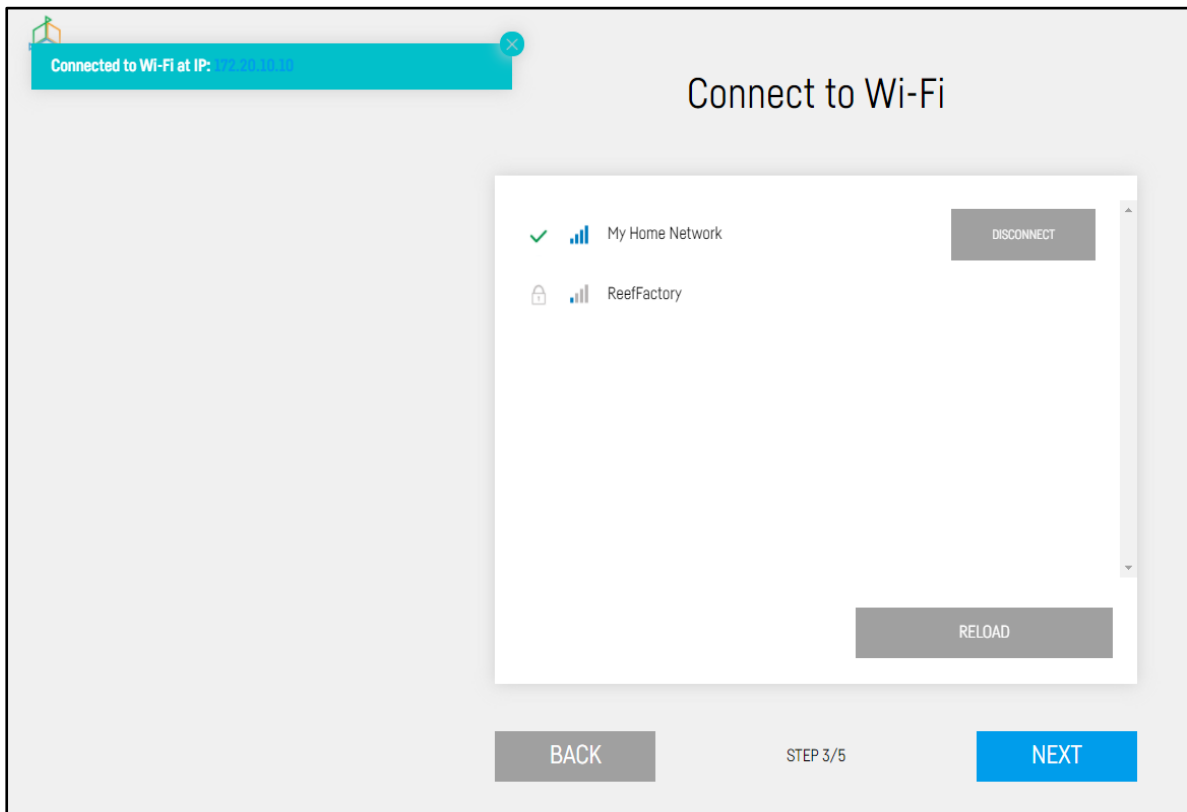
By dragging the red dots left or right, set the minimum and maximum KH value appropriate for your tank. When the KH value reaches a level below or above the range determined in this way, the device will immediately notify you accordingly. The range scale changes automatically and adjusts itself to the values selected. The measurement is performed to an accuracy of two decimal places, to 0.01 dKh. This can be modified at any time after set up is complete.

Step three - connect the device to your home Wi-Fi network. If the network is secured, enter the password that protects your home network against unauthorized access.



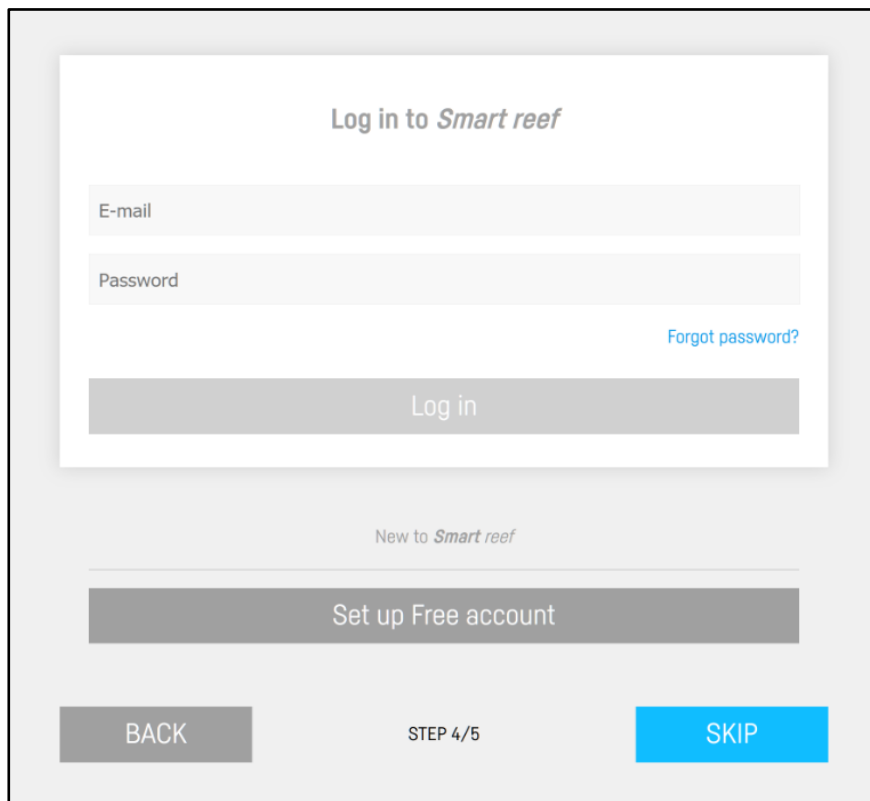
If the device cannot connect to your home Wi-Fi network at first, repeat the procedure. Successful connection may depend on the type of network device you use and its manufacturer. The signal of your wireless network should be as strong as possible. Remember that in order to enable communication with the **Smart Reef** system, the network device which is connected to **KH keeper** needs to have Internet access.

When the **KH keeper** successfully connects to your Wi-Fi network, its IP number will appear in the upper left corner of the screen.



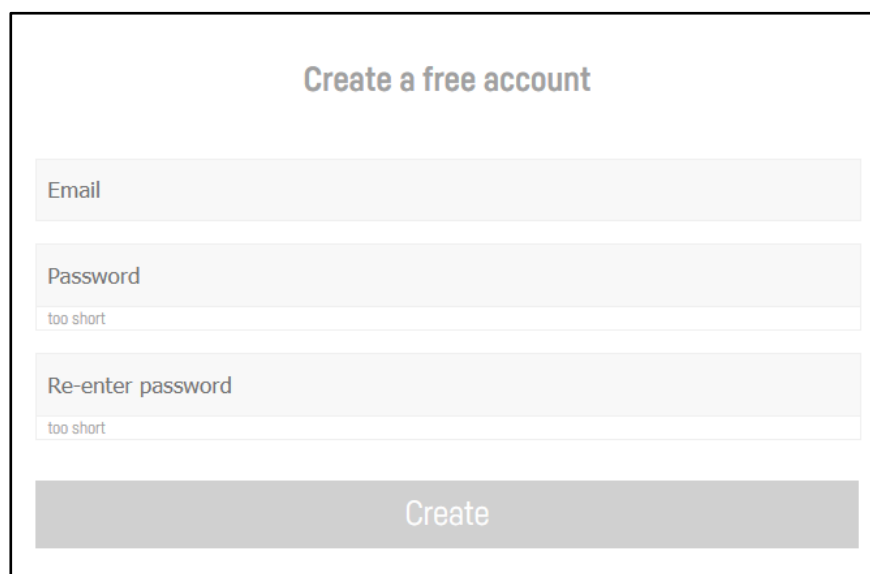
The appearance of the IP number means that everything is alright.

Step four - create a free **Smart Reef** account, by pressing the “Create a free account” button.



The image shows a mobile application screen for logging in to 'Smart reef'. At the top, the title 'Log in to *Smart reef*' is displayed. Below it are two input fields: 'E-mail' and 'Password'. To the right of the password field is a blue link that says 'Forgot password?'. Below these fields is a grey 'Log in' button. Further down, the text 'New to *Smart reef*' is shown, followed by a grey 'Set up Free account' button. At the bottom of the screen, there are three buttons: a grey 'BACK' button on the left, the text 'STEP 4/5' in the center, and a blue 'SKIP' button on the right.

If you already have a **Smart Reef** account, enter your login data to add your new device to the system.



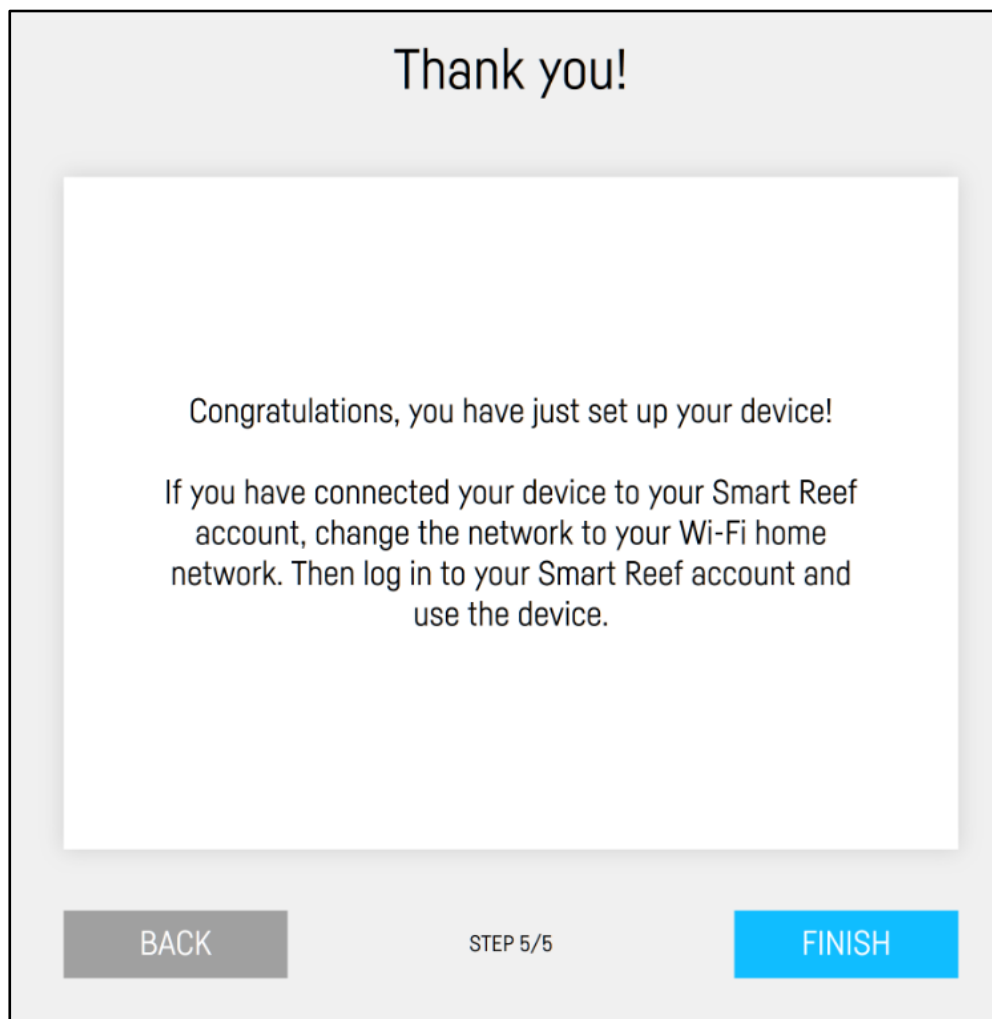
The image shows a mobile application screen titled 'Create a free account'. It features three input fields: 'Email', 'Password', and 'Re-enter password'. Below the 'Password' field, there is a red error message that says 'too short'. Similarly, below the 'Re-enter password' field, there is a red error message that says 'too short'. At the bottom of the screen is a grey 'Create' button.



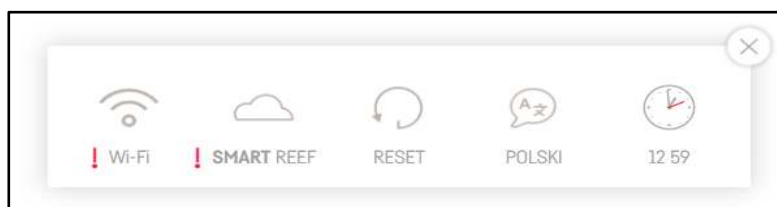
Your account password should be appropriately obscure and difficult to crack.

This way, you will be able to operate the device remotely and access its additional functionalities. If you already have a **Smart Reef** account, enter your login data to add another device. If you don't need to manage your device remotely, you may ignore this step. However, by doing so you will miss out on several additional features, such as access to device updates.

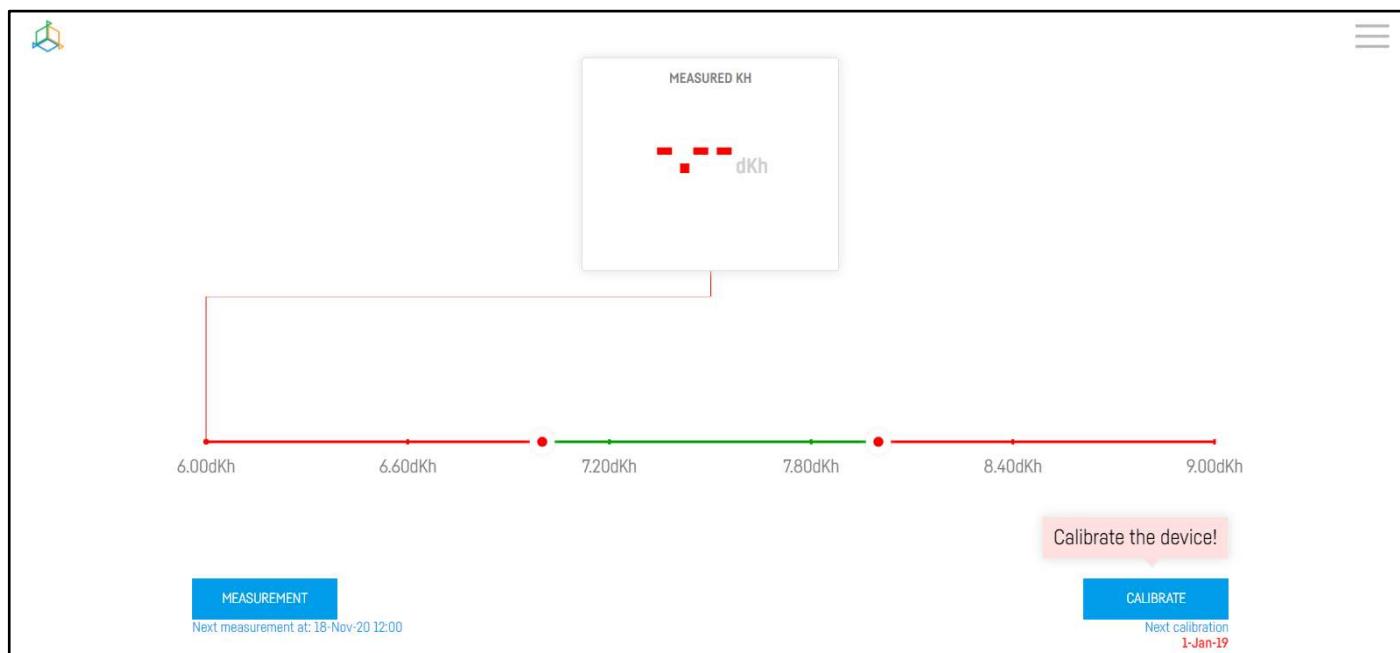
Step five - congratulations, you have successfully set up your **KH keeper** device.



Notice the icons located in the upper right corner of the screen. They make it possible to change the date and time, language, view the history of notifications registered by the device, contact us and access many more interesting features offered by the device.

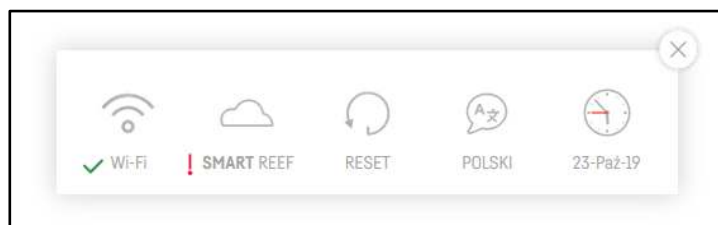


After the setup procedure is finished [after pressing the “FINISH” button], the screen will display the current status of your device as well as additional options. Please note that your new smart KH value gauge comes with several additional functions. They will be described in the following sections of this manual.



At any time, you can adjust the KH value range appropriate for your tank by dragging the red dots left or right. This way, you will set the minimum and maximum KH values. The range scale changes automatically and adjusts itself to the values selected. The measurement is performed to an accuracy of two decimal places, to 0.01 dKh.

In the upper right corner of the screen you will find a drop-  down menu icon. There you can introduce any necessary changes or repeat the device setup procedure. It also contains additional functions, including options for Wi-Fi network management, device network password, which protects your device against any unauthorized remote access, **Smart Reef** account management, time and date setting, language selection and the possibility to restore your device to default settings. Moreover, the icons indicate the current status of connection to your wireless network and to the **Smart Reef** system.

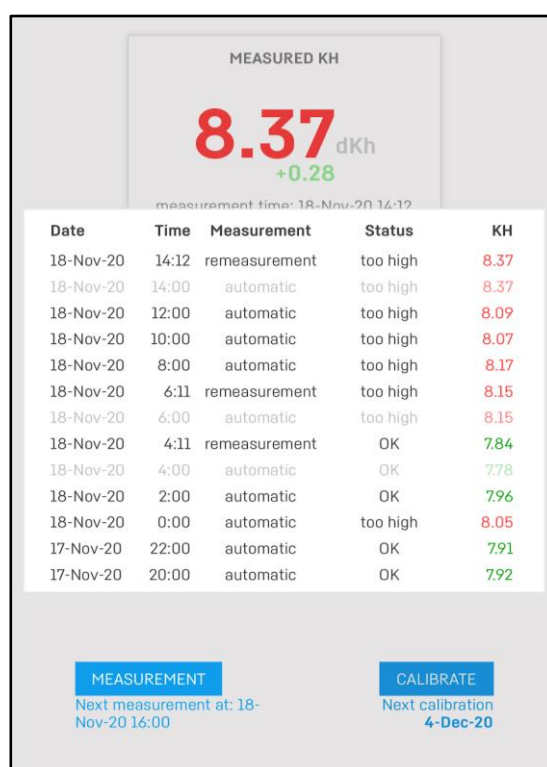


The  symbol means that the connection is OK, while the  symbol means that there is no connection.

VIII. KH keeper functions

1. The center of the device screen displays the current KH value measured during the last measurement. Below, the difference is displayed with respect to the previous measurement (in the example below it is +0.20) and the date when the last measurement was taken. After pressing the button “Show more...”, you will see the measurement history as in the graphic below. The measurement statuses will also appear:

- **OK** - the measured value falls within the specified range.
- **below range** - the measured value is outside the measurement range of the device.
- **too low** - the measured value is below the specified range.
- **too high** - the measured value exceeds the specified range.
- **too rapid change** - change in the value exceeds the defined acceptable difference between the measurements (details will be described in the following sections of this manual). In case the change in the KH value is too rapid, the device performs another control measurement - see the Measurement column. When its result is identical with that of the original measurement, the device considers it to be correct.



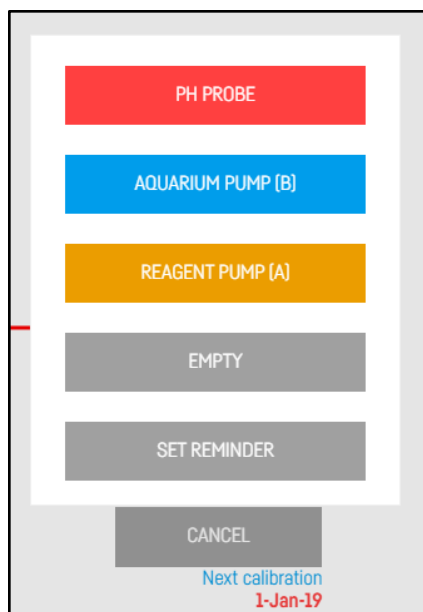
2. The button  allows you to display historical measurements that are no longer included in the list visible after pressing the “Show more...” button. This function is available when your device is logged into the **Smart Reef** system. When your device is not logged into the system, this function is not available.
3. In the upper right corner of the screen you will find a drop-down menu icon. There you can introduce any necessary changes or repeat the device setup procedure. It also contains additional functions, including options for Wi-Fi network management, device network password, which protects your device against any unauthorized remote access, **Smart Reef** account management, time and date setting, language selection and the possibility to restore your device to default settings. Moreover, the icons show the current status of connection to your wireless network and to the **Smart Reef** system.

IX. Calibration procedure

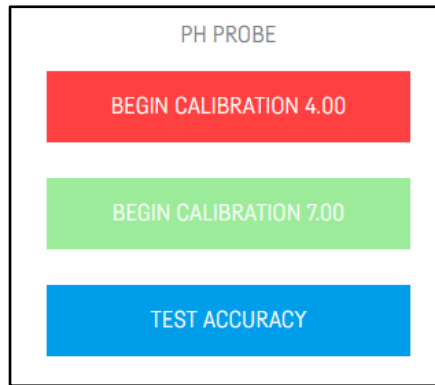
1. In the lower right corner of the screen you can find the device calibration function . Proper calibration is very important, because it influences the measurement precision. Remember to calibrate your new device immediately after installing it and always after changing its location or after any change related to its connected components [e.g. after changing the length of tubes, adding new filters or valves, etc.]. The calibration process should be repeated periodically according to the “Next calibration” prompt displayed on the device. The calibration covers three steps as it requires calibrating the pH probe and two pumps.



If you use a precision scale during the calibration process, remember that 1 ml of seawater weighs 1.026 g. Make sure to account for it in the measurement in order to obtain an accurate result.

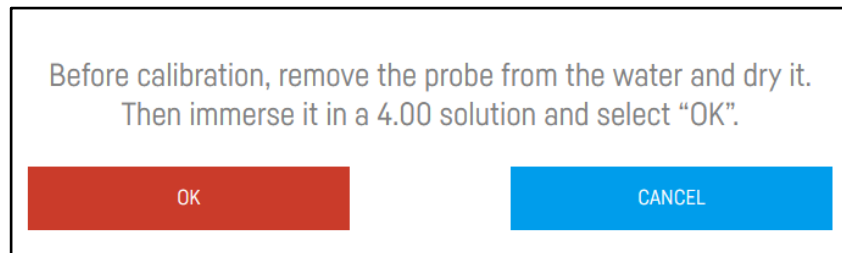


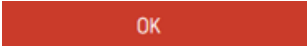
2. The pH probe calibration  - for this purpose, use the pH4 and pH7 calibration solutions included in the kit. Clean the pH probe with RO water. Dry the probe with a paper towel. Put the pH probe in the pH4 solution, wait 5 minutes. Then press the BEGIN CALIBRATION button.

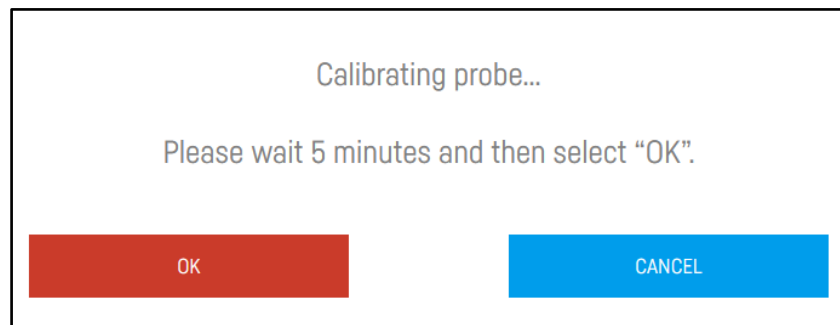


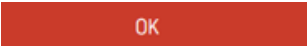
3. Before calibration, remove the pH probe from water and pat it dry.

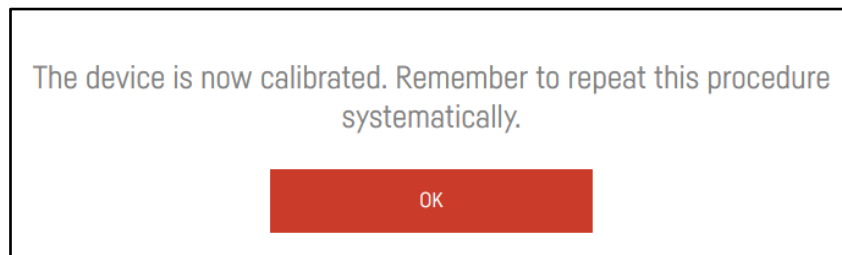
4. To start the pH probe calibration process, press the  button.



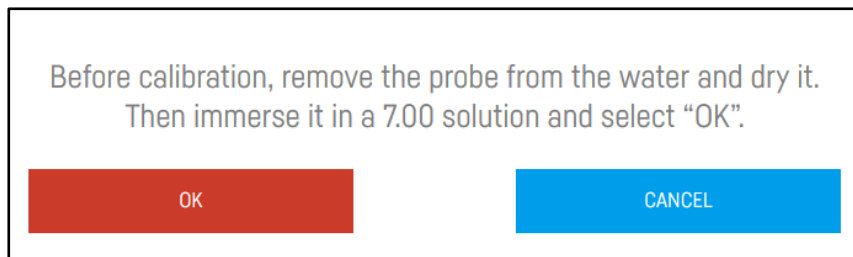
5. Submerge the pH probe in the pH4 solution and press the  button.



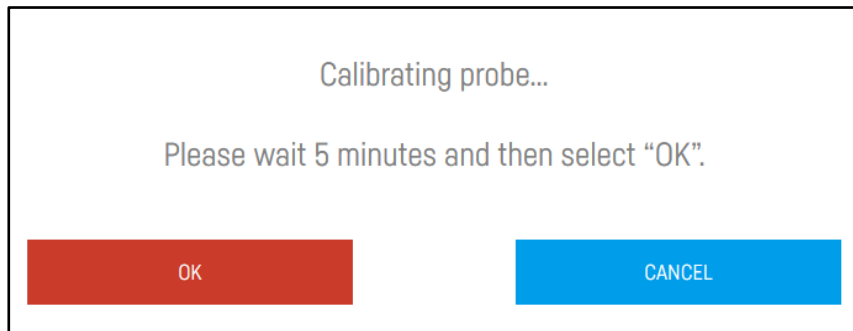
6. After 5 minutes press the  button.



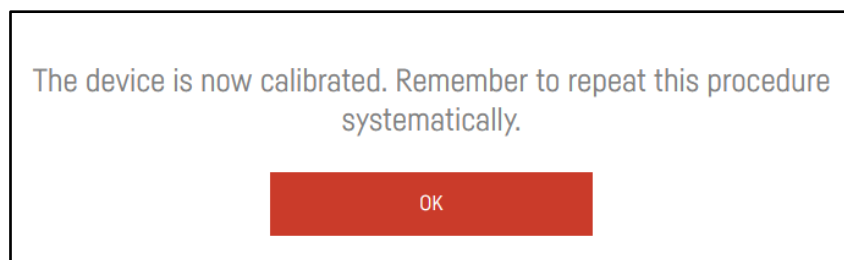
7. Pat the probe dry and press the  button to start the second step of the pH probe calibration process.



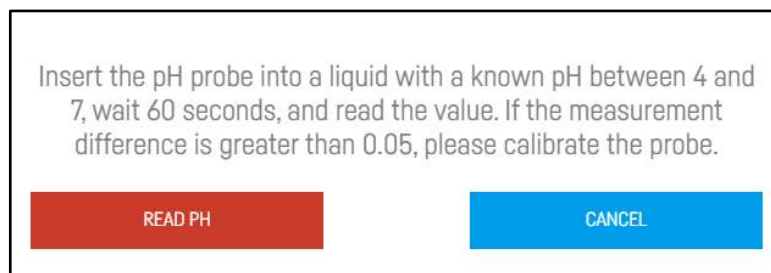
8. Submerge the pH probe in the pH7 solution and press the  button.



9. After 5 minutes press the  button.



10.  is an additional feature for checking the pH probe.



11. After pressing the  button, the measured pH value will appear in the upper left corner of the screen.

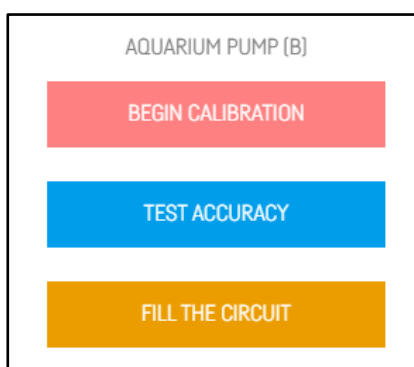


- 12.** If the difference between the measurement result and the pH value of the solution is greater than 0.05, the calibration process must be repeated.

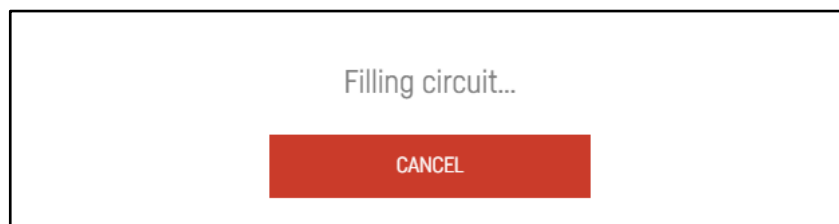


If the measurement result still differs significantly when recalibrating, it may be due to a faulty pH probe. The probe usable life is 6 to 24 months (depending on operating conditions and frequency of measurements). It is a consumable component that is subject to periodic replacement.

- 13.** Calibration of the aquarium pump [B]  - this pump pours water from the aquarium in exact 50 ml doses. This amount of water from the tank is required for the correct KH value measurement, therefore the correct calibration of this pump is very important. After pressing the AQUARIUM PUMP [B] button, additional functions will be displayed.



- 14.** To properly calibrate the pump, fill the tube that takes the water from the aquarium with water from the tank using the  function. The pump will automatically run for 15 seconds to fill the tubing. Check if the entire tube has been filled with water so that no air bubbles remain inside. There should be a small amount of water [excess water from the tubing] in the beaker.



- 15.** Pour out any excess water collected in the beaker [follow the instructions in Section III, "Assembly and disassembly of the glass beaker"] and dry the beaker. Next, remove the beaker. If you are using a scale for measurement, place an approximately 100 ml graduating measure [not included] or other small container under the tube of the water supply pump [be sure to weigh the empty container first and subtract its weight after pouring in the liquid]. Start the pump calibration process by pressing the  button. After pressing it, a message will be displayed on the screen announcing readiness for calibration and the time required for the pump to pour the aquarium water.

Calibration

The pump **B** will be turned on for 60 s.
Check how much liquid will be dispensed during this time.

Remember to fill the circuit before calibration.

START

CANCEL

- 16.** Press the START button to start calibration.

Calibration

Calibration in progress...
Please wait...

CANCEL

- 17.** Check the amount of water in the graduated measure or other container and enter an appropriate number of milliliters into the table. Next, confirm it by pressing the OK button. When calibrating, you can use a precision scale with a measurement accuracy of 0.01 g. This will make the pump calibration process much more accurate.



If you use a precision scale during the calibration process, remember that 1 ml of seawater weighs 1.026 g. Make sure to account for it in the measurement in order to obtain an accurate result.

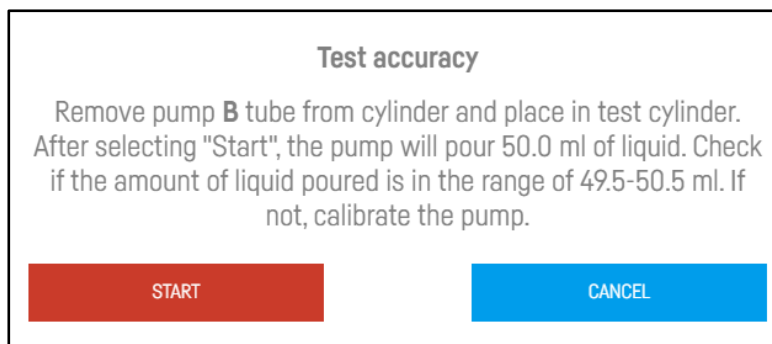
Calibration

Specify how many ml have been dispensed.

OK

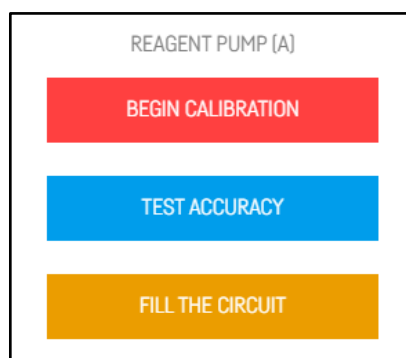
CANCEL

- 18.** At any time, you can check if the pump is dosing correctly by using the TEST ACCURACY function. When it is enabled, a message will appear describing the next steps [see graphic below].

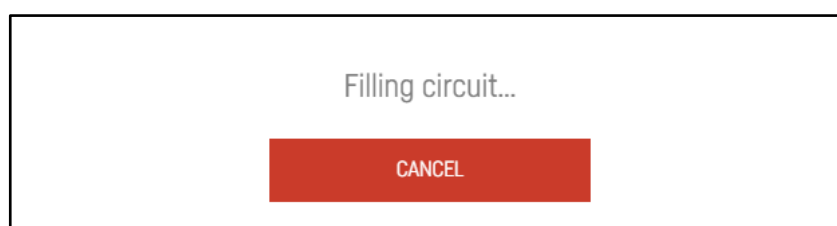


19. After pressing the START button, the pump should pour 50 ml of the liquid with an accuracy of ± 0.5 ml. If the amount of liquid added is lower or higher, it is necessary to recalibrate pump B.

20. Reagent pump [A] calibration **REAGENT PUMP [A]** - it is a reagent dosing pump. Correct and precise dosing of the reagent is crucial for the proper measurement process, therefore proper calibration of this pump is very important. After pressing the REAGENT PUMP [A] button, additional functions will be displayed.



21. To properly calibrate the pump, fill the reagent uptake tube by using the **FILL THE CIRCUIT** function. The pump will automatically run for 15 seconds to fill the tubing. Check if the entire tube has been filled with reagent so that no air bubbles remain inside. Next, use the red pipette to pour a small amount of the reagent [a few drops] into the glass beaker.



22. Pour out any excess water collected in the beaker [follow the instructions in Section III, "Assembly and disassembly of the glass beaker"] and dry the beaker. Next, remove the beaker. If you are using a scale for measurement, place an approximately 10 ml graduating measure [not included] or other small container under the tube of the reagent supply pump [the red plastic needle located behind the pH probe]. When doing so, be sure to weigh the empty container first and subtract its weight after pouring in the liquid. Start

the pump calibration process by pressing the **BEGIN CALIBRATION** button. After pressing it, a message will be displayed on the screen announcing readiness for calibration and the time required for the pump to pour the reagent.

Calibration

The pump **A** will be turned on for 60 s.
Check how much liquid will be dispensed during this time.

Remember to fill the circuit before calibration.

START

CANCEL

23. Press the **START** button to start calibration.

Calibration

Calibration in progress...
Please wait...

CANCEL

24. Check the amount of reagent in the graduating measure or other container, enter the appropriate number of milliliters into the table. Next, confirm by pressing the OK button. Try to make this value as accurate as possible, for example to one decimal place. When calibrating, you can use a precision scale with a measurement accuracy of 0.01 g. This will make the pump calibration process much more accurate.



If you use a precision scale during the calibration process, remember that 1 ml of seawater weighs 1.026 g. Make sure to account for it in the measurement in order to obtain an accurate result.

Calibration

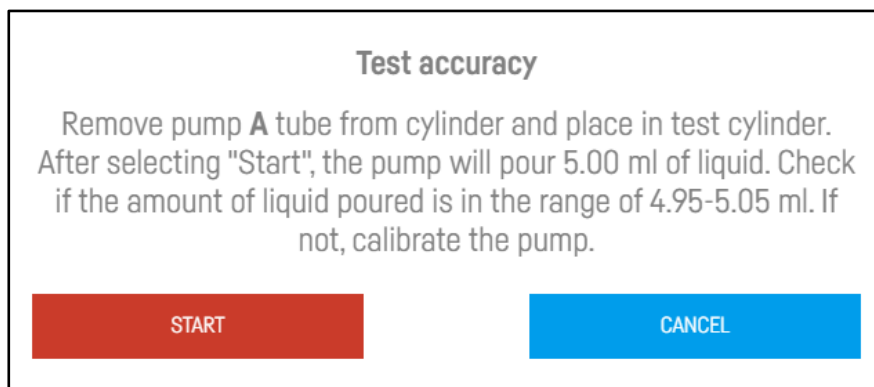
Specify how many ml have been dispensed.

6,4

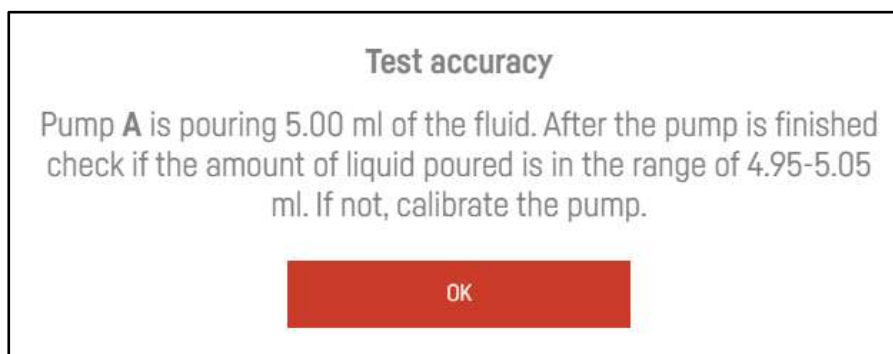
OK

CANCEL

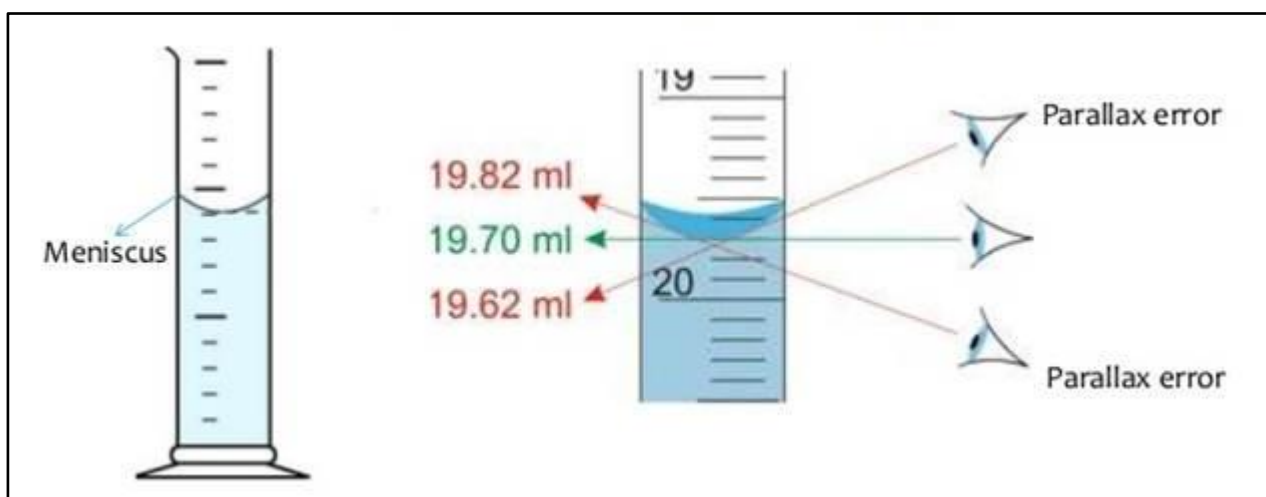
- 25.** At any time, you can check if the pump is dosing correctly by using the **TEST ACCURACY** function. When it is enabled, a message will appear describing the next steps [see graphic below].



- 26.** After pressing the START button, the pump should pour 5 ml of the liquid at an accuracy of ± 0.05 ml. If the amount of liquid added is lower or higher, it is necessary to recalibrate pump A.

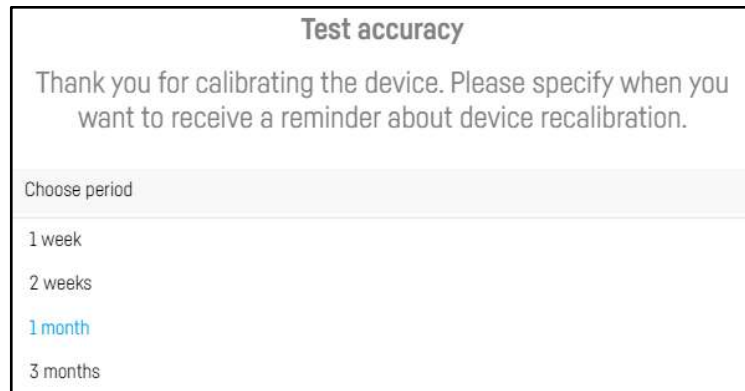


- 27.** After calibrating all pumps and the pH probe, run two tests. The result of the first test can be inaccurate, as the pH probe may contain residual RO water, air bubbles or some pH calibration solution. Carefully read the liquid level. When reading it from an angle, bear in mind the parallax effect. This is illustrated in the graphic below.



- 28.** The **EMPTY** function allows you to pump the liquid out of the glass beaker.

29. The **SET REMINDER** function allows you to set a reminder to recalibrate the device (see graphic below).



Test accuracy

Thank you for calibrating the device. Please specify when you want to receive a reminder about device recalibration.

Choose period

- 1 week
- 2 weeks
- 1 month**
- 3 months



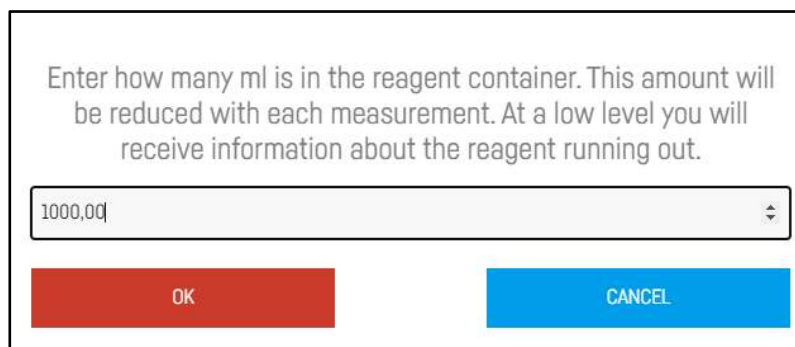
We recommend calibrating the pumps once a month.

REMEMBER: It is possible that the first few measurements might be inaccurate. Before changing your dosing program or before any change in supplements, we recommend carrying out a series of tests. We also advise that you calibrate the device again after 7 days from starting it. After this initial period, the device will become very precise.

30. In the bottom left corner of the screen, you will find an **MEASUREMENT** option, allowing you to configure the measurement-related functions. After pressing it, additional functions will be displayed.

31. The **MANUAL TEST** button starts the on-demand measurement function. This means that after pressing the button, the device starts measuring.

32. The **REAGENT AMOUNT 1000.00ml / 17 day(s)** button indicates the remaining amount of the reagent and the number of days left until it is used up. After pressing it, a window will appear on the screen where you can enter the current amount of reagent after it has been refilled. The device uses 5 to 15 ml of reagent per measurement. This value depends on the KH level in the tank.



Enter how many ml is in the reagent container. This amount will be reduced with each measurement. At a low level you will receive information about the reagent running out.

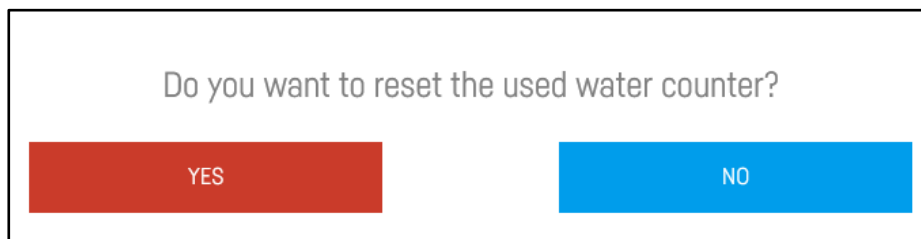
1000,00

OK **CANCEL**

33. The amount of the reagent will be reduced by the amount used during each measurement so that you always know how much reagent is left in the container. This value also allows the **KH keeper** to calculate

the number of days remaining until the reagent is used up. The **KH keeper** device will notify you five days before you run out of the reagent to give you time to refill it.

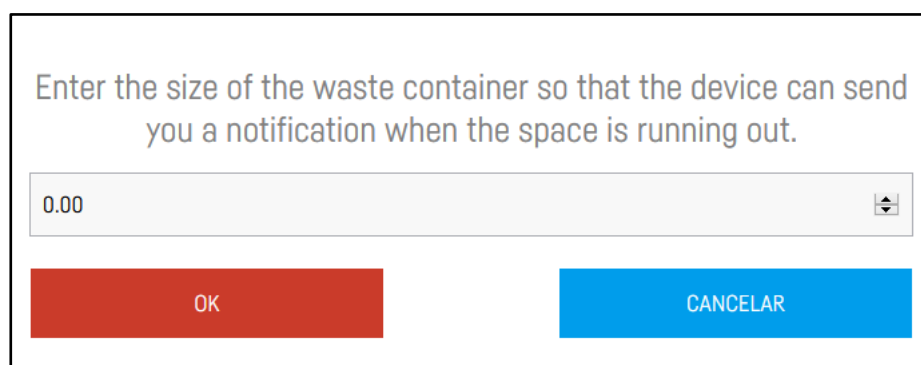
34. The **USED WATER** 2535.00 ml button shows how much water has been drawn from the tank, and when you press it, a message will be displayed, enabling you to reset the consumed water meter.



Do you want to reset the used water counter?

YES NO

35. The **WASTE CONTAINER** -/- ml button allows you to preset the water container capacity used during the measurements. Pressing it brings up a window where you can set the capacity of the container so that the device may inform you when it needs to be emptied.

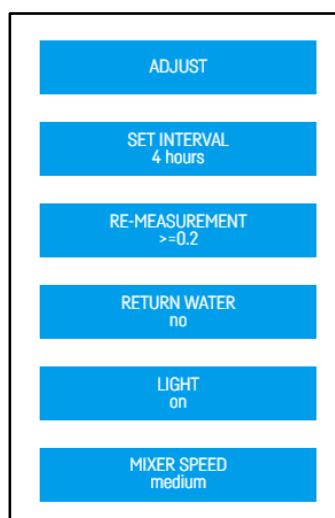


Enter the size of the waste container so that the device can send you a notification when the space is running out.

0.00

OK CANCELAR

36. The **SETTINGS** button opens an additional configuration menu related to taking the KH value measurement.



ADJUST

SET INTERVAL
4 hours

RE-MEASUREMENT
>=0.2

RETURN WATER
no

LIGHT
on

MIXER SPEED
medium

37. The **ADJUST** function allows the measured KH value to be adjusted to the value obtained in another reference measurement. For example, if the KH value measured by the device differs significantly from the result of a measurement performed with the use of another reference method [e.g. the drip method], it is possible to enter the obtained reference value, which will cause the KH keeper to adjust its measurement to the value entered [its results will match the results of the reference measurement].

The result of the last KH measurement is 8.53. If it is different from the measurement made with another device or with a drop test, calibrate the device. If after the calibration the difference is still significant, enter the KH value measured with another device.

To reset the adjusted value, enter 0.

OK CANCEL



In the event of a discrepancy between the measurement result obtained with the KH keeper device and another reference measurement result, we suggest recalibrating the KH keeper as the first step. The measurement adjustment function should be used only if the difference continues after recalibration.

38. The **SET INTERVAL 4 hours** function allows you to specify the time intervals at which the device will measure the KH value. The measurement always takes place on the hour [e.g. 12:00]. After pressing the button, an additional selection menu will appear on the screen [see graphic below].

Select measurement interval

4 hours

1 hour

2 hours

4 hours

8 hours

12 hours

off

39. The **RE-MEASUREMENT ≥ 0.2** function allows you to perform an automatic remeasurement of the KH value when the difference between the last two measurements is greater than the specified value. After pressing this button, an additional field will appear on the screen [see graphic below] where you can enter the difference value to automatically trigger this function. If after the remeasurement the measured value is still outside the defined range, the **KH keeper** will notify you of a rapid change in the KH value.

Enter at which difference between the KH measurements repeat the measurement.

0,2

OK CANCEL

40. Activating the **RETURN WATER** no function will direct the water from the beaker back into the aquarium after the measurement is taken. Disabling it will cause the water to go into the sewer or into an external wastewater container. Enabling this function will return the water along with the reagent back to the aquarium. This function is very useful when it is not possible to pour the measurement water into an external container or when the measurement is carried out in a small capacity container. It serves to reduce the loss of water and to prevent rapid changes in salinity levels. The amount of the reagent used during the measurements is small [5 to 15 ml] and depends on the KH level in the tank. However, it is recommended to pour the liquid into an external tank after the measurement.

41. The **LIGHT** on function turns on or off the light signaling related to the measurement or its result [green - measurement correct, red - measurement incorrect, blue - measurement in progress]. The graphic below shows the signaling of the device operating mode and the measurement result.



Measurement in progress

Correct measurement

Incorrect measurement

42. The **MIXER SPEED** medium function enables you to choose the operating mode for the magnetic stirrer [slow, medium, and fast mode]. We recommend using the slow stirring mode. After selecting and confirming the selection, the stirrer will be turned on for 10 seconds in order to simulate the set operating mode.

43. Proper mixing of the reagent with the tank water has a major impact on the result of the KH value measurement. In some cases, the speed of the stirrer in the fast mode may cause it to stop or freeze. If this is the case, a slower stirring mode should be chosen. In order to determine the correct operating mode for the stirrer, it is recommended to perform several tests where the **KH keeper** is installed.

X. Error signals

If the device detects measurement error or irregularities, it will notify you by sending an email or a notification in the mobile app. The messages that can be sent by **KH keeper** are listed below:

- **KH value is too low** - the measured KH value is lower than the specified value.
- **KH value is too high** - the measured KH value is higher than the specified value.
- **KH value is below the measuring range** - the measured KH value is lower than 5.00 dKH.
- **KH value is above the measuring range** - the measured KH value is greater than 15.00 dKH.
- **Reagent is running out** - the level of the reagent remaining is low and will be enough for about 5 days. Refill the reagent and indicate its amount in the container after refilling.
- **You ran out of reagent / no reagent** - refill the reagent and indicate its amount in the container after refilling. If necessary, fill the circuit.
- **pH probe measurement error** - the pH probe makes an incorrect measurement. Check the probe connection and then calibrate the probe using the pH4 and pH7 calibration solutions.
- **Rapid change in KH level** - the change in KH values obtained during two consecutive measurements is too rapid (it is higher than the acceptable value of the change between two consecutive measurements).

XI. Resetting the device

If your device does not work properly, or you want to repeat the setup procedure, or you cannot connect to it despite several attempts, you may restore it to its default settings by placing a magnet (included in the package) on the housing in the place shown in the picture at the beginning of this manual.



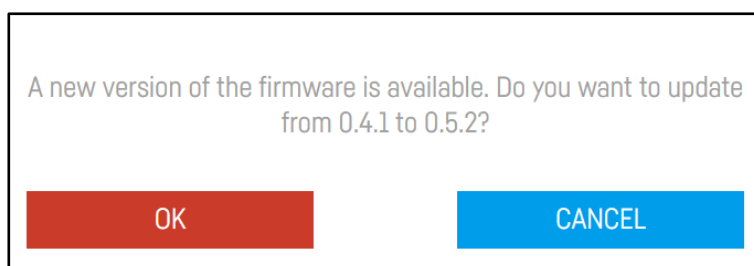
Place the magnet in the indicated place near the **Reset** sticker.

XII. Smart Reef system

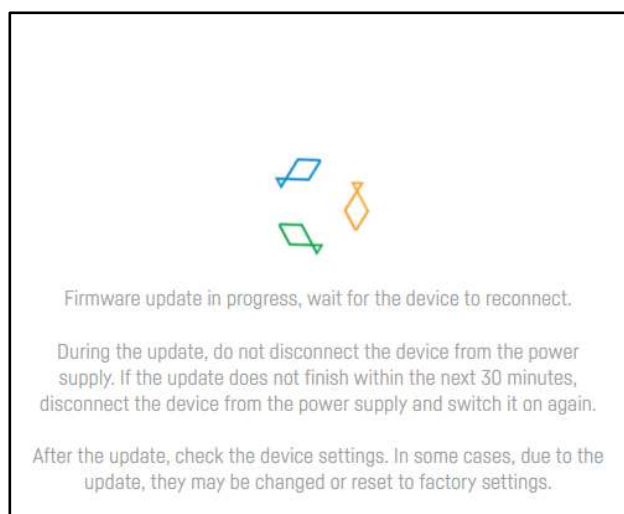
Connect to your Internet network via a computer or a mobile device. Next, go to www.reeffactory.com and log in to your **Smart Reef** account. Check, if your device has been properly added to the list of your devices.

You can change its name and assign it to one of your aquariums. The serial number of your device and its firmware version are displayed in the lower right corner of the screen.

Our devices are SMART; therefore, we constantly improve them. From time to time, you will receive information about firmware updates that will make your device work even better.



By pressing the OK button you will start the automatic device update process.



Additional and up-to-date information about the device, its operation and setup can be found at our website www.reeffactory.com, in the relevant product tab.

XIII. Technical problems and their possible causes

The following table provides information about the problems that you may face while using the device, along with the tips for remedying them yourself.

 Problem	 Possible cause	Solution
The device does not power on and does not broadcast a Wi-Fi signal	No power	Check if the power cord plug is properly connected to the power supply. Then, use the magnet and try to reset the device to factory settings. Check if the problem is resolved.
Can't log into the device	No direct connection between the computer or phone and the device	Check if your computer or phone is connected to the device's network. Sometimes, the device may automatically switch to another network, for instance your home network. Check if the problem is resolved.
The device is not visible in the Smart Reef system	The device has not been properly connected to your home network or is not logged in to the Smart Reef system	Log in to your device and then check if the icons of the Internet and Smart Reef system connection indicate a valid connection. If not, reconnect the device to the network and log it into the Smart Reef system.
The device loses connection with the Smart Reef system	Your home network has insufficient coverage	Remember that your home network coverage may vary. Sometimes, the signal level is too low where your device is installed. Try to move the device closer to your router or use a repeater to extend your home network range in the area. Check if the problem is resolved.
The device does not broadcast a Wi-Fi signal or you can't log into the device	The device settings may require a reset	Briefly place the magnet on the device housing at the point marked with the Reset sticker. Wait for 5 seconds and then search for the device's Wi-Fi. Connect with the device.
The pH value does not change during the pH probe calibration	The probe is incorrectly connected	Unscrew the rear part of the housing, disconnect and then reconnect the BNC connector of the pH probe. Screw the rear part of the housing back. Check if the problem is resolved.
The pH value does not change during the pH probe calibration	pH probe failure	Unscrew the rear part of the housing and replace the pH probe with a new one. To do this, disconnect the power connector from the reagent pump, disconnect the BNC connector of the probe, unscrew the reagent pump, reposition the pH probe cable and disassemble the probe. Install the new probe, reposition the signal cord, and then screw on the reagent pump. Connect the power connector of the reagent pump and the BNC connector of the pH probe. Check if the problem is resolved.
The pump does not draw liquid	System leak	Check if all connectors are connected together, then check if the tube is not damaged, e.g. frayed or broken. Next, check if the tube in the pump head is not scratched and check if the tubes in the beaker are properly fixed (slipped over the plastic connectors). If the tube in the head is scratched, replace the head with a new one (it is a removable part).
The pump does not run	Head wear	Remove the head from the pump and then start the pump without it. If the pump is working properly without the head, you will need to replace the head with a new one.

(the head does not rotate)		
The magnetic stirrer does not rotate	The stirrer operating mode is too fast or the stirrer has moved too much in the beaker	Push the beaker as far as possible against the back of the device housing and then move the magnetic stirrer towards the central part of the beaker. Pour water into the beaker to about half-way (approx. 50 ml), and then start the stirrer.
WARNING: The reagent is running out, please refill!	Refill the reagent	Pour in some properly prepared reagent. Remember that the reagent you have purchased is concentrated and needs to be mixed with RO water.



If the above methods have not worked, please contact us and describe your problem by writing to support@reeffactory.com. Additional and up-to-date information about the device, its operation and setup can be found at our website www.reeffactory.com, in the relevant product tab.

REMEMBER: Never repair the device yourself unless you have the right expertise and experience. The device is powered by voltage ranging from 110 to 230 V, and working with live devices may cause electric shock, loss of health or even life.

XIV. Dedicated power adapter - user guide

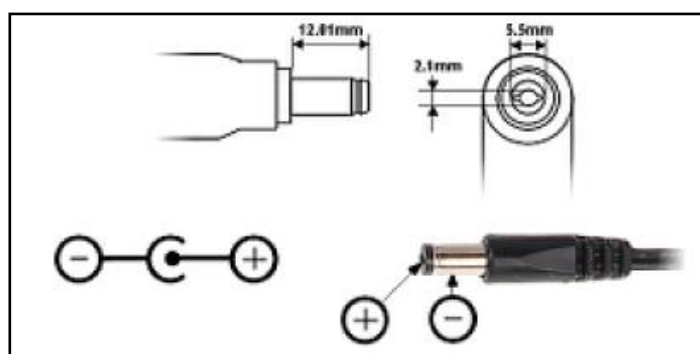
1. Make sure to connect the power adapter first to the device and next to power supply.
2. The power adapter is supplied from the grid. There is a risk of electric shock. Do not remove the power adapter housing yourself!
3. There is a risk of fire or electric shock. Leave the power adapter vents exposed to enable natural air circulation and protect the device from foreign objects or liquid spillage.
4. Using a wrong DC plug or forcing the DC plug into an electronic device may cause damage to the device or its malfunction.
5. Desktop power adapters should be placed on a stable surface. Falling can lead to permanent damage.
6. Do not place power adapters in high humidity locations or near water.
7. Do not place power adapters in high ambient temperature locations or near sources of heat or fire.
8. The output current and output power must not exceed the rated values provided in the specification.
9. Disconnect the device from power supply before cleaning. Do not use liquid or aerosol cleaners. Only use a damp cloth for wiping.
10. To dispose of this product, contact a local licensed recycling company. Do not dispose of your power adapter with mixed municipal waste.

The table below lists the power adapters dedicated for our devices along with the models and names of the devices they can be used with.

Power adapter model	Power adapter parameters	Power adapter specification	List of compatible devices
TPS-1201000ZZ	Plug power adapter 12 V 1 A DC	Input voltage: 100-240 V AC Operating frequency: 50-60 Hz Maximum input current: 0.6 A Output voltage: 12 V DC [11.4-12.6 V] Output current: Max. 1 A Input connector type: DC 5.5/2.1	1. Level sensor * 2. Thermo view * 3. pH meter Plus * 4. TDS meter Plus * * First generation devices were powered by a 3.3 V 2 A power adapter. Before purchasing a power adapter, contact us to find out which power adapter is suitable for your device.
TPS-1202000ZZ	Plug power adapter 12 V 2 A DC	Input voltage: 100-240 V AC Operating frequency: 50-60 Hz Maximum input current: 0.6 A Output voltage: 12 V DC [11.4-12.6 V] Output current: Max. 2 A Input connector type: DC 5.5/2.1	1. Dosing pump 2. Dosing pump Pro 3. Dosing pump X3 4. Salinity guardian
TPS-1204000ZZ	Plug power adapter 12 V 4 A DC	Input voltage: 100-240 V AC Operating frequency: 50-60 Hz Maximum input current: 1.2 A Output voltage: 12 V DC [11.4-12.6 V] Output current: Max. 4 A Input connector type: DC 5.5/2.1	1. Dosing pump Large
GST120A24R7B	Desktop power adapter 24 V 5 A DC	Input voltage: 85-264 V AC Operating frequency: 47-63 Hz Maximum input current: 1.4 A Output voltage: 24 V DC [23.8-25.2 V] Output current: Max. 5 A Input connector type: R7B 4 PIN	1. Reef flare S 2. Reef flare Pro S
GST220A24R7B	Desktop power adapter 24 V 9.2 A DC	Input voltage: 85-264 V AC Operating frequency: 47-63 Hz Maximum input current: 1.7 A Output voltage: 24 V DC [23.8-25.2 V] Output current: Max. 9.2 A Input connector type: R7B 4 PIN	1. Reef flare M 2. Reef flare Pro M 3. Reef flare L

GST280A24R7B	Desktop power adapter 24 V 11.67 A DC	Input voltage: 85-264 V AC Operating frequency: 47-63 Hz Maximum input current: 2.0 A Output voltage: 24 V DC [23.8-25.2 V] Output current: Max. 11.67 A Input connector type: R7BF 4 PIN	1. Reef flare Pro L
GST280A24R7B	Desktop power adapter IDLC-45A-500	Input voltage: 90-295 V AC Operating frequency: 47-63 Hz Maximum input current: 0.16 A Output voltage: 35-50 V Output current: Max. 0.5 A Input connector type: N/A	1. Reef flare Bar S 2. Reef flare Bar M
GST280A24R7B	Desktop power adapter IDLC-45A-1050	Input voltage: 90-295 V AC Operating frequency: 47-63 Hz Maximum input current: 0.4 A Output voltage: 16.8-24 V Output current: Max. 1.05 A Input connector type: R7BF 4 PIN	1. Reef flare Bar L

DC 5.5/2.1 connector:



R7B and R7BF connector:

