KHG Quick Set Up.

Make up KHG calibration solution. You should use 1500 grams of RODI water for dilution. Please note the unit of RODI water is grams, not millilitres. Please use an electronic scale to weigh 1500 grams of water and keep the error to within 1 grams – then add the KHG calibration solution. Mix the solution thoroughly.

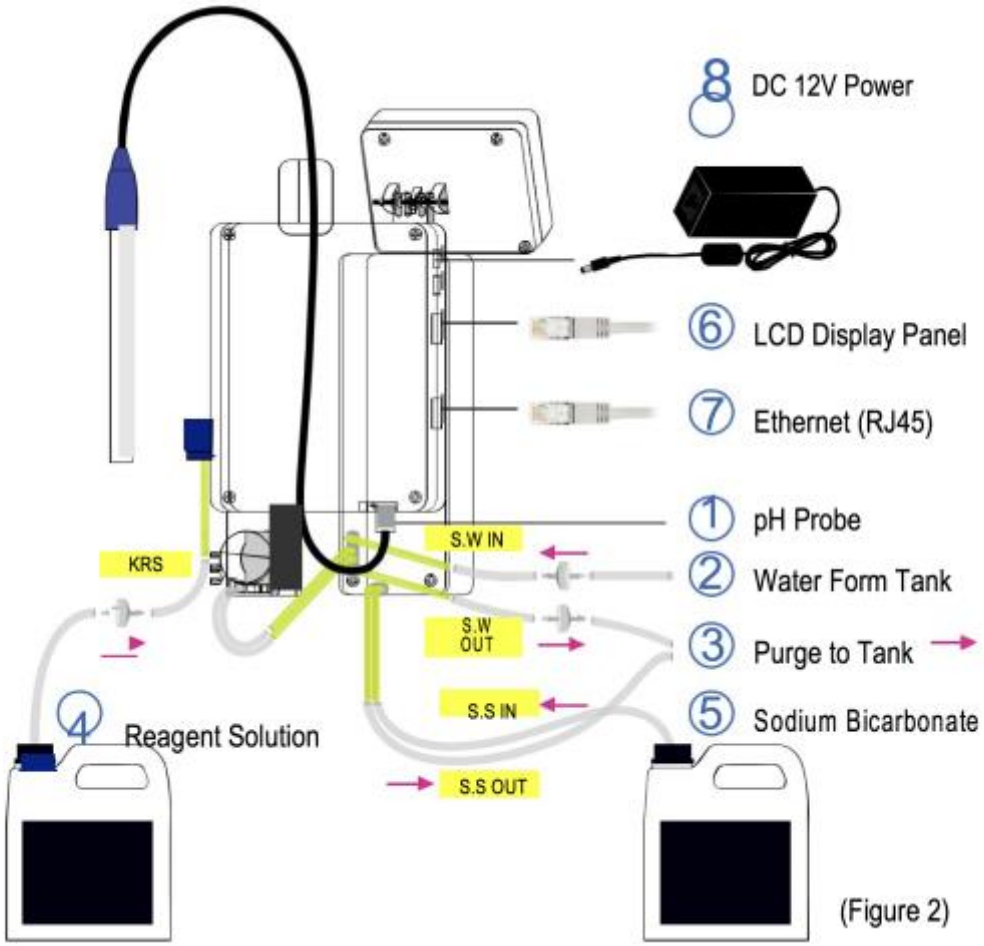
The KHG reagent usage depends on testing frequency and the alkalinity of the water being tested. Typically, with an alkalinity of 7.5kH, the KHG will use approx. 2.2mls of reagent per measurement. With an alkalinity of 13kH, the KHG will use approx. 3.8mls of reagent per test.

1. The KHG comes with auto supplementation of Sodium Bicarbonate. To use this feature, please prepare your Sodium Bicarbonate solution by mixing 65 grams of sodium bicarbonate powder per one liter of water. Please keep the error tolerance to within 5%.

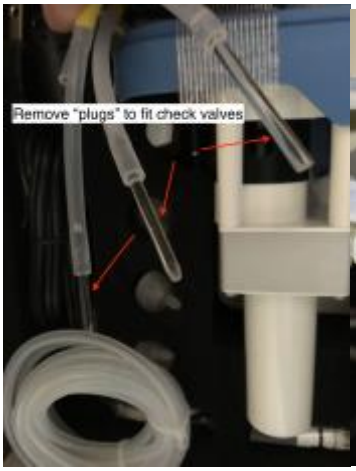
2. Find a suitable **stable** (it is important the KHG does not get bumped during measurement as this will result in inaccurate measurements) and **level** and location for the KHG with 1m of the tank it will be monitoring.

3. Ensure that the electrical connections cannot be splashed with water as this will invalidate the warranty.

4. Connect the 5 reagent lines to the KHG using the supplied check valves as detailed below – be sure to place in the correct direction. If only using as a monitor (recommended initially), then S.S In and S.S Out do not need to be connected at this stage**. Do not place the S.W. Out or S.S Out tubes in the tank water to prevent any possible siphon.** ***Please ensure SW in tube is as far away as possible from any dosing input or calcium reactor output. Failure to observe this can lead to spurious results.***



(Figure 2)



SW IN
Saltwater in. This tube connects to your tank water for the sample to be taken. The source of tank water must be filtered by the 500 micron check valve to keep tubes free of blockage. Please make sure the medical grade check valve (included with KHG) is installed in the right direction.

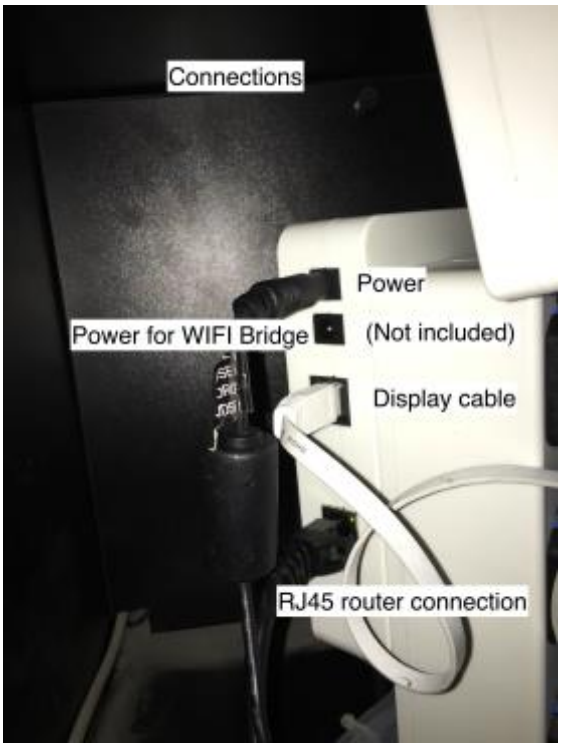
SW OUT
Saltwater OUT. This tube is for purging the reaction chamber water. Please make sure the medical grade check valve (included with KHG) is installed in the right direction and that the tube is not immersed in the water to prevent any possible siphon. This waste has been tested and is safe to add directly to the tank water**. If you decide to catch the waste, separately, be aware that each test will use approximately 65ml of water, so over the course of 1 week, (if testing every 4 hours) the KHG will remove almost 2 litres of tank water.**

S.S. IN
Sodium Bicarbonate Solution IN. This tube connects to your Sodium Bicarbonate Solution Reservoir.

S.S. OUT
Sodium Bicarbonate Solution OUT. This tube connects to your tank or sump. It delivers the sodium bicarbonate solution to your tank to use in combination with the KH auto correction feature of KHG. Make sure that the tube is not immersed in the tank water to prevent any possible siphon

KS
Reagent Solution. This tube connects to the KHG reagent solution bottle.

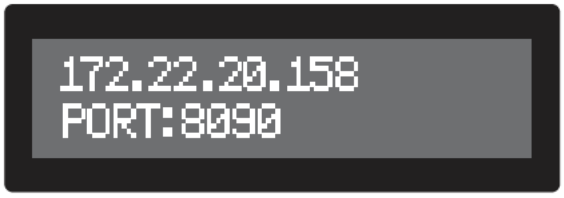
5. Connect the display cable



6. Connect the supplied RJ45 to the KHG and your router (can be connected to a wifi bridge such as https://www.amazon.co.uk/gp/product/B00NIUHAG6/ref=oh_aui_detailpage_o07_s00?ie=UTF8&psc=10
   If using a wireless bridge, be sure to connect your wireless bridge to your router wirelessly also!

7. Be ready with a pen and paper (or phone camera) to record details of IP and port number that will be displayed on power up. Apply power.

8. After switching on the KHG, the display panel will show the IP and port number automatically assigned by the network DHCP – see example below.

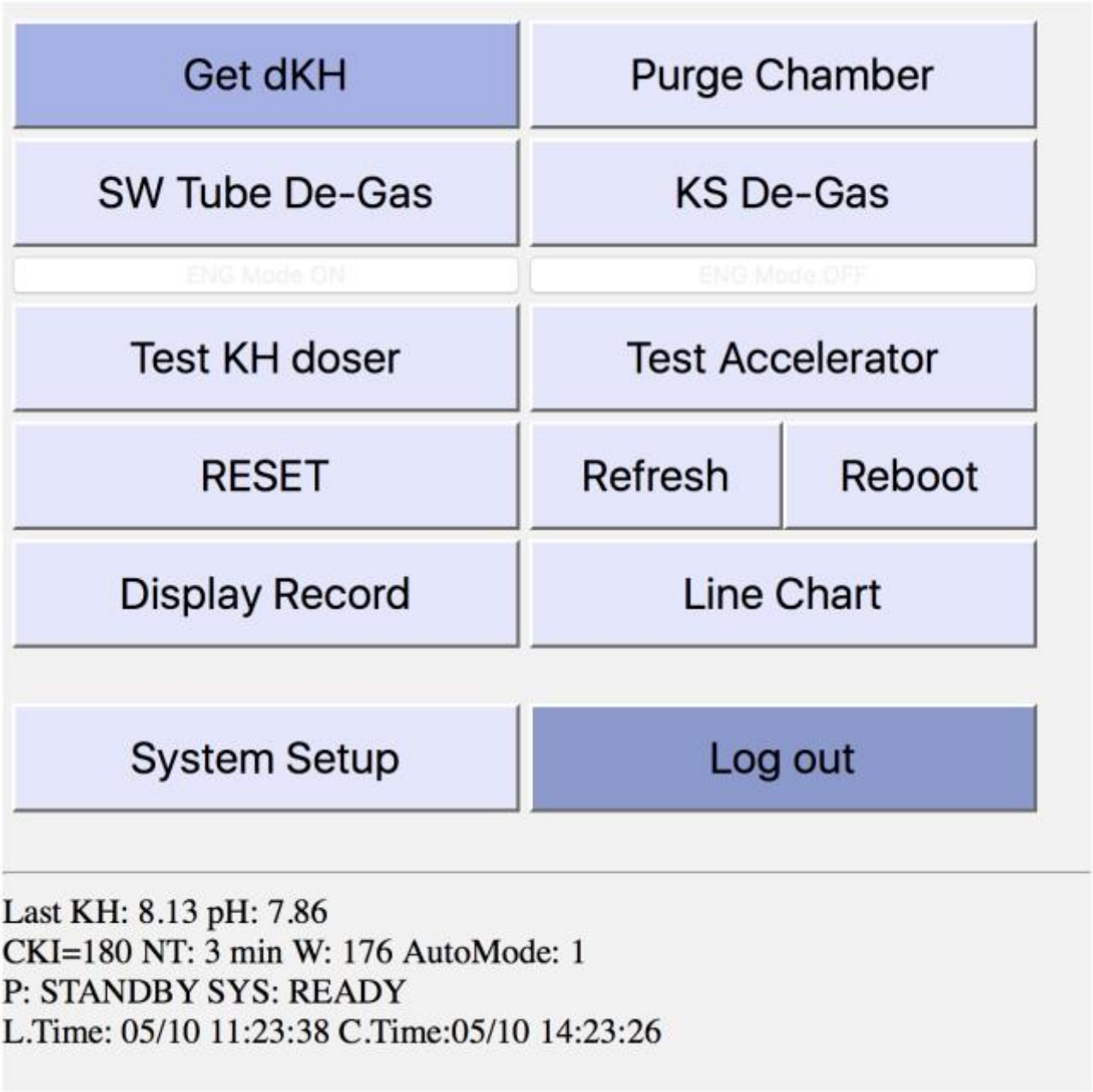


9. Please write down the IP and port number shown on the display, and enter it to the browser of your computer or mobile device to access controls of the KHG

10. If your network DHCP did not automatically assign an IP to KHG, the default IP will be 192.168.1.10. For example, if the display were shown as above, then you should enter http://172.22.20.158:8090 into your browser. When the login window appears as Figure 8, enter the password (default setting is "Admin") and Click the Login button.

(Figure 8)

11. You will then be able to access the controls of KHG as Figure 9.



pH probe calibration & installation

You must perform the 2 point calibration in the order of pH7 first and pH4 second.

12. Connect the pH probe to the connector on rear panel of KHG unit – see below.

13. Rinse pH probe with distilled water, and pat dry with fine tissue paper. When drying, **please do not twist dry probe surface with the tissue paper as this will damage the coating on the probe sensor**, and will render the probe inaccurate.

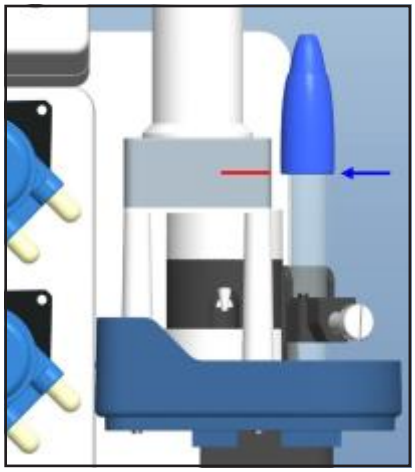
14. Please insert the pH probe into pH 7.0 calibration solution of at least 1.5 cm deep. Observe pH display on bottom left of display – when stable Press and hold number 2 and number 4 buttons simultaneously for 3 second until you hear a beep and release both buttons. Now the pH 7.0 calibration is complete.

15. Before proceeding to pH 4 calibration, please rinse pH probe with distilled water and pat dry with fine tissue paper as above.

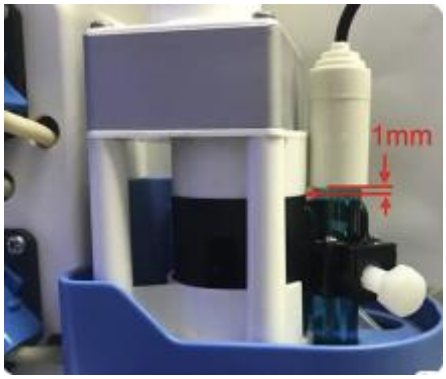
16. Please insert pH probe into pH4 solution of at least 1.5 cm deep. Observe pH display on bottom left of display – when stable Press and hold number 1 and number 4 buttons simultaneously for 3 seconds until you hear a beep and release both buttons. Now the pH 4.0 calibration is complete.

17. ***You must perform the 2 point calibration in the order of pH7 first and pH4 second.*** You must complete both calibrations before proceeding to the next installation step. A 2 point calibration must be performed every time you clean the pH probe or attempt to re calibrate.

18. **KHG Controller ONLY (Glass pH Probe)** Please insert the calibrated pH probe until the cap of pH probe is level with the Red line (red line for illustrative purposes – there is no red line on the KHG itself). (Figure 5) Hand tighten the white knob to secure pH probe in place. Over tighten the white knob could break the glass sleeve of pH probe.



19. **KHG Monitor ONLY (Plastic pH Probe)** Please insert the calibrated pH probe until the cap of pH probe is level with the Red line (red line for illustrative purposes – there is no red line on the KHG itself). (Figure 5) Hand tighten the white knob to secure pH probe in place. Over tighten the white knob could break the pH probe.

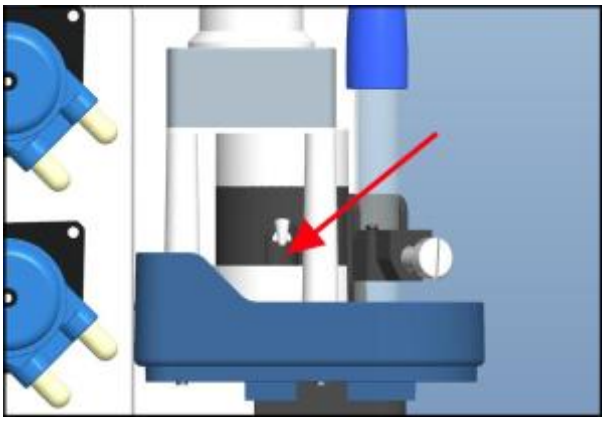


20. Go to your browser and click on "SW Tube De-Gas" to purge air from your tank water inlet tube. During the first attempt to draw tank water and purge air, KHG may show NSWE error message (No Salt Water Entering). To cancel the error message, you should press and hold the number 4 button until you hear a beep and release the button.

21. Please click on the "SW Tube De-Gas" for as many times as necessary until you can see the tank water is flowing in the inlet tube.

22. Please click on the "KS De-Gas" on your browser to purge air from your KHG reagent solution tube.

23. Please look into the observation hole (Figure 6 below) until you see reagent solution is dropping at the rate of one drop per 3 seconds. Please let the reagent solution drip at least 10 times before cancelling the air purging by clicking on the "RESET" in your browser screen, or by pressing and holding number 4 button for 3 seconds to stop the purging procedure.



24. If KHG shows "KS_ERR", there may be blockage in the tube and KHG will forced into a reboot. If this happens, please check if the tube is free from blockages and make sure there is reagent solution in the storage bottle.

25. If you intend to use auto correction of alkalinity, next you need to prime the bicarb line by pressing the test KH Doser button. Do this until line fully primed.

26. The system is now ready to set up.

27. Upon initial assembly and installation, please make sure to perform 5 (five) dKH readings to ensure optimal performance and accuracy. This can be done by selecting Get KH.

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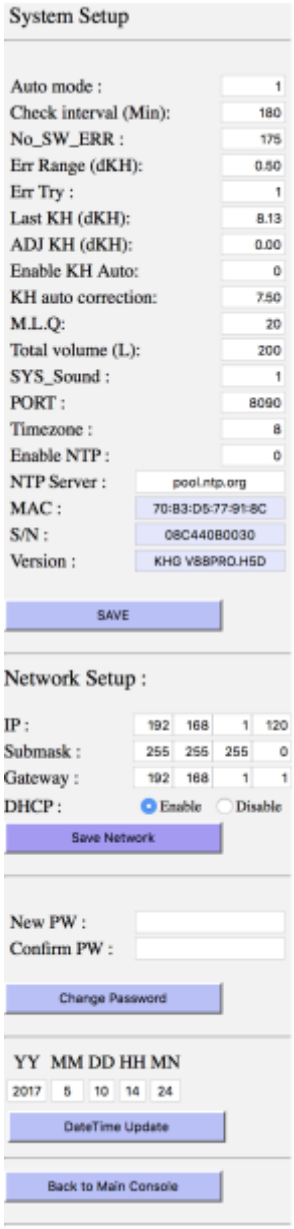
KHG SYSTEM SETUP

Select System Setup



1. **Auto Mode:** The default value is 1. This puts the KHG is in automatic mode and the KHG will test at the check interval set. Any other value will disable automatic mode.

2. **Check intervals (Min):** This is to set the time interval between the start of each KHG test. Unit is minutes. We recommend setting the interval to 180 minutes. You can shorten the testing interval time, but that will also use up KH reagent solution faster.

3. **No_SW_ERR :** This is to set the alarm if the number of steps of the step motor has turned, but still not enough water has been pumped into the reaction chamber. Default value is from 140 to 160. The unit is number of steps for the step motor. This is useful to determine if there were blockage in the SW feeder tube. Depending on how far your KHG is placed from the tank water source and how much head there are to pump water into the reaction chamber. You can adjust this value to best suit your environment. However, caution must be taken if you deviate from the recommended range too far, it may result in excessive water being pumped out of your system (if you do not return your waste to your tank).

4. **Err Range (dKH):** This is to set the variance range in comparison to the previous dKH measurement. If this test deviates by this setting or more compared to the last known dKH value, the KHG will perform a second testing immediately to verify the result. The unit of value is dKH. We recommend to set it at 0.5 dKH.

5. **Err Try :** This is to set the number of retests to be performed, if the Err Range condition were met.

6. **Last KH (dKH) :** This is only used after a system reset or diagnostics, or if instructed by a qualified KHG support staff.

7**.ADJ KH (dKH) :** This is to apply a correction to the value obtained by KHG. This is normally used if you believe there is a constant deviation between the value tested by KHG versus another test kit, and you believe KHG's value need to be adjusted every time. You can enter the deviation in here. The adjustment value can be either positive or negative.

8.**Enable KH Auto :** Enter "1" to activate automatic adjustment mode. Any other number will cancel the automatic mode i.e. Bicarbonate will not be dosed if not set to "1".

9.**KH auto correction :** This is to set your target dKH value. The unit is dKH. As a fully functioning dKH controller, KHG not only monitors your tanks alkalinity, but with KH auto correction, KHG will also actively maintain your desired dKH level. Regardless if you normally maintain your tank alkalinity by kalkwasser, calcium reactor, or alkalinity dosing, we highly recommend you set your usual alkalinity dosing to a level slightly below your desired target, and let KHG do the final fine tuning for your tank automatically. For example. If your target tank dKH is 7.5, then please set this number at this field. At the same time, please setup your normal alkalinity dosing to near 7.0, and let KHG do the rest. KHG will calculate the difference of the actual tank alkalinity level versus the desired target. Taking account of the total tank volume, KHG will calculate how much sodium bicarbonate solution to add after each testing.

10. **M.L.Q :** MLQ sets the maximum amount of sodium bicarbonate that KHG can add at any given time. Unit is milliliter (ml). This is the safety feature for your tank to prevent too much alkalinity to be added into the tank at any given time. For example, if the KHG determines 80 ml of bicarbonate should be added into your tank, but you have set the MLQ at 35 ml, then KHG will only add 35 ml this time into the tank. As a rough calculation, with the bicarbonate solution made up at 65g/litre, the solution will raise the kH as follows: 4.7mls/100 litres/0.1kH. e recommend setting the MLQ to 35mls for each 200 litres of tank volume. So for example a 1000 litre tank would have the MLQ set to 175mls.

11. **Total volume (L) :**This is to set the total water volume of your tank in Litres. KH auto correction will use this data to calculate how much sodium bicarbonate solution should be dosed after each test.

12**. SYS_Sound :** Set as "1", system sound will be ON. Any other number will deactivate system sound. Cancelling system sound will NOT silence alarm.

13. **PORT :** This is to be used only as instructed by your network administrator. Default value is 8090.
14**. Timezone :** This is to set time zone (UTC) at your location. Please set to "8" for UK.

Enable NTP: Please set to "0" keep set to UK time.

15. **NTP Server :** This is only to be used if instructed by your network administrator.

16. **MAC : The** MAC Address of your KHG which cannot be changed.

17. S/N : Serial Number of this KHG and cannot be changed.

18**. SAVE :** Save all settings above to the memory. KHG will force reboot after new settings have been saved.

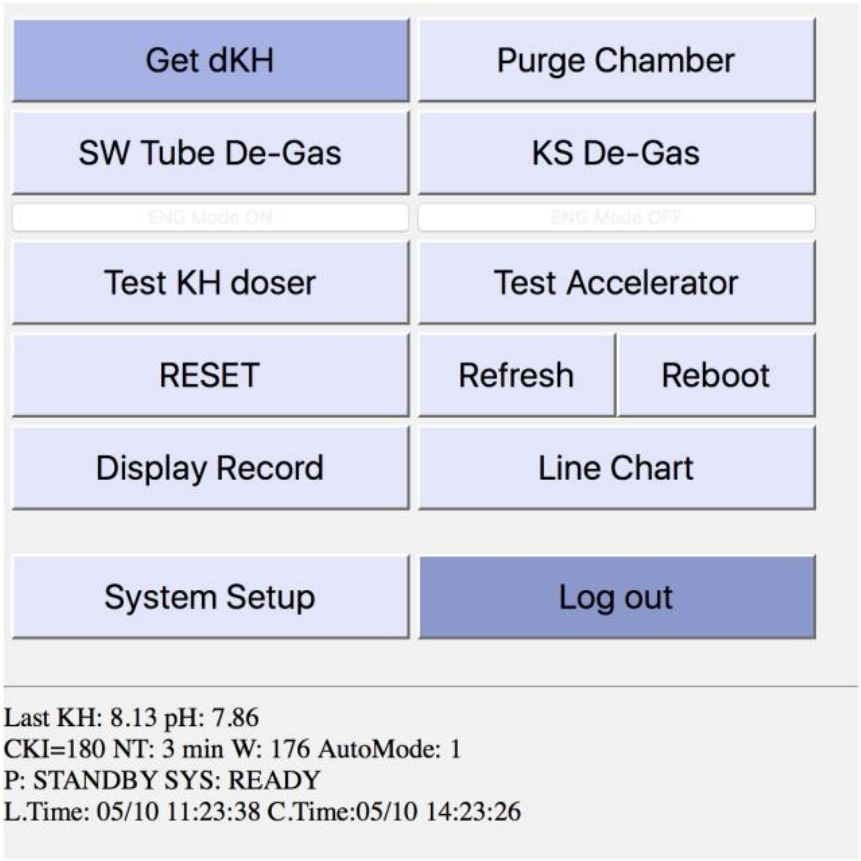
Network Setup: To be confirmed.

19. **New PW :** Please enter new password. Password allows maximum 8 characters include spaces, numbers, letters or mixed. No special characters are allowed. Case sensitive.

20. **Confirm PW :** Please re-enter your new password. Press “Change Password” after to complete and store your change. No reboot necessary.

21. **Clear SD:** Press “DO” to initiate SD card memory purge. The KHG has a log feature for user analysis. However, the record log takes up memory on the SD card, and we recommend performing the SD card memory purge every 3 months. Low available SD card memory will slow down the display refresh speed. Every time you do a “Clear SD”, please unplug KHG from power outlet for 3 seconds and reconnect the power cord to the electrical outlet. This will reboot the system to re-enable the logging function.

KHG System Software:



Get dKH
Press to initiate a test and obtain KH value. Counter will be reset after the testing is completed.

Purge Chamber
Press to purge and empty all solutions in the reactor chamber. ***This must be performed every time you intend to move the KHG***. It is crucial to purge the reaction chamber to prevent solutions damaging the optical lens and other electronic components. Failure to purge chamber could result in KHG failure.

SW Tube De-Gas
Press to pump saltwater sample into the reaction chamber. This is normally only used for the initial setup of KHG, or after reassembly of the step motor head. By pressing this, saltwater will be pumped up the intake tube, purging gas from the tube. If there were any blockages in the intake tube, after a preset amount of time and no water has been pumped into the reaction chamber, the display would show S.W_ERR error message.

KS De-Gas
Press to purge air from the intake tube of KH reagent solution. Please look into the observation window to check if KH reagent solution are flowing into the reaction chamber. After seeing reagent solution is flowing and the LED is blinking steadily, please press the "RESET" button to stop.

ENG Mode ON
Advanced function only. Do not use unless being instructed by a qualified KHG support staff.

ENG Mode OFF
Advanced function only. Do not use unless being instructed by a qualified KHG support staff.

Test KH doser
Press to test if the Sodium Bicarbonate solution is pumping and also used to prime Bicarbonate tubes

Test accelerator
Press to test if the reaction chamber agitator is functioning normally.

RESET
Press to reset warning signals. Also used to stop KS De-Gas function.

Refresh
Press to refresh your browser display on your computer or mobile devices.

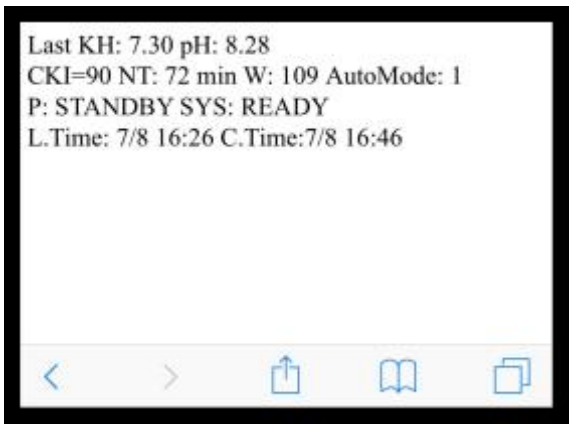
Display Record
Press to display the log.

Line Chart
Press to display the line chart – see example below:

Reboot
Press to force reboot of the KHG.

System Setup
Press to enter system setup.

Definition of the data shown on the bottom of the main control page (Figure 10):



Last KH: n.nn
This is the last dKH value obtained by the KHG.

pH: n.nn
This is the last pH value obtained by the KHG.

CKI = nn
This is the testing interval (unit: minutes). Testing Interval can be changed in the KHG system setup.

NT: nn min
This is the time (minutes) remaining until next testing.

W: nnn
This is the step motor setting value to control how many steps motor will turn to pump water into the reaction chamber (unit: steps).

AutoMode: n
Automatic testing mode (1 = ON, 0 = OFF).

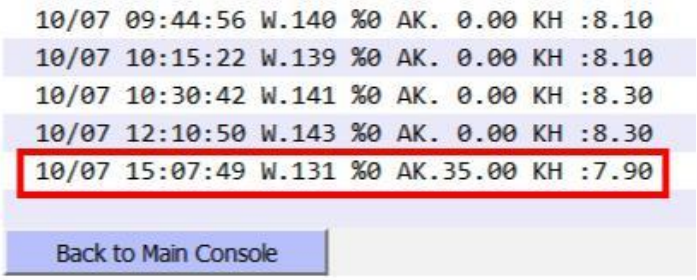
P: STANDBY
Current system status.

SYS: READY
Sublevel control status (For support staff use only).

L.Time: MM/DD hh:mm
Date and time of the last testing performed.

C.Time: MM/DD hh:mm
Date and time of the current testing performing.

Definition of the Log Field



10/07 15:07:49
Date and Time of measurement.

W.131
The number of steps required by Tank Water Stepper Pump before tank water is detected.

%0
optically matching agent dropped speed to assess the percentage of possible errors.

AK.35.00
calculated amount of bicarbonate dosed (only dosed if Enable KH Auto is set to “1”)

KH :7.90
The KH value measured (before adding bicarbonate).

Error Messages and Troubleshooting

After an error has been cleared, to remove the error from the display, push button 4 for about 5 seconds.

SW>ERR
System water intake error.
A. Please go to control menu and press “SW Tube De-Gas” and also check if the Sodium Bicarbonate pump is functioning.
B. Please check all sections of tank water intake tube and make sure they are free of blockage.

C. Please gently open the “Reaction Chamber” and make sure the white water level sensor is freely movable up and down.

D. Sensor may have malfunctioned. Please contact your dealer.

SW<ERR
Reaction chamber water purging error
A. Please go to control menu and press “Purge Chamber” and make sure the “Waste Water Purge Pump” is functioning.
B. Please check all sections of purge tube and make sure they are free of blockage
C. Please gently open the “Reaction Chamber” and make sure the white water level sensor is freely movable up and down.
D. Sensor may have malfunctioned. Please contact your dealer.

KS_ERR = KRS (KHG Reagent Solution)
solution suction error
A. Please check if the KRS solution is empty and needs replacement
B. Please check all sections of KRS solution intake tube and make sure they are free of blockage.
C. Please go to control menu and press “KS De-Gas” and also check if the KRS pump is functioning.
D. If the KRS pump is turning, please look into the observation window and check if the drop sensor light is blinking when each drop of the KRS solution is dropping. (One short blink, One long blink)
E. Sensor may have malfunctioned. Please contact your dealer.

KH>ERR
KH value high error
A. This error message indicates the tested value is 1.5dKH larger than the “KH auto correction” setting. System would recognize this as obnormality.
B. Please check if your “KH auto correction” setting is correct.
C. Please check if your KRS solution tube has too much air bubbles.
D. Please check if the pH probe is secured at proper depth.
E. Please check if the dilution ratio of your sodium bicarbonate solution is correct.
F. If all settings are correct, please contact your dealer.

KH<ERR
KH value low error
A. This error message indicates the tested value is 1.5dKH lower than the “KH auto correction” setting. The KHG will stop dispensing Sodium Bicarbonate until this error has been cleared.
B. Please check if your “KH auto correction” setting is a reasonable.
C. Please check if your KRS solution tube has too much air bubbles.
D. Please check if the pH probe are secured at proper depth.
E. Please check if the dilution ratio of your sodium bicarbonate solution is correct.
F. If all settings are correct, please contact your dealer.

AC_ERR
KH accelerator error
A. Please gently open the “Reaction Chamber” and check if the small white agitator is missing.
B. Please check if the pH probe is secured at proper depth.
C. Accelerator may have malfunctioned. Please contact your dealer.

pH<ERR
pH reading low error
A. This error message will occur if the pH reading is below 4.5. An alarm will activate.
B. Please check if the pH probe is properly secured in the socket.
C. Please execute the pH probe calibration procedure.
D. Please gently open the “Reaction Chamber” and check if it is dry inside.
E. If the “Reaction Chamber” is dry, please check the water level sensor if it can move up and down freely.
F. If all settings are correct, please contact your dealer.

pH>ERR
pH reading high error
A. This error message will occur if the pH reading is higher then 8.8. Alarm will activate.
B. Please check if the pH probe is properly secured in the socket.
C. Please execute the pH probe calibration procedure.
D. If all settings are correct, please contact your dealer.

Additional Information.
At any time if you wish to move KHG, you must use the "Purge Chamber" function to completely drain out all liquids in the Reaction Chamber. Moreover, please detach and invert the Reaction Chamber from the unit and pat dry the insides with paper towel. Failure to do so may cause the corrosive salt water to spill and may damage the parts of KHG. In severe cases, the damage maybe permanent.

Only use KHG approved pH probe. Non-approved pH probe will result in inaccuracy. If possible, please always have a spare pH probe at hands ready to use. We recommend exchanging the pH probe every three months, and perform pH4 and pH7 calibration every time at the exchange. When removing a pH probe for storage, you must thoroughly clean the probe, pat dry the surface. To store the pH probe, the glass bulb at the tip of the probe must be immersed in 3M potassium chloride solution.

Life of pH probe is approximately 18 months, and may reduce accuracy after long exposure to salt water. Please do not allow pH probe to dry completely for 12 hours or more, it could result in permanent damage of the probe.

Use of non-approved KHG reagent solution is strictly prohibited. The factory supplied KH reagent is a special mixture of reagents. We carefully select reputable reagent chemical suppliers with quality certifications. Non-KHG approved reagents may damage the patent pending interference resistant rare earth material coating in the Reaction Chamber, and may result in permanent damage to the accuracy.

To best protect your reef tank inhabitants, we did not add preservatives to the factory supplied KHG reagents. However, the lack of preservatives may result in black color bacteria substances growing in the tubing. From the test result of using KHG in the last 4 years, these substances do not cause inaccuracy to the tests, and do not have negative influences to the reef tank inhabitants. If accidental diluted reagent solution exposure to your eyes or skin, please do not panic and simply rinse with large quantities of fresh tap water. Please keep KHG reagent solutions away from children at all times.

KHG currently is not WIFI capable due to various country regulations. You must use RJ45 network cables to physically connect KHG to your LAN. There is a 12V power jack already provided with KHG that can be used in conjunction with RJ45 WIFI Bridge. If user wish to make KHG WIFI capable, please contact with your seller or authorized dealer. KHG parent company does not offer WIFI related support for the users.

KHG does not support fixed IP and must be attached to the network that uses DHCP. For any reasons if KHG fails to obtain IP from the DHCP server, KHG will fix itself at default settings :

IP : 192.168.1.120 Submask : 255.255.255.0 Gateway : 192.168.1.1 Port : 8090

Please note the above default setting cannot be changed.

If your mobile devices are in this IP range, you can connect to the KHG by entering below in your browser : http://192.168.1.120:8090

Each time the KHG reboots, it will attempt to obtain time to the network time server. If not obtainable from the network server, KHG will use its internal clock. If the internal clock also fails, the date and time will display "Time N/A".

When positioning the KHG, the intake tube must be within 100cm and the KHG must not be positioned below the water surface of the location of intake tube water source.

The KHG S.W intake tube shall not be positioned to the bottom of the tank, and should be protected to prevent debris from entering into the intake tube and result in blockage in the tubing.

We would strongly recommend to keep KHG in a protected container away from saltwater splashes. Please contact your dealers for details.

Please do not attempt to open the cover of the KHG other than normal cleaning along the path of the liquid tubings. Warranties are void if the KHG body cover has been opened.

Please do not apply lubricants to the heads of the Sodium Bicarbonate pump, Tank Water Intake Pump and Waste Water Purge Pump. Use only dry paper towels to wipe clean if necessary.

The KHG Reagent Pump should be taken apart for lubrication every 6 months. Use only Molykote EM-30L Grease for lubrication. Other lubricants are strictly prohibited. The tubing for the peristaltic motor should be replaced at least once a year.

Complete system test will be performed on every KHG during factory pre-shipment tests. Salt residue may be present in the tubing upon purchase. The residue will be purged out during the initial setup.

Display Panel Short-Cuts:

1. **To calibrate pH 7**: Press and hold buttons 2 + 4 for 3 seconds.

2. **To calibrate pH 4**: Press and hold buttons 1 + 4 for 3 seconds.

3. **To KS_DS_Gas**: Press and hold buttons 1 + 2 for 3 seconds.

4. **To SW_Tube De_Gas**: Press and hold buttons 1 + 3 for 3 seconds.

5. **To Purge Chamber**: Press and hold buttons 3 + 4 for 3 seconds.

6. **To C.W. & dKH (Get dKH**): Press and hold buttons 2 + 3 for 3 seconds.