

# KH Tester

---

This English version is Google translated

## Foreword

This open source project is an automated KH test device (the automatic control KH code is not tested, use it with caution)

The principle of this equipment is the hydrochloric acid titration method. Due to the selected peristaltic pump flow rate, dripper, reaction chamber volume and other reasons, the test accuracy is 0.1dkh, which basically meets the daily monitoring needs of sea tanks.

The hydrochloric acid used for detection was 0.1N (0.1mol/L) standard solution. After testing, the detected wastewater can be directly discharged into the tank.

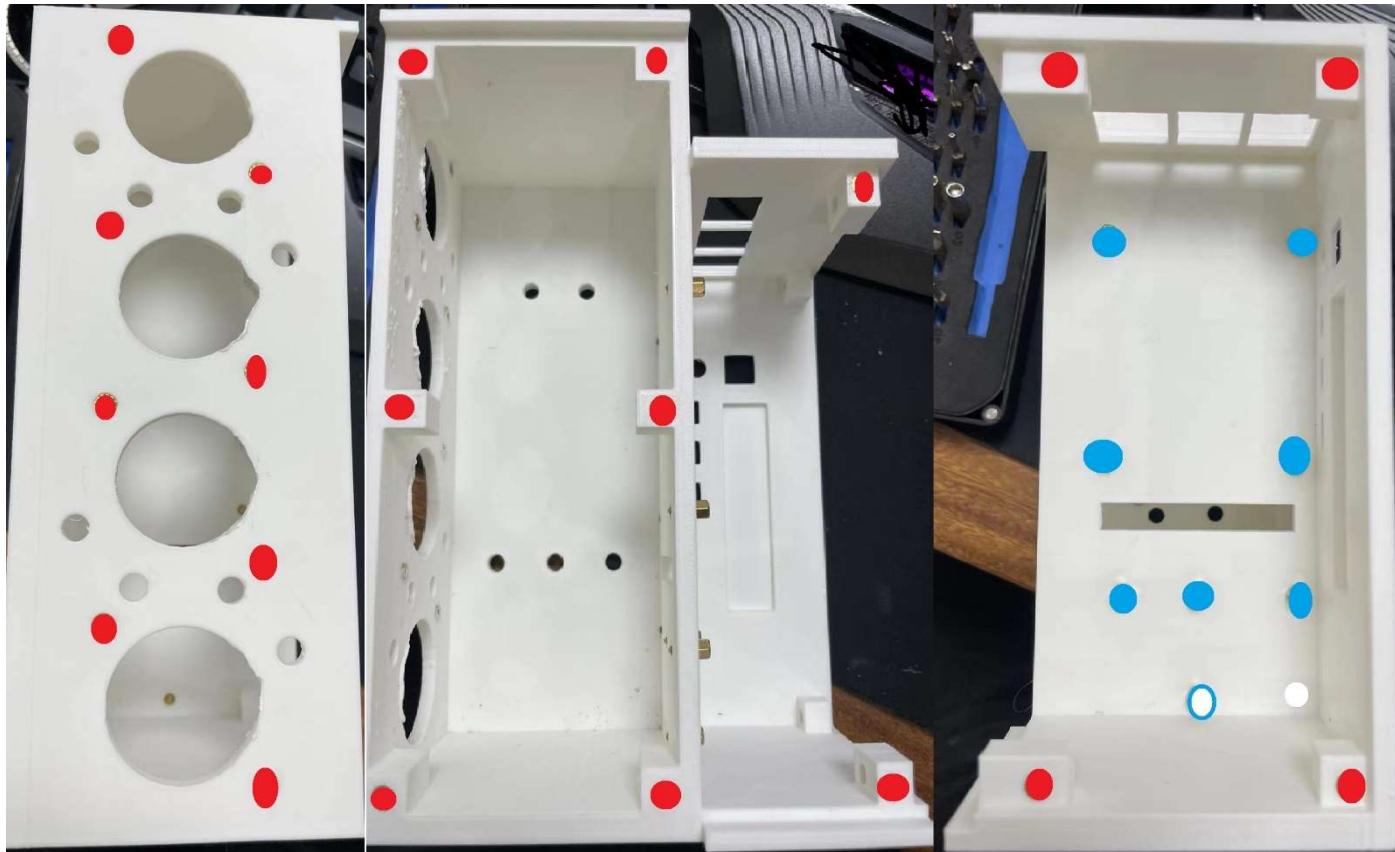
This project follows the "GNU General Public License V3.0", you can carry out any secondary development and modification of this project, but it shall not be used for commercial projects, and some functions have patents.

# 3D Printed

1. There are 7 3D printed parts in total. Since the reaction chamber and the water level switch bracket are in contact with the seawater in the tank for a long time, please try to use non-PLA materials (PLA is a degradable plastic), which can be printed on PETG, and the rest can be printed with PLA.
2. When printing the main body and the cover, try to use a printer with a sealed box (not needed in summer), because the printing time exceeds 20 hours, otherwise it will be easily warped and insulated.
3. Filling: The top cover of the reaction chamber is more than 5 layers, walk horizontally for 3 times, and fill it with 30% to prevent water leakage. Other infills can be 15%, of course the higher the infill, the stronger the print time and the longer the print time.
4. Please enable support when printing. You can set support for Brim to be turned on, and support traffic to be set to 70%, which is convenient for removing support later.

# Fastener

1. Put in the knurled nut. Put the hot embedded nut in the blue hole, and then screw it on the M2.5X5+6 single-head hexagonal copper column.



红色放入5X4XM3热埋螺母  
蓝色放入4X4XM2.5热埋螺母

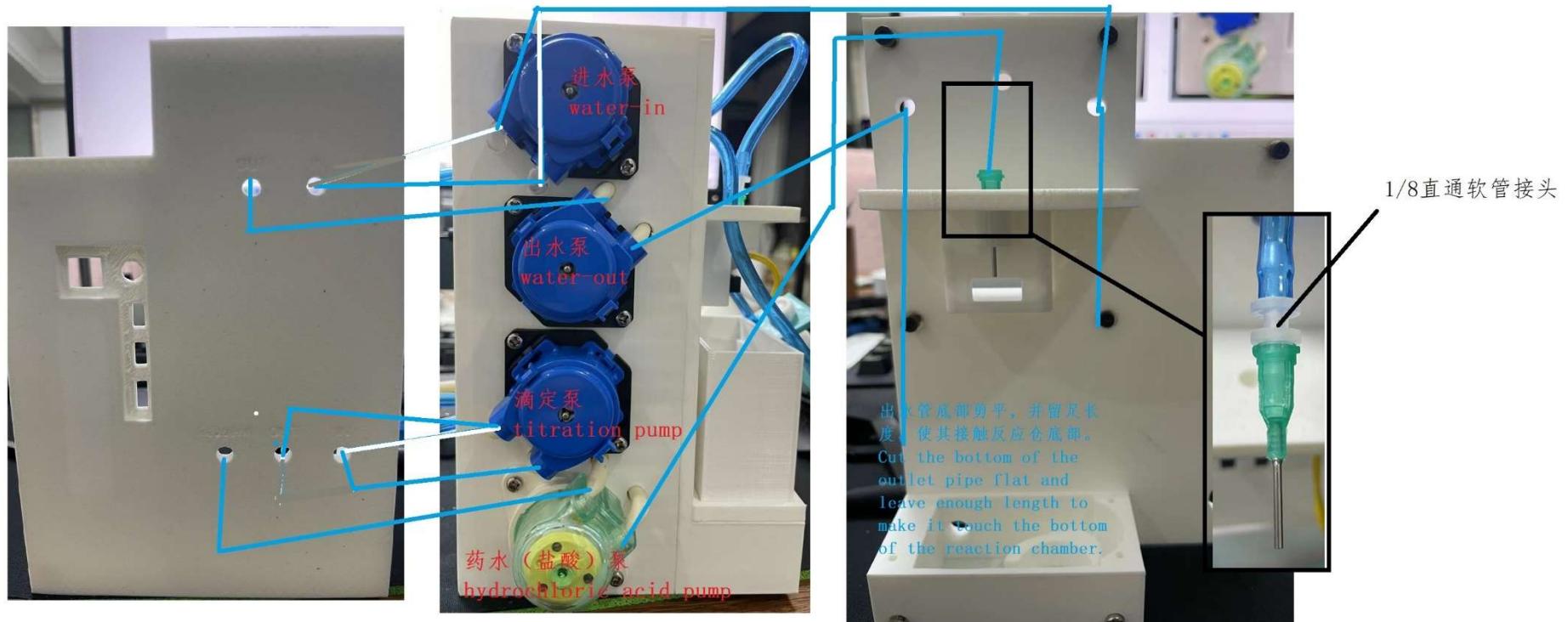
PS: 热埋螺母请用电烙铁加热后顶着螺母放入。

Red hole for 5X4XM3 Knurled Nut  
Blue hole for 4X4XM2.5 Knurled Nut

PS:Please heat the knurled nut with an electric soldering iron and put it into the shell against the nut

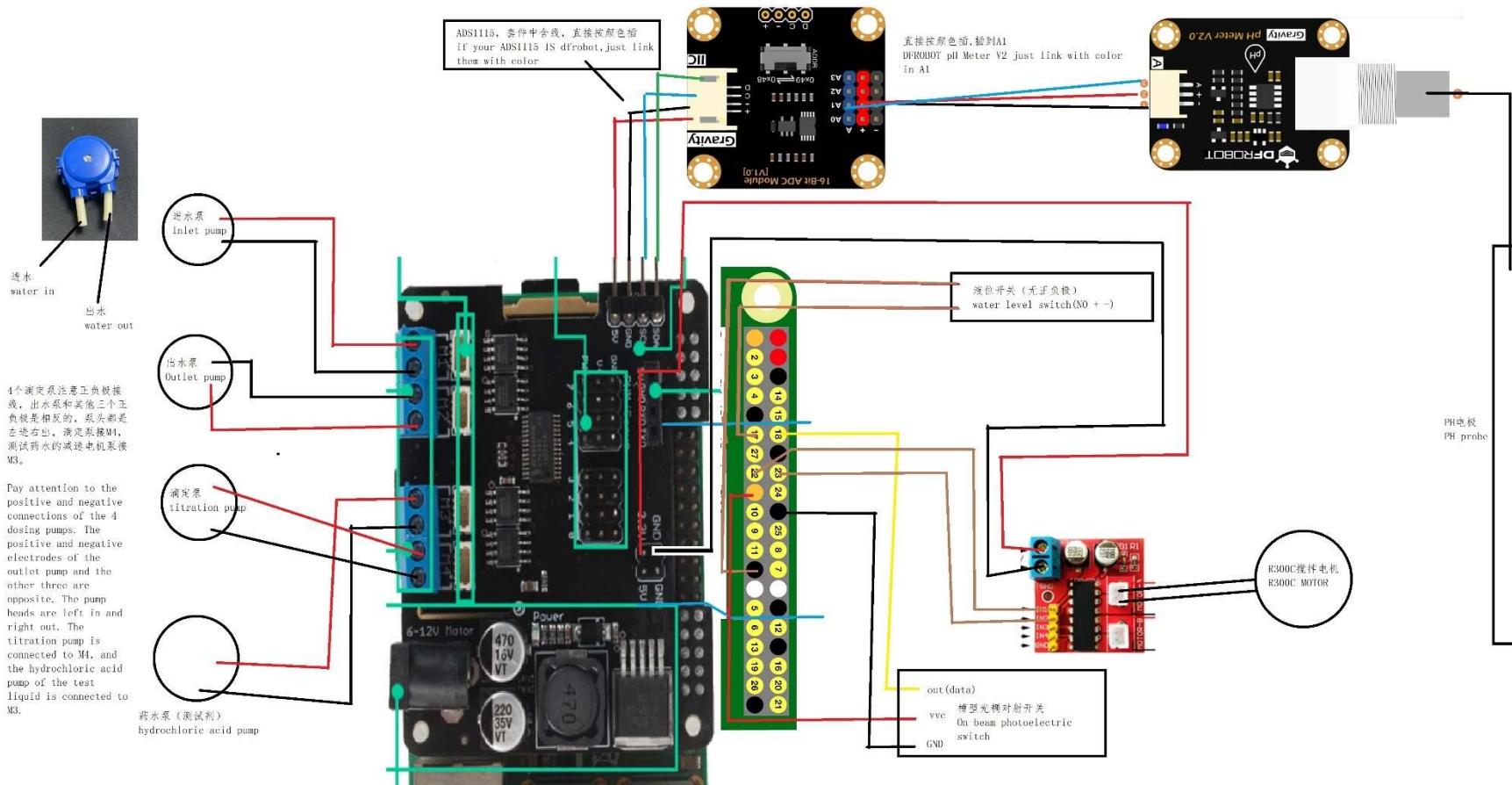
# Pipe connection

1. After the BPT tube on the peristaltic pump is connected to the shell, connect the burette with a 1/8 straight hose connector, cut the bottom of the outlet tube flat, and leave a sufficient length to make it touch the bottom of the reaction chamber. The water inlet pipe only needs to exceed the water level switch bracket.



# electric

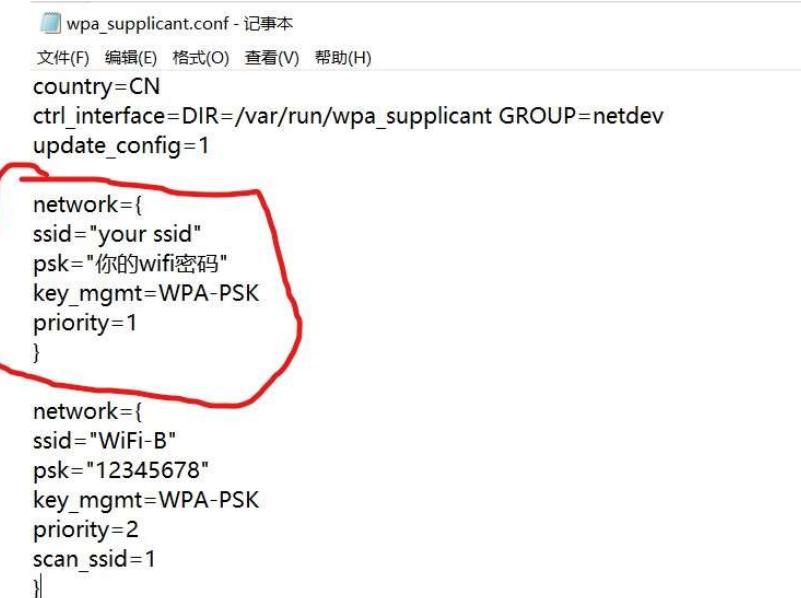
Please connect in strict accordance with the following figure (positive and negative poles, interface), enlarge the picture and read the remarks carefully.



# Software

IMG file:

- 1、 DOWNLOAD IMG FILE。unzip
- 2、 Write the decompressed IMG file into the TF card with Win32DiskImager software.
- 3、 Open the wpa\_supplicant.conf file with Notepad and modify the network item. Most new routers are WPA encrypted, So just change “your ssid” to your WIFI name and “your WIFI” password to your password



```
wpa_supplicant.conf - 记事本
文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)
country=CN
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1

network={
    ssid="your ssid"
    psk="你的wifi密码"
    key_mgmt=WPA-PSK
    priority=1
}

network={
    ssid="WiFi-B"
    psk="12345678"
    key_mgmt=WPA-PSK
    priority=2
    scan_ssid=1
}
```

如果你的 WiFi 没有密码

```
network={
    ssid="你的无线网络名称 (ssid) "
    key_mgmt=None
}
```

如果你的 WiFi 使用WEP加密

```
network={
    ssid="你的无线网络名称 (ssid) "
    key_mgmt=None
    wep_key0="你的wifi密码"
}
```

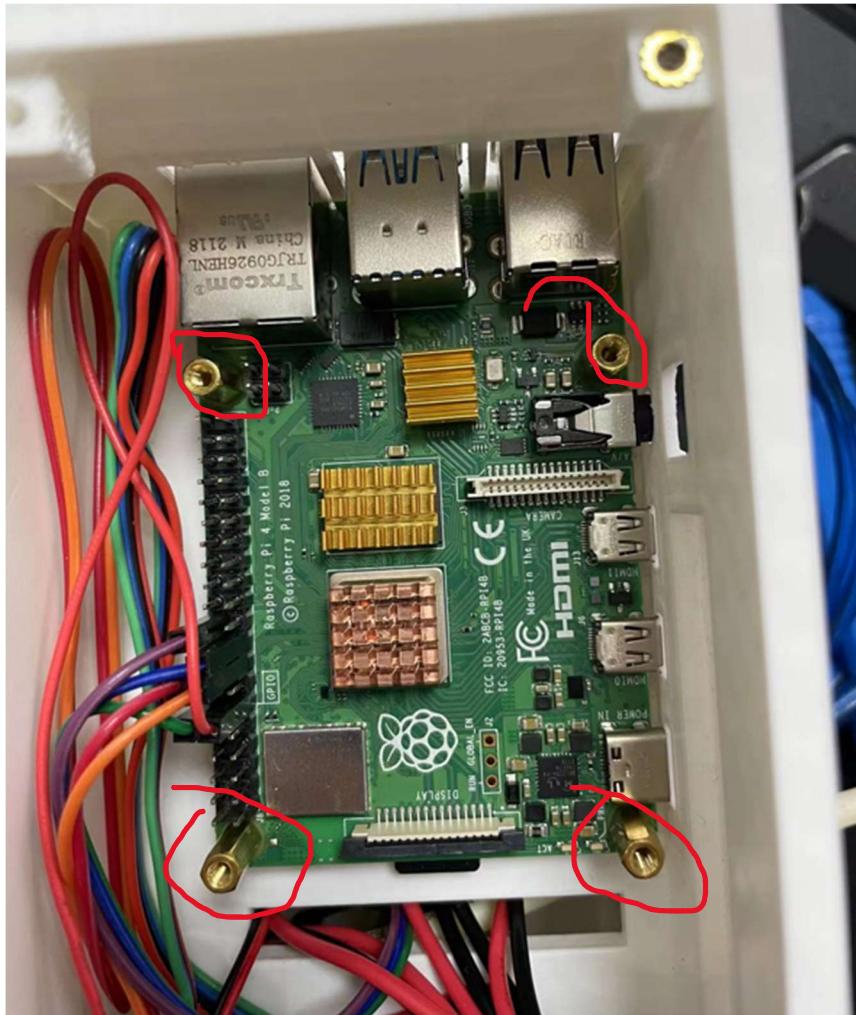
如果你的 WiFi 使用WPA/WPA2加密

```
network={
    ssid="你的无线网络名称 (ssid) "
    key_mgmt=WPA-PSK
    psk="你的wifi密码"
}
```

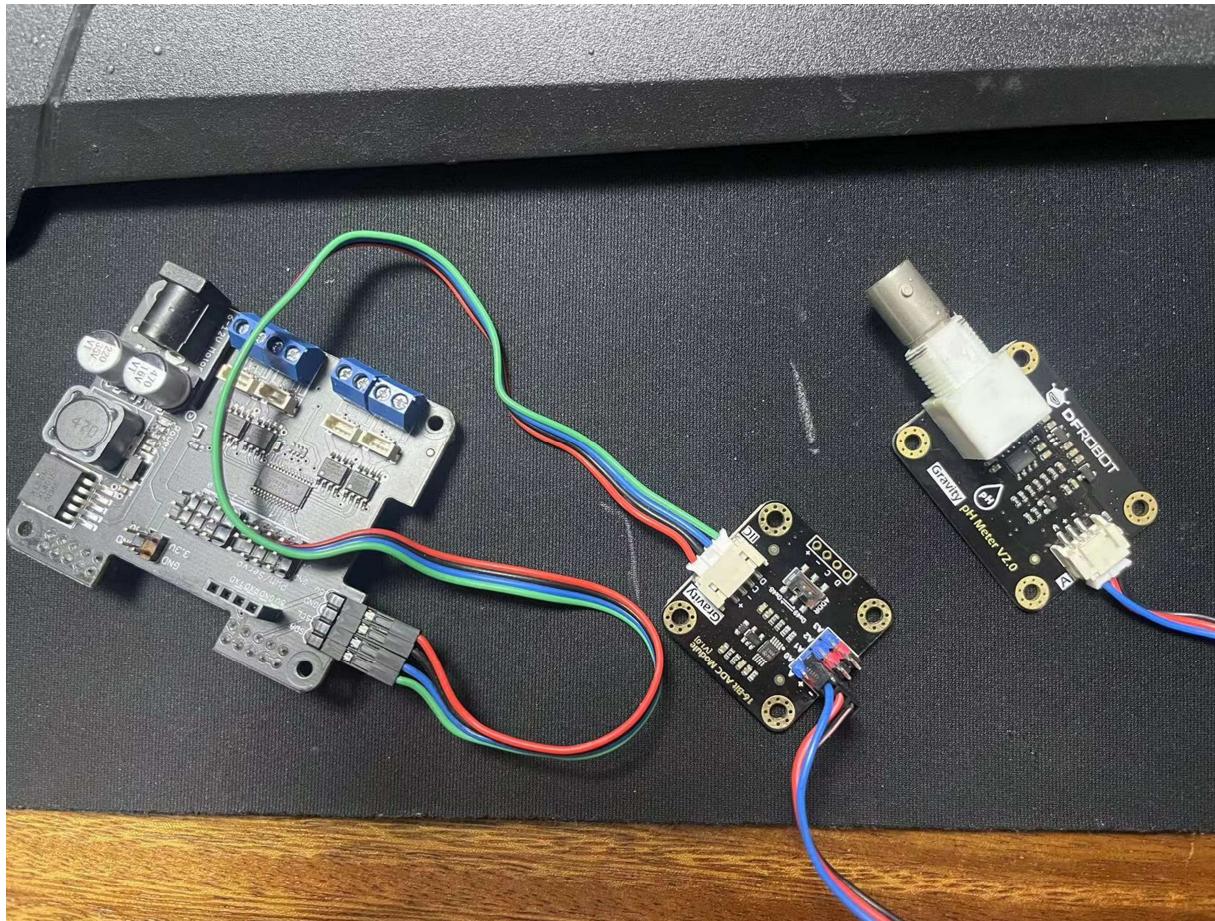
- 4、 After saving, copy the entire folder to the BOOT disk of the TF card.
- 5、 Insert the TF card into the Raspberry Pi.

# Assembled

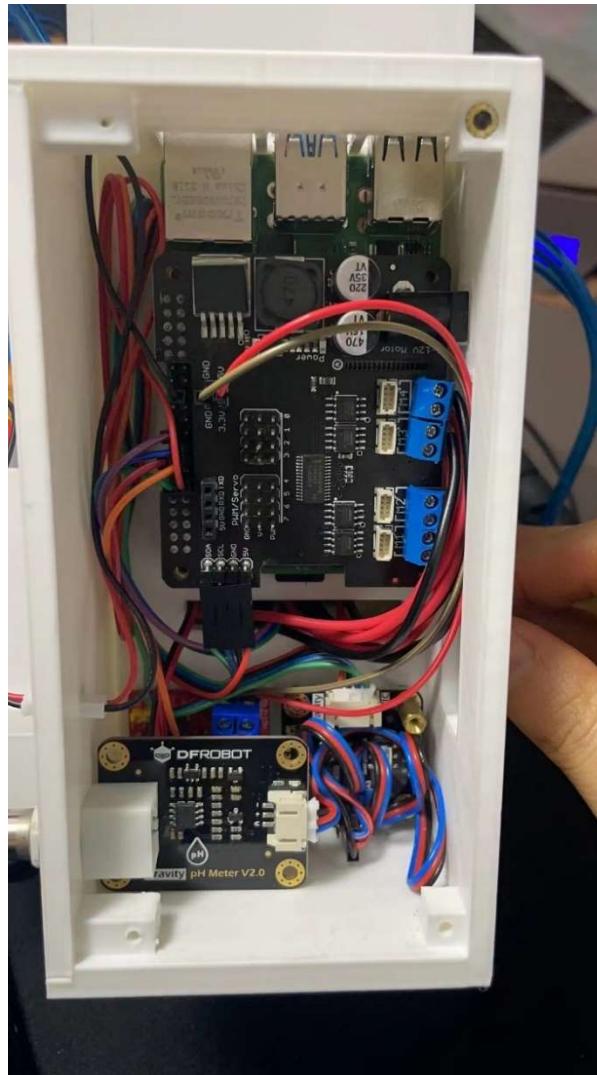
1. Fix the Raspberry Pi with M2.5\*11+3 as shown below.



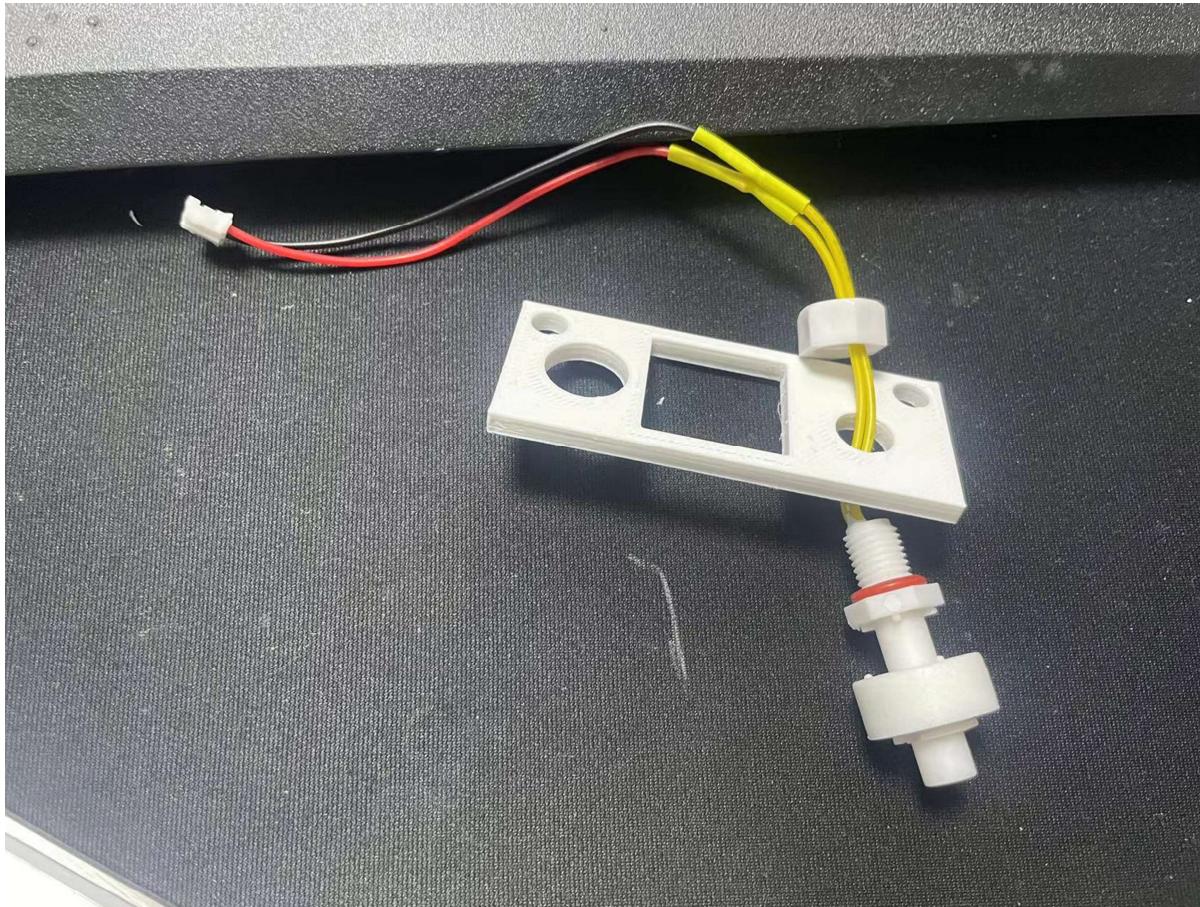
- 2、Fix 4 peristaltic pumps with M3X10 countersunk head bolts according to the pipeline connection part,
- 3、Connect the Qiguo Pi Raspberry Pi motor expansion board and 4 peristaltic pumps according to the circuit connection part (pay attention to the positive and negative poles and the online order)
- 4、Insert the Raspberry Pi Motor Expansion Board into the top of the Raspberry Pi (see the picture below for wiring),
- 5、Connect the Qiguo Pi Raspberry Pi motor expansion board and the DFRobot I2C ADS1115 analog-to-digital conversion module to the following diagram according to the circuit connection part.



- 6、Use M2.5X5 bolts to fix the Qiguo Pi Raspberry Pi motor expansion board, DFRobot I2C ADS1115 analog-to-digital conversion module and 2.5A dual-channel motor acquisition board module for forward and reverse PWM.
- 7、Connect the mainboard of the PH meter to the ADS1115 module and fix it on the front panel. The final result is as shown below。



- 8、Glue the photoelectric beam switch to the corresponding seat of the front shell (press firmly), and connect it to the main board (try installation with glue front line to ensure that the internal printing support is completely removed).
- 9、Connect the water level switch to the PH2.0 male head, and then fix it on the water level switch bracket with the matching nut (as shown in the figure! Pay attention to the direction!)



10. Put a PH2.0 female header into the square hole on the front panel and connect it to the main board. After the water level switch is connected to the PH2.0 male header, insert the female header. (If it is troublesome, you can abandon the PH plug and directly connect the water level switch to the main board. If the water level switch is damaged and replaced in the future, it will be more troublesome).
11. Press the 8X3 rubidium magnet into the magnetic stirring bracket (!! Pay attention to the north and south poles of the magnet, one is north up and one is south up!!), install the printer on the shaft of the R300C motor, and try to make the upper end parallel to the top of the shaft , and then put the motor into the hole on the front panel and connect it to the motherboard, as shown below..



12. Use M2.6X10 flat tail self-tapping screws to fix the stirring motor cover, as shown in the figure below:



13. Pass the tubing of the peristaltic pump through the holes on the front panel and the rear of the main unit casing (according to the pipeline section), as shown in the figure below



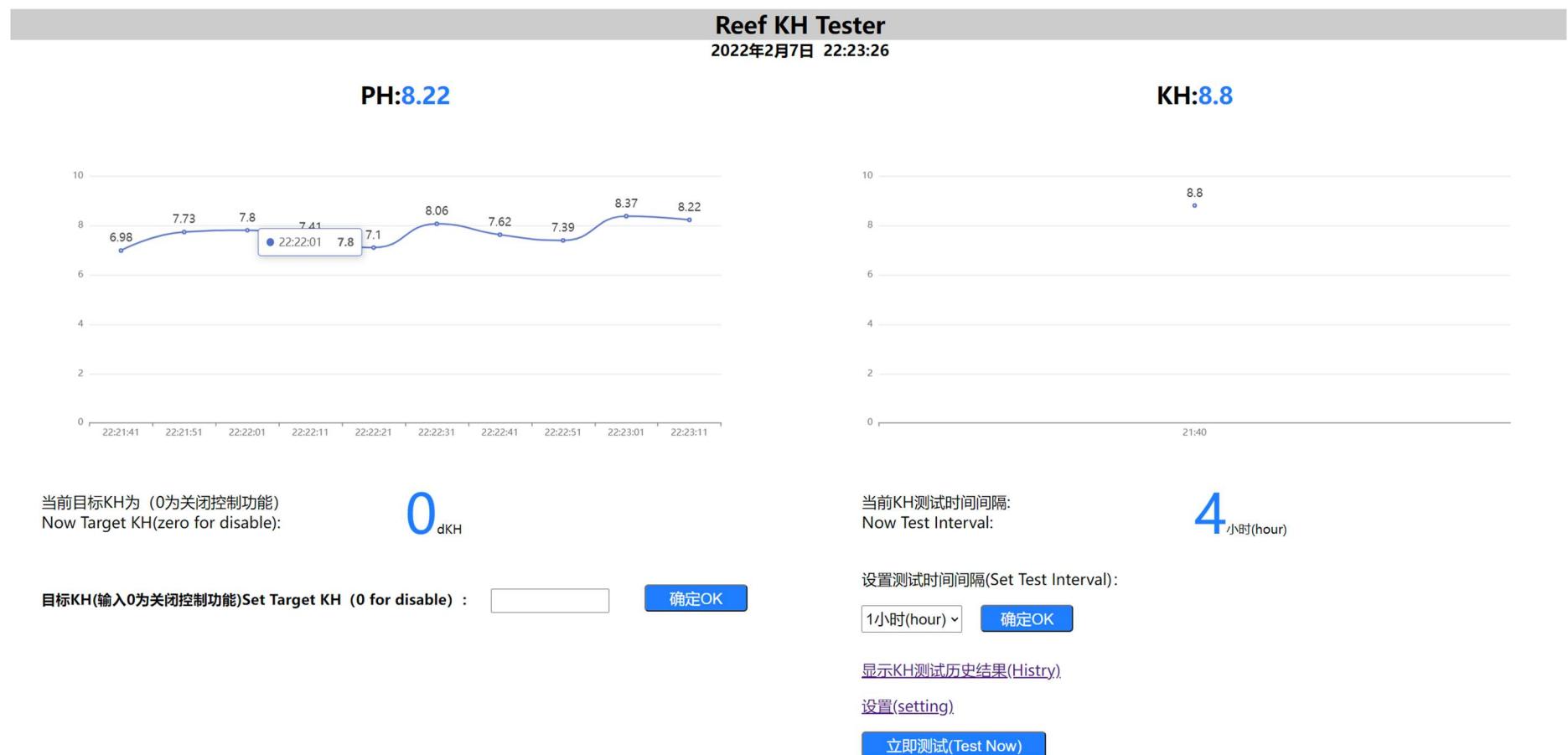
14. Combine the front panel and the main body shell, and fix them with bolts (M3X45 countersunk head bolts for the stirring motor, and M3X10 countersunk head bolts for the rest).
15. Pass the water inlet and outlet pipes of the front panel through the water level switch bracket and put it into the reaction chamber (the bracket should be completely in contact with the steps in the reaction chamber, the left drain pipe should be cut flat and contact the bottom of the reaction chamber, and the right side should be in contact with the bottom of the reaction chamber. If the water pipe only needs to exceed the bracket, too long will definitely affect the water level switch,) ! ! Important, this step affects test accuracy! ! The final picture is as follows



16. Use M3X10 countersunk head bolts to fix the revision of the right motherboard.
17. Connect the pH electrode and insert it into the reaction chamber through the hole.

# First Time Using

1. Prepare the container to import a certain amount of 0.1N hydrochloric acid solution, and connect the liquid into the hydrochloric acid.
2. Connect all the water inlet and outlet pipes to the tank. If you mind the discharge of hydrochloric acid back to the fish tank, you can also connect the outlet pipe to other waste water buckets.
3. Enter the software default IP: 192.168.1.90:5000 in the browser to enter the main interface.



4、Click "setting" in the lower right corner to enter the setting page

**Reef KH Tester**

[返回首页\(HOME\)](#)

<a href="#">校准PH电极(Calibration PH Probe)</a>	<a href="#">开启进水泵(Open Water-in Pump)</a>	<a href="#">关闭进水泵(Close Water-in Pump)</a>
<a href="#">校准反应仓容积(Calibration reaction chamber volume)</a>	<a href="#">开启排水泵(Open Water-out Pump)</a>	<a href="#">关闭排水泵(Close Water-out Pump)</a>
当前反应仓容积为(Current reaction chamber volume): 52.92672毫升(ml)		
设置反应仓容积(Set reaction chamber volume): <input type="text"/>	<a href="#">确定(OK)</a>	<a href="#">打开滴定泵(Open Titration Pump)</a>
<a href="#">校准药水泵流量(Calibration Reagent pump flow)</a>		
当前药水泵流量为(current reagent pump flow): 1.98毫升每100滴 (ml per 100 drops)		
设置药水泵流量 (100滴) set eagent pump flow (100 drops) : <input type="text"/>	<a href="#">确定OK</a>	<a href="#">关闭滴定泵(Close Titration Pump)</a>
<a href="#">校准滴定泵流量 (Calibration Titration Pump flow))</a>		
当前滴定泵流量为 (current Titration Pump flow) : 7.8333毫升/10秒 (ml/s)		
设置滴定泵流量 (set Titration Pump flow) : <input type="text"/>	<a href="#">确定OK</a>	

Click to open water-in pump, the inlet pump starts to work, click to close water-in pump immediately after the water starts to enter the reaction chamber.

Click to open titration pump, the titration pump starts to extract hydrochloric acid, and when the hydrochloric acid drips from the flat-headed needle, close titration pump.

5、Calibration

A、Calibrate the PH electrode: put the electrode into the PH4.0 or PH7.0 standard solution, click to "calibrate PH Probe", the system will automatically separate the 4.0 or 7.0 standard solution, and the two standard solutions will be automatically saved after calibrating

B、Calibration chamber volume: Using an electronic scale commonly used to weigh salts, the reaction chamber is weighed and recorded. Click to calibrate the volume of the reaction chamber, the inlet pump starts to work, and water is injected into the reaction chamber. When the liquid level switch rises, the inlet pump will automatically stop water supply. Take out the reaction chamber, add water again and weigh, subtract the mass of the first few empty

chambers, which is the mass of the internal water. According to volume = mass / density, what we usually call salinity 1.02\*\* is actually the density of seawater. So the volume is the mass of water / the salinity of the current seawater. After getting the volume, enter the text box after setting the volume of the reaction chamber below, and click OK

C. Calibrate the medicine pump flow. Put a small test tube (you can use the small bottle of Sarifa) under the flat needle tube (below the photoelectric switch), click to calibrate the flow rate of the liquid medicine pump, and the liquid medicine pump will point out 100 drops of hydrochloric acid. After the end, use a 1ml small syringe to extract the medicine to see how many milliliters are in total. Fill in the result in the text box below and press OK.

D. Calibrate the flow rate of the dosing pump. First make sure that the entire water pipe in the burette has water (if not, use the switch on the right water pump), connect a container after the titration outlet pipe, and click to calibrate the titration pump. The dosing pump will work for 10 seconds. Use a syringe to test the volume of titrant in the container, enter the result into the text box below and press OK.

6. Click on the top left to return to the home page. The graph on the left shows the PH of the current reaction chamber, and the graph on the right shows the result of the previous KH test
7. The lower left corner is the automatic titration KH function, (input 0 is off, the default is off) **the automatic titration function has not been tested, please use it with caution**
8. Set the test interval and manual test in the lower right corner. Each test must be separated by 15 minutes.
9. After completing the above calibration and initialization, click Manual Test to perform the first test.