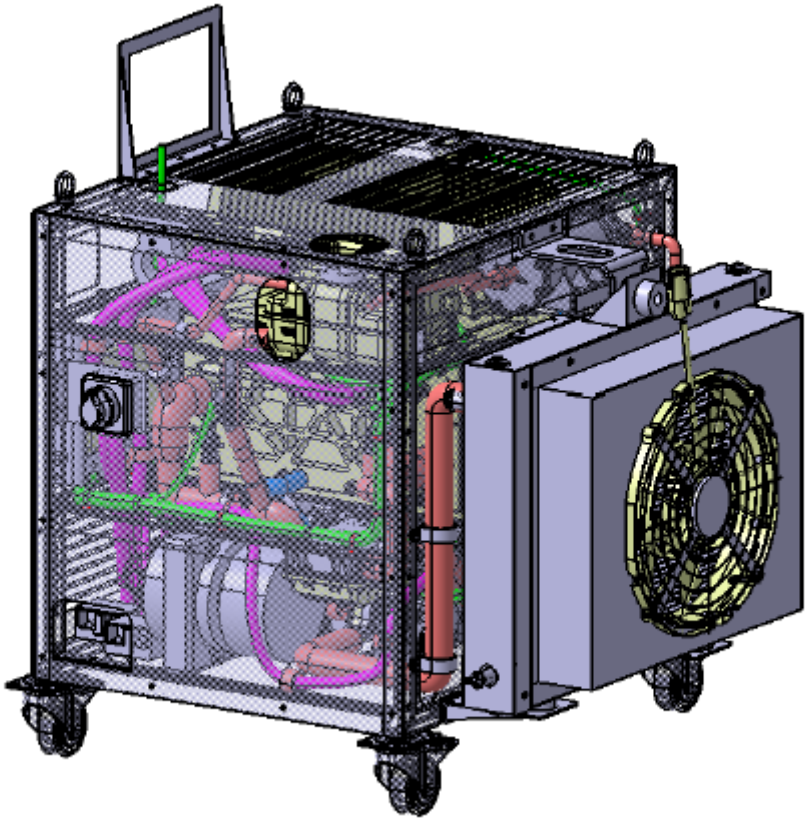
10kW

HORIZON FUEL CELL SYSTEM SPECIFICATION



Disclaimer

This manual contains safety guidelines and operation suggestions. However, this does not mean that this manual can cover all situations. The customer is responsible for meeting all local safety requirements to ensure the safety of the fuel cell system during operation, maintenance and storage.

Although every effort has been made to ensure the accuracy and completeness of the information contained in this document, Jiangsu Qingneng Co., Ltd. reserves the right to change the information at any time and assumes no responsibility for the accuracy of the information.

The following actions will void the fuel cell system warranty:

- In any case, disassemble or improperly tamper with a fuel cell system.
- Operate the fuel cell system in a manner not specified in system Settings or in the product-specific user manual.
- Damage to a fuel cell system due to accident, misuse, human injury, or negligence.
- Use of impure or incorrect fuel.
- Supply hydrogen to the fuel cell system using a hydrogen source that does not meet the requirements of Horizon.
- The hydrogen source pressure that does not meet the requirements of Horizon. is used to supply hydrogen to the fuel cell system.

Do not, under any circumstances, attempt to disassemble or tamper with the system. If disassembly or tampering occurs, the warranty is void. If you have any questions about the system and its technology or need help, please contact

Contact person: Yang Xinlin Tel: 15051705873

Contents

1. Product Uses and Functions

1.1 Product Uses

Horizon 10kW fuel cell system is one of the best fuel cell systems in the hydrogen fuel cell industry and its main applications are in the following areas:

1. It can be used in the field of electric vehicles such as buses, group vehicles, logistics vehicles, tractors and rail transit, and can be used as a direct power source or range extender for vehicles;

2. It can be used as a backup power supply for hospitals, schools and other units, and can also be used as a grid-connected power supply.

1.2 Product Function

Hydrogen fuel cell is a power generation device that converts the chemical energy of hydrogen and oxygen directly into electrical energy. The basic principle is that hydrogen in the anode through the catalyst action to release electrons, electrons through the external circuit to the cathode, protons through the proton exchange membrane to the cathode and with oxygen under the action of the catalyst, water, electricity and heat. Fuel cell systems have the following advantages:

1. High efficiency: the fuel cell directly converts chemical energy into electrical energy, without the intermediate conversion of thermal energy and mechanical energy (generator), and is not limited by the Carnot cycle effect;

2. Zero emissions: The fuel of the fuel cell is hydrogen and oxygen, the only emission is water, it does not produce carbon monoxide and carbon dioxide, nor does it emit sulfur and particles. Therefore, hydrogen fuel cell vehicle is the true sense of zero emission, zero pollution car, hydrogen fuel is the perfect vehicle energy;

3. Short hydrogenation time: Hydrogen fuel cell vehicles use hydrogen storage tanks to store fuel, each time the fuel is used up, continue to hydrogenate to the hydrogen storage tank. Each refueling time is about 5-10 minutes, which can be used for the vehicle to run 300-500 kilometers continuously, which greatly reduces the intermediate residence time of vehicle operation compared with new energy vehicles using lithium batteries.

2. Product Performance Introduction

2.1 Working Principle

The fuel cell system is a power generation device that converts the chemical energy of hydrogen and oxygen directly into electrical energy. Its core part is the electric pile, which needs to match the oxygen supply system, hydrogen supply system, heat dissipation system, electrical control system, etc.

The air compressor draws air from the environment, filters it through the air filter, humidifies the air through the humidifier, and finally enters the fuel cell stack. The hydrogen is stored in the hydrogen storage tank of the hydrogen supply system, passes through the decompression device, and enters the fuel cell stack. After the reaction of hydrogen and oxygen, water, electricity and heat are generated, and the excess heat generated by the reaction is carried out by the heat dissipation system, and is dissipated by convection with the atmosphere through the radiator. The generated electricity is converted through the DCDC boost to supply power to external loads. The water produced by the reaction is discharged into the atmosphere along with the air remaining from the reaction and the trace amount of hydrogen that is not fully reacted. In addition, the system also needs a 24V low-voltage power supply platform to accurately control the system under different working conditions through CAN and controller, and to exchange information with the vehicle control system through the control system. The working principle of the gas-electric system is shown in Figure 2-1.

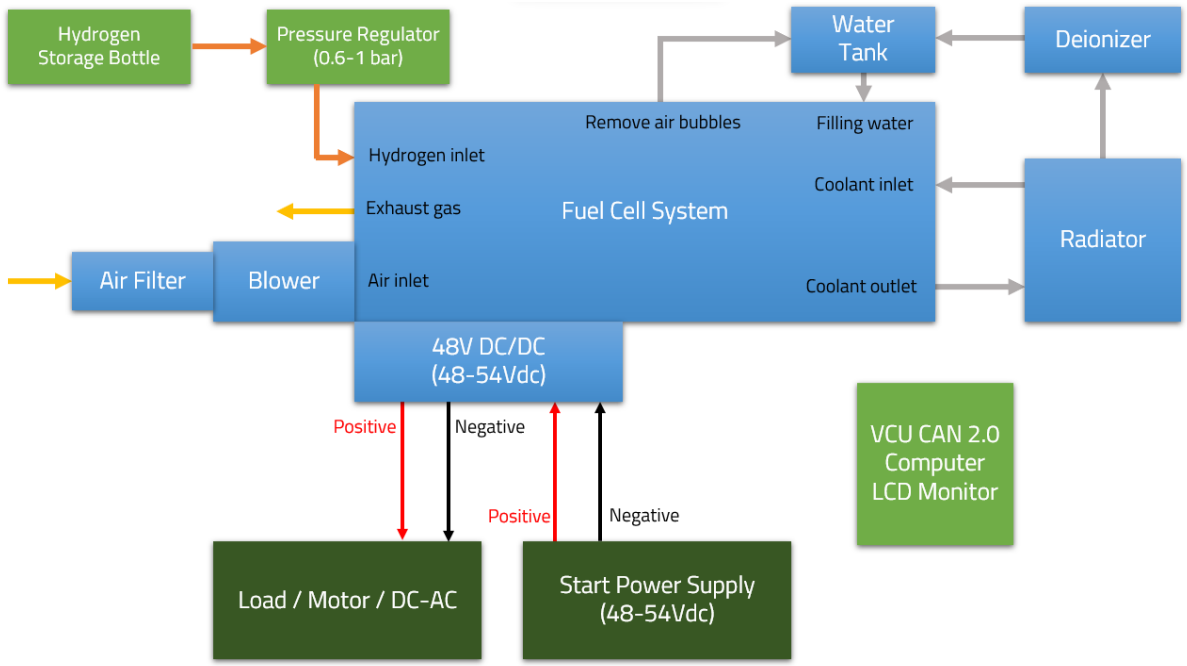


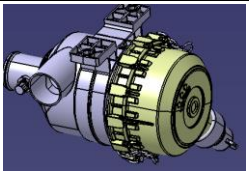
Figure 2-1: Schematic diagram of the fuel cell system

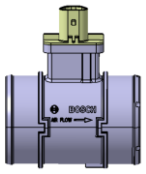
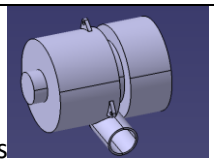
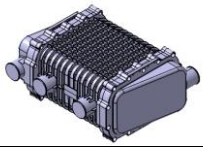
2.2 Product Composition

Functionally, the fuel cell system is mainly composed of five subsystems: oxygen supply system, hydrogen supply system, heat dissipation system, electrical control system and fuel cell stack.

1. Oxygen supply system: Oxygen supply system is mainly composed of air filter, air flow meter, air compressor and humidifier, etc. The diagram and function of each part are shown in Table 2-1:

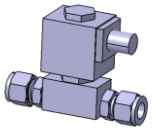
表 2-1：Oxygen supply system parts list

Number	Component Name	Pictures	Action
1	**Air Filter**		Purifying air

2	**Air Flow Meter**		Monitor feedback air flow
3	Air compressor		Provide sufficient reaction air for the stack
4	Humidifier		Add humidity to the air entering the stack

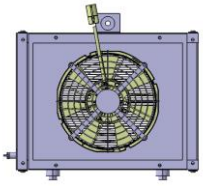
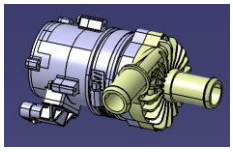
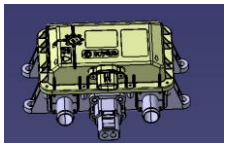
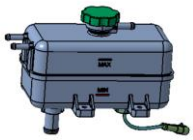
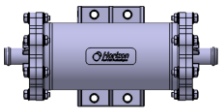
2． Hydrogen supply system: The hydrogen supply system is mainly composed of hydrogen storage bottles and solenoid valves. The parts diagram and functions are as follows: 2-2：

Table 2-2： Hydrogen supply system parts list

Number	Component Name	Pictures	Action
1	The electromagnetic valve		Controlling external hydrogen ingress

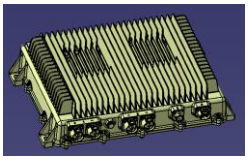
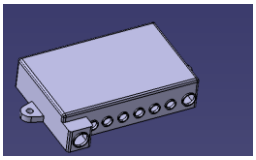
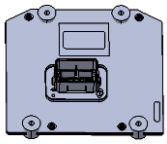
3． Cooling system: The cooling system is mainly composed of radiator, water pump, PTC heater, water supply tank and deionizer. The parts diagram and function are as follows: 2-3：

Table 2-3：Cooling system parts list

Number	Component name	Pictures	Action
1	Heat sink		Removes excess heat generated by the system
2	Water pump		Power the cooling system
3	PTC Heater		Used for heating the coolant when starting the system
4	Water tank		For replenishing water and exhausting the cooling system
5	Deionizer		Absorbs ions in the coolant and reduces the conductivity of the coolant

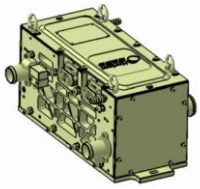
4．Electrical control system: The electrical control system mainly consists of DCDC, low-voltage distribution box and controller. The parts diagram and functions are as follows: 2-4：

Table 2-4：Electrical Control System Parts List

Number	Component name	Pictures	Action
1	DCDC		Convert the stack voltage to provide a high-voltage power platform for external loads
2	Low voltage distribution box		Provide a low-voltage power platform for electrical appliances within the system
2	Controller		Control system, system communicates with external loads

5．Fuel cell stack: The fuel cell stack is the core component of the fuel cell system. It is the component that reacts with oxygen and hydrogen and outputs voltage. The diagrams and functions of the components are as follows: 2-5：

Table 2-5：fuel cell stack

Number	Component name	Pictures	Action
1	Fuel Cell stack		Oxygen and hydrogen react here, and the output voltage

In addition to the above components, the fuel cell system is also equipped with some sensors to feed back the temperature, pressure and humidity signals during operation of the controller system, so that the controller system can know in real time that other components are working in the appropriate state.

The various components of the oxygen supply system and cooling system within the system also need to be connected with silicone tubes and multi-way joints to ensure the circulation of fluids in the system; the circulation of hydrogen in the system is connected with stainless steel tubes or steel wire hoses.

The fixation of each component of the system requires bracket support, and the entire system requires a fixed frame, which is connected and fixed together through the frame.

Finally, many electrical parts in the system need to be connected with high-voltage wiring harnesses or low-voltage wiring harnesses.

2.3.1 Fuel and coolant requirements

The fuel cell stack generates electricity by converting the chemical energy generated by the reaction of hydrogen and oxygen in the air into electrical energy, and uses coolant to circulate inside the stack to dissipate heat. Therefore, in order to ensure the normal operation of the stack, the fuel gas, oxidation Gases and coolants have strict requirements. Detailed requirements are shown in Table 2-6 below.

Table 2-6 Gas and liquid specification table

Type	Specification
Fuel gas（＞99.97% hydrogen）	
other impurities	＜300ppm
	＜2ppm CO_2
	＜0.1ppm CO
	＜5ppm H_2O
	＜2ppm hydrocarbons
	＜5ppm O_2
	＜300ppm He
	＜200ppm N_2、Ar

	＜0.004ppm Sulfur compounds
	＜0.01ppm formaldehyde
	＜0.2ppm Formic acid
	＜0.1ppm NH_3
	＜0.05ppm Halogenated compounds
Oxidizing gas (air)	
oxygen	＞20.95%
Nitrogen	＜78.08%
Other gas components	
	＜0.1ppm CO
	＜1% CO_2
	＜1ppm O_3
	＜0.01ppm SO_2
	＜0.04ppm hydrogen sulfide
	＜0.025ppm NO
	＜0.05ppm NO_2
	＜0.008ppmvolatile organic compounds
	＜0.01ppm NH_3
Atmospheric particulate composition	
	＜90μg/m^3 PM10
	＜15μg/m^3 PM2.5
coolant	
	Deionized water
	particle size ＜100μm
	Conductivity＜5μs/cm

- **Notice:**
- **If there is a lot of dust in the working environment, you need to install an air filter to filter the air; if there are too many NOx, SOx and other pollutants in the working environment, you need to chemically filter the air.**
- **The coolant should be selected carefully. Coolants widely used on the market may not be suitable because they may contain additives that cause the conductivity to be too high and the insulation resistance to be too low.**

2.3.2 System working conditions requirements

The operating condition point of the system also affects the normal operation of the system. The allowable operating conditions of the system are shown in Table 2-7.

Table 2-7 System operating conditions table

Environmental requirements	Specific parameters
Stack starting temperature	≥ -10℃（＜5℃ requires auxiliary heating）
Storage temperature	-20℃~60℃
Altitude range	0~1000m（Exceed 100mReduce power at altitude）
Humidity range	0%~100%RH（non-condensing state）
air inlet pressure	0~0.2barg
Hydrogen inlet pressure	0.3~0.6barg

1.3 System Performance

10kW System performance parameters are as follows:

See the table below for stack parameters 2-10：

2-9：10kWFuel cell system parameters

序号	**Performance**	parameter
1	System rated output power（kW)	10（Does not contain DC Loss of efficiency）
2	Stack rated power（kW)	12
3	Idle power（kW）	≤1.5
4	Number of cells（piece）	90
5	System efficiency（%）	≥42（Does not contain DC Loss of efficiency）

6	Working temperature	-10-40℃
7	Storage ambient temperature	-10-60℃
8	Response time (start to idle speed) (s)	＜30S（ambient temperature > 5℃）
9	-10℃ cold start time	＜15min
10	Working environment humidity	0-95%
11	work pressure	≤50kPa
12	IP Grade	IP54
13	Noise	≤80dB
14	Voltage and current output	222A@54V
15	Size (mm)	860*820*825
16	Weight (kg)(Include DC/DC and radiator)	180
17	DC output voltage (V)	54
18	Stack operating temperature (℃)	60-70
19	Hydrogen requirements	＞99.97%
20	Hydrogen inlet pressure（MPa）	0.6-1
21	Hydrogen source reserved interface model	1/2 inch compression fitting
22	Hydrogen flow (l/min)	≤250
23	Insulation resistance (Ω/V)	≥500Ω/V
24	Coolant	Conductivity ≤5us/cm

3. System Running

The fuel cell system is equipped with an electrical control system, which allows relevant engineers to perform manual, automatic or monitored operations on the fuel cell system, and is also equipped with automatic alarm and protection devices when the running fuel cell system fails. It will automatically send out an alarm signal and even shut down to ensure that the fuel cell system is in normal working condition at any time or to notify engineers for targeted maintenance.

3.1 Routine checks before start-up

1. The fuel cell engine system needs to conduct the following checks before starting but is not limited to the following:
2. 1. Appearance inspection of the stack module. Check whether the fuel cell stack module is damaged, deformed, etc., and whether there are scratches on the surface.
3. 2. Hydrogen concentration detection. Use a hydrogen leak detector to detect the hydrogen concentration above the system. If there is a leak, you need to open the hydrogen valve under ventilation to find the leak and repair it.
4. 3. Check the interface. The cooling water valve of the fuel cell engine system is closed, and there is no leakage or looseness at the interface; the hydrogen pipeline joint is not blocked by debris and is firmly and reliably fixed; the stack cooling water inlet and outlet pipe interface is not loose or leaking; the air pipeline clamp is not loose , fixed firmly; the CAN line external plug-in connection is normal and not loose; the controller 24V low-voltage harness connection is normal; the weak current connection line has no empty plug and is firmly fixed.
5. 4. Check the water level in the water tank. The water level in the water tank needs to be ensured to be within the normal water level range. If it is insufficient, the specified coolant needs to be added.
6. 5. Radiator inspection. Check the radiator for damage or deformation and for leaks.

3.2 Working Process

During the operation of the system, real-time monitoring of relevant parameters and status is

required to see whether they are normal. Items that need to be monitored include: whether the communication is normal (whether there is interference, delay or acceleration), loading rate, output voltage and current. You can click the system status, stack status, historical faults and other buttons at the bottom of the control panel to enter different interfaces to learn the corresponding information. You can also view the real-time status of relevant data during the stack operation.

3.3 System fault reset operation

If the system reports relevant fault information during operation, to return the system status to the standby state, proceed as follows:

1. Turn off the 24V power supply;
2. Follow the normal boot process again, and the system status will show standby on the display.

3.4 Safety precautions in use

1.4 1. Use the operating gap to regularly check whether there are any abnormal phenomena such as water leakage, air leakage, hydrogen exhaust tail opening, or other abnormal noises in the fuel cell system, and report and handle them in a timely manner, and check regularly every day whether the water level in the water tank is normal.

1.5 2. Network monitoring personnel need to do a good job in monitoring, discover problems in time and deal with them, and keep records of the use process.

1.6 3. Users collect system operation data in a timely manner during equipment operation and maintenance, and download and record system data regularly.

1.7 4. Avoid operating the system in areas with serious air pollution (such as black smoke, burning whips, heavy dust, etc.).

5. No open flames are allowed around the system.

3.5 System communication protocol

For details, please refer to: "Communication Agreement".

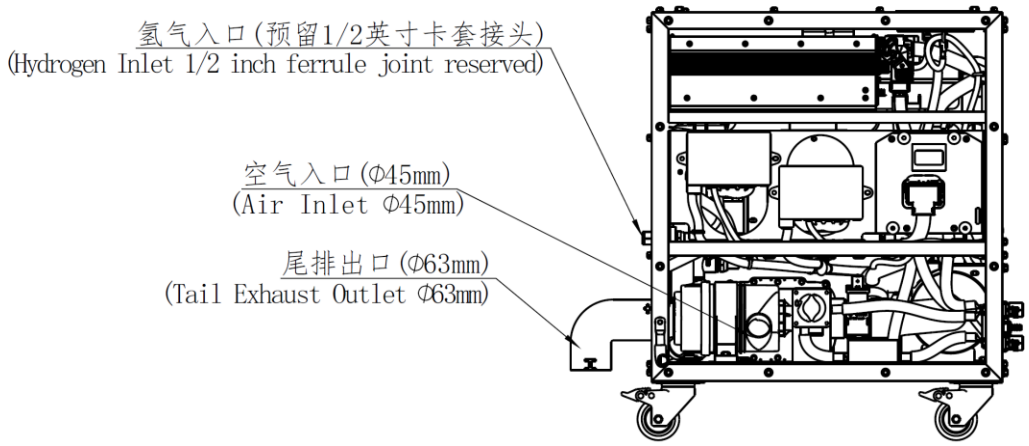
3.6 System error

For details, please refer to: "Error Code Table".

4. System operation

The fuel cell system mainly consists of a fuel cell stack module, a hydrogen supply module, an oxygen supply module, a cooling module, and an electrical control module. The hydrogen supply module provides hydrogen required for reactions of the fuel cell system. The oxygen supply module provides the air required for the reaction of the fuel cell system. The cooling module is mainly used for heat dissipation of the fuel cell system and dissipates heat through the circulation of coolant. Electrical control modules control components throughout the system.

4.1 System connection instructions



necessary to connect the tail exhaust pipe of the system, the hydrogen inlet (which needs to be connected to the hydrogen source) and the high-pressure end of the DCDC (which needs to be connected to the load). After all the pipes are connected, manually add a certain amount of deionized water to the system kettle.

Picture 4-1 a System connection diagram

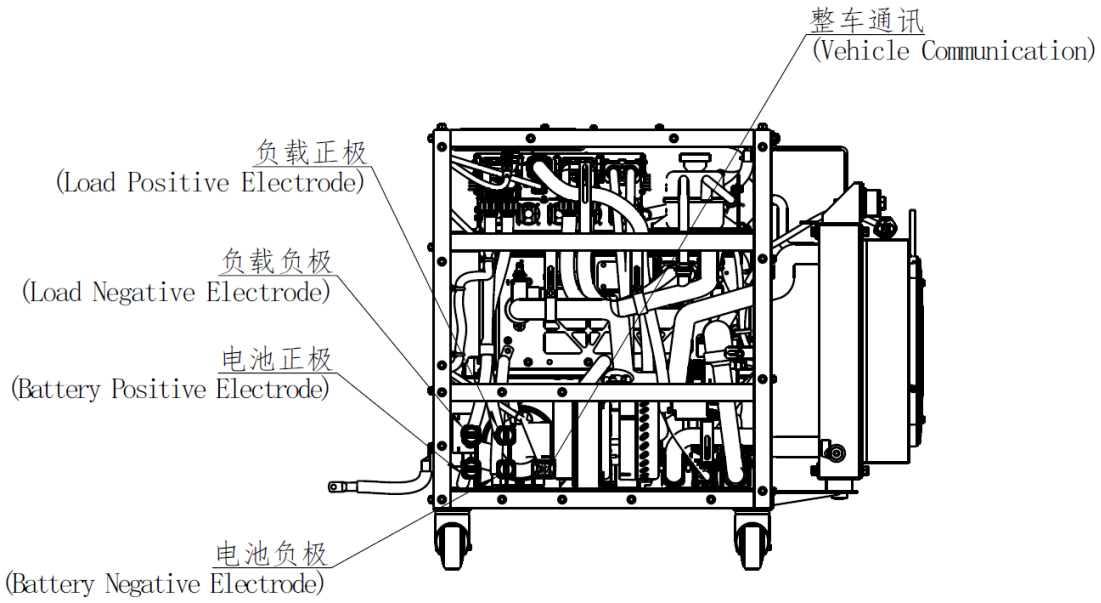


图 4-1 b 系统连接图

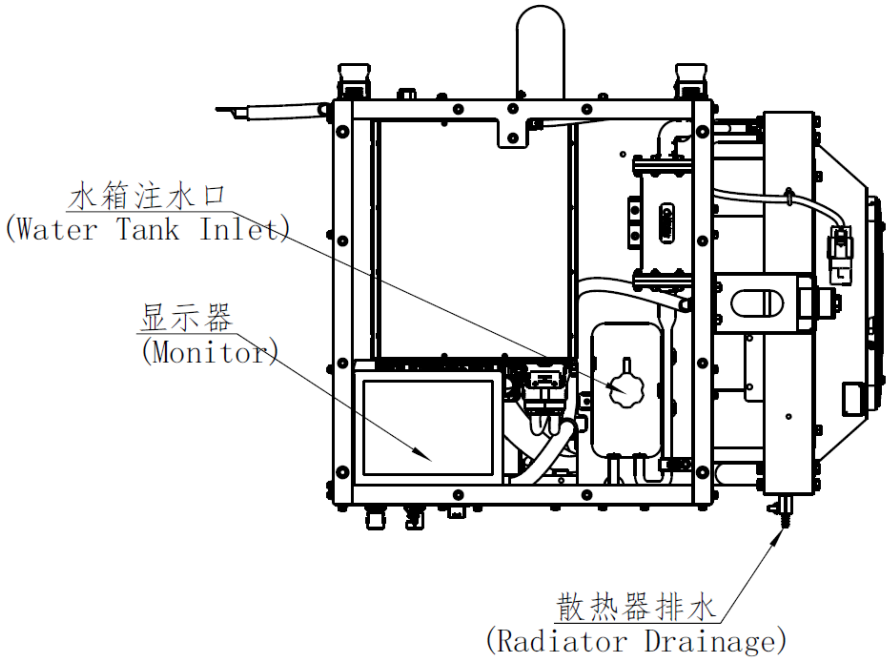
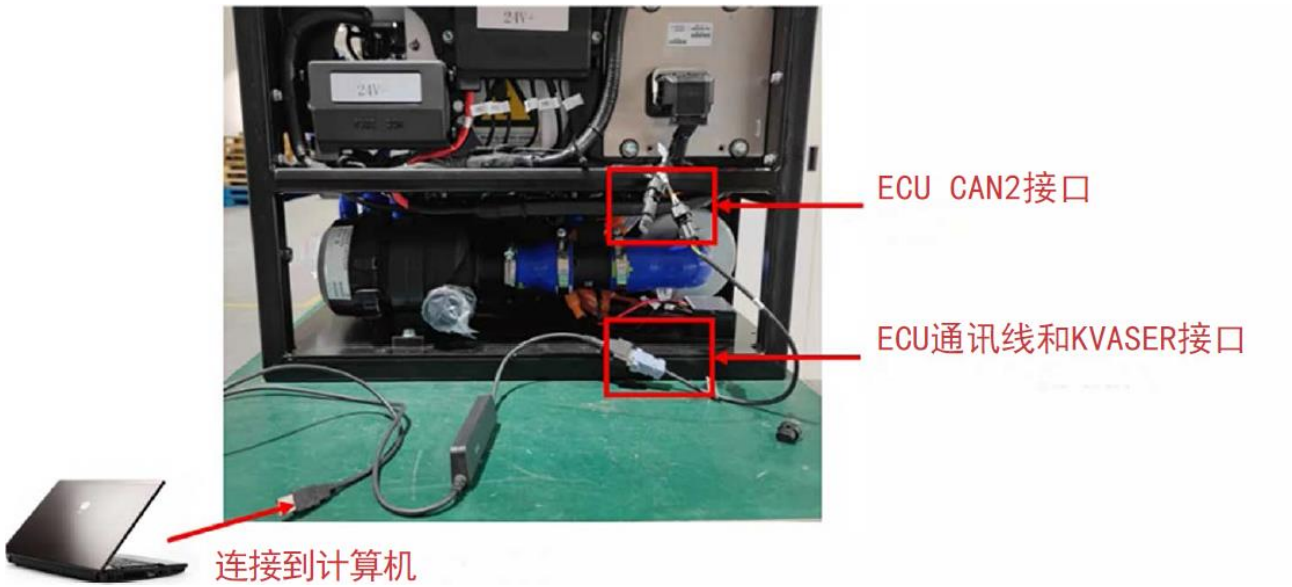


图 4-1 c 系统连接图

4.2 System communication line connection

As shown in the picture 4-2 As shown, this is the connection method of the communication line between the system and the computer. We use the communication line configured by KVASER to connect. One end of the communication line is connected to the CAN2 interface of the system ECU, and the other end of KVASER is connected to the computer.



Picture 4-2 Communication line connection

4.3 Screen display control instructions

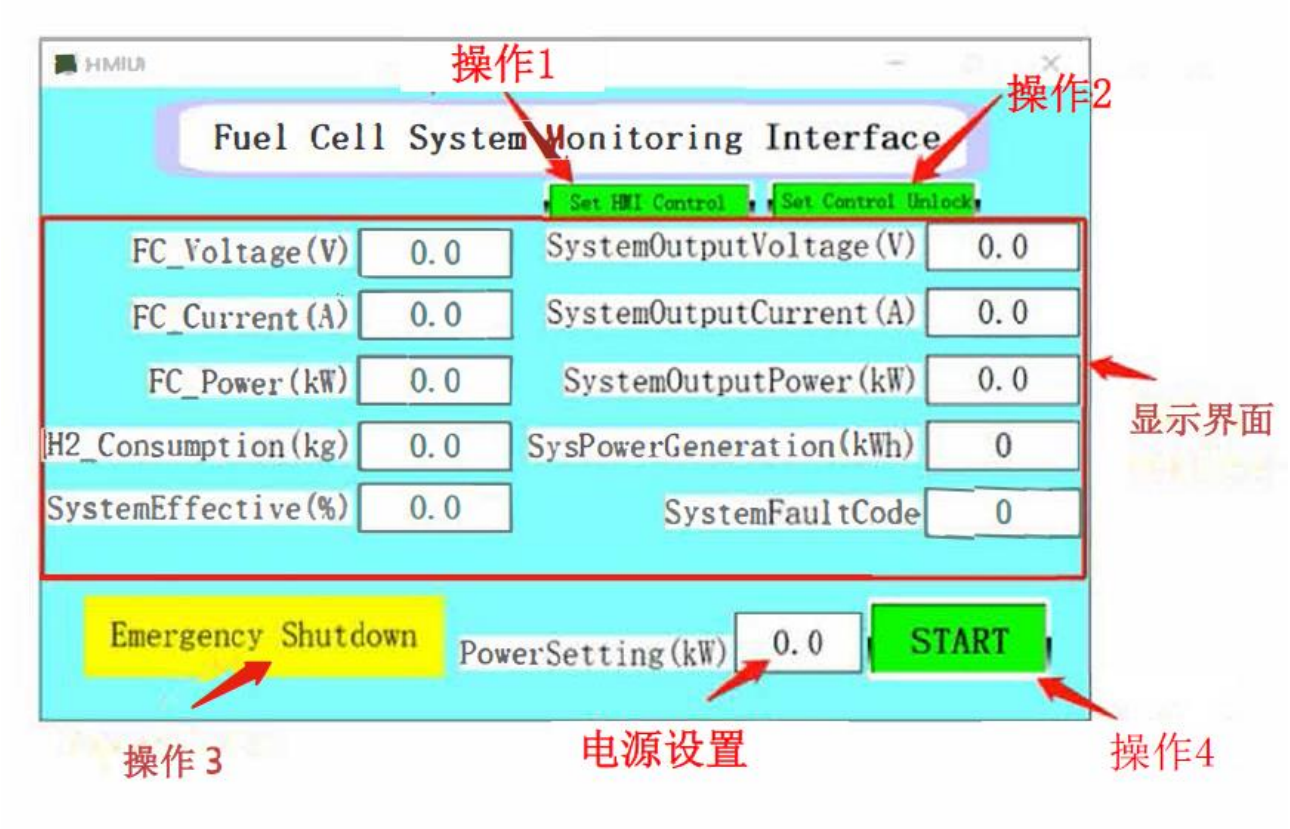
As shown in Figure 4-3, it is the control interface of our system. You can start and shut down the system and modify the power supply through the control of the screen.

Action 1: When you click this button, it will change to Set Remote Control . At this point, it can operate on the display, otherwise, network operations will be performed.

Operation 2: This button is the lock key of the screen. Before performing power settings and other operations, click this button and it will become Set Control Lock. Otherwise, the screen will not work.

Operation 3: This is the system emergency stop button. When the button changes to Reset Normal Mode, the system will be in emergency stop state.

Operation 4: After the power settings are completed, click this button to change to STOP to start the system. Clicking again will stop the system.



Picture 4-3 Screen control interface

5. Software operating instructions

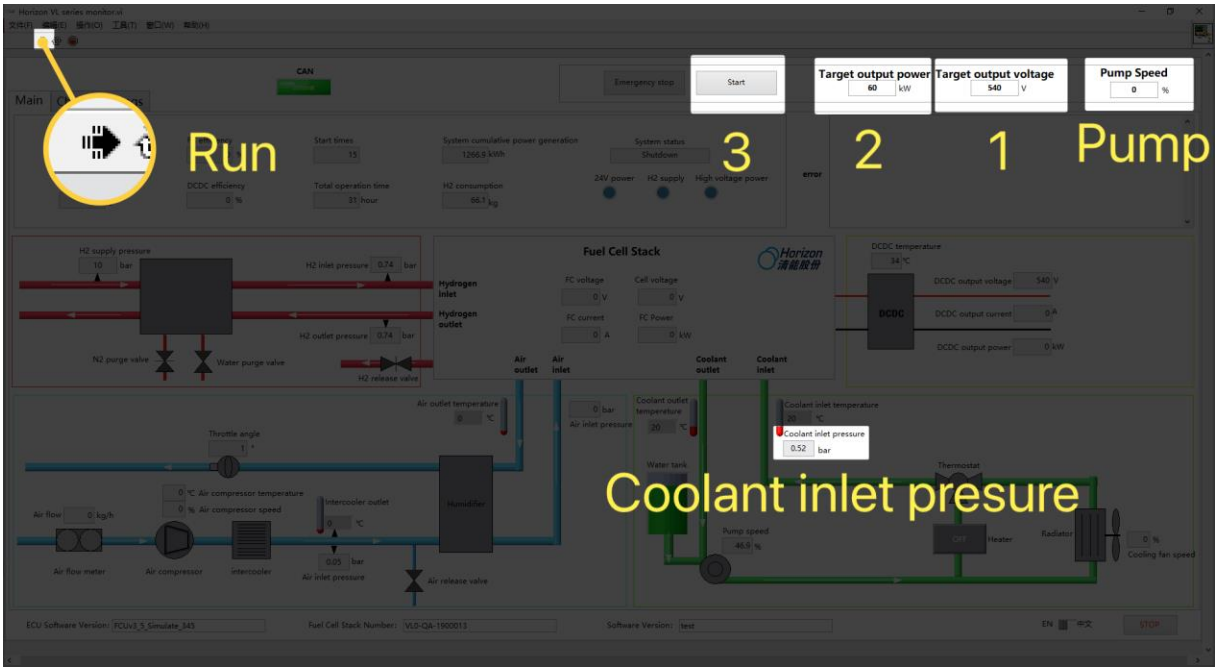
5.1 Open the software

Unzip the application package and run **Horizon VL series monitor.exe**. NOTE: If the package is unzipped to C drive, please right click on your computer mouse to allow Horizon VH series monitor.exe Run in administrator mode. Otherwise, the software cannot write Excel and blf files and therefore cannot record.

5.2 Getting Started

Getting Started First, make sure the fuel cell system is wired correctly. Second, provide 24V power supply. Third, click the RUN button. As long as the CAN connection indicator light shows ONLINE, it means that the system communication is running normally. Fourth, wait for the system to complete its self-test and then enter standby mode before the fuel cell system is ready to operate.

NOTE: Sufficient deionized water needs to be added and all air removed from the coolant loop to start the fuel cell system for the first time



Picture 5-1 Software operation interface

Getting started

(1). Set the output voltage at mark 1;

(2). Set the target power at mark 2;

(3). Click the button marked 3 to start the fuel cell system. If the system needs to be stopped, click the button labeled 3 again.

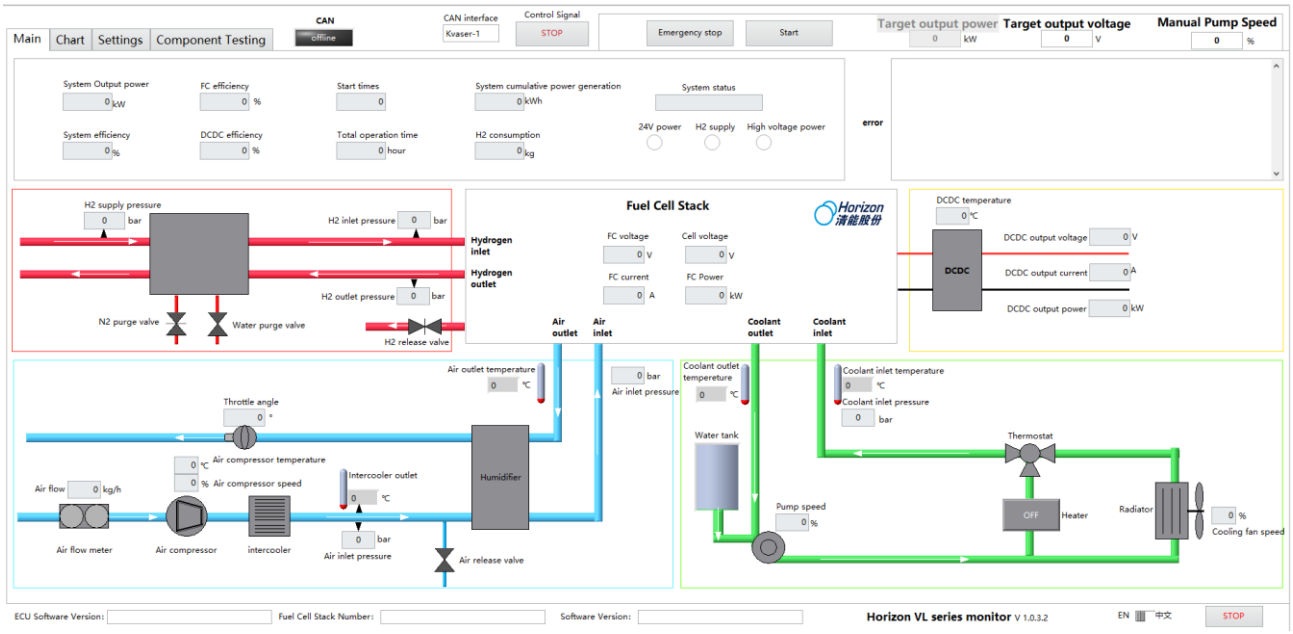
Before operating the fuel cell system, the water pump needs to be started to remove the air from the coolant line. When the coolant inlet pressure is stable within ±0.01bar, the air in the coolant circuit can be considered to have been exhausted. Please refer to the table below for specific steps to set the pump speed and waiting time. Before starting the fuel cell system, make sure the water pump speed is 0.

Pump speed	10%	20%	30%	40%	50%	40%	30%	20%	10%	0%	50%
Waiting Time	2min	2min	2min	2min	2min	2min	2min	2min	2min	2min	2min

5.3 Monitor system status

5.3.1Main

On the main page you can see various real-time observations from the fuel cell system.



Picture 5-2 Main interface

5.3.2 Chart

On the chart page, you can see historical data curves for some observations. Both the X-axis and Y-axis can change the range of the axis by modifying the numbers on both sides of the axis. The Y-axis supports mouse operation. When the mouse moves to the corresponding Y-axis range, the Y-axis can be zoomed in and out through the mouse wheel.

4：You can check the options on the left side of the chart to show/hide the curves.

5：The box on the right is the curve setting options, and you can change the curve color and other

setting items.

Picture 5-3 Chart interface

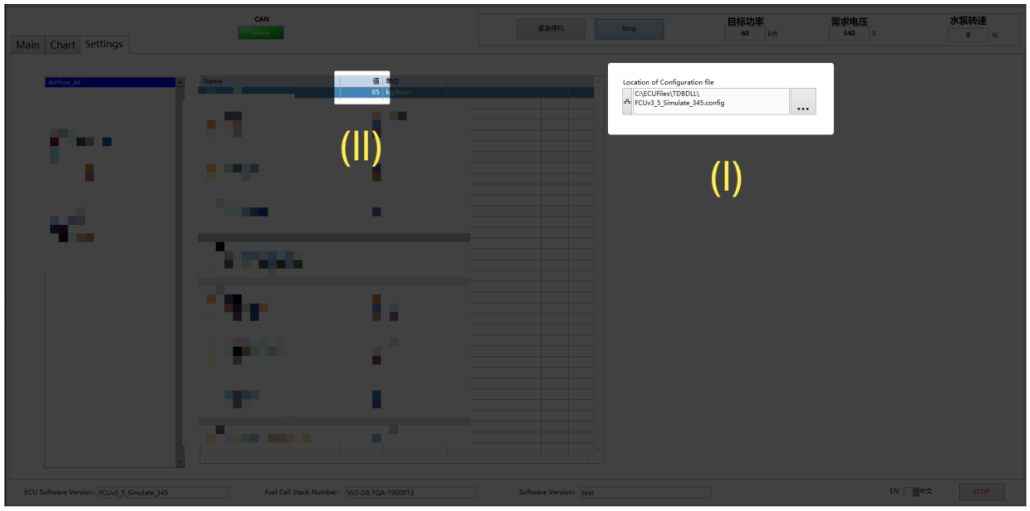
5.4 Calibration parameters

This operation is highly risky and must be performed under Horizon's technical guidance.

（Ⅰ）：Click the path selection icon to select the file. After selecting the correct file, the calibration interface will appear.

（Ⅱ）：Click to select the parameter to modify and the selected row will be highlighted. Click the

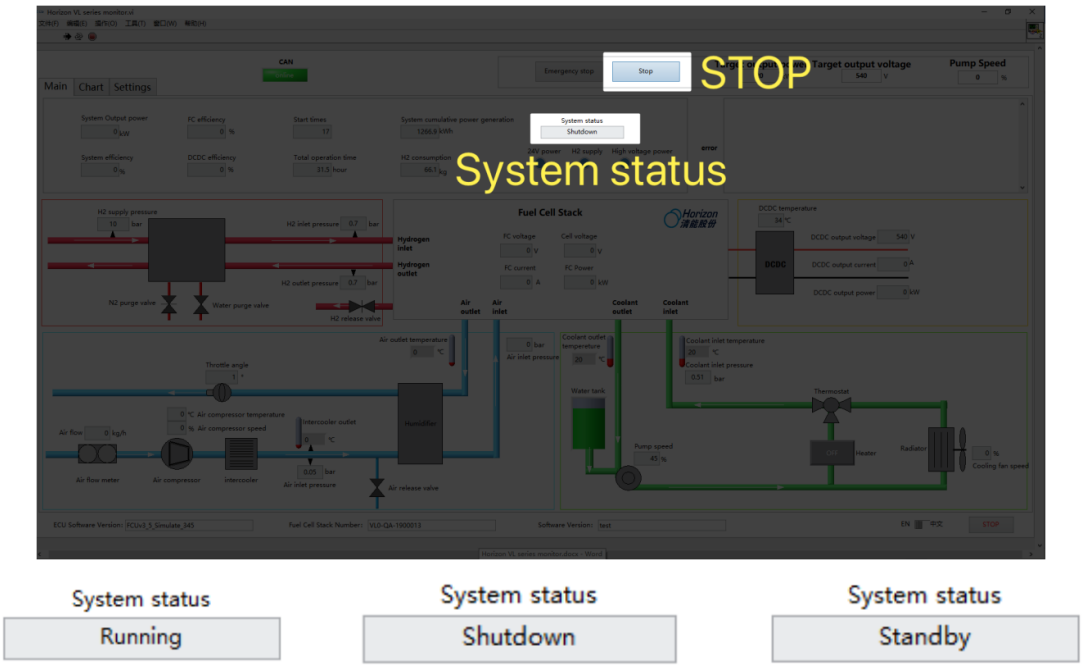
value again and when the value changes to the input state, you can modify it.



Picture 5-4 Calibration parameter interface

5.5 System shutdown

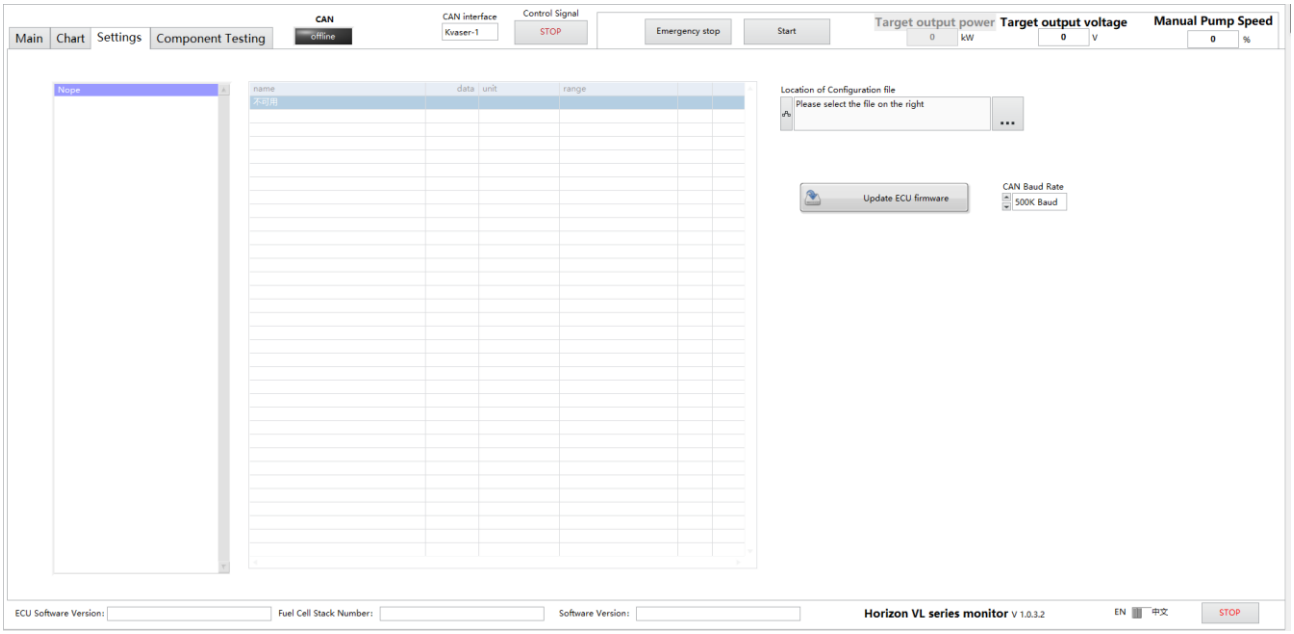
Click the Stop button and wait for the system to execute the shutdown command. When the system status changes to standby status, it means the shutdown command ends.



Picture 5-5 Downtime steps

5.6 Firmware update

When the stack is in self-test, standby and fault status, you can click the Update ECU Firmware button to update the program. Select the .srz file required by the updater and click Start to initiate the update. After the program is updated, click Update ECU Firmware again and shrink the window before starting the



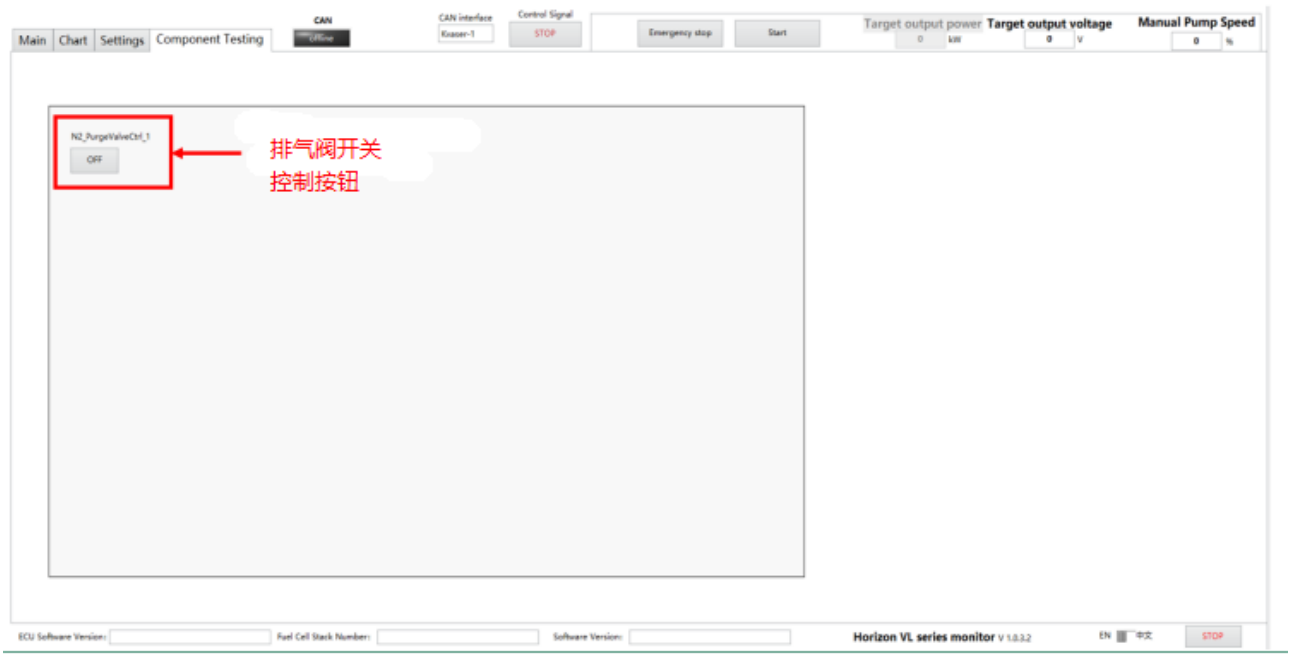
FLash

Picture 5-6 Firmware update

5.7 Manually open the exhaust valve

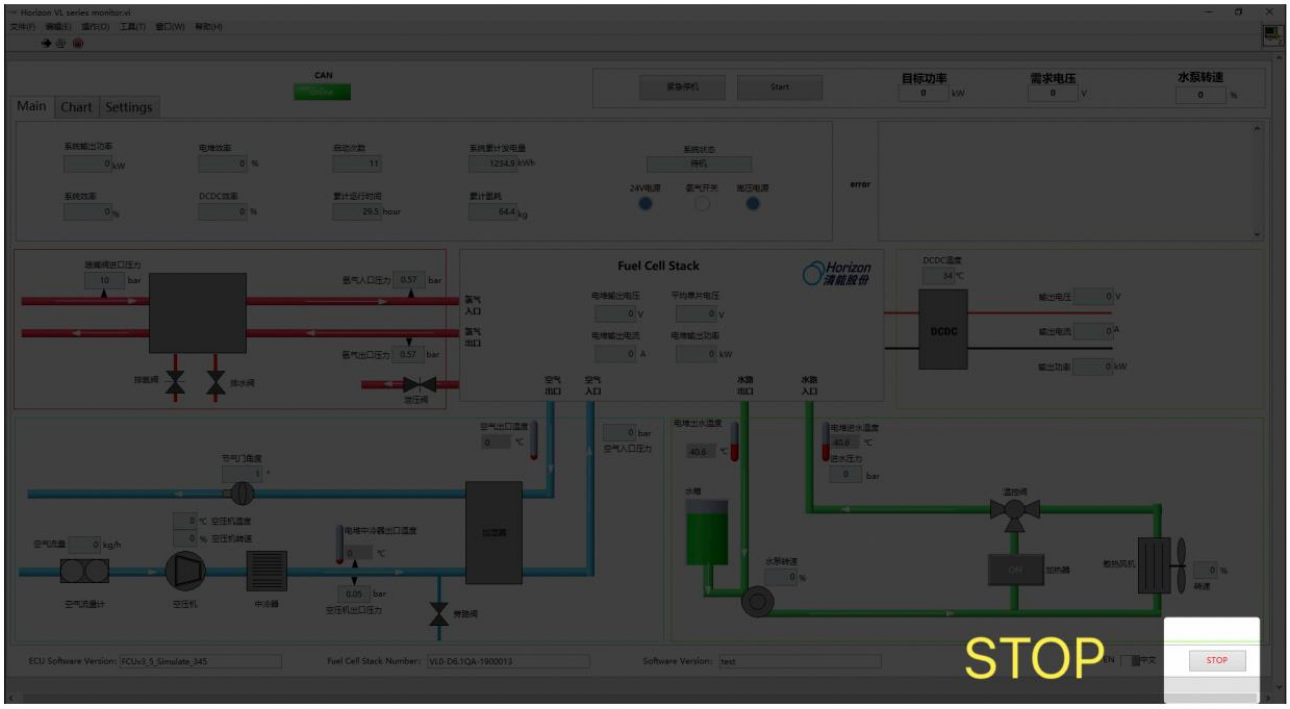
Before performing a pure hydrogen test, you need to manually open the exhaust valve, then open the air intake switch to ensure that the exhaust time exceeds 5 seconds, and then close the exhaust valve (at this time the air intake switch is in a normally open state) before the system can operate.

Component Testing is the control interface for the exhaust valve switch.



5.8 Stop Horizon VL series monitor

Click STOP button， Stop Horizon VL series monitor The software runs.



5.9 Data Record

After the program runs correctly, Labview will automatically save the data to a folder named save, which belongs to the same folder where the application is located.

6. Maintenance and Repair

6.1 Fuel Cell System Maintenance

The daily maintenance of the fuel cell system is divided into: daily inspection and maintenance, weekly inspection and maintenance, monthly inspection and maintenance and long-term parking inspection and maintenance. Below are brief descriptions in table form.

Tabela 4-1： Fuel cell system daily inspection and maintenance item record form

Item	Maintenance item	Specific operation method	Estimated time	Remark
1	After starting, observe whether each parameter is normal.	After the it is powered on, it is started, and various parameters are observed through the display screen and visually inspected.	5min	

Table 4-2 Fuel cell system weekly inspection and maintenance item record form

Item	Maintenance item	Specific operation method	Estimated time	Remark
1	Check cooling water level	Visually check water tank level	3min	When the liquid level is lower than the lower line, replenish the antifreeze in time and do not exceed the upper liquid level.
2	System hydrogen circuit leak	The system is powered on, hydrogen is introduced through	5min	Leak detector shows no hydrogen

	detection	system control, and the handheld measuring instrument detects leaks.		leak
3	System cleaning	Clean with an air gun or vacuum cleaner to remove foreign matter	5min	Clean and free of foreign matter

Table 4-3 Fuel cell system monthly inspection and maintenance item record form

Item	Maintenance item	Specific operation method	Estimated time	Remark
1	High and low voltage electrical components	Check whether the high and low voltage plug-ins are loose, whether the wiring harness is securely fixed, and whether there is any wear.	5min	Provide timely feedback when abnormalities are discovered
2	System component fixation inspection	Check whether all parts are firmly fixed and whether the bolts are loose	5min	Provide timely feedback when abnormalities are discovered
3	Radiator inspection	Check whether the radiator is blocked by foreign matter	5min	

Table 4-4 Fuel cell system long-term storage (more than 30 days) maintenance item record form

Item	Maintenance item	Specific operation method	Estimated time	Remark
1	Before long-term shutdown and storage	Make sure the fuel cell is shut down and purged normally, and the 24V power supply main switch is turned off. If deionized water or purified water is added, please drain the coolant in the pipeline.	10min	Ensure that the fuel cell is shut down and purged normally, and the 24V power supply main gate is turned off. If deionized water or purified water is added, please drain the coolant in the pipeline (if

				the lowest ambient temperature is below 5°C, special antifreeze for fuel cells must be used)
2	Check fuel regularly	Turn on the 24V handle switch, start the fuel cell to work for more than 20 minutes, and then shut down the system normally.	30min	Start and stop the fuel cell once a month

6.2 Fuel cell system regular maintenance

6.2.1 System Component Maintenance

In order to ensure the safe and stable operation of fuel cell system, periodic preventive maintenance of the fuel cell system is required to ensure that the system continues to operate safely. Users need to perform maintenance tasks according to the maintenance schedule and record each maintenance task and date. The maintenance requirements are shown in Table 4-5 below.

表 4-5 维护清单

Item	Maintenance items	Maintenance category	Maintenance cycle	Remark
1	Air filter element	1、 1. Purging and dust removal 2. Replacement	The filter element should be maintained after 150 working hours	
2	Deionizer	replace	500h	It is recommended to replace it every two months after first use.
3	Coolant	replace	1 Year	

4	Fixing points and connectors	troubleshooting	half a year	Check all fixed points and connectors of the fuel cell system every six months

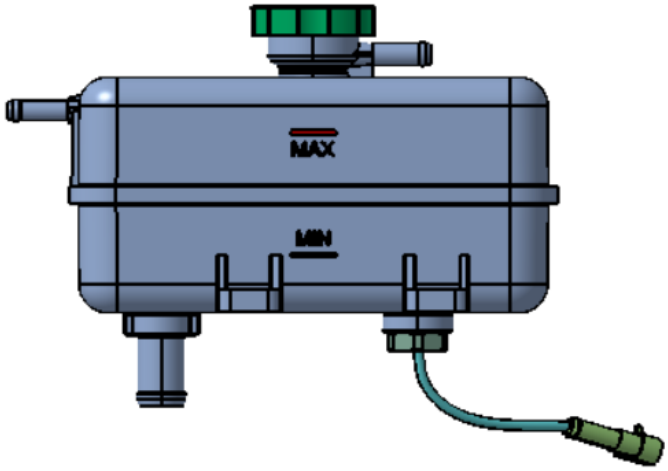
6.2.2 Replacement of wearing parts

1. The fuel cell system needs to check the coolant condition regularly:

1) If the lowest ambient temperature is below 5°C, all coolant needs to be replaced with fuel cell-specific antifreeze. The mixing ratio of ethylene glycol and deionized water is 1:1. If the ambient temperature is higher than 5°C, use deionized water. Just water.

2) Fill every month according to the liquid level. The water level in the water replenishing tank needs to be between the minimum and maximum water levels, as shown in Figure 4.1 below.

Picture 4.1 Water Tank



2、Radiator maintenance

1) Confirm that the vehicle is in parking state, the fuel cell system is in shutdown state, and the high and low voltage power supply is not connected to the vehicle;

2) Remove the air hood and electronic fan on the surface of the radiator;

3) Use a high-pressure water gun to clean the surface of the radiator and clean away dust, catkins, leaves and other foreign matter deposited on the fins of the radiator;

4) Use high-pressure air to dry the radiator fins;;

5) Clean branches, leaves, and other foreign objects inside the protective net, and use high-pressure air to blow the electronic fan blades and motor grooves to clean the deposited dust;

6) Reinstall the draft hood and electronic fan on the radiator;

3、Recommended replacement steps for deionizer

1) Drain the coolant in the system;

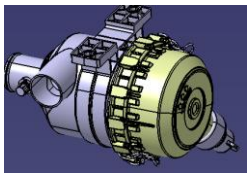
2) Loosen the four bolts fixing the deionizer;

3) Remove the deionizer and replace it with a new one;

4) Reinstall the brackets at both ends of the deionizer;

5) Refill coolant.

4、Recommended replacement steps for air filters



1) Loosen the metal buckle on the air filter;

2) Take out the filter element of the air filter and replace it with a new one;

6.3 Fuel Cell System After Sales

If you encounter problems that cannot be solved while maintaining this fuel cell system, you should contact our company in time;

Contact person: Yang Xinlin Tel: 150 5170 5373

7. Transportation and Storage

7.1 System Transportation

- Products should not be subject to severe vibration, impact or inversion during transportation.
- The transportation temperature is within the range of -20℃ ~ 40℃.
- Products should be able to adapt to sea and air transportation conditions.
- When products are transported by sea or air, sealed packaging and other protective measures should be taken to avoid unnecessary damage.

7.2 System Storage

A safe and reliable storage site or warehouse should be provided to prevent product damage. Products should specify the appropriate method for receipt and release of goods in the warehouse. In order to detect damage, the status of the products stored in the warehouse should be checked frequently.

The product should be placed in a ventilated and dry environment, and the storage temperature should be within the range of 5℃ ~ 35℃.

7.3 Long Term Storage

Long-term storage means the system does not turn on for more than 1 month. The fuel cell system has recoverable attenuation due to long-term storage, and is required to be turned on and run once a month for at least 20 minutes each time.

8. Safety

The fuel cell stack will generate high-voltage electricity, and when the fuel cell system is running, high-temperature and high-pressure gas and liquid will flow. Please strictly follow all warnings, precautions and safety instructions. Failure to comply may result in safety accidents such as burns, electric shock, and electrical injuries.

8.1 General Principles of Security

1. The fuel of the fuel cell system is hydrogen and oxygen, so open flames are strictly prohibited around it.
2. In the non-operating state, the fuel cell stack may have residual voltage. Please confirm the voltage before repairing.
3. When the system is running, please ensure that all interfaces, screens, and electrical enclosures are firmly connected.
4. Do not place or use the fuel cell stack in a humid environment.
5. When operating the fuel cell stack or system, please take off any jewelry, watches, rings, and metal objects you carry with you to avoid short circuits.

8.2 High Temperature and Pressure Safety

1. When operating in an outdoor environment, the temperature of the fuel cell stack can reach 80°C and above. Do not touch the stack while it is in operation or shortly after the stack stops operating.
2. When the fuel cell stack and auxiliary system use high-pressure gas, there may be a risk of impact. Before opening each pipeline and fittings, the entire circuit must be depressurized.
3. The fuel cell stack is assembled under high pressure. Please do not disassemble the stack at will.

8.3 High Voltage Safety

1. Before operating the stack, first connect the positive and negative poles of the power supply voltage of the stack to a suitable load.

2. If the electrical equipment is not completely insulated somewhere, the stack may leak electricity. Leakage may occur inside or outside the stack module. Reduce current leakage as much as possible, ensure that all electrical equipment and wires in the stack module are completely insulated, and ensure that electrical and electrical equipment are insulated.

3. Select the stack high-voltage wire harness according to the required voltage, current, and insulation temperature. According to the specific application and operating environment of the end customer, conditions such as rated voltage, current load, and rated insulation temperature are met.

4. In the event of vehicle insulation failure, never touch conductive parts, such as busbars and connectors.

5. Ensure that all electrical interfaces and electrical connectors can be installed and connected properly. Do not use excessive force when installing electrical interfaces and electrical connectors to avoid damage to the stack.

6. Please avoid the following unsafe situations:

- Incorrect grounding;
- Foreign substances or debris appear between stack components and hardware, resulting in degradation of insulation performance;
- Operate wires or electrical equipment with wet hands, or touch wet floors;
- Use frayed wires;
- Each electrical interface is incorrectly connected or reconnected multiple times;
- Short circuit occurs;

8.4 Safety of Hydrogen

1. Hydrogen is a colorless, odorless, highly flammable gas.

2. When operating hydrogen, it is necessary to strictly abide by the specifications and recommendations of the gas supplier.

3. Hydrogen is non-toxic, but it will consume oxygen in the air and cause oxygen deficiency. Before an accident occurs, there will be no alarm.

Hydrogen molecules are smaller than any other gas molecules, making them difficult to dissolve. Hydrogen can diffuse through a variety of gas seal materials. Fuel lines, non-welded joints, non-metallic materials such as gaskets, O-rings, pipe threads, packaging, etc. may present potential leak points or penetration points. Moreover, due to the small size of hydrogen molecules, which generates great buoyancy and diffusivity, the leaked hydrogen will spread and be diluted in the atmosphere quickly. The leakage rate of hydrogen gas from the stack will gradually increase as the service life of the stack increases.

The responsibility for detecting and mitigating hydrogen leaks lies with the customer. Hydrogen leakage originates from the stack and can be quickly detected with a hydrogen detector, which issues a warning before the hydrogen/oxygen mixture reaches a flammable concentration.

8.5 Safety of Stack Ablation

When the stack is running, it may cause internal corrosion of the stack. The following situations may cause stack ablation:

- When operating the stack, the stack is seriously short of hydrogen (the exhaust gas is insufficient and the stack is in a supercooled operating state for a long time);
- Operate the stack above its maximum operating temperature.

8.6 Safety of Hypoxia

When the stack is operating, oxygen is consumed. When the stack is poorly ventilated and occupies a small space, special attention needs to be paid to the fact that the oxygen concentration cannot be lower than the standard safety line.

8.7 Warning Label Description

(1) Beware of high temperature warning signs:

(2) Beware of electric shock warning signs:

(3) No pedaling warning signs:

(4) Antifreeze warning sign：