wayeal 皖仪

Helium Leak Detector
Model SFJ-231

USER MANUAL

全球品质 分析专家

Global Quality Analysis Expert

Instructions

The contents of this manual are subject to change without notice.

No warranty or implied warranty of merchantability or fitness for a particular purpose is given for the use of the materials in this manual. We will not be responsible for any accidents or damage caused by the use of this material.

Version: V6.0.2

SFJ-231 Helium Mass Spectrometer Leak Detector

Table of Contents

1 Foreword

This manual introduces the installation, use, maintenance and troubleshooting of the SFJ-231 helium mass spectrometer and its corresponding unit at the customer's site.

This manual is intended for operators who need to install, use and maintain the "SFJ-231 Helium Leak Detector" or the corresponding unit, and etc. This manual should be read carefully by customers or third party operators other than our own employees.

Please contact our customer service for the latest information on our products, related document revisions and errata.

export@wayeal.com.cn

http://www.wayeal.com.cn

1.1 Meaning of Symbols

Symbols and Meaning

Operations that may cause injury to persons must be operated by professionals identified by our company.

It must be operated in strict accordance with the procedures of the manual and after confirming safety, or by a professional, otherwise it may cause malfunction.

Precautions to be taken in daily operation

¨ Sections and Chapters being referred

If you are using this instrument for the first time, please read all chapters of this manual carefully.

The pictures in this manual are for reference only. The manufacturer reserves the right to upgrade the product without notice, provided that the performance and operation methods are not affected.

To ensure the safety of the operator and the instrument, please read the User's Manual carefully before use.

2 General Descriptions

Helium Mass Spectrometer Leak Detector is an instrument for rapid localization and quantitative measurement of leaks in sealed containers. Compared with bubble identification method, pressure decay method and halogen leak detection method, helium mass spectrometry leak detection method has high detection sensitivity, fast speed and wide application range. In addition, helium mass spectrometer leak detector selects non-toxic, non-destructive and light inert gas helium as the exploring gas, so it is safe and reliable. At present, leak detection technology is widely used in the following fields,

- Scientific Research
- Aerospace
- Automotive Refrigeration
- Military Industry
- Analytical Instruments
- Power Plant
- Nuclear industry
- Pressure vessels
- Precision machining
- Medical instruments/instruments
- Vacuum furnace, coating equipment and other devices or systems
- Engineering of high vacuum and ultra-high vacuum
- Semiconductor industry, etc.

The helium mass spectrometer leak detector will provide you with faster, more economical and more accurate leak detection solutions.

3 Performance parameters of the instrument

3.1 Ambiences

Table 1 Working Conditions

Model	Ambients	Limits
SFJ-231	Ambient temperature(℃)	10～40
	Relative humidity	≤ 80%
	Voltage	Single phase, 220V±10% ,50Hz
	Max. current (A)	10A

Cautions

- Please make sure the instrument is reliably grounded before using this product, it is strictly forbidden to use this product without grounding! If the instrument is damaged or the person is injured or killed due to no reliable grounding, our company will not take any responsibility.
- No strong magnetic field interference, no violent vibration, no corrosive gas near the instrument; the room should be well ventilated to prevent helium gas interference.
- The instrument should wait for more than 40 minutes after shutdown before moving, otherwise it may affect the molecular pump.

Special Attention

When using the external auxiliary vacuum system, please ensure that the leak detector is in standby mode before evacuating the auxiliary vacuum system, otherwise it may cause the mechanical pump of the leak detector to return to oil.

Warranty Void Conditions

The instrument comes with a precision filter, mainly filtering dust particles, to avoid particles into the internal instrument, causing valve jamming and air leakage, or even cause damage to the molecular pump, if the leak detection port is not placed with our filter and lead to failure of the instrument, our company is free of warranty, and repair will be charged at cost.

The mechanical pump oil of the instrument needs to be replaced and refueled regularly. If the oil level is lower than the scale line of the pump oil window, it needs to be refueled in time; if the pump oil appears black, brown or white emulsion, it needs to be replaced, otherwise the pump will be damaged or cause other failures under long-term operation. During the overhaul, if our maintenance staff found the above leading to failure, it is out of warranty, needs to be charged additionally.

3.2 Performance Parameters

Table 2 Performance Parameters

Model#	Parameters	Values
SFJ-231	Minimum detectable leak rate (Pa·m^3/s) / Vacuum mode	5.0E-13
	Minimum detectable leak rate (Pa·m^3/s) / Sniffer mode	1.0E-8
	Detectable gas	^{4}He
	Response time (s)	＜1
	Start-up time (min)	≤2
	Leak rate detection range (Pa·m^3/s)	5.0E-13～1.0E-02
	Max. allowable leak detection pressure (Pa)	1500
	Mass spectrometry chamber sector field	180º
	Ion source filament	2
	Test port	25 KF
	Measurement unit	Pa·m^3/s, mbar.l/s, atm.cc/s, ppm
	Human-machine interface	7” touch screen
	Language	Chn, Eng
	Wireless remote	Optional
	Sniffer	Optional
	Trolley	Equipped
	Power	1000w
	Measurements (W)×(D)×(H)	645 x 678 x 965mm

4 Brief Introductions

4.1 Gas Circuit

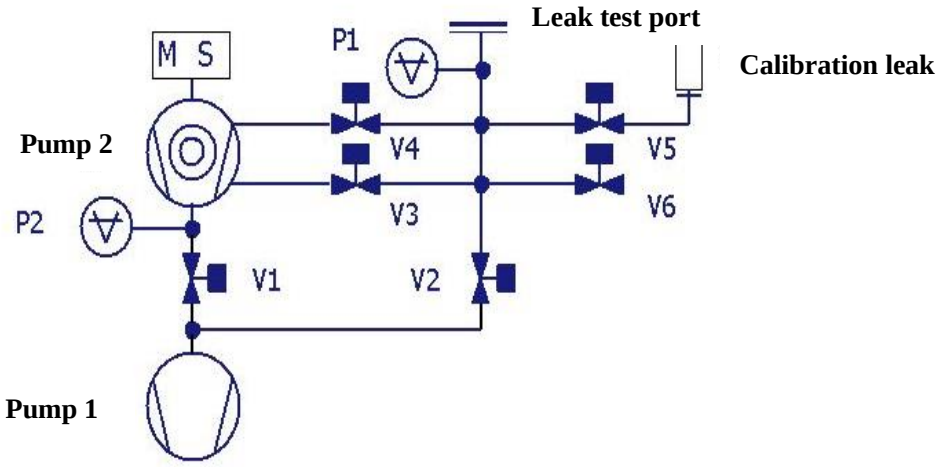


Figure 1 System Diagram

Table 3 Components

Component	Name	Description
Pump 2	Molecular pump	Provide high vacuum in the mass spectrometry chamber so that the filament can operate properly
P2	Resistance gauge tube	Measuring the vacuum at the outlet of the molecular pump
V4	Solenoid valve	Precision check valve
V3	Solenoid valve	Mid-check valve
Pump 1	Mechanical pump	Rough pumping
V1	Solenoid valve	Rough check valve
V2	Solenoid valve	Pre-pumping valve
V6	Solenoid valve	Bleed valve
Calibration	Calibration leak	In-built
V5	Solenoid valve	Marker leak valve
P1	Vacuum gauge	Sensor measuring the pressure at the leak detection port
Test port	Leak test port	Access port for the interface of the inspected part
MS	Mass spectrometry chamber	Chamber for ion flight

4.2 Electrical System Modules

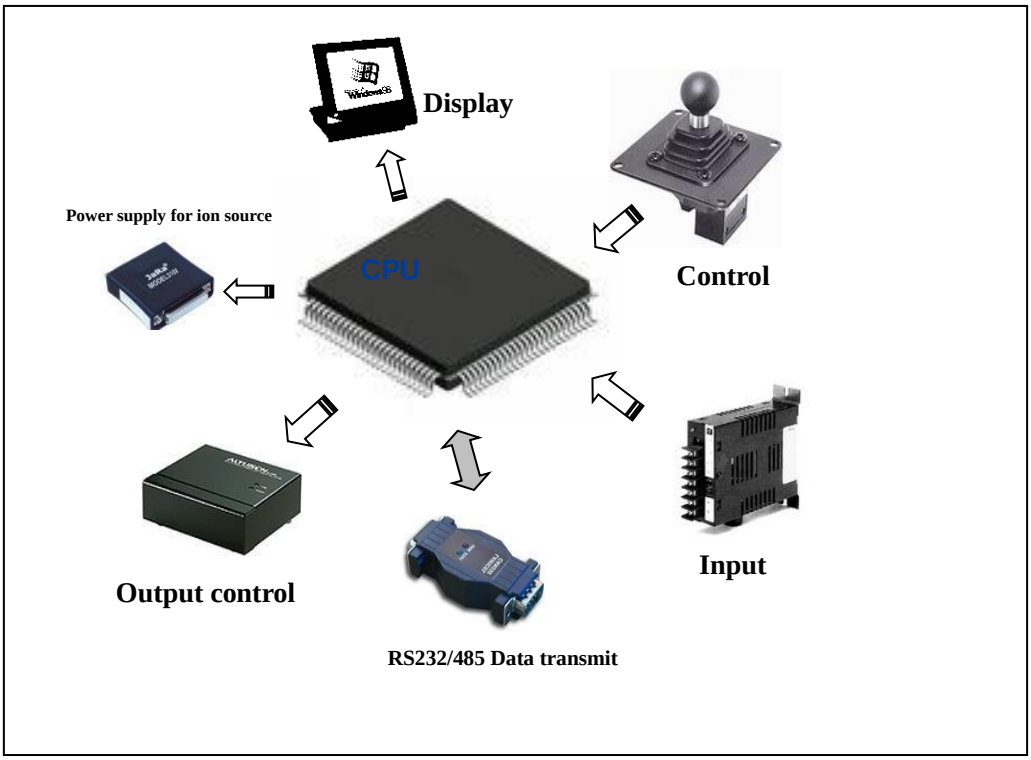


Figure 2 Electrical system diagram

Table 4 Modules

Module Name	Functions
CPU	Heart of the entire electronic system, coordinating all operations
Display	Display of leakage rate, pressure and other data
Control	Push button to complete each designated operation
Input	Sampling and transmits it to the CPU
RS232 data transmit	Communicate with external 232 devices, also can be connected to line controllers
Output control	Controls relays, solenoid valves for leak detection, stopping, and gas circuit switching
Power supply for ion source	Control the power supply of the ion source

4.3 Workflow of the System

4.3.1 Start-up Process

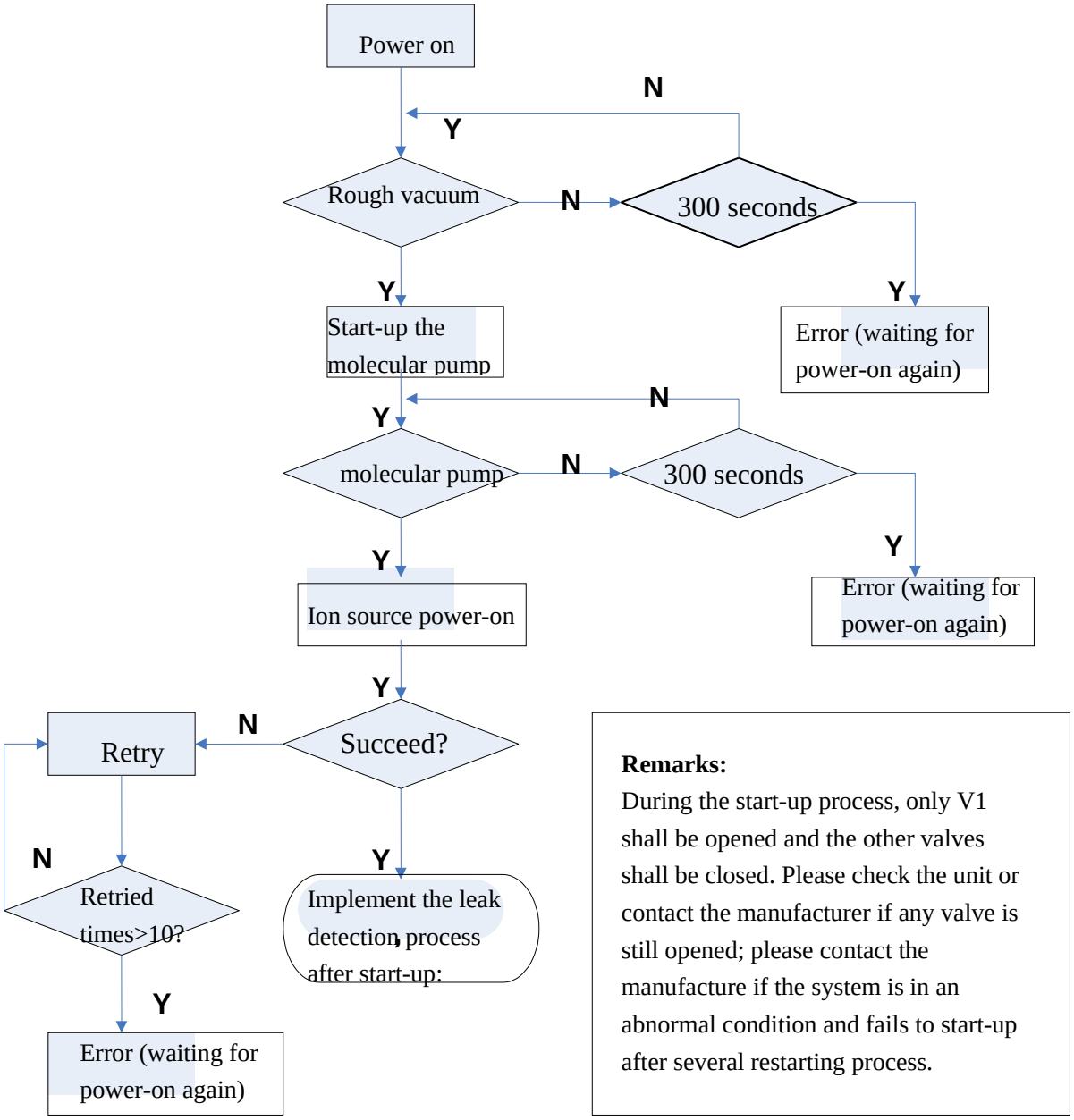


Figure 3 Starting-up Process

4.3.2 Leak Detection Process

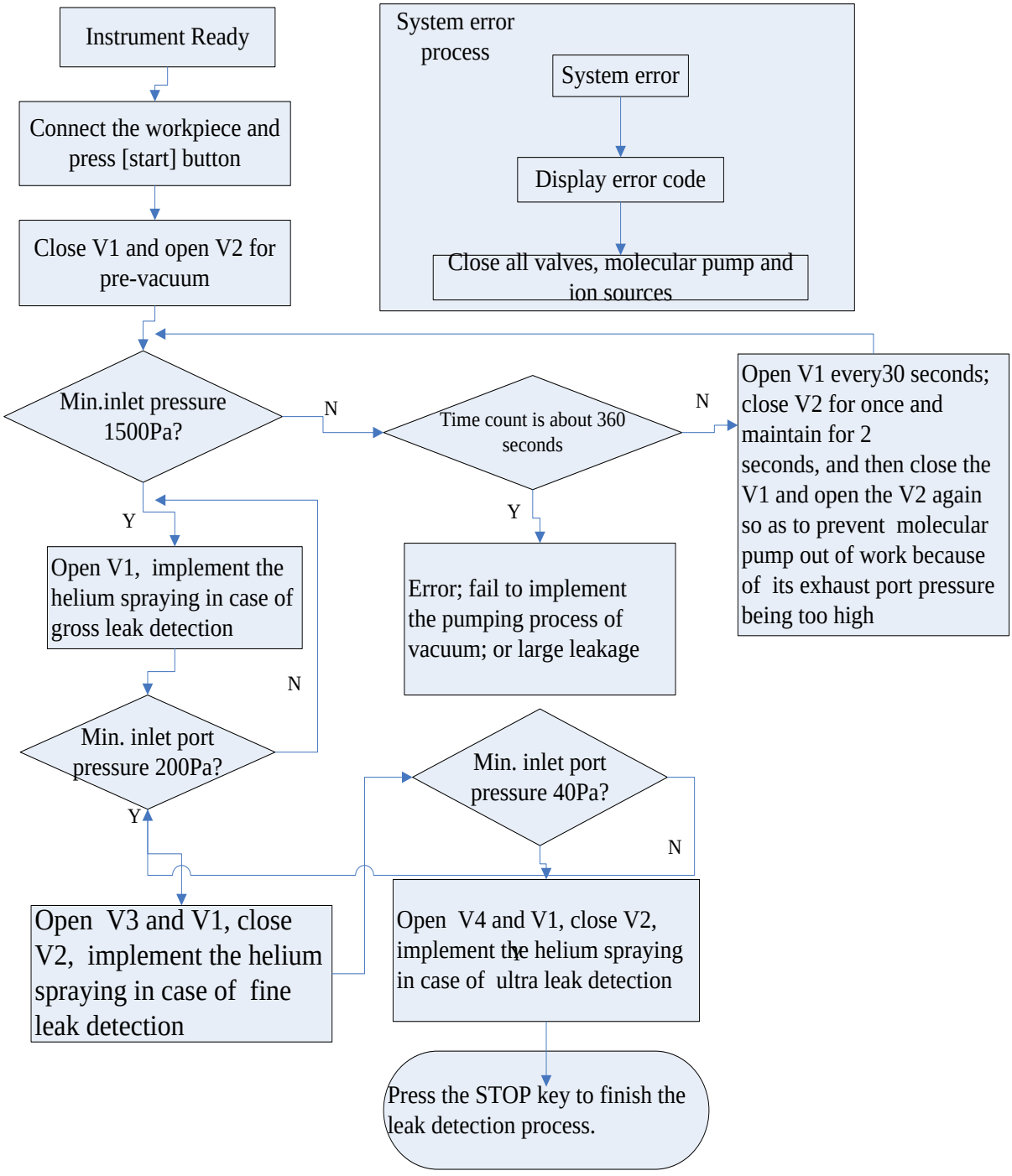


Figure 4 Leak Detection Process

4.4 Dash Board

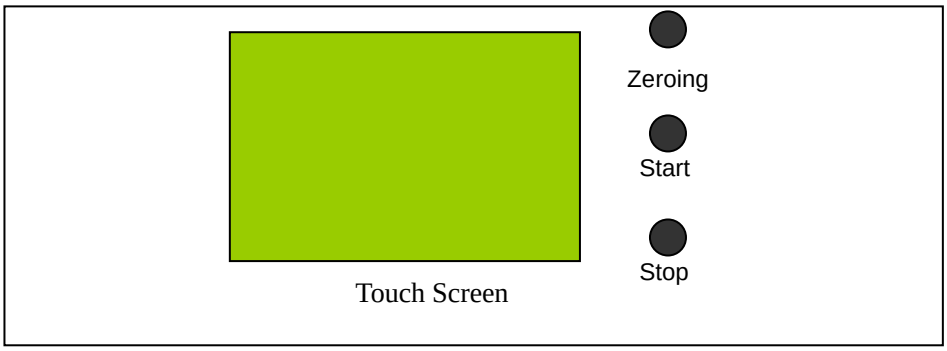
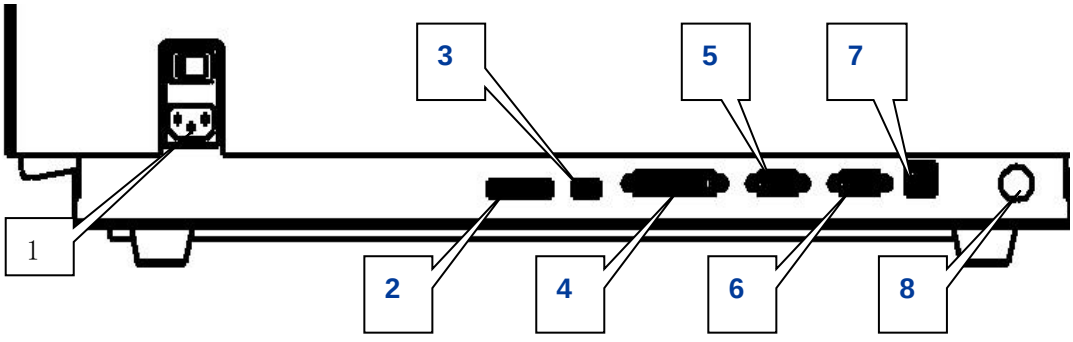


Figure 5 Dashboard

Table 5 Dashboard Details

Part	Type	Description
Touch screen	Display	Display the current operating status of the equipment, and change the parameters by screen touch.
Start/Stop	Button	Start or Stop the leak detection operation, long press stop to let air come in the detection port then replace the workpiece.
Zeroing	Button	Press and hold the button to automatically deduct the current background, long press to cancel zeroing.

4.5 Exterior Ports of the Device



s

Figure 6 Exterior Ports

Table 6 Exterior Ports

No.	Category	Description
1	Power interface	Including: switch/fuse/power jack
2	Analog output	Analog output of leakage rate signal
3	485 interface	485 communication interface
4	I/O interface	Exterior control, interior output interface
5	Remote interface	Remote control interface
6	232 interface	232 communication interface
7	USB interface	USB communication interface
8	Gas exhaust	Gas exhaust port for mechanical pump

4.5.1 Analog Output

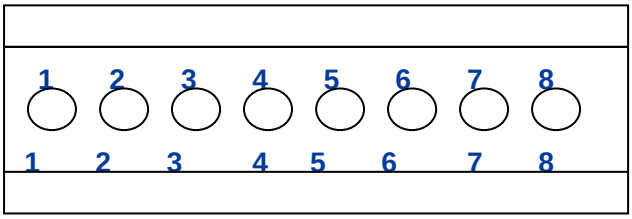


Figure 7 Layout of analog output ports

Table 7 Analog Output Ports

Serial#	Descriptions
1	AO-1
2	AGND
3	AGND
4	AO-2
5	GND
6	Audio signal (+)
7	Audio signal (-)
8	GND

❖ Linear Model

AO-1: Leak rate signal analog output (unit: V);

【(12-exp)×5041+base×504】*10/65535

AO-2: empty

❖ Exponential Model

AO-1: leak rate signal base (unit: V);【base×10×655】*10/65535

AO-2: leak rate signal base (unit: V);【(12-exp)×5041】*10/65535

4.5.2 Remote Control Ports, 232 Ports

Ports: BD9 (male)

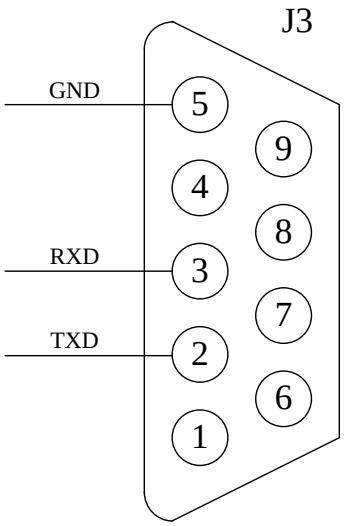


Figure 8 RS232 ports

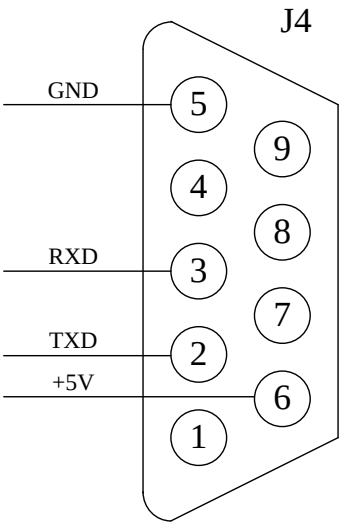


Figure 9 Remote control ports

4.5.3 RS485 Ports

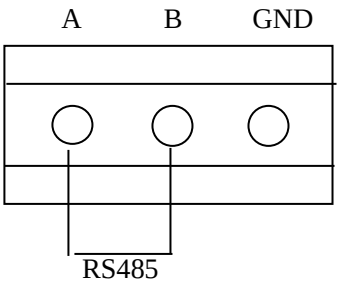
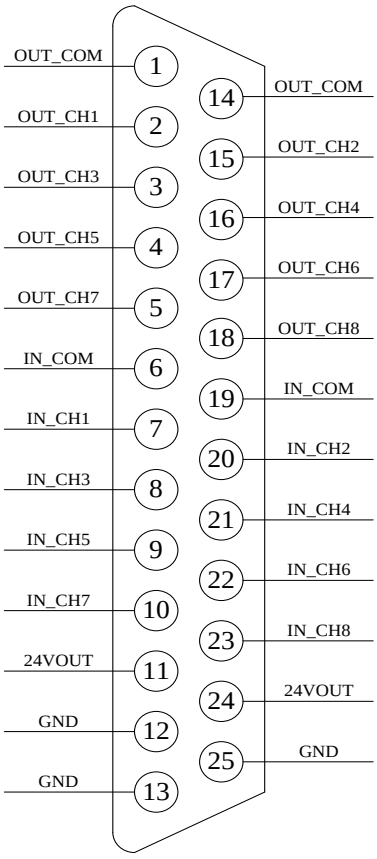


Figure 10 RS485 ports

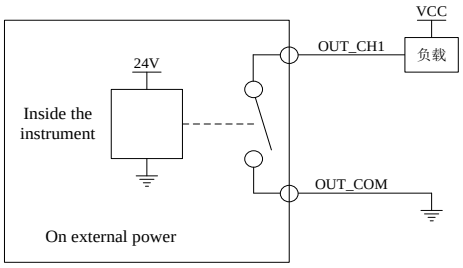
4.5.4 I/O Ports

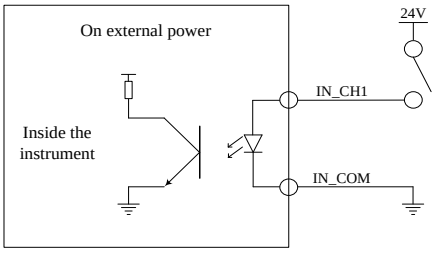
Ports: DB25 (female)

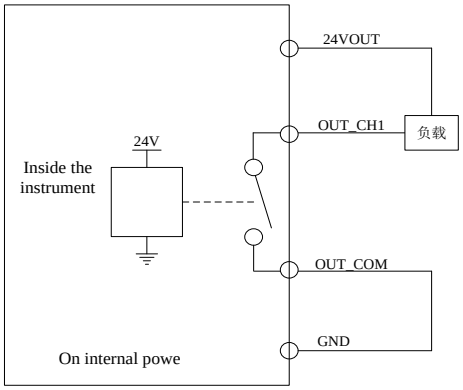


Channel No.	Trigger MOde	Level Mode
IN_CH1	Calibration	Calibration(1)
IN_CH2	Vacuum mode/sniffer mode	Vacuum mode/sniffer mode (0 / 1)
IN_CH3	Zero	Zero(1)
IN_CH4	Stop	Stop(1)
IN_CH5	Stop/Start	Stop/Start （0 / 1）
IN_CH6	Undefined	Undefined
IN_CH7	Undefined	Undefined
IN_CH8	Undefined	Undefined
Note: in level mode, please ensure that IN_CH5=0 when calibrtating, and use stop signal IN_CH4 if you need to clear calibration state.		

Channel No.	Signal Definition
OUT_CH1	Alarm value 1 output
OUT_CH2	Alarm value 2 output
OUT_CH3	Alarm value 3 output
OUT_CH4	Alarm value4 output
OUT_CH5	Vacuum value 1 output
OUT_CH6	Vacuum value 2 output
OUT_CH7	Standy output
OUT_CH8	Error output







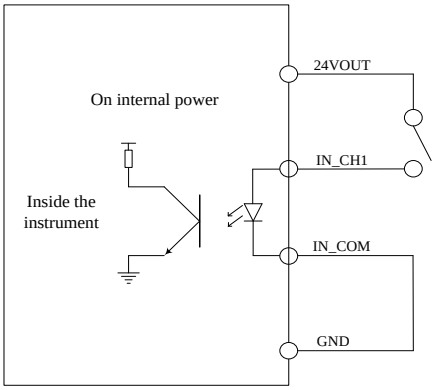


Figure 11 I/O Ports layout

5 Instrumental Operations

- Transport the device to the leak detection site.
- Find 220V±10% ,50Hz AC power supply and make sure grounding is OK.
- Prepare a 3-prong outlet and make sure the capacity is 250V*10A.
- Prepare helium, sprayer, other accessories like bellows, quick release flange, and etc.

5.1 Basic Operations

5.1.1 Start-up

Stuff the leak detection inlet port with a special plug, turn power ON, press the power switch to the "-" position, the device begins to power up. The device displays the start-up screen like following:

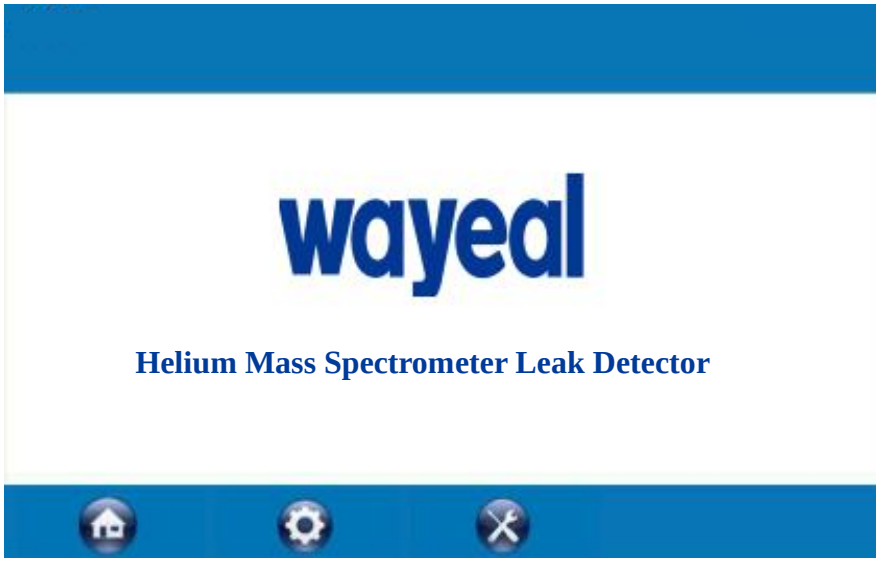


Figure 12

After couple of seconds, coming into Monitoring Screen:

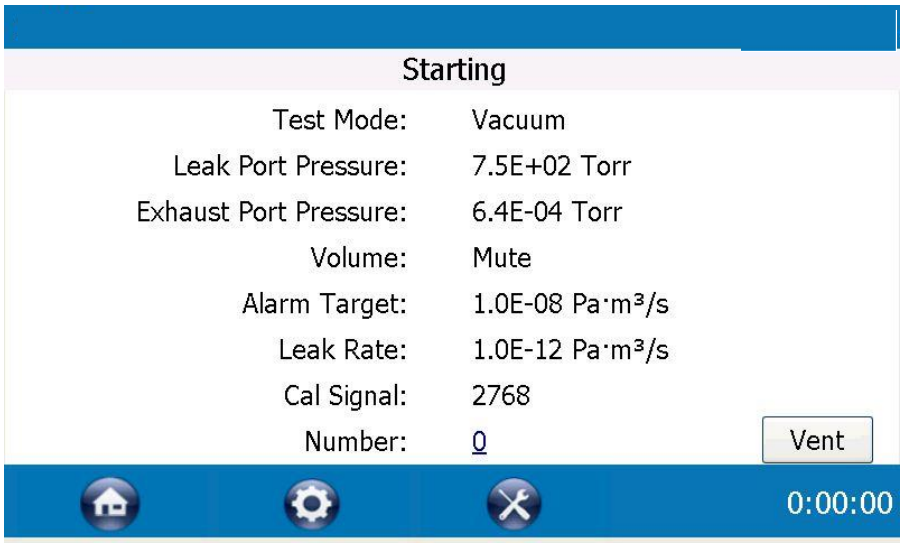


Figure 13

Table 8 Items Displayed in the Start-up Screen

No.	Item	Description
1	Start-up time	Time elapsed from power-on
2	Leak Port Pressure	Pressure of leak detection inlet port
3	Gas Exhaust Port Pressure	Pressure of molecular pump gas exhaust port

Screen after finishing start-up:

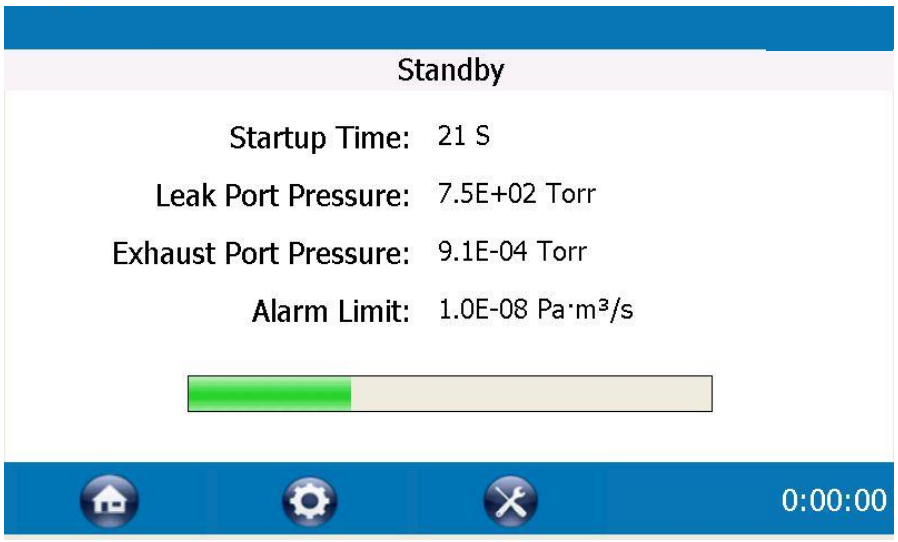


Figure 14

Standby Screen Items and Meaning:

Table 9 Items and Meaning

No.1	Item	Description
1	Test mode	Indicate current leak detection working mode (vacuum/ Sniffer mode)
2	Leak port pressure	Display current pressure of the leak detection port
3	Exhaust port pressure	Pressure on molecular pump gas exhaust port
4	Alarming volume	Display the alarm volume of the speaker
5	Alert limits	Display alarming value setting
6	Leak rate	Display base leak rate of the mass spectrometer chamber
7	Serial no. of tested product	Click the figures to number the detected products (space input is forbidden)

In case of abnormality, system automatically comes into alerting interface as below,

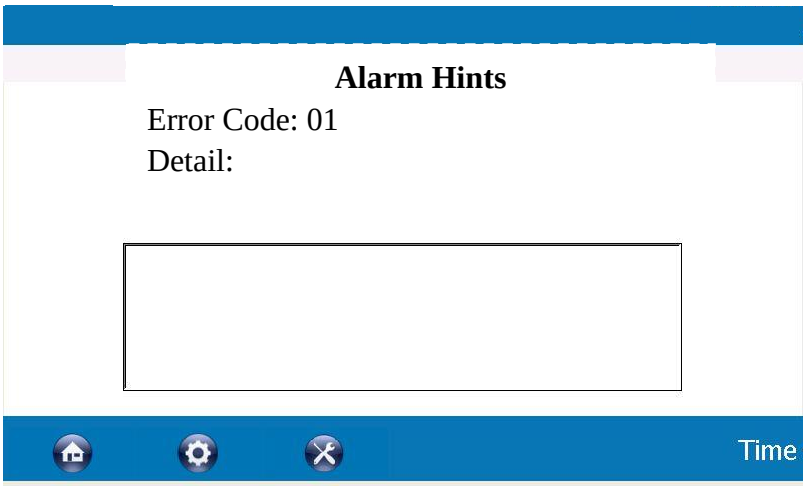


Figure 15

The most likely factors for this failure are listed in the causes, and users can follow the prompts to troubleshoot, or contact the manufacturer for repair if they cannot. If the device enters the standby state, it means that the system boot is complete.

ⓘ **If the instrument is used for the first time or used again after a long time out of**

service, more residual gas in the mass spectrometer chamber may cause a longer start-up time, and it is better not to let the leak detection port go straight through with the atmosphere when starting up, and it is recommended to use a special plug to block it.

5.1.2 Parameters and Setting

At Standby screen, click “  ”to enter the following screen:

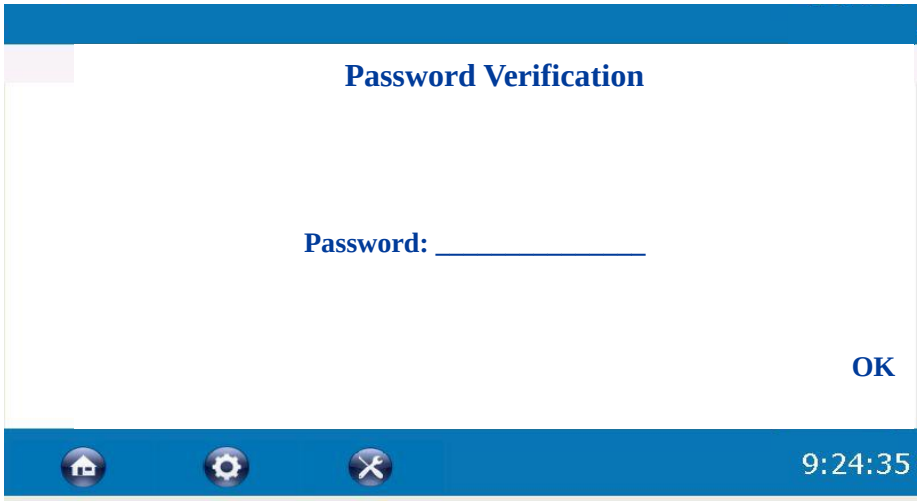


Figure 16

Click the password input area, to enter:

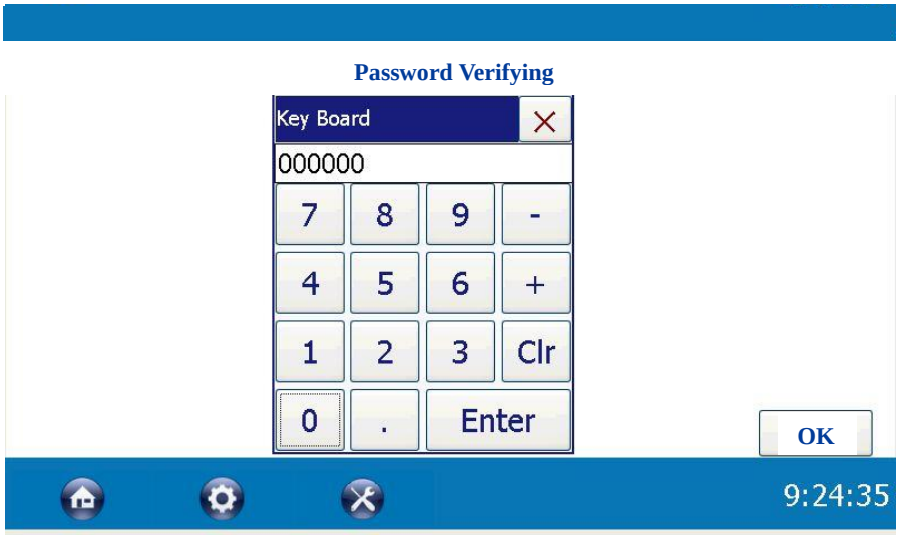


Figure 17

Passwords are divided into low level password and high level password. Screens of different levels will be different, and low-level password is for the user to enter into parameters setting area, **while high-level password is for the manufacturer to enter into parameters setting area (it is not recommended that user enters to modify them)**.

Enter correct low-level password to see this screen:

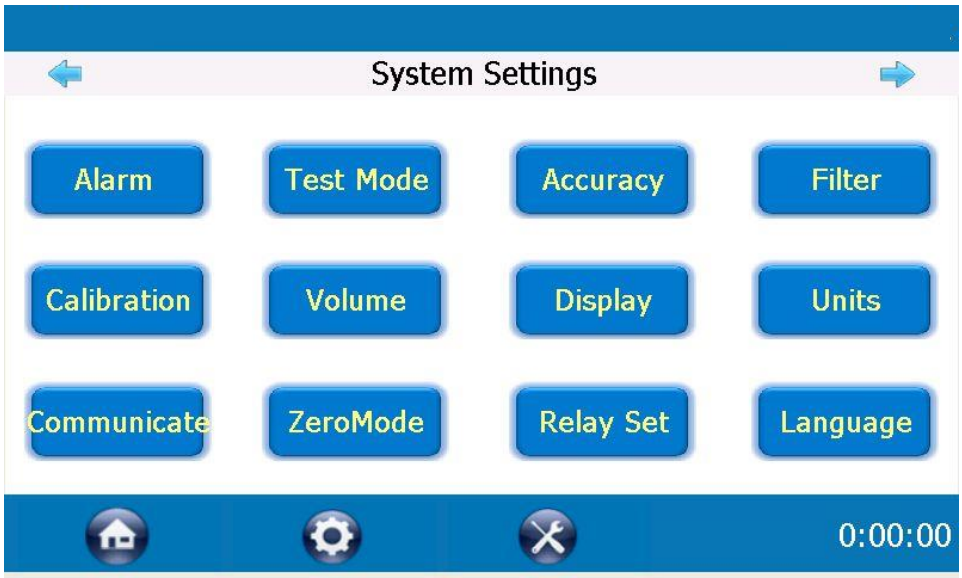


Figure 18

Enter correct high-level password to see this screen:

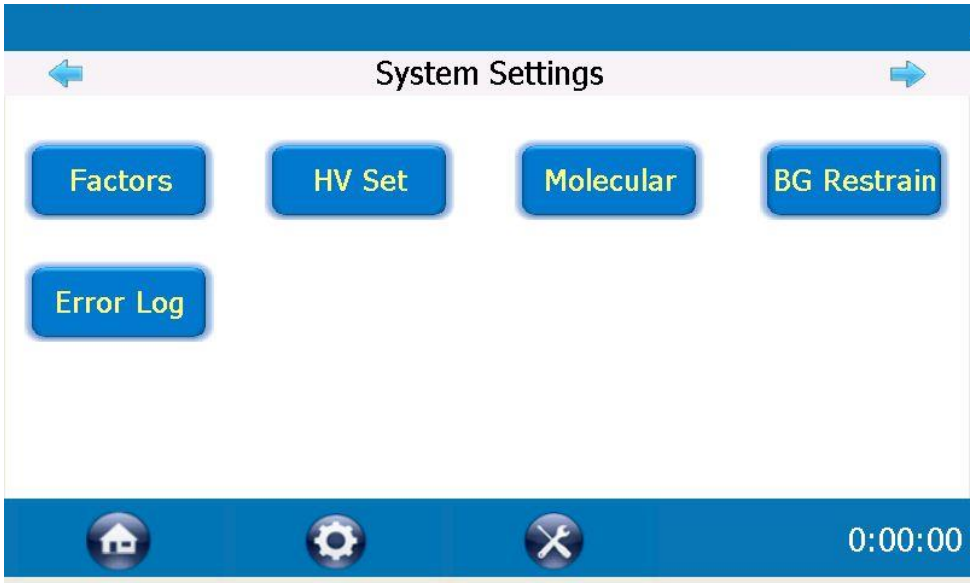


Figure 19

- ❖ Parameters can be configured while entering the above screen
- ❖ If you want to return the main screen, please click “ ”
- ❖ Touch the PageUp“ ”or PageDown “ ” to locate the functions

5.1.3 Alerting Limits Setting

进入设定后,按[报警阈值]Figure 标进入如下画面:

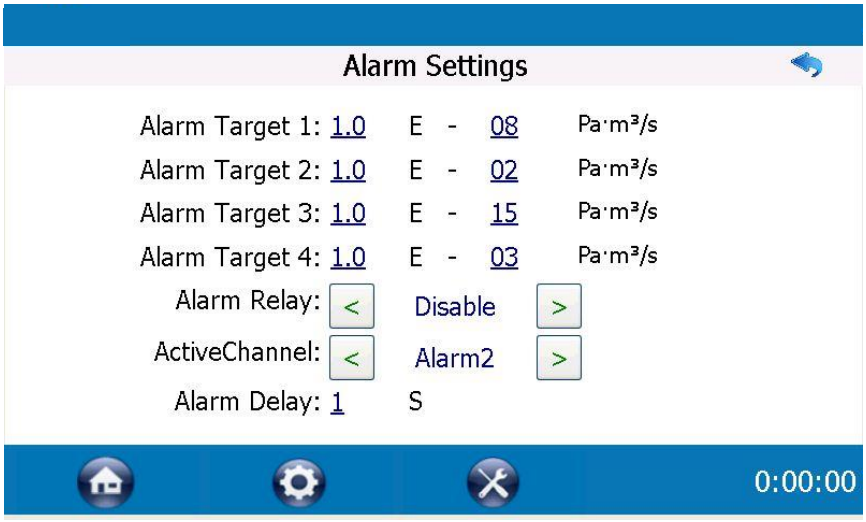


Figure 20

Table 10 Parameter meaning

#	Description	Remarks
1	Alarm threshold	After setting this value, if the actual leak rate value is greater than that value, it will alarm.
2	Alarm delay	Set the time delay alarm judgment, the time delay starts from the leak detection screen (open V1 valve).
3	Alarm relay	Disable output: When an alarm occurs, the output relay is not allowed to act. Enable output: When an alarm occurs, the output relay is allowed to operate.
4	Currently enabled channel	After selecting a channel (such as alarm threshold 2), the leak rate value column in [Data View] in the system settings is the value set for this channel (alarm threshold 2), and the [Data View] test result is based on the actual leak rate value greater than this channel. (Alarm threshold 2) value is NG, less than this channel value is OK.

- ❖ Click the data to be modified and then input the alarm value to be set in the

pop-up keyboard.

❖ If you want to input: 1.0×10^{-10}, you can click the position of the base 1.0 on the screen, press [1] on the keyboard, then press [.] and [0], and then press [ENT] to confirm the input. To set the index 10, press the position of the index and then enter the corresponding value on the keyboard to confirm. After inputting, if you want to return to the monitoring of the main screen, you can press " " to enter, and if you want to reset a new setting item, you can press " " to return and enter the setting option.

5.1.4 Leak Detection Modes

When the instrument is in shutdown or standby state, enter the option of system setting. Press [leak detection mode] to enter the following screen:

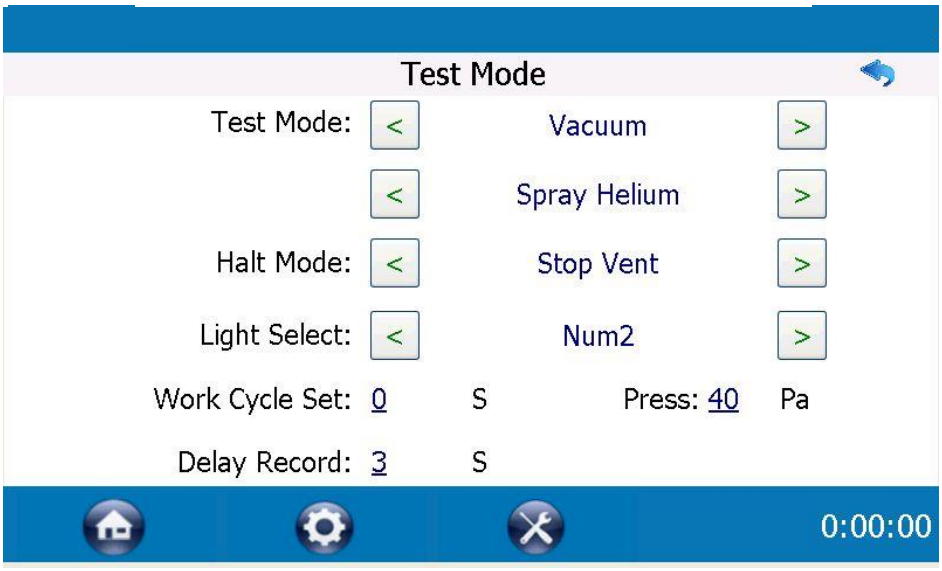


Figure 21

- Leak Test Mode: vacuum/ sniffer; Vacuum mode (negative pressure) includes helium spraying &back pressure mode; Sniffer Mode (positive pressure) leak detection for work pieces.
- Halt Mode: stop &venting, stop &not venting, whether the leak port to vent at stop
- Light select (filament): auto, filament 1, filament 2 (to be effective after rebooting)

- Auxiliary pumping: use at low accuracy, use at medium accuracy, use at high accuracy, forbidden to use

  Attention: please set it to Forbidden to Use, only open for special cases

- Work Cycle Set: when it is set to "0", detection time of the instrument is not limited, which can be stopped only by manual control; when set to other numbers, the instrument will be automatically stopped when time is off.
- Delay Record: Record delay time of instrument staying on the main screen and only record once (Remarks: when the work cycle is set other numbers other than zero, it must be set not less than delay time)

5.1.5 Leak Detection Accuracy

When the instrument enters [System Setting] in shutdown or standby mode, press the [Accuracy], the following screen appears:

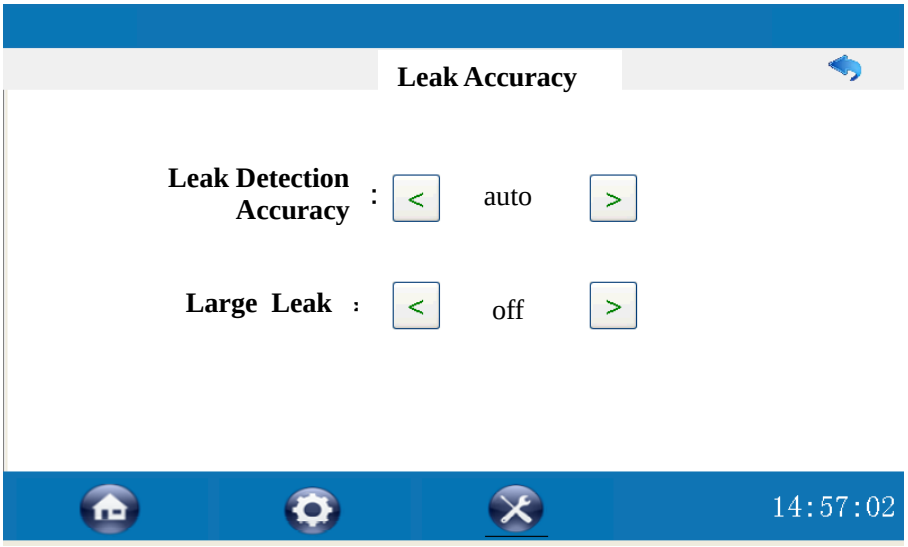


Figure 22

Change parameter settings by [＞]or[＜];

Leak Accuracy: Auto, high, middle, low;

Different accuracy will open different leak valves; "automatic" is suggested here if there is no special request.

Large Leak Mode: set to “off”.

5.1.6 Leak Detection Pressure

When the instrument enters [System Setting] in shutdown or standby mode,

press the [leak detection pressure], the following screen appears

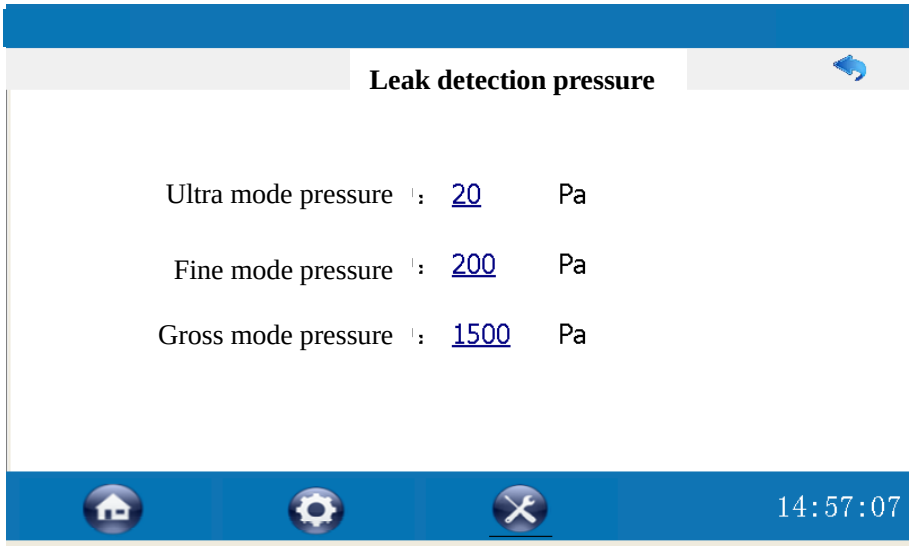


Figure 23

Ultra mode: ultra detection valve (V4) open, pressure of leak test port (P1), setting range is 1~40, and default is 20Pa.

Fine mode: medium detection valve (V3) open, pressure of leak test port (P1), setting range is 41~200, and default is 200Pa.

Gross mode: medium detection valve (V1) open, pressure of leak test port (P1), setting range is 201~1500, and default is 1500Pa.

Use the popup keyboard to change the pressure figures.

5.1.7 Unit Settings

When the instrument enters [System Setting] in shutdown or standby mode, press the [Unit], the following screen appears:

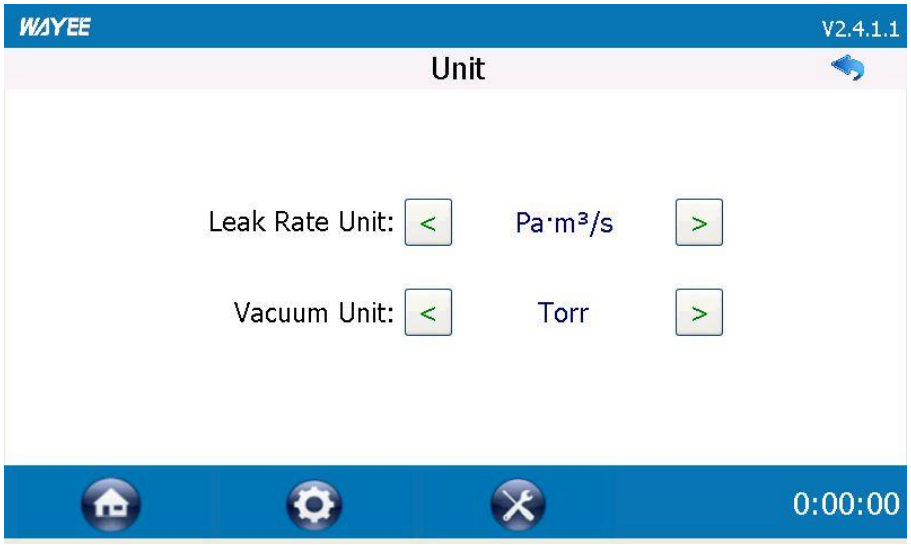


Figure 24

Use [＞] or[＜] to change the right parameters.

5.1.8 Display Range

When the instrument enters [System Setting] in shutdown or standby mode, press the [Display], the following screen appears:

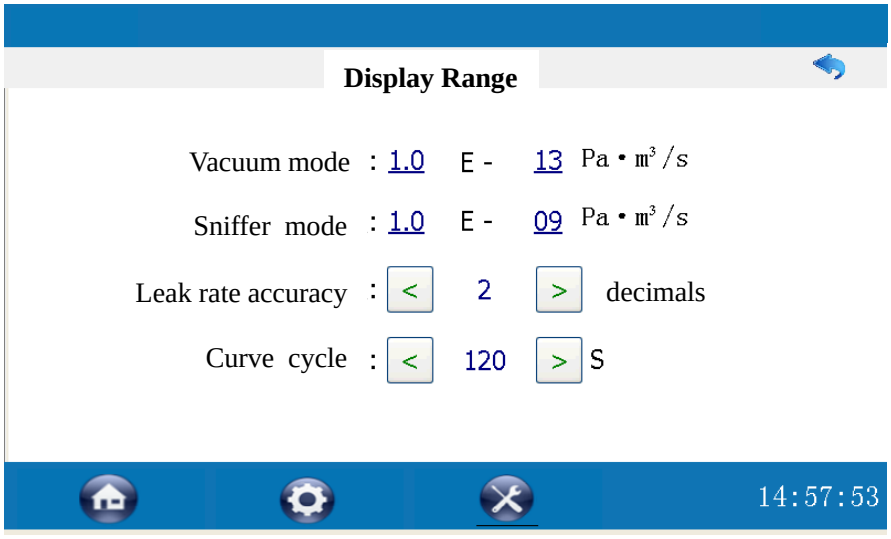


Figure 25

Change parameter settings by [＞]or[＜]

The lower limit displayed respectively in vacuum and sniffer mode is the value in corresponding mode.

Leak Accuracy: here the value indicates digits behind the decimal point of leak rate.

Curve cycle: time of one cycle for the curve

5.1.9 Volume Setting

When the instrument enters configuration options, press the [Volume], the following screen appears:

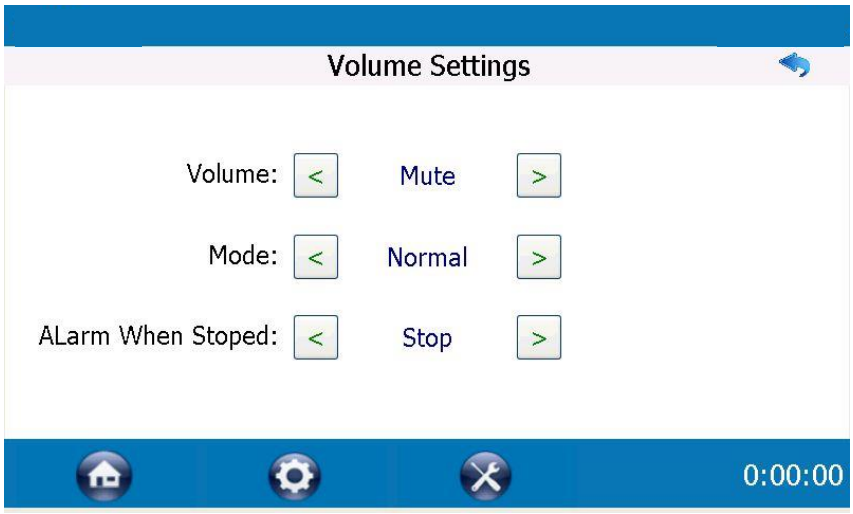


Figure 26

- Volume: press [＞] or [＜]to choose mute, small, middle or high;
- Mode: press [＞] or [＜] to choose normal or change;

5.1.10 Communication Settings

When the instrument enters [System Setting] in shutdown or standby mode, press the [Communicate], the following screen appears:

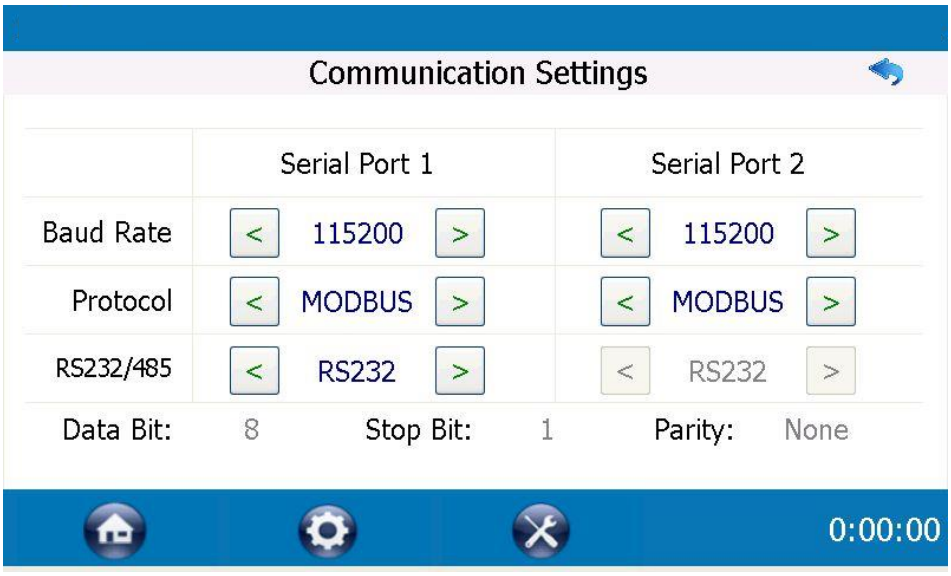


Figure 27

Baud rate of serial port 1: 9600、19200、38400、57600、115200.

Baud rate of serial port 2: 9600、19200、38400、57600、115200，it is recommended to use the default 9600, otherwise it may cause low communication stability.

Protocol: MODBUS、Protocol 1、Protocol 2.

Change parameter settings by [＞]or[＜]

5.1.11 Device Calibration

When the instrument enters [System Setting] in shutdown or standby mode, press the [Calibration Settings] and enter into the following screen:

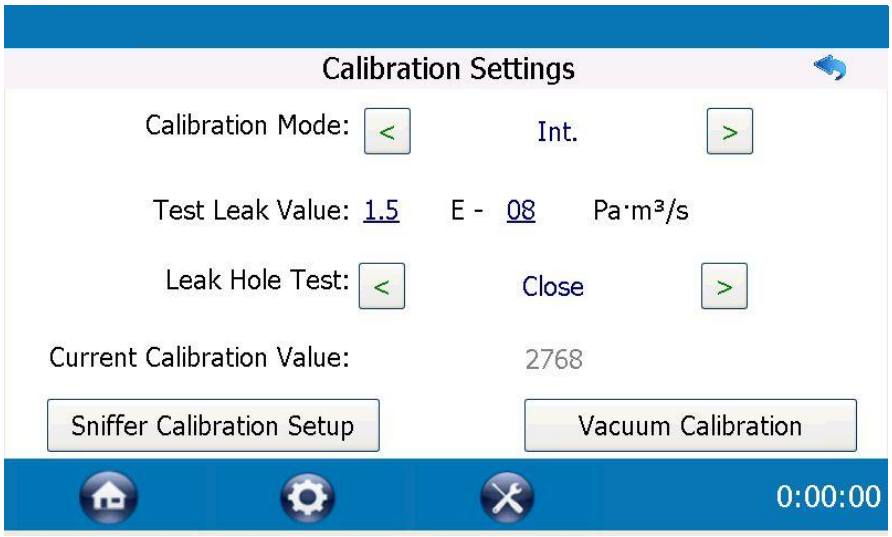


Figure 28

- Calibration Mode: External standard leak (without switch), External standard leak (with switch), internal standard leak; it is recommended to use an external standard leak (without switch) when you have external calibration. Internal one means calibrating by the inner standard leak of leak detector.
- Test Leak Value: Input the standard leak values according to the values displayed on calibration standard \ leak, and please note that the standard leak unit is Pa • m3 / s.
- Leak Hole Test: open/ close, press the start button after completion of the internal standard leak calibration, the instrument will automatically detects the internal standard leak value and verify the calibration value.
- Calibration in vacuum mode, click [vacuum calibration] to conduct vacuum standard leak automatic calibration.
- Calibration in sniffer mode, click [sniffer calibration] to enter the following

parameter setting screen:

- [1.5 * 10-7Pa·m3/S] is the standard leak value in sniffer calibration mode, the value should be set as standard leak hole value while having sniffer calibration.
- Sniffer press: detect suction gun press.
- Sniffer leak press: detect suction gun leak press.
- Click [sniffer calibration], enter the following screen:

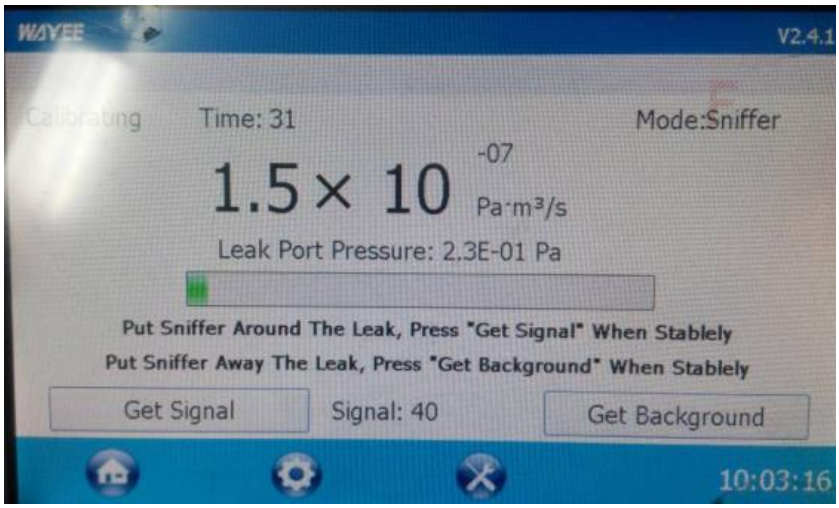


Figure 29

Put sniffer around the leak, press “get signal” when stably;

5.1.12 Zeroing Mode

When the instrument enters [System Setting] in shutdown or standby mode, press the [Zero Mode], the following screen appears:

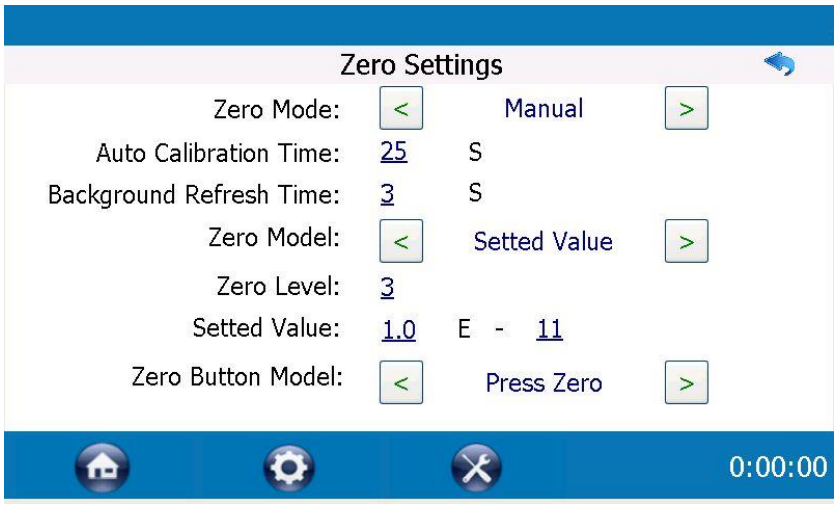


Figure 30

Change parameter settings by clicking [＞]or[＜];

Zero Mode

Automatic: after the waiting time when the leak detection valve is opened, the system automatically enters into the zeroing mode (automatic deduction of current value).

Manual: It is required to press [zeroing] on the panel to enter into the mode of deduction of current value.

Time: In automatic mode, it will enter into the mode of deduction of current value after this time.

Zero Level

After entry into the mode of automatic deduction of current value, the display value will be the value of the indicator before the deduction minus this setting value.

Zero Model:

5.1.13 SYS Relay

When the instrument enters [System Setting] in shutdown or standby mode, press the [SYS Relay Set], the following screen appears:

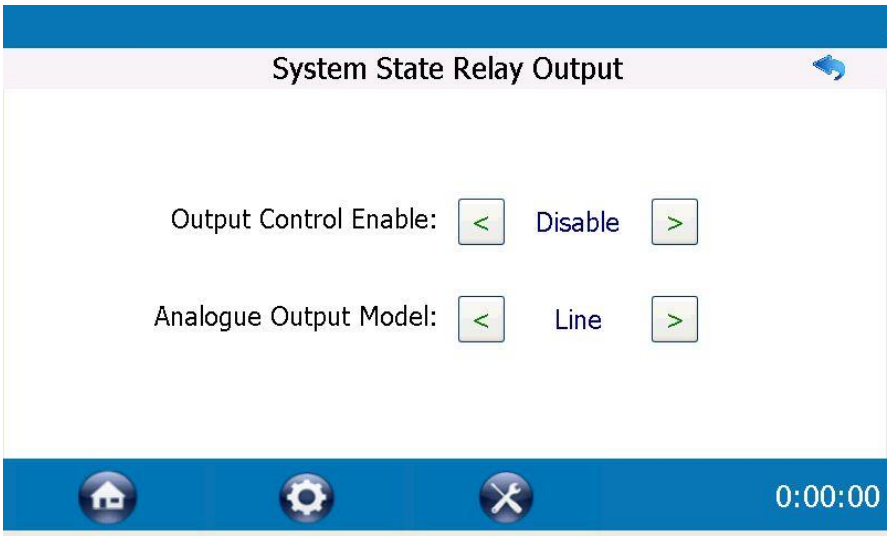


Figure 31

- Change parameter settings by [>]or[<]
- Relay output control enable: disable, able; to control the leak rate alarm and state

output. (see 4.5.3 I/O input and output interface)

- Analogue output model: line, log， instrument leak rate output. (see 4.5.1 analogue output interface)

5.1.14 External Control

When the instrument enters [System Setting] in shutdown or standby mode, press the [External], the following screen appears:

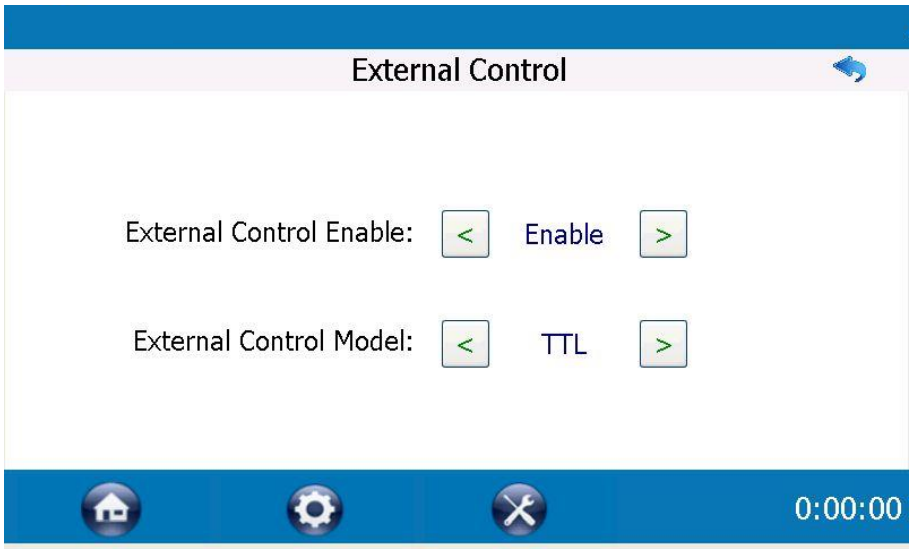


Figure 32

External Control Enable: Enable、Disable

External Control Model: TTL、PPS (See 4.5.3 I/O input and output)

5.1.15 Vacuum relay output

When the instrument enters [System Setting] in shutdown or standby mode, press the [Output], the following screen appears:

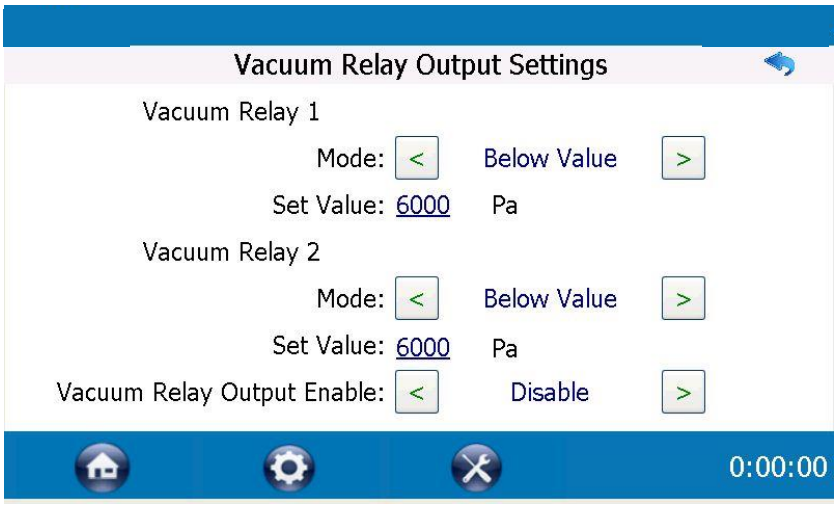


Figure 33

- Vacuum Relay 1: according to leak port vacuum value, output the state of open or close.
- Vacuum Relay 2: according to leak port vacuum value, output the state of open or close.
- Vacuum relay output enable: allow vacuum state account output by I/O input/ output interface or not.

  Change parameter setting by clicking [＞] or [＜] (unit is mbar)

5.1.16 Filter Mode Setting

When the instrument enters [System Setting] in shutdown or standby mode, press the [Filter Mode], the following screen appears:

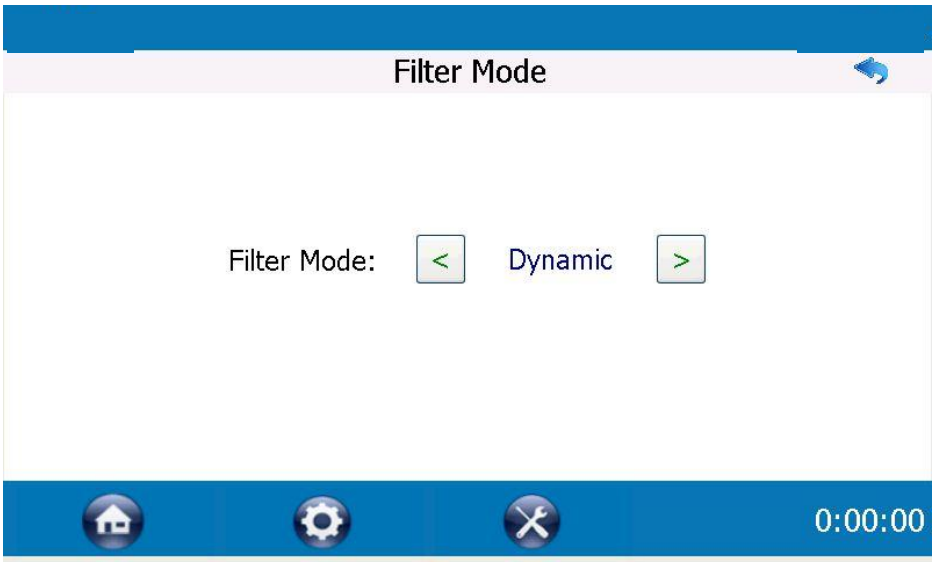


Figure 34

- Change filter mode by clicking [＞]or[＜]

Dynamic Filtering: Dynamic filtering is of high precision, but somewhat it has a slower response time.

Static Filtering: The static filtering is volatile, but the speed is faster.

- Users can choose according to the actual situation.。

5.1.17 Language Setting

When the instrument enters [System Setting] in shutdown or standby mode, press the [Language], the following screen appears:

Figure 35

Language Setting: Simplified Chinese, American English.

5.1.18 Time Setting

When the instrument enters [System Setting] in shutdown or standby mode, press the [Date＆Time], the following screen appears:

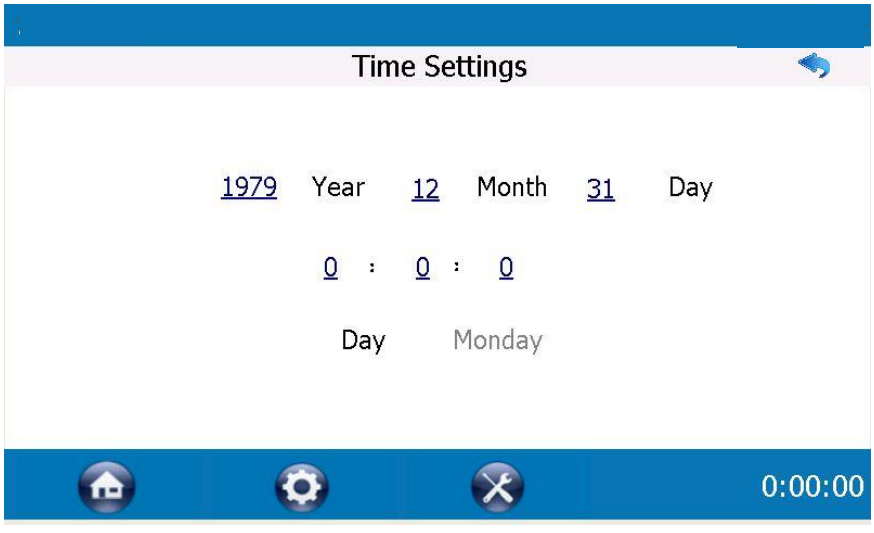


Figure 36

To modify the time, you can directly input the figures on the screen keyboard.

5.1.19 Screen Protection

When the instrument enters [System Setting] in shutdown or standby mode, press the [Screen Protection], the following screen appears:

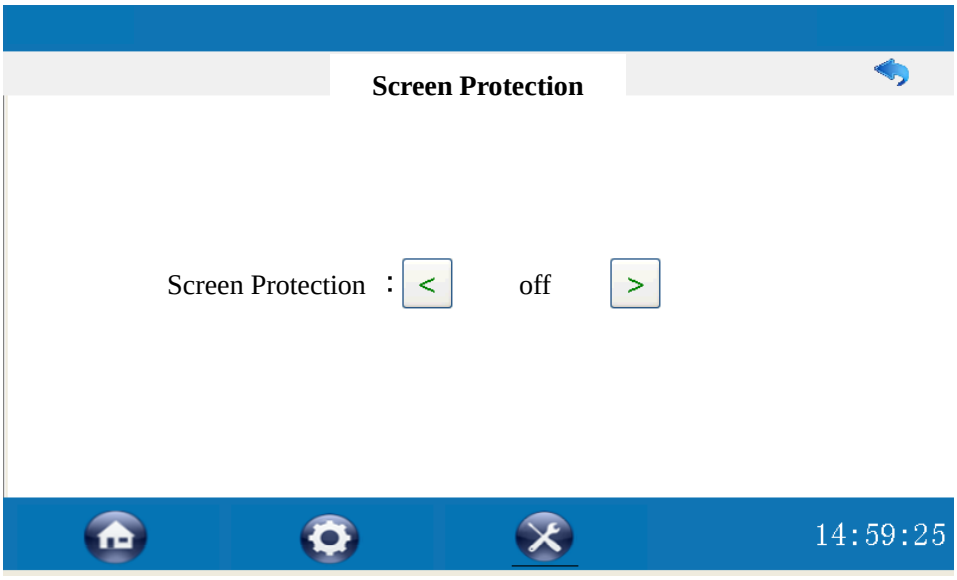


Figure 37

Screen protection: off, 5min, 10min, 15min, 20min, 30min

Use[＞] , [＜] to change the figures.

5.1.20 Password Setting

When the instrument enters [System Setting] in shutdown or standby mode, press the [Password], the following screen appears:

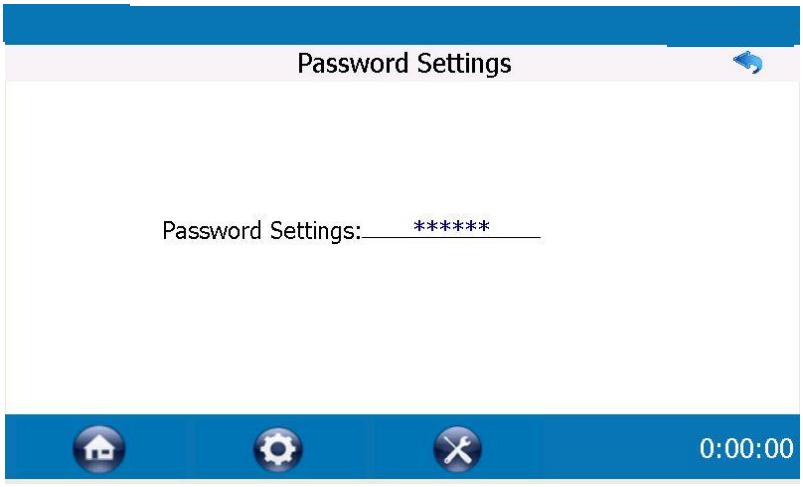


Figure 38

- ❖ Type a new set of low-level password in the password setting area.
- ❖ Type a new set of low-level password in the password setting area.

5.1.21 Factor of the Device

When the instrument enters [System Setting] in shutdown or standby mode, press the [Factor of the device], the following screen appears:

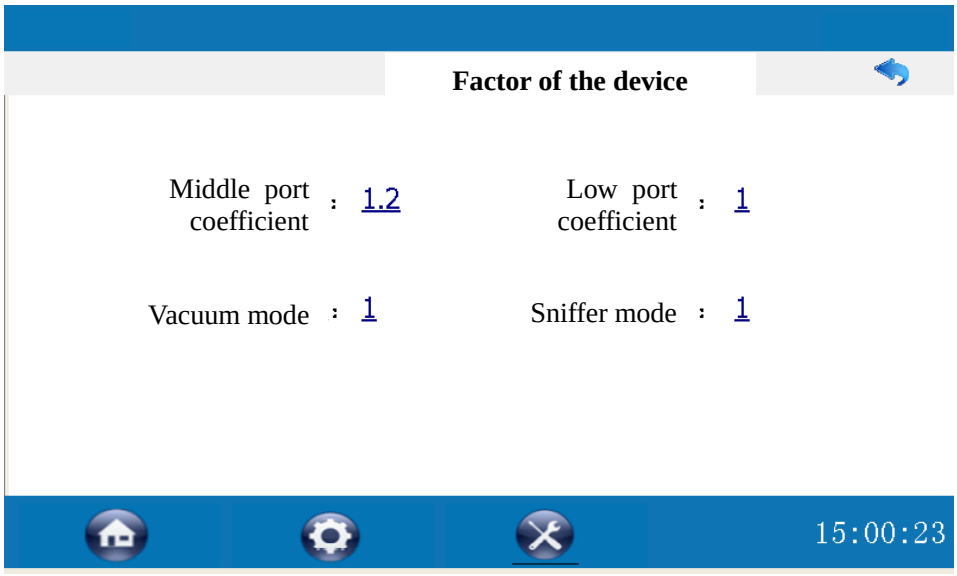


Figure 39

Click the [numbers] to configure them.

Middle port coefficient: correction factor for the leak rate display when the device is in the mid-check (V3) state. Correction range 0.7~1.3.

Low port coefficient: correction factor for the leak rate display when the device is in the low-check (V1) state. Correction range 0.7~1.3.

Vacuum mode, sniffer mode, the factor is defaulted to “1”.

5.1.22 Large Leak Protection

When the instrument enters [System Setting] in shutdown or standby mode, press the [Large leak protection], the following screen appears:

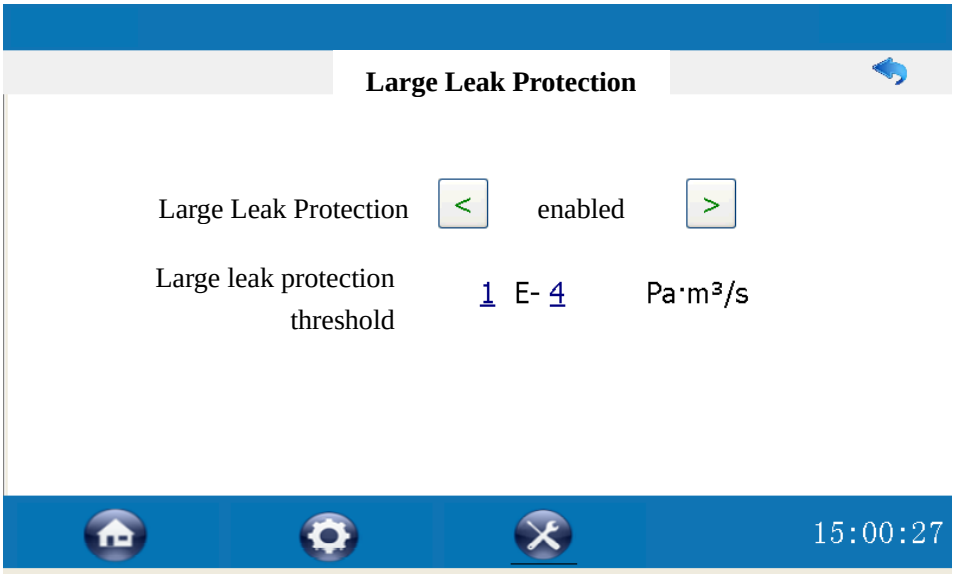


Figure 40

Enable large leak protection: use [＞] , [＜] to change the setting.

Large leak protection threshold: input numbers to set, **Leak rate displayed on the device is greater than the figures set here, the device will come into standby, and manual confirmation needed.**

5.1.23 Maintenance Period

When the instrument enters [System Setting] in shutdown or standby mode, press the [Maintenance Period], the following screen appears:

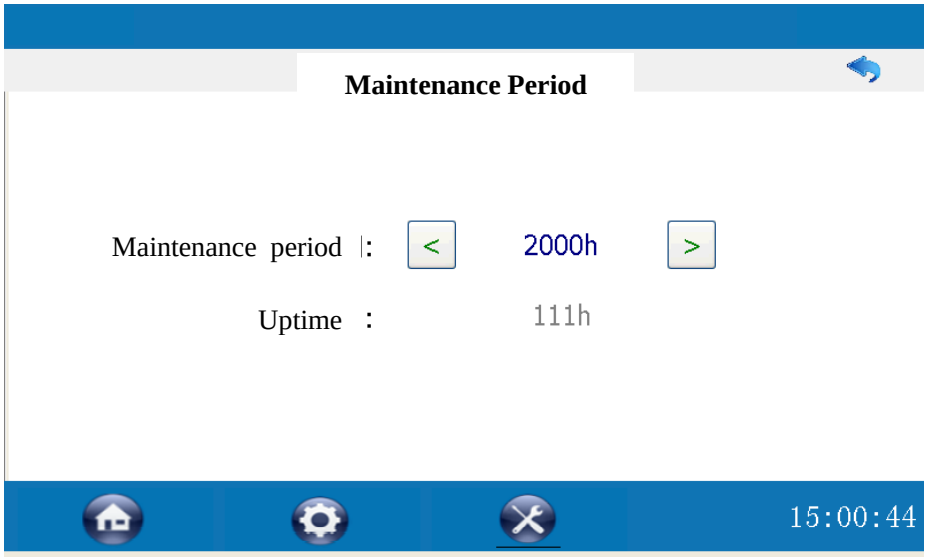


Figure 41

Maintenance period: default maintenance interval for pump is 2000h.

Uptime: device operation time.

5.2 Leak detection (Spraying Method)

At halt or standby mode, press [Start], to activate vacuum pumping-out from the workpiece, and wait for following screen to appear,

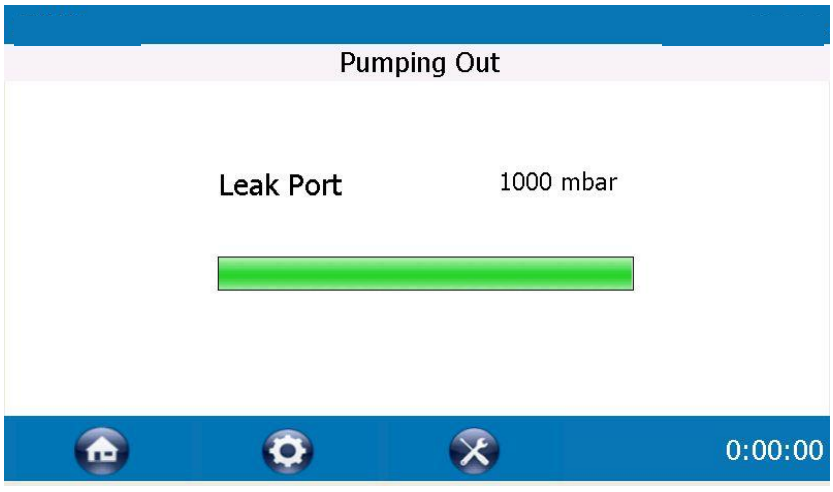


Figure 42

If the V1 valve is opened, you can carry out helium spray large leak detection on the work pieces; if V4 valve is opened, you can carry out helium spray micro leakage detection on the work pieces (4.3.2 leak detection process).

The leak detection screen displays as follows:

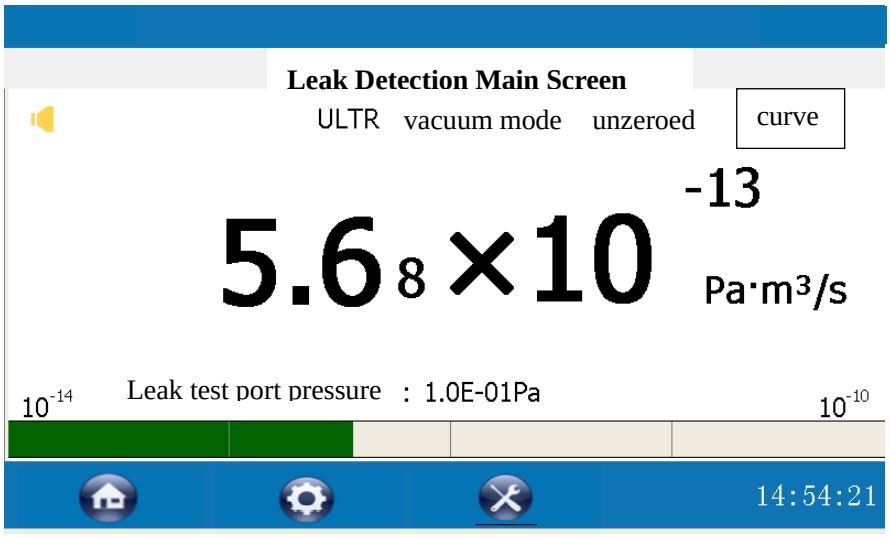


Figure 43

At this point, you can carry out helium spray leak detection on the detected work pieces, the leak rate value will be indicated in the leak rate indication area.

Click the button [Wave] on the top right of the homepage into the leak rate curve picture.:

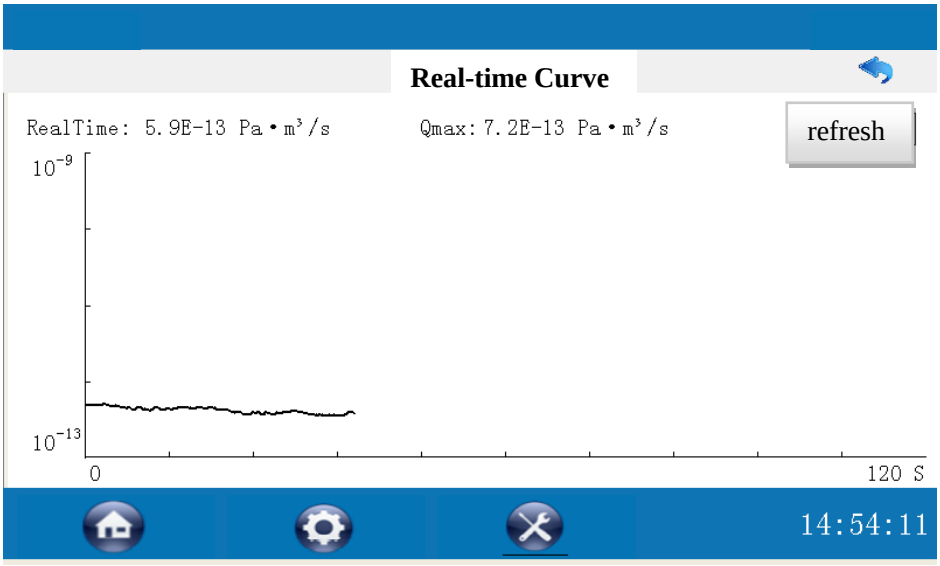


Figure 44

Click the touch key "Refresh" at the top right corner of the screen, the curve is re-recorded from the 0 second and the Qmax value is re-recorded.

5.2.1 5.2.1 Standard Leak Calibration

Connect the standard leak to the leak detection port, then the instrument will enter

[System Setting] in shutdown or standby mode, press the [Calibration Settings] and enter into the following screen:

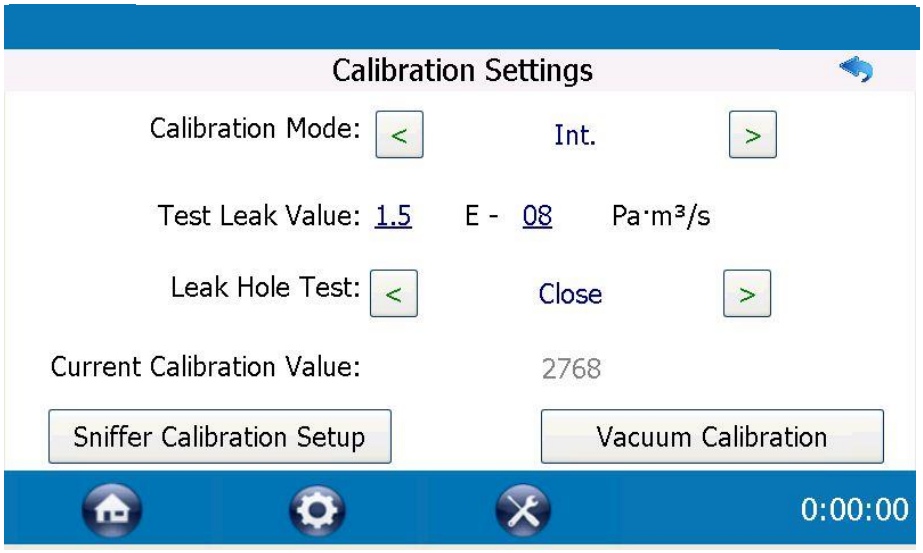


Figure 45

Input the standard leak values according to the values displayed on calibration standard leak, and please note that the standard leak unit is Pa • m3 / S.

After input is complete, you can press [Back] to set other parameters, or you can press [Vacuum calibration] to calibration, as the following screen: (Note: After entering the parameter setting according to [sniffer calibration setting], press [sniffer calibration] to calibrate the sniffer)

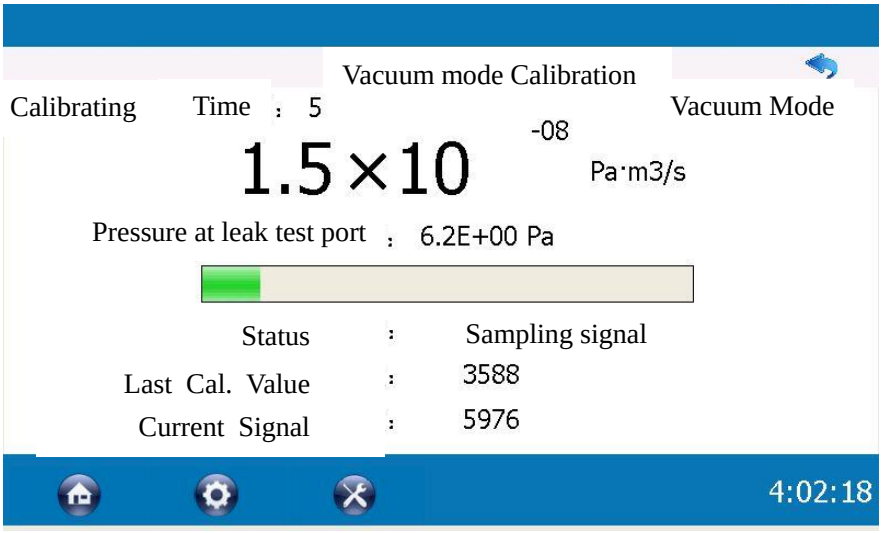


Figure 46

Wait for the instrument to acquire the signal automatically, acquire the background and then return to the standby screen after the calibration is completed.

When the leak test is set to "on", press the "start" button for the first time after returning to standby, which is to test and verify the built-in standard leak.

5.2.2 Check System Status

Click the "  " touch button at the bottom left corner of the screen to enter the system status interface, view the current settings of the leak detector, the status of each item.

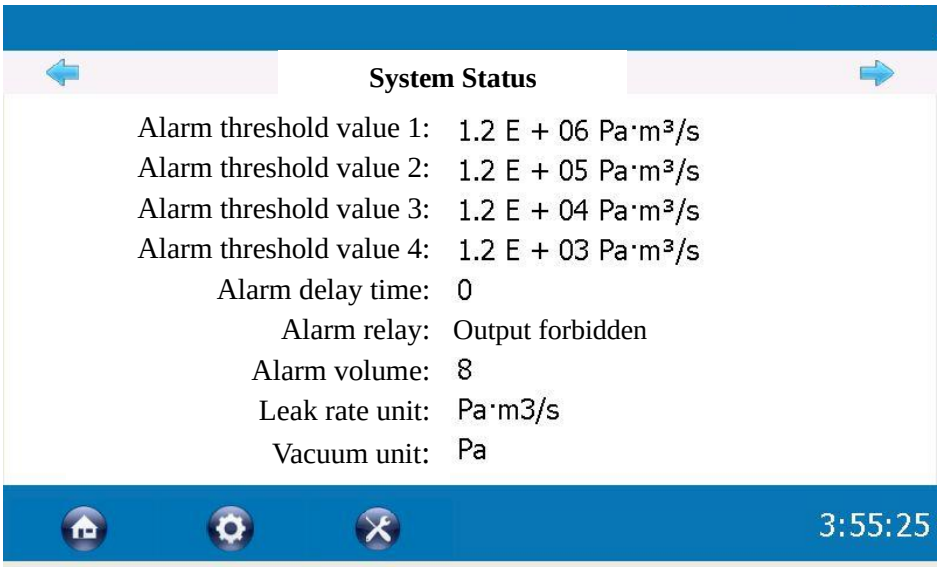


Figure 47

Touch “  ” 或“  ” to turn pages.

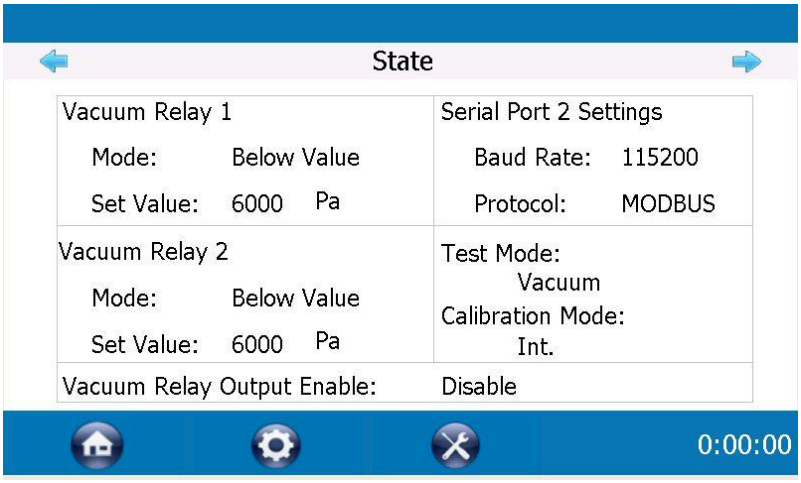


Figure 48

5.2.3 Data Management

Enter in [Settings], click [Data View] to enter the following screen:

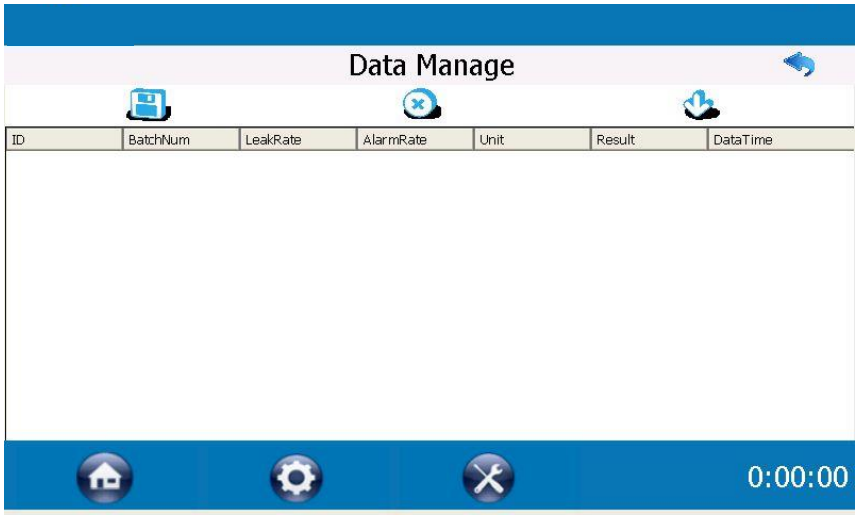


Figure 49

- Data Download: connect USB to the external interface of leak detector, press the touch button , you can download data from detector after confirmation.
- Data Deletion: press the touch button can delete the stored data of leak detector.

5.2.4 Zeroing (Zero)

When the device is in the leak detecting state, press "Zero" to deduct the current background signal, so that the reading shown by the device is the absolute leak rate.

5.2.5 Stop

In the standby or leak detecting state, press "Stop" to stop the device, and long press the set key to open the air release valve to put air into the leak test port so as to replace the tested workpiece.

5.2.6 Shutdown and power off

After leak detection is finished, make sure the device at stop or standby state, plug the leak test port with special plug, press the power button behind the case to turn off, and

unplug the power.

5.3 Operation of other leak detection methods

5.3.1 Leak detection by sniffer method

The operation of the sniffer method is the same as the basic operation of the spraying method, except that the leak test port is connected to a special sniffer probe instead of the workpiece to be tested. The specific operation is: the workpiece to be tested is filled with helium or helium - nitrogen (air) gas mixture (pressure@1 atm), the special sniffer probe will be connected to the leak detection port, press the "Leak Detection" button, the sniffer probe against the suspected leak, if there is a leak can be detected, and the leak is greater than the set value, the device automatically alarms.

5.3.2 Leak detection by back-pressure method

The basic operation is the same as the spraying method, except that helium gas is pressed into the workpiece and then the workpiece is put into the leak testing tank for leak testing.

6 Maintenance

6.1 Leak rate calibration

Perform once after a long period of time without power on.

Refer to (5.1.11) Instrument Calibration.

6.2 Chassis opening

Before opening the chassis, make sure that the device is powered off and the power cable is unplugged. Insert an Allen wrench into the latch holes on the left and right sides of the chassis to open or close the chassis latch as shown in following Figure. Latches on both sides opening and closing are in the same direction.

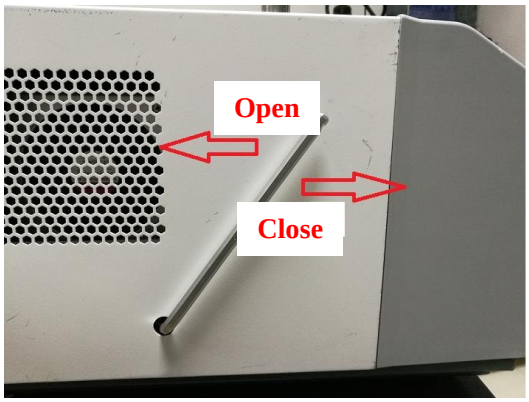


Figure 50

After loosening the latches on the left and right sides, screwing the leak detection port chassis pressure block, hold up the rear chassis cover and open the chassis.

6.3 Maintenance of Mechanical Pump

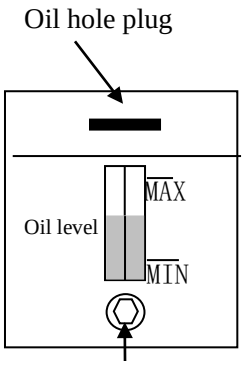


Figure 51

Observe the mechanical pump oil level at certain intervals as shown in the figure above. Make sure the oil level in above MIN and add oil to the mechanical pump if the oil level is below MIN and replace any brown black oil. Operate as follows:

- Turn off the instrument and open the casing.
- To fill oil: take off the oil-way plug and then fill in the special mechanical pump oil through the hole while making sure the oil will not exceed the MAX line. Put back the oil-way plug again.
- To replace oil: first take off the oil-way plug and then the oil drain plug, exhaust the oil out of the pump oil tank, and put back the oil drain plug.

6.4 Maintenance of Molecular Pump

Molecular pumps are precision unit, please handle with care while carrying, and keep the inner part of the pump body clean. If any dirt accidentally comes into the pump body, must clean it as soon as possible with special cleaning fluid and tools.

The maintenance of molecular pump should be carried out under the guidance of professional technicians, in case of damages from unauthorized person to the device, the manufacturer will not be responsible.

6.5 Mass Spectrometer Tube and Ion Source Cleaning

Please contact the manufacturer or re-seller for any contamination to the mass spectrum tube over long time service.

7 Common Problems and Solutions

Table 11

Type of Problem	Description	Diagnosis &Problem-solving
Power	No display after power ON. Mechanical pump no working. Radiator fan no working	Check AC 220V availability. Check plug/socket contacting. Check switch on/off. Check fuse damaged or not.
	No display after power ON. Mechanical pump no working	Check if the transformer connector in the electrical box is loose. Check if the connection wire to the display module is loose.
Fan	Fan no working.	Check if the fan is ok. Check if the fan socket is loose.
Mechanical pump	Displayed after power ON. Pump no working.	Check its power connection. Check the pump condition.
	Abnormal sound &noise	Check the connecting clamps. Check if detect port is sealed. Check oil level.
	Malfunction	Check if there is big leak
Molecular pump	Malfunction	Check power socket. Check signal cable. Check all the connectors.
Display	Error display, no display	Check power of display module
Leak detect port	Vacuum pumping not fulfiled	Check solenoid V2
Filaments &ion source	Filaments not powered	Check molecular pump. Check ion source socket.
	Ion source repeated powered-up	Check it power socket
Buttons	No working	Check if they are broken.
	Constant buzzing	Check if any button is choked.

Please contact the manufacturer or re-seller for any failure not included in the table above.

Table 12 Error Codes &Problem-solving

Code	Meaning	Causes	Solutions
E01	Filaments protection	1.Pressure fluctuation at the inlet port. 2.Big leaks while detecting.	Restart the device
E02	Excessive number of repeated evacuations when marking leaks	1: The pressure of the leak detection port can not be pumped, the leak detection port is not connected or the leak hole is faulty. 2: V2 valve is not opened or not completely opened.	1. Check the leak detection port for large leaks and leak detection holes 2. Check V2 valve
E03	Leak marking timeout, unable to acquire signal	The vacuum at the leak detection port is not pumped down when calibrating the leak	Internal/external calibration leak is not connected properly.
E04	Leak marking timeout, unable to acquire base signal	The calibration signal has been very large, or the calibration leak valve V5 is not closed tightly.	Check whether the calibration leak valve can be closed properly
E05	Calibration under vacuum mode, difference between the background and signal is too small	The calibration leak is invalid or the filament is aging.	Check the calibration leak, ion source
E06	Calibration under vacuum mode, the background is higher than signal	The calibration leak is invalid or the filament is aging.	Check the calibration leak, ion source
E07	Calibration under sniffer mode, difference between the background and signal is too small	The helium background in the environment is too high or the calibration leak is invalid and the filament is aging.	Wait for the background to drop in the environment before using calibration leak, or inform the manufacturer.
E08	Calibration under sniffer mode, the background is higher than signal	The helium background in the environment is too high or the calibration leak is invalid and the filament is aging.	Wait for the background to drop in the environment

			before calibrating the leak, or inform the manufacturer.
E09	Excessive number of valve switching during leak calibration	Poor contact or damage to the calibration leak.	Check the calibration leak.
E10	The sensor value of leak detection port is too small	The leak detector sensor is not in good contact or is damaged.	Check the vacuum gauge at the leak detection port.
E11	Excessive number of repeated evacuations during leak detection	The pressure at the leak detection port cannot be pumped, the workpiece being inspected has a leak or the leak detection port is not connected properly.	Check the leak detection port or check the workpiece for large leaks.
E12	Excessive valve switching during leak detection	The vacuum at the leak detection port is not stable or the workpiece is too big.	Set the leak detection accuracy to "low" and inform the manufacturer if you cannot solve the problem.
E13	High pressure at the mechanical pump inlet	Air rushes in.	Restart.
E14	Mechanical pump inlet pressure fluctuates	Poor contact of resistance gauge.	Check the resistance gauge.
E15	Filament cannot be powered up	The filament is broken or poorly contacted.	Check ion source.
E16	Start timeout	The molecular pump cannot be properly powered up.	Check the molecular pump.
E17	When V1 is opened, the atmosphere suddenly rushes in	Attach the workpiece properly and restart.	
E18	When V3 opens, the atmosphere suddenly rushes in		
E19	When V4 opens, the atmosphere suddenly rushes in	Attach the workpiece properly and restart.	
E20	Anode high voltage	Check anode power supply, ion source cable, filament	

	error	board.
E21	Low emission current	Press the stop button and restart.
E22	High emitting current	Press the stop button and restart.
E23	Lamp board 24V fault	Check and repair lamp board.
E24	80V voltage fault	Check and repair lamp board.
E25	Molecular pump not ready	Check the front vacuum, molecular pump's self diagnosis.
E26	Molecular pump communication failure	Check and repair the communication line, main control board.
E27	Molecular pump communication timeout	Check and repair the communication line, main control board.
E28	Sniffer probe stuffed	Check the sniffer probe filter
E29	Sniffer probe leaks	Check whether the pressure at the leak detection port is >300pa after entering the leak detection state.

Please contact the manufacturer or re-seller for any failure not included in the table above.

8 Appendixes

8.1 Communication Protocols

- Protocol format

  COMMAND <CR>

  PARAMETER n1 n2 n3 …. <CR>

  <CR>is Return, HEX value is 0X0D, all data kept in ASCII codes.

- Commands of reading leak rate and status

  LR<CR>, G4<CR>

  Return date format: LR=1.00E-09 MEAS<CR>

  LR=1.00E-09 means leak rate

  follows a “blank”, data after it may be:

  MEAS: current status is leak detecting

  STBY: current status is standby

  CALI: current status is calibrating

  ACCL: current status is activating

  ERRO: current status is in error

  TSTC: current status is testing the standard calibration leak

- Command of zeroing

  ZERO<CR>

  Return date format: OK<CR>

  Reply by the device after successful zeroing

- Command of cancel zeroing

  ZERO<CR>

  Return date format: OK<CR>

Reply by the device after successfully cancelling zeroing

- Command of read leak rate

  G1<CR>

  Return date format: 1.00E-09 <CR>

  1.00E-09 means leak rate

- Command of reading status

  S1<CR>

  Return date format: MEAS<CR>

  MEAS: current status is leak detecting

  STBY: current status is standby

  CALI: current status is calibrating

  ACCL: current status is activating

  ERRO: current status is in error

  STOP: current status is pausing

- Command of start leak detection

  START<CR>

  Return date format: OK<CR>

  Data list returned:

  OK: leak detection started; command executed successfully.

  ER01: start command void, the device is in standby

- Command of stop leak detection

  STOP<CR>

  Return date format: OK<CR>

  Data list returned:

OK: command of stop leak detection successfully executed

ER01: command of stop leak detection void, still in lead detecting

❖ Command of read working status

S2<CR>

Return date format, 8 pieces of BYTE type value<CR> eg.:00100001<CR>, former is high latter is low

BYTE7: 0=current leak rate not exceeding alerting limits, 1=current leak rate exceeding one of the 4 alerting limites

BYTE6: 0=device not in start-up,1=in start-up

BYTE5: backup

BYTE4: backup

BYTE3: backup

BYTE2: 0=device not in leak detecting,1=in leak detecting

BYTE1: 0=external control disable, 1=external control enable

BYTE0: 0=vacuum mode, 1=sniffer mode

❖ Command of read relay status

S3<CR>

Return date format,8 pieces of BYTE type value<CR> eg.:00100001<CR>, former is high latter is low

BYTE7: backup

BYTE6: 0=alerting limit 1 relay no action,1= alerting limit 1 relay action

BYTE5 : 0= alerting limit 2 relay no action,1= alerting limit 2 relay action

BYTE4: 0= alerting limit 3 relay no action,1= alerting limit 4 relay action

BYTE3: 0= alerting limit 4 relay no action,1= alerting limit 4 relay action

BYTE2: backup

BYTE1: backup

BYTE0: 0=system error relay no action,1=system error relay action

- Command of read current leak detection port pressure

  G3<CR>

  Return date format,1.0E-5<CR>

  1.0E-5 is current value of the vacuum degree

- Command of read leak rate measuring unit

  G5<CR>

  Return date format,1<CR>

  0=Pa.m^3/S

  1=mbar.l/s

  2=atm.cc/s

- Command of read vacuum measuring unit

  G6<CR>

  Return date format,1<CR>

  0=Pa

  1=mbar

  2=atm

- Command of set alerting limit 1

  U13412<CR>

  U1, means setting alerting limit 1

  34, means leak rate alerting base value is 3.4

  12 means leak rate alerting exponent value is 12

  U13412 means alerting value 1 being set to 3.4E-12

  Alerting base value is 10～99

Alerting exponent value is 00～12

Return date format: OK<CR>

- Command of set alerting limit 2

  U23412<CR>

  Return date format: OK<CR>

- Command of set alerting limit 3

  U33412<CR>

  Return date format: OK<CR>

- Command of set alerting limit4

  U43412<CR>

  Return date format: OK<CR>

- Command of set filter mode

  U50<CR>

  U5 means set filter mode

  0 means dynamic filter

  1 means stationary filter

  Return date format: OK<CR>

- Serial port control calibration

  EXT CAL<CR>

  Working properly returns <OK>otherwise no return

- Serial port test leak

  TESTC<CR>

  Working properly returns OK<CR>

Working improperly returns ER01<CR>

- Set sound volume

  U615<CR>

  Return data OK<CR>

- Set standard leak value

  U81508<CR>

  Return data OK<CR>

- Set leak detection mode

  U91<CR>

  0=automatic

  1=gross

  3=fine

  Return data OK<CR>

8.2 MODBUS Communication Protocol

MODBUS Communication Protocol				
Protocol	Modbus RTU			
Baud rate	9600 19200 38400 57600 115200			
Data bits	8			
Stop bit	1			
Check bit	N			
Address	1~200			
Input Discrete Register				
Register address	Meaning	Scope	Type	Description

1	Current work status	30~40	unsigned int 16	30 startup 31 standby 32 evacuation 33 leak detecting 35 vacuum calibration 36 sniffer calibration 40 alerting
7	Leak detection port pressure base value*10	10~99	unsigned int 16	10 means 1.0
8	Leak detection port pressure exponent value	0~10	unsigned int 16	
9	Leak detection port pressure symbol(exponent)	0~1	unsigned int 16	0 plus symbol, 1 minus symbol
12	Molecular pump exhaust outlet pressure base value *10	10~99	unsigned int 16	10 means 1.0
13	Molecular pump exhaust outlet pressure exponent value	0~10	unsigned int 16	
14	Molecular pump exhaust outlet pressure symbol(exponent)	0~1	unsigned int 16	0 plus symbol, 1 minus symbol
49	Current leak rate symbol (exponent)	0~1	unsigned int 16	0 minus symbol, 1 plus symbol
50	Current alarming volume	0~10	unsigned int 16	00 mute, 10 low, 20 medium, 30 high
51	2nd decimal of current leak rate base value	0~9	unsigned int 16	
52	Zeroing status	0~1	unsigned int 16	0 means not zeroed, 1 means in zeroing
53	Base value of current leak rate*10	10~99	unsigned int 16	10 means 1.0
54	Exponent value of current leak rate	0~13	unsigned int 16	
61	NG signal indicator	0~1	unsigned int 16	0 means current leak rate not exceeding all the alerts, 1 means current leak rate exceeds one of the alerts
62	Indicator of the relation between current leak rate and alerting 1	0~1	unsigned int 16	0 means current leak rate<alerting 1, 1 means leak rate≥ alerting 1

65	Indicator of the relation between current leak rate and alerting 4	0~1	unsigned int 16	0 means current leak rate<alerting 4, 1 means leak rate≥ alerting 4
66	Current leak detection accuracy	1~3	unsigned int 16	1 low precision 2 medium precision 3 high precision
71	Alerting codes	120~150	unsigned int 16	
Holding Register				
Register address	Meaning	Scope	Type	Description
1	Alerting 1 base value*10*10	10~99	unsigned int 16	10 means 1.0
2	Alerting 1 exponent value	0~10	unsigned int 16	
4	Unit of leak rate	0~3	unsigned int 16	0 means pa.m3/s 1 means mbar.l/s 2 means atm.cc/s 3 means ppm
8	Leak detection mode	0~2	unsigned int 16	0, vacuum mode 1, sniffer mode
9	Unit of vacuum dgree	0~3	unsigned int 16	0 means mbar 1 means pa 2 means atm 3 means torr
39	Alerting 2 base value*10	10~99	unsigned int 16	10 means 1.0
40	Alerting 2 exponent value	0~10	unsigned int 16	
41	Alerting 3 base value *10	10~99	unsigned int 16	10 means 1.0
42	Alerting 3 exponent value	0~10	unsigned int 16	
43	Alerting 4 base value *10	10~99	unsigned int 16	10 means 1.0
44	Alerting 4 exponent value	0~10	unsigned int 16	
61	Alerting 1 symbol	0~1	unsigned int 16	0 means minus,1 means plus
62	Alerting 2 symbol	0~1	unsigned int 16	0 means minus,1 means plus
63	Alerting 3 symbol	0~1	unsigned int 16	0 means minus,1 means plus
64	Alerting 4 symbol	0~1	unsigned int 16	0 means minus,1 means plus

8.3 Device Profiles

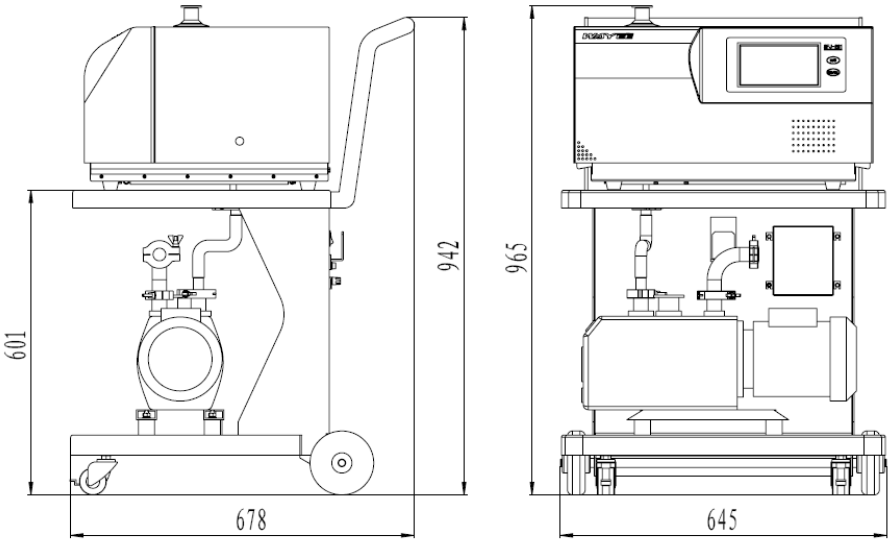


Figure 52