



**In-situ Gassing Volume Monitor
GVM2200**

INSTRUCTIONS

INITIAL ENERGY SCIENCE&TECHNOLOGY(XIAMEN)

Content

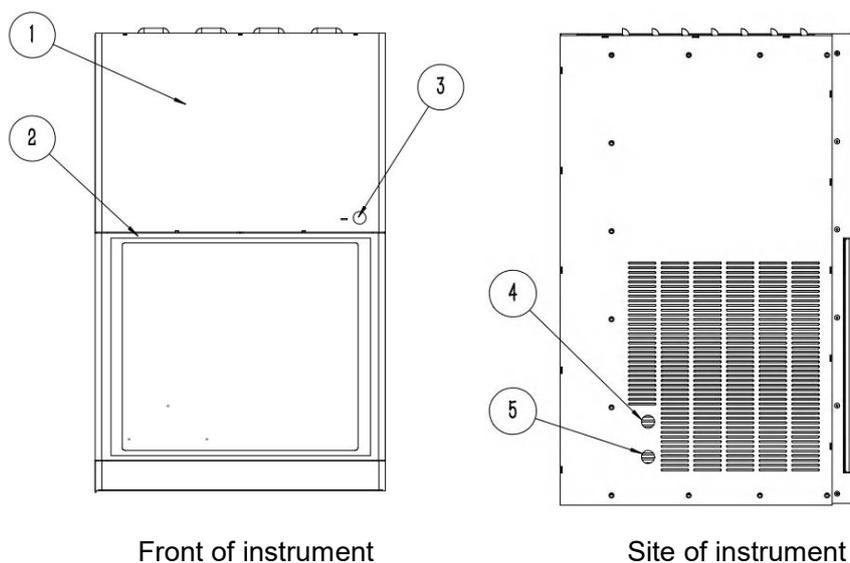
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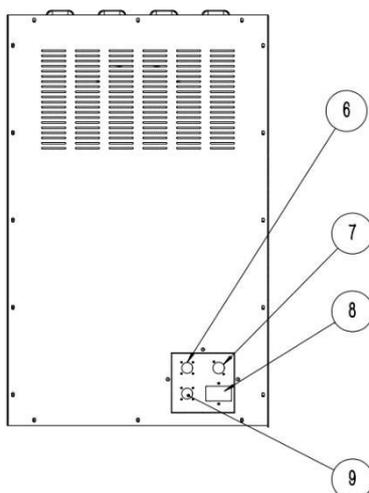
1 Function Instruction

The production of lithium ion batteries is accompanied by a lot of gas production. Their gas production is closely related to the chemistry of the cell, anode and cathode materials, electrolyte composition and formation conditions. The magnitude of gas production can characterize the degree of film-forming reaction in the cell to a certain extent, and the gas production and the rate of gas production can be correlated with the voltage, which can quickly and intuitively make further understanding and analysis of the film-forming reaction of the cell.

In situ gassing volume monitor can monitor the volume change of cell formation and cycle in situ, and correlating it with electric chemical reaction to obtain the corresponding relationship between volume change amount and volume change rate and electric chemical reaction, so as to analyze the gassing behavior of cell.

2 Instrument cosmetic





Back of instrument

The front of the instrument consist of a power button and a protective door. The power button controls the power on and off of the internal sensor, and the protective door provides protection for the test process. The names of the instruments are as follows:

NO.	Names	NO.	Names
1	Host device	6	Charge-discharge channel 1
2	Protective door	7	Data serial port cable
3	Power button	8	Power plug
4	Outlet	9	Charge-discharge channel 2 (GVM2200 Only)
5	Inlet	/	/

3 Parameter

Parameter	
Total weight of pouch cell to be tested	10~1000g
Resolution of volume change	1 μ L
Detection accuracy of volume change	$\leq 20\mu\text{l}$ (RT25°C、 $\leq 30\text{min}$)min $\leq 50\mu\text{l}$ (RT25°C、30min~12h)
Cell test temperature	25~85°C
Temperature control range	$\pm 1^\circ\text{C}$

4 Installation requirements

Installation requirements of host device	
Power	200~240V/50~60Hz
Voltage variation tolerance	$\pm 10\%$
Power consumption	150W
Environment temperature	25 $\pm 5^\circ\text{C}$
Environmental magnetic field	Keep away from intense electromagnetic
Environment humidity	35~85%RH (No condensation)
Battery soaking liquid	Mineral oil (like silicone oil)
Net weight	50kg
Dimension (W*D*H)	500*500*750 (mm)

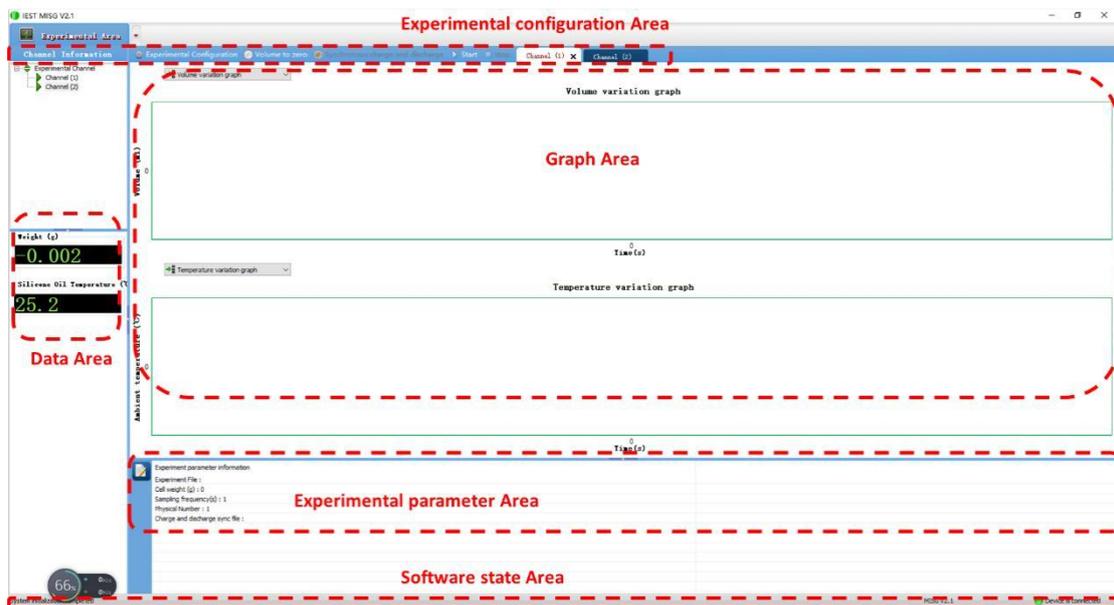
5 Attentions

1. The equipment belongs to high-precision measuring equipment, which should be far away from strong magnetic field and vibration. Do not collide or touch the equipment during the test, so as not to affect the test results;
2. Please refer to the manual of charging and discharging equipment for the relevant precautions of charging and discharging equipment;
3. Please refer to the instruction manual of the constant temperature water bath circulator for the use of the constant temperature water bath circulator;
4. When the device is powered off, it is necessary to turn off the front sensor power supply first, and then cut off the main power supply, so as to avoid damaging the sensor by wrong operation;
5. In case of sudden power failure during the test, do not operate the equipment (including opening the protective door, hanging the battery cell, moving equipment, etc.) until the power is restored and the sensor power is connected;
6. Do not pull the test clamp force fully when hanging the test cell to avoid damaging the sensor;
7. During the test, the cell should be completely immersed in the silicone oil, and only part of the electrode lug are exposed above the silicone oil level;
8. After adjusting the position of the test clamp, the adjusting device should be tightened to prevent the test clamp from sliding down and affecting the test results;
9. The position of the positive and negative test clamps should be adjusted to be symmetrical in the middle to avoid affecting the test results;
10. Clean the silicone oil on the surface of the test clamp and the cell after each test;
11. When taking out the silicon oil beaker, close the constant temperature water bath circulator and the water outlet on the left side of the equipment.
12. In case of sudden power failure and communication interruption during use, restart the software after power on.

6 Software Instruction

The equipment is equipped with the software of MISG independently developed by Initial energy company, which is used to collect and record the volume, temperature, current, voltage, capacity and other relevant data in the test process with one button, so as to easy to customers to carry out data statistical analysis.

6.1 Software interface

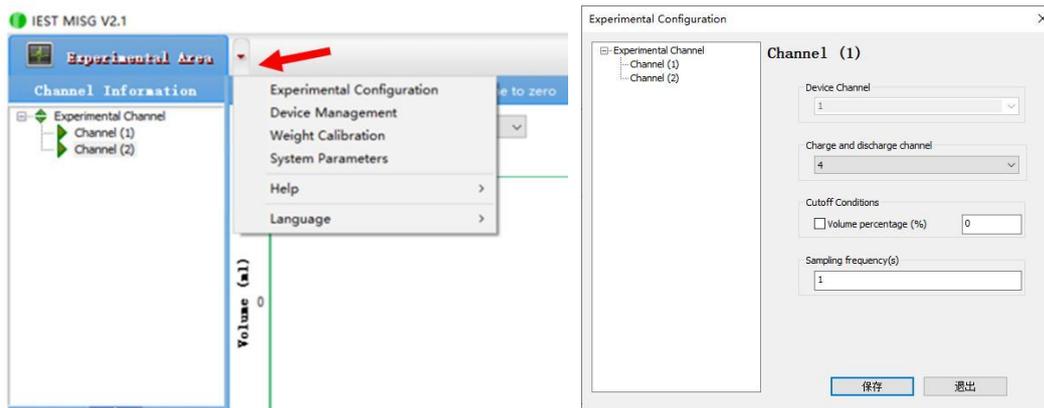


Software consist of five main area as below

1. Parameter configuration area: control test start and stop, set test parameters and equipment calibration;
2. Data display area: real-time display of relevant information during the test;
3. Graphic display area: display real-time test data in graphic form, and the type of ordinate can be freely selected;
4. Experimental parameter information area: display the test condition information of the current experiment;
5. Software status area: display whether the software communication is successful;

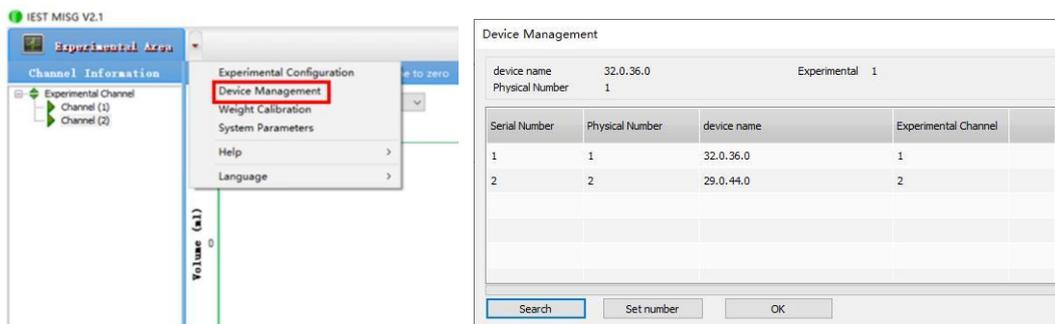
6.2 Experimental configuration

Click "Experimental Configuration" in the menu bar or the small triangle symbol on the side of the experimental area to configure the test-related parameters. The user needs to confirm the channel number of the charging and discharging instrument corresponding to the volume test channel, and select the cut-off condition and sampling frequency.



6.3 Device Management

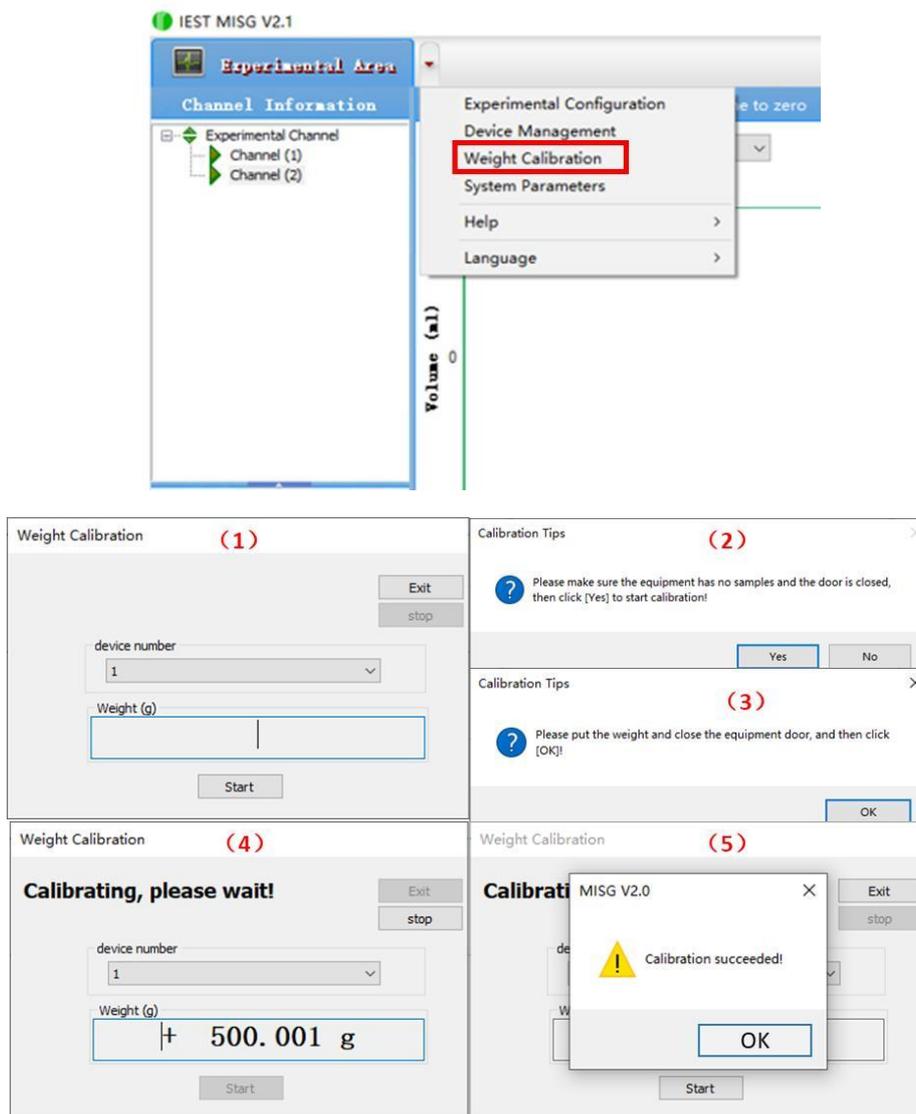
In the "device management" mode in the experimental area, the device name information needs to be configured when the charge-discharge device is connected for the first time, and no other modification is required in subsequent using.



6.4 Weight calibration

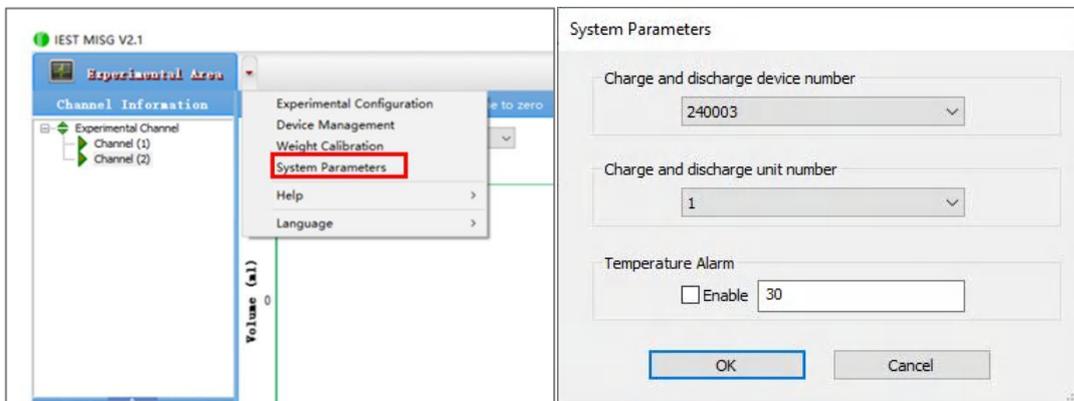
The "weight calibration" mode in the experimental area can calibrate and compensate the displayed weight of the device. The detailed steps can be operated according to the software operation prompts:

- (1) Click "Start";
- (2) Follow the prompts to ensure that the equipment is unloaded and click "Yes";
- (3) Follow the prompts, hang a 500g weight on the internal support of the equipment, and click "OK";
- (4) Waiting for the equipment to be calibrated until the software prompts "calibration successful";



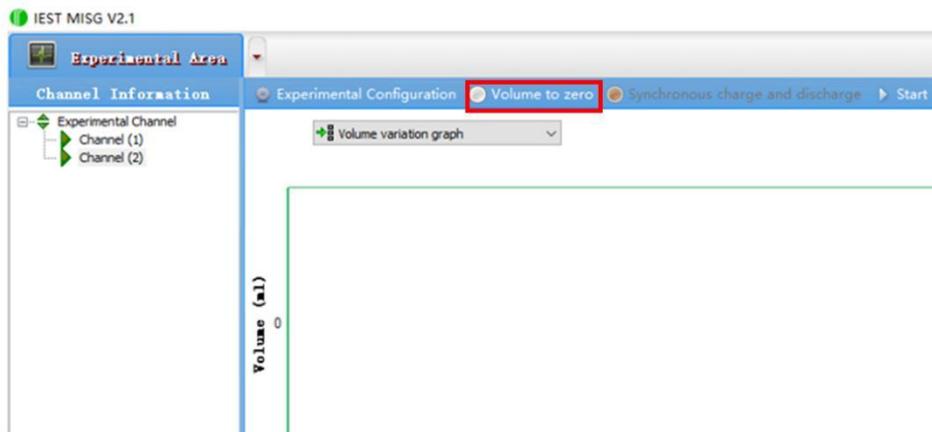
6.5 System parameter

In the "system parameters" in the experimental area, you need to select the connection of "charge and discharge device number" and "charge and discharge unit number". If you want to start the safe temperature alarm of the device, you can check "Enable", and then set the upper temperature limit. During the cell test, when the temperature in the chamber is greater than this temperature, the device will start the alarm and cut off the charge and discharge power. After hearing the alarm, the user should turn off the power of the device in time, and restart the power of the device after handling the abnormality of the battery cell, and going on a normal test.



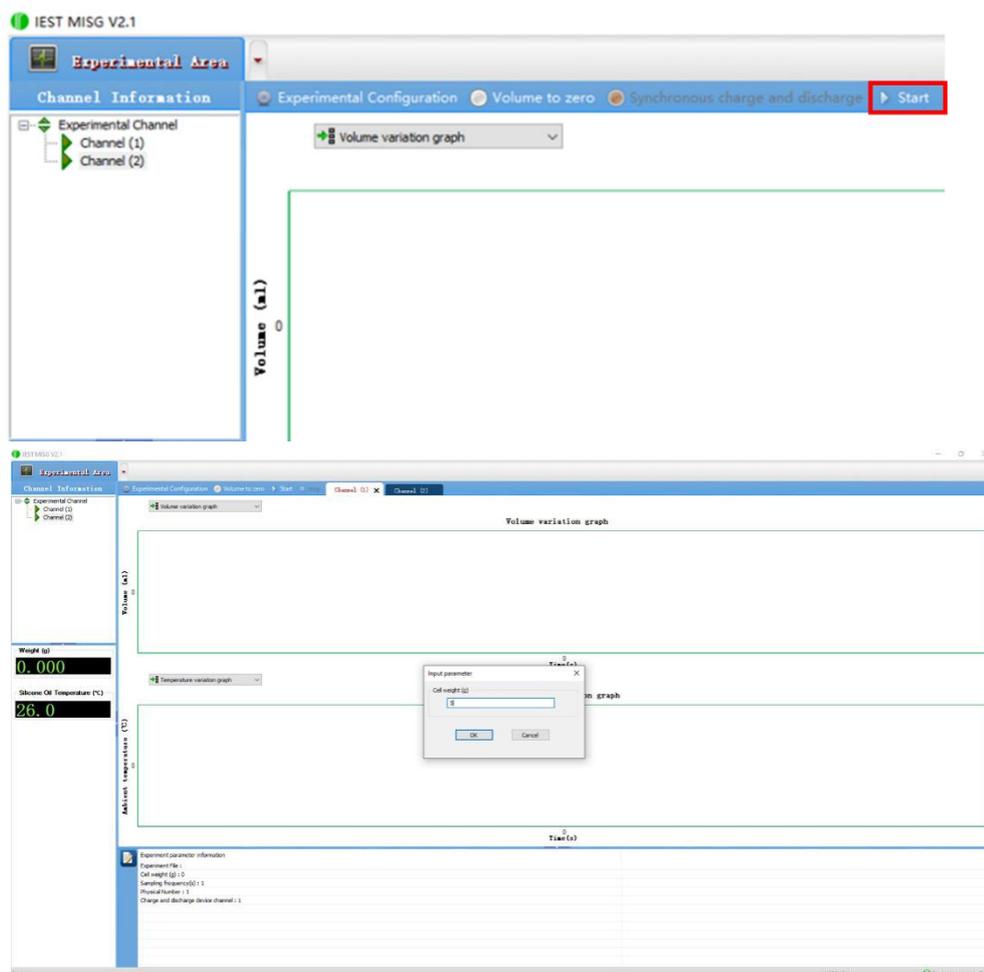
6.6 Volume to zero

Before the test starts, if the "real-time weight" in the data display area is not zero, you need to click "volume to zero" in the menu bar to reset the baseline.



6.7 Start Test

First use a balance to weigh the cell to be tested for the initial mass, then click "start " in the software menu bar, enter the "cell quality" as prompted, click "OK" and name the test data to start the test.



7 Sample Test

Before testing, connect the constant water bath circulator and the double-sided beaker, fill the beaker with silicone oil, connect the charge and discharge device and complete the basic channel configuration on the software. The specific test steps are as follows:

- 1、 Initial weighing of the measuring core m_0
- 2、 Click "volume to zero" (Note: no sample in the instrument)

- 3、 Open the door and clamp the electrode lug of the cell with the test clamp (Note: the red wire is the positive electrode, and the black wire is the negative electrode)
- 4、 Loosen the fixing device and adjust the position of the test clamp so that the cell is completely immersed in the silicone oil and only the polar lug is exposed
- 5、 Adjust the position of the cell according to the sketch map in Figure 8 and Figure 9, and then tighten the fixing device again
- 6、 Click "start test" by software, and input the quality of the cell according to the steps
- 7、 Select the saving path of data file and name it
- 8、 After setting the charge-discharge process on the charge-discharge software, start the charge-discharge test (Note: the sampling time should be consistent with MISG software)
- 9、 Return to MISG software interface, after about 1min, the software automatically extracts the corresponding charge and discharge data
- 10、 After the charge-discharge process finished, click "stop" in the MISG menu
- 11、 Open the door and take out the cell (Note: taking out after the cell drip dry)
- 12、 Clean the silicone oil on the test clamp with non-dust paper
- 13、 Close the door
- 14、 Turn off the relevant power supply in the following order: charge-discharge instrument → inlet and outlet of main equipment → constant temperature water circulator