ANEVH-AN53 Series Programmable DC Power Supply

Computer Software User Manual（v1.0）

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1. System Framework

1.1 Overview

This application software is suitable for ANEVH series bidirectional programmable DC power supply and AN53 series wide range programmable DC power supply produced by Ainuo company. This software allows users to remotely operate all functions of the power supply. When using this software, the PC must be connected to the communication interface of the power supply as the transmission channel of communication control. It has the following features:

- Supports LAN interface communication via RS232.
- Cost controlling software allows you to set parameters inside the instrument, as well as monitor output measurements.
- Controlling software allows users to set parameters for storage, allowing them to simply open a stored file to perform an action.
- Cost controlling software allows you to query historical data and draw waveforms, as well as exporting historical data to CSV files.

1.2 Models

Control software can support all models of ANEVH series bidirectional programmable DC power supply and all models of AN53 series wide range programmable DC power supply.

1.3 Installation and operation configuration requirements

The recommended control computer configuration is as follows:

Intel CPU 1.2GHz or higher CPU.

A hard disk with a storage capacity of 20GB or higher.

512MB or more memory.

Standard 17 "LCD monitor.

Windows7(32-bit / 64-bit) operating system or later

Microsoft.NET Framework4.0 and above

OFFICE(2007 and above)

2. Installation Tutorial

2.1 Software installation

The contents of the CD are shown in Figure 2.1.1:

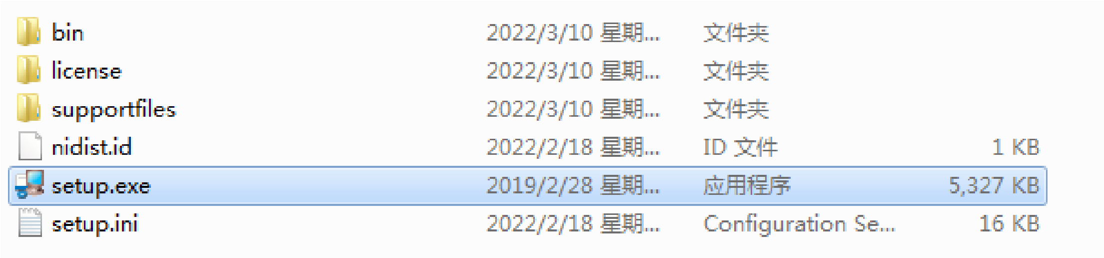


Figure 2.1.1 Installation package

Double-click setup.exe in the installation package to install the software and select the default path.

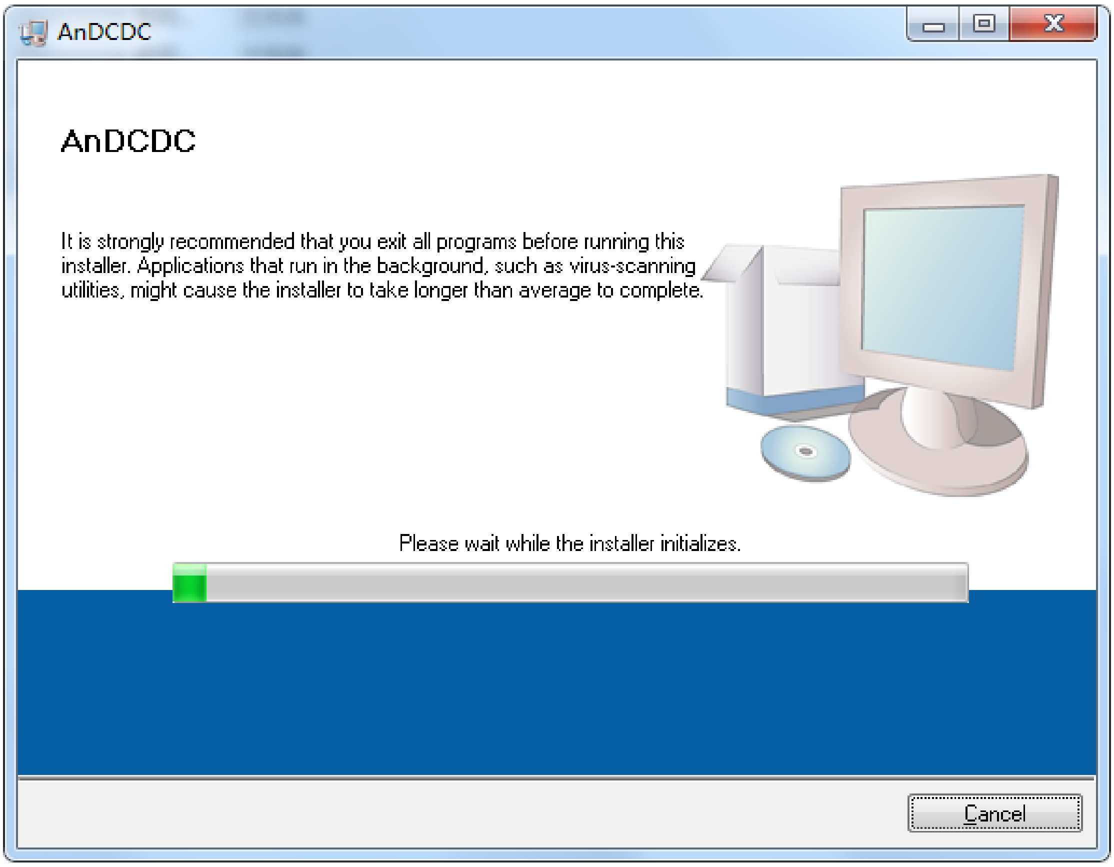


Figure 2.1.2 Installation procedure 1

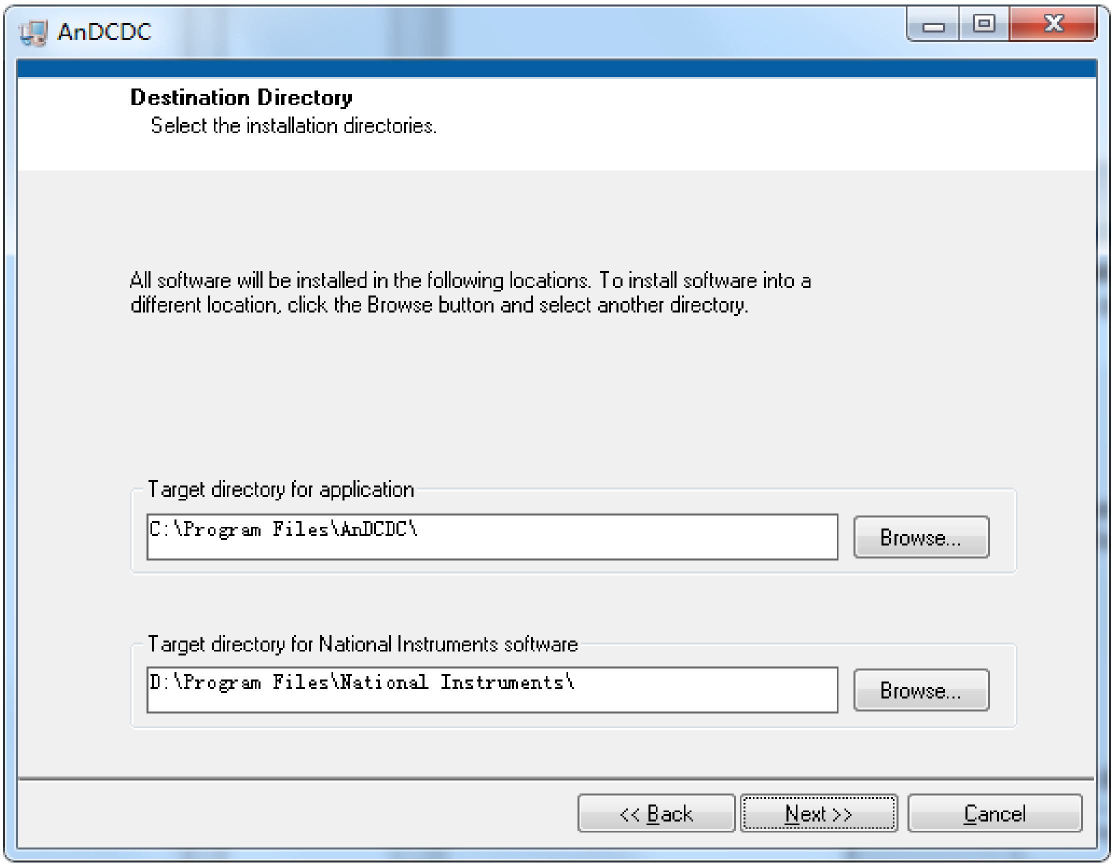


Figure 2.1.3 Installation procedure 2

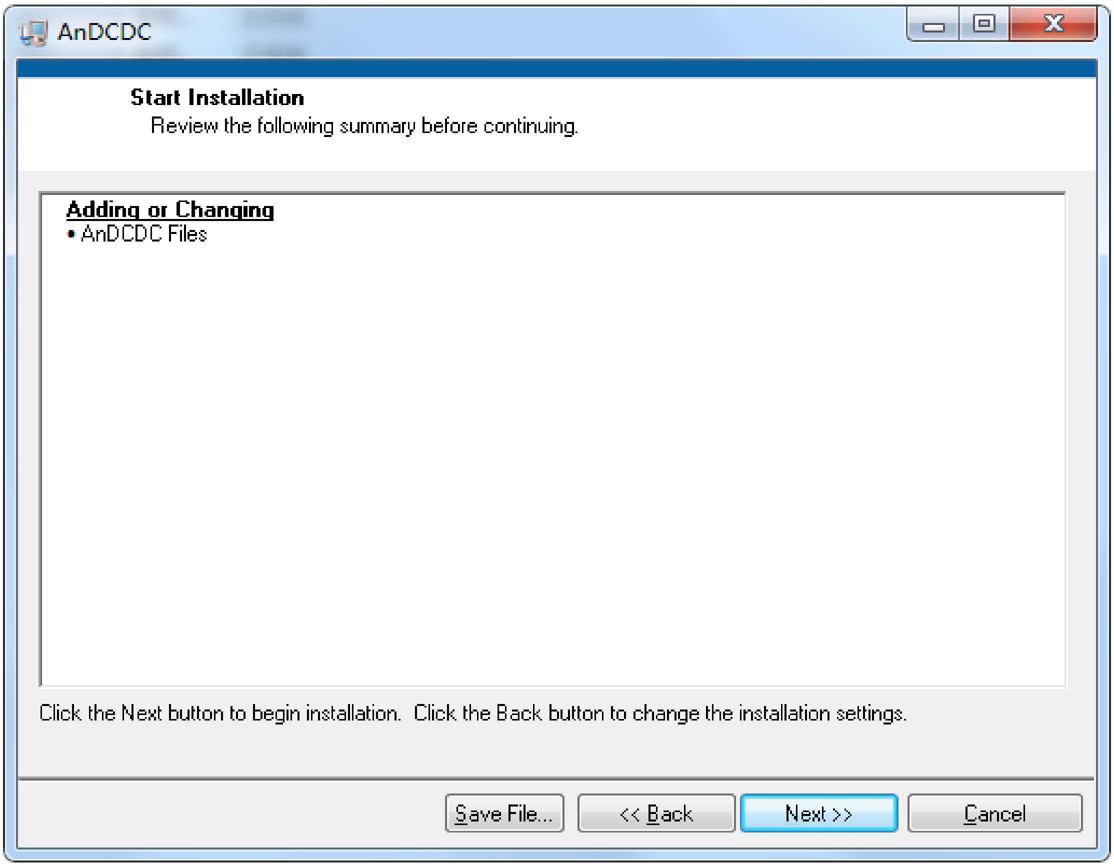


Figure 2.1.4 Installation procedure 3

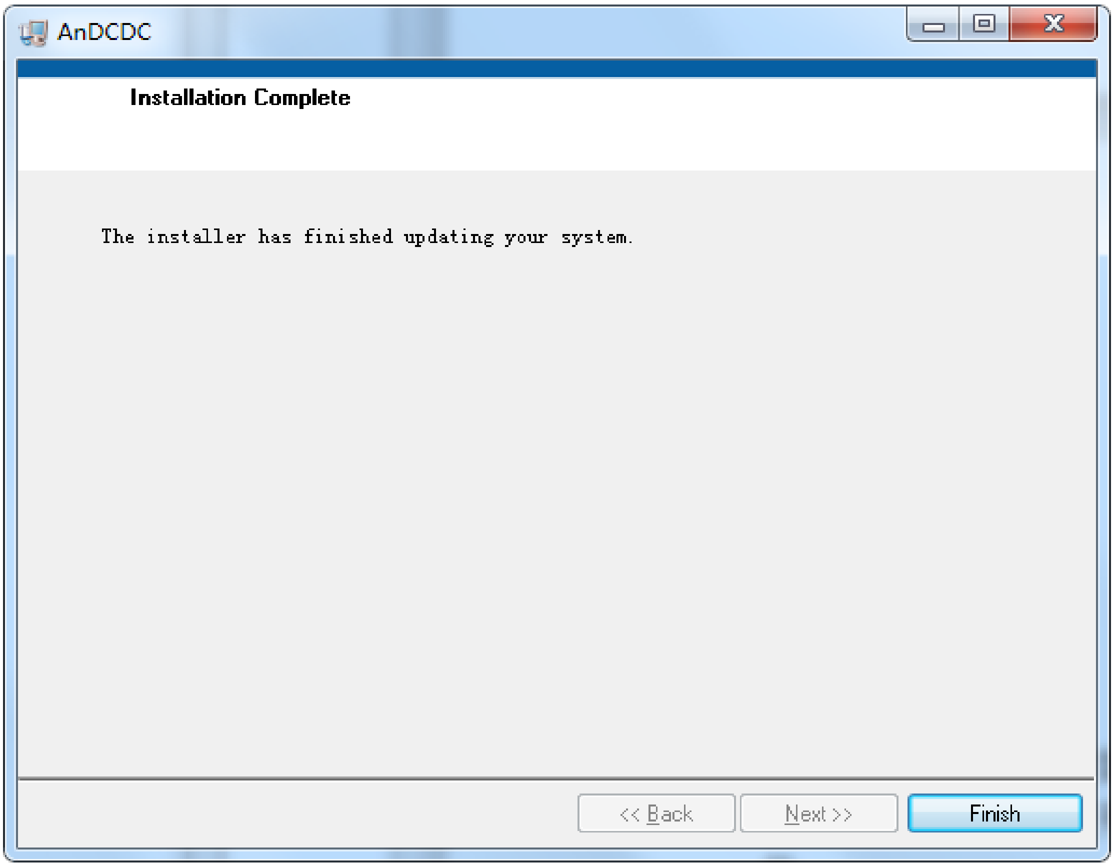


Figure 2.1.5 Installation procedure 4

After waiting for some time, the screen shown in Figure 2.1.5 appears, and press Finish. After the installation is complete, an icon 

will appear on the desktop. Double-click to open it to enter the control interface.

2.2 Uninstall software

The operation steps are as follows:

Click "Start" menu -> select "Control Panel" -> Select "Programs" -> find "AnDCDC" in the open list - double-click -> click "Delete" in the pop-up dialog box to uninstall the software.

3 Instruction

3.1 Open software

After installation, double-click the icon 

on the desktop to open the software and enter the control interface, as shown in Figure 3.1.1.

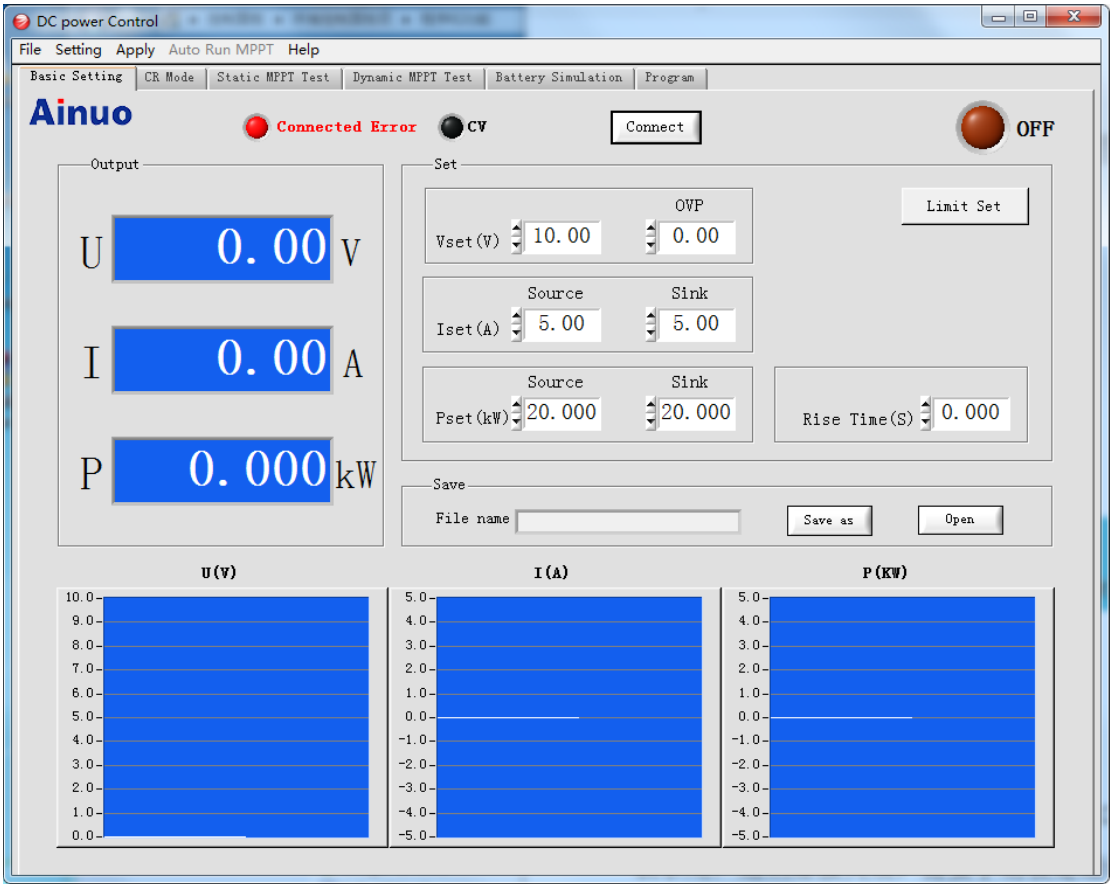


Figure 3.1.1 Main display

3.2 Communication connection

When using the computer software for the first time, communication parameters need to be set manually, as shown in Figure 3.2.1. Click "Setting" -> "Port Setting" in the menu bar, and the communication Setting interface will pop up, as shown in Figure 3.2.2. If you open the software again, it will automatically connect according to the current communication parameters.

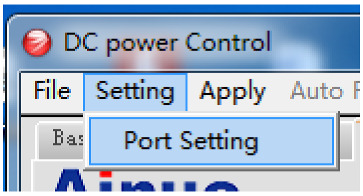


Figure 3.2.1 Port setting

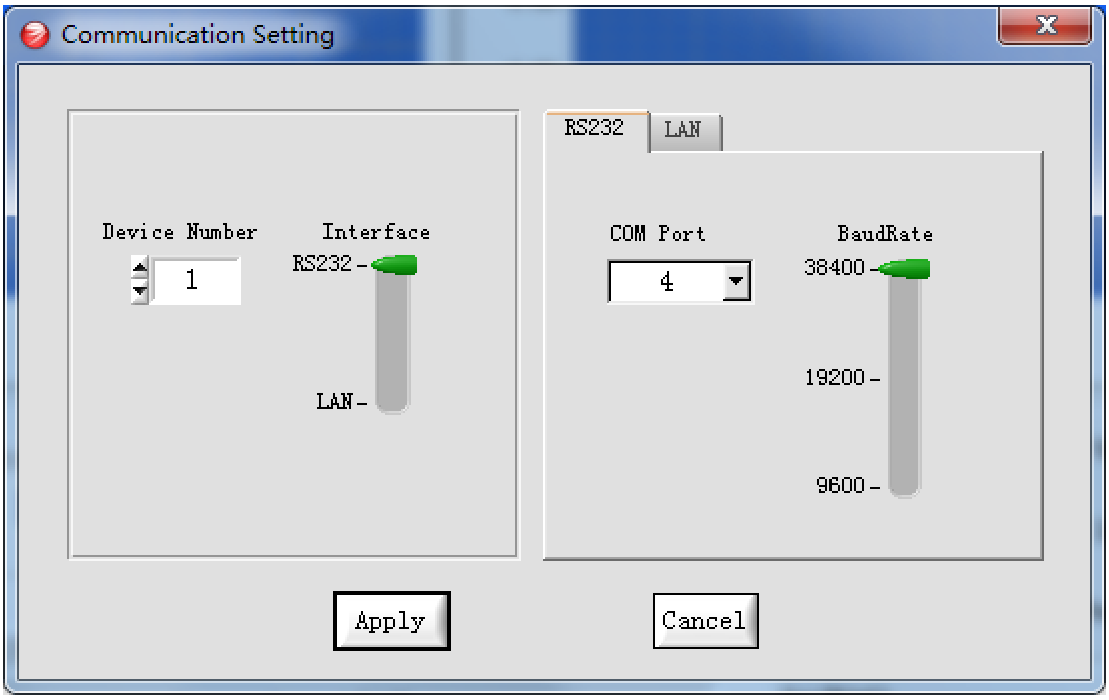


Figure 3.2.2 Communication setting

Device Number is the communication address of the connected power supply.

Interface is used to select the communication mode. Select RS232 for either RS232 or RS485 communication mode. Select LAN for lan port communication.

RS232 connection:

(1) Setting of upper computer: As shown in Figure 3.2.2, after setting "Device Number" and "BaudRate", click Apply. The value of Device Number is the same as that of address, and the value of BaudRate is the same as that of BaudRate.

(2) Power supply setting: Press F4 under the general interface to enter "Comprehensive Setting", and then press F1 to enter "Communication Setting" for editing.

The editing steps are as follows:

a) In the case of no indicator, rotate the VOLTAGE knob or ▲, ▼ keys to switch parameters which need to be set.

b) Press F1 key or VOLTAGE knob key to enter editing state and the cursor will appear.

c) After the cursor appears, rotate the CURRENT knob or press F2 and F3 keys to modify parameters.

d) After setting the parameters, press ENTER or F1 to confirm the modification and save the Settings. Press ESC or F4 to cancel the modification.

e) Press F4 to return to the standby screen.

If 232 communication is selected, as shown in figure 3.2.3, the communication interface is selected as "RS232", the communication protocol is selected as "AN3.0", the address selection is consistent with "Device Number" of the upper computer, and the BaudRate selection is consistent with "BaudRate" of the computer.

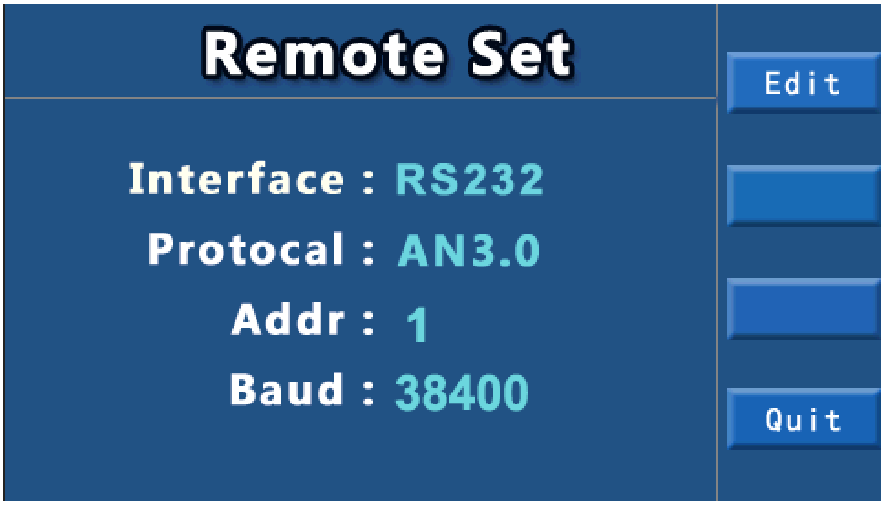


Figure 3.2.3 Power supply 232 communication setting

(3) Wiring diagram: As shown in Figure 3.2.4, if USB to 232 cable is used, the serial port still needs to be connected to RS232 communication cable and then connected to the power supply.

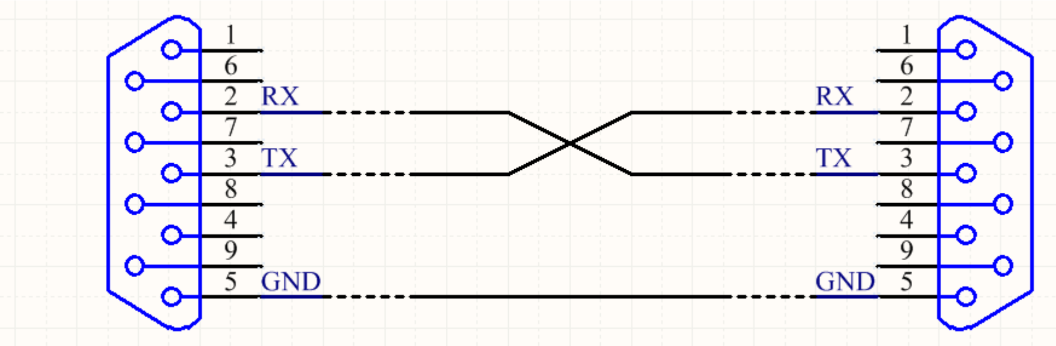


Figure 3.2.4 232 wiring diagram

RS485 connection:

(1) Setting of upper computer: as shown in Figure 3.2.2, RS232 is still selected as the communication Interface of "Interface". After setting "Device Number" and "BaudRate", click $\boxed{\text{Apply}}$. The value of Device Number is the same as that of power supply address, and the value of BaudRate is the same as that of power supply BaudRate.

(2) Power supply setting: Press $\boxed{\text{F4}}$ under the general interface to enter "Comprehensive Setting", and then press $\boxed{\text{F1}}$ to enter "Communication Setting" for editing. If 485 communication is selected, as shown in figure 3.2.5, the communication interface is selected as "RS485", the communication protocol is selected as "AN3.0", the address selection is consistent with "Device Number" of the computer, and the BaudRate selection is consistent with "BaudRate" of the computer.

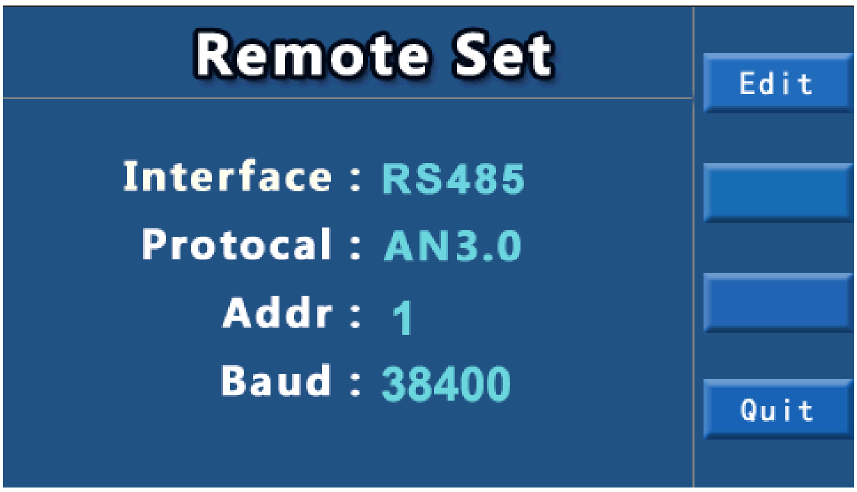


Figure 3.2.5 Power supply 485 communication setting

(3) Wiring diagram: If 232 to 485 converter or USB to 485 converter is used, the 485 terminal still needs to be connected to the RS485 communication cable as shown in Figure 3.2.6, and then connected to the power supply.

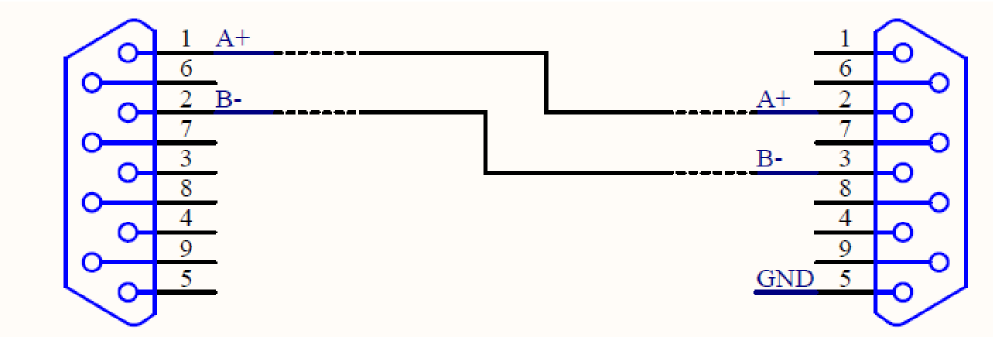


Figure 3.2.6 485 wiring diagram

LAN connection:

(1) Connect the power supply to the PC using a common network cable. For example, use 192.168.0.XXX network segment.

(2) Change the IP address of the computer: Set the IP address of the computer to 192.168.0.201, subnet mask to 255.255.255.0, and default gateway to 192.168.0.1, as shown in Figure 3.2.7. Because win7 and Win10 version is not the same, you can search the IP location on the computer.

Take Windows 7 as an example: Find the network and sharing center under the control panel, as shown in Figure 3.2.7 below.

Figure 3.2.7

Click adapter settings to enter figure 3.2.8.

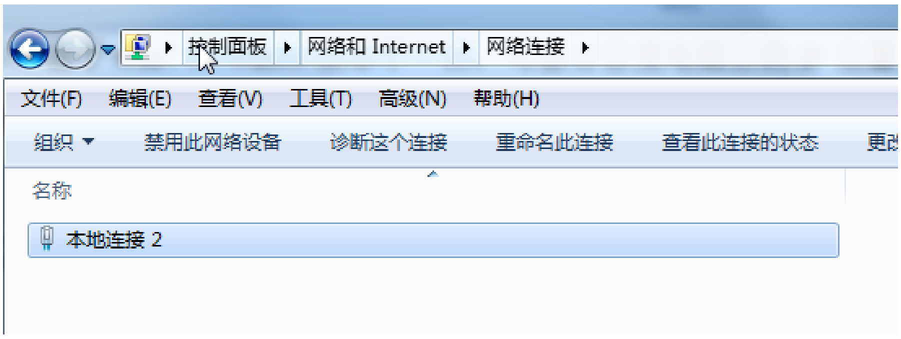


Figure 3.2.8

Double-click local connection, and the dialog box pops up. Set as shown in Figure 3.2.9 and Figure 3.2.10. Click "OK" after setting.

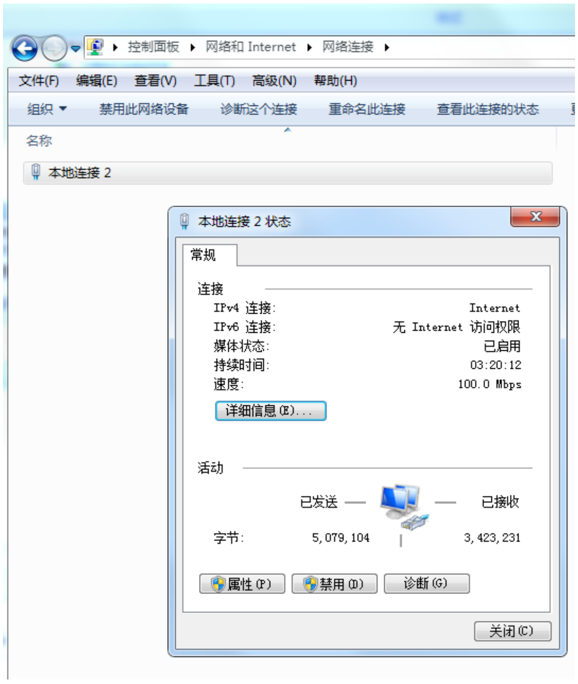


Figure 3.2.9

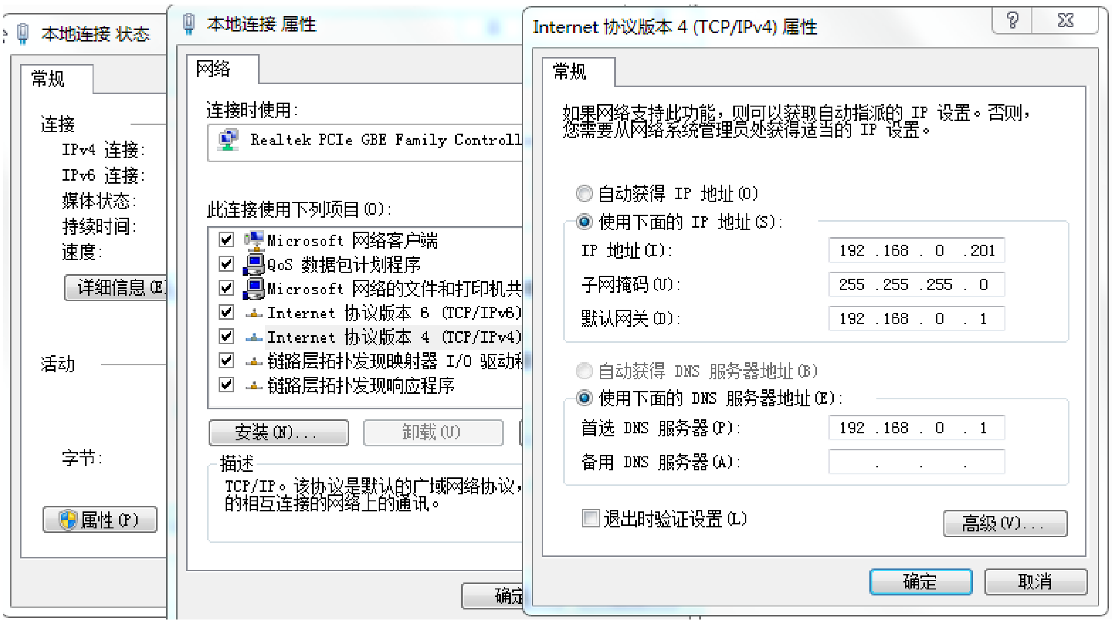


Figure 3.2.10

(3) Power supply setting:

In the general interface, press F4 to enter "General Settings", and then press F1 to enter "Communication Settings" for editing. As shown in Figure 3.2.11, select "Network Port" for communication interface, "AN3.0" for communication protocol, and select the same address as "Device Number" for computer.

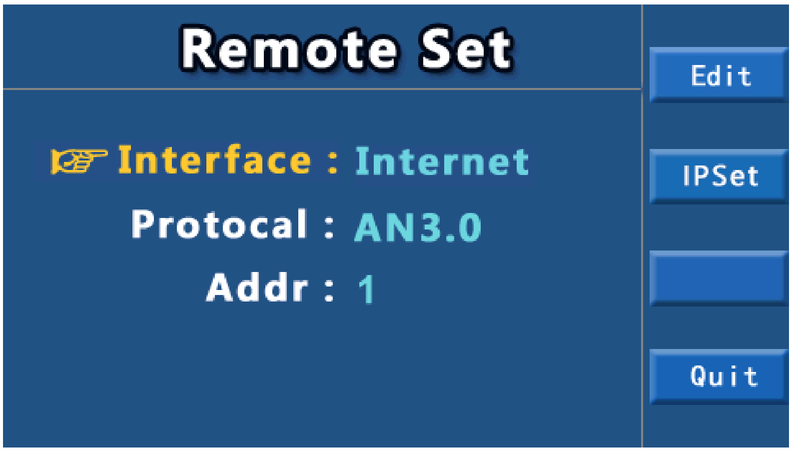


Figure 3.2.11 LAN port power supply setting

Press F2 to enter “Parameter Settings”. Set “IP Address”, “Subnet mask”, “Gateway”, “Port”, and “Working Mode”, as shown in Figure 3.2.12 and 3.2.13.

Note: (1) When setting the IP address, it is best to follow the following rules: the default gateway of the computer is the same as the gateway of the power supply, for example, 192.168.0.1; The IP address of the PC must be on the same network segment as that of the power supply. (2) When using the host, the working mode of power supply should be SELECTED as TCP Server (Server side).

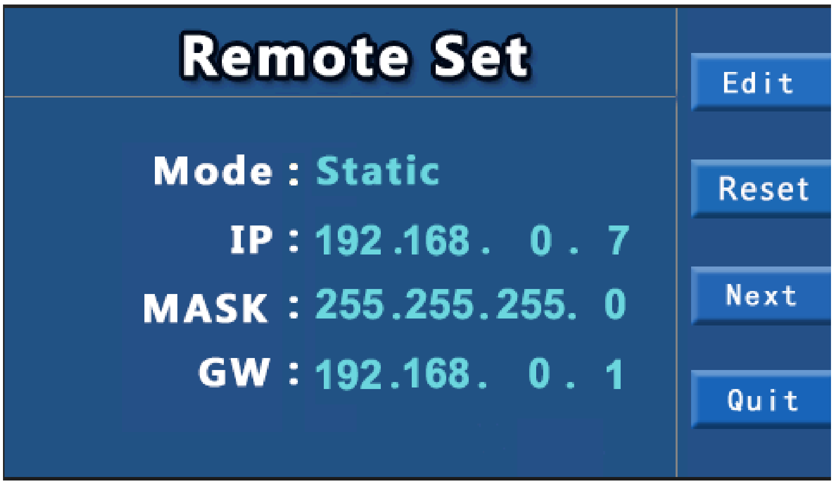


Figure 3.2.12 LAN port power supply parameter setting 1

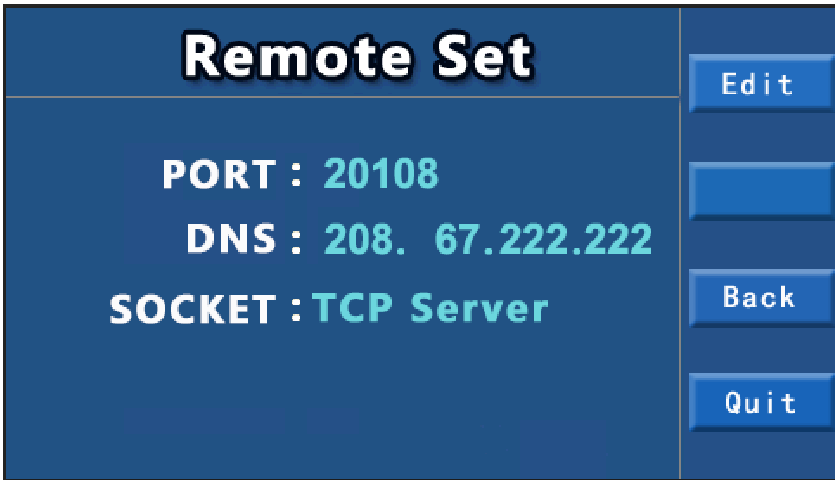


Figure 3.2.13 LAN port power supply parameter setting 2

(4) Setting of computer: As shown in Figure 3.2.14, select LAN as the communication Interface for "Interface", the value of "Device Number" is consistent with that of "Address" of the power supply, "IP address" is the IP address of the power supply, and "Port Number" is the Port Number of the power supply. After filling in the information, click Apply.

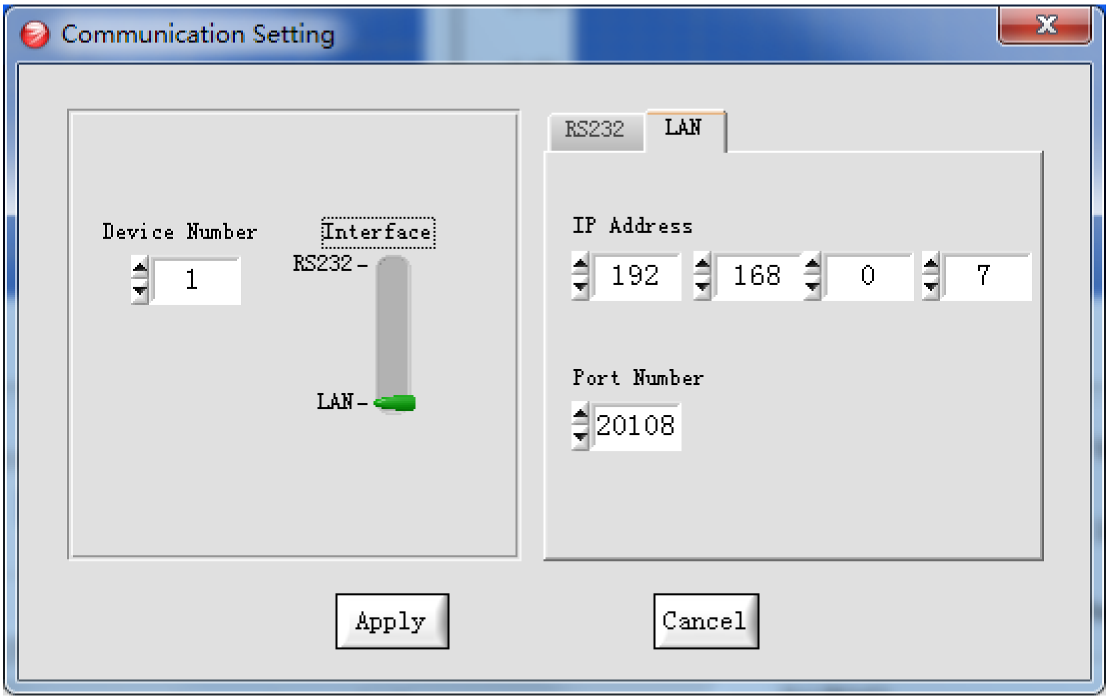


Figure 3.2.14 LAN port computer setting

After the above communication parameters are configured, click the $\boxed{\text{Connect}}$ button and the connection will be successful, as shown in Figure 3.2.15. The connection status light will be green and the connected power supply model will be displayed.

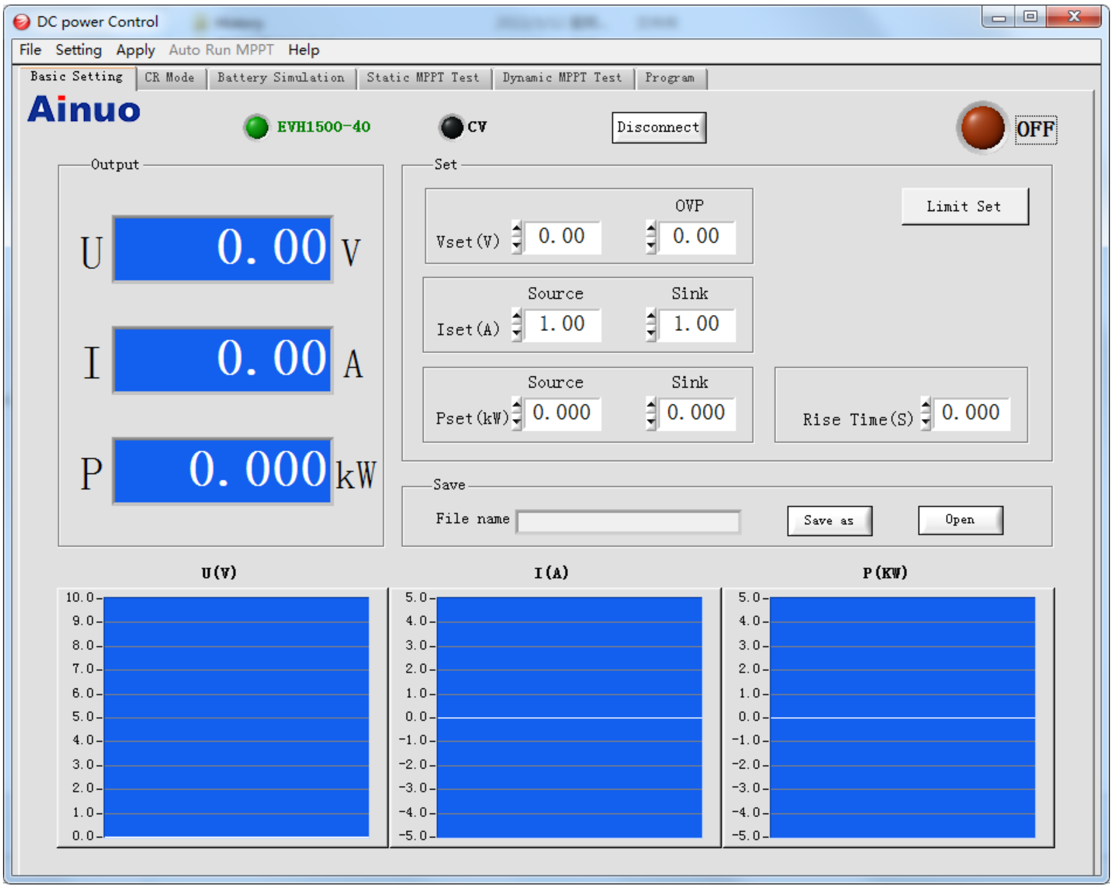


Figure 3.2.15 Communication connection successful

If the connection fails, check whether the parameters related to the power supply and the network port on the host are correct.

To Disconnect, click the Disconnect button.

3.3 Parallel connection

If more than one power supply using master-slave system, when using the line connecting the master only, according to the steps of chapter 3.2 master power communication Settings, click the Connect button to connect, connection status lights display will be green, the power model display is for the model after the parallel, and all the features of the current and power limit are the maximum after parallel.

Take five ANEVH2250-25 parallel power supply units as an example. After the connection is successful, the model will be 

.

4 Function Introduction

ANEVH series bidirectional programmable DC power upper computer functions: conventional function, CR mode, fixed battery simulation, static photovoltaic simulation, dynamic photovoltaic simulation, sequence testing and data monitoring functions.

AN53 series wide range programmable DC power upper computer functions: routine function, static photovoltaic simulation, dynamic photovoltaic simulation, sequence testing and data monitoring functions.

4.1 Menu bar

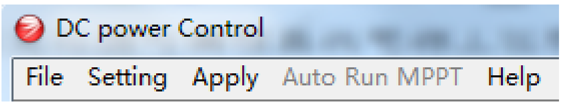


Figure 4.1.1 Menu bar

Table 4.1.1 Menu bar overview

File	Exit	Exit the software
Setting	Port Setting	Communication Settings
Apply	Data Report	Waveform display and export of output data (detailed in Section 4.2)
Auto Run MPPT		Photovoltaic automatic test MPPT efficiency (temporarily unavailable)
Help	Help	Bring up the help file
	About	Software Version Description

4.2 Data display and export

This function page is used to record output parameters, waveform display, and export data to a table. When the control software is successfully connected to the power supply, the control software will automatically record the output measurement data to the software database when the power supply is started. This feature must have Microsoft Office installed in order to record correctly.

Click "Data Report" under the "Apply" menu item in the main interface to enter the Data display and export interface, as shown in Figure 4.2.1.

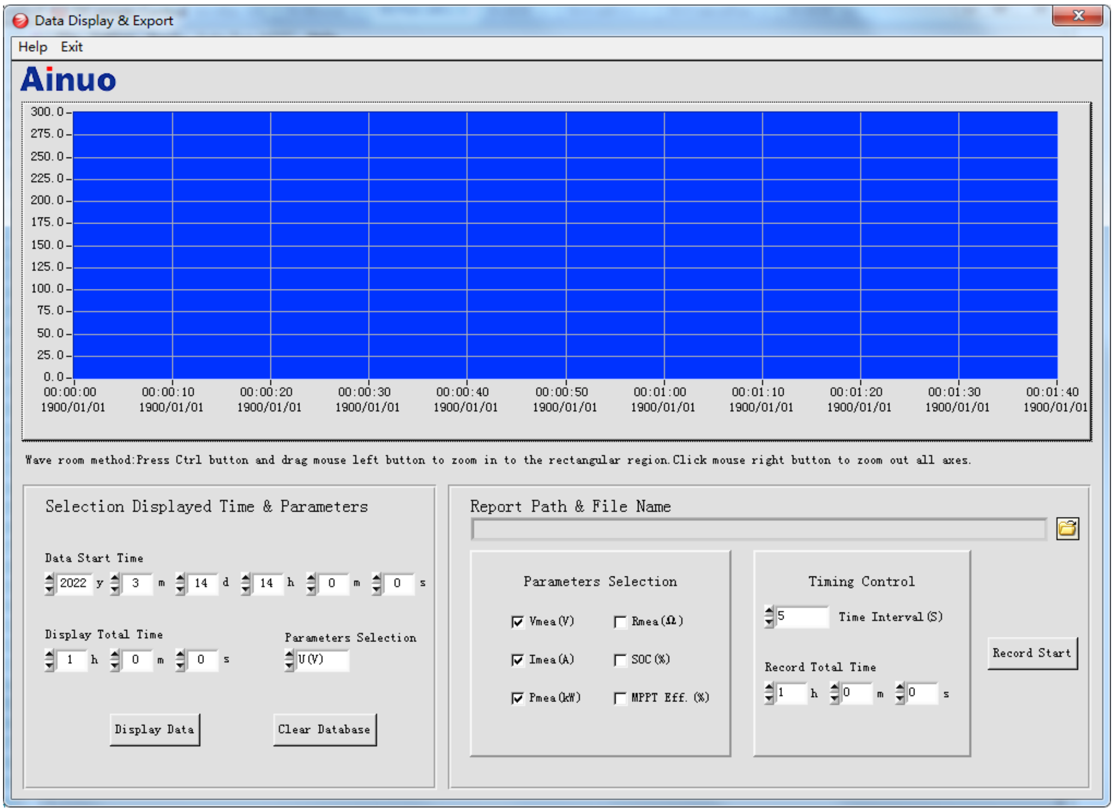


Figure 4.2.1 Data display and export

4.2.1 Menu function description

Table 4.2.1 Menu list of data display and export interface

Help	None
Exit	Exit the data display and export screen to return to the main screen

4.2.2 Waveform display

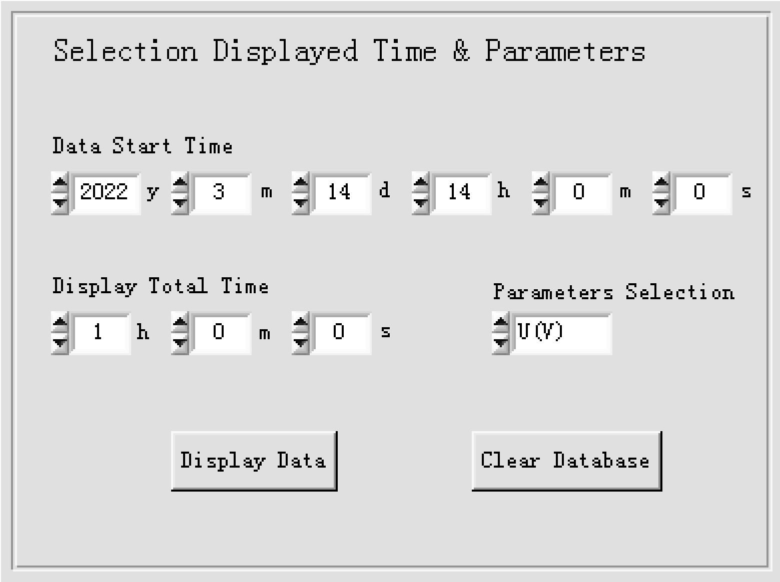


Figure 4.2.2 Data selection

"Data Start Time": Displays from this moment

"Display Total Time": Displays the total time

"Parameters Selection": Select parameters for waveform display, including output voltage U, output current I, output power P, output resistance R (available in operation CR mode), charge amount SOC (available in battery simulation) and PHOTOVOLTAIC MPPT efficiency (available in photovoltaic simulation).

Set "Start time of Data to be displayed", "Total Display time" and "Display Parameters". After setting, click the Display Data button, and the Data Display image box at the top of the screen will Display the measurement curve within this period, as shown in Figure 4.2.3.

Note: (1) the power supply does not output during the period, then the measured value is always 0; (2) The selected parameter is not output during the period, and the measured value is always 0. For example, after running in CR interface, select SOC for waveform display, the waveform display is 0.

The Clear Database button deletes all software measurement history data to reduce disk footprint.

Note: The historical database cannot be restored after being deleted. Use it with caution.

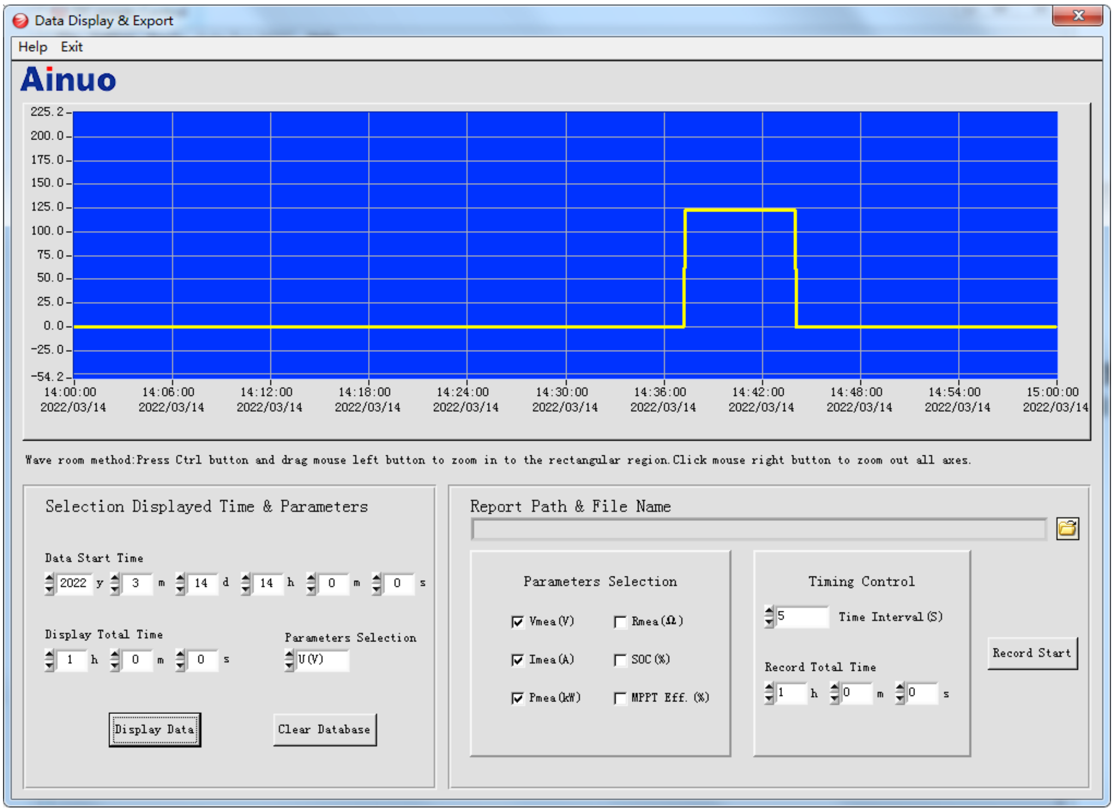


Figure 4.2.3 Data waveform display

4.2.3 Export data

When the data export function is used, the output parameters of the selected time range are exported to a table.

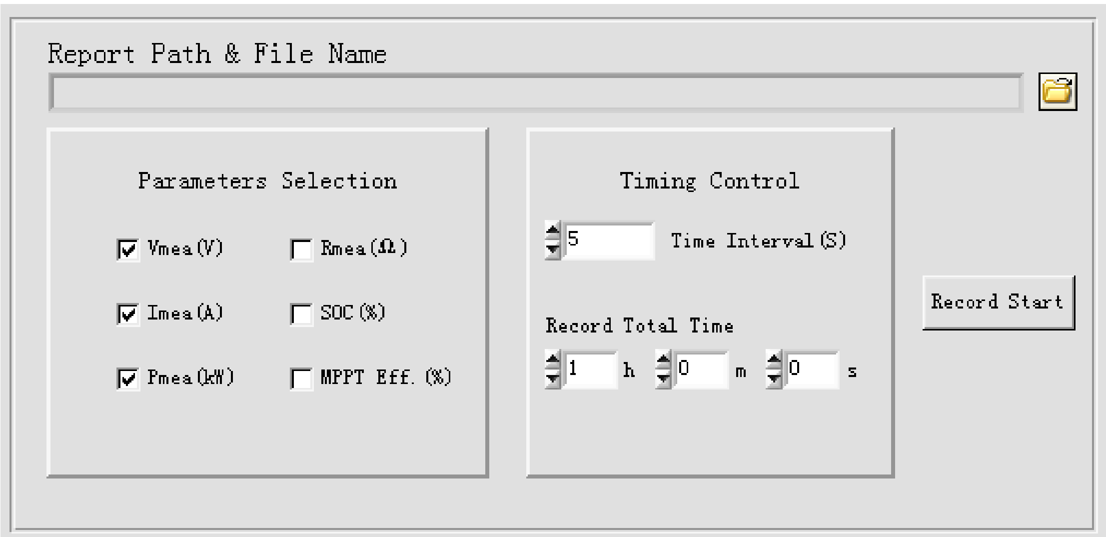


Figure 4.2.4 Export data

“Report Path&File Name”: Sets the path of the table

“Parameters Selection”: Selects the parameters to export

“Time Interval”: Time interval

“Record Total Time”: Report the total time

Set the initial Time in "Data Start Time" on the left, and then click the  in Figure 4.2.4 to select the path and file to save in the pop-up dialog box. Then select the parameters and time interval to Record, set the total time of Record, click the Record Start button, and wait for a period of time. After the data output is completed, the data export success dialog box pops up, as shown in Figure 4.2.5, indicating that the data is exported successfully.

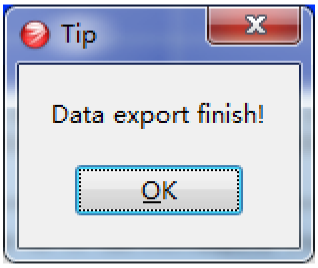


Figure 4.2.5 Data export success dialog box

Note :(1) if the power supply does not output during the period, the data will not be exported. (2) If the selected parameter has no output, the measured value is always 0.

4.3 General mode

This function page is mainly used to set and display the basic power output, which can output CV, CC and CP modes. See Figure 4.3.1.

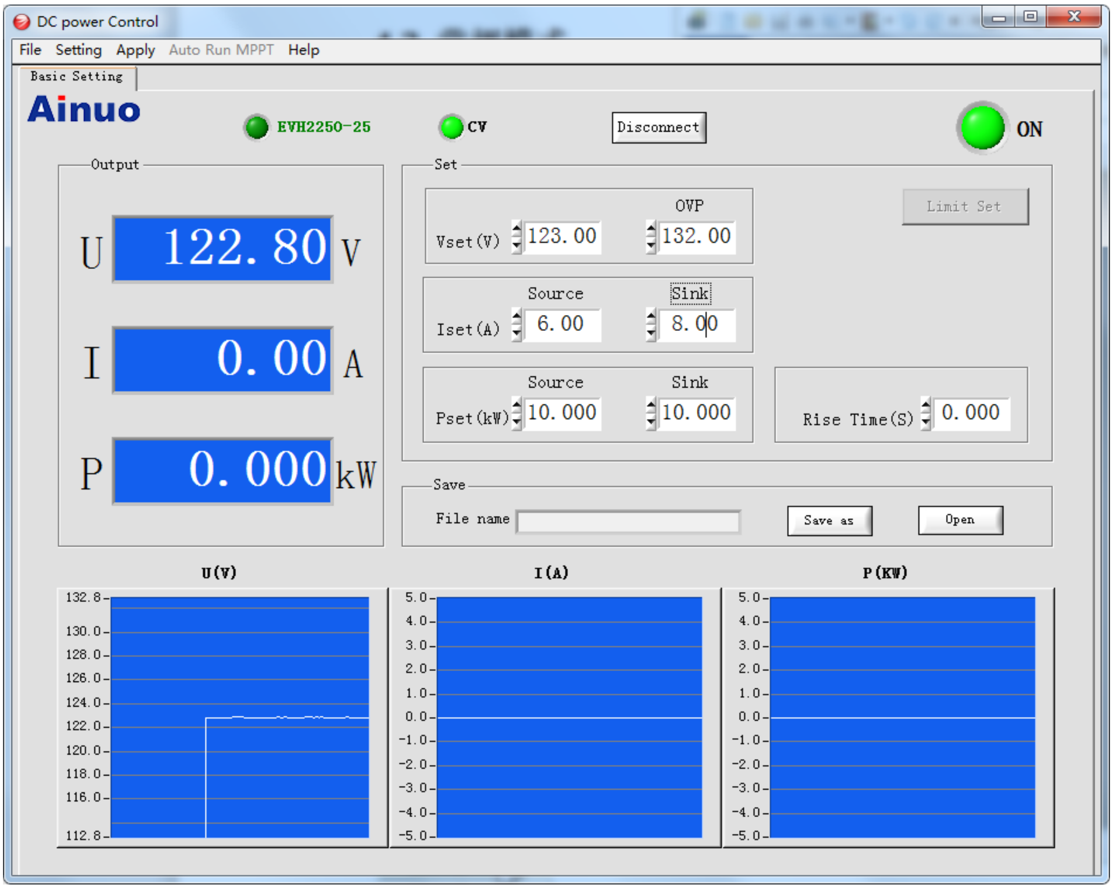


Figure 4.3.1 General display

4.3.1 Set the parameters

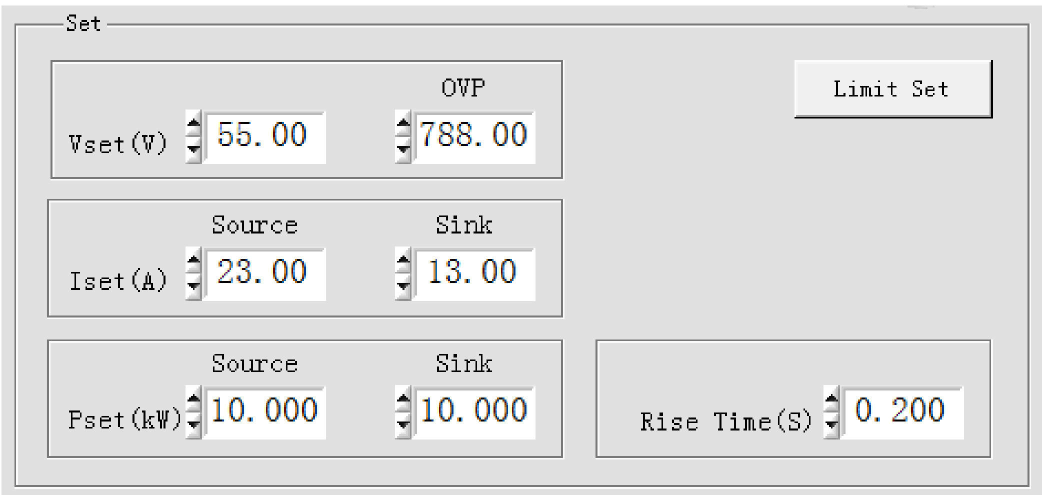


Figure 4.3.2 Setup section

“Vset”: Set the output voltage, the unit is V.

“Iset”: Set the output current. Source is the Source current, Sink is the load current, the unit is A.

"Pset": Set the output power. Source is the Source power, Sink is the load power, the unit is kW.

"OVP": Set the protection value of overvoltage. The value ranges from 0 to 1.1 times maximum power supply voltage, the unit is V. When the output voltage is higher than this value, the power supply alarms and stops the output.

"Rise Time": When it starts, the time required for the voltage to rise from 0V to the preset value. The value ranges from 0 to 99.999s, the unit is second.

Limit Set: Click this button to pop up the upper and lower limit setting interface, as shown in Figure 4.3.3, which is used to limit the setting range of Vset, Iset and Pset. See Table 4.3.1 for parameter description. After setting parameters, click Apply.

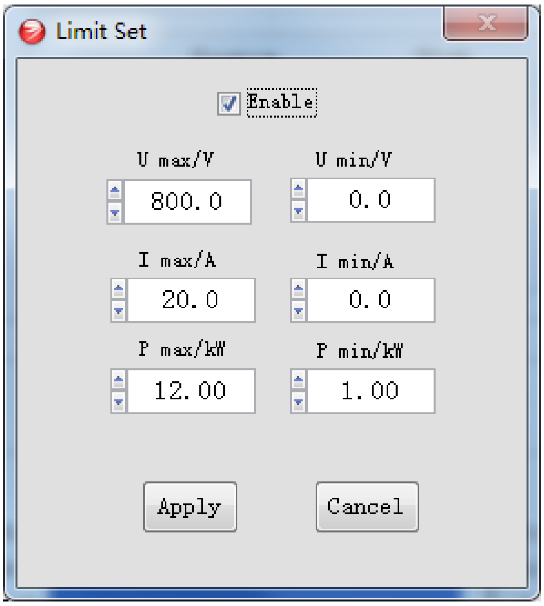


Figure 4.3.3 Upper and lower limits setting display

Table 4.3.1 Limit parameter description

Parameter	Description
Enable	Checked √: Enable the setting range of Vset, Iset, and Pset Unchecked √: Vset, Iset, and Pset are set to the rated value of the power supply
Umax	A maximum of Vset can be set up
Umin	A minimum of Vset can be set up

Imax	A maximum of Iset can be set up
Imin	A minimum of Iset can be set up
Pmax	A maximum of Pset can be set up
Pmin	A minimum of Pset can be set up

4.3.2 Save and read setting parameters

This function records the parameters set by "Vset", "Iset", "Pset", "OVP" and "Rise Time" into the table, and can be set directly by reading the table when opening the host again. This feature not only records parameters set by the user, but also simplifies the process of entering parameters.

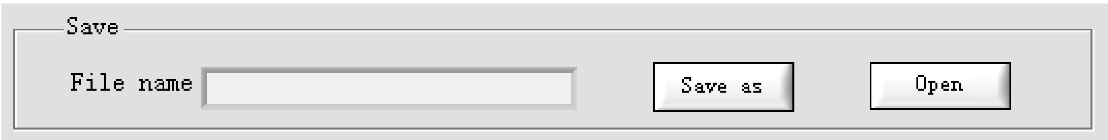


Figure 4.3.4 Save and read

As shown in Figure 4.3.4, click the Save as button, and the dialog box as shown in FIG. 4.3.5 pops up. At this time, select the path to store and create a new form file, click "Save" to store immediately, and press "Cancel" to store no data.

After data storage is completed, a dialog box as shown in Figure 4.3.6 will pop up indicating that data storage is successful. Click OK to continue operation panel.

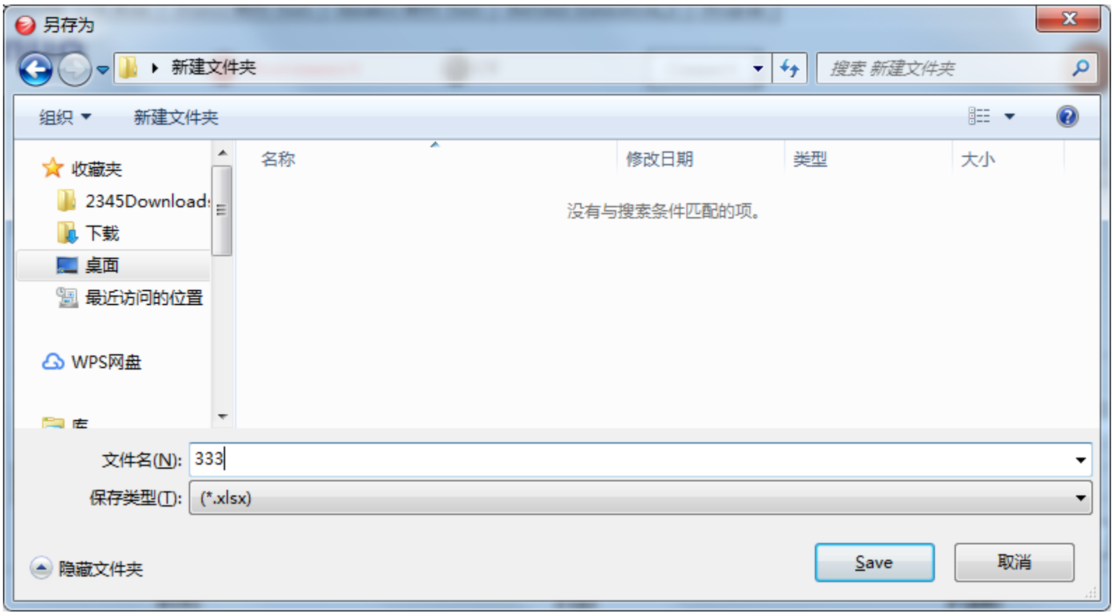


Figure 4.3.5 Storage path

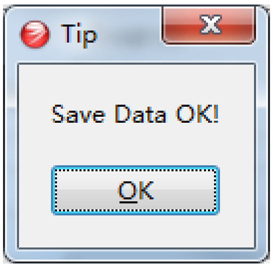


Figure 4.3.5 Data Storage succeeded

Click the Open button in Figure 4.3.4, and the dialog box as shown in FIG. 4.3.7 pops up. Select the table that has been stored in the disk and click "Load" to Load data directly into the interface of the upper computer, as shown in Figure 4.3.8. The internal parameter format of the table saved in disk must be the same as that saved in Save as; otherwise, the table cannot be read.

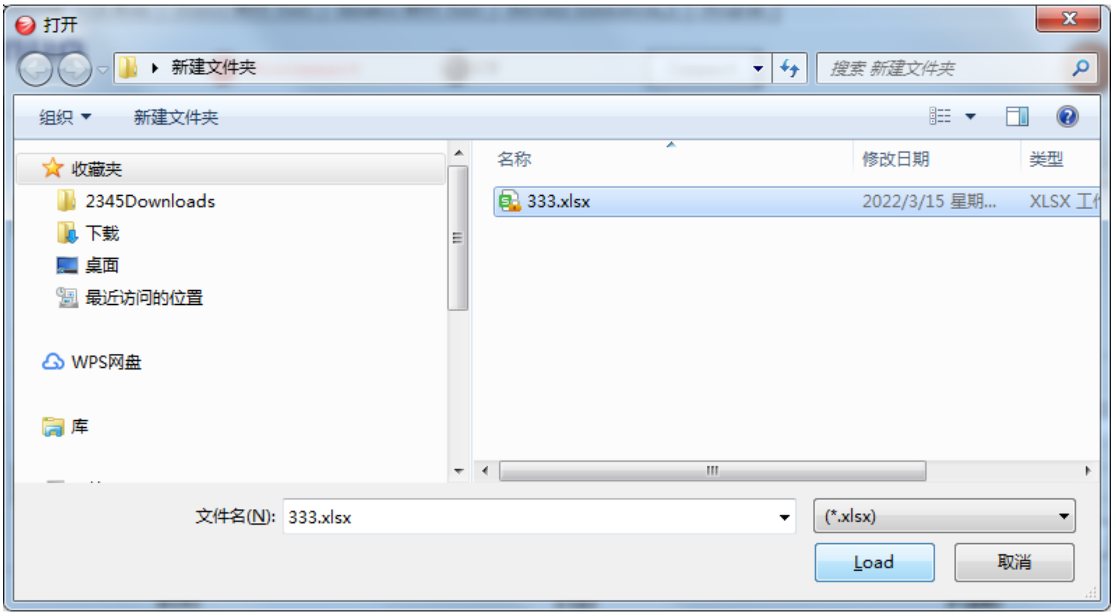


Figure 4.3.7 Storage path

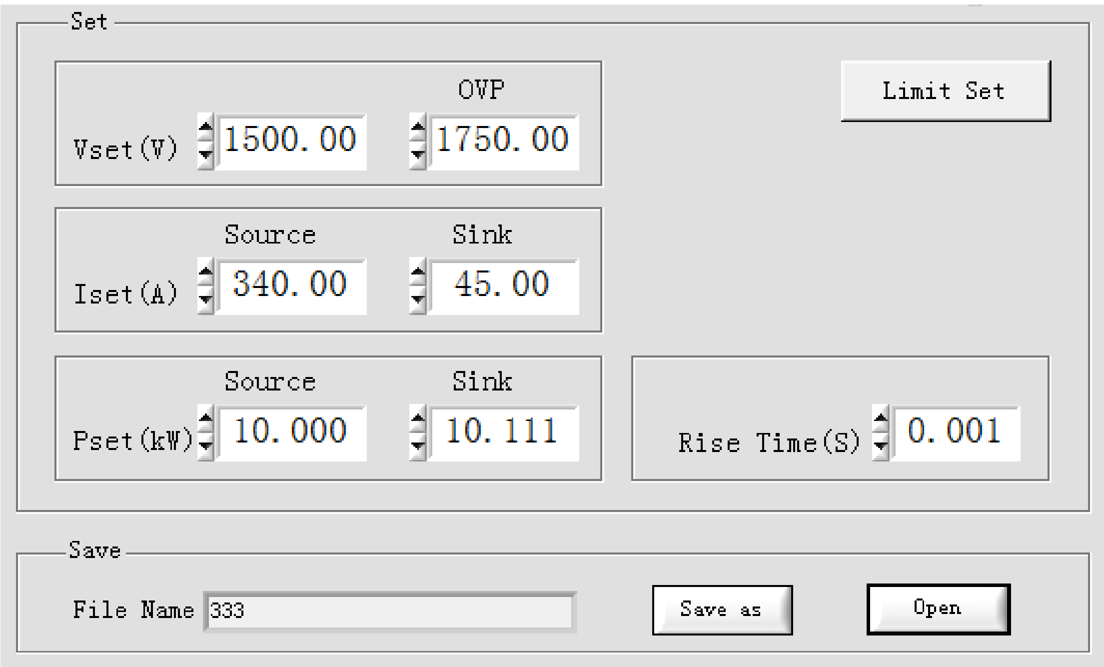


Table 4.3.8 Table read succeeded

4.3.3 Output and waveform display

Click the start button 

, and the output voltage, current and power values will be displayed in the blue box on the left in real time, as shown in Figure 4.3.9. The corresponding curve will also change in real time. Double-click the corresponding curve display area to clear the curve.

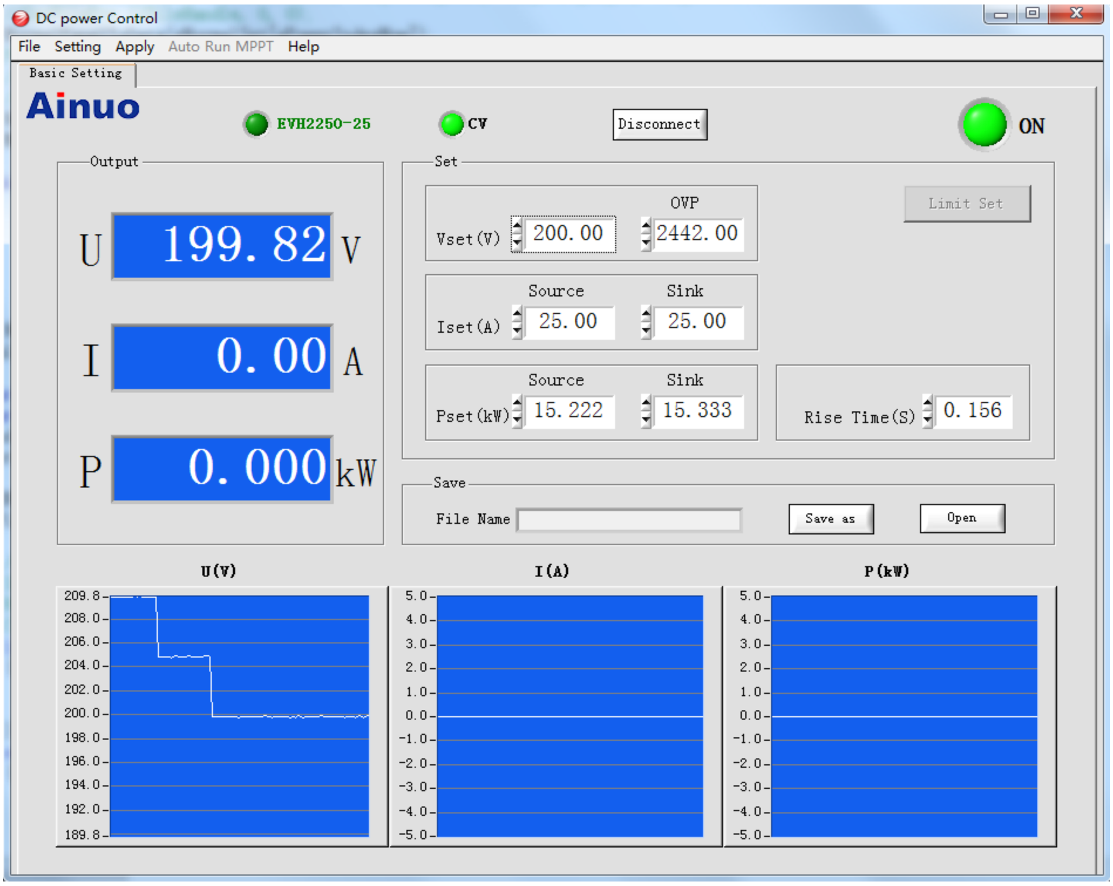


Figure 4.3.9 Output display

4.4 Internal resistance adjustment/constant resistance mode

This function page mainly through the setting of voltage and current resistance to control the power supply to electronic load in internal resistance adjustment/constant resistance mode work, can output CV, CC, CP and CR four modes, only CR mode is working in internal resistance adjustment/constant resistance mode. This feature is available only with the ANEVH series bidirectional programmable DC power supply. This function page is shown in Figure 4.4.1, and its interface operation refers to the general interface, which is not described here.

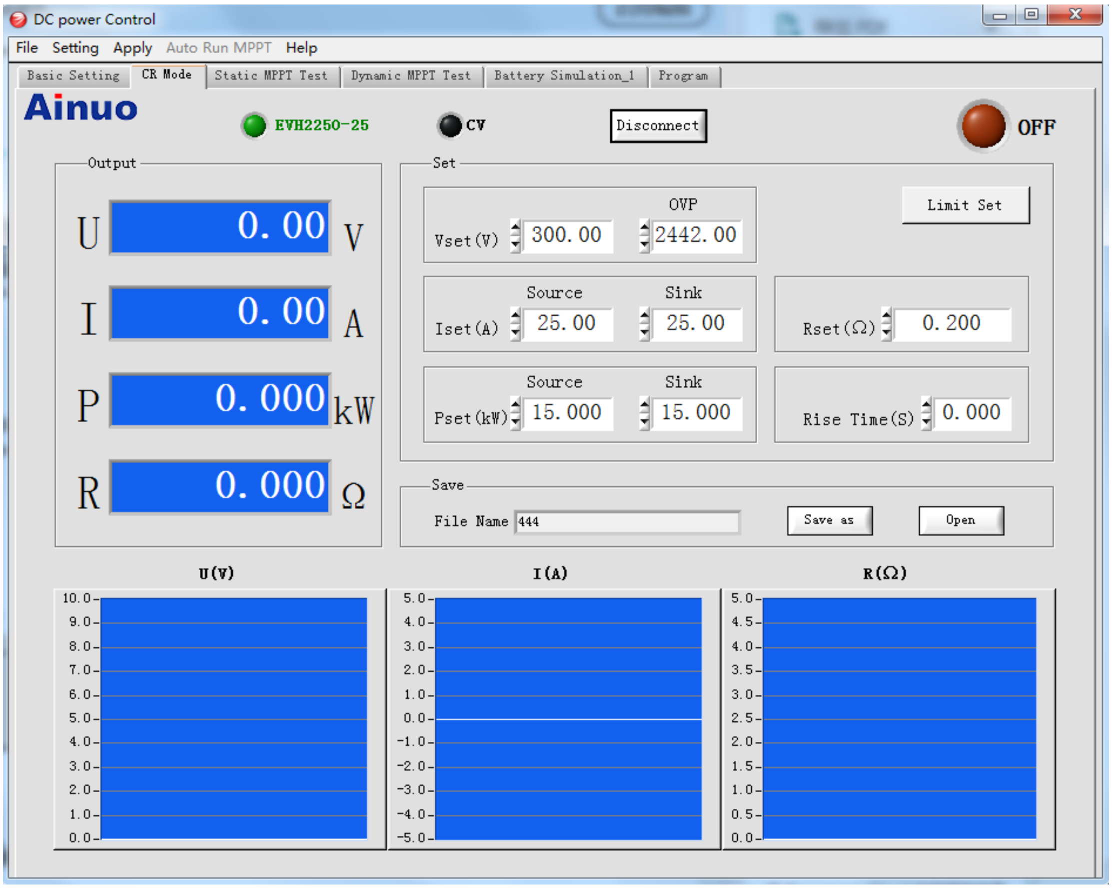


Figure 4.4.1 CR mode

4.4.1 Principle of constant resistance mode

Its operating principle is based on variable internal resistance. Constant resistance mode (CR) is basically its inherent characteristic. The load attempts to set the internal resistance to a value defined by the user through the input current and voltage, based on Ohm's law IIN=UIN/RSET. For the ANEVH series, the difference between the external supply voltage and the internal set value determines the true current. There are the following two situations:

1） When the DC input voltage is higher than the set voltage, the above formula is extended to IIN=(Uin-USET)/RSET.

2） When the DC input voltage is lower than or equal to the set voltage

ANEVH does not absorb any current and switches to CV mode. If the supplied input voltage is almost equal to or oscillates near the set voltage, the internal resistance adjustment/constant resistance mode will always switch between CV and CR modes. Therefore, it is not recommended to adjust the setting voltage to the same level as the external power supply.

Note:

(1) Internal resistance is usually limited between 0 and the maximum value. Since the internal resistance cannot be 0, the minimum value can be set according to the voltage level of the power supply (please refer to the power supply user manual for the specific value), so as to ensure that the internal electronic load absorbs a larger input current from the power supply source at a very low input voltage to the maximum.

(2) When the internal resistance is adjusted/constant resistance mode, the feedback current is greater than 0.5A and above to meet the accuracy requirements.

4.4.2 Examples of constant resistance modes

Two ANEVH2250-25 power supplies are used for drag to achieve constant resistance mode in this time.

For example, if the dc input voltage is higher than the set voltage, the setting principle is that the output current capacity of the source (the set current of the source) should be greater than the theoretical current value IIN=(UIN-USET)/RSET. Table 4.4.1 shows the parameter Settings of the two power supplies.

Table 4.4.1 Parameter settings

	Power supply 1（CR）	Power supply 1 set instruction	Power supply 1（source）	Power supply 2 set instruction
Voltage	0V	< Voltage of power supply 2	200V	> Voltage of power supply 1
Forward current	15A	No requirement	25A	$>(U_{IN}-U_{SET})/R_{SET}$
Reverse current	25A	$>(U_{IN}-U_{SET})/R_{SET}$	15A	No requirement
Forward power	15kW	Pmax is recommended	15kW	Pmax is recommended

Reverse power	15kW		15kW	
Resistance	10 Ω	Ensure (UIN-USET)/RSET within the accuracy range		

Power supply 1 works in constant resistance mode, and its output is shown in Figure 4.4.2.

Figure 4.4.2 Power supply 1 CR mode

Power supply 2 works in CV mode, and its output is shown in Figure 4.4.3.

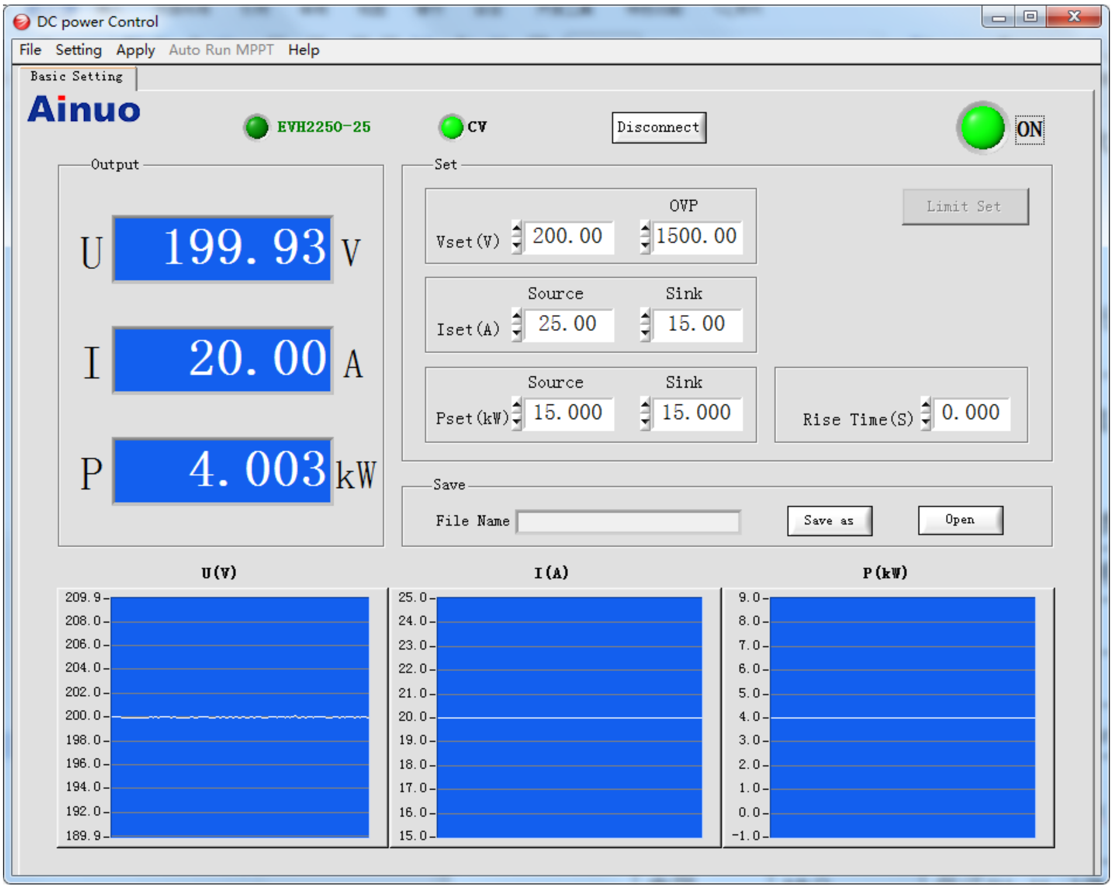


Figure 4.4.3 Power supply 2 (source) -CV mode

4.5 Battery simulation fixed battery

As shown in Figure 4.5.1, this function page simulates a variety of battery output characteristic curves, which can be used in the test of electric vehicle drive motor (controller), energy-storage inverter, and two-way electric vehicle charger. This feature is available only with the ANEVH series bidirectional programmable DC power supply.

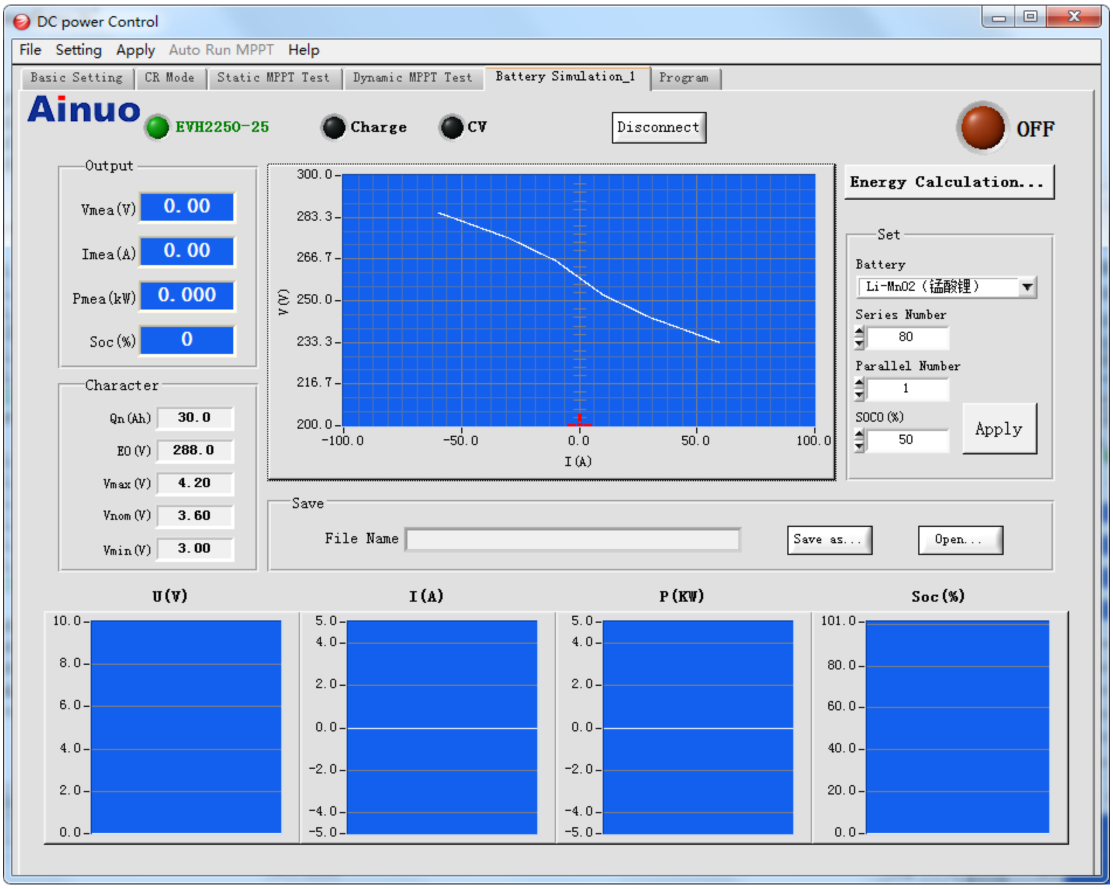


Figure 4.5.1 Battery simulation fixed battery interface

4.5.1 Parameter setting

Figure 4.5.2 Parameter setting

"Battery": Select the battery type, a total of lithium manganese acid, lithium cobalt acid, lithium iron phosphate, lead acid battery, nickel metal hydride battery five types.

"Series Number": Set series number, series number * upper voltage ⩽ the maximum voltage of the power supply; Series number * standard voltage = E0.

"Parallel Number": Set the number of parallel connections. Number of parallel connections x unit capacity (Qn) x 2⩽ The maximum power supply current.

"SOC0%": Set the initial SOC%, which ranges from 1 to 100.

Take the set parameters of lithium manganate battery as an example. After all parameters are set, click Apply in Figure 4.5.2 to generate preview curve and update feature display parameters according to the set parameters, as shown in Figure 4.5.2. The battery characteristic parameters are in the lower left corner, as follows: Parallel capacity "Qn", series voltage "E0", upper voltage "Vmax", standard voltage "Vnom", lower voltage "Vmin".

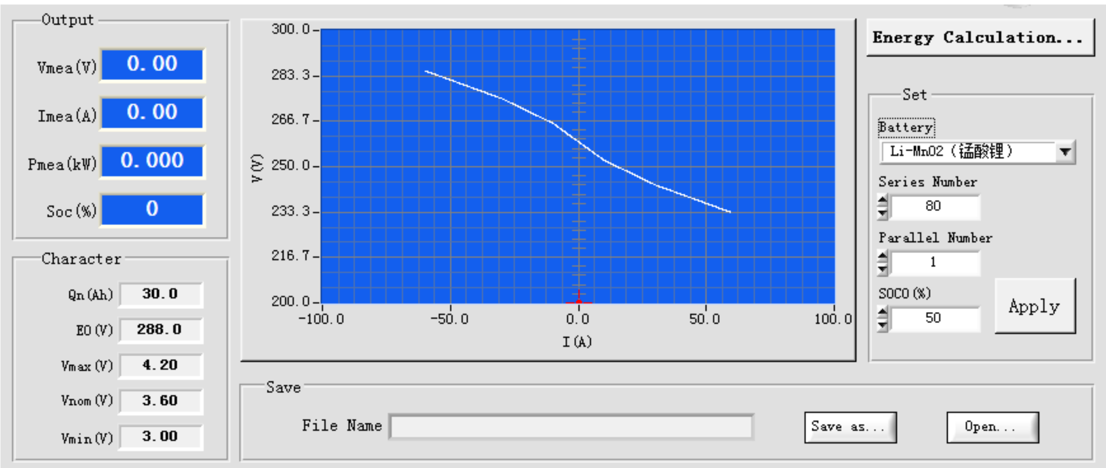


Figure 4.5.2 Feature display and preview curves

4.5.2 Save and read setting parameters

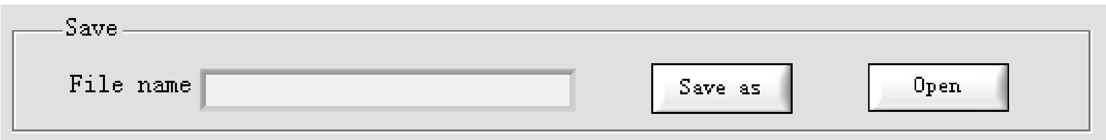


Figure 4.5.2 Save and read

As shown in Figure 4.5.2, click the Save as button, and the dialog box as shown in Figure 4.5.3 pops up. At this time, select the path to store and create a new form file, click "Save" to store immediately, and press "Cancel" to store no data.

After data storage is completed, a dialog box as shown in Figure 4.5.4 will pop up indicating that data storage is successful. Click OK to continue operation panel.

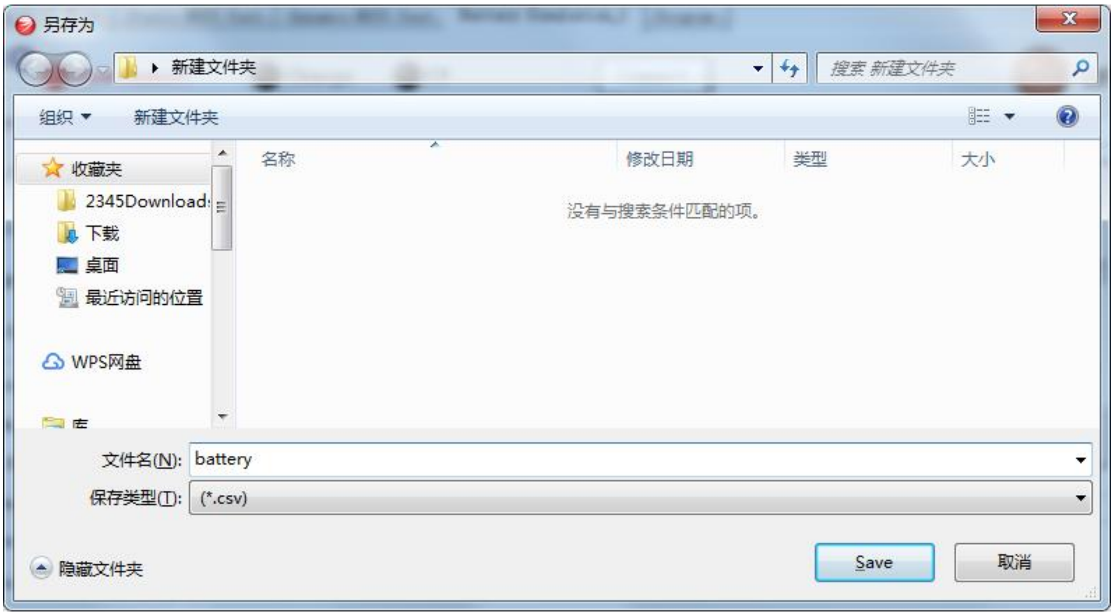


Figure 4.5.3 Storage path

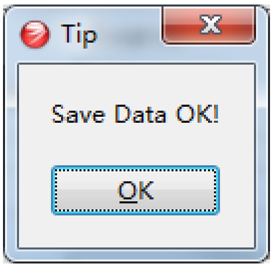


Figure 4.5.4 Data storage succeeded

Click the Open button in Figure 4.5.2, and the dialog box as shown in Figure 4.5.6 pops up. Select the table that has been stored in disk, click "Load", and the data can be directly loaded into the interface of the upper computer. The internal parameter format of the table saved in disk must be the same as that saved in Save as; otherwise, the table cannot be read.

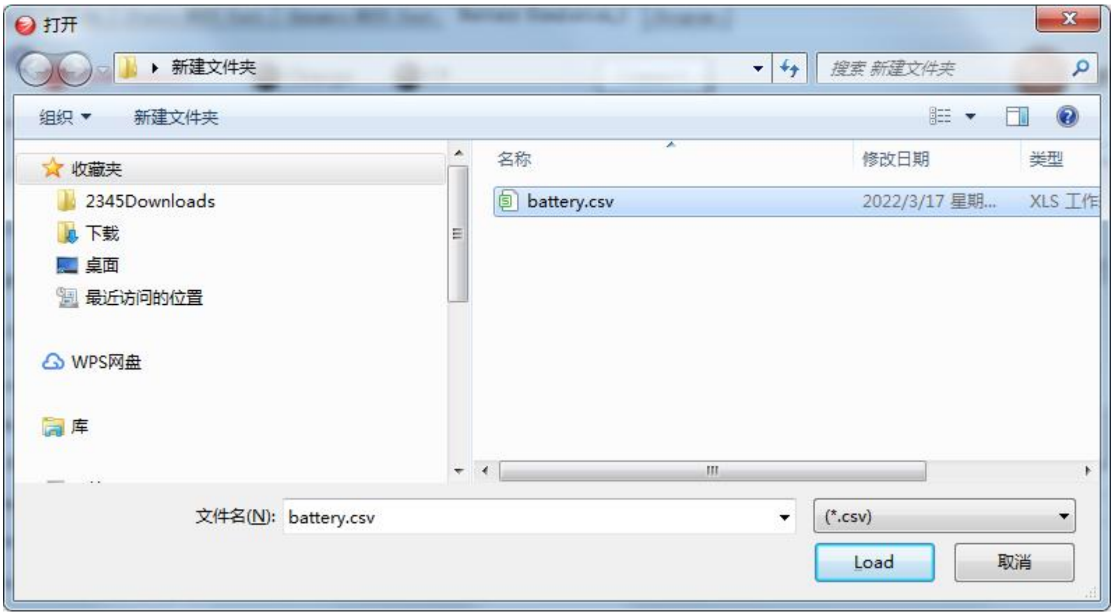
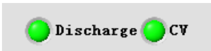


Figure 4.5.6 The path to be read

4.5.3 System operation

Click 

to start and stop the output, and CC/CV/CP status and charging-discharging status 

can be displayed in the status display area. It is necessary to ensure that the battery simulator works in CV state, because only in CV state can the battery charge and discharge be simulated.

Two ANEVH2250-25 power supplies are used for drag to realize the battery simulation operation process this time. Power supply 1 runs battery simulation, and power supply 2 provides positive and negative conventional output.

Power supply 1 is set as follows: Take lithium manganese acid battery as an example, set the series number to 100. Since the single capacity (Qn) is greater than the maximum current of power supply is 25A, the parallel number can only be set to 1 and SOCO% to 50%.

（1）Discharge:

Power supply 2 as the load, its voltage setting should be less than the series number * lower limit voltage value. Table 4.5.1 shows the parameter Settings of power supply 2.

Table 4.5.1 Power supply 2 parameter setting

	Power supply 2（source）	Power supply 2 set instruction
Voltage	200V	< Number of series of power supply 1 * lower limit voltage
Forward current	25A	No requirement
Reverse current	10A	Make sure power supply 1 runs in CV state
Forward power	15kW	Pmax is recommended
Reverse power	15kW	

After the system runs, the V-I curve generated according to Soc changes will be drawn in real time. The red dots on the curve track the output voltage and current of the system in real time, as shown in Figure 4.5.7. On the left side of the V-I curve, the current output voltage, current power and SOC value of the power supply are displayed in real time, and the waveform is also displayed below.

As can be seen from FIG. 4.5.7, its operating current is the reverse current 10A set by power supply 2. Since Qn is 30Ah, theoretically THE SOC from 0% to 100% can run for a total of 3 hours. Our initial SOC was 50%, and after 1.5 hours, the SOC decreased to 0%. The battery emulator stops automatically when the SOC reaches 0%.

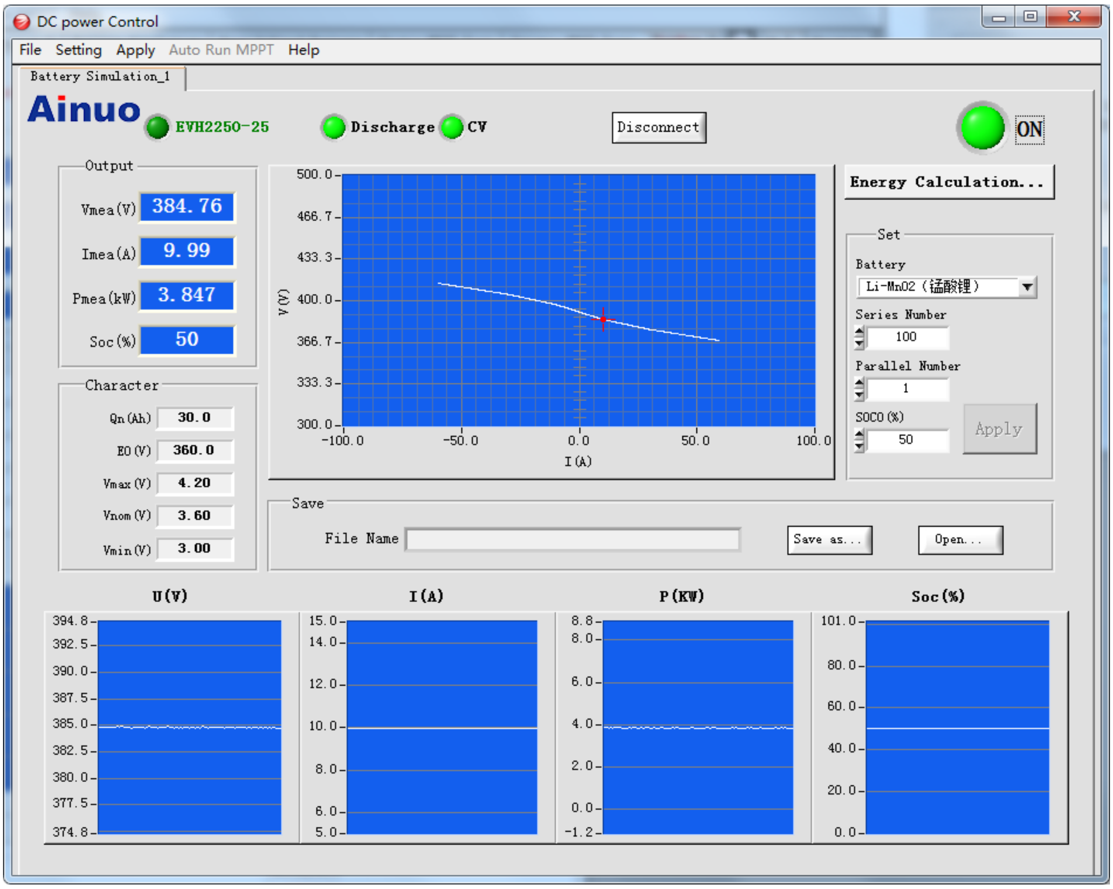


Figure 4.5.7 Fixed battery startup interface - discharge

（2）Charge:

Power supply 2 as the source, its voltage setting should be greater than the series number * upper voltage value. Table 4.5.2 shows the parameter Settings of power supply 2.

Table 4.5.2 Power supply 2 parameter setting

	Power supply 2（source）	Power supply 2 set instruction
Voltage	500V	> Series number * upper voltage value
Forward current	10A	No requirement
Reverse current	25A	Make sure power supply 1 runs in CV state

Forward power	15kW	Pmax is recommended
Reverse power	15kW	

After the system runs, as shown in Figure 4.5.8, its running current is 10A forward current set by power supply 2. Since Qn is 30Ah, theoretically the SOC from 0% to 100% can run for a total of 3 hours. Our initial SOC was 50%, and after 1.5 hours, the SOC rose to 100%. The battery simulator stops automatically when the SOC reaches 100%.

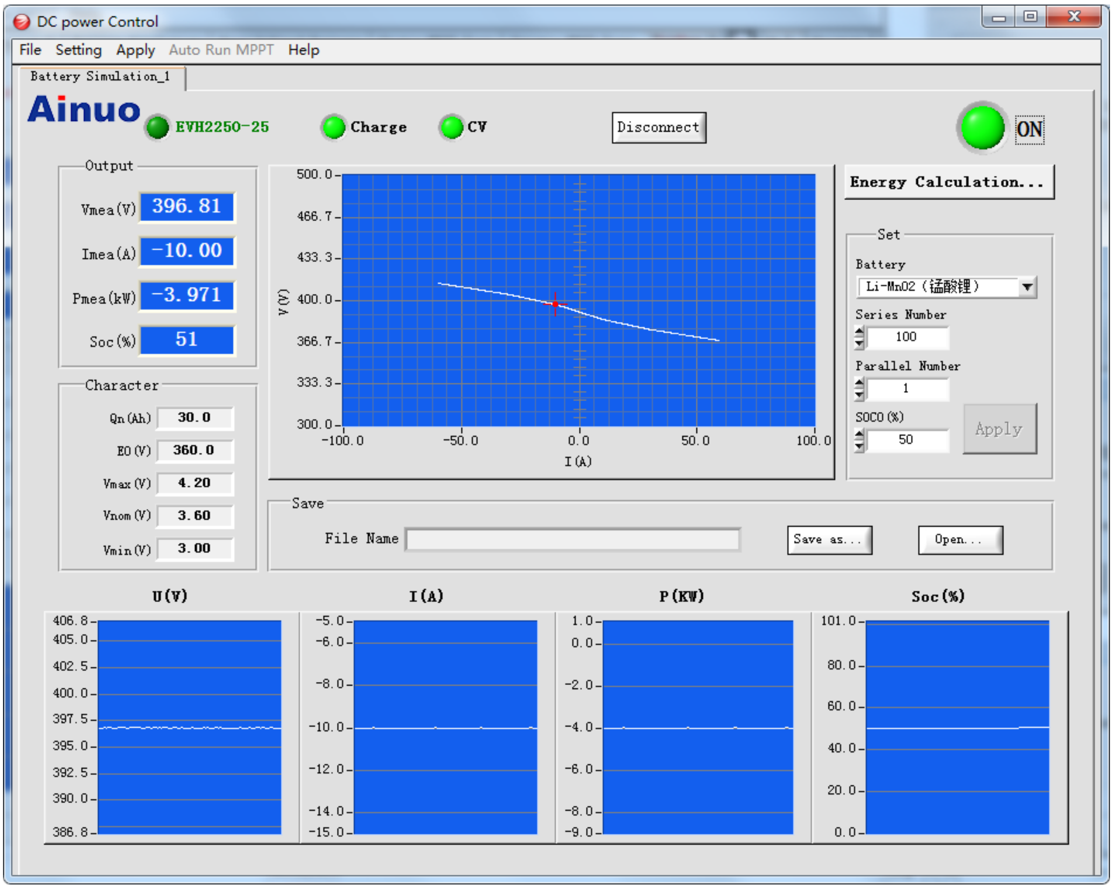


Figure 4.5.8 Fixed battery startup interface - charge

4.4.3 Electric energy measurement

When the battery is simulated, it can be used to measure electric energy. Click **Energy Calculation...** to enter the interface of electric energy measurement, as shown in Figure 4.5.9. The part on the left is the current calculated energy consumption, energy feedback, ampere-hour and running time, and the part on the right is the historical measured value, 10 groups in total.

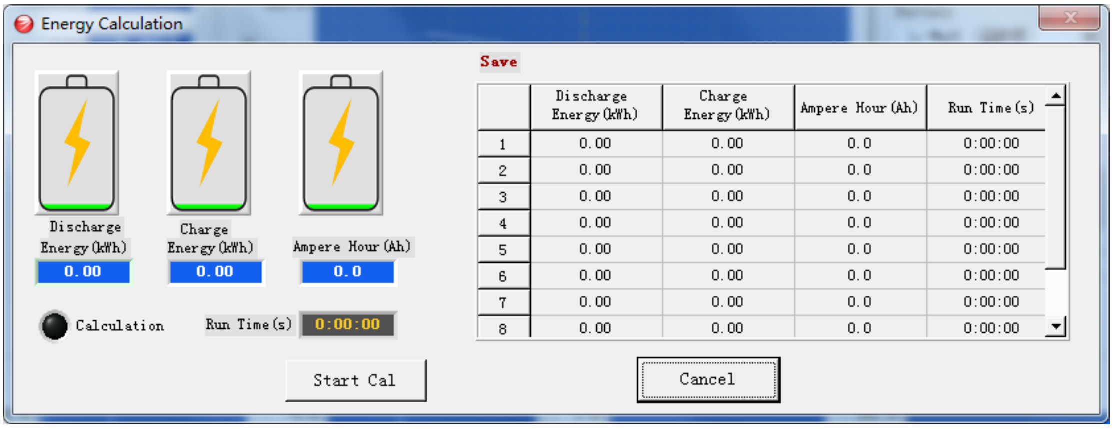


Figure 4.5.9 Energy measurement interface

Click Start Cal, the electric energy metering function starts to work, and the indicator light Calculation is green. Figure 4.5.10 shows the real-time calculation of energy feedback and ampere-hour during charging.

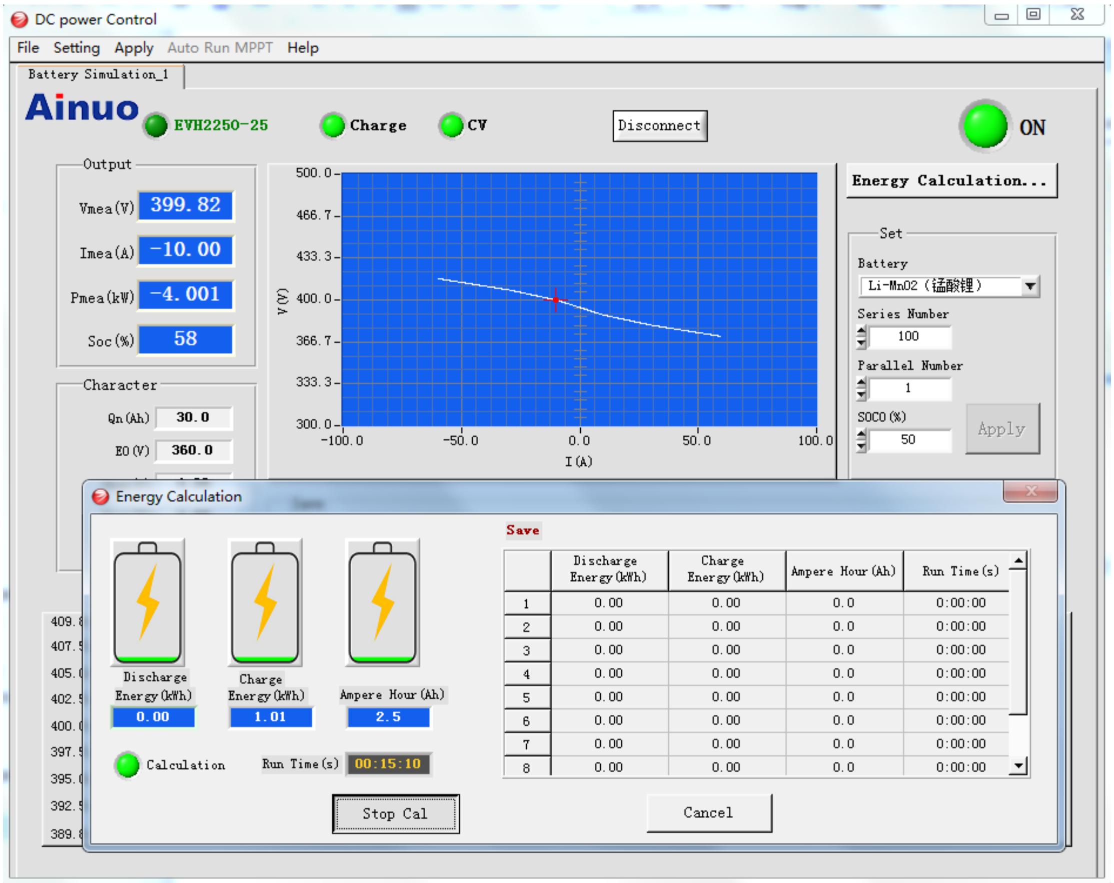


Figure 4.5.10 Electric energy measurement start

Click 

to stop electric energy measurement and the data will be automatically saved to the table on the right. When 10 items are recorded, the data will be moved forward successively.

4.6 Static photovoltaic

As shown in Figure 4.6.1, this feature page is a static test of the Solar Array Simulation (SAS) function, measuring the static MPP tracking data of the solar inverter and tracking efficiency. Combined with a set of power supplies (the master of a stand-alone or master-slave system), various solar modules/panels with different characteristics are simulated.

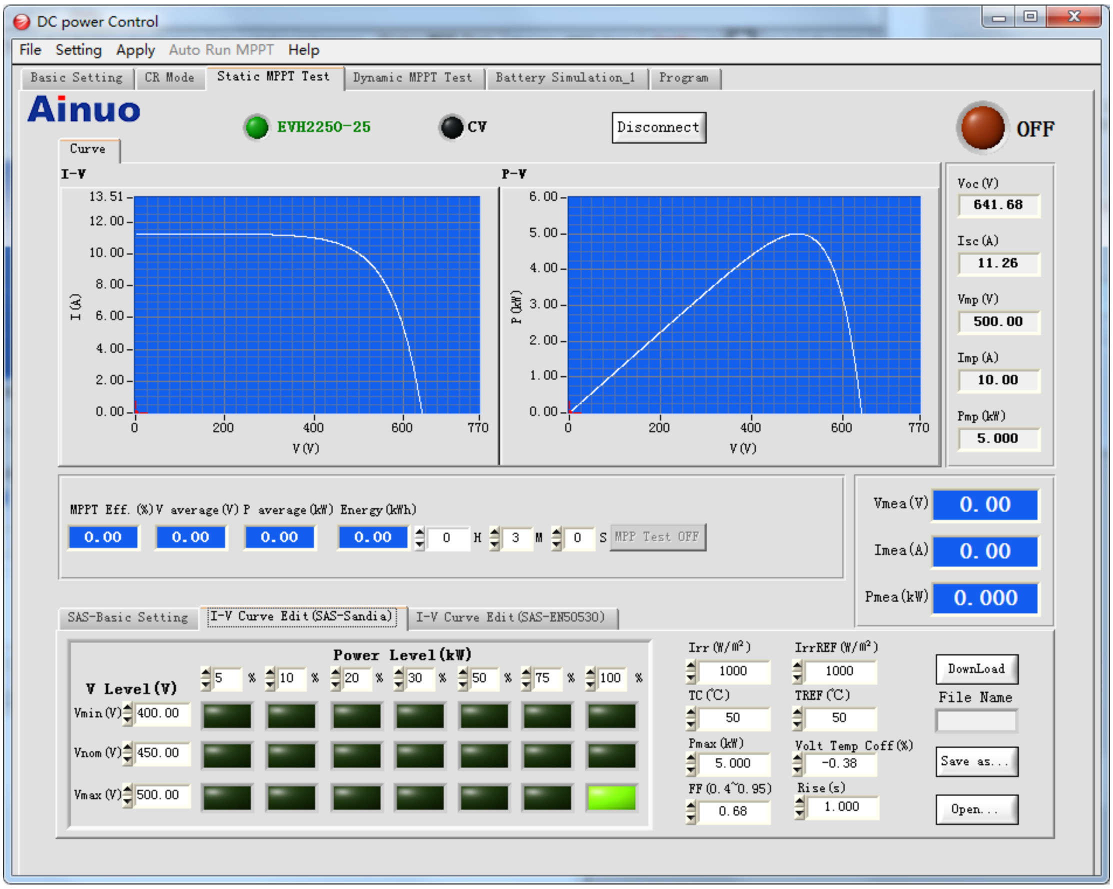


Figure 4.6.1 Static photovoltaic interface

4.6.1 Mathematical model

Static pv simulation provides three kinds of mathematical models to obtain the SOLAR array IV curve, including the simple model with only Voc, Vmp, Isc, Imp, SANDIA model and the most commonly used EN50530 model. It is convenient for users to edit various IV curves, and test the static MPPT efficiency and conversion efficiency of the solar inverter. The use of these three models is described below.

1、The simple model

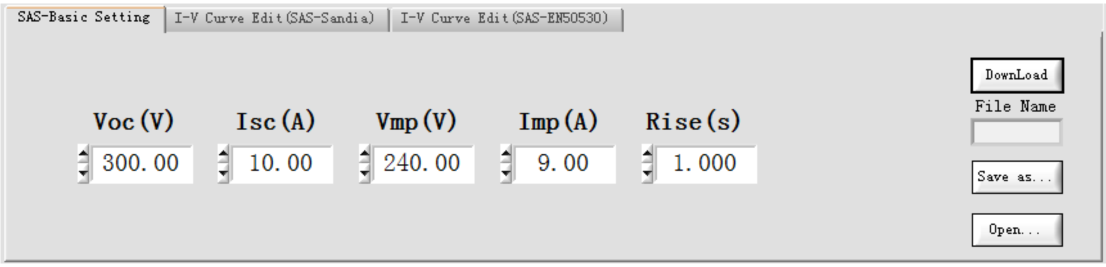


Figure 4.6.2 The simple model

"Voc": Open circuit voltage

"Isc": Indicates the short-circuit current

"Vmp": Indicates the voltage of the maximum power point

"Imp": Indicates the current of the maximum power point

"Rise": The time when the power supply slowly rises from 0V to Voc at startup. The minimum value is 1 second.

Due to the factors of the model formula, the Vmp and Imp input by the user will be different from the Vmp and Imp of the maximum power point obtained by the formula. The smaller the filling factor is, the greater the difference. The setting principles are as follows:

（1）Fill factor (FF) definition: $FF = \frac{V_{mp} I_{mp}}{V_{oc} I_{sc}}$; according to experience, under the principle of Vmp=0.8Voc and Imp=0.9Isc, the Vmp and Imp input by the user and the MAXIMUM power point obtained by the formula have the least difference.

（2）Voc, Isc, Vmp, Imp parameter setting limits:

- $V_{oc} > V_{mp} > 0$;

- $I_{sc} > I_{mp} > 0$;
- $V_{mp} > V_{oc}\left(1 - \frac{I_{mp}}{I_{sc}}\right)$

Users can set their own solar panel parameters according to manufacturers, to simulate the output curve of their solar array. Take the parameters in Figure 4.6.2 as an example. After setting, click the $\boxed{\text{DownLoad}}$ button and send the parameters to the power supply under control. I-v and P-V curves are generated and the actual Voc, Vmp, Isc, Imp and Pmp are calculated, as shown in Figure 4.6.3.

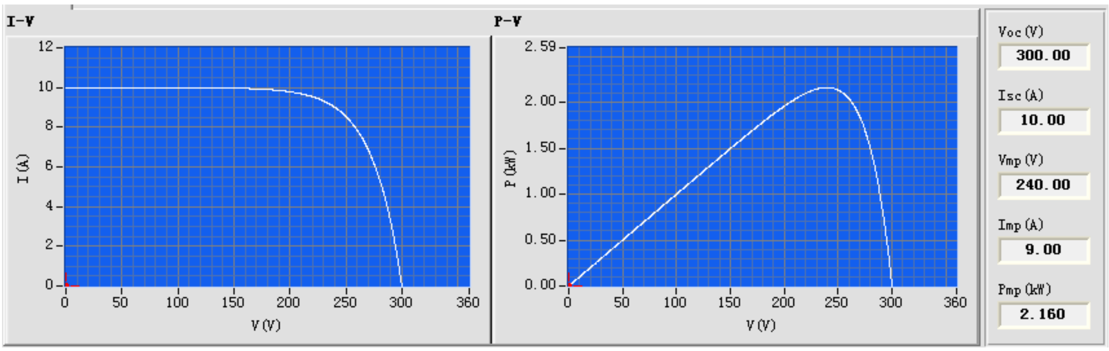


Figure 4.6.3 Analog graph

If the parameter settings are incorrect, Vmp is greater than Voc as shown in Figure 4.6.4. Click $\boxed{\text{DownLoad}}$, and the parameter setting error dialog box will pop up.

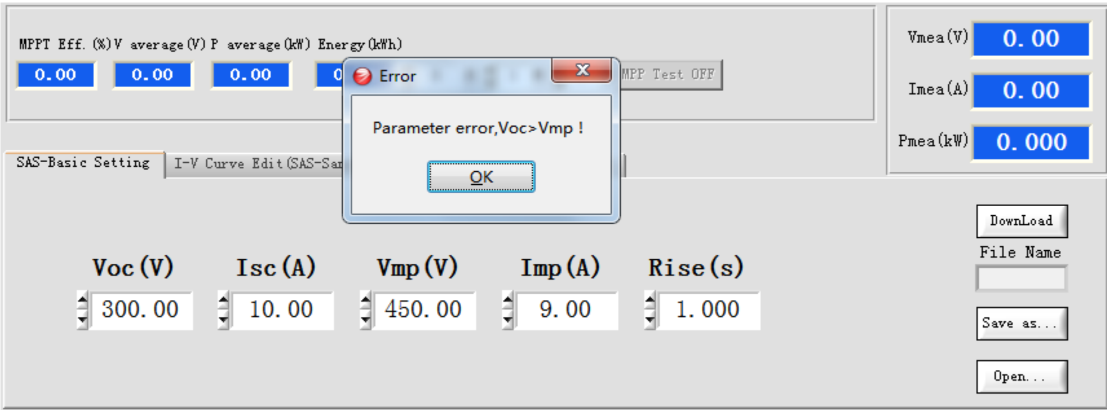


Figure 4.6.4 Parameter setting error

2、SANDIA model

SANDIA model takes light intensity and temperature into account. Users can set input parameters of Irr, TC, IrrREF, TREF, β, Pmax, Vmax and FF, and add button selection table of Power Level (kW) % and V Level (V) 3*7 array to light corresponding LED lights. The Curve can be displayed on IV Curve and PV Curve, and the actual Voc, Vmp, Isc, Imp and Pmp can be calculated. The user can observe whether the curve and the actual MAXIMUM power point Pmp are pre-tested. If you can click the $\boxed{\text{DownLoad}}$ button, send them to the controlled power supply under the parameters.

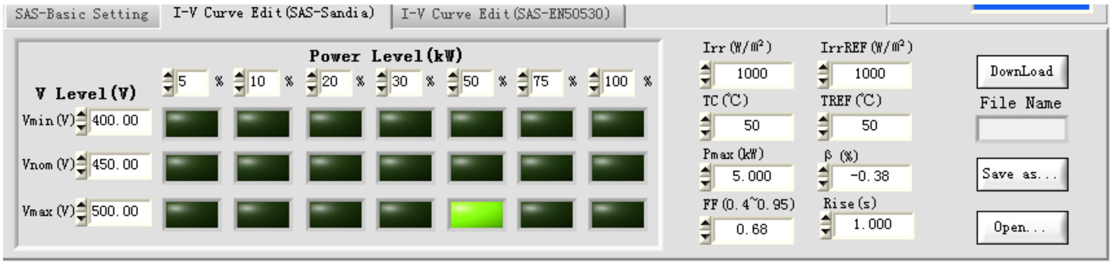


Figure 4.6.5 SANDIA model setting interface

"Irr": Actual light intensity. The value ranges from 0 w /m² to 3000W/m².

"IrrREF": The value ranges from 0 w /m² to 3000W/m².

"TC": Indicates the actual temperature of the photovoltaic panel. The value ranges from -40 ° C to 85 ° C.

"TREF": Pv panel reference temperature, which ranges from -40 ° C to 85 ° C.

"β" : Power supply temperature coefficient, depending on the material of photovoltaic panel, setting range -2~0%.

"FF": The filling factor varies according to the material of the photovoltaic panel. The setting range is 0.4 to 0.95.

In general, the setting principles of β and FF are shown in Table 4.6.1.

Table 4.6.1 The setting principle of β&FF

Array Type	Nominal Fill Factor（FF）	Voltage Temperature Coefficient（β,%/℃）
Thin-film	0.55	-0.25
Standard Crytalline or Multi- crystalline	0.68	-0.38
High-efficiency Crystalline	0.80	-0.50

"Pmax": Indicates the maximum power. The setting range depends on the model and specification of the power supply.

"Rise": The time when the power supply slowly rises from 0V to Voc at startup. The minimum value is 1 second.

For example, as shown in Figure 4.6.6, after setting Pmax=5.000kW and lighting the LED lamp corresponding to Vnom=450V and 75% Pmax, the actual Pmp=3.750kW is calculated and the maximum power point of the generated I-V and P-V curves is also 3.750kW. Click the DownLoad button and send it to the power supply under the parameters.

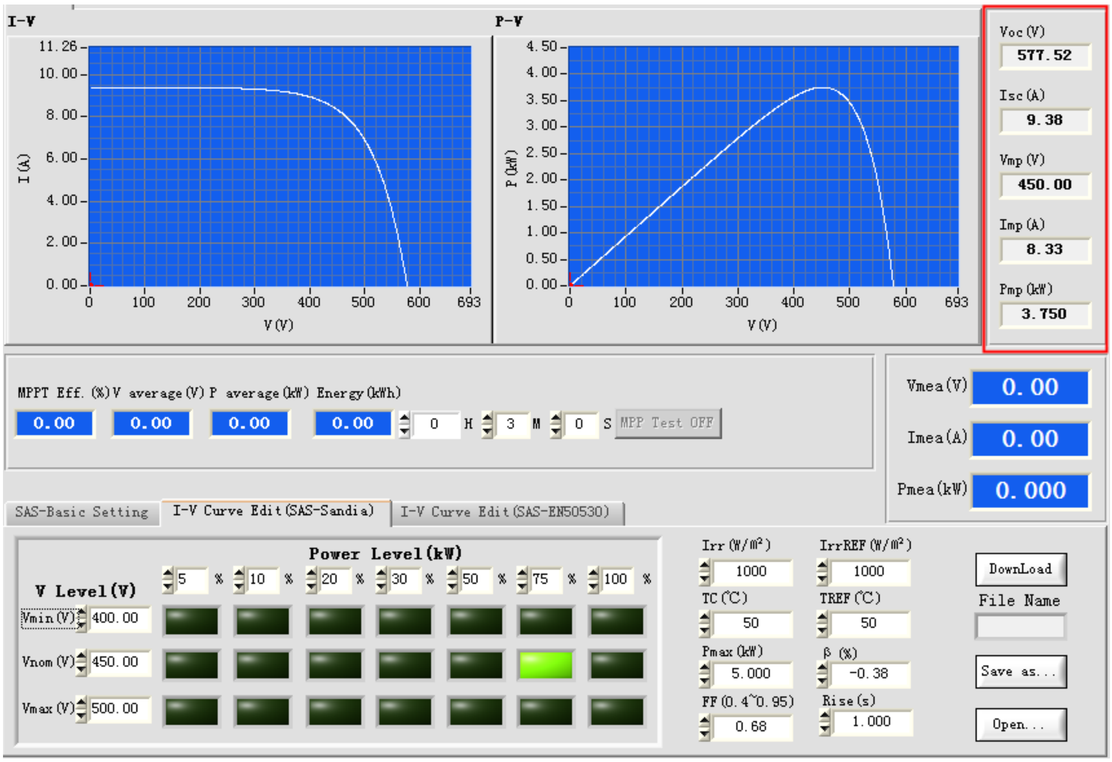


Figure 4.6.6 Examples of SANDIA model usage

3、EN50530 model

Similar to SANDIA model setting interface, it is also a button selection table for Power Level (kW) % and V Level (V) 3*7 array. As long as the corresponding LED lamp is lit, curves can be displayed on IV Curve and PV Curve. And calculate the actual Voc, Vmp, Isc, Imp and Pmp. The difference is that the user only needs to set Irr, Pmax, and select FF.

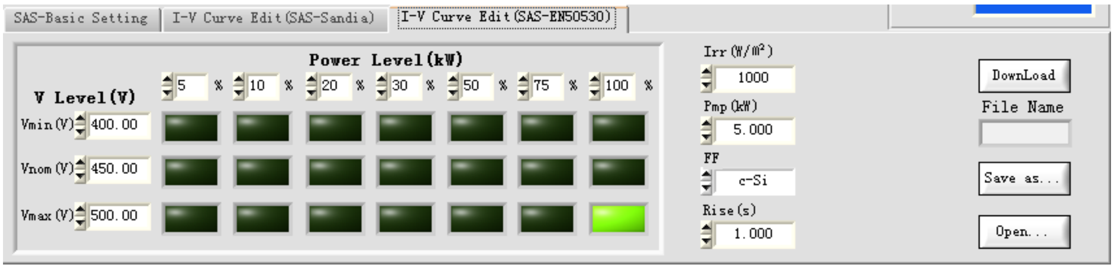


Figure 4.6.7 EN50530 model setting interface

“Irr”: Actual light intensity. The value ranges from 0 w /m² to 3000W/m².

“Pmax”: Indicates the maximum power. The setting range depends on the model and specification of the power supply.

"FF": CSI-technology (silicon photovoltaic panels) and Thin film-technology (Thin film photovoltaic panels) can be selected, depending on the material, the coefficients used in EN50530 built-in formula are different.

"Rise": The time when the power supply slowly rises from 0V to Voc at startup. The minimum value is 1 second.

Note: No matter it is simple model, Sandia standard curve model or EN50530 standard curve model, the maximum power point of IV curve calculated by the set value is always a little deviation from the set maximum power point (the smaller the FF value is, the bigger the deviation is), so the Vmp,Imp and Pmp of the calculated maximum power point are displayed on the right side of the curve.

4.6.2 Save and read setting parameters

The setting parameter interfaces of simple model, Sandia model and EN50530 model all have operation buttons as shown in Figure 4.6.8. The DownLoad button is used to deliver parameters to the control power supply, and the Save as button is used to Save parameters set on this interface into a table. The Open button is used to read parameters previously saved in the table back to the screen, simplifying the user's input of parameters." File Name displays the File Name of the table read.

Figure 4.6.8 Save and read

Note: For the table read by using the Open button, its internal saved parameters must conform to the interface; otherwise, the reading fails. For example, the internal saved parameters of the table are the setting parameters of EN50530 model. If the table is read by using the Open button in the setting interface of Sandia model, an error will be reported.

4.6.3 Running

Before startup, if the DownLoad button is not clicked for parameter delivery, the prompt as shown in Figure 4.6.9 will pop up if the Start button is clicked.

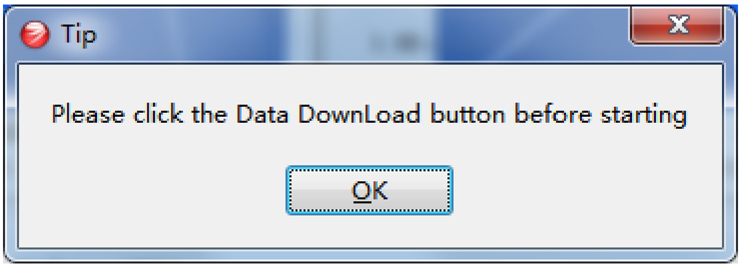


Figure 4.6.9 Error message before startup

Taking ANEVH2250-25 as an example, EN50530 model is used for setting, as shown in Figure 4.6.10.

After setting Irr=1000W/m^2, Pmp=5.000kW, FF as C-SI, lighting the LED lamp corresponding to Vmax=500 and 100% Pmax, the actual Pmp=4.996kW was calculated. The Rise delay is set to 1s.

Click the start button 

to start the operation, the power supply takes 1s to slowly rise from 0V to 624.47V, as shown in Figure 4.6.10, is currently working in CV state, and then waits for the inverter to adjust until the maximum power point is found, as shown in Figure 4.6.11. At this time, it is working in CC state.

If you want to change the parameters online, you must click the DownLoad button after lighting the corresponding LED light, and the upper computer and the power supply under control will update the curve and parameters.

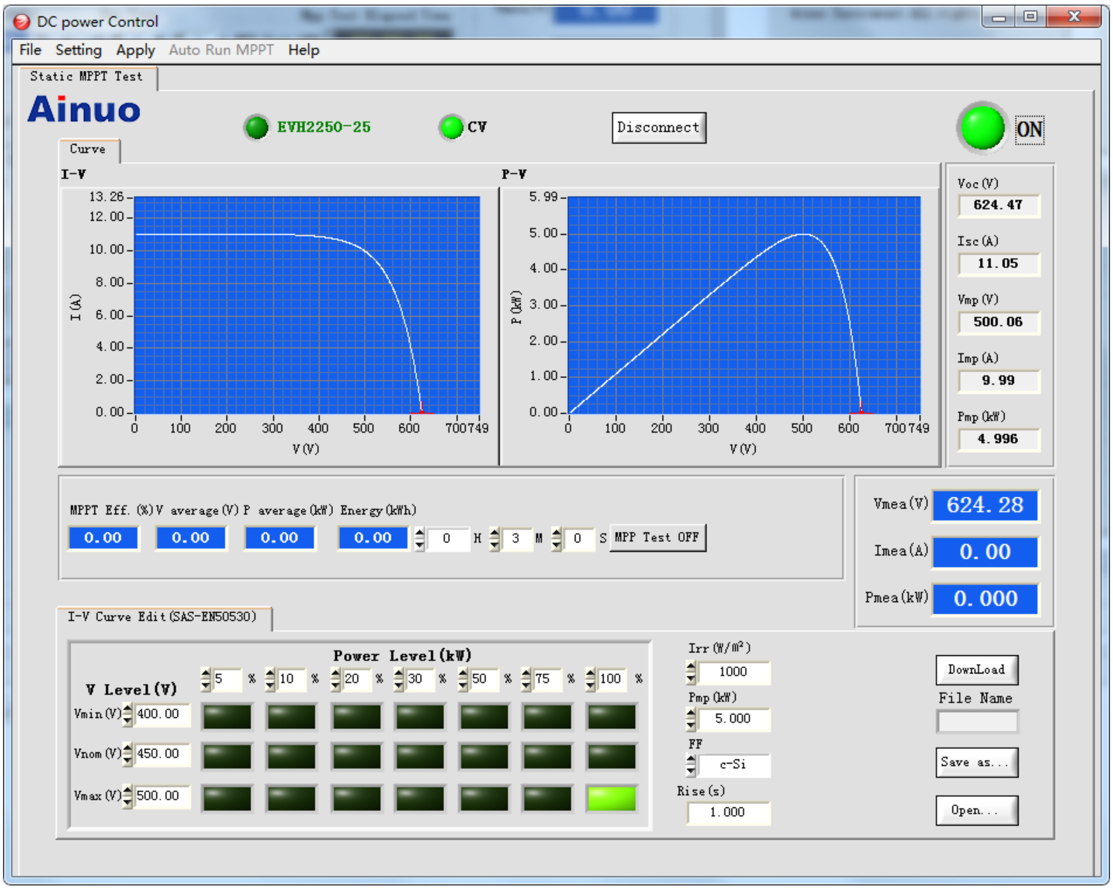


Figure 4.6.10 Power supply just started

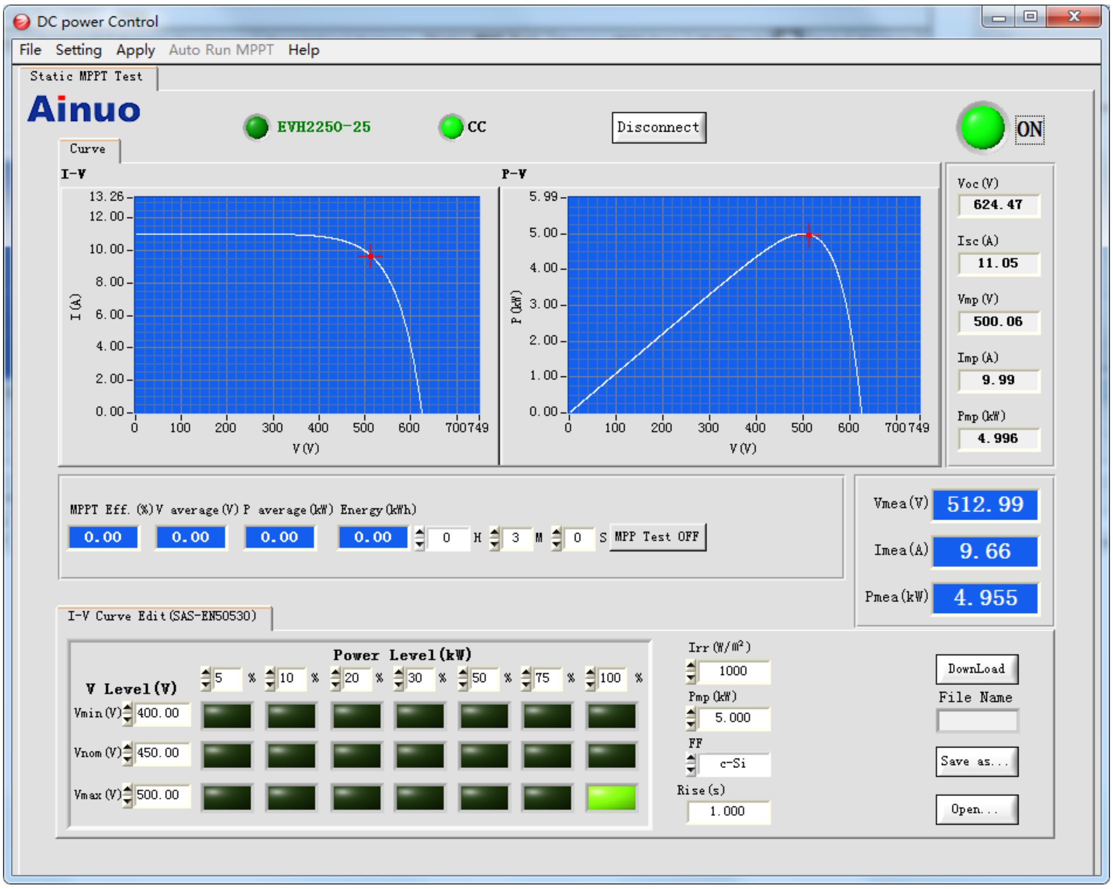


Figure 4.6.11 Find the maximum power point

4.6.4 MPP test

As shown in Figure 4.6.12, this function is used to test and track the Static MPPT tracking Efficiency of photovoltaic inverters. It allows users to set the Static MPPT Efficiency test duration. It is recommended that the test duration is 60s~600s for the optimal Static MPPT EFF% Efficiency analysis.

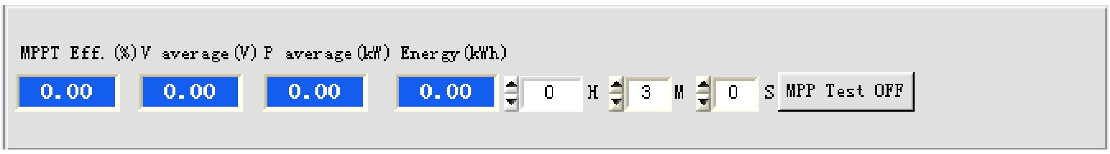
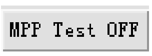


Figure 4.6.12 Static MPPT Efficiency test - not enabled

This test must be performed after the inverter finds the maximum power point and becomes stable. After the user sets the test time 

, click 

to start the MPP test, as shown in Figure 4.6.13. When executing, MPP

Tracking Efficiency, V Average, P Average, and Energy will be calculated and the current execution time will be displayed. When the execution time is complete, the calculation will stop or the user manually clicks the button to stop the test, but the output will not stop.

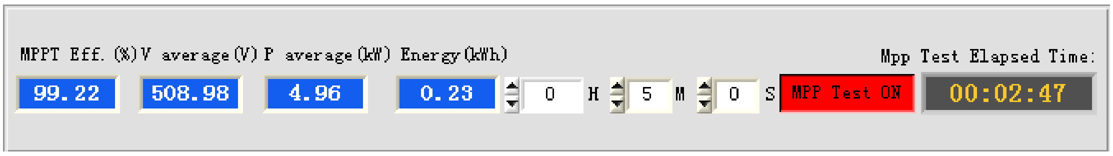


Figure 4.6.13 Static MPPT Efficiency test - enabled

The MPP Tracking Efficiency of the test can be exported to the table, as shown in Section 4.2 data Display and Export.

Note: MPP Tracking efficiency is defined as the power output divided by the maximum power of the set IV-curve over a period of time, and its theoretical value is not greater than 100%. However, when the parameter is changed, the MPP Tracking efficiency test will be inaccurate at the moment of change, but after a long time of cumulative calculation, it will gradually recover to the normal value.

4.7 Dynamic photovoltaic

Dynamic MPPT test built-in Sandia&EN50530 dynamic MPPT test project, used to simulate the light intensity and temperature changes in the actual weather I-V curve test photovoltaic inverter dynamic MPPT tracking efficiency. In addition, users can customize the execution time and temperature change time of dynamic I-V curve from low illuminance to high illuminance, and set the number of execution repetitions.

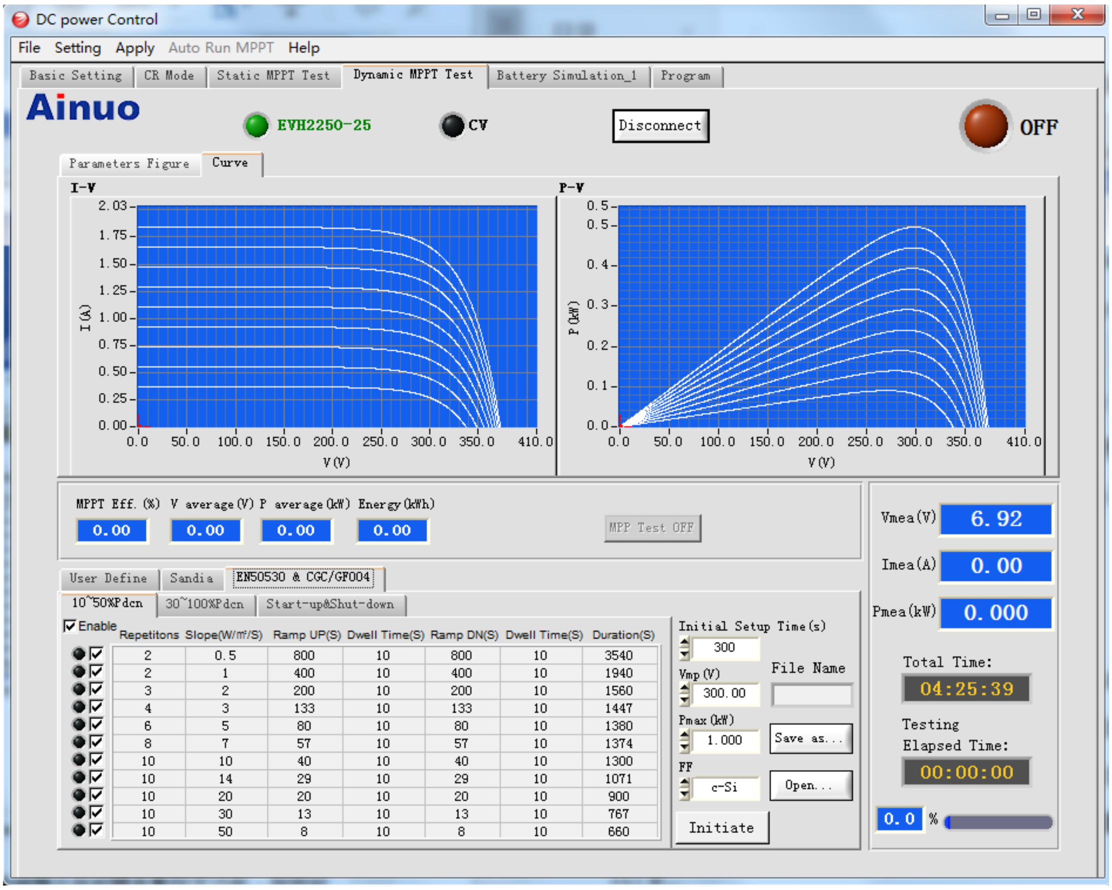


Figure 4.7.1 Dynamic MPPT test interface

4.7.1 Parameter settings

Dynamic mode simulates the working process of the curve as shown in Figure 4.7.2:

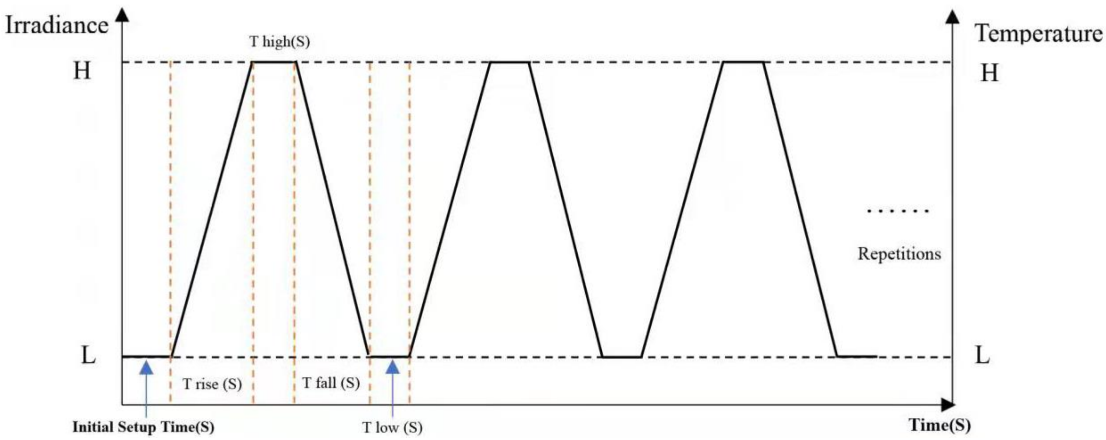


Figure 4.7.2 Illuminance and temperature curve

Irradiance represents light intensity and Temperature represents ambient

Temperature. This mode simulates the operation of solar cells at two constant light intensity and ambient Temperature and during the transition between these two environments. This can simulate the operation of solar cells in a day.

1、User defined

Users can use this page to set i-V curve waveform output that is not specified in Sandia or EN50530 standards.

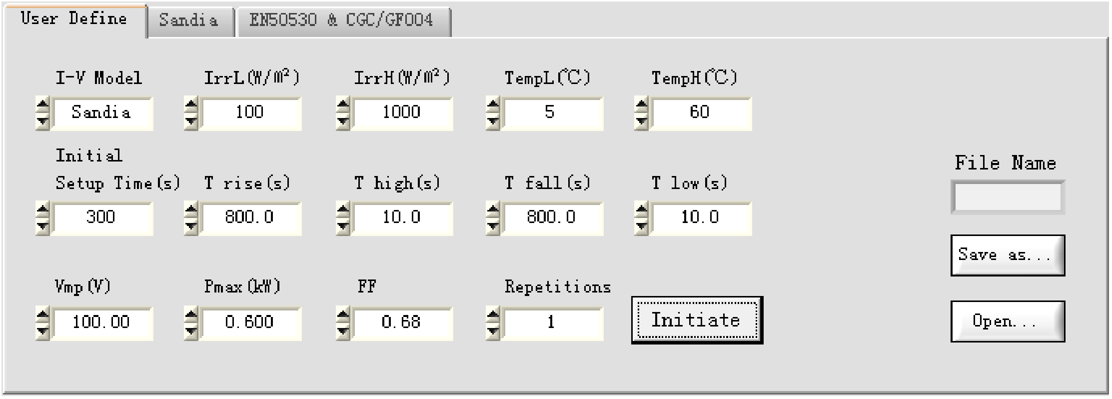
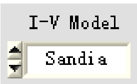
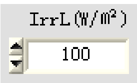


Figure 4.7.3 User-defined settings interface

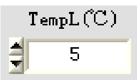


: You can choose the mathematical model of built-in I-V curve, Sandia or EN50530.

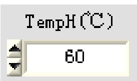


: Set low illumination parameters, ranging from 0 to 3000W/m².

: Set the parameters for high illumination, ranging from 0 to 3000W/m².



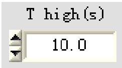
: Set low temperature parameters, ranging from -40 ° C to 85 ° C.



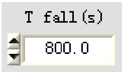
: Set high temperature parameters, ranging from -40 ° C to 85 ° C.

: Set the time to maintain before the initial illumination and temperature change, because it takes a certain time to find the maximum power point under the initial illumination and temperature condition when the inverter just runs.

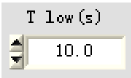
: Set the time for the illumination and temperature to rise at the same time, ranging from 0 to 4000 seconds.



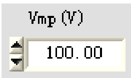
: Sets the time for the inverter to maintain the maximum power point under the highest illumination and temperature conditions of the solar panel, ranging from 0 to 4000 seconds.



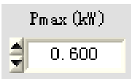
: Sets the time for the illumination and temperature to drop at the same time ranging from 0 to 4000 seconds.



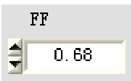
: Sets the time for the inverter to maintain the maximum power point under the lowest illumination and temperature conditions of the solar panel, ranging from 0 to 4000 seconds.



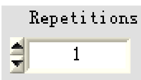
: Maximum power point voltage, the range depends on the controlled power supply model.



: Maximum power point. The range depends on the type of power supply controlled.



: Depending on the material of solar panels, it is recommended to refer to the setting principles of Table 4.6.1 β and FF when selecting Sandia model.



: Sets the number of repetitions, ranging from 1 to 50000.

After setting the above parameters, click the button 

to simulate the solar cell characteristic curve according to the set parameters, as shown in Figure 4.7.4, i-V and P-V curves.

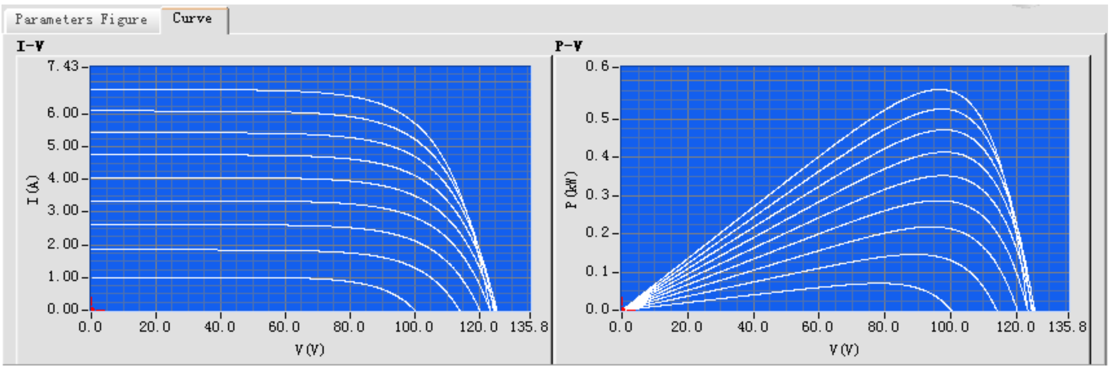


Figure 4.7.4 I-V and P-V characteristic curves

2、Sandia standard

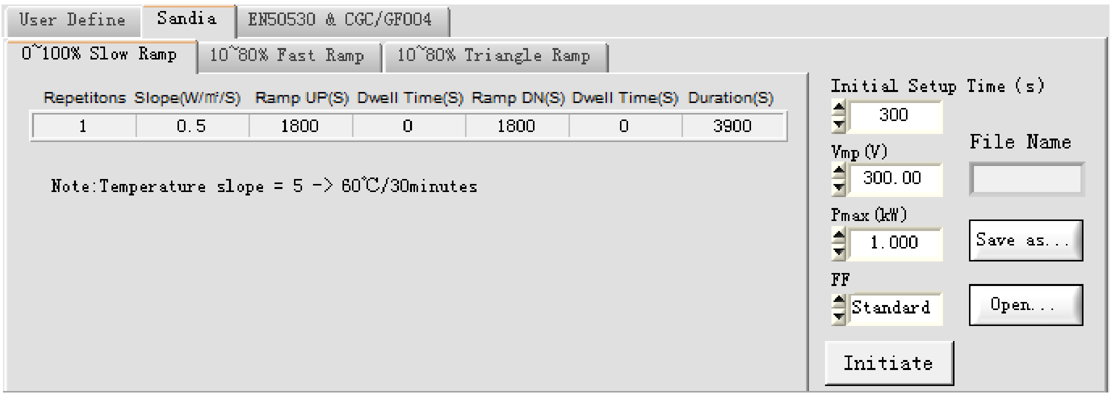


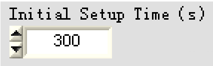
Figure 4.7.5 Sandia standard settings interface

: This page allows you to select the three illuminance change test parameters suggested by Sandia Laboratories, which are slow, fast and similar to triangular curve illuminance change. The changing speed of illumination is defined on each page for users' reference. See Table 4.7.1 for detailed description of the parameters.

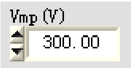
Table 4.7.1 Parameter description

Parameter	Description
Repetitions	Times of repetition
Slope	Illuminance change slope
Ramp UP	Illuminance rise time
Dwell Times	Time to maintain high illumination
Ramp DN	Illuminance drop time
Dwell Times	Time to maintain low illumination

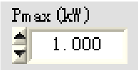
Duration	Total time: Ramp UP + Dwell Times + Ramp DN + Dwell Times + Initial Setup Time



: Set the time to maintain before the initial illumination and temperature change, because it takes a certain time to find the maximum power point under the initial illumination and temperature condition when the inverter just runs.



: Maximum power point voltage, the range depends on the controlled power supply model.



: Maximum power point. The range depends on the type of power supply controlled.

: Refer to table 4.6.1 β and FF for setting principles.

After setting the above parameters, click the button 

to generate i-V and P-V characteristic curves, as shown in Figure 4.7.6.

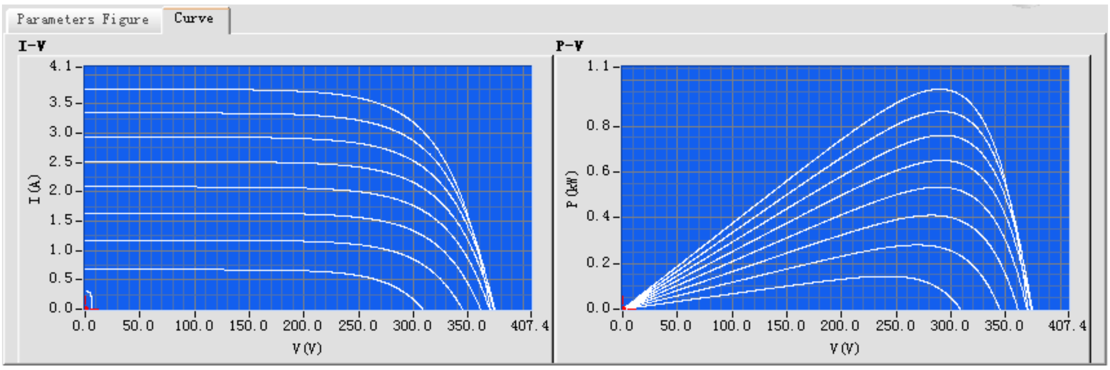
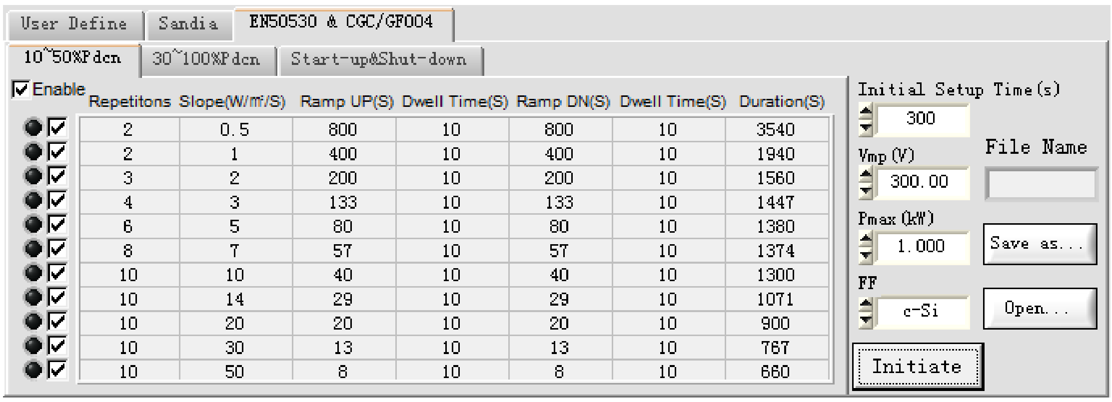


Figure 4.7.6 I-V and P-V characteristic curves under Sandia standard

3、EN50530 standard



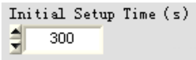
Repetitons	Slope(W/㎡/S)	Ramp UP(S)	Dwell Time(S)	Ramp DN(S)	Dwell Time(S)	Duration(S)
2	0.5	800	10	800	10	3540
2	1	400	10	400	10	1940
3	2	200	10	200	10	1560
4	3	133	10	133	10	1447
6	5	80	10	80	10	1380
8	7	57	10	57	10	1374
10	10	40	10	40	10	1300
10	14	29	10	29	10	1071
10	20	20	10	20	10	900
10	30	13	10	13	10	767
10	50	8	10	8	10	660

Figure 4.7.7 EN50530 standard setting interface

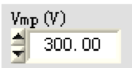
: This page allows you to select the three models of illuminance variation recommended by EN50530. Each page defines the change rate of illumination for users' reference. See Table 4.7.2 for detailed description of the parameters.

Table 4.7.2 Parameter description

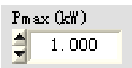
Parameter	Description
Enable	Tick √ : Run this line; Unchecked √ : This line will not run.
Repetitions	Times of repetition
Slope	Illuminance change slope
Ramp UP	Illuminance rise time
Dwell Times	Time to maintain high illumination
Ramp DN	Illuminance drop time
Dwell Times	Time to maintain low illumination
Duration	Total time: Ramp UP + Dwell Times + Ramp DN + Dwell Times + Initial Setup Time



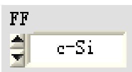
: Set the time to maintain before the initial illumination and temperature change, because it takes a certain time to find the maximum power point under the initial illumination and temperature condition when the inverter just runs.



: Maximum power point voltage, the range depends on the controlled power supply model.



: Maximum power point. The range depends on the type of power supply controlled.



: CSI-technology (silicon photovoltaic panel) and Thin film-technology (Thin film photovoltaic panel) can be selected. The coefficients used in EN50530 built-in formula are different according to different materials.

After setting the above parameters, click 

to generate i-V and P-V characteristic curves, as shown in Figure 4.7.8.

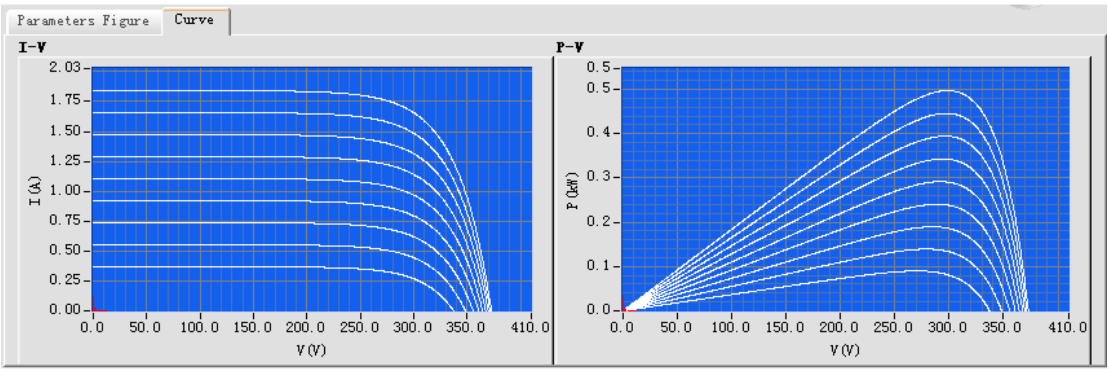


Figure 4.7.8 I-V and p-v characteristic curves under EN50530 standard

4.7.2 Save and read setting parameters

Dynamic mode Each parameter setting screen has operation buttons as shown in Figure 4.7.9. The Save as button is used to save the parameters set in this screen to the table, and the Open button is used to read the parameters previously saved in the table back to the screen, simplifying the steps for users to enter parameters. “File Name” displays the File Name of the table read.

Figure 4.7.9 Save and read

Note: For the table read by using Open button, its internal saved parameters must conform to the interface; otherwise, the reading fails. For example, the internal saved parameters of the table are setting parameters of EN50530 standard, and an error will be reported if the table is read by using Open button in the setting interface of Sandia standard.

4.7.3 Run and MPPT test

Before startup, if Initiate button is not clicked to generate a curve, an error message as shown in Figure 4.7.10 will pop up if the start button is clicked.

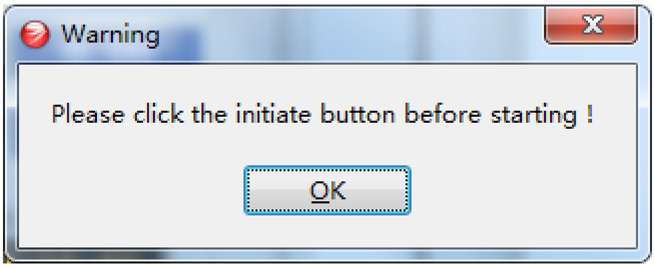
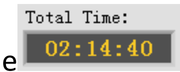


Figure 4.7.10 Error message before startup

Take an ANEVH2250-25 as an example, test with 10-50% Pdcn under EN50530 standard. Parameter Settings are shown in Figure 4.7.11. Set Initial Setup Time=180s, Vmax=400, Pmp=7.000kW, FF = C-SI. Click Initiate to automatically generate the characteristic curve and calculate the Total Time 

. Since only lines 1, 3, 5, 7, and 9 are enabled, the Total Time is the sum of Duration in lines 1, 3, 5, 7, and 9.

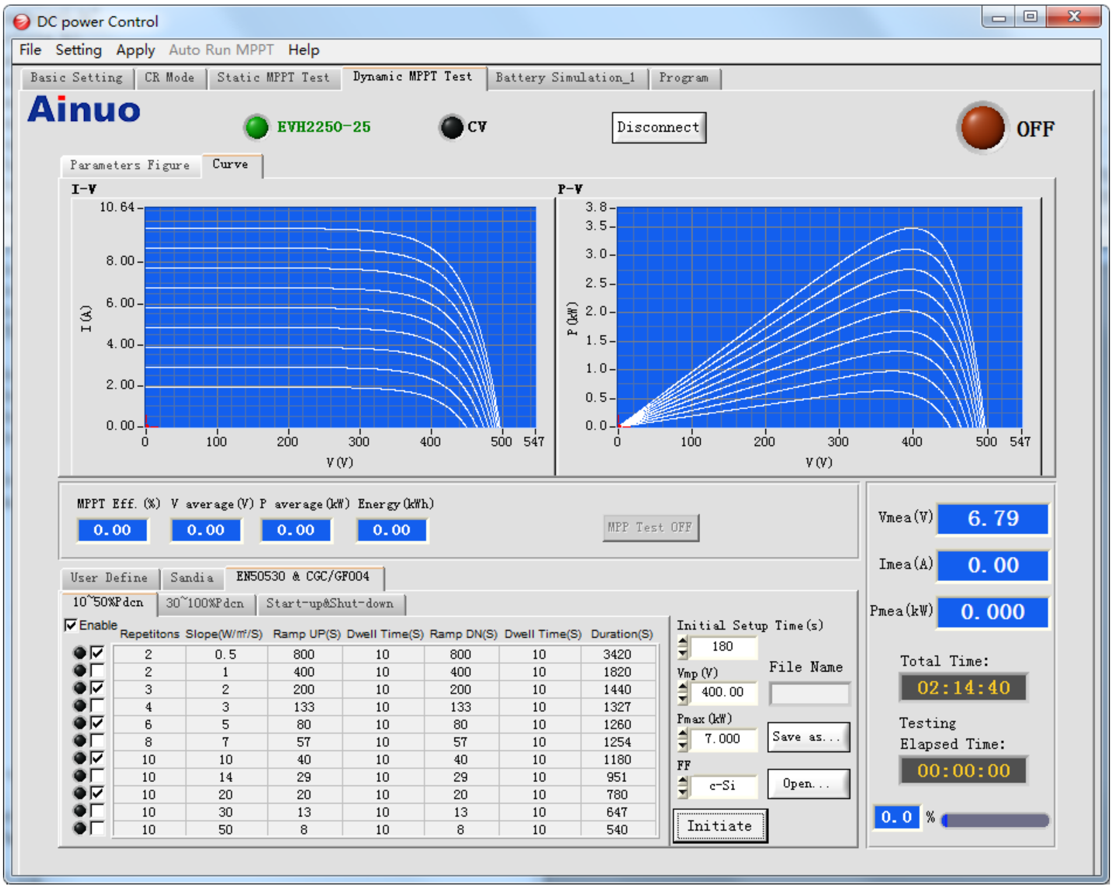


Figure 4.7.11 Parameter Settings of 10-50% Pdcn in EN50530

Click the start button  to start the operation, wait for the inverter to adjust, find the maximum power point under the condition of low illuminance, 180 seconds (Initial Setup Time set) after the automatic test of MPPT efficiency, and the illuminance starts to change, as shown in FIG. 4.7.12, the green curve is the running characteristic curve. The red point is the execution under the current illuminance, and in the P-V curve is the maximum power point under the current illuminance.

Operation process: Taking the first behavior as an example, after 180 seconds (Initial Setup Time), the red measurement point gradually rises from the maximum power point on the characteristic curve under low illumination (100W/m²) to the maximum power point on the characteristic curve under high illumination (500W/m²) with the adjustment of the inverter. This process takes 800 seconds. It then stays at the maximum power point on the characteristic curve for 10s under high illumination (500W/m²). It then descends gradually until it reaches the maximum power point on the characteristic curve under low illumination (100W/m²), which takes 800s, and finally stays at the maximum power point on the characteristic curve under low illumination (100W/m²) for 10s. This process is repeated twice. Run at the following speed after 2 times.

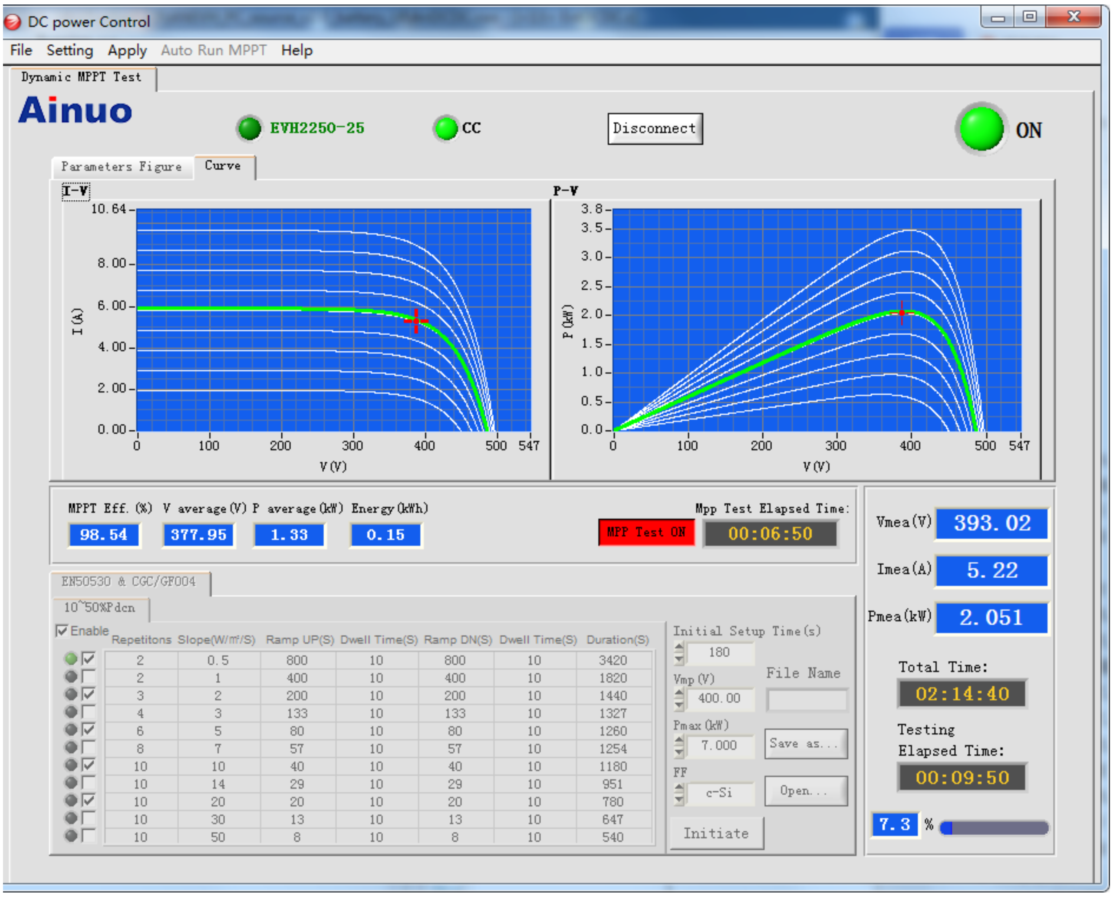
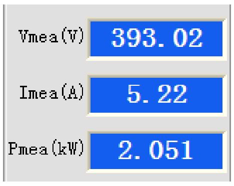
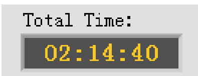


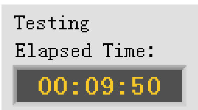
Figure 4.7.12 Dynamic pv operation process



: Output voltage, current and power of the controlled power supply;



: Total running time;



: Run time;

: Run progress, run time/Total run time *100%.

MPPT test: After running for 180 seconds (the set Initial Setup Time), the MPPT efficiency test is automatically started. It must be ensured that the set Initial Setup Time is enough for the inverter to find and stabilize the maximum power point on the characteristic curve under the condition of low illumination; otherwise, the MPPT efficiency test is inaccurate.

Dynamic MPPT efficiency test is continuously tested without human intervention until the enabled row runs out, the next enabled row runs out, and then automatically starts after the next enabled row runs out of the set Initial Setup Time.

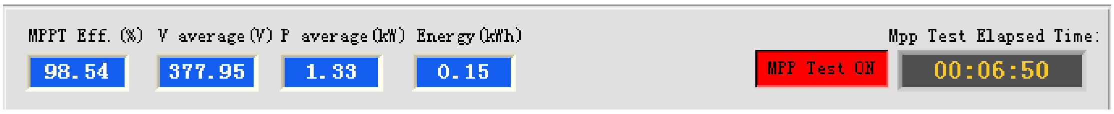


Figure 4.7.14 Dynamic MPPT Efficiency test - enabled

4.8 Sequence test

Sequence test function allows the user to set a series of voltage, current, power, and automatically output to the set rules, better meet the user for automatic test and aging applications. A total of 50 sequences are stored, and each sequence contains 20 steps. Functions of each step can be set independently, including rich control functions such as loop control and slope mode output.

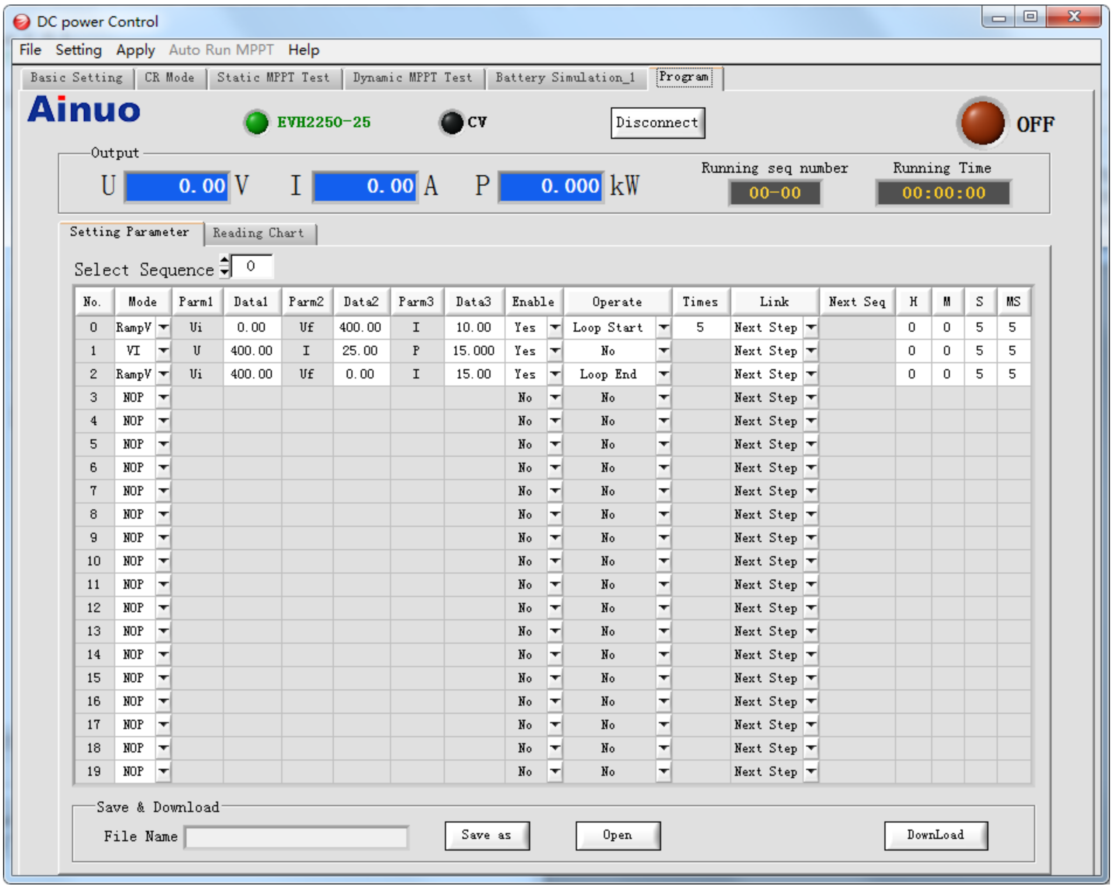
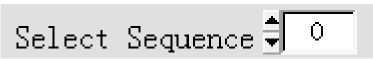


Figure 4.8.1 Sequence test interface

4.8.1 Sequence editor

As shown in Figure 4.8.2, a total of 50 sequences are available for this feature,



is used to select which sequence to set. Each sequence has 20 steps, i.e., lines 0 to 19 of "No."

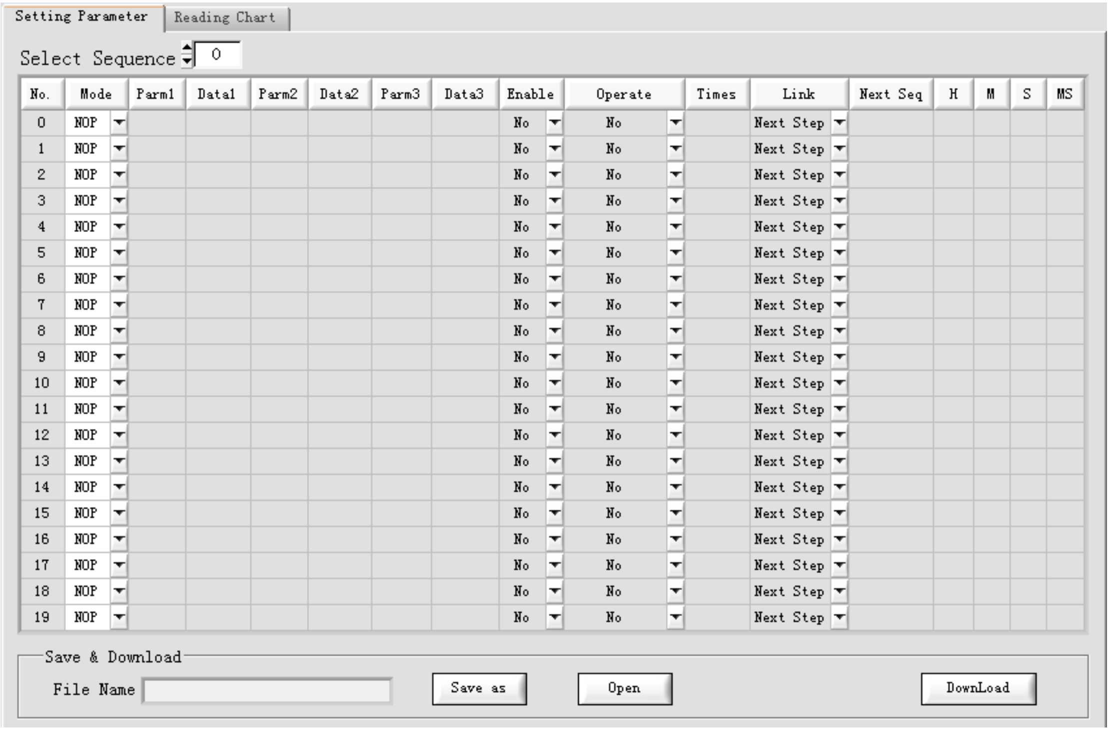


Figure 4.8.2 Sequence editor

“No.”: Lines 0 to 19 are the steps 0 to 19 in the current sequence. If Link is not set, the sequence is executed by default.

"Mode": as shown in Figure 4.8.3, NOP can be selected - this step cannot be used; VI - General mode; RampV -- voltage slope mode; Ramp - Current slope mode.

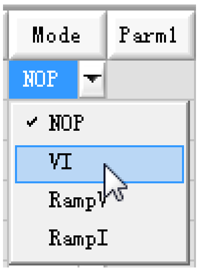
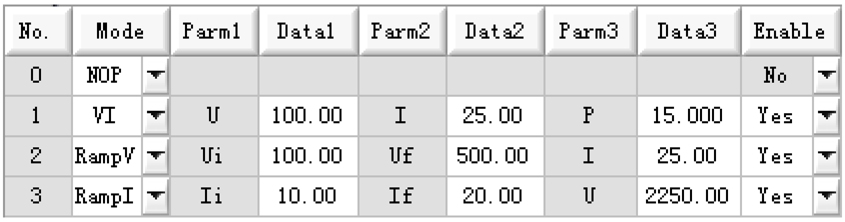


Figure 4.8.3 Select operation mode

“Enable”: Yes - Run this step. No - If this step is not run, the next step is skipped automatically. If the 20 steps in the current sequence are not enabled, the step cannot be run.

After selecting different modes, the parameters to edit change accordingly, as shown in Figure 4.8.4.



No.	Mode	Parm1	Data1	Parm2	Data2	Parm3	Data3	Enable
0	NOP							No
1	VI	U	100.00	I	25.00	P	15.000	Yes
2	RampV	Ui	100.00	Uf	500.00	I	25.00	Yes
3	RampI	Ii	10.00	If	20.00	U	2250.00	Yes

Figure 4.8.4 The interface after mode selection

Line 0: After NOP is selected, "Enable" automatically changes to No. This line is unavailable and cannot be edited.

Line 1: After the VI mode is selected, Enable is automatically set to Yes. For other parameters, see Table 4.8.1.

Table 4.8.1 Parameter description

Parameter	Parm1	Data1	Parm2	Data2	Parm3	Data3
Description	U-voltage	Voltage value	I-current (forward and backward current)	Current value	P-power (forward and backward power)	Power value

Line 2: After RampV mode is selected, Enable is automatically set to Yes. For other parameters, see Table 4.8.2.

Table 4.8.2 Parameter description

Parameter	Parm1	Data1	Parm2	Data2	Parm3	Data3
Description	Ui-start voltage	Start voltage value	Uf-end voltage	End voltage value	I-current (forward and backward current)	The current value proposal set as a maximum of power supply

The output voltage starts at the initial voltage (Ui) and slopes up to the final voltage (Uf) at a set time, running in CV state. During execution, the power supply automatically calculates an appropriate slope control function to drive the power output according to Ui, Uf and the set time.

Line 3: After RampI mode is selected, Enable is automatically set to Yes. See Table 4.8.3 for other parameters.

Table 4.8.3 Parameter description

Parameter	Parm1	Data1	Parm2	Data2	Parm3	Data3

Description	Ii-start current	Start current value	If-end current	End current value	U-voltage	The voltage value proposal set as a maximum of power supply

Output current from the initial current value (Ii), in a set time, gradually slope to the set termination current value (If), need to run in CC state.

Operate as shown in Figure 4.8.5. The options are as follows: No - No other action, Loop Start - Loop Start, Loop End - Loop Stop, Pause - Pause, and Stop - Stop.

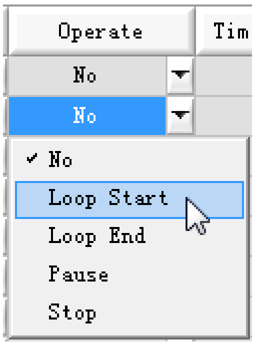


Figure 4.8.5 Operating options

If Loop Start is selected, Times is used to set the number of cycles. The value ranges from 0 to 999. When set to 0, the loop is infinite. If other items are selected, "Times" is unavailable, as shown in FIG. 4.8.6. Select the start of the cycle and set the cycle Times to 5.

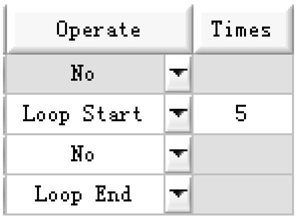


Figure 4.8.6 Loop times

Note: Loop Start and Loop End need to be used together. The number of Times set by "Times" should be repeated for all steps between Loop Start and Loop stop (including the steps where the Loop Start and Loop stop are located). After executing the set number of Times, the following steps of the Loop stop command should be continued. **If loop start is not used in conjunction with loop stop, the sequence will not run as expected by the customer.**

Link: indicates the command to be executed after the current step is complete.

As shown in Figure 4.8.7, Next Step - Perform the Next Step sequentially. If the Next Step is not enabled, skip it and perform the Next enabled Step. If all the steps following the current Step are not enabled, the execution of this Step will stop automatically. Next Seq - Next executes the selected sequence. Use to combine multiple sequences to compose a single test.

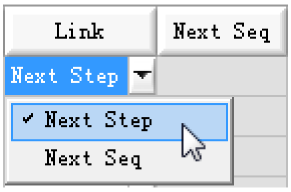
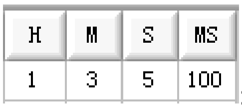


Figure 4.8.7 Link options

If Link is set to Next Seq, Next Seq is available to select the sequence to be executed Next. As shown in FIG. 4.8.8, after executing this step, run to sequence 2. If all steps in sequence 2 are not enabled, it will stop automatically.

Figure 4.8.8 Select the sequence to execute



: Sets the time of each step, namely: hour, minute, second, and millisecond.

4.8.2 Data delivery and storage

After the sequence is set, click DownLoad as shown in Figure 4.8.9 to send the data to the controlled power supply. The delivery process takes about 1 minute, so a message as shown in Figure 4.8.10 will pop up during the delivery: Please wait patiently!

Figure 4.8.9 Data delivery and storage

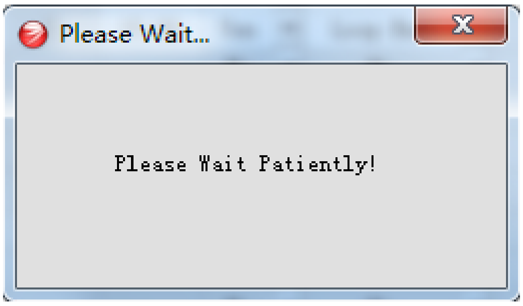


Figure 4.8.10

In order to simplify the process of user input parameters, after the sequence is set, click the Save as button in Figure 4.8.9 to record the set sequence in the table. When the host is opened again, the table can be directly loaded into the interface by reading the table.

After data storage is completed, a dialog box as shown in Figure 4.8.11 will pop up indicating that data storage is successful. Click OK to continue operation panel.

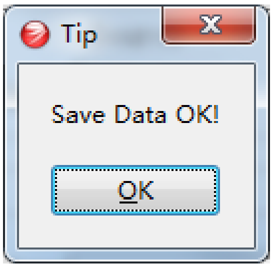


Figure 4.8.11 Data Storage succeeded

Click the Open button in Figure 4.8.9, select the table stored in disk and click "Load" in the dialog box as shown in Figure 4.8.12 to Load data directly into the interface of the upper computer. "File Name" in Figure 4.8.9 is the File Name of the table read. The internal parameter format of the table saved in disk must be the same as that saved in Save as; otherwise, the table cannot be read.

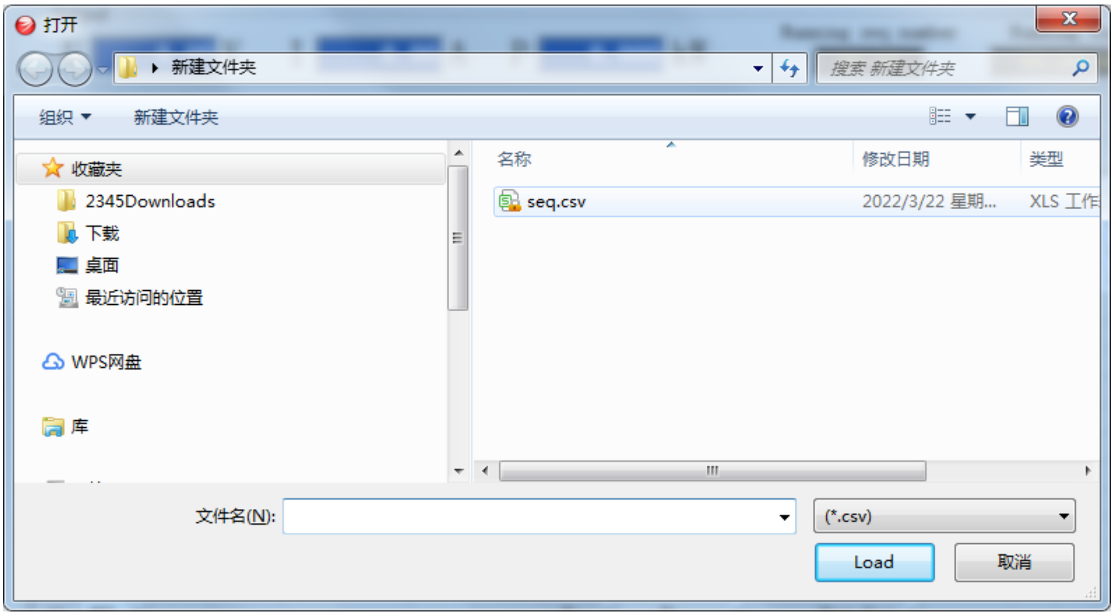


Figure 4.8.12 Storage path

4.8.3 Sequence of the sample

Example 1: Use of loops

The waveform shown in Figure 4.8.13 is a typical cyclic waveform. First, the measured object is output voltage with a certain slope, which lasts for a period of time when the voltage reaches a certain height. Then, the voltage drops to zero in the form of slope, which lasts for a certain period of time, and then the measured object is output voltage with a certain slope, and the cycle continues.

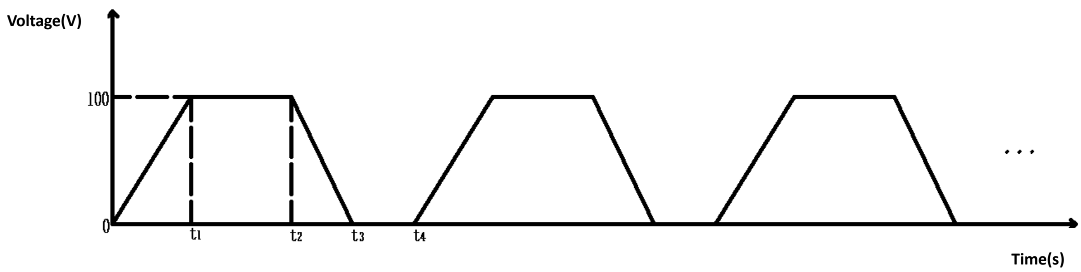


Figure 4.8.13 Example 1 waveform

To realize this waveform, we first need to know how to set each step correctly. It can be seen from Figure 4.8.13 that 0~ T4 is a cycle, and a total of 4 steps need to be set, so a sequence can be used. The specific Settings are shown in Figure 4.8.14.

Select Sequence 0

No.	Mode	Parm1	Data1	Parm2	Data2	Parm3	Data3	Enable	Operate	Times	Link	Next Seq	H	M	S	MS
0	RampV	Ui	0.00	Uf	100.00	I	25.00	Yes	Loop Start	5	Next Step		0	0	4	0
1	VI	U	100.00	I	25.00	P	15.000	Yes	No		Next Step		0	0	5	0
2	RampV	Ui	100.00	Uf	0.00	I	15.00	Yes	No		Next Step		0	0	3	0
3	VI	U	0.00	I	25.00	P	15.000	Yes	Loop End		Next Step		0	0	2	0

Figure 4.8.14 Example waveform implementation Settings

Select Sequence 0 : Select sequence 0 for editing and implementation.

Step 0: 0~ T1, set RampV mode and output from 0V to 100V in slope mode. It takes T1 seconds. Take 4 seconds as an example. For example, set Operate to Loop Start and Times to 5. If you want to Loop indefinitely, set this parameter to 0.

Step 1: T1 ~ T2, set VI mode, keep 100V output T2-T1 seconds, set the time to 5 seconds as an example.

Step 2: T2 ~ T3, set RampV mode and drop from 100V to 0V in slope mode. It takes T3-T2 seconds, taking 3 seconds as an example.

Step 3: T3 ~ T4, set VI mode, keep 0V output T3-T2 seconds, take 2 seconds as an example. This step is the last step in a Loop, so "operate" selects Loop End, meaning five repetitions from step 0 to step 3.

Note: since waveform is the output of voltage, it is necessary to ensure CV state operation throughout the whole process. It is recommended that the current and power be set to the maximum value of the controlled power supply.

After setting the sequence, click DownLoad and send the data to the controlled power supply. The delivery process takes about 1 minute. Please wait patiently. Power on after data delivery.

Example 2: Use of links

The waveform shown in Figure 4.8.15 firstly outputs voltage to the measured object at a certain slope, which lasts for a period of time after reaching a certain height, and then suddenly rises to another voltage, which lasts for a period of time, and finally drops to zero in the form of slope. A sequence of voltage switching cycle tests is then followed.

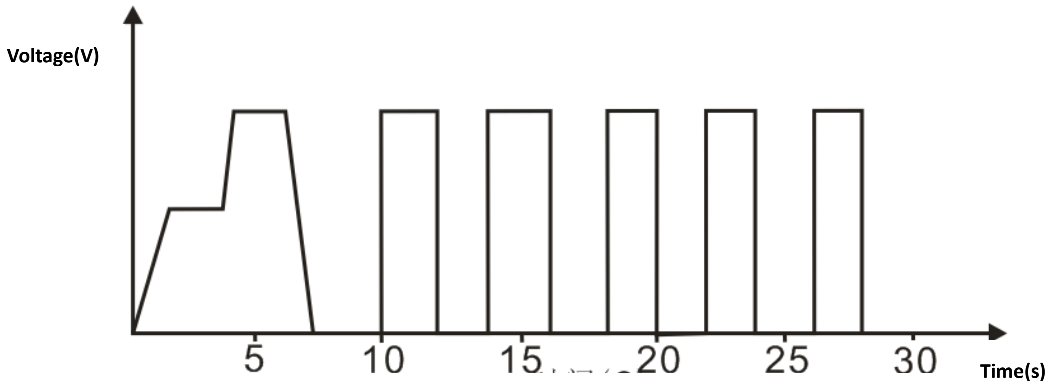


Figure 4.8.15 Example 2 waveform

The waveform in Figure 4.8.15 can be edited in one sequence or implemented with two sequences. In order to demonstrate the use of "Link", two sequences are used to achieve the example 2 waveform by linking. The other implements the voltage output cycle. The specific Settings are shown in Figure 4.8.16 and 4.8.17.

Select Sequence 1

No.	Mode	Parm1	Data1	Parm2	Data2	Parm3	Data3	Enable	Operate	Times	Link	Next Seq	H	M	S	MS
0	RampV	Ui	0.00	Uf	100.00	I	25.00	Yes	No		Next Step		0	0	1	0
1	VI	U	100.00	I	25.00	P	15.000	Yes	No		Next Step		0	0	2	0
2	RampV	Ui	100.00	Uf	200.00	I	25.00	Yes	No		Next Step		0	0	0	500
3	VI	U	200.00	I	25.00	P	15.000	Yes	No		Next Step		0	0	2	500
4	RampV	Ui	200.00	Uf	0.00	I	25.00	Yes	No		Next Step		0	0	1	0
5	VI	U	0.00	I	25.00	P	15.000	Yes	No		Next Seq	2	0	0	2	0

Figure 4.8.16 Sequence 1 settings

Select Sequence 2

No.	Mode	Parm1	Data1	Parm2	Data2	Parm3	Data3	Enable	Operate	Times	Link	Next Seq	H	M	S	MS
0	VI	U	200.00	I	25.00	P	15.000	Yes	Loop Start	5	Next Step		0	0	2	0
1	VI	U	0.00	I	25.00	P	15.000	Yes	Loop End		Next Step		0	0	2	0

Figure 4.8.17 Sequence 2 settings

Select Sequence 1 : Select the first sequence for editing to realize the slope of voltage rise, continue and fall.

Step 0: Set RampV mode and output from 0V to 100V in slope mode. It takes 1 second.

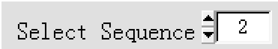
Step 1: Set VI mode and hold 100V output for 2 seconds.

Step 2: Set RampV mode and slope from 100V to 200V in 500ms.

Step 3: Set VI mode and hold 200V output for 2.5 seconds.

Step 4: Set RampV mode and slope from 200V to 0V in 1 second.

Step 5: Set VI mode and hold 0V output for 2 seconds. "Link" is set to Next Seq, and "Next Seq" is set to sequence 2, meaning that after this step, the Next step is linked to sequence 02 to continue execution.



: Select the second sequence for editing, to achieve the voltage output cycle.

Step 0: Set VI mode and hold 100V output for 2 seconds. Select Operate to Loop Start and Times to 5.

Step 1: Set VI mode and hold 0V output for 2 seconds. "Operate" select Loop End (Loop stop).

Note: since waveform is the output of voltage, it is necessary to ensure CV state operation throughout the whole process. It is recommended that the current and power be set to the maximum value of the controlled power supply.

After setting the sequence, click DownLoad and send the data to the controlled power supply. The delivery process takes about 1 minute. Please wait patiently. Power on after data delivery.

4.8.4 Sequence start

Before startup, if the DownLoad button is not clicked for parameter delivery, the prompt as shown in Figure 4.8.18 will pop up if the Start button is clicked.

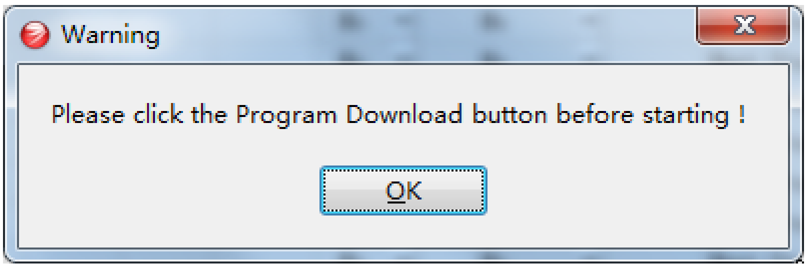


Figure 4.8.18 Error message before startup

Use an ANEVH2250-25 at no load to implement the waveform of example 1 in Chapter 4.8.3.

Click the start button 

to start the operation. During the operation, no parameter can be changed at will. The startup interface is shown in Figure 4.8.19.

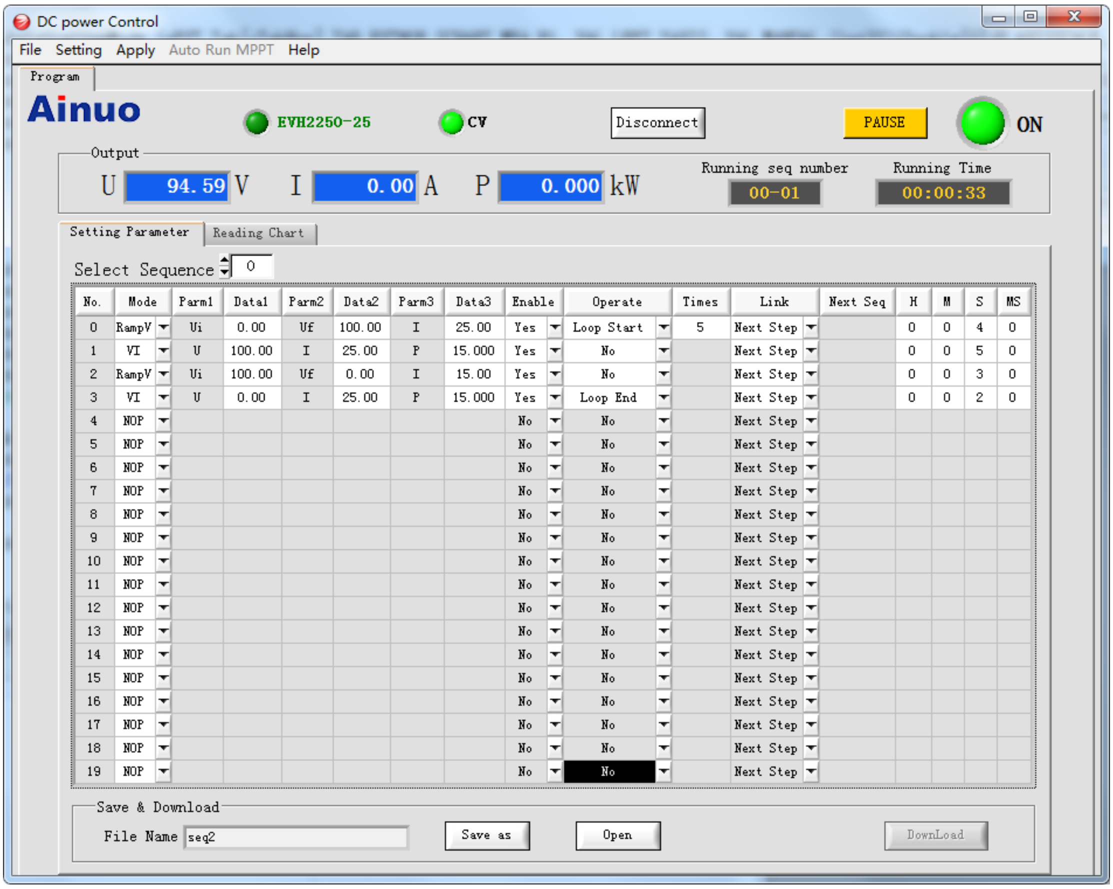
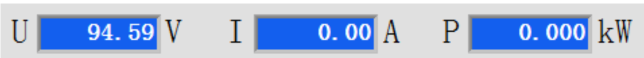


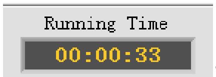
Figure 4.8.19 Start interface

is used to pause and continue sequences.



: Displays the output voltage, current, and power in real time.

: Displays the current running sequence and the number of steps. Let's say we're running step 1 of sequence 0.



: Displays the current running time. For example, it has been running for 33 seconds.

In addition, the curve corresponding to the output voltage, current and power will be updated in real time, as shown in Figure 4.8.20. The voltage curve shows the waveform of Example 1. Double-click the corresponding curve display area to clear the curve.

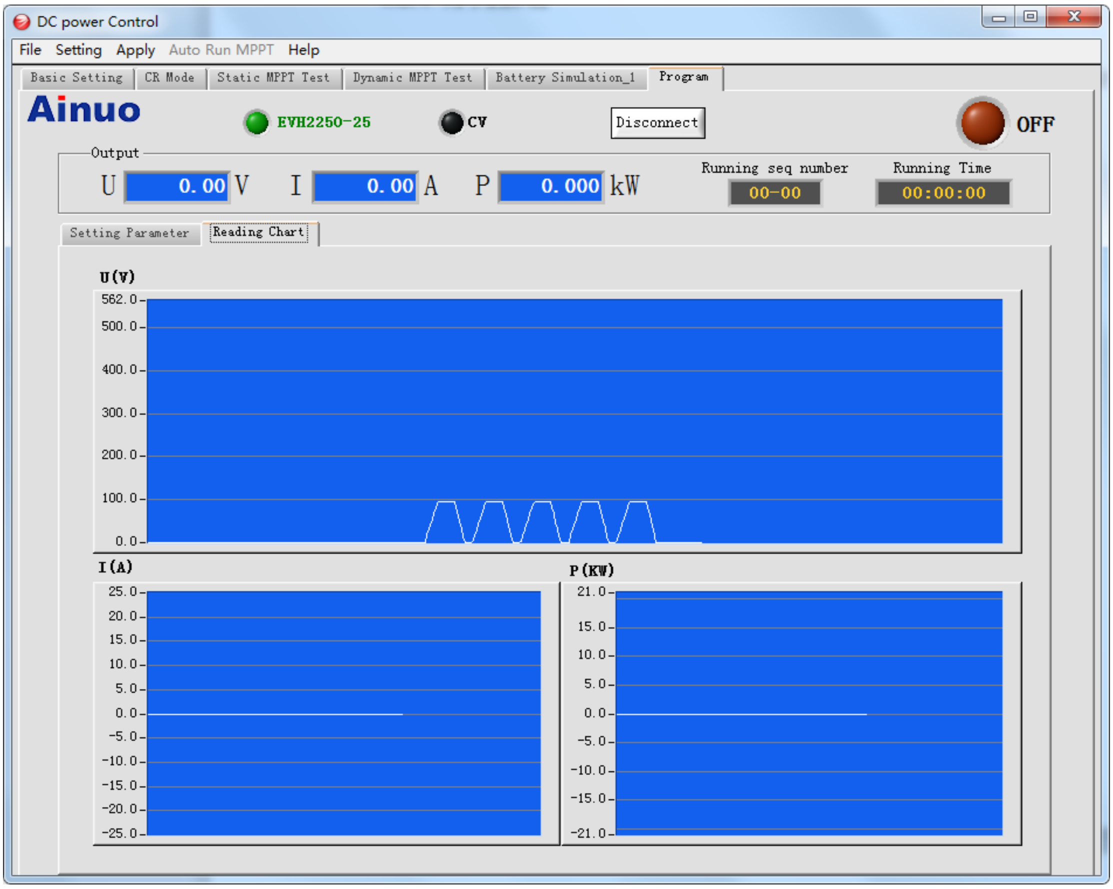


Figure 4.8.20 Output curve

To run a sequence from sequence 1, 

selects sequence 1.

4.9 Alarm prompt

As shown in Figure 4.9.1, connection status, output status and alarm status will be displayed at the top of each function page. When the power supply generates an alarm, for example, the voltage is too high, the alarm light will be red and the alarm code will be displayed. Meanwhile, the clear alarm button 

will be displayed. Click the clear button and the alarm will be cleared.

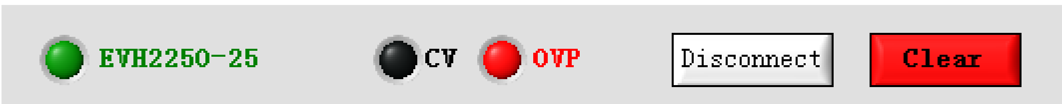


Figure 4.9.1 Alarm display

Table 4.9.1 Alarm code description

Alarm code	Description	Remarks
OVP	Voltage output greater than OVP setting	None
Input is unregulated	Input power supply is abnormal.	Please contact us
OTP	Overheating	Please contact us
U＜Lower limit	The output voltage is lower than the user set minimum voltage	Set the protection value in the power Supply General Settings -> Alarm Settings interface. The computer does not exist temporarily.
U＞Upper limit	The output voltage exceeds the maximum protection value	
I＜Lower limit	The output current is lower than the lower protection value	
I＞Upper limit	The output current exceeds the preset maximum current protection value	