Titan Series Bidirectional Programmable DC Simulation Source

Product User Manual

V2.5

Table of Contents

1. Preface

1.1 Preface

Dear Customer, thank you for choosing our company's Titan series bidirectional programmable DC simulation source. We sincerely hope that this product meets your needs. We also welcome your valuable feedback on the product's performance and functionality. We are committed to continuous improvement, enhancing product performance, and improving the quality of our services.

1.2 About This Manual

1.2.1 Retention and Use

This manual should be kept near the product for easy reference during operation. It must be transferred with the equipment if the storage location or user changes.

1.2.2 Copyright Notice

Reproduction or copying of this manual, in whole or in part, or its use for any other purpose is strictly prohibited. Violators will be held liable for any legal consequences arising from such actions.

1.2.3 Validity

This manual applies to the Titan series of bidirectional programmable DC simulation source products manufactured by our company. Before using this equipment, please read and understand this manual carefully, paying close attention to safety information and operating specifications.

1.3 Safety Instructions

This product's design complies with relevant safety standards and has undergone comprehensive safety testing before being approved for shipment. Failure to follow operating procedures during use may compromise the provided safety features. Therefore, please strictly adhere to the operating procedures.

High temperatures and pressures are present within the system. During the installation, operation, and maintenance of the equipment, local safety regulations and related operating procedures must be followed to avoid personal injury or equipment damage. The safety precautions mentioned in this manual supplement local safety regulations. Our company assumes no liability for consequences arising from violations of general safety operating requirements or safety standards during the design, production, or use of the equipment.

1.3.1 Safety Labels

To remind users of safe operation, the following safety labels are affixed to the power supply. Before using this product, be sure to carefully read the following safety precautions.

	This label reminds users that this product should only be operated or used by trained professionals under supervision; non-professionals are prohibited from operating or using this product.
	This label reminds users that if operation or maintenance is required, avoid contact with areas where hazardous voltage may still be present. For safety reasons, after powering off the product, wait 10 minutes until the voltage drops below 36V DC before performing any operation or maintenance.

1.3.2 Symbols Used

The following symbols in this manual indicate important notices and warnings! Please strictly adhere to all warnings and operating instructions in this manual and on the equipment. Before operating or using this product, please refer to the relevant information in this manual and keep it in a safe place.

	Danger: Risk of electric shock. Incorrect operation may result in severe personal injury or death.
	Caution: Incorrect operation may cause personal injury or damage to the product.

1.3.3 Precautions

Carefully read and understand the following safety precautions before operating the equipment.

	● To avoid electric shock, do not expose the power supply to moisture, and do not touch or operate it with wet hands. ● It is Prohibited to touch the Power supply input and Output terminals or any areas marked with high-voltage warning signs; doing so could result in electric shock. ● Only technical personnel authorized by the company should modify or repair this product; unauthorized modifications or repairs may create a risk of electric shock.
	● To ensure user safety, the Power supply chassis must be properly grounded. Ensure reliable grounding before use. ● The Power supply's input and Output terminal screws must be tightened to prevent overheating and potential fire hazards. ● Before moving the equipment or replacing cables, disconnect the Power supply and wait 10 minutes after shutdown to avoid electric shock. ● To prevent product damage, avoid subjecting the product to strong impacts during transportation and operation, especially impacts from dropping it. ● Please ensure that the air inlet and outlet are unobstructed. Poor ventilation of the air inlet and outlet will cause the internal temperature to rise, shortening the lifespan of the internal components, and consequently affecting the overall lifespan of the unit. ● The use of defective, cracked, worn, or damaged power cords is strictly prohibited. If any are found, please contact personnel immediately. ● In the event of a fire in or around the power supply, first disconnect the power supply, and then use a dry powder fire extinguisher. Never use a liquid fire extinguisher, as this could create a risk of electric shock. ● This unit is a dedicated power supply and should not be used to power other loads, as this may lead to unforeseen consequences.

1.4 Personnel Requirements

Operators must undergo professional training and be familiar with electrical safety regulations and professional operating skills. Operators must read this manual in its entirety to understand the product's safe operating procedures. Because this series of products involves high Voltage, operators must wear personal protective equipment, including insulated gloves and shoes.

2. Product Introduction

2.1 Introduction

The Titan series bidirectional programmable DC simulation source is a bidirectional programmable DC source launched by AE Power Systems Co., Ltd. of Xi'an, hereinafter referred to as the "TD series DC simulation source." It can supply energy to the load and return all energy from the load back to the grid. Utilizing high-frequency switching devices, fully digital controllers, and other advanced technologies, it exhibits excellent dynamic characteristics. The main product is the TD series Battery simulator.

The TD series Battery simulator is a high-precision, high-dynamic, and high-real-time Power supply designed for comprehensive Battery characteristic simulation. Featuring powerful software functions, it offers a variety of Battery simulation capabilities, comprehensively simulating Battery Output characteristics. It also boasts robust Programming functions, allowing for the simulation of diverse waveform Outputs via Step, List, and Wave Programming methods to meet the testing requirements of various industries, including electric vehicle motors, controllers, and energy storage converters.

2.2 System Structure

The main circuit block diagram of this Power supply is shown in Figure 1-1 and primarily consists of a soft-start circuit, a power frequency transformer, a PWM converter, and an Output chopper. The main functions of each part are as follows:

- Soft start circuit: achieves zero impact on the power grid during power supply startup;
- Power frequency transformer: primarily provides voltage level conversion and input/output isolation;
- PWM converter: rectifies AC voltage into DC bus voltage and can feed load energy back to the power grid;
- Output chopper: converts the bus voltage into a controllable DC voltage output.

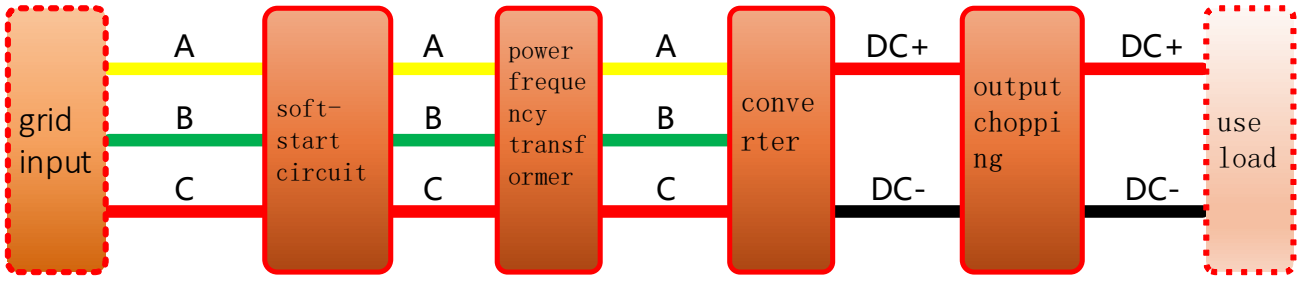


Figure 1-1 Power Supply Main Circuit Block Diagram

Figure 1-2 is a simplified diagram of the power supply's topological structure. Due to variations in output parameters, modules may be connected in series or parallel depending on the model.

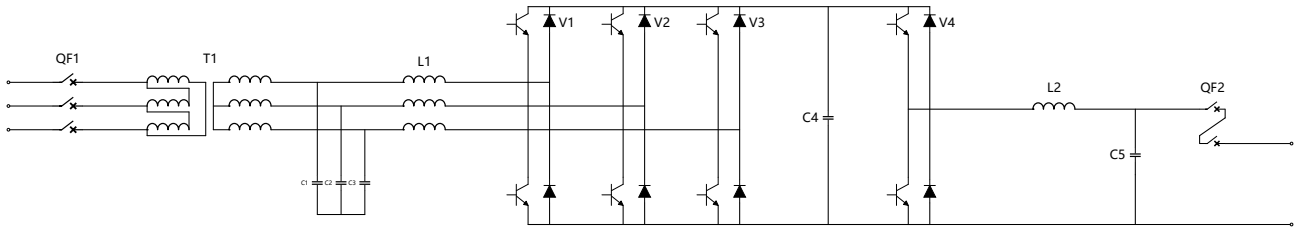


Figure 1-2 Power Supply Topological Structure Simplified Diagram

2.3 Product Highlights

- High precision: Voltage accuracy ±0.1% F.S., Current accuracy ±0.1% F.S.;
- High dynamic performance: TD series products feature a load rise/fall time (10%~90%) of 2ms, a positive/negative load switching time (-90%~90%) of 4ms, and a voltage slew rate of 300V/ms.
- High real-time performance: 1ms instruction update rate.
- Comprehensive Battery simulation: Simulates 7 common Battery types; Features open 1st, 2nd, and 3rd order RC Battery models; Supports importing Simulink Battery models.
- Features powerful general Programming capabilities.
- Multiple units of the same model can be connected in Parallel to increase Output capacity and facilitate Capacity upgrades.
- Multiple communication interfaces: RS485/LAN/CAN.

2.4 Model Information

2.4.1 Model List

Table 2-1: Model List

Model	Power (kW)	Output Voltage (V)	Output Current (A)	Dimensions (mm) Width x Height x Depth	Weight (kg)
TD300-1k5-04	±300	20~1500	±400	2010×1955×1200	2850
TD400-1k5-06	±400	20~1500	±600	2010×1955×1200	2850
TD500-1k5-07	±500	20~1500	±700	2010×1955×1200	2850
TD600-1k5-08	±600	20~1500	±800	3410×1955×1200	5080
TD750-1k5-10	±750	20~1500	±1000	3410×1955×1200	5080

2.4.2 Naming Convention

Example: TDXXX-1k5-XX

TDXXX: T is short for “Titan”, D is short for ACTIONPOWER DC source, and XXX represents the Power level in kW. For example, TD500 represents an ACTIONPOWER “Titan” series DC source with a Rated power of 500kW.

1k5: Indicates the Output Voltage level, i.e., the Rated Voltage is 1500V.

XX: Indicates the Output Current level; for example, 07 indicates a maximum Current of 700A.

2.4.3 Technical Specifications

Technical Name	Category	Content
Basic Parameters	Output Mode	CV, CC, CP, CR, Programming, Battery simulation function
	Energy Feedback	Receives load energy and feeds the energy back to the power grid.
	Isolation function	Electrical isolation between input and output
	Parallel function	Multiple units of the same model can be installed in parallel.
DC Output		
Voltage	Setting resolution (V)	0.01
	Accuracy	±0.1% F.S.
	Ripple (RMS)	0.1% F.S (Resistive load)
	Voltage slew rate	300 V/ms
	Setting resolution (V)	0.01
	Accuracy	±0.1% F.S.
	Ripple (RMS)	0.1% F.S. (Resistive load)

Current	Current slew rate	500 A/ms
	Rise time	≤2ms (10% to 90% Rated current)
	Switching time	≤4ms (-90% to +90% rated current switching)
Battery simulation	Battery Type	It can simulate different types of batteries, such as Lithium Manganate, Lithium Cobalt Oxide, Lithium Iron Phosphate, Nickel-Hydrogen, Ternary Lithium, Lithium Titanate, and Lead-Acid batteries. Supports user-defined battery types and open first, second, and third-order RC battery models.
	Parameter	Parameters such as the number of batteries in series, the number of batteries in parallel, Initial State of Charge, Initial Temperature, Internal Resistance, and Battery Capacity are supported.
	Import/Export	Supports CSV format import/export of battery types and parameters.
Virtual Internal Resistance	Range	-2 to +2 Ω
	Resolution	1 mΩ
Universal Programmable	Programming Steps	1000 Steps
	Programming Parameters	Voltage/Current, Rise Time, Hold Time, Trigger Pulse Output
	Rise Time Range	1 ms - 99999 s
	Top Time Range	1 ms - 99999 s
	Minimum Programming Time Step	1 ms
	Edit Mode	Add, Delete, Import, Export
	Operating Mode	Run, Stop, Cycle
	Trigger Mode	Auto, Manual, External
Measurement	Voltage Accuracy	±0.1% F.S.
	Voltage Resolution (V)	0.001
	Current accuracy	±0.1% F.S.
	Current resolution (A)	0.001
	Power accuracy	±0.2% F.S.
	Power resolution (kW)	0.001
	Connection mode	Three-phase, three-wire ABC+PE
	Frequency (Hz)	47 - 63

AC input	Voltage range (V)	400 v±10%
	Power factor	0.99 @ full load
	Efficiency	Models 300kW and above: > 94%; other models: > 90%.
	Harmonic current	≤3%
Other	Protection functions	OVP、OCP、OPP、OTP
	Communication interface	Standard configuration: LAN; Optional: RS485, CAN
	External Interlock	External interlock input normally open/closed; external interlock output normally open/closed.
	Trigger signal	Trigger Input/Output
	Control and Display	Touch screen control and remote host control; displays Voltage, Current, Power, and operation trend charts.
	Bleeder Resistor Cabinet (optional for systems below 1000V only)	In the event of an abnormal system operation, energy will be released through the bleeder resistor cabinet to ensure the safety of the device under test.
	PDU Compensation Cabinet (optional for systems below 1000V only)	Voltage drop caused by cable impedance and Voltage ripple generated by the device under test.
	Insulation and Withstand Voltage	≥3MΩ/DC500V; Input to Output 5400VDC/1min
	Cooling method	Forced air cooling
	Operating temperature	-10 ℃ ~ 40 ℃
	Relative humidity	10% ~ 90%, non-condensing
	Altitude	≤2000 m
	Indoor, outdoor	Indoor use only, suitable for dry environments
	Protection level	IP20
	Noise (dB)	<750kW: No load 70; Half load 75; Full load 80 ≥750kW: No load 70; Half load 75; Full load 85

2.5 Typical Applications

- Electric vehicle industry: Motor drive testing, transmission and powertrain testing.
- Battery simulation: Testing of battery packs, recyclers, and battery performance.
- Capacitor and supercapacitor testing: Testing of capacitance and energy storage devices.

- On-board charger and EVSE testing: Testing of Electric Vehicle Supply Equipment (EVSE) and charging systems.
- Bidirectional converter testing: Testing of bidirectional power converters.
- Marine electric drive system: Testing of marine electric propulsion and drive systems.
- Energy-saving applications: Replacing actual Battery Power supplies in energy-saving scenarios.
- Automated Test System (ATE): Power supplies for factory automation and production line testing.

3. Host computer operation and usage

3.1 Power On

Before powering on the DC simulation Power supply, please refer to the detailed installation instructions and initial power-on steps in the *Titan series* Bidirectional Programmable DC simulation source Product Installation Manual.

3.2 Host Computer Usage Instructions

3.2.1 Data Source

- The *TD series* DC simulation source actively uploads simulated source Running Data, operating status, and Fault alarm information via the controller.
- The operating parameter settings for all DC simulation sources can be modified by the operator via the settings interface.

3.2.2 Host Computer Overview

The main features of the DC power supply host computer are as follows:

- Real-time monitoring: Continuously monitors the running status, data, and fault alarms.
- Fault alarm storage: Records and stores fault alarm information.
- Parameter setting: Allows operators to set and adjust the operating parameters of the power supply through the software interface.

The main functions of the Titan series DC simulation source host computer include CV, CC, CP, CR, and Battery simulation. Constant voltage, Constant current, Constant power, and Constant resistance are the basic output modes. The steady-state parameter interface is the default view when the software is first launched.

3.2.3 Screen Layout

As shown in Figure 3-1, the Host computer Interface Diagram, and Table 3-1, the Host computer Interface Annotation Table, the entire Interface is divided into the following sections:

Table 3-1 Host computer Interface Annotation Table:

No.	Name	Description
1	Operation Bar and Status Bar	Basic start/stop functions, reset operations, and System Status monitoring
2	Option Bar	Function selection and basic Settings
3	Navigation Window	Displays the global device name and channel Power supply operating conditions

4	Setting Window	Used for assigning and distributing Output Data for the Power supply
5	Limit Parameters	Used to set Parameter limits for Power supply operation
6	Output Operation Bar	Used for closing and opening the Power supply Output Switch and Output Standing, etc.
7	Desktop	Real-time monitoring of Voltage, Current, and Power Running Curve.

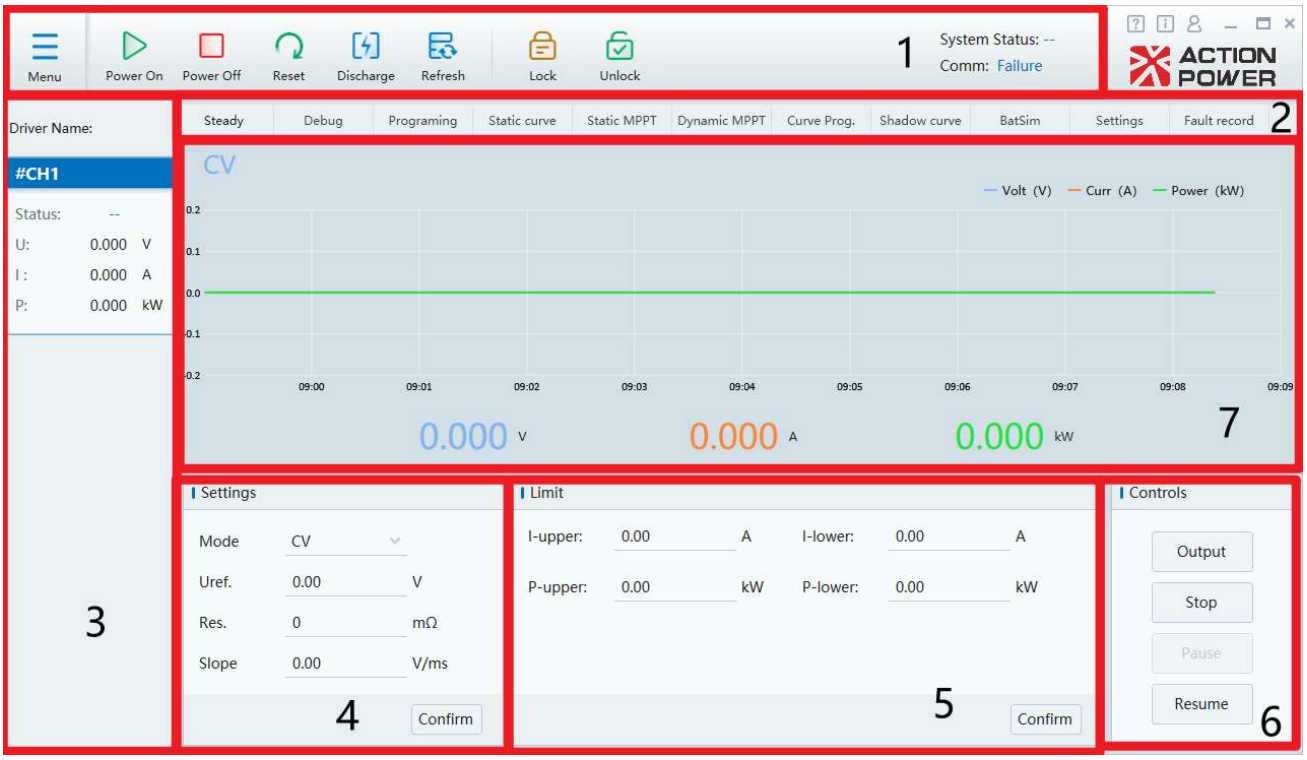


Figure 3-1 Host computer Interface Diagram

3.2.4 Advanced Settings

Parameter Setting before operation is mainly done in the advanced Setting Interface, which requires the Power supply to be in the Shutdown state. See Host computer advanced Setting Interface Figure 3-2.

3.2.4.1 System Status Identification and Confirmation

Table 3-2 System Status Identification and Confirmation Table:

Name	Function and Role
System Status	Indicates the current System Status of the device, which is divided into five types: Shutdown, Standby, Running, Reset, and Fault. Shutdown: Indicates that the device is fault-free and not operating. Standby: Indicates that the Power supply rectifier is on, but the Output Switch is not closed. Running: Indicates that the Power supply Output Switch is closed, and the Output is normal. Reset: Reset can restore the device to Standby state. When a Fault has been investigated and resolved, the user can click the Power/Reset button or use the function to restore the device to the Standby state. Fault: The device has a fault and has not been reset.
Communication Status	"Normal" indicates a normal communication connection. "Fault" indicates a communication failure; check the Ethernet interface connection and communication settings.
Parallel Connection Mode	Depending on the configuration, the system can operate in full parallel or series-parallel modes. The device can be set to single, master, or slave mode as required.
Parallel Connection Status	Includes handshake waiting, normal operation, overcurrent, overvoltage, undercurrent, undervoltage, series-parallel inconsistency, medium line N column, etc.

3.2.4.2 Parameter Settings

Table 3-3 Advanced Parameter Settings:

Name		Function
Channel and Parallel Connection Settings	Parallel Connection Mode	It is divided into full parallel and series-parallel configurations, depending on the operating mode.
	Port 1	Sets the device column parallel connection status. There are three options: standalone, master, and slave, which should be selected according to the application.
	Port 2	Sets the device row parallel connection status. There are three options: standalone, master, and slave, which should be selected according to the application.
Protect Equipment		Set the upper and lower protection limits for voltage, current, and power, as well as the protection time.

Communication Settings		Used for switching between local and remote control, and for selecting the communication interface.

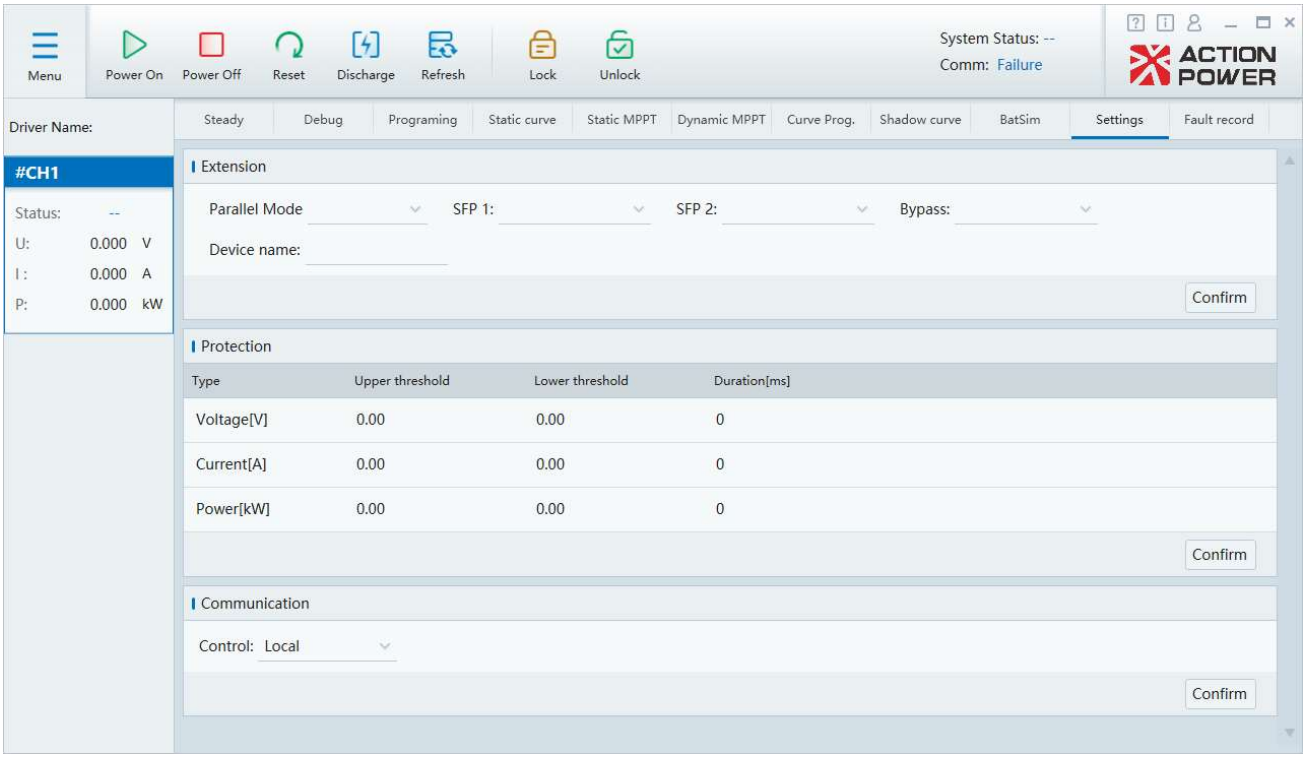


Figure 3-2: Advanced Settings Interface Diagram

3.2.5 Menu Function Introduction

The above system describes how to use the power supply and the application of each functional block. This section briefly introduces the function and usage of commonly used menu functions. See Figure 3-3 below for functional modules.

Figure 3-3 Menu Function Interface Diagram

- Power On: Used to start the rectifier and put the power supply into standby state.
- Shutdown: Used to shut down the rectifier and put the power supply's main circuit into the shutdown state.
- Reset: Typically used after troubleshooting a fault, requiring the software to requery the device status.
- Discharge: After the device is shut down, if personnel need to replace cables, troubleshoot faults, or perform equipment maintenance, for safety reasons, click the “Discharge” button. The device will automatically discharge based on the circuit's energy until the Bus Voltage is below 29VDC.

- Refresh: Used when the interface data updates slowly; not commonly used.
- Lock/Unlock: To prevent accidental changes to user-defined parameters during operation, this series of devices includes
- Add a “Lock” button. When clicked, the display parameters become read-only; only browsing is permitted. Click the “Unlock” button to exit the locked state.

3.2.6 Fault Inquiry

The fault list displays historical and current faults, sorted by time with the most recent fault listed first. When a fault occurs, the first entry displays specific fault information, and the fault status indicates that a fault has occurred. The fault is cleared after a reset. The fault log can record up to 1000 entries. When a fault occurs, the running status bar in the upper left corner displays "Fault" in red. Switch to the menu bar to view detailed fault information, as shown in Figure 3-4.

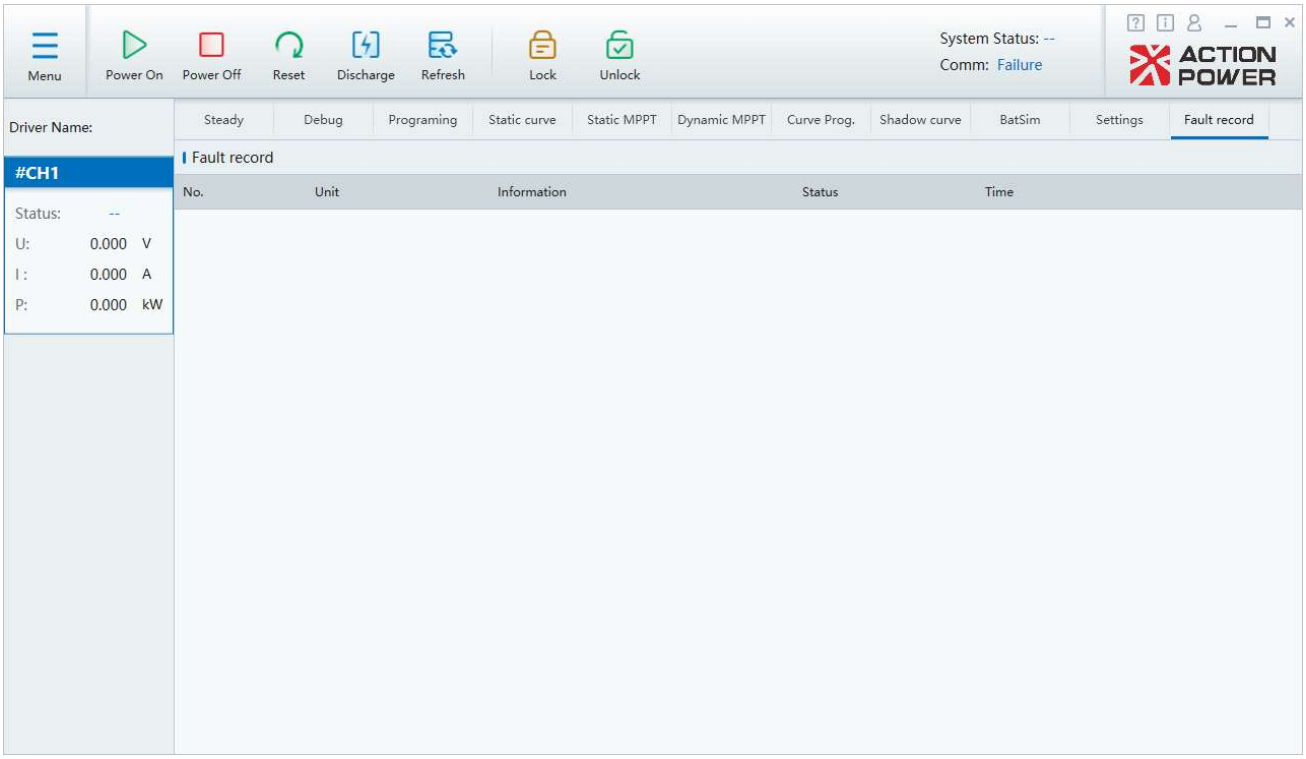


Figure 3-4 Fault Record Interface Diagram

3.3 Host Computer Function Usage

3.3.1 General Functions

3.3.1.1 Steady-State Output Operation

After completing the parameter settings, return to the “Steady-State Parameter” interface to configure the power supply operation, as shown in Figure 3-5:

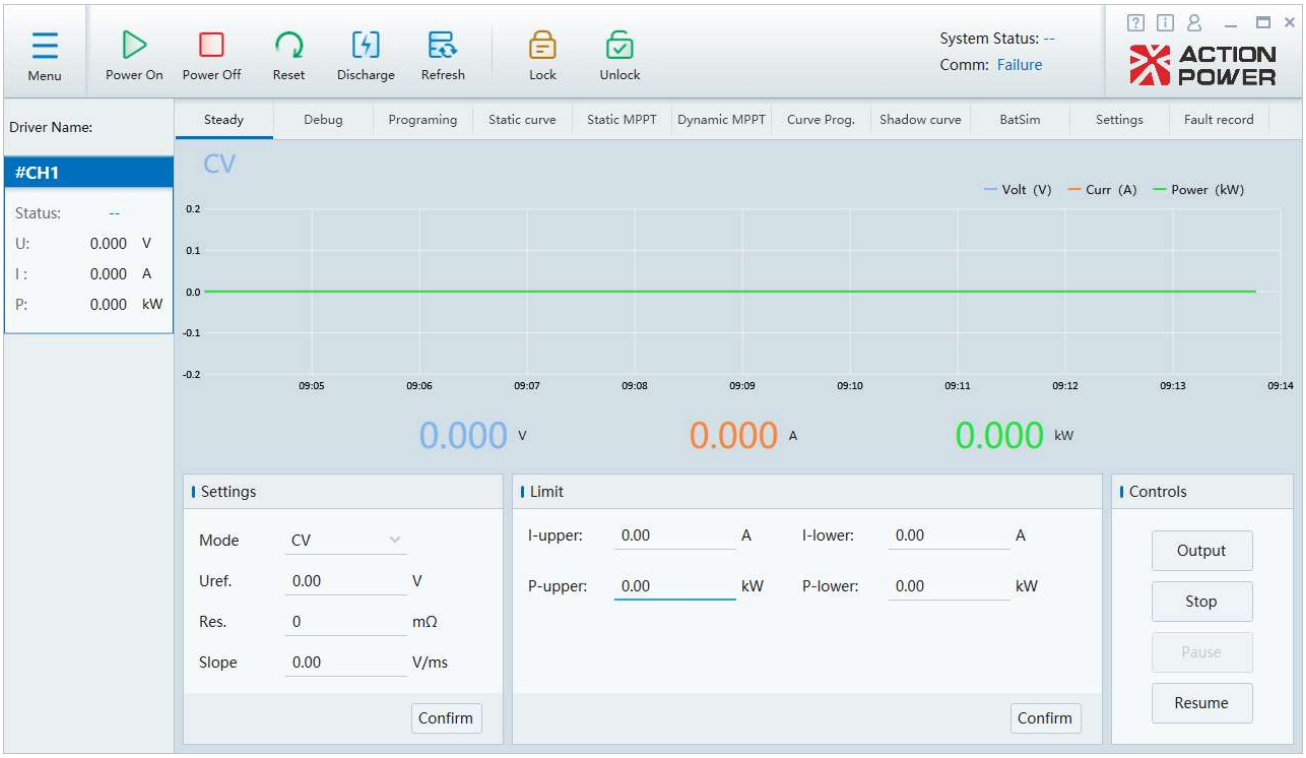


Figure 3-5 Steady-State Operation Interface Diagram

3.3.1.1.1 Limit Parameter Settings

You can set output limits for voltage, current, and power according to the test specifications. When the output of a parameter reaches its limit, a red dot will appear before the parameter on the interface, indicating that the parameter's output has been limited. The power supply will not shut down.

For example, in Constant Voltage Mode, if the upper current limit is set to 100A, increasing the setpoint will cause the output current to reach a maximum of 100A. The device will then enter Constant Voltage Current Limit Mode. To exit the limit mode, increase the current limit or change the setpoint.

If a red dot appears before a value on the power supply monitoring interface, it indicates that this value has been limited.

In addition, Constant Voltage with Power Limit, Constant Current with Voltage Limit, Constant Current with Power Limit, Constant Power with Current Limit, and Constant Power with Voltage Limit are also available as operating modes.

3.3.1.1.2 Initial Output Setting

- Operating Mode: The TD series DC simulation source supports Constant Voltage (CV), Constant Current (CC), Constant Power (CP), and Constant Resistance (CR) modes. Select the desired mode from the drop-down menu, and click 'Confirm' to send the data.
- Initial Setting: Double-click the setting value to display the keyboard as shown in Figure 3-6. Enter the desired value directly, and click 'ENT' when finished. After the keyboard closes, verify that the setting value has changed, and then click 'Confirm' in the output setting to send the parameters.

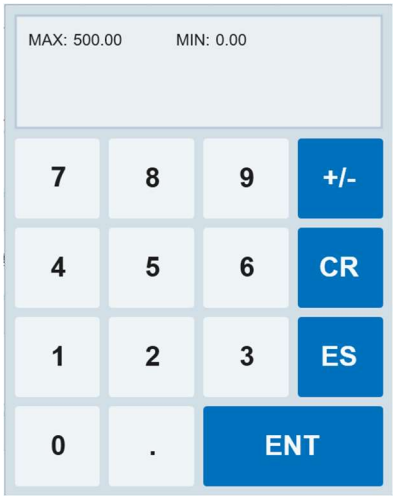


Figure 3-6 Host computer keyboard Interface diagram

Note: On the keyboard, positive and negative can be switched using "+/-"; "CR" indicates clear; "ES" indicates cancel; "ENT" indicates that the parameter has been sent.

- **Slope setting:** Enables the output to increase according to the specified slope.

  If the running mode is set to "Constant Voltage Mode", the output voltage slope is specified in units of "V/ms". For example, if set to 100V/ms, the rise time of the output voltage from 100V to 500V will be 4ms.

  If the running mode is set to "Constant Current", the output current slope is specified in units of "A/ms". If the running mode is set to "Constant Power Mode", the output power slope is specified in units of "kW/ms".

- **Internal resistance setting:** When the power supply is set to Constant Voltage Mode, it exhibits a certain internal resistance, in units of mΩ (range:-1000 ~ 1000). This option is not applicable to Constant Current and Constant Power modes.

3.3.1.1.3 Starting the Power Supply

After confirming that the above Settings are correct, the Power supply can be started.

- **Start the rectifier:** Click the “Power On” button in area 3 of the Interface shown in Figure 3-3. When the “System Status” in the upper right corner of this area displays “Standby”, you can prepare for the next operation. At this time, only the rectifier is started; the Power supply has no Output yet.
- **Output operation:** After completing the previous step, click the “Output” button in area 4 of the Interface shown in Figure 3-3. The Output Switch will engage, and when the “System Status” in the upper right corner displays “Running”, the Power supply will Output normally.
- **Stop Output (select one of the following two options as needed):**

Stop: Click the “Stop” button in the Interface area of Figure 3-3 to disengage the Output Switch and stop the Output.

Standing: Click the "Standing" button in the Interface area shown in Figure 3-3. The Output Switch remains on;

only pulse blocking is activated, stopping the Output. Click the "Resume" button to immediately return to the previous operating state.

3.3.1.1.4 Power supply Shutdown

Shutdown: Click the "Shutdown" button. The "System Status" in the upper right corner of the area will display "Shutdown". The Power supply is now off. (It is recommended to press the Shutdown button after stopping the Output.)

3.3.1.2 General Programmable Functions

General Programming primarily includes three Programming types in Constant voltage or Constant Current mode: Step, List, and Wave. Each Programming type supports 100 00 cycles. List and Wave support 1000 Data steps, as shown in Figure 3-7 below. The following sections detail the operating procedures:

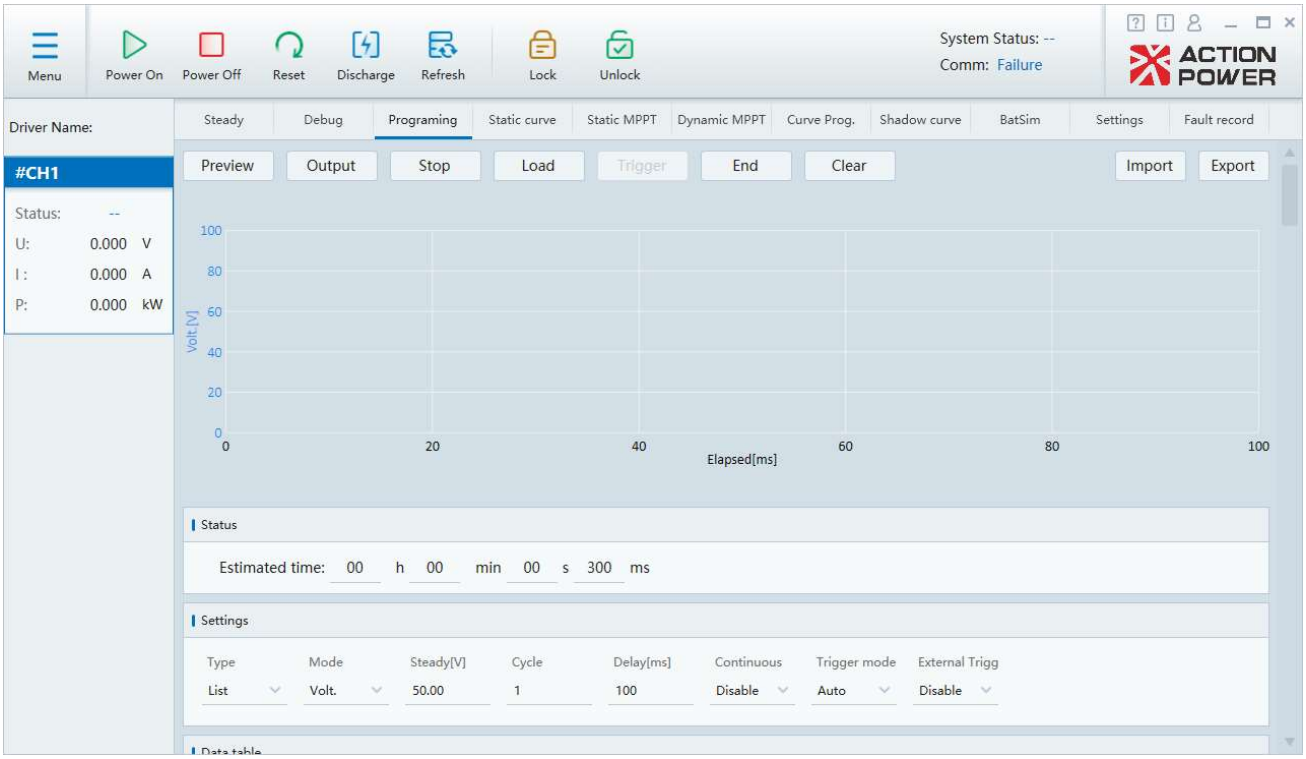


Figure 3-7 General Programmable Interface Diagram

3.3.1.2.1 Programming Setting (Using Voltage Programming as an Example):

3.3.1.2.1.1 Step Programming:

A 'step' describes the function of incrementally increasing or decreasing the output value by a fixed amount until a final value is reached. This function is suitable for precisely measuring over/undervoltage and overcurrent protection thresholds, allowing users to quickly identify critical protection values.

Configure the settings according to the following steps:

Step 1: Set the initial voltage for programming.

Step 2: Set the final voltage for programming.

Step 3: Set the voltage increment. As shown in Figure 3-8, a setting of '2' indicates a voltage increment of 2V.

Step 4: Set the hold time, which is the duration the voltage is maintained after each step change.

Step 5: Set the number of loops to specify how many times the programmed curve should run.

Step 6: Set the steady-state voltage, which is the voltage value before programming starts and after it ends.

Step 7: Set the trigger time. This is the delay after a trigger before the programming sequence begins. For example, a steady-state voltage of 50V and a trigger time of 100ms means the voltage will be 50V for 100ms before the programmed curve begins.

Step 8: Trigger settings: When continuous triggering is set to “Enable,” the programming sequence can be re-executed by clicking the trigger button after the sequence completes. When continuous triggering is set to “Prohibited,” the programming data must be reloaded before the trigger can be activated. When the trigger mode is “Automatic,” the programming steps are executed sequentially and continuously. When the trigger mode is “Manual,” each trigger click executes only one programming step. When external triggering is enabled, the programming executes in response to an external trigger signal.

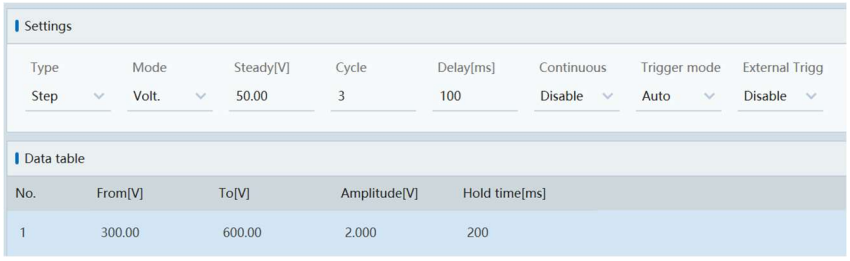


Figure 3-8 Step Setting Interface

Programming Example:

As shown in the Programming Data in Figure 3-9, the initial Steady-state Voltage is 50V. After a Trigger Delay of 100ms, the Voltage rises to 100V. The resulting Programming profile is shown in the coordinate diagram in Figure 3-10. The Voltage remains at 100V for 50ms, then changes to 200V. The Voltage remains at 200V for 50ms, then changes to 300V, and so on. After Programming End, the Voltage returns to 50V.

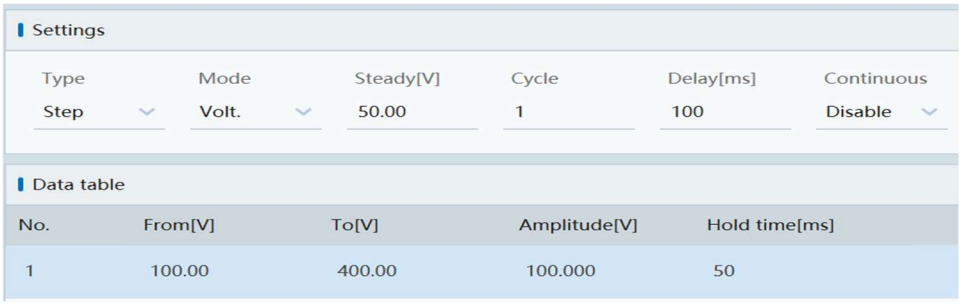


Figure 3-9 Step Programming Example

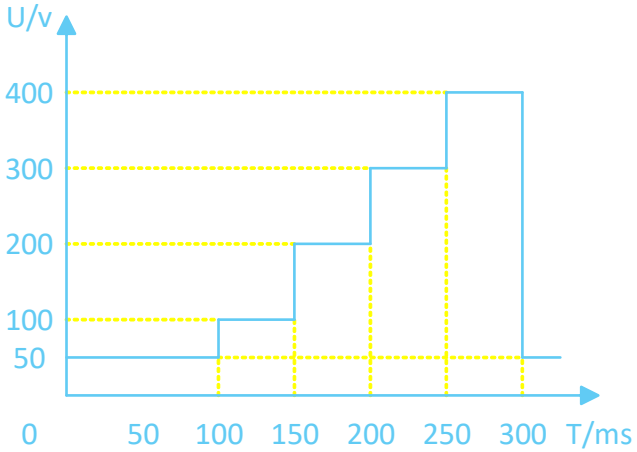


Figure 3-10 Step Programming Example Result

3.3.1.2.1.2 List Programming:

The List function programs a set of Curves that define the relationship between Time and Amplitude. Up to 1000 sequences of Voltage and Current Data can be programmed.

Configure the settings according to the following steps:

Step 1: Set the initial voltage for a single step.

Step 2: Set the final voltage for the single step.

Step 3: This indicates the hold time for the voltage after each step is completed. As shown in Figure 3-11, a hold time of 50ms is set, meaning that after holding for 50ms, step NO.1 proceeds to the next programming step, NO.2. (The difference from Step programming is that the hold time for each step can be set independently.) Step 4: Click '+' to increase the number of programming steps, and click '-' to decrease the number of programming steps.

The remaining settings are the same as the steps above.

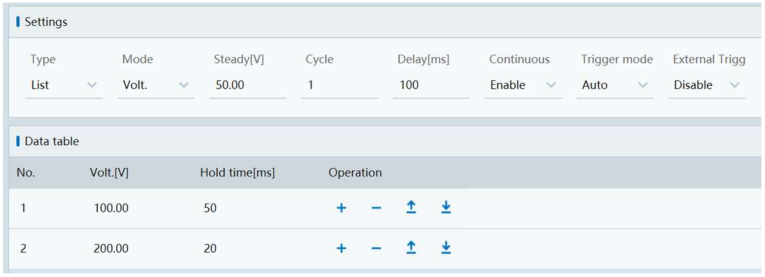


Figure 3-11: List Setting Interface

Programming Example:

As shown in the programming data in Figure 3-12 below, the initial Steady-state Voltage is 50V, and it reaches 100V after a Trigger Delay of 100ms. The resulting programming waveform is shown in coordinate diagram 3-13. 100V is held for 50ms and then changes to 200V. 200V is held for 100ms and then changes to 400V, and so on. After holding at 400V for 150ms, the voltage returns to 50V at the End of Programming. (The difference from Step programming is that the Hold time for each step can be set independently.)

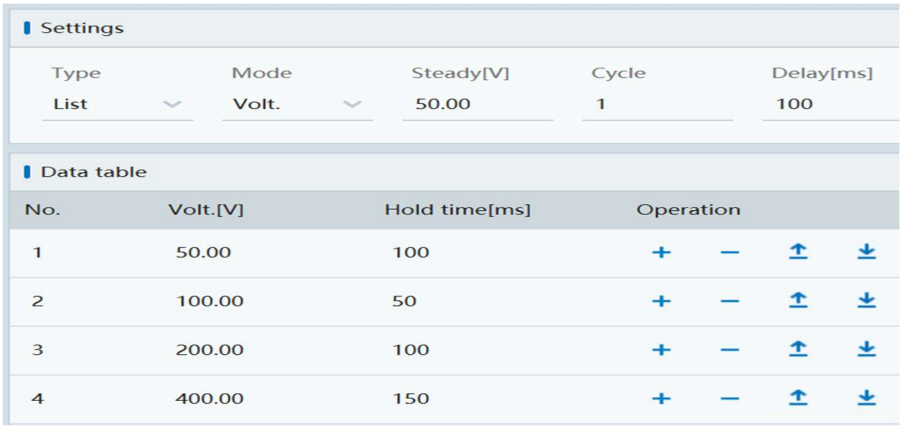


Figure 3-12 List Programming Example Diagram

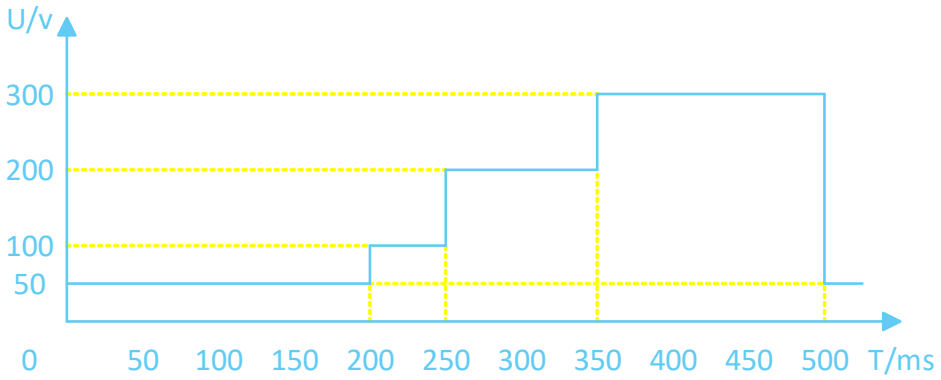


Figure 3-13 List Programming Example Effect Diagram

3.3.1.2.1.3 Wave Programming:

The Wave function programs a set of curves describing the relationship between time and amplitude coordinates (Time, Amplitude). For example, the voltage amplitude needs to reach 1000V after 3s, and 200V after 5s. By setting a series of state points, the system automatically generates connecting lines through these points to program the waveform. Follow these steps for setting:

Step 1: Set the initial voltage for a single step.

Step 2: Set the final voltage for the single step.

Step 3: This represents the voltage change time from each step to the next. As shown in Figure 3-13, setting 50ms indicates that the change time to NO.1 is 50ms (the difference from Step programming is that the hold time for each step can be set freely).

Step 4: Click "+" to increase the number of programming steps, and click "-" to decrease the number of programming steps.

The remaining settings are the same as described in the steps above.

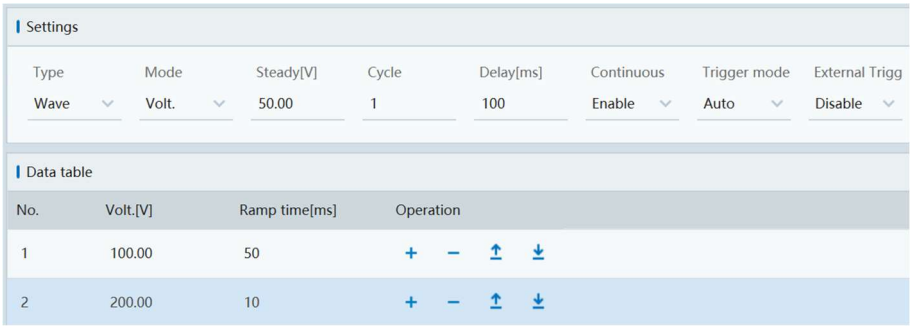


Figure 3-14: Wave Setting Interface Diagram

Programming Example:

As shown in Figure 3-15 (Programming Data), the initial Steady-state Voltage is 50V. After a Trigger Delay of 100ms, the voltage starts at 50V. The resulting programming waveform is illustrated in coordinate diagram 3-16 below. The Time taken for the voltage to change from 50V to 100V is 50ms; from 100V to 100V is 100ms; from 100V to 300V is 1ms; from 300V to 400V is 100ms; and from 400V back to 50V is 50ms. Wave programming offers greater flexibility and can achieve a variety of different voltage profiles.

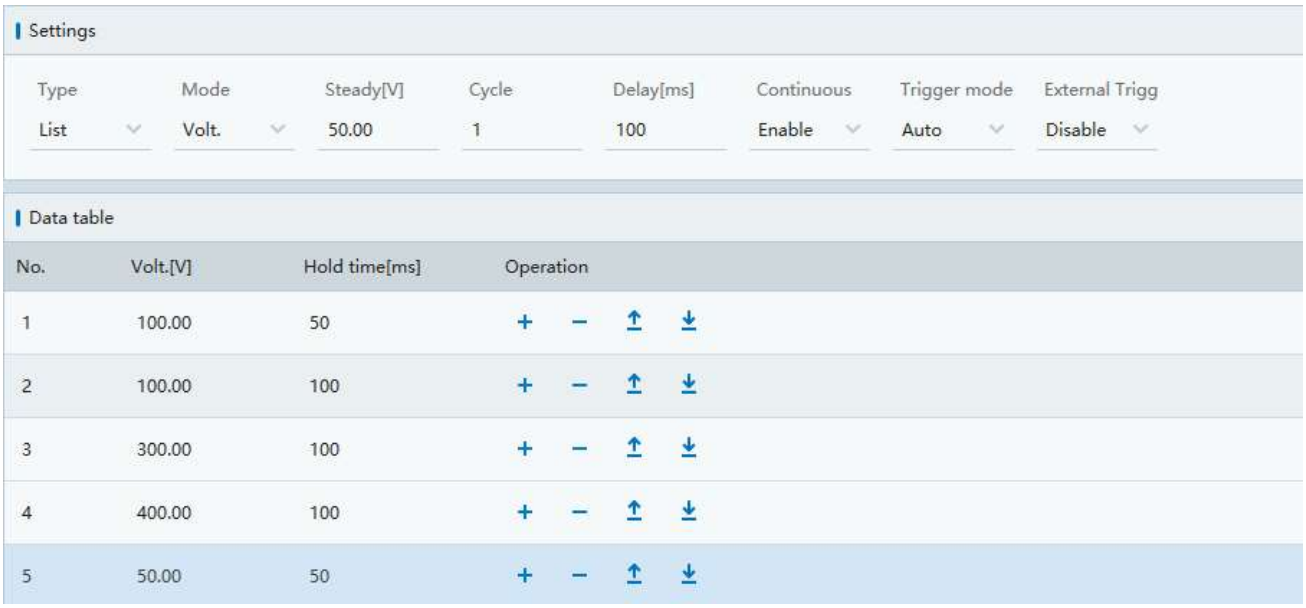


Figure 3-15: Wave Programming Example

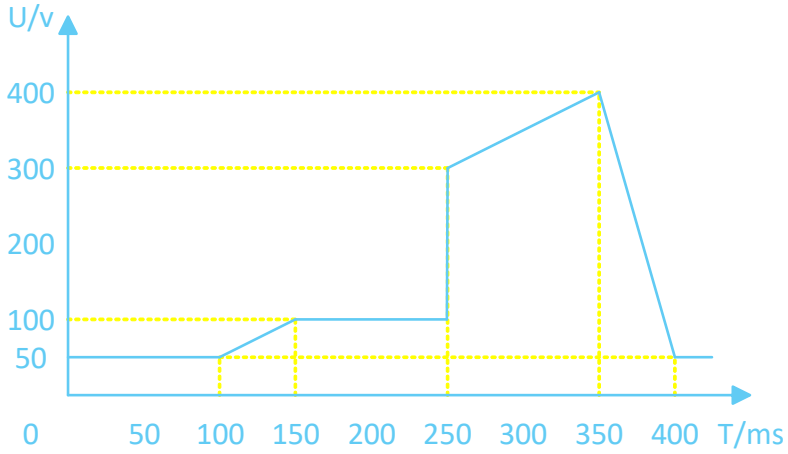


Figure 3-16: Wave Programming Example Waveform

If you have programming data, you can directly import programming parameters by clicking the "Import" button in the upper right corner (the imported file format is limited. You can click "Export" first to save the programming template).

3.3.1.2.2 Status Confirmation

As shown in Figure 3-17, the total programming time and test progress are displayed. Verify that they match your expectations.

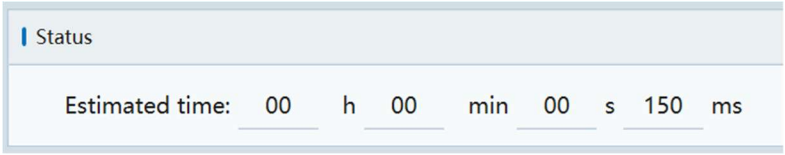
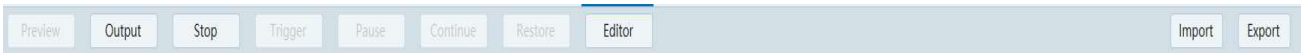


Figure 3-17 General Programmable Test Total Time Diagram

3.3.1.2.3 Start Programming

After confirming the programming parameters, first click "Loading" to load the parameters, and then select whether to "Trigger" based on your settings. After loading, click "Output". The power supply will run according to the programming data. See Figure 3-17 for the execution interface.



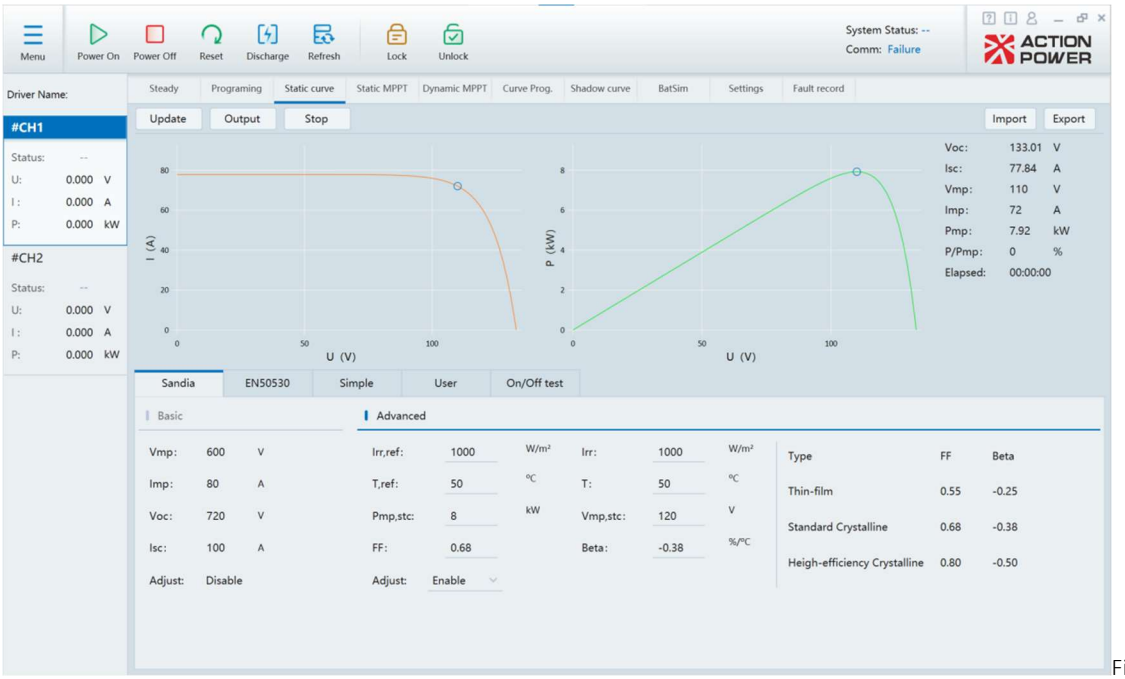


Figure 3-18 General Programmable Execution Interface Diagram

If you need to end programming prematurely, click the "End" button to exit the programming mode. To pause programming, click the "Stop" button; the device will maintain the data output at the point of stoppage.

3.3.2 TD Series Application Function: Photovoltaic Simulation

3.3.2.1 Static Curve

The Static Curve feature includes three model algorithms: Sandia, EN50530, and Simple, all of which support 1024-point customization. Sandia and EN50530 are further divided into Basic and Advanced models. The Update button allows you to preview the curve, and the Save button saves the Curve Parameters to the DC source, as shown in Figure 3-19:

3.3.2.1.1 Sandia-Basic Model

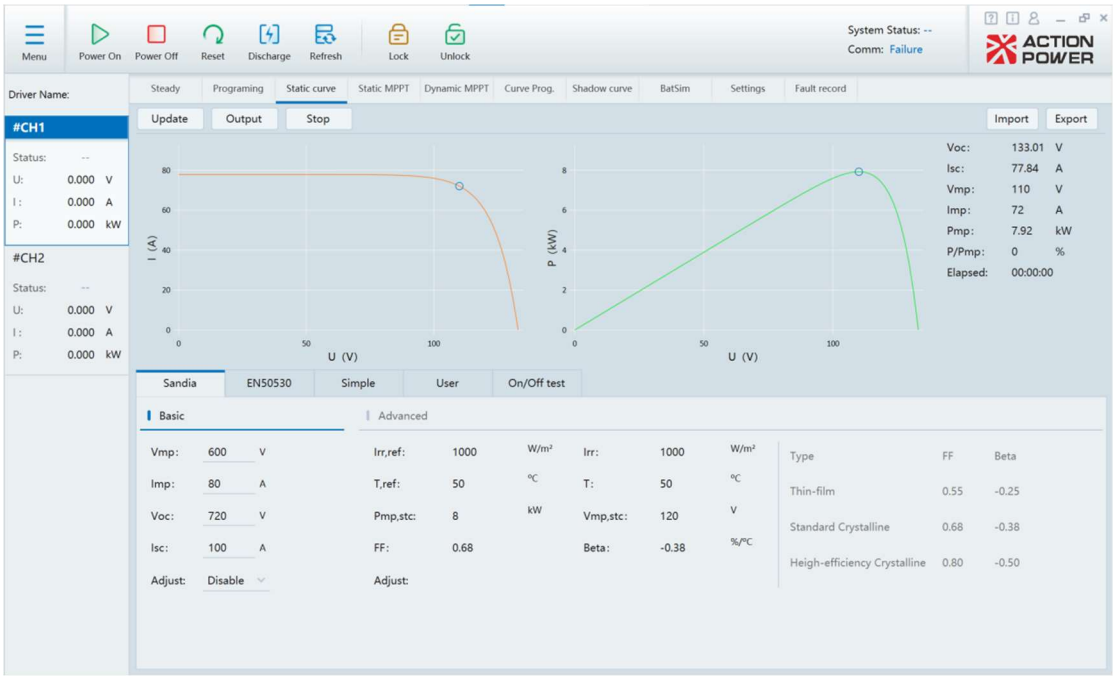


Figure 3-19 Static Curve Sandia-Basic Model Interface

This model only supports setting the following four Parameters: Vmp, Imp, Voc, and Isc. You can optionally Enable or Prohibit calibration. If calibration is set to “Prohibited”, the generated curve's Voc and Isc will match the Setting values. If calibration is set to “Enable”, calibration will be performed based on the Maximum Power Point, and the generated curve's Vmp and Imp will match the Setting values. After configuration, click “Update” to preview the waveform, and then click “Output” after confirming it is correct.

3.3.2.1.2 Sandia-Advanced Model

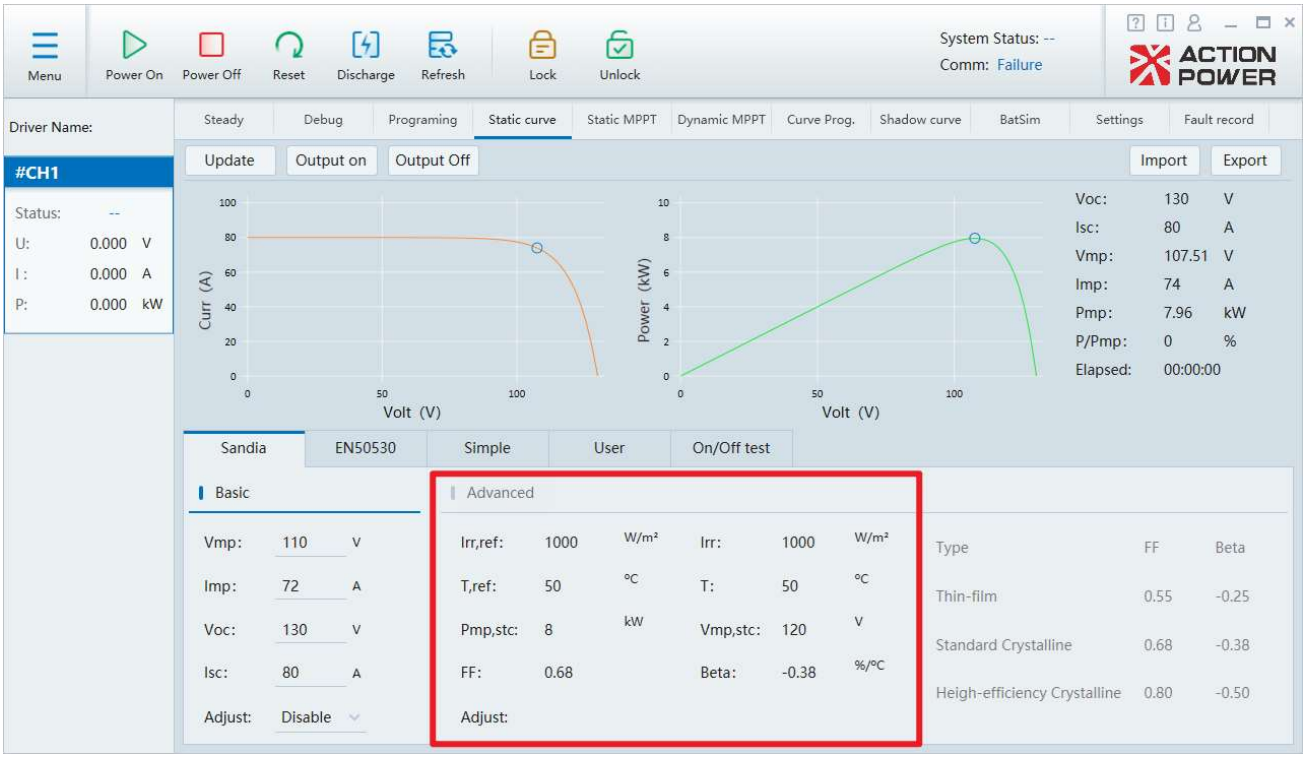


Figure 3-20 Static Curve Sandia-Advanced Model Interface Diagram

Unlike the Sandia-Basic model, the settable parameters within the area of the upper frame in the figure are accessible, allowing for more flexible settings. Irr_ref represents the reference illumination, Irr represents the actual illumination, T_ref represents the reference Temperature, and T represents the actual Temperature.

The application operation method is the same as the Sandia-Basic model.

3.3.2.1.3 EN50530-Basic Model

Test model designed according to the EN50530 standard.

EN50530-Basic Model: Only supports setting four parameters: Vmp, Imp, Voc, and Isc. The Battery panel type is not selectable.

After setting, first click “Update” to preview the waveform, and click “Output” after confirming it is correct.

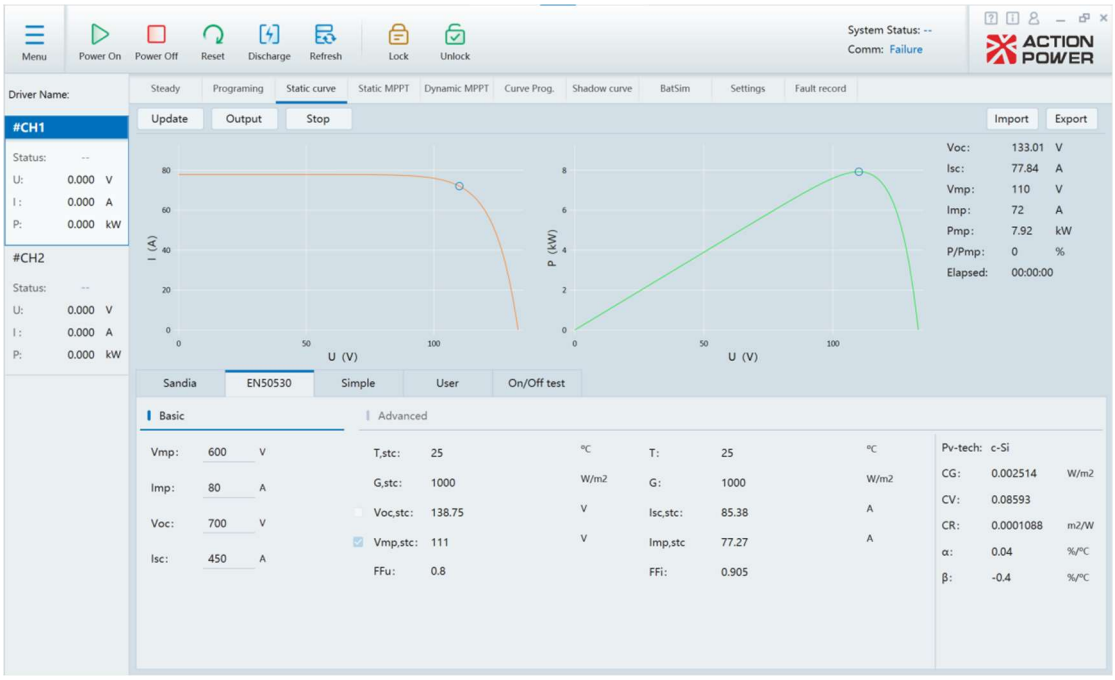


Figure 3-21 Static Curve EN50530-Basic Model Interface Diagram

3.3.2.1.4 EN50530-Advanced Model

EN50530-Advanced Model: Unlike the EN50530-Basic model, it allows setting parameters within the area of the box shown below. Tstc and Gstc represent the standard temperature and irradiance, respectively, and cannot be set. T and G are the temperature and irradiance that users can set. The closer these parameter settings are to the standard values, the closer the actual output will be to the standard output. Select Voc and Isc to set the open-circuit point and calculate the MPPT point parameters; select Vm and Im to set the MPPT point and calculate the open-circuit point parameters. Select Vm and Im to set the MPPT point and calculate the open-circuit point parameters.

The model supports two battery panel technologies: Crystalline Silicon (c-Si) and Thin-film. For other battery panel types, parameters can be defined by the user.

After setting, first click “Update” to preview the waveform, and click “Output” after confirming it is correct.

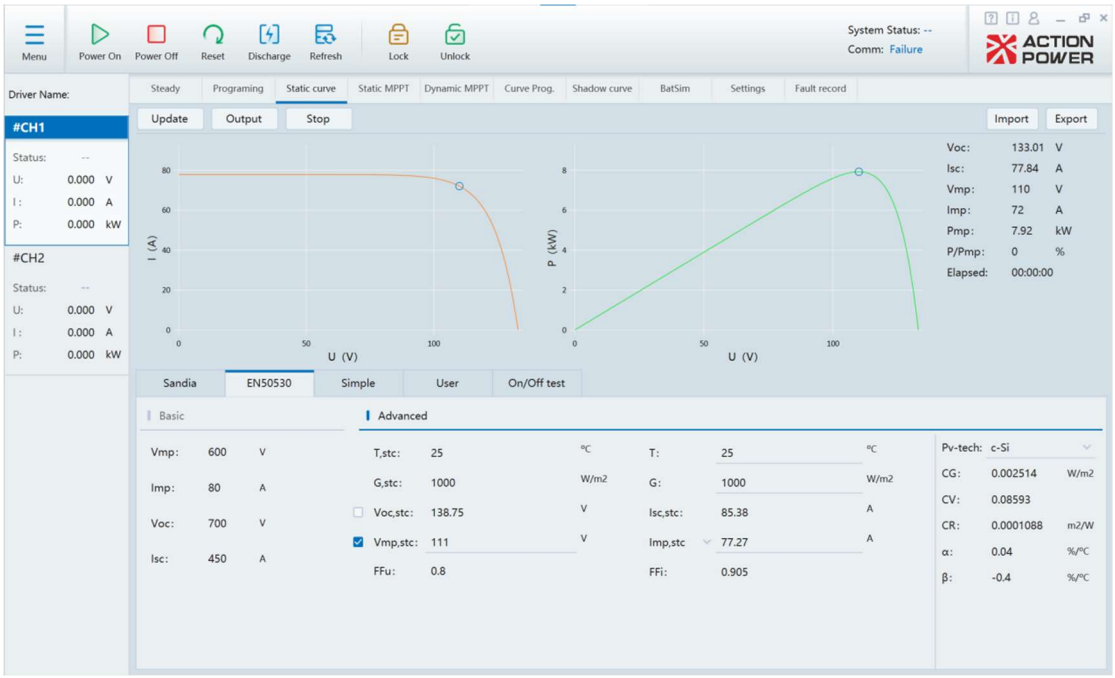
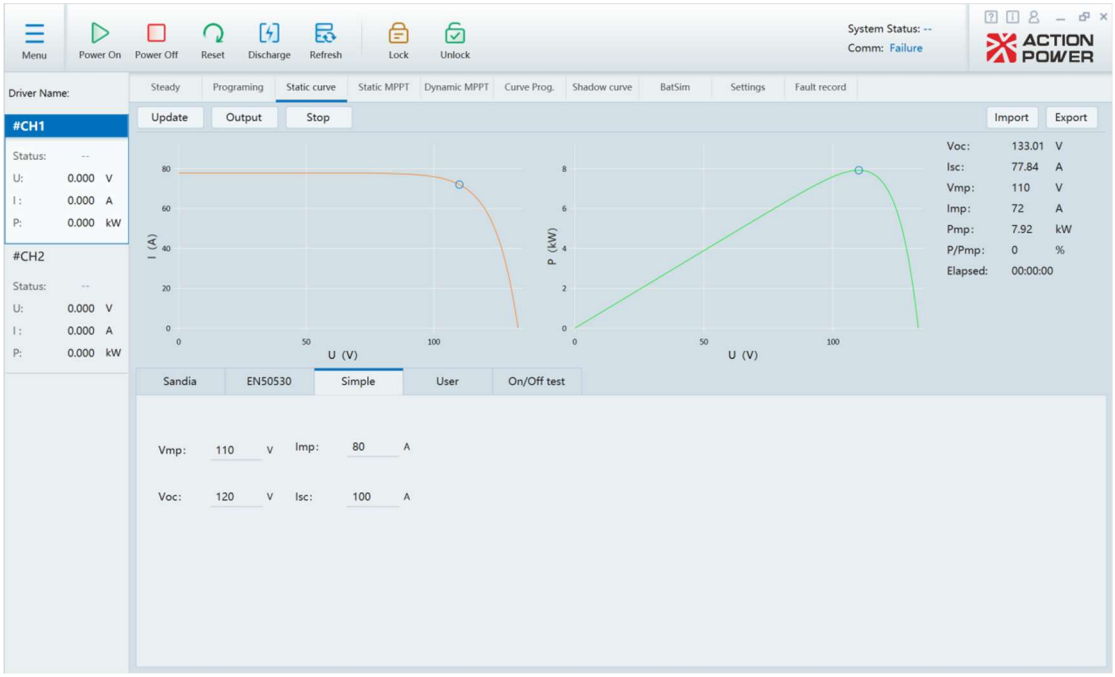


Figure 3-22: Static Curve EN50530-Advanced Model Interface Diagram

3.3.2.1.4 Simple Model

This is a customized model for users; further information is available upon request.



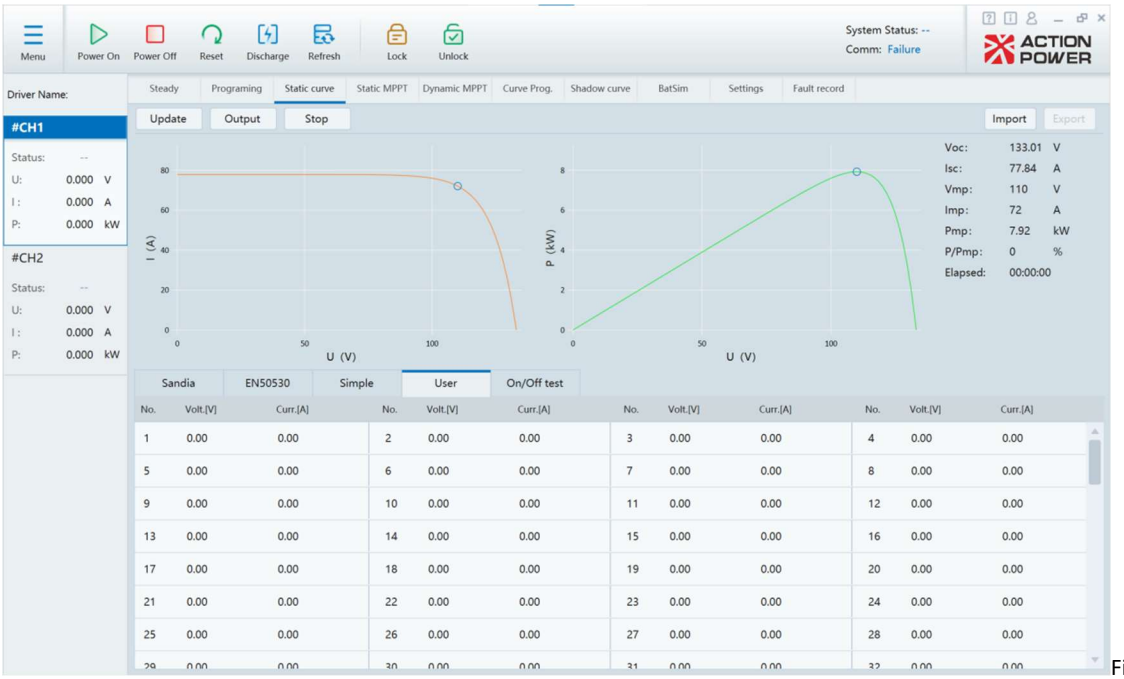


Figure 3-23: Static Curve Simple Model Interface Diagram

The custom 1024-point function supports importing curve data from CSV files and EXCEL spreadsheets. The data requirements are as follows:

- The number of valid data points for voltage and current must be equal.
- The current values must be in descending order, with the final current value being zero.
- The voltage values must be in ascending order, with the initial voltage value being zero.

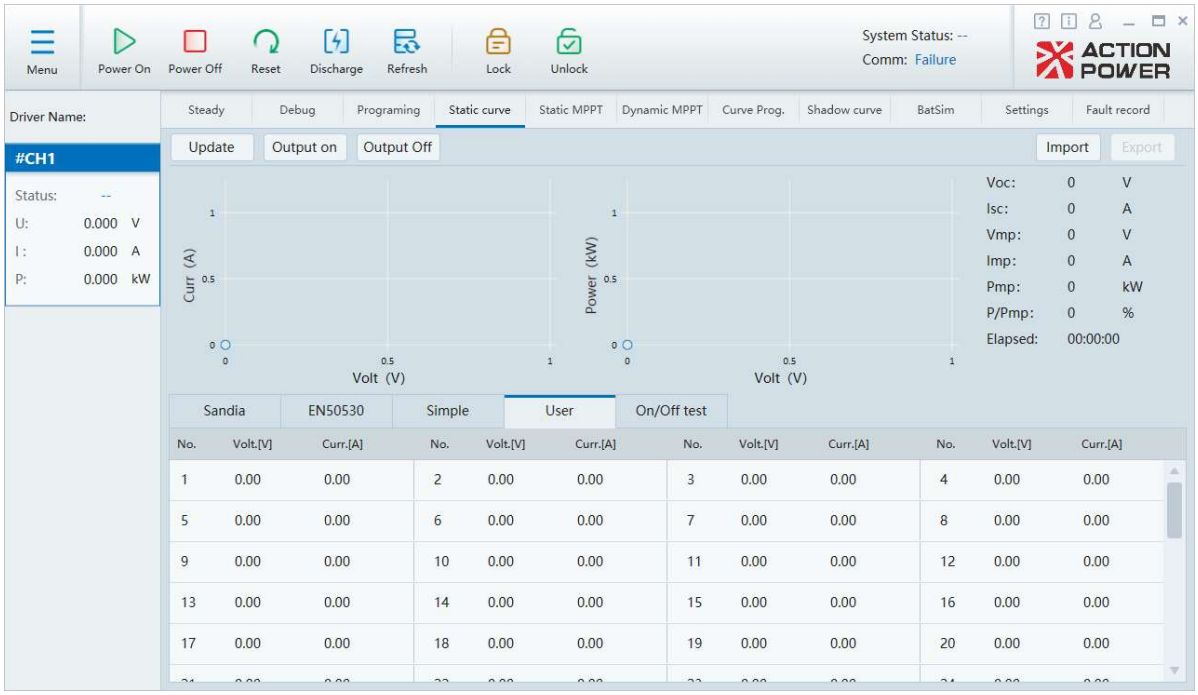


Figure 3-24 Static Curve, custom 1024-point Interface diagram.

3.3.2.2 Static MPPT Curve

Static MPPT Curve: This tests the static MPPT efficiency of Photovoltaic inverters at different Power levels and Voltage levels. The test method is performed according to the requirements of BS EN 50530:2010, with a total of 5 Voltage levels and 6 Power levels (Power level percentage is adjustable), supporting Manual Mode and Automatic Mode, as shown in Figures 3-25 and 3-26.

Manual Mode:

Select “Regular manual” for the execution method, choose the Battery panel type, and configure the parameters indicated in Figure 3-26:

1- Minimum voltage; 2- Maximum voltage; 3- Temperature; 4- Illumination; 5- Maximum power point.

After completing the Setting, manually click the "Running" button for the desired test condition. The IV and PV characteristic Curve preview chart displays the actual Output tracking point. The device starts Running, and the Running information is displayed on the right side of the middle section (Total efficiency is calculated once per minute, and the single efficiency calculation Time can be freely set).

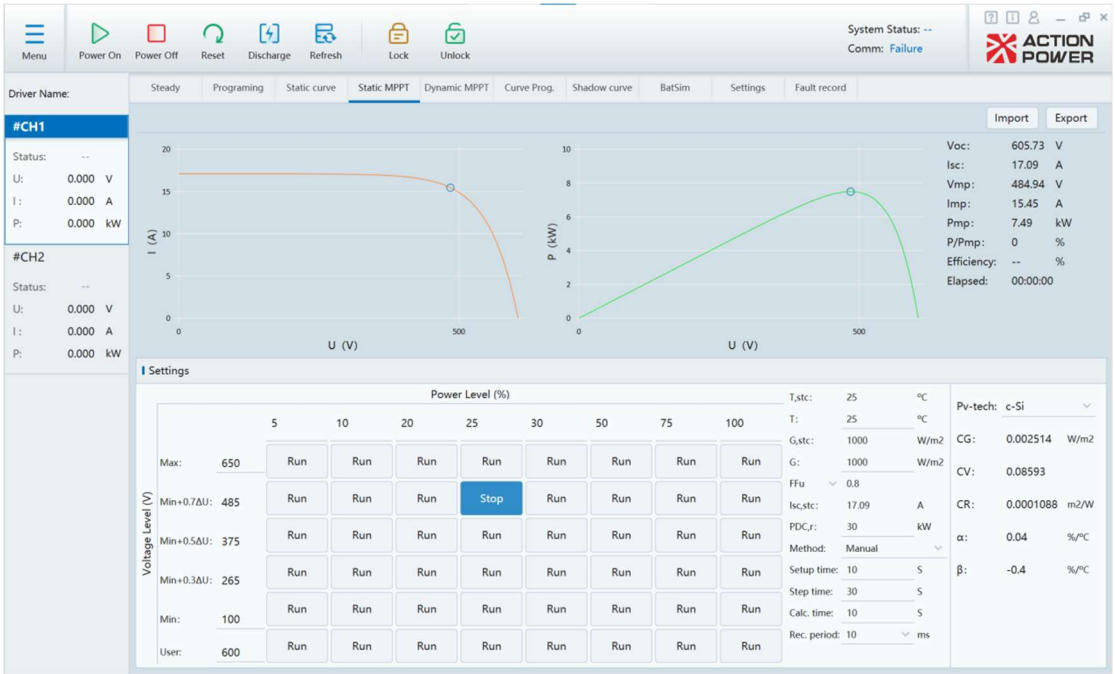


Figure 3-25 Static MPPT Curve Interface/Manual Mode Interface Diagram

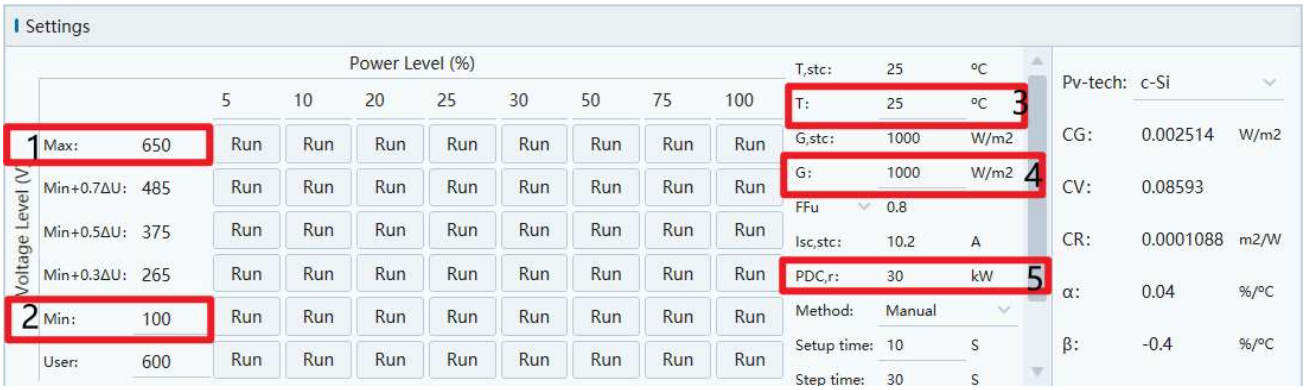


Figure 3-26 Static MPPT Curve Interface/Manual Mode Parameter Setting Interface Diagram

Automatic Mode: Select "Automatic Programming" for the execution method, as shown in Figure 3-26. Select the Battery panel type and set the Parameters, as shown in Figure 3-27:

1- Minimum voltage; 2- Maximum voltage; 3- Temperature; 4- Light; 5- Maximum power point; 6- Preparation Time: Preparation Time before entering the IV Static Curve, allowing the inverter to prepare for startup; 7- Single step duration: Setting for the Running Time of each step.

After the Setting is complete, click the Output button above to automatically execute 40 Static Curves, combining 5 Voltage levels and 8 Power levels, in sequence from top to bottom and left to right, excluding any custom Voltage. The efficiency for each operating condition is automatically calculated and displayed in the corresponding coordinate box.

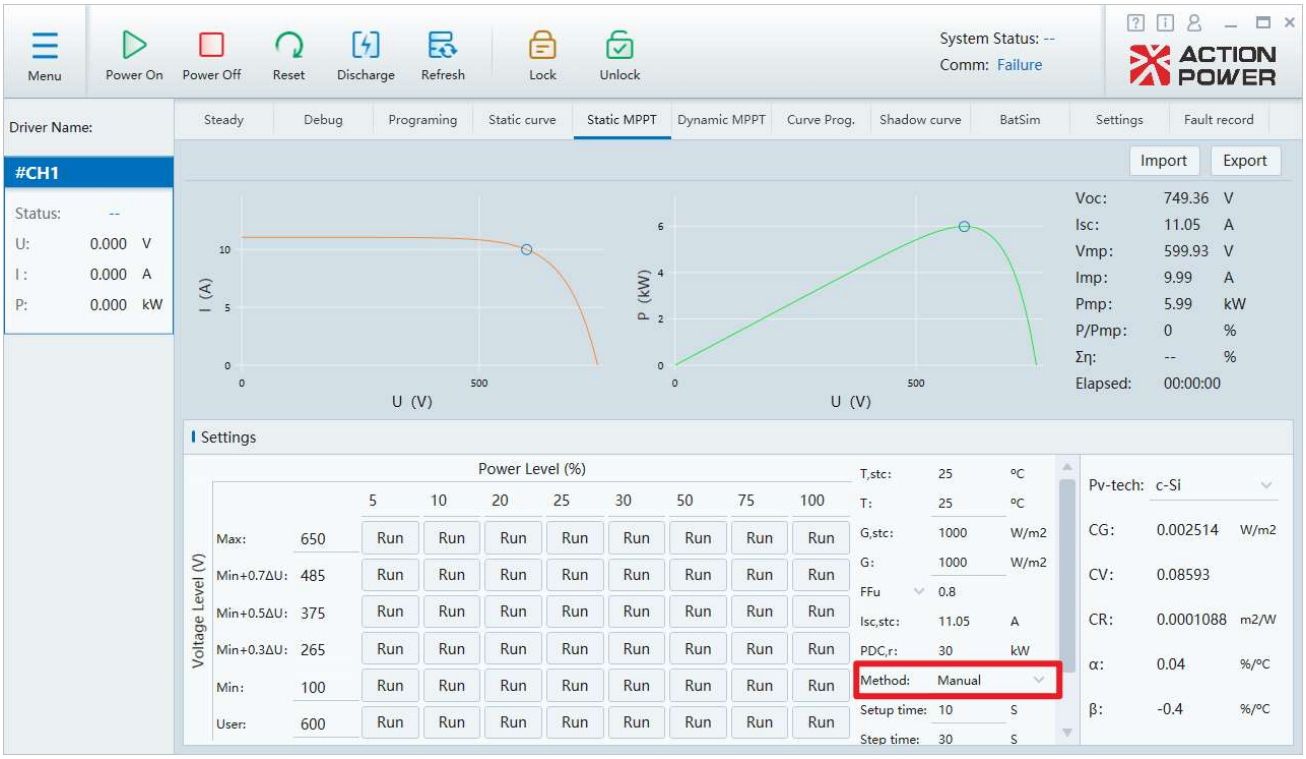
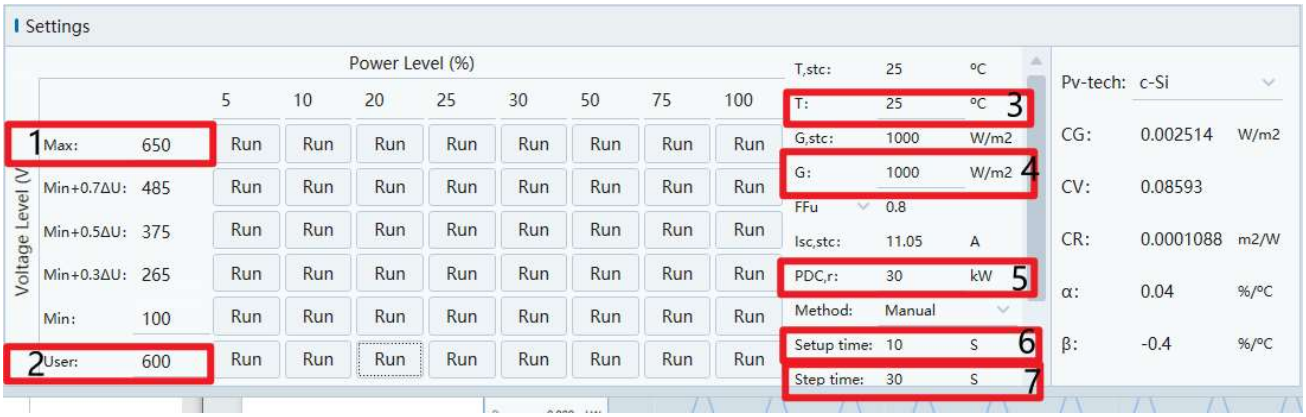


Figure 3-27 Static MPPT Curve Interface / Automatic Mode Interface Diagram

Figure 3-28 Static MPPT Curve / Automatic Mode Parameter Setting Interface Diagram



3.3.2.3 Dynamic MPPT Curve

Dynamic MPPT Curve: This tests the dynamic MPPT efficiency of a Photovoltaic inverter under varying irradiance levels. The test method follows the requirements of BS EN 50530:2010. Each generated Curve has an execution Time of 500ms and contains 4096 Data points. Irradiance levels are 0~10%, 10%~50%, and 30%~100%. Both manual and Automatic Modes are supported.

The preparation time after the test starts is configurable, as shown in the figure below:

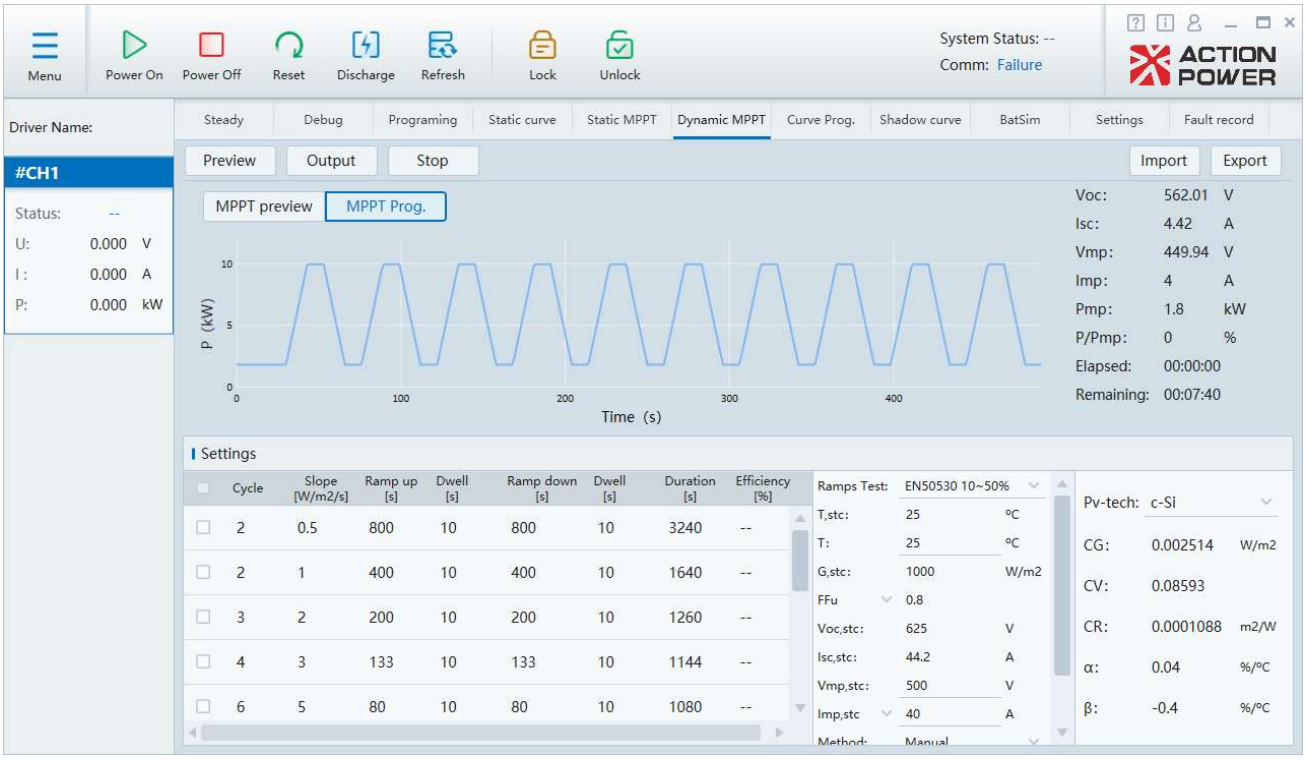


Figure 3-29 Dynamic MPPT Interface (MPPT Programming) Diagram

Regular Manual:

Select “Manual” for the execution method. Select the battery panel type and set the annotation parameters as shown in Figure 3-17:

1- Irradiation Level; 2- Air Temperature; 3- MppPoint Voltage; 4- MppPoint Current; 5- Curve Selection.

After completing the settings, click “Preview” to view the configured curve. After confirming the settings, click “Output” to begin the test. The PT trapezoidal preview chart displays the actual output tracking points in real-time. The specific running data can also be observed in real-time on the right side of the image (Total efficiency is calculated once per minute).

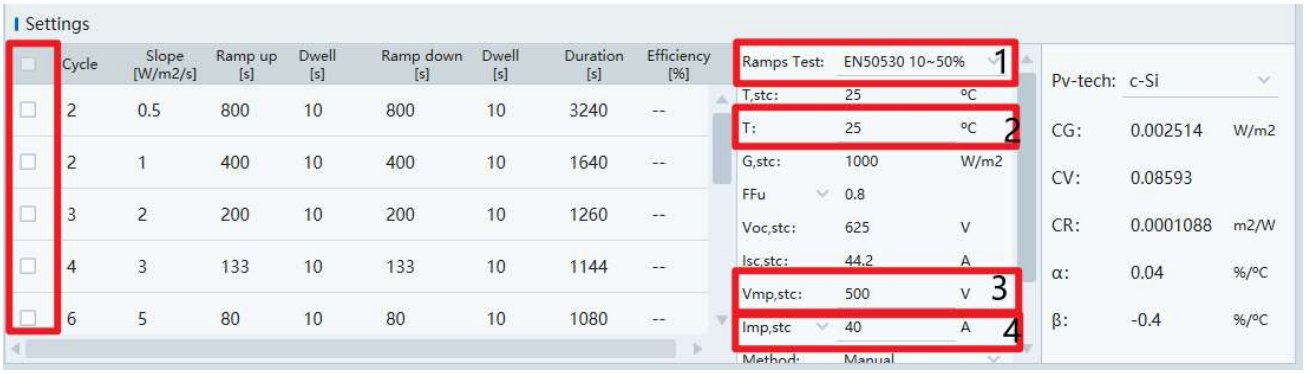


Figure 3-30 Dynamic MPPT Interface (MPPT Programming) Parameter Settings Diagram

Automatic Programming:

Unlike the “Regular manual” operation, there is no need to select a "radiation level". After setting the remaining parameters, click "Preview" to view the setting curve. After confirming it is correct, click "Output" to start the test. The system will then automatically perform tests sequentially from radiation levels 0-10%, 10-50%, and 30-100%.

3.3.3 TD Series Application Function: Battery Simulation

3.3.3.1 Instructions for Using Common Battery Types

The ABS series can simulate the output, charging, and discharging characteristics of various battery types, including Lithium Iron Phosphate, Ternary lithium, Lithium titanate, Lithium manganate, Lithium cobalt oxide, Nickel-metal hydride, and Lead-acid batteries. Adjustable parameters include series-parallel configuration, temperature, SOC, internal resistance, and capacity. In addition, it offers the option to enable 1st, 2nd, or 3rd order RC battery models with fully customizable parameters for accurate simulation.

3.3.3.2 Model Layout

The layout of the battery simulation interface is shown in Figure 3-31 below.

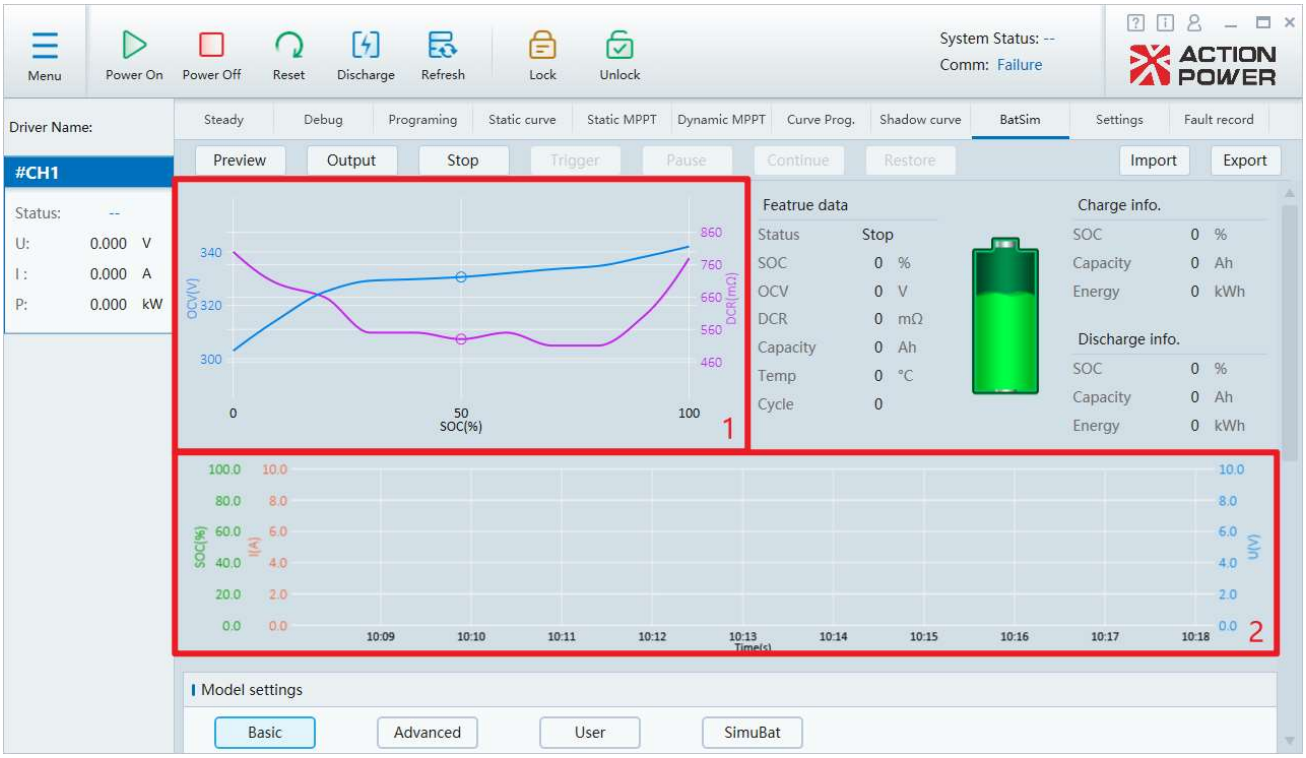


Figure 3-31: Battery Simulation Interface Diagram

3.3.3.3 Functional Areas:

- **Preview Button:** Displays the battery characteristic curve based on the selected model parameters (as shown in Figure 3-32).
- **Output Button:** Sends the model and configuration parameters to start the battery simulator.
- **Stop Button:** Ends the experiment and stops the battery simulator.
- **Trigger Button:** After the simulation starts, initiates the experiment according to the configured battery model.
- **Pause Button:** Pauses the experiment.
- **Continue Button:** Resumes the paused experiment.
- **Reset Button:** Resets the battery simulator to its initial experimental state.
- **Import button:** Imports the parameter file into the Battery simulator.
- **Export button:** Exports the parameters as a configuration file for saving.
- **Curve:** Displays the real-time curves of SOC, Current, Voltage, and Time during the experiment in area 2 of Figure 3-31.

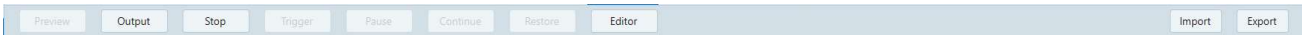


Figure 3-32 Battery simulation function area diagram

3.3.3.4 Model Parameters:

The Battery simulation parameter Setting diagram is shown in Figure 3-33 below.

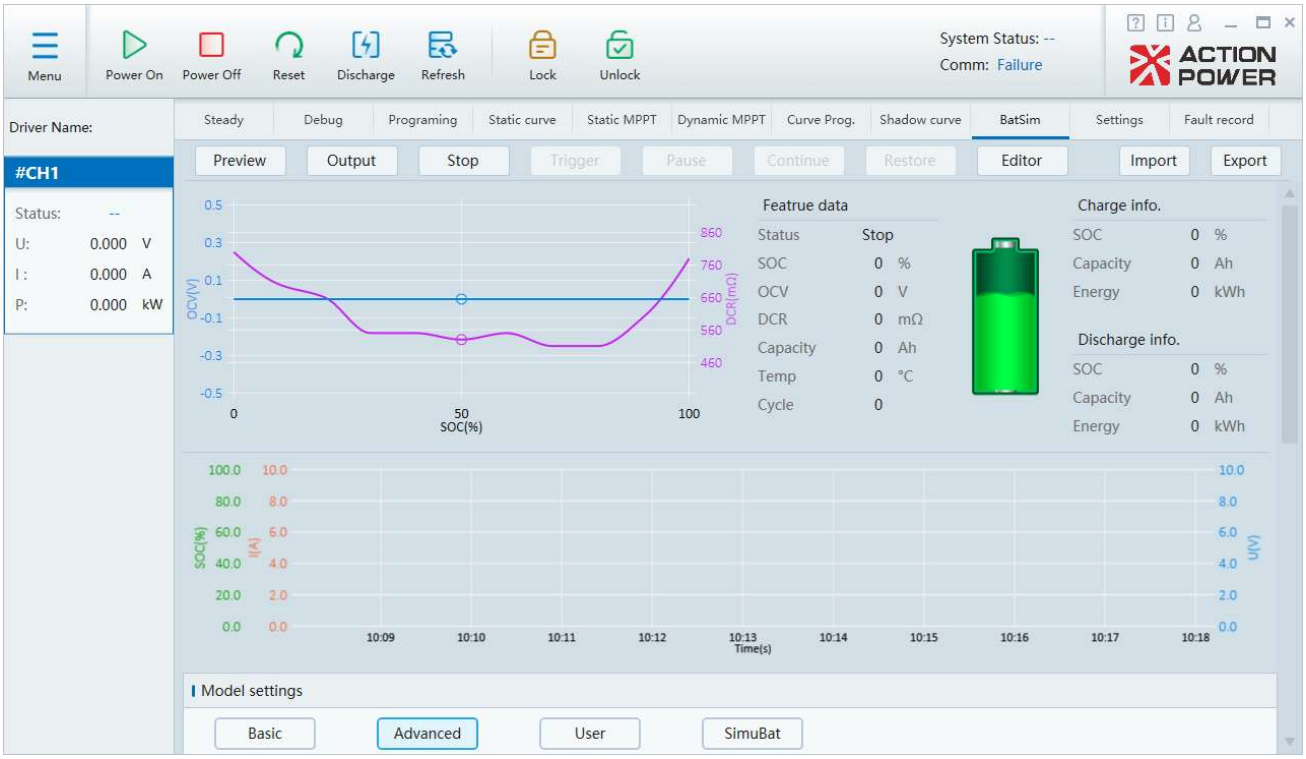


Figure 3-33 Battery simulation parameter Setting diagram

3.3.3.4.1 Model

[Model Selection]: Select from Basic (built-in), Advanced (built-in + custom), User (fully custom), and SimuBat.

[Battery Technology]: Choose from 7 built-in Battery models.

[Initial SOC]: The initial state of charge (SOC) of a single battery cell.

[Internal Resistance]: Equivalent impedance of a single battery cell.

[Number of Parallel Cells]: Number of battery cells connected in parallel within the battery pack.

[Initial Temperature]: The initial temperature of the battery.

[Charging Efficiency]: The conversion efficiency during battery charging.

[Start Delay]: The delay period before the experiment begins.

[Capacity]: Capacity of a single battery cell.

[Initial Capacity]: Initial capacity of a single battery cell.

[Cable Impedance]: Equivalent impedance of the battery pack cable.

[Number of Series Cells]: Number of single battery cells connected in series within the battery pack.

[Temperature Enable]: Enables/disables the influence of temperature on the battery model.

[Discharge Efficiency]: The energy loss efficiency during battery discharge.

[Pre-charge]: Changes the voltage slope and calculates the voltage step change during charging and discharging.

[Number of Points]: The number of points in the custom model curve.

[Order]: The order of the customized RC battery model (not displayed by default).

3.3.3.4.2 Battery Pack Information

[Initial Capacity]: The initial State of Charge (SOC) of the battery pack.

[Capacity]: The initial capacity of the battery pack.

[SOC 0% Voltage]: The open-circuit voltage of the battery pack at 0% SOC.

[SOC 100% Voltage]: The open-circuit voltage of the battery pack at 100% SOC.

[50% Internal Resistance]: The equivalent internal resistance of the battery pack at 50% SOC.

3.3.3.4.3 Configuration

[Alarm]: Enable/Disable experiment alarm function.

[Charging SOC]: Single SOC alarm threshold during charging.

[Discharge SOC]: Single SOC alarm threshold during discharging.

[Charging Voltage]: Battery voltage alarm threshold during charging.

[Discharge Voltage]: Battery voltage alarm threshold during battery discharging.

3.3.3.4.4 Battery Pack Alarm Parameters

[Charging SOC]: Battery pack SOC alarm threshold during charging.

[Discharge SOC]: Battery pack voltage alarm threshold during charging.

[Charging Voltage]: Battery pack SOC alarm threshold during discharging.

[Discharge Voltage]: Voltage alarm threshold when the Battery pack is discharging.

3.3.3.4.5 Battery Pack Protection Parameters

[Protection]: Enable/disable the experiment protection function.

[Charging SOC]: Protection threshold for a single SOC during Charging.

[Discharge SOC]: Single SOC protection threshold during Discharge.

[Charging Voltage]: Unit voltage protection threshold during Charging.

[Discharge Voltage]: Single voltage protection threshold during Discharge.

[Fusing Current]: Battery pack Charging and Discharging Current protection threshold.

3.3.3.4.6 Experiment Configuration Parameters:

[Cyclic Test]: Enable/disable the experiment cycle function.

[Cycle Count]: The number of battery simulation experiment cycles.

[Cutoff SOC]: The state of charge (SOC) at the end of a single cycle.

[Cutoff Capacity]: The capacity at the end of a single cycle.

[Measurement Period]: The time interval for storing battery log data.

4. Display Operation and Usage

The ABS/APS display screen function interface is divided into 7 parts, as shown in Figure 4-1.

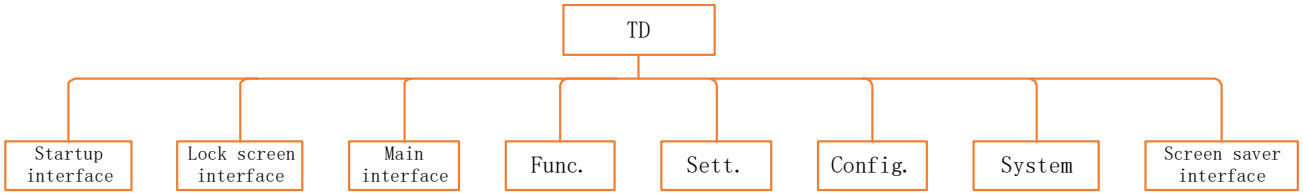


Figure 4-1 Function Tree Diagram

4.1 Startup Interface

When the power supply is turned on, it first enters the startup interface, and then proceeds to either the lock screen interface (if the lock screen password is enabled) or the main interface (if the lock screen password is disabled). See Figure 4-2 for the startup interface.

Figure 4-2 Startup Interface Diagram

4.2 Lock Screen Interface

After enabling the lock screen password in the “System-Screen-Lock Screen” interface, the lock screen interface

will appear after exiting the startup interface or screen saver. If disabled, the lock screen interface will not appear. See Figure 4-3 for the lock screen interface.

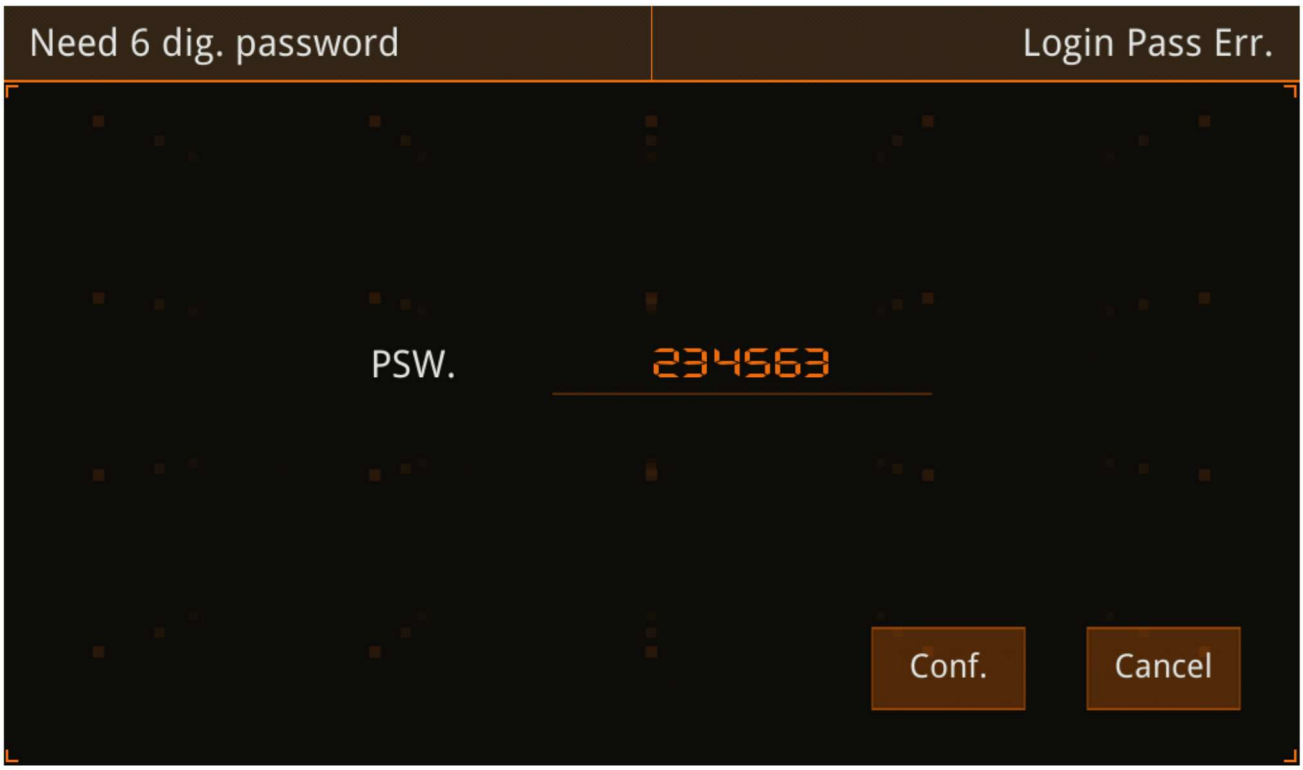


Figure 4-3 Lock Screen Interface Diagram

4.3 Main Interface

The screen is divided into four main interfaces: the Source-Load Main Interface, the SAS Main Interface, BAT Main Interface 1, and BAT Main Interface 2. Refer to Figures 4-4, 4-5, 4-6, and 4-7 for diagrams illustrating the area divisions of each main interface.

Note: The interface shown is an example. The layout may vary slightly depending on the model.

Figure 4-4 Source-Load Main Interface Area Division Diagram

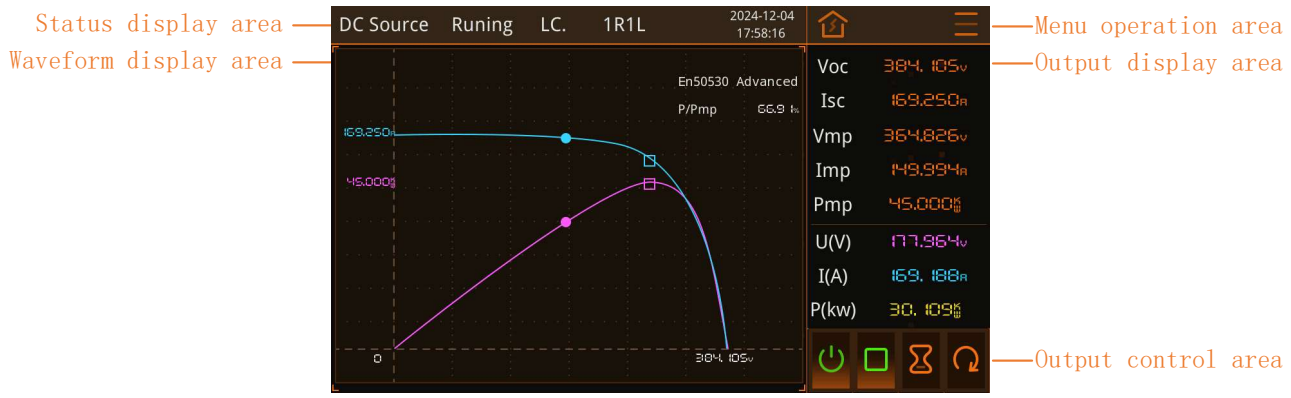


Figure 4-5 SAS Main Interface Area Division Diagram

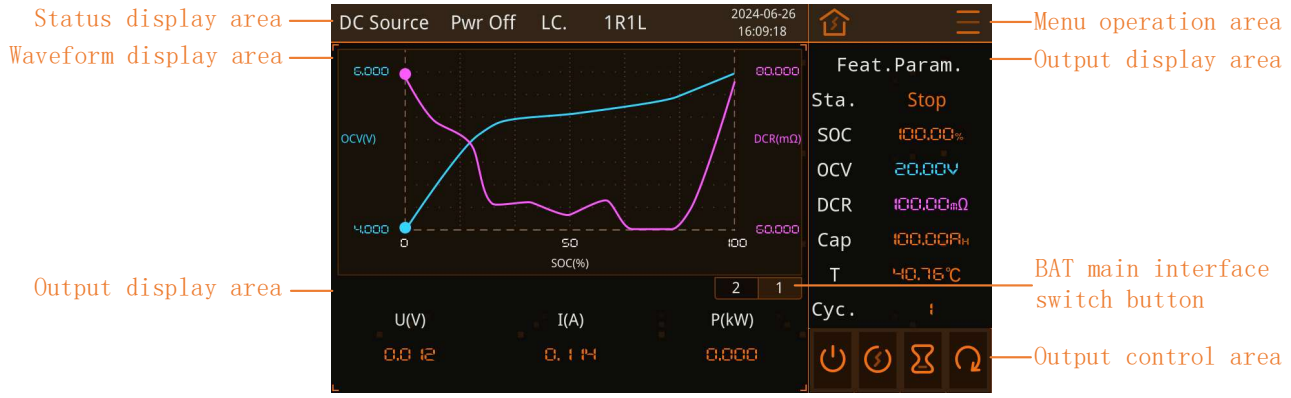


Figure 4-6 BAT Main Interface 1 Area Division Diagram

Figure 4-7 BAT Main Interface 2 Area Division Diagram

4.3.1 Status Display Area

The status display area at the top of the screen indicates the power supply's operating status and working mode, as shown in Figure 4-7. See Table 4-1, Status Display Area Function Table, for detailed information.

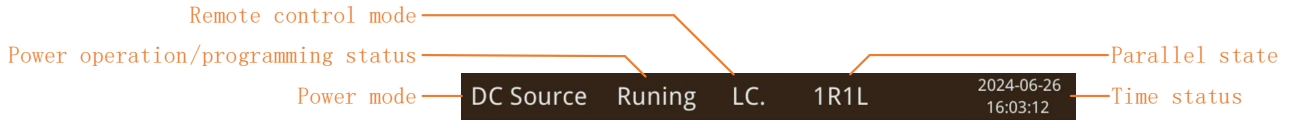


Figure 4-7: Status Display Area Diagram

Table 4-1: Status Display Area Function Table

Status Area	Display Content	Definition and Application
Power Supply Mode	DC Source	Source Mode.
Power Supply Running/Programming Status	Shutdown	Shutdown state: “Shutdown” is displayed in white, steady.
	Standby	Standby state: “Standby” is displayed in white, steady.
	Running	Running Status: “Running” is displayed in white, steady.
	Fault	Fault Status: “Fault” is displayed in red and flashing. Click to view the fault record (see Figure 4-8: Fault Pop-up Window Interface).
	Reset	Reset Status: “Reset” is displayed in white, steady.
	Programming Status Display	Programming Status: The current programming status is displayed in a white scrolling text.
Remote Control Mode	Local Control	Local Control Mode: 'Local' is displayed in white, without flashing.
	LAN	Remote Control LAN Mode: 'LAN' is displayed in white, without flashing.
	RS485	Remote Control RS485 Mode: 'RS485' is displayed in white, without flashing.
	CAN	Remote Control CAN Mode: 'CAN' is displayed in white, without flashing.
Parallel Connection Status	xRxL	Indicates x row x column, 'xRxL' is displayed in white without flashing. See Figure 4-9 for the parallel connection pop-up interface. Note: After modifying the model parameters using the host computer, click the parallel connection button to update the model parameters. When 1R1L, clicking displays an information box with the following content: Series-Parallel Combination: xSxP (P: Parallel Number, S: Series Number) Total power (kW): xxx.x (Rated power * Number in series * Number in parallel) Total voltage (V): xxx.x (Rated voltage * Number in series) Total current (A): xxx.x (Rated current * Number in parallel) Number of rows in this column: x (Current number of rows in this column) When 1RnL (n>1), click to display the information box with the following content: Series-parallel combination: xSxP Number of rows in this column: x When nRnL (n>1), click to display the information box with the following content:

		Series-parallel combination: xSxP
	Handshake	“Handshake” flashes yellow
	SP-ERR	“SP-ERR” flashes yellow
Time status	Example: 2021-06-11 13:29:14	Displays the current time (YYYY-MM-DD-HH-MM-SS)

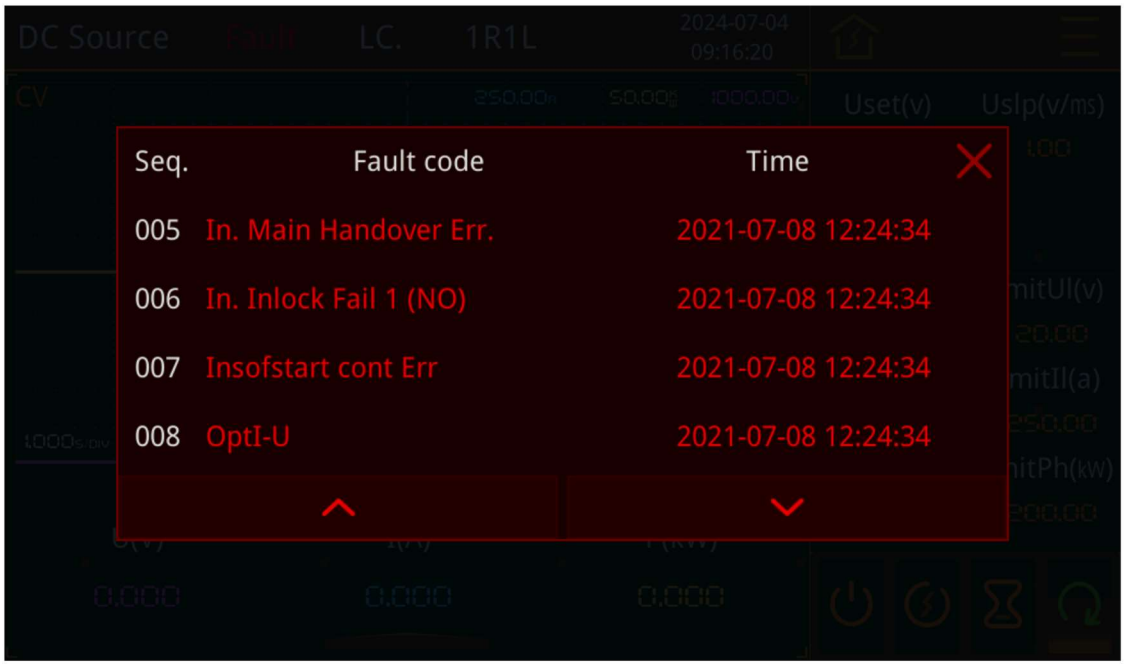


Figure 4-8: Fault pop-up interface diagram

Figure 4-9 Parallel Connection Pop-up Interface

4.3.2 Output Display Area

The display area of each Main interface shows different Data content. See Table 4-2 for details.

Table 4-2 Output Display Area Content:

Output Display Area		Display Content
Source-Load Main Interface	U(V)	Output Voltage; U(V) flashes a red dot every 500ms when in Voltage Limit Mode.
	I(A)	Output Current; I(A) flashes a red dot every 500ms when in Current Limit Mode.
	P(kW)	Output Power; P(kW) flashes a red dot every 500ms when in Power Limit Mode.
SAS Main Interface	Voc	Open-Drain Voltage
	Isc	Short-Circuit Current
	Vmp	Maximum Power Point Voltage
	Imp	Maximum Power Point Current
	Pmp	Maximum Power Point Power
	U(V)	Output Voltage
	I(A)	Output Current
	P(kW)	Output Power
BAT Main Interface 1	Status	Charge/Discharge Status
	SOC	Current Capacity Ratio
	OCV	Current Open-Circuit Voltage
	DCR	Current Internal Resistance
	Cap	Current Capacity
	T	Current Temperature
	Cycle	Number of Cycles
	U (V)	Output Voltage: U (V) flashes a red dot for 500ms in Voltage Limit Mode
	I (A)	Output Current: I (A) flashes a red dot for 500ms in Voltage Limit Mode
	P (kW)	Output Power: P (kW) flashes a red dot for 500ms in Voltage Limit Mode
BAT Main Interface 2	SOC	Current Capacity Ratio
	Cap	Current Capacity
	En	Current Energy

	U(V)	Output Voltage: U (V) flashes a red dot for 500ms in Voltage Limit Mode
	I(A)	Output Current: I (A) flashes a red dot for 500ms in Voltage Limit Mode
	P(kW)	Output Power: P (kW) flashes a red dot for 500ms in Voltage Limit Mode

4.3.3 Menu Operation Area

The Menu Operation Area is shown in Figure 4-10. Clicking it from any interface will access the Main Interface, and clicking it from any interface will access the first-level menu interface, as shown in Figure 4-11. Figure 4-10: Menu Operation Area DiagramFigure 4-10: Menu Operation Area Diagram

Figure 4-10: Menu Operation Area Diagram

Figure 4-11: Hierarchical Menu Interface Diagram

In Specific terminology, the first-level menus "Function" and "Setting" are grayed out, and the buttons are disabled.

In Running mode, the first-level menu "Configuration" is grayed out, and the buttons are disabled.

4.3.4 Output Setting Area

Only the Source-Load Main Interface has an Output Setting Area. See Table 4-3 for details on the setting parameters.

Table 4-3: Output Setting Area Content

Given/Limit		Setting Parameter	
Given Parameter	Source-Load - Constant Voltage Mode	Uset(V)	Voltage Setting
		Uslp(V/ms)	Voltage slew rate
		RnSet(mΩ)	Internal Resistance Setting
	Source-Load - Constant Current Mode	Iset(A)	Current Setting
		Islp(V/ms)	Current slew rate
	Source-Load - Constant Power Mode	Pset(kW)	Power Setting
		Pslp(kW/ms)	Power Slope
	Source-Load - Constant Resistance Mode	Rset(mΩ)	Internal Resistance Setting
		Rslp(mΩ/ms)	Internal Resistance Slope
Limit Parameters		LimitUh(V)	Voltage Output Upper Limit (Non-Constant Voltage Mode)
		LimitUl(V)	Lower voltage output limit (non-Constant Voltage Mode)
		LimitIh(A)	Upper current output limit (non-Constant Current Mode)
		LimitIl(A)	Lower current output limit (non-Constant Current Mode)
		LimitPh(kW)	Upper power output limit (non-Constant power mode)
		LimitPl(kW)	Lower power output limit (non-Constant power mode)

4.3.5 Output Control Area

This area allows you to control the Power supply Output. See Figure 4-12 for the Output control buttons, Figure 4-13 for Output button descriptions, and Table 4-4 for detailed button functions.

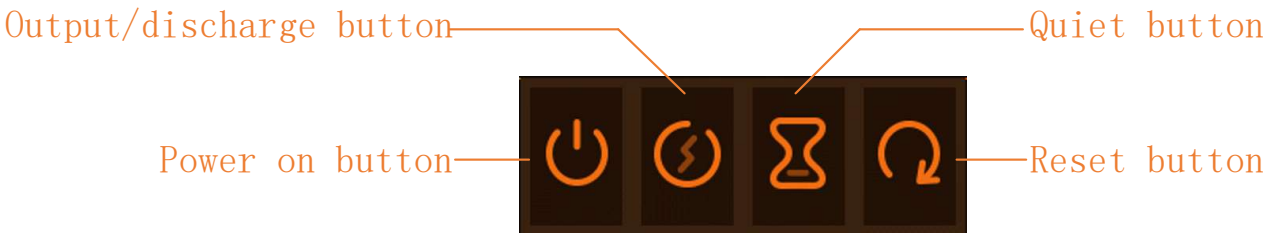


Figure 4-12: Output Control Button Diagram

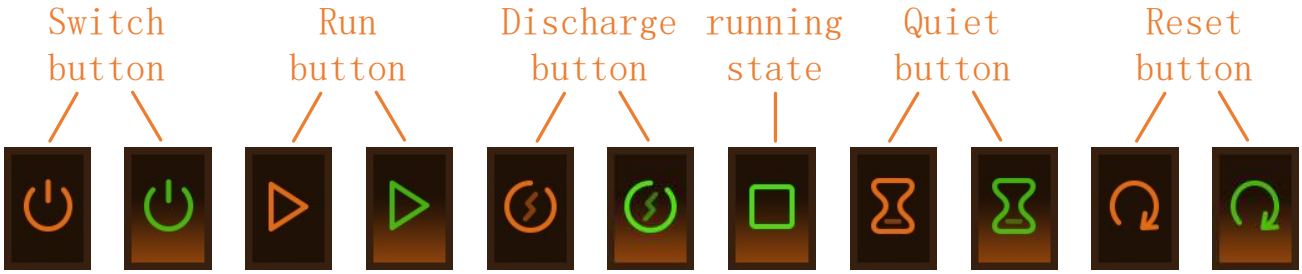


Figure 4-13: Output Control Button Description Diagram

Table 4-4: Output Control Button Function Table

Button Type	Function (button disabled in Specific terminology)
Power On Button	A: Enable Status: Enabled in any state. B: Display Status: Displayed in Shutdown state and Standby state; Alternating flashing display when transitioning between Shutdown and Standby states (frequency: 100ms). C: Command transmission: If the device is in the Shutdown state, click to send the power-on command; if the device is not in the Shutdown state, click to send the Shutdown command.
Output/Discharge Button	A: Enable Status: This button is Prohibited when in the Standing or Fault state; During the first startup in Photovoltaic mode Standby state, if the function Photovoltaic Interface - Static Curve - Curve is not accessed; B: Display Status: Displays Shutdown state, Discharge state, Standby state, Running Status, Static state, and flashes (100ms frequency) during the transition from Shutdown to Standby state. C: Command transmission: Source-Load Mode: In Standby state, click to send the Running command; In Running Status, click to send the Standby command. Photovoltaic Mode: In Standby state, click to send the Running command first, then send the Photovoltaic Parameters, followed by the Parameter Update Command after 100ms; In Running Status, click to send the Standby command. Battery mode: From the Standby state, first send the Battery simulator parameters, then send the Parameter Update Command after 100ms. After sending the Parameter Update Command, delay for 1000ms, and then send the Running command. After sending the Running command, wait to receive the Battery simulator Trigger flag before sending the Trigger command. From the Running Status, first send the stop

	Trigger command, and then send the Standby command.
Standing button	A: Enable status: This button is enabled only in the Running or Standing status. B: Display status: Orange display when not in the Standing status, green display when in the Standing status ; C: Send command: Send the Standing command when not in the Standing status, and send the resume command when in the Standing status.
Reset Button	A: Enable Status: This button is enabled only when a Fault Status exists. B: Display Status: Displayed in both non-fault and fault statuses. C: Send Command: Click to send a reset command.

4.4 Function

The function menu includes Programming, Photovoltaic, and Battery options, as shown in Figure 4-14.

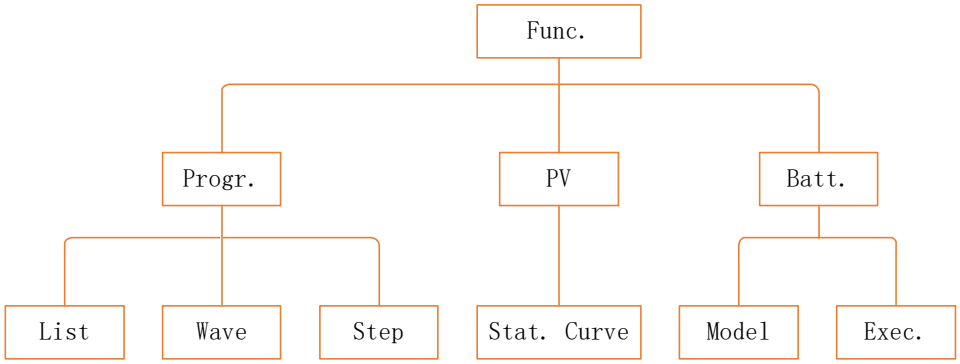


Figure 4-14: Function Tree Diagram

Click the first-level menu “Function” to access the second-level menu, Function. See Figure 4-15 for details.

Figure 4-14: Function Tree Diagram

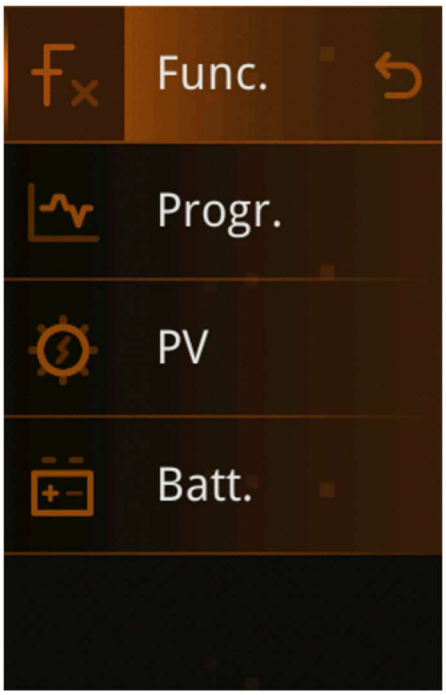


Figure 4-15: Second-Level Menu - Function

Source-Load Mode:

Click the “Programming” menu to access the third-level menu: Function- Programming.

Clicking the “Photovoltaic” menu displays a prompt window stating, “Please set the power supply to SAS mode.”

Clicking the "Battery" menu will display a prompt window stating, "Please set the power supply to BAT mode."

BAT Mode:

Clicking the "Programming" menu will display a prompt window stating, "Please set the power supply to Source-Load Mode";

Click the "Photovoltaic" menu to access the third-level menu: Function > Photovoltaic;

Clicking the "Battery" menu will display a prompt window stating, "Please set the power supply to BAT mode."

SAS Mode:

Clicking the "Programming" menu will display a prompt window stating, "Please set the power supply to SAS mode";

Clicking the "Photovoltaic" menu will display a prompt window stating, "Please set the power supply to mode";

Click the "Battery" menu to access the third-level menu: Function > Battery.

4.4.1 Programming

Click the second-level menu: Function > "Programming" to access the third-level menu: Programming. See Figure 4-16 for details.

The third-level menu for Programming includes the "List", "Wave", and "Step" options.

Figure 4-16: Third-level menu - Programming diagram

4.4.1.1List Programming

List Programming provides three interfaces: Configuration, Data, and Storage.

Refer to Figure 4-17 and Parameter Function Table 4-5 for details on the Programming List Configuration interface.

Refer to Figure 4-18, Parameter Function Table 4-6, and Button Function Table 4-7 for details on the Programming List Data interface.

Refer to Figure 4-19 and Button Function Table 4-8 for details on the Programming List Storage page.

Figure 4-17: Programming List Configuration Interface Diagram

Table 4-5: Parameter Function Table for the Programming Configuration Interface:

Parameter	Function
Number of Cycles	Set the number of programming loops.
Trigger Delay	Set the Trigger Delay before a trigger action.
Experimental Data	Select the data type for experimental output: Voltage, Current, Power, or Resistance.
Continuous Trigger	Enable/Disable Continuous Trigger
Trigger Mode	Set the Trigger mode: Auto - automatically execute each column of Data; Manual - manually execute a single column of Data.
External Trigger	Enable/Disable External Trigger

Figure 4-18 Programming List Data Interface Diagram

Table 4-6 Programming List Data Interface Parameter Function Table:

Parameter	Function
Total sequence	Displays the total sequence number.
Execution Sequence	Displays the execution sequence number.
Number of Cycles	Displays the number of cycles.
Sequence Number	Marks the execution order of parameters.
[A] [V] / Current / Voltage Power [kW] / Resistance [Ω]	Experimental Data - Constant Voltage: The title displays “Voltage [V]” Experimental Data - Constant Current: The title displays “Current [A]” Experimental data for constant power: The title displays “Power [kW]” Experimental data for constant resistance: The title displays “Resistance [Ω]”
Hold Time [ms]	Set the hold time parameter for each sequence.

Table 4-7 Programming List Data Interface Button Functions:

Button	Function (White when enabled, gray when disabled)
Loading	When running, the “Loading” button is enabled. Click to load programming data. When not

	running, the “Loading” button is disabled. After loading is complete, the “End” button is enabled. Click to end programming.
Trigger	The button is enabled after loading is complete. Click to trigger programming. The button is disabled when loading is not complete.
Add	The button is enabled when the total sequence is less than 1000. Click to add a sequence. The button is disabled when the total sequence is greater than or equal to 1000.
Delete	The button is enabled when the total sequence is greater than 1. Click to delete a sequence. The button is disabled when the total sequence is equal to 1.
Previous Page	This button is enabled when the current page number is greater than 1. Click to navigate to the previous page. The button is disabled when the current page number is 1.
Next Page	This button is enabled when the current page number is less than the total number of pages. Click to navigate to the next page. The button is disabled when the current page number equals the total number of pages.

Figure 4-19: Programming List from Storage Interface Diagram

Table 4-8: Programming Storage Interface Button Functions

Button	Function
Read	This button is always enabled. If Programming Data for the current mode is stored in instance x, clicking this button will read the data from instance x and Update the current Programming Data. If Programming Data for the current mode is not stored in instance x, a pop-up message will indicate

	that the read operation failed. (x ranges from 1-100)
Save	This button is always enabled. Clicking this button will save the current Programming Data to instance x. (x ranges from 1-100)

4.4.1.2 Wave Programming

Wave programming has three interfaces: Configuration, Data, and Storage.

See Figure 4-20 for the Wave Programming Configuration interface, and refer to Table 4-5 for parameter functions.

See Figure 4-21 for the Wave Programming Data interface, refer to Table 4-6 for parameter functions, and refer to Table 4-7 for button functions.

See Figure 4-22 for the Wave Programming Storage page, and refer to Table 4-8 for button functions.

Figure 4-20 Wave Programming Configuration Interface Diagram

Figure 4-21 Wave Programming Data Interface Diagram

Figure 4-22 Wave Programming Storage Interface Diagram

4.4.1.3 Step Programming

Step programming has three interfaces: Configuration, Data, and Storage.

See Figure 4-23 for the Step Programming Configuration interface, and refer to Table 4-9 for parameter functions.

See Figure 4-24 for the Step Programming Data interface, refer to Table 4-6 for parameter functions, and refer to Table 4-10 for button functions.

See Figure 4-25 for the Programming Step storage page; refer to section 4-8 for the button function list.

Figure 4-23 Programming Step Configuration Interface Diagram

Figure 4-24 Programming Step Data Interface Diagram

Table 4-9 Programming Step Data Interface Parameter Function List:

Parameter	Function
Total sequence	Total sequence = (Starting - End) ÷ Change + 1 (divisible) Total sequence = (Starting - End) ÷ Change + 2 (not divisible)
Execution Sequence	Displays the execution sequence number.
Number of Cycles	Displays the number of cycles.
Serial Number	Marks the execution order of parameters.
Starting Voltage [V]	Experimental Data - Constant Voltage: The title displays “Starting Voltage [V]”
Starting Current [A]	Experimental Data - Constant Current: The title displays “Starting Current [A]”
Starting Power [kW]	Experimental Data - Constant Power: The title displays “Starting Power [kW]”
Starting Resistance [Ω]	Experimental Data - Constant Resistance: Title displays "Starting Resistance [Ω]"
End Voltage [V]	Experimental Data - Constant Voltage: Title displays "End Voltage [V]"
End Current [A]	Experimental Data - Constant Current: Title displays "End Current [A]"
End Power [kW]	Experimental Data - Constant Power: Title displays "End Power [kW]"
End Resistance [Ω]	Experimental Data - Constant Resistance: Title displays "End Resistance [Ω]"
Voltage Variation [V]	Experimental Data - Constant Voltage: Title displays "Voltage Variation [V]"
Current Variation [A]	Experimental Data - Constant Current: Title displays "Current Variation [A]"
Power Variation [kW]	Experimental Data - Constant Power: Title displays "Power Variation [kW]"
Resistance Variation [Ω]	Experimental Data - Constant Resistance: The title displays “Resistance variation [Ω]”
Hold Time [ms]	Set the hold time parameter for each sequence.

Table 4-10 Programming Step Data Interface Button Menu:

Button	Function (White when enabled, gray when disabled)
Loading	When running, the “Loading” button is enabled. Click to load programming data. When not running, the “Loading” button is disabled. After loading is complete, the “End” button is enabled. Click to end programming.
Trigger	The button is enabled after loading is complete. Click to trigger programming. The button is disabled when loading is not complete.

Figure 4-25 Programming Step Storage Interface Diagram

4.4.2 Photovoltaic

Click the second-level menu- Function “Photovoltaic” to enter the third-level menu- Photovoltaic. See Figure 1.4.2_1 for details.

The third-level menu- Photovoltaic includes a “Static Curve” menu.

Figure 4-26 Third-level Menu - Photovoltaic Diagram

4.4.2.1 Static Curve

The Static Curve feature provides nine interfaces: Curve Model, Curve Parameters (Sandia Basic), Curve Parameters (EN50530 Basic), Curve Parameters (Sandia Advance), Curve Parameters (Sandia Advance PV Tech), Curve Parameters (EN50530 Advance), Curve Parameters (EN50530 Advance c-Si PV Tech), Curve Parameters (EN50530 Advance Thin-Film PV Tech), and Curve Parameters (EN50530 Advance Customer PV Tech).

Note: Each time you enter the Curve Model or Curve Parameters interface, the current Static Curve data is displayed. If data has been modified, the modified data is displayed. Click the "Update" button to send the modified data.

4.4.2.1.1 Curve Model Interface

After selecting the model and mode on this interface, click 'Curve Parameters' to access the Curve Parameter interface for the selected model and mode.

See Figure 4-27 and Parameter Function Table 4-11 for details about the Curve Model interface.

Figure 4-27: Curve Model Interface Diagram

Table 4-11: Curve Model Interface Parameter Function Table

Parameter	Function
Model	The following models are available: Sandia, EN50530, and Simple.
Mode	Based on the selected model, the available modes are Basic and Advance (refer to the Host computer description for function details).

4.4.2.1.2 Curve Parameters (Sandia Basic)

The Curve Parameters Interface (Sandia Basic) is shown in Figure 4-28, and the parameter function table is in Table 4-12.

Figure 4-28 Curve Parameters Interface (Sandia Basic)

Table 4-12 Curve Parameters (Sandia Basic) Interface Parameter Function Table:

Parameter	Function
Vmpstc	Vmp (Peak Voltage) is used to set the voltage of the photovoltaic module at the Maximum Power Point (MPP).
Vocstc	Voc (Open-circuit Voltage) is used to set the open-circuit voltage of the photovoltaic module.
Impstc	Im (Peak Current) is used to set the current of the photovoltaic module at the Maximum Power Point (MPP).
Iscstc	Isc (Short-Circuit Current) is used to set the short-circuit current of the photovoltaic module.

4.4.2.1.3 Curve Parameters (EN50530 Basic)

The Curve Parameters (EN50530 Basic) interface is the same as the Curve Parameters (Sandia Basic) interface, as shown in Figure 4-28. Refer to Function Table 4-12.

4.4.2.1.4 Curve Parameters (Sandia Advance)

The Curve Parameters (Sandia Advance) interface is shown in Figure 4-29. Refer to Function Table 4-13.

Figure 4-29 Curve Parameters (Sandia Advance) Interface Diagram

Table 4-13 Curve Parameters (Sandia Advance) Interface Parameter Function Table:

Parameter	Function
MMP Correction	Refer to the calibration enable function of the host computer and
Vmpstc	Vmp (Peak Voltage) is used to set the voltage of the photovoltaic module at the Maximum Power Point (MPP).
Pmpstc	Pmp (Peak Power) is used to set the power value of the photovoltaic module at the maximum power point (MPP).
FF	FF (Fill Factor) is used to set the ratio of the maximum power of the Photovoltaic module to the product of the Open-circuit Voltage and Short-Circuit Current.
Bate	Voltage Temperature Coefficient
Irrstc	Irrstc (Illumination Setting) is used to set the reference illumination value.
Irr	Irr (Actual Illumination) is used to set the actual illumination simulation value.
Tstc	Irrstc (Temperature Setting) is used to set the reference Temperature value.
T	T (Actual Temperature) is used to set the actual Temperature simulation value.

4.4.2.1.5 Curve Parameters (Sandia Advanced PV Tech)

The parameters on the Curve Parameters (Sandia Advanced PV Tech) Interface are not configurable. See Figure 4-30 and Parameter Function Table 4-14 for details.

Figure 4-30: Curve Parameters (Sandia Advanced PV Tech) Interface

Table 4-14 Curve Parameters (Sandia Advance PV Tech) Interface Parameter Function Table:

Parameter	Function
Array Type	Array Type
Thin-Film	Thin Film Technology Parameters
Standard Crystaline	Standard Crystalline Parameters
High-effic-Crystaline	High-Efficiency Crystalline Parameters

4.4.2.1.6 Curve Parameters (EN50530 Advance)

The Curve Parameters interface (EN50530 Advance) is shown in Figure 4-31. The parameter function table is shown in Table 4-15.

Figure 4-31 Curve Parameters (EN50530 Advance) Interface

Table 4-15 Curve Parameters (EN50530 Advance) Interface Parameter Function Table:

Parameter	Function
Vmpstc	Vmp (Peak Voltage) is used to set the voltage of the photovoltaic module at the Maximum Power Point (MPP).
Pmpstc	Pmp (Peak Power) is used to set the power value of the photovoltaic module at the maximum power point (MPP).
Irrstc	Irrstc (Illumination Setting) is used to set the reference illumination value.
Irr	Irr (Actual Illumination) is used to set the actual illumination simulation value.
PV Tech	Battery panel technology selection: c-Si (Crystalline Silicon); Thin-film; Customer (Customer Defined)
Tstc	Irrstc (Temperature Setting) is used to set the reference Temperature value.
T	T (Actual Temperature) is used to set the actual Temperature simulation value.

4.4.2.1.7 Curve Parameters (EN50530 Advance c-Si PV Tech)

Curve Parameters (EN50530 Advance c-Si PV Tech) interface parameter Setting, as shown in Figure 4-32, parameter function table 4-16.

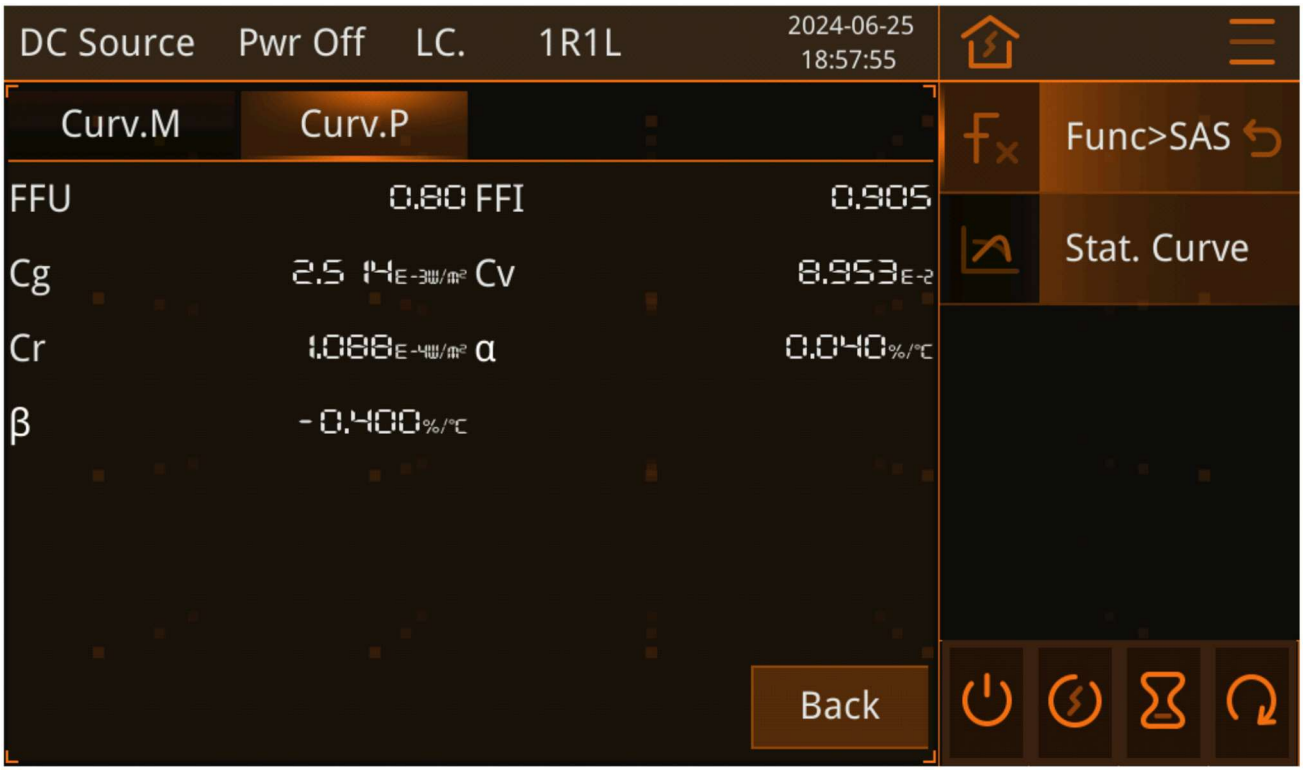


Figure 4-32 Curve Parameters (EN50530 Advance c-Si PV Tech) Interface

Table 4-15 Curve Parameters (EN50530 Advance c-Si PV Tech) Interface Parameter Function Table:

Parameter	Function
FFU	FFU (Voltage Fill Factor)
FFI	FFI (Current Fill Factor)
Cg	Model Parameters
Cv	Model Parameters
Cr	Model Parameters
α	α (Current Temperature Coefficient)
β	β (Voltage Temperature Coefficient)

4.4.2.1.8 Curve Parameters (EN50530 Advance Thin-Film PV Tech)

The Curve Parameters (EN50530 Advance Thin-Film PV Tech) Interface is consistent with the Curve Parameters (EN50530 Advance c-Si PV Tech) Interface, as shown in Figure 4-32, parameter function table 4-15.

4.4.2.1.9 Curve Parameters (EN50530 Advance Customer PV Tech)

The Curve Parameters (EN50530 Advance Customer PV Tech) interface is identical to the Curve Parameters

(EN50530 Advance c-Si PV Tech) interface, but all parameters are configurable, as shown in Figure 4-33 and Parameter Function Table 4-15.

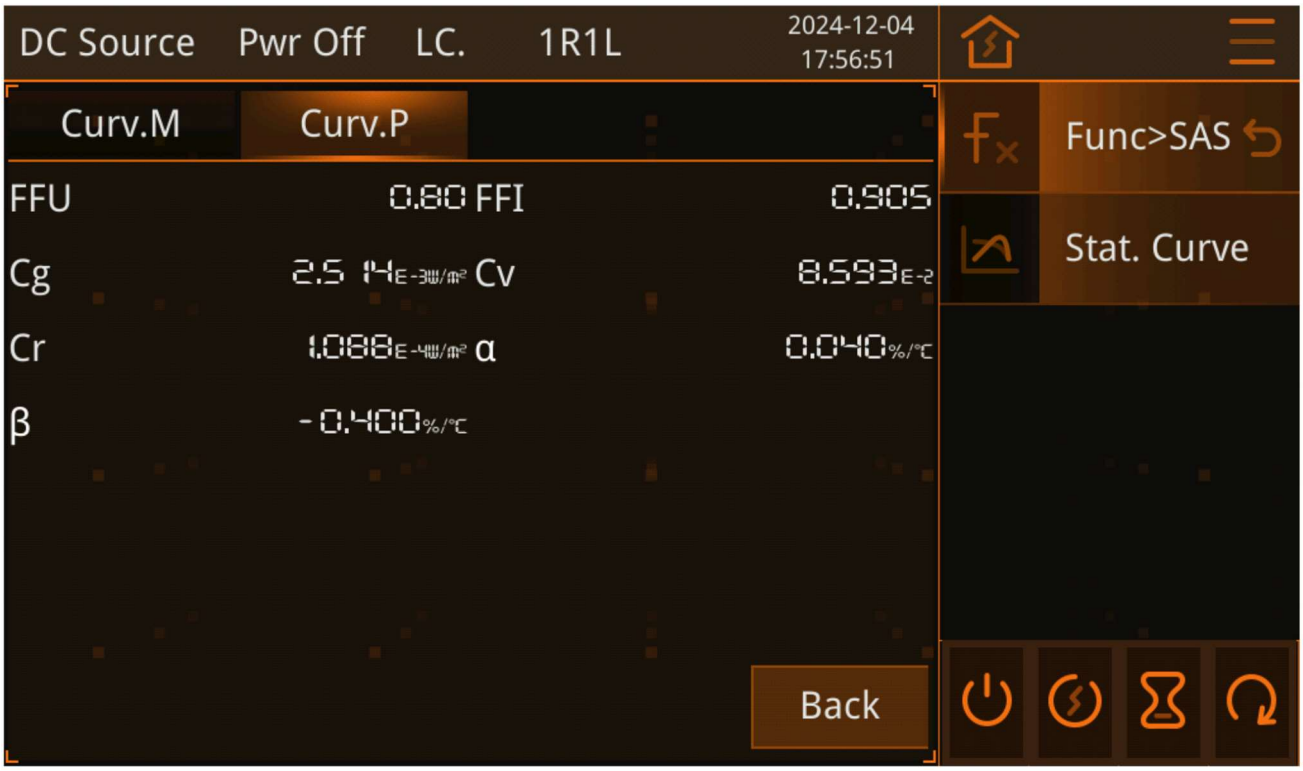


Figure 4-33 Curve Parameters (EN50530 Advance Customer PV Tech) Interface

4.4.3 Battery

'Battery' to access the third-level menu 'Battery', as detailed in Figure 4-35.

The third-level menu 'Battery' contains the 'Model' and 'Execute' menus.

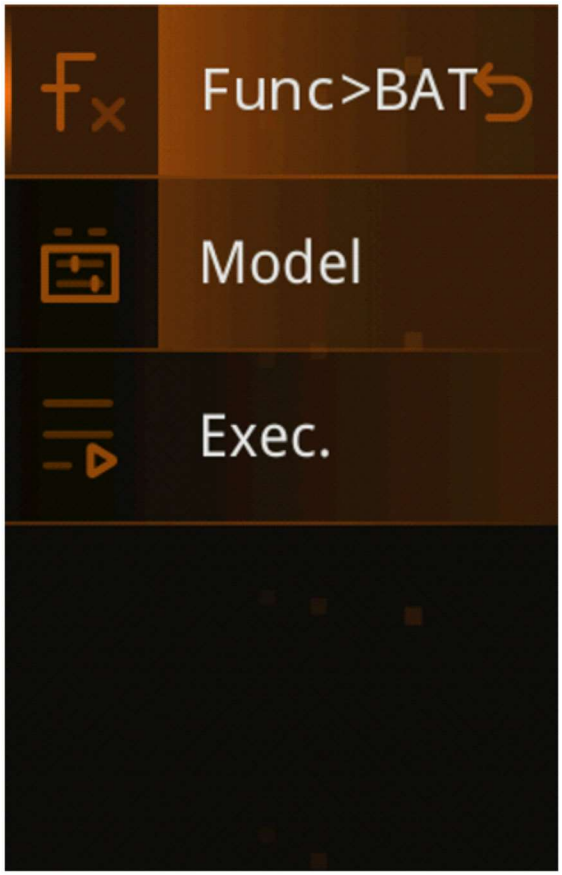


Figure 4-34 Third-level Menu - Battery Diagram

4.4.3.1 Model

The 'Model' menu has two interfaces: 'Information' and 'Setting'.

4.4.3.1.1 Model Information Interface

After setting the battery parameters in the model setting interface, this interface displays battery pack information.

See Figure 4-35 and Parameter Function Table 4-16 for details on the model information interface.

Figure 4-35 Model Information Interface

Table 4-16 Parameter Function Table for Model Information Interface:

Parameter	Function
Initial Capacity	Battery Pack Initial Capacity
Capacity	Battery Pack Total Capacity
SOC 0% Voltage	SOC (State of Charge): Voltage value when the battery remaining power percentage is zero.
SOC 100% Voltage	SOC (State of Charge): Voltage value when the battery remaining power percentage is one hundred.
50% Internal Resistance	SOC (State of Charge): Battery internal resistance value when the battery remaining power percentage is fifty.

4.4.3.1.2 Model Setting Interface

The model information interface is shown in Figure 4-36, with parameter function table 4-17.

Figure 4-36 Model Setting Interface Diagram

Table 4-17 Model Setting Interface Parameter Function Table:

Parameter	Function
Mode	Parameter Mode
Battery Technology	Set Battery Type
Initial SOC	Set Battery Remaining Power Percentage
Single Cell Internal Resistance	Set the Internal Resistance Value of the Single Battery Cell
Initial Capacity	Set the Initial Capacity of the Battery Pack
Single Cell Capacity	Set the Single Battery Cell Capacity
Initial Temperature	Set the Initial Temperature of the Battery Pack
Cable Impedance	Set Cable Impedance
Series Number	Set the number of series connections for the Battery pack.
Parallel Number	Set the number of Battery packs.

4.4.3.2 Execution

The execution section includes three interfaces: Protection, Alarm, and Setting.

4.4.3.2.1 Execution Protection Interface

The execution protection interface is shown in Figure 4-37, with parameter function table 4-18.

Figure 4-37: Execution Protection Interface Diagram

Table 4-18: Execution Protection Interface Table

Parameter	Function
Protection	"Enable" activates protection; "Prohibited" deactivates protection.
Charging SOC	Set the Battery remaining power percentage protection threshold during Charging of the Single Battery Cell.
Discharge SOC	Set the Battery remaining power percentage protection threshold during Discharging of the Single Battery Cell.
Charging Voltage	Setting the protection voltage threshold when charging a Single Battery Cell
Discharge Voltage	Setting the protection voltage threshold when discharging a Single Battery Cell
Fusing current	Setting the fusing current protection threshold

4.4.3.2.2 Alarm Execution Interface

See Figure 4-38 and Parameter Function Table 4-19 for details of the Alarm Execution Interface.

Figure 4-38 Alarm Execution Interface Diagram

Table 4-19 Parameter Function Table of Alarm Execution Interface:

Parameter	Function
Alarm	"Enable" enables the alarm; "Prohibited" disables the alarm.
Charging SOC	Setting the warning threshold for Battery remaining power percentage when charging a Single Battery Cell
Discharge SOC	Setting the warning threshold for Battery remaining power percentage when discharging a Single Battery Cell
Charging Voltage	Setting the Warning Voltage Threshold for Single Battery Cell Charging
Discharge Voltage	Setting the Warning Voltage Threshold for Single Battery Cell Discharging
Fusing Current	Setting the Fusing Current Warning Threshold

4.4.3.2.3 Execution Setting Interface

The Execution Setting Interface is shown in Figure 4-39, with Parameter Function List in Table 4-20 and Button Function List in Table 4-21.

Figure 4-39: Execution Setting Interface

Table 4-20: Execution Setting Interface Parameter Function List

Parameter	Characteristic
Temperature Enable	“Enable” activates temperature simulation; “Prohibited” deactivates temperature simulation.
Pre-Charge	Changes the voltage slope and calculates the charging/discharging voltage step size.
Start Delay	The simulation takes effect after the set start delay time.
Charging efficiency	Sets the charging efficiency of the simulated battery pack.
Discharge efficiency	Sets the discharge efficiency of the simulated battery pack.
Cycle test	"Enable" activates automatic cycle charging and discharging; "Prohibited" deactivates automatic charging and discharging.
Cutoff SOC	Percentage threshold of remaining battery pack capacity at cutoff.
Cutoff Capacity	Battery pack capacity at cutoff.
Number of Cycles	Sets the number of cycles for the simulation model.

Table 4-21: Function list of buttons on the execution setting interface:

Button	Function (White when enabled, gray when disabled)
Pause	This button is enabled when the Battery simulator is triggered and the characteristic parameter status is not paused; other buttons are disabled.

Continue	This button is enabled when the Battery simulator is triggered and the characteristic parameter status is paused; other buttons are disabled.
Reset	This button is enabled when the characteristic parameter status is paused; other buttons are disabled.

4.5 Setting

The Setting function is shown in Figure 4-40. Users can configure the Operating Mode, Source-Load Mode parameters, and Power supply protection features.

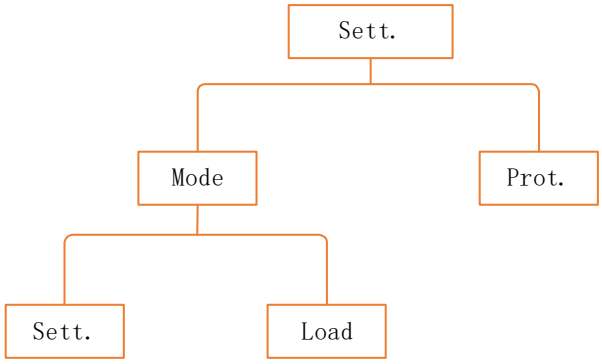


Figure 4-40 Setting Tree Diagram

Click the first-level menu “Setting” to access the second-level menu- Setting, as shown in Figure 4-41.

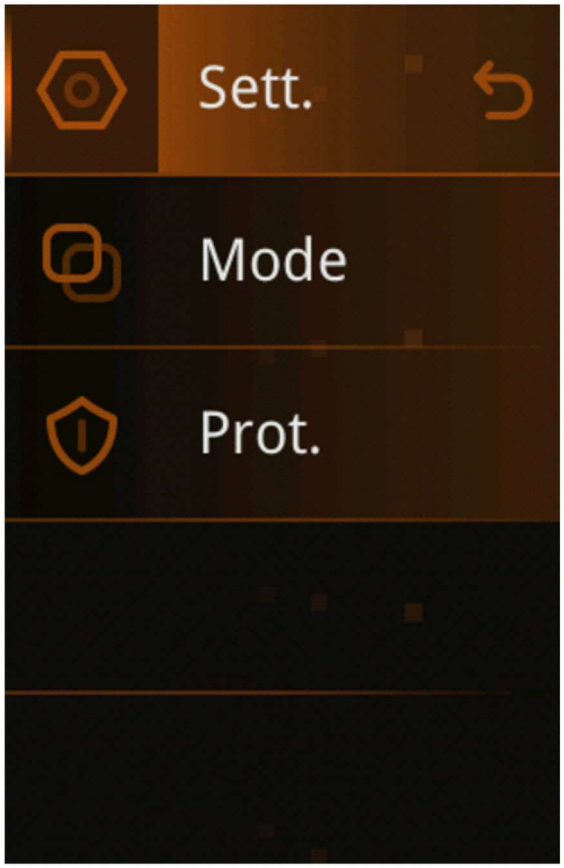


Figure 4-41 Auxiliary Menu - Setting Diagram

In Running mode, the “Mode” option in the second-level menu- Setting is grayed out, and the button is disabled.

4.5.1 Mode

The Mode menu contains two interfaces: Setting and Source-Load.

4.5.1.1 Setting

See Figure 4-42 for the Mode Setting Interface and Parameter function table 4-22.

Figure 4-42 Mode Setting Interface Diagram

Table 4-22: Mode Setting Menu Interface Parameters

Parameter	Function
Mode	After switching modes, the device will switch to the main interface.

4.5.1.2 Simulation Source Loading

See Figure 4-43 and Parameter Function Table 4-23 for details on the mode source loading interface.

Figure 4-43 Mode Source Interface Diagram

Table 4-23 Mode Source Interface Parameter Function Table:

Parameter	Function
Mode	Four modes are available: constant voltage, constant current, constant power, and constant resistance.

4.5.2 Protection

See Figure 4-44 and Parameter Function Table 4-24 for details on the protection settings interface.

Figure 4-44 Protection Settings Interface Diagram

Table 4-24 Protection Settings Interface Parameter Table Function:

Parameter	Function
Voltage	Set the upper and lower limit thresholds for the output voltage. If the output voltage exceeds either threshold and the duration reaches the set protection time, the power supply will trigger protection and stop the output.
Current	Set the upper and lower limit thresholds for the Output Current. When the Output Current exceeds either threshold and the Time reaches the set protection time, the Power supply will Trigger protection and stop the Output.
Power	Set the upper and lower limit thresholds for the Output Power. When the Output Power exceeds either threshold and the Time reaches the set protection time, the Power supply will Trigger protection and stop the Output.

4.6 Configuration

The Configuration function is shown in Figure 4-45. Users can configure communication methods, parallel functions, and expansion functions.

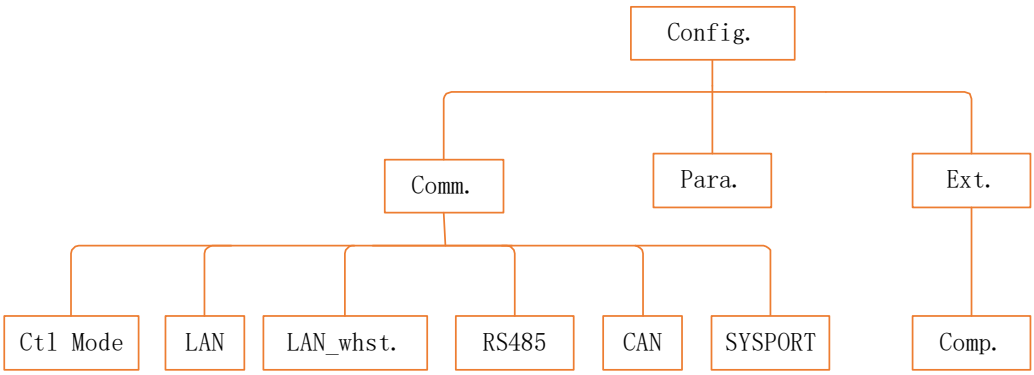


Figure 4-45 Configuration Tree Diagram

Click the first-level menu “Configuration” to enter the second-level menu- Configuration, as shown in Figure 4-46. Figure 4-14: Function Tree Diagram

Figure 4-46 Second-level Menu - Configuration Diagram

In remote control mode, the “Parallel” and “Expansion” functions in the second-level menu- Configuration can be disabled by pressing the gray button.

4.6.1 Communication

The communication menu contains six Interfaces: Control Mode, LAN, LAN Whitelist, RS485, CAN, and SYSPORT.

4.6.1.1 Control Mode

See Figure 4-47 and Parameter Function Table 4-25 for details on the communication control mode Interface.

Figure 4-47: Communication Control Mode Interface Diagram

Table 4-25: Parameter Function Table for Communication Control Mode Interface

Parameter	Function
Communication Port	Screen; LAN; RS485; CAN

4.6.1.2LAN

See Figure 4-48 and Parameter Function Table 4-25 for details on the communication LAN Interface.

Figure 4-48: Communication LAN Interface Diagram

Note: After setting the Parameters on the LAN Interface, click the OK button to send all Data on this page. The OK button is Enabled after Data modification, and disabled after the Data is sent.

Table 4-25: Parameter Function Table for Communication LAN Interface

Parameter	Function
Communication Protocol	The protocol used in LAN mode is Modbus-TCP.
IP Address	IP Address Configuration
Subnet Mask	Communication Subnet Mask Configuration
Default Gateway	Communication Default Gateway Configuration
Port Number	Communication Port Number Configuration
MAC Address	Communication MAC Address Display

4.6.1.3 LAN Whitelist

See Figure 4-49 and Parameter Function Table 4-26 for details about the Communication LAN Whitelist Interface.

Figure 4-49: Communication LAN Whitelist Interface Diagram

Table 4-26: Communication LAN Whitelist Interface Parameter Function Table

Parameter	Function
Whitelist	"Enable" activates the whitelist; "Prohibited" deactivates the whitelist.
Whitelist Quantity	Set Whitelist Quantity
Whitelist IP1	Whitelist IP1 Entry
Whitelist IP2	Whitelist IP2 Entry
Whitelist IP3	Whitelist IP3 Entry
Whitelist IP4	Whitelist IP4 Entry
Whitelist IP5	Whitelist IP5 Entry

4.6.1.4RS485

See Figure 4-50 and Parameter Function Table 4-27 for the RS485 communication interface.

Figure 4-50: RS485 Communication Interface Diagram

Table 4-27: RS485 Communication Interface Parameter Function Table

Parameter	Function
Baud Rate	Sets the communication baud rate for RS485.
Communication Address	Used to set the communication address for RS485.

4.6.1.5CAN

See Figure 4-51 for the communication CAN Interface and Parameter Function Table 4-28.

Figure 4-51: Communication CAN Interface Diagram

Table 4-28: Communication CAN Interface Parameter Function Table

Parameter	Function
Baud Rate	Used to set the communication baud rate for CAN.
Communication Address	Used to set the communication address for CAN.

4.6.1.5SYSPORT

See Figure 4-52 for the communication SYSPORT Interface and Parameter Function Table 4-29.

Figure 4-52: Communication SYSPORT Interface Diagram

Note: After setting the parameters on the SYSPORT Interface, click the OK button to send all data on the page. The OK button is enabled after data modification and disabled after the data is sent.

Table 4-29: Communication SYSPORT Interface Parameter Function Table

Parameter	Function
Communication Protocol	The protocol used in SYSPORT mode is Modbus-TCP.
IP Address	IP Address Configuration
Subnet Mask	Communication Subnet Mask Configuration
Default Gateway	Communication Default Gateway Configuration
Port Number	Communication Port Number Configuration
MAC Address	Communication MAC Address Display

4.6.2 Parallel Connection

See Figure 4-53 for the Parallel Interface and Parameter Function Table 4-30.

Figure 4-53 Configuration Interface Diagram for Parallel Connection

Table 4-30 Configuration Interface Parameter Function List for Parallel Connection:

Parameter	Function
Parallel Connection Mode	When port 1 is a single unit, the "Series-Parallel" option in Parallel Connection mode is grayed out, and the button is disabled.
Port 1	When port 2 is the master or slave unit, the "Slave" option for port 1 is grayed out, and the button is disabled.
Port 2	When port 1 is a slave unit, the "Master" and "Slave" options for port 2 are grayed out, and the button is disabled.
Parallel Connection Transparent Transmission	When neither port 1 nor port 2 is a single unit, the "Enable" option for Parallel Connection Transparent Transmission is grayed out, and the button is disabled.

4.6.3 Expansion

A compensation Interface is available under the extended menu.

See Figure 4-54 for the extended compensation Interface and Parameter Function List 4-31.

Figure 4-54 Extended Compensation Interface Diagram

Table 4-31 Extended Compensation Interface Parameter Function List:

Parameter	Function
PDU	"Enable" activates the PDU; "Prohibited" deactivates the PDU.
Remote Compensation	When the PDU is prohibited, the "Enable" option for remote compensation is grayed out, and the button is disabled.

4.7 System

The system functions are shown in Figure 4-55. Users can configure display screen information and query the version number.

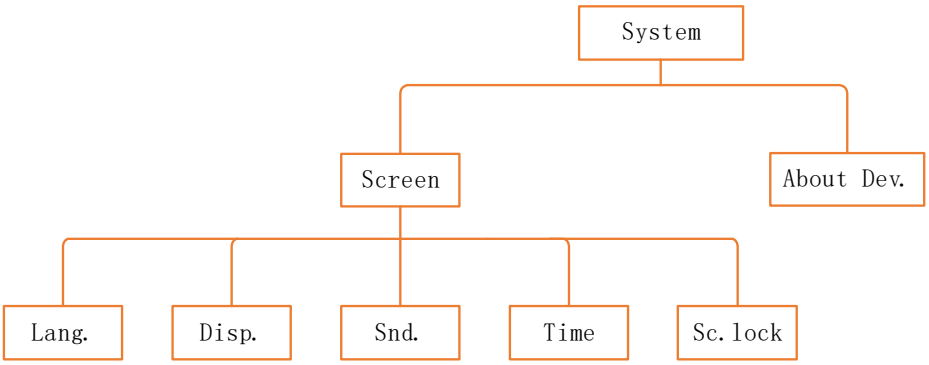


Figure 4-55 System Tree Diagram

Click the first-level menu “System” to access the second-level menu, System, as detailed in Figure 4-56.

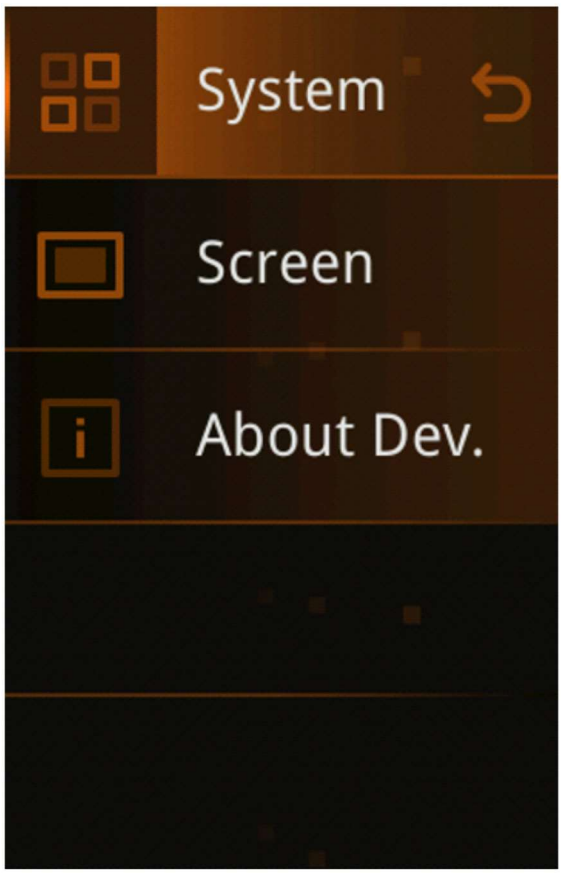


Figure 4-56 Second-level Menu - System Diagram

4.7.1 Screen

The screen menu contains four interfaces: Language, Display, Sound, and Time.

4.7.1.1 Language

See Figure 4-57 for the screen language interface and parameter function table 4-32.

Figure 4-57 Screen Language Interface Diagram

Table 4-32 Screen Language Interface Parameter Function List:

Parameter	Function
Language	Display language. Currently, only Chinese and English are supported.

4.7.1.2 Display

See Figure 4-58 for the screen display interface and parameter function list in Table 4-33.

Figure 4-58 Screen Display Interface Diagram

Table 4-33 Screen Display Interface Parameter Function List:

Parameter	Function
Brightness	Display screen brightness. Move the slider to adjust the display screen brightness.
Screen Saver	Set the inactivity time before the screen saver activates. For example, setting it to 30s will activate the screen saver if the display screen is not touched for 30 seconds.

4.7.1.3 Sound

See Figure 4-59 for the screen sound interface and Parameter Function Table 4-34.

Figure 4-59: Screen Sound Interface Diagram

Table 4-35: Screen Sound Interface Parameter Function Table

Parameter	Function
Alarm Sound	The display screen buzzer will sound an alarm when a fault occurs.
Touch Sound	The display screen will beep each time it is touched.
Power-On Sound	The display screen will beep when powered on.

4.7.1.4 Time

See Figure 4-60 for the screen time interface and Parameter Function Table 4-36.

Figure 4-60: Screen Time Interface Diagram

Table 4-37: Screen Time Interface Parameter Function Table

Parameter	Function
Date	Set the display screen date.
Time	Set the display screen time.

4.7.1.5 Screen Lock

See Figure 4-61 for the lock screen interface, and Table 4-38 for the parameter function table.

Figure 4-61 Lock Screen Interface

Table 4-38 Lock Screen Interface Parameter Function Table:

Parameter	Function
Lock Screen Password	When the lock screen password is enabled, the lock screen interface will appear after exiting the startup interface or screen saver. If disabled, the lock screen interface will not appear.
Change Password	Click to change the lock screen password.

4.7.2 About the Device

See Figure 4-62 for the System About Device interface, and Table 4-39 for the parameter function table.

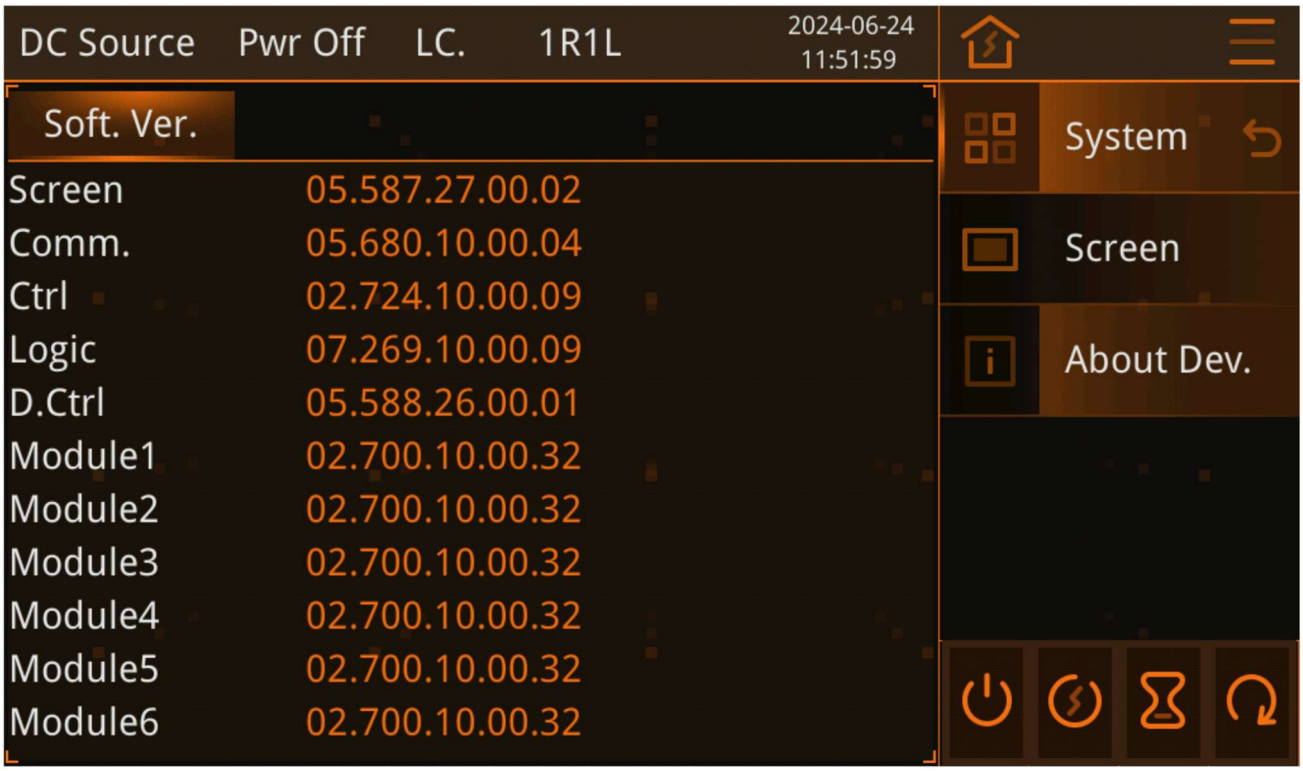


Figure 4-62 System About Device Interface

Table 4-39 System About Device Interface Parameter Function Table (Screen Time):

Parameter	Function
Software Version	Screen - Display Program
	Display Control - Display Control Program
	Control - Central Control M4 Program
	Communication - Central Control M7 Program
	Logic - FPGA Program
	Module - Module Program

4.8 Record

The recording function is shown in Figure 4-63. Users can query fault records, front-end/back-end temperature monitoring, and configure the insulation monitoring module.

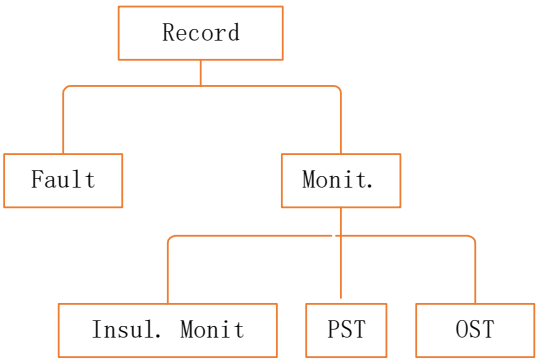


Figure 4-63: Record Tree Diagram

Click the first-level menu "记录" (Record) to enter the second-level menu- "记录" (Record). See Figure 4-64 for details.

Figure 4-64: Second-level menu- "记录" (Record) diagram

4.8.1 Fault

See Figure 4-65 for the fault record interface and Table 4-40 for button functions.

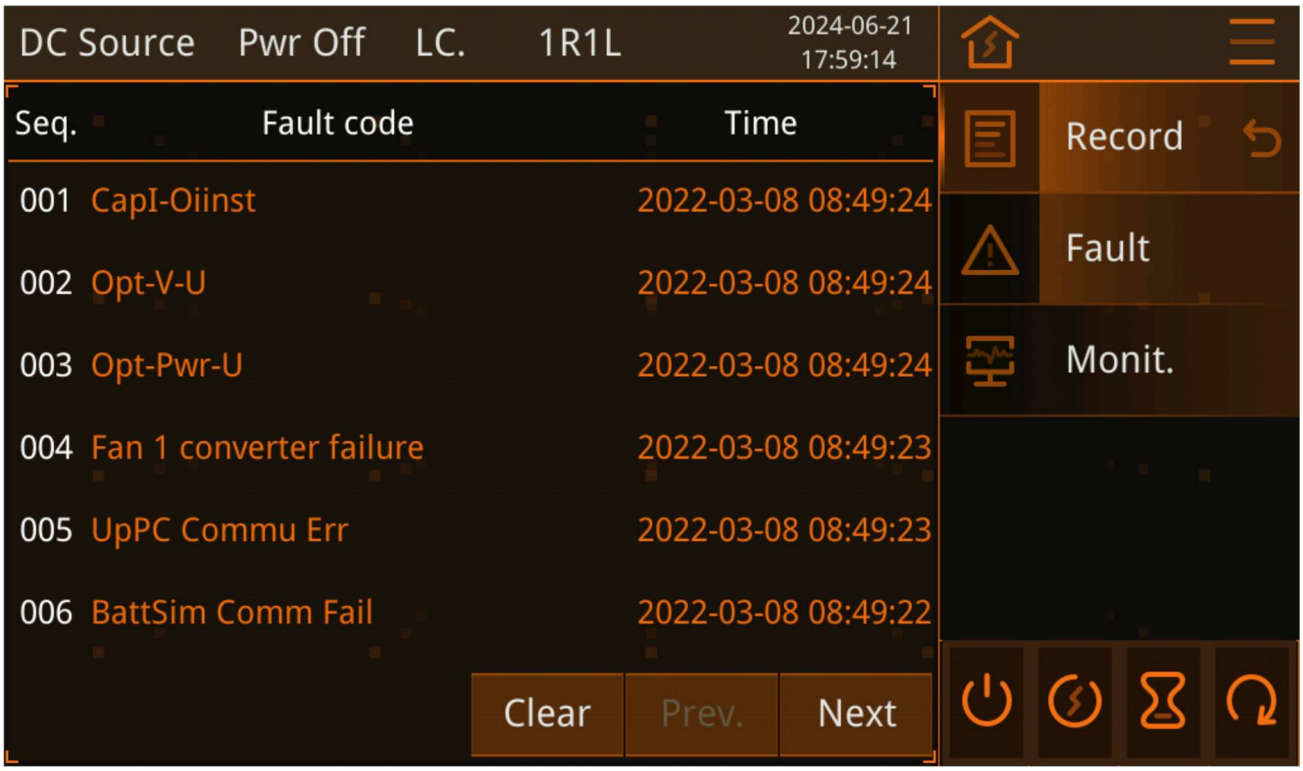


Figure 4-65: Fault Record Interface Diagram

Table 4-40: Fault Record Interface Button Function Table

Parameter	Function
Clear	Enabled when a fault record exists. Click to clear the fault record.
Previous Page	Enable based on the number of Faults. Click to view Fault records.
Next Page	Enable based on the number of Faults. Click to view Fault records.

4.8.2 Monitoring

The monitoring menu includes an insulation monitoring Interface, a front-stage Temperature Interface, and a rear-stage Temperature Interface.

4.8.2.1 Insulation Monitoring

When insulation monitoring is Prohibited in the system Configuration for the entire machine model Parameter, the insulation Resistance and protection threshold display "——", and the protection threshold button is disabled. When insulation monitoring is Enabled and the insulation Resistance is zero, "——" is displayed. If the insulation Resistance is non-zero, the current value is displayed, the protection threshold displays the current value, and the protection threshold button is Enabled. After Setting the protection threshold, wait 4 seconds before making another Setting.

The insulation monitoring Interface is shown in Figure 4-66, Parameter function table 4-41.

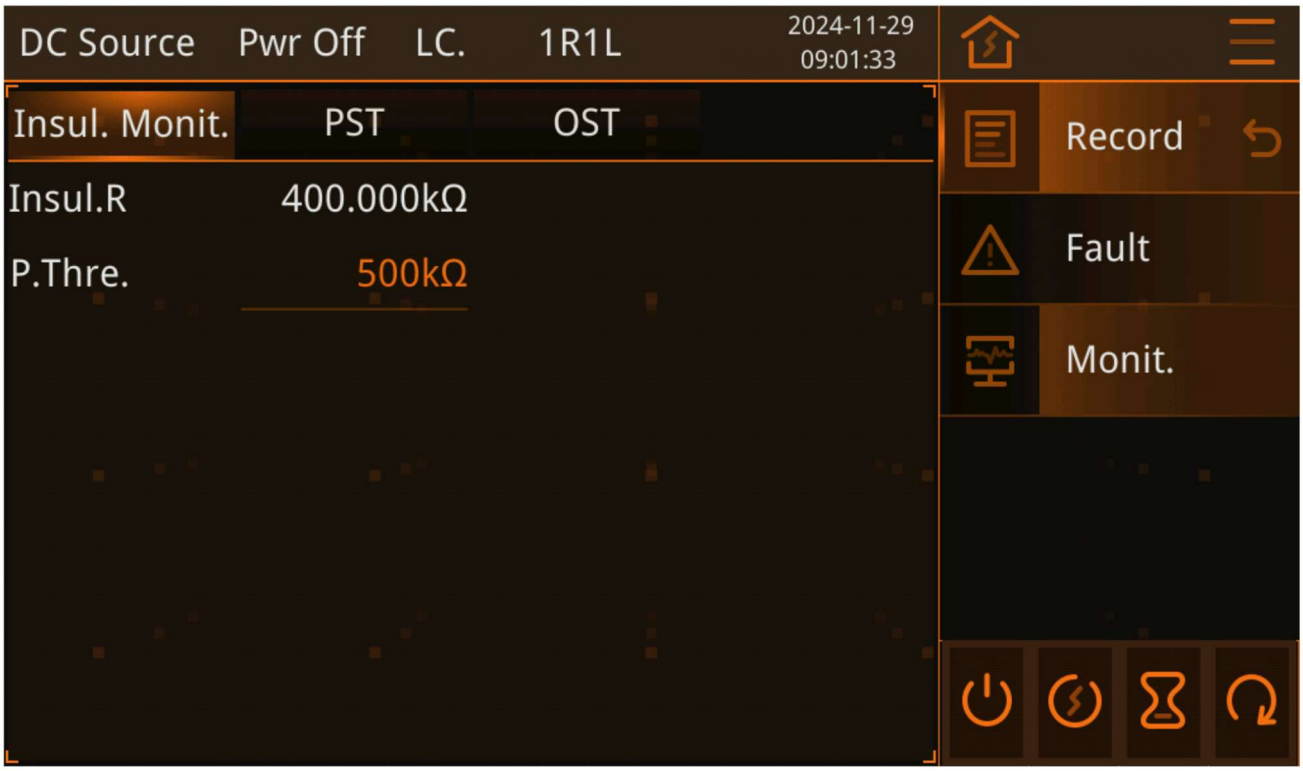


Figure 4-66 Insulation Monitoring Interface Diagram

Table 4-41 Insulation Monitoring Interface Parameter Function Table:

Parameter	Function
Insulation Resistance	Displays "---" when Prohibited; displays the current value when Enabled.
Protection Threshold	Displays "---" when Prohibited, and the button is disabled. When Enabled, the current value is displayed, and the button is enabled. After setting the protection threshold once, wait 4 seconds before setting it again.

4.8.2.2 Front-Stage Temperature

See Figure 4-67 for the Front-Stage Temperature Interface and parameter function table 4-42.

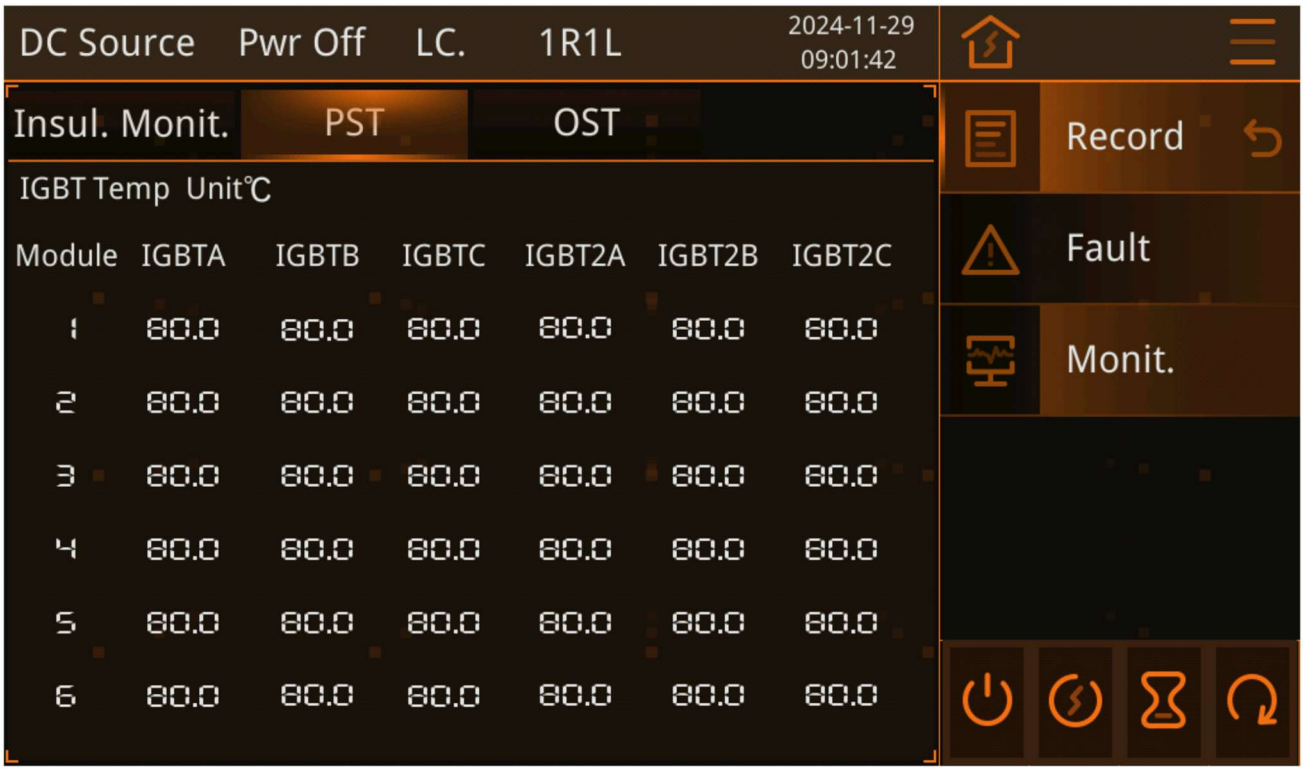


Figure 4-67 Front-Stage Temperature Interface Diagram

Table 4-43 Front-Stage Monitoring Temperature Interface Parameter Function Table:

Parameter	Function
IGBTA-2C	Displays IGBT Temperature (based on the actual number of IGBTs).

4.8.2.3 Rear Stage Temperature

See Figure 4-68 for the rear stage temperature interface and parameter function table 4-44.

Figure 4-68: Rear Stage Temperature Interface Diagram

Table 4-44: Rear Stage Monitoring Temperature Interface Parameter Function Table

Parameter	Function
IGBT1-8	Displays the IGBT temperature. If module IGBT1-IGBT8 reports a Fault, it is displayed in red. When the Fault is cleared, it is displayed in white (the display will reflect the actual number of IGBTs).

4.9 Screen Saver Interface

If the display screen is idle for the duration of the screen saver Time, it will switch to the screen saver Interface. Clicking anywhere on the screen saver Interface will exit the screen saver. After exiting the screen saver, if the lock screen password is enabled, the system will switch to the Lock screen interface. After logging in on the Lock screen interface, the system will return to the Interface that was displayed before the screen saver activated. If the lock screen password is disabled, the system will return directly to the Interface that was displayed before the screen saver activated. See Figure 4-69 for the screen saver Interface.

Figure 4-69 Screen Saver Interface Diagram

The screen saver interface logo is displayed every 10 seconds in each of the four corners and the center of the screen.

5. Maintenance

5.1 Introduction

If the power supply cannot be operated normally, refer to the fault troubleshooting procedures and suggestions in Section 5.2 of this chapter. If the provided troubleshooting advice does not resolve the issue, please contact the supplier from whom you purchased the power supply.

5.2 Emergency Troubleshooting

The power supply has comprehensive fault protection and self-diagnostic capabilities. Due to human error or issues with the power supply itself, faults may inevitably occur during operation. If the control board and human-machine interface are functioning normally, the touchscreen will automatically record and save fault information if a fault occurs.

When a Fault Occurs:

First, disconnect the input main circuit breaker.

Refer to the troubleshooting steps listed in Table 5-1.

Table 5-1: Common Fault Troubleshooting Methods

Fault Name	Cause Analysis	Solution
Emergency Stop	Emergency Stop Switch Activated	Check whether the emergency stop button is in the normal position. If not, rotate the emergency stop button approximately 45 degrees in the direction indicated by the label. The emergency stop button will pop up automatically, and the fault will be cleared after a Reset.
Soft Start Main Handover Abnormality	Soft Start Main Handover Feedback Wiring Loose Connection	Completely disconnect the power supply, check the auxiliary contact wiring for looseness, and tighten the wiring screws.
Output soft-start contactor abnormal	Output soft-start contactor feedback Wiring loose	Completely disconnect the power supply, check the auxiliary contact wiring for looseness, and tighten the wiring screws.
Main transfer abnormal	Main switching feedback connection loose	Power supply completely cut off. Check if the auxiliary contact wiring is loose and tighten the wiring screws.
Output contactor abnormal	Output main switching feedback wiring Loose Connection	Power supply completely cut off. Check if the auxiliary contact wiring is loose and tighten the wiring screws.

Output discharge abnormal	Output discharge feedback wiring loose	Power supply completely cut off. Check if the auxiliary contact wiring is loose and tighten the wiring screws.
Transformer overheating	Transformer temperature too high	Check if the transformer, inductor coil, and core are overheating. Check if the transformer and inductor temperature feedback wires are loose.
Input soft-start timeout time	AC input undervoltage	Check if the input power supply voltage is too low.
Input overvoltage	AC input voltage too high	Check if the input voltage exceeds the rated value. The operating range is (0.85-1.15)* 380V.
Input undervoltage	AC input voltage too low	Check if the input voltage is lower than 320V. The operating range is (0.85-1.15)* 380V.
Phase sequence error	AC input phase sequence reversed One phase is not connected	Check that the input wiring phase sequence on the grid side is correct. Confirm that one phase voltage is missing or too low.
Output voltage out of limit Output overvoltage	Output exceeds voltage protection limit	Check whether the output voltage is higher than the limit. Display the protection parameter Interface to view the limit for each channel. Does the device under test have a large instantaneous reverse Current?
Output Current limit exceeded Output overcurrent Inductor overcurrent	Output Current limit exceeded	Check whether the Output Current exceeds the threshold. The threshold for each channel can be viewed on the protection Parameter Interface. Is the Output short-circuited?
Output Power limit exceeded Output overload	Output Power limit exceeded	Check whether the Output Power exceeds the threshold. The threshold for each channel can be viewed on the protection Parameter Interface.
IGBT module overcurrent	Driver module detection error	Check whether the driver wire and fiber optic connector are loose.
Output soft-start timeout	Output contactor not closed	Check whether the Output contactor closes during startup.
Bus overvoltage	Bus Voltage is too high.	Check the device under test for large instantaneous reverse current.
Other Fault Information		Contact after-sales service for further assistance.

5.3 Troubleshooting Guide

Fault repair must ensure the power supply is in good electrical and mechanical condition to avoid danger caused by improper repair. Report equipment defects and safety hazards promptly, and discontinue use of the power supply until its safety is assured. Before performing any inspection or maintenance, ensure the power supply is in good condition to avoid safety hazards.

Precautions:

- Disconnect all power supplies and wait at least 10 minutes to ensure no residual power remains in the equipment.
- If troubleshooting is required while the equipment is powered, ensure trained personnel are present who know how to disconnect the power supply and provide emergency assistance if needed.

These operations should be performed by qualified professionals.

5.4 Maintenance

Environmental factors such as temperature, humidity, dust, and vibration can cause the internal components of the grid simulator to age, potentially leading to faults. Therefore, regular daily maintenance of the grid simulator is necessary to ensure its normal running and extend its service life.

The details of daily maintenance and the recommended maintenance schedule are shown in Table 5-2 below:

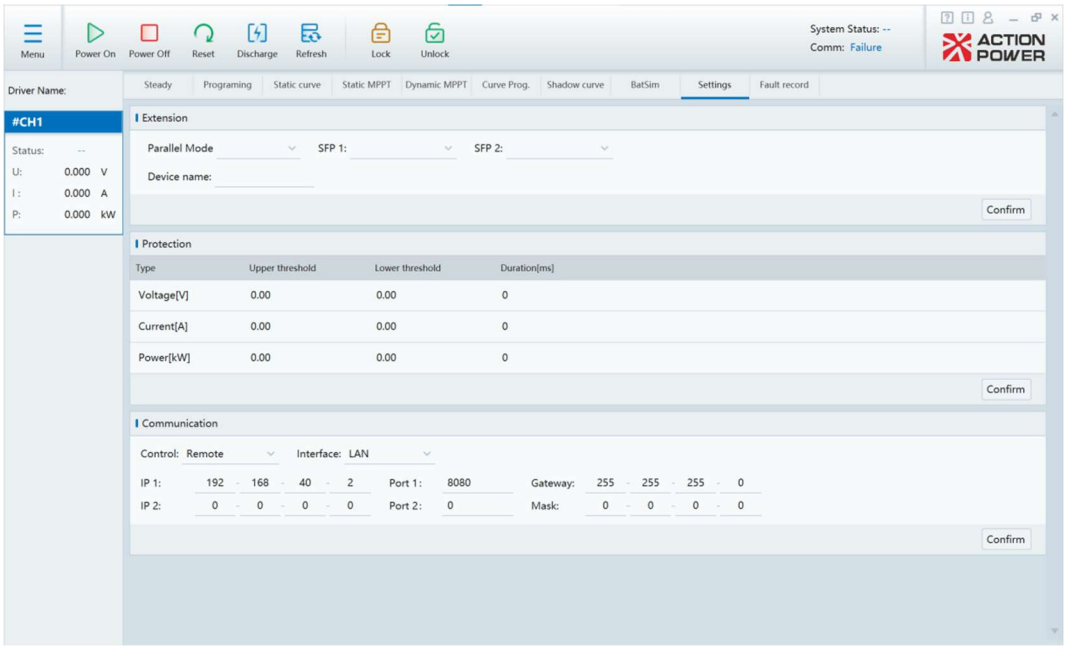
Table 5-2: Recommended Maintenance Schedule

Maintenance Items		Maintenance Cycle
Item	Method	
Store Software Data	1. Read Data from the Data Collector 2. Save Running Data, Parameters, and Logs to Disk or File 3. Check Parameter Settings 4. Software Update	1 month (depending on system size)
Operating Conditions and Environmental Testing	1. Check the ABS cabinet for damage or deformation. 2. Check for abnormal sounds during ABS Shutdown, Standby, and Running operations. 3. Check the variables while the system is Running. 4. Check if the Main Components are Normal. 5. Check if the ABS cabinet is overheating; it is recommended to install a thermal monitor. 6. Check if the Air Duct is Normal and Unobstructed.	6 months

	7. Check the Environmental Humidity and Dust Levels of the ABS Cabinet. 8. Warning! The air outlet ventilation must be checked; the module may fail due to overheating.	
System cleaning	1. Check the circuit board and components for excessive accumulation of wet dust, dirt, moisture, and external water seepage. 2. Check the radiator temperature and for dust. If necessary, use pressurized air and turn on the fan to clean the module. 3. Clean or replace the dust filter. 4. Pay attention to insect prevention; clean the air inlet and outlet.	6 months (depending on environmental quality)
Power supply circuit wiring inspection	1. Check if the power supply cord connection is loose and tighten it to the specified torque. 2. Check the power cord's insulation for damage, and inspect the control cable for breaks, especially at points of contact with metal surfaces for any signs of cuts. 3. Check if the insulation tape on the power cord terminals is broken or has come loose.	6 months after the initial configuration, then every 6-12 months.
Terminal and Wiring Inspection	1. Check if the control terminals are loose, and ensure the terminal locking tabs are securely engaged. 2. Check the main circuit wiring terminals for poor contact and the screw locations for overheating. 3. Visually inspect equipment terminal connections and cable distribution.	12 months
Cooling fan function test	Check the function and running noise of all fans, and inspect the blades for cracks. Replace any abnormal fans promptly.	12 months
Protection function test	1. Routinely check all metal parts for corrosion. 2. Annual inspection of contactors (auxiliary switches and micro switches): circuit breakers, input soft-start circuit breakers, output contactors, auxiliary power circuit breakers, and disconnect switches. Regularly check their functionality and the integrity of their components to ensure the machine is in good working condition. 3. Overheat function test: Check the overheat safety circuit.	6 - 12 months
Safety function test	1. Check the warning labels and replace if necessary. 2. Check the emergency stop button and LCD stop function. 3. Shutdown simulation and signal communication check.	6 months

Appendix 1: Ethernet Remote Connection Instructions

Step 1: Enable remote control and set the IP address, as shown in the red box in Figure 1-1 of Appendix 1:

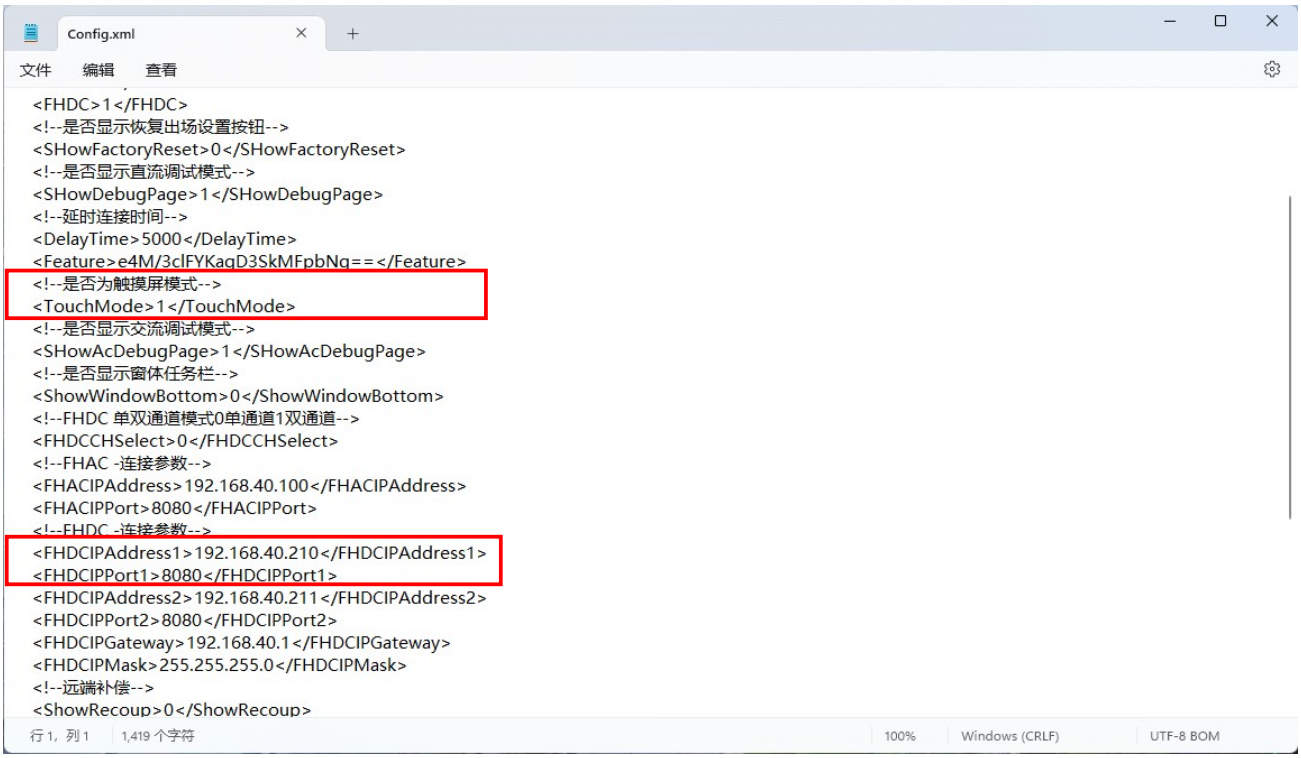


Appendix 1-1: Host computer IP address setting Interface

Note: Ensure that the IP address is on the same network segment as the host.

Step 2: Open the computer and navigate to the Config.xml file in the Debug folder.

- If using touch screen mode, change the value from 1 to 0.
- Modify the IP address and port Setting in the blue box (refer to Figure 1-2 in Appendix 1). For single-channel devices, only the contents within the box can be edited. The circled content is protected and cannot be modified without proper authorization.



Attachment 1-2: Reference Diagram of Host Computer Config.xml File

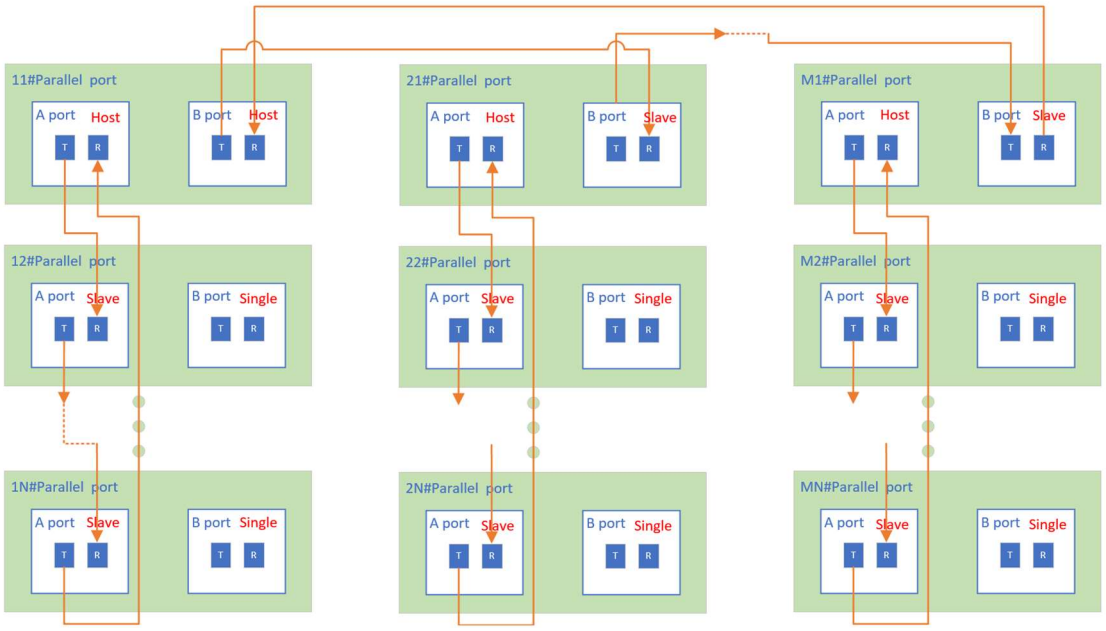
Appendix 2: Instructions for Parallel Operation

Communication Topology

Considering that each node's optical fiber physical interface has two receivers and two transmitters, the final Parallel connection requirement is 10x10. The communication topologies proposed for the node include vertical parallel and horizontal parallel Configurations. These topologies use optical fiber A and optical fiber B as communication channels.

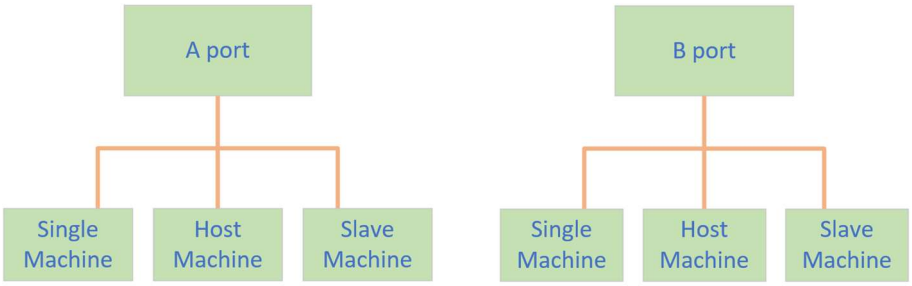
- A Port Merge Setting: The merge function of port A is the factory default Configuration, which users can customize.
- B Port Merge Setting: The merge function of port B is user-developed and allows for customized Configuration.

Master-Slave Configuration



Attachment 2-1: Parallel Connection Instance Diagram

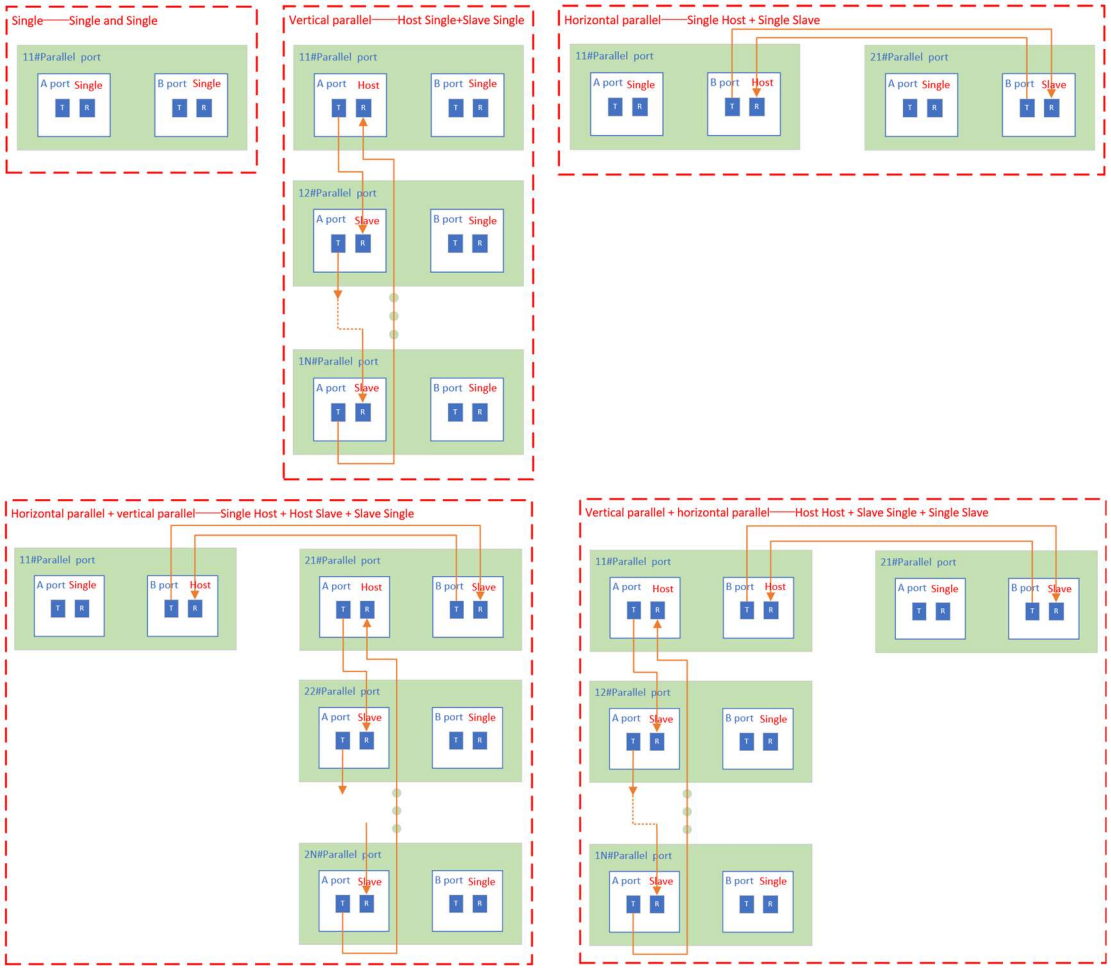
Considering the limitations of the network topology, a communication initiator is required. Therefore, it is necessary to distinguish between master and slave devices, which are currently configured via the Host computer for the optical fiber:



Appendix 2-2 Interface Setting Diagram

Note: If the master-slave configuration is incorrect, the network may fail to identify the fault. Ensure correct configuration to avoid issues.

For parallel operation, consider the following:



Appendix 2-3 Voltage Running Connection Example Diagram

- If both Fiber A and Fiber B are configured for single-unit use, the power supply will operate as an independent unit.
- If either Fiber A or Fiber B is configured as a slave, the power supply will enter parallel mode.
- If neither Fiber A nor Fiber B is configured as a slave, the power supply will operate as the master.

6. Legal Information

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

Our company makes no express or implied warranties regarding the sale, use, or other applications of this user manual. We are not responsible for any errors or omissions in this manual, or for any direct, indirect, incidental, or consequential damages arising from the use of this document or reliance on its content.

7. Contact Information

Address: No. 12, Information Avenue, High-tech Zone, Xi'an, Shaanxi, China, Postcode: 710119

Tel: +86-029-85691870 85691871 85691872

Fax: +86-029-85691773 85692080

Website: https://www.actionpowertest.com/

e-mail：info@actionpowertest.com