OPERATION MANUAL

TH6600 Series Regenerative Power System

V1.0.1@202502

Catalogs

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Chapter 1 Overview

Thank you for purchasing and using our products. Before using the device, please first confirm according to the "Complete Set and Warranty" section at the end of the instructions. If there is any discrepancy, please contact us as soon as possible to protect your rights.

1.1 Instrument Introduction

The TH6600 is a bi-directional DC power supply with regenerative capability. This series can be used as both a power supply and an electronic load, and the two modes can be switched automatically. The device can save energy by returning excess energy to the power grid. The instrument adopts an embedded system composed of two high-speed 32-bit LPC1788 processors and a professional FPGA chip. It has the characteristics of full functionality, compact structure, stable testing, easy operation and good human-machine interface. It can well adapt to the needs of fast operation in production sites and the needs of high accuracy and stability in laboratories. The high-power density, high efficiency and feedback characteristics of the bidirectional high-power DC power supply provide better, more efficient and more energy-saving solutions for applications in fields such as batteries and new energy vehicles.

This manual covers seven instruments of TH6600 series (the following TH6600 indicates the common points of these seven instruments, and the differences are marked with specific models), all belong to the returnable bidirectional DC power supply, and the seven instruments of this series, in addition to the basic output voltage and current functions, also have additional functions such as function generator, data logging, and so on. At the same time, the instrument provides an analogue external interface, RS232 interface, GPIB interface and USBTMC/CDC interface, LAN interface, for the instrument for remote operation of the computer provides the conditions; the difference between the different models mainly lies in the range of output current and power size, the maximum output current of 360A, the maximum output power of 15,000W, the specific differences can be seen in the following table of the instrument model comparison.

Key features of the instrument:

- A two-way power supply that combines a laboratory power supply and an electronic load.
- Automatic range and wide range output: voltage range 0-1000V, current range 0-360A
- High energy recovery efficiency and energy saving
- Automatic conversion between four operating modes: constant voltage, constant current, constant power, and constant resistance to meet various test requirements

- 7-inch 24-bit LCD display (800*480 resolution)
- High accuracy and resolution, low ripple and noise
- Intelligent fan control saves power and reduces noise
- Knob and cursor for fine tuning of values
- Remote control function: the instrument provides a variety of interfaces such as RS232, LAN, GPIB and USB, which can be connected to a computer for remote control.
- Timing functions: the instrument's output can be timed or scheduled.
- Function generator function: the user can customize the output of sine, triangle, and other waveforms.
- Multi-machine parallel connection function: multiple machines can be connected in parallel/series to achieve higher power.
- Data logging function: real-time recording of device status information such as voltage and current, and saving to USB drive
- Protection function: full protection against overvoltage, overcurrent and overpower, and user-defined alarm events
- Analog interface: This interface is used for external test triggering and external control inputs.

1.2 Unpacking and Inspection

After unpacking the instrument, check to make sure it has not been damaged in transit. We do not recommend turning on the instrument if it is damaged.

The front panel of the instrument is marked with the specific model number and main measuring range of the instrument. Check that it matches the model you ordered and confirm it with the packing list. If there is any discrepancy, please contact our company or distributor as soon as possible to protect your rights.

The following table 1-1 shows the instrument model numbers and their basic functions:

Model	Differences and Functional Description
TH6680-120-05	Maximum output current 120A, maximum output power 5000W, can be fed back to the grid
TH6680-240-10	Maximum output current 240A, maximum output power 10000W, can be fed back to the grid
TH6680-360-15	Maximum output current 360A, maximum output power 15000W, can be fed back to the grid
TH66200-70-05	Maximum output current 70A, maximum output power 5000W, can be fed back to the grid
TH66200-140-10	Maximum output current 140A, maximum output power 10000W, can be fed back to the grid
TH66200-210-15	Maximum output current 210A, maximum output power 15000W, can be fed back to the grid
TH66360-40-05	Maximum output current 40A, maximum output power 5000W, can be fed back to the grid
TH66360-80-10	Maximum output current 8A, maximum output power 10000W, can be fed back to the grid
TH66360-120-15	Maximum output current 120A, maximum output power 15000W, can be fed back to the grid
TH66500-30-05	Maximum output current 30A, maximum output power 5000W, can be fed back to the grid
TH66500-60-10	Maximum output current 60A, maximum output power 10000W, can be fed back to the grid
TH66500-90-15	Maximum output current 90A, maximum output power 15000W, can be fed back to the grid
TH66750-20-05	Maximum output current 20A, maximum output power 5000W, can be fed back to the grid
TH66750-40-10	Maximum output current 40A, maximum output power 10000W, can be fed back to the grid
TH66750-60-15	Maximum output current 60A, maximum output power 15000W, can be fed back to the grid
TH661000-40-15	Maximum output current 40A, maximum output power 15000W, can be fed back to the grid
TH661500-30-15	Maximum output current 30A, maximum output power 15000W, can be fed back to the grid

Table 1-1 Comparison Table of Instrument Models and Basic Functions

Note: After unpacking, it is best to store the instrument's carton properly to avoid unnecessary damage to the instrument during future transportation due to mismatched cartons.

1.3 Conditions of Use

Power Connection

Supply voltage: 342～528 VAC

Power frequency: 45～66 Hz

Power supply range: not less than 50 VA.

This unit has been carefully designed to reduce interference from AC power line inputs. However, it should be used in an environment with as little interference as possible. If this is unavoidable, please install a mains filter.

WARNING: To prevent damage to the equipment or personal injury from electrical leakage, the user must ensure that the ground wire of the power supply is reliably connected to ground.

Fuse

The instrument is equipped with a fuse when it leaves the factory, and the user should use the fuse provided by the company.

Environment

Normal operating temperature: 0℃～40℃ , humidity: 20～80%RH

Reference operating temperature: 20℃ ± 8℃, humidity: < 80%RH

Transportation ambient temperature: 0℃～55℃ , humidity: ≤ 93%RH

Do not use in dusty, vibrating, direct sunlight, or corrosive gas environments.

This tester must be well ventilated. Do not block the left ventilation hole to ensure the accuracy of the instrument.

This instrument has been carefully designed to reduce interference from AC power. However, it should be used in a low-noise environment as much as possible. If it is unavoidable, please install a line filter.

If the instrument is not to be used for a long time, please store it in its original or similar box in a ventilated room with a temperature of 5℃~40℃ and a relative humidity of not more than 85%RH. The air should not contain harmful impurities that may corrode the instrument, and direct sunlight should be avoided.

Preheating

To ensure accurate measurement and stability, the instrument should be allowed to warm up for at least 30 minutes before use.

Do not turn the instrument on and off frequently to avoid internal data confusion.

Chapter 2 Front and Rear Panel Description

This chapter provides a basic overview of the TH6600 Series instrument. Please read this chapter carefully before using the TH6600 series instrument so that you can quickly become familiar with the operating structure of the TH6600 series instrument.

2.1 Front Panel Description

Figure 2-1 provides a brief description of the TH6600 Series front panel.

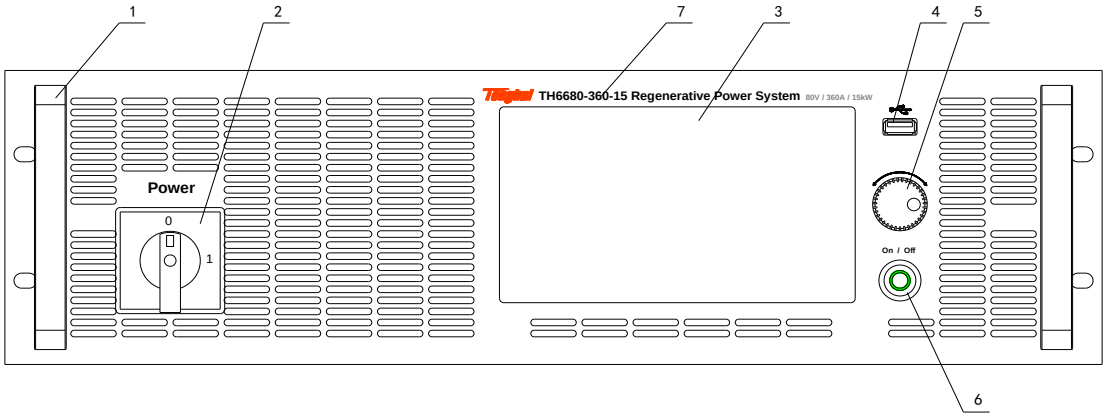


Figure 2-1

Label	Name	Use
1	Front panel handle	For transportation and handling of machines
2	Instrument main switch	Turning the instrument on/off
3	LCD liquid crystal display	7-inch LCD touch screen for displaying test results and human-computer interaction operations
4	USB Host	USB host interface for USB flash drive storage and updates
5	Knobs	For changing and fine-tuning settings
6	Power output switch	For turning the output on/off
7	Trademarks & models	Displays instrument model and test range

Table 2-1 Front Panel Description

2.2 Rear Panel Description

Figure 2-2 provides a brief description of the TH6600 Series rear panel.

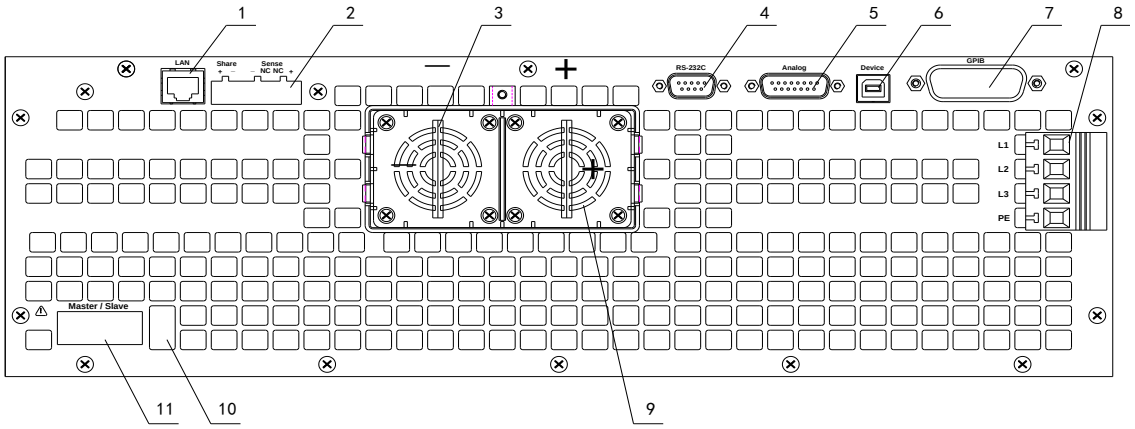


Figure 2-2

1	LAN port	Wired LAN interface for LAN communication
2	Share & Sense terminal	The share end is a shared bus for master and slave; the sense end is used for the output port of the four-terminal sampling
3	DC output terminal +/-	The instrument's output port is marked with positive and negative
4	RS232C serial port	Communication between the computer and the instrument can be achieved via the serial port
5	AI analog interface	The instrument can be controlled via the external analog interface
6	USB Device	Communication between the computer and the instrument can be achieved via the USB DEVICE interface
7	GPIB interface	Communication between the computer and the instrument can be achieved via the GPIB interface
8	Three-phase input terminal	Power supply for the instrument
9	Protective cover	Used to protect the output end and to isolate it
10	Master-slave remote compensation DIP switch	Used to compensate for losses caused by long connecting cables in master-slave connections
11	Master-slave port	For interconnection of instrument masters and slaves

Table 2-2 Rear Panel Description

2.3 Power-on

Connect the three-phase power plug to ensure a reliable connection to ground. Turn on the main power switch of the unit, and the unit will automatically start up and display the startup screen with various text information.

Figure 2-3

Figure 2-3: The boot system startup screen displays text that includes the system modification date, the series name corresponding to the instrument, the software version number, etc.

2.4 On-screen Display

TH6600 Series uses a 7" 16-bit color LCD capacitive touch screen with 800*480 resolution.

The content displayed on the screen is divided into the display areas shown in the figure 2-4 below:

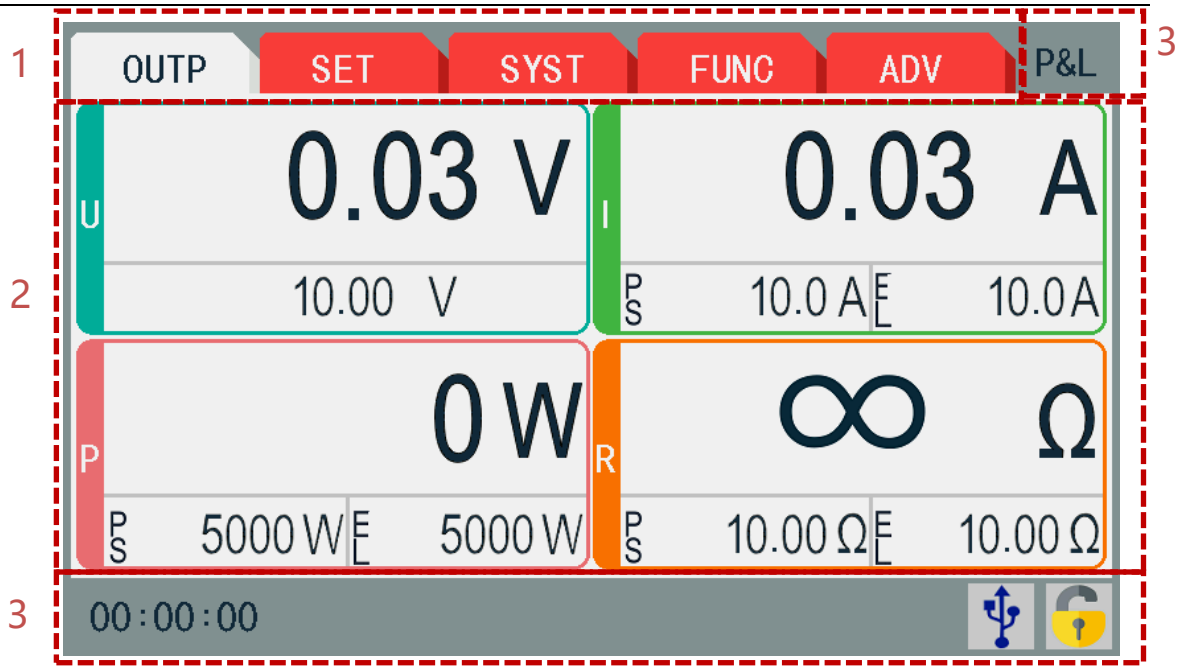


Figure 2-4

1	Header paging bar	The page displays the title of each page function;
2	Measurement result display and parameter setting area	This area displays the test results and measurement parameter settings on the settings page;
3	Status line	This area displays the status information of the instrument, including the status of the lock key, alarm information, master-slave, and so on.

Table 2-3 Explanation of the Meaning of Each Area

Chapter 3 Measurement Display and Description

This chapter mainly describes the functions of each screen of the instrument.

3.1 Output Page

Click [OUTP] to enter the output page as shown in Figure 3-1 below, and the contents can be set as described in Table 3-1 below:

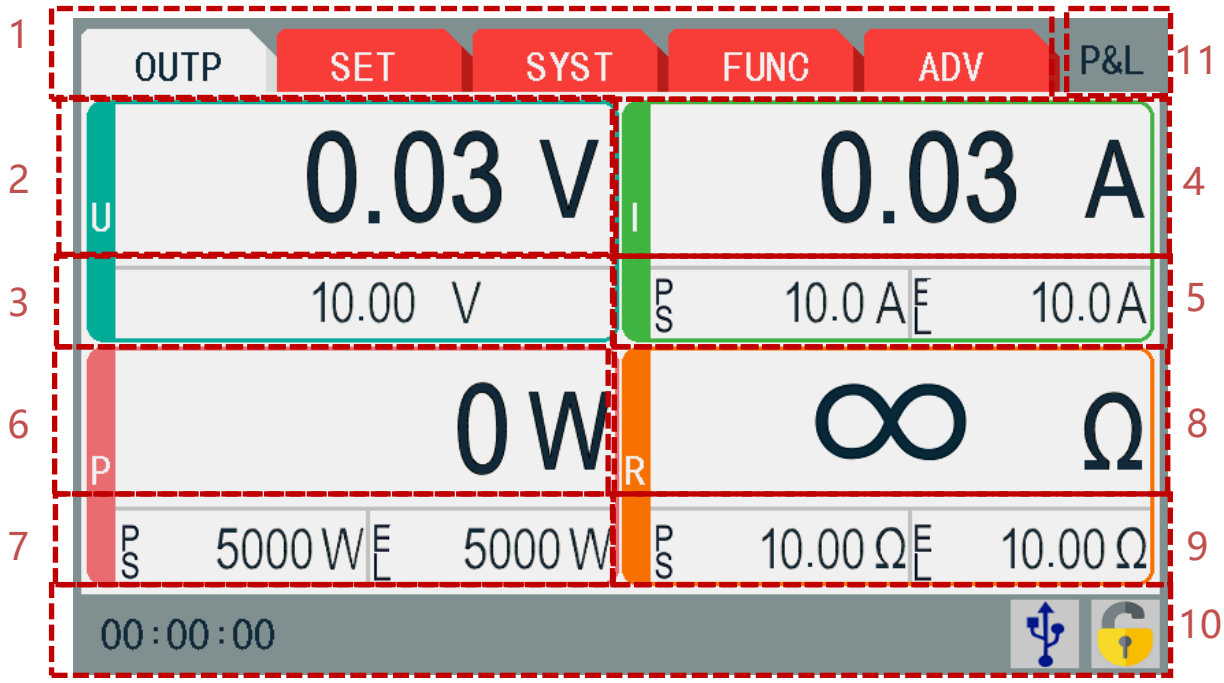


Figure 3-1

1	Switching interfaces ([OUTP], [SET], [SYST], [FUNC], [ADV])
2	Voltage display value
3	Set voltage
4	Current display value (negative values indicate load mode)
5	Set current (source current, load current)
6	Function display value (negative values indicate load mode)
7	Set power (source power, load power)
8	Resistance display value
9	Set internal resistance (source internal resistance, load internal resistance)
10	Output time, USB logo (indicating that a USB device is plugged in), LOCK key (for locking the screen)
11	Operating mode display (source load, source, load)

Table 3-1 Description of Settable Contents of Measurement Page

3.2 Setting Interface

Click [SET] to enter the setting page, as shown in Figure 3-2 below, and the contents that can be set are described in Table 3-2 below:

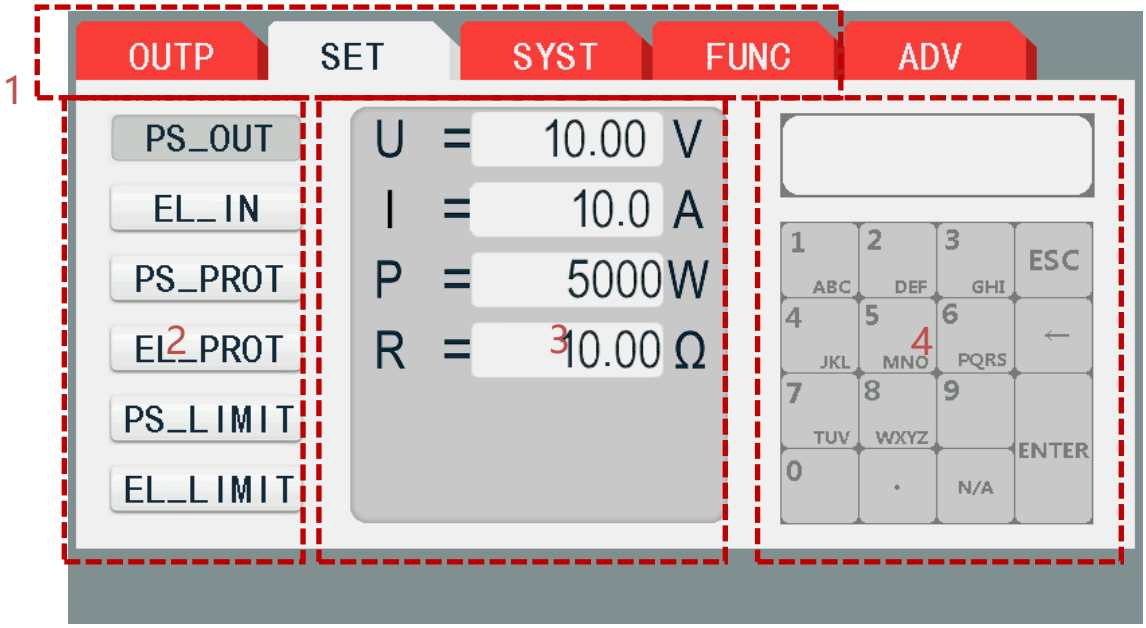


Figure 3-2

1	Switching interfaces ([OUTP], [SET], [SYST], [FUNC], [ADV])
2	Select the item to be set: ① PS_OUT: Power output setting values U/I/P/R ② EL_IN: Load input setting values U/I/P/R ③ PS_PROT: Power output protection values OVP/OCP/OPP ④ EL_PROT: Load input protection values OVP/OCP/OPP ⑤ PS_LIMIT: Power output protection values Umin/Umax/Imin/Imax/Pmax/Rmax ⑥ EL_LIMIT: Load input limit values Umin/Umax/Imin/Imax/Pmax/Rmax
3	Select the value to be set
4	Numeric keypad: for entering numerical values

Table 3-2 Description of Settable Contents of Setting Page

3.3 System Page

Click [SYST] to enter the system page, as shown in Figure 3-3 below, and the contents that can be set are described in Table 3-3 below:

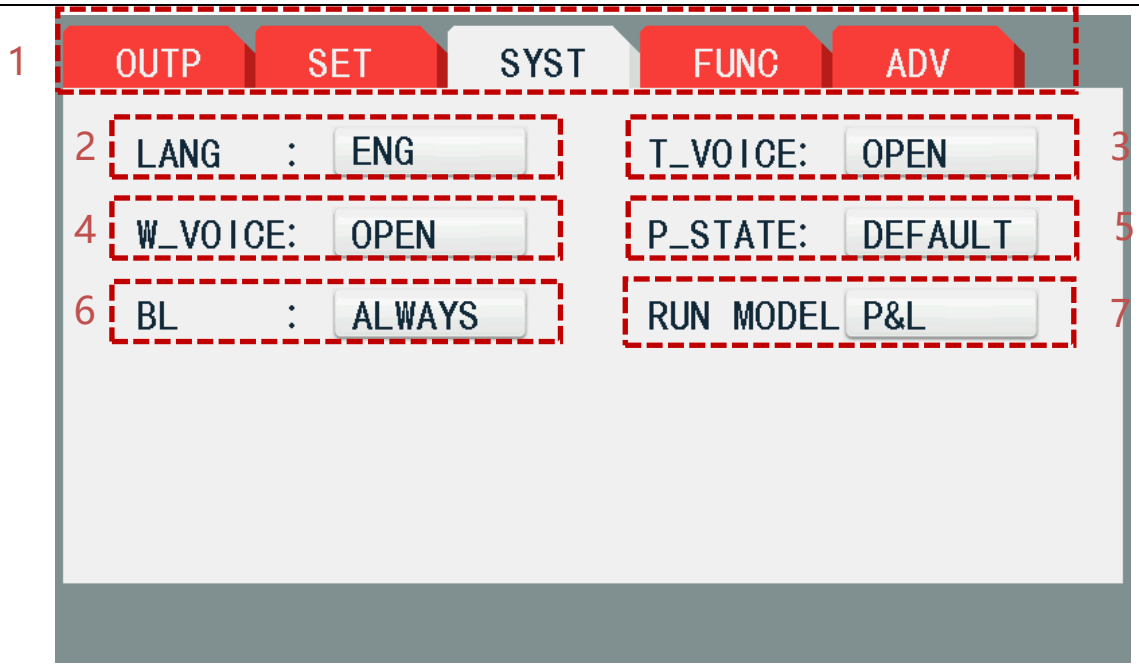


Figure 3-3

1	Switching interfaces ([OUTP], [SET], [SYST], [FUNC], [ADV])
2	LANG: The instrument is available in Chinese and English.
3	T_VOICE: can be switched on or off as required
4	W_VOICE: can be switched on or off as required
5	P_STATE: This function is mainly used to select whether to load the factory parameters or user parameters when starting up. Factory parameter: no parameter is loaded when the instrument is turned on, and the instrument is turned on with the factory setting. User parameters: when the instrument has set some parameters and wants to load these parameters when powering on next time, you need to choose to load this function, when powering on next time, the instrument will be loaded automatically.
6	BL: always on, off after 60s
7	RUN MODEL: P&L, P, L

Table 3-3 Description of Settable Contents of System Page

3.4 Function Page

Click [FUNC] to enter the function page, as shown in Figure 3-4 below, and the contents that can be set are described in Table 3-4 below:

Figure 3-4

1	Switching interfaces ([OUTP], [SET], [SYST], [FUNC], [ADV])
2	Each function area: ① Basic Settings ②Remote Control ③File ④User Events ⑤Auxiliary Functions ⑥Update

Table 3-4 Description of Settable Contents of Function Page

3.5 Advanced Page

Click [ADV] to enter the advanced page, as shown in Figure 3-5 below, and the contents that can be set are described in Table 3-5 below:

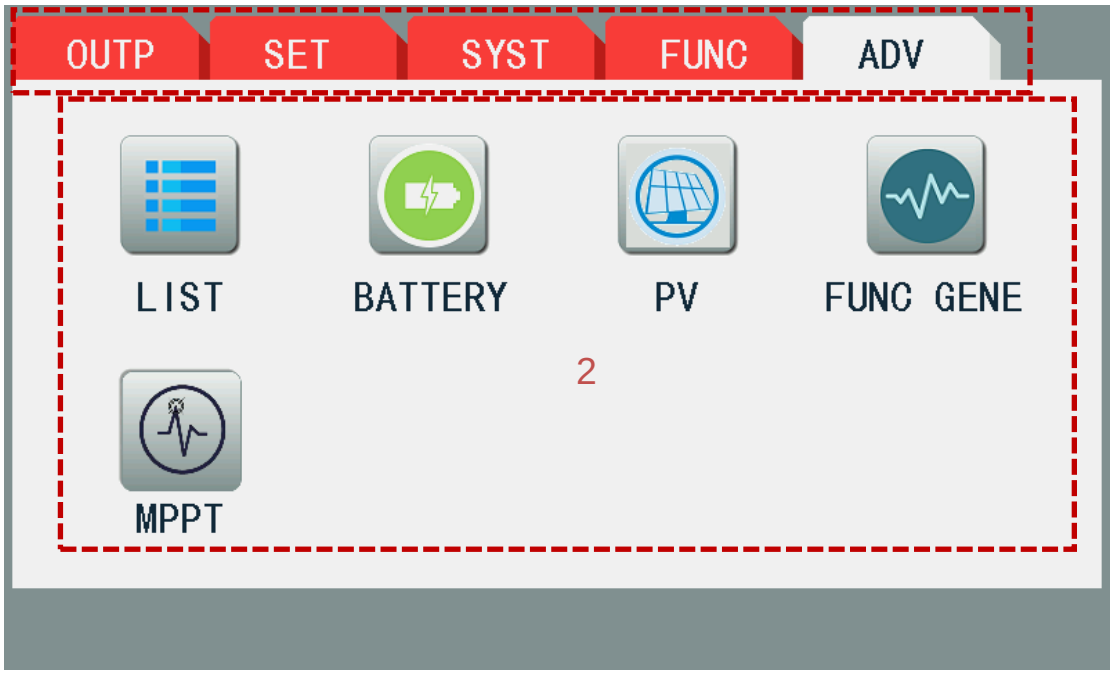


Figure 3-5

1	Switching interfaces ([OUTP], [SET], [SYST], [FUNC], [ADV])
2	Each function area: ① List ② Battery ③ PV ④ Function Generator ⑤ MPPT

Table 3-4 Description of Settable Contents of Function Page

Chapter 4 Basic Operating Instructions

4.1 Connect Wire

The connection between the TH6600 series power supply and the mains must be made via the 5-pin connector on the rear of the product. A cable with at least 3 wires (L2+L3+PE) of the appropriate gauge and length must be used to connect to this connector. Some models may require a 4-wire (L1+L2+L3+PE) connection cable.

The following rules should also be followed when specifying the connection between the DC terminal and the load/power source:

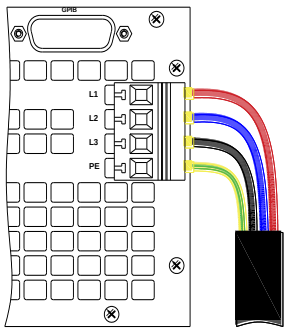
This product is equipped with a 5-pin power cord. Depending on the model and as indicated on the plug label, it is connected to a 2-phase or 3-phase power supply. The connection phases on the power supply side are required as follows:

Rated power	Input pins on the AC outlet	Type of power supply
5 kW Models	L2, L3, PE	two or three phase
≥10 kW Models	L1, L2, L3, PE	three-phase

Select the correct diameter of the connecting cable, which is determined by the rated AC current of the product and the length of the cable. Based on the connection of a single product, the following table lists the maximum input current for each phase and the recommended minimum cable diameter:

	L1		L2		L3	
Rated power	ø	Imax	ø	Imax	ø	Imax
5 kW	-	-	2,5 mm ²	16 A	2,5 mm ²	16 A
10 kW	4 mm ²	28 A	4 mm ²	16 A	4 mm ²	16 A
15 kW	4 mm ²	28 A	4 mm ²	28 A	4 mm ²	28 A

The AC power connector provided accepts wire ends up to 6 mm ². The longer the power cord, the greater the voltage drop due to the internal resistance of the wire. Therefore, the power cord should be as short as possible, or a larger diameter wire should be used.

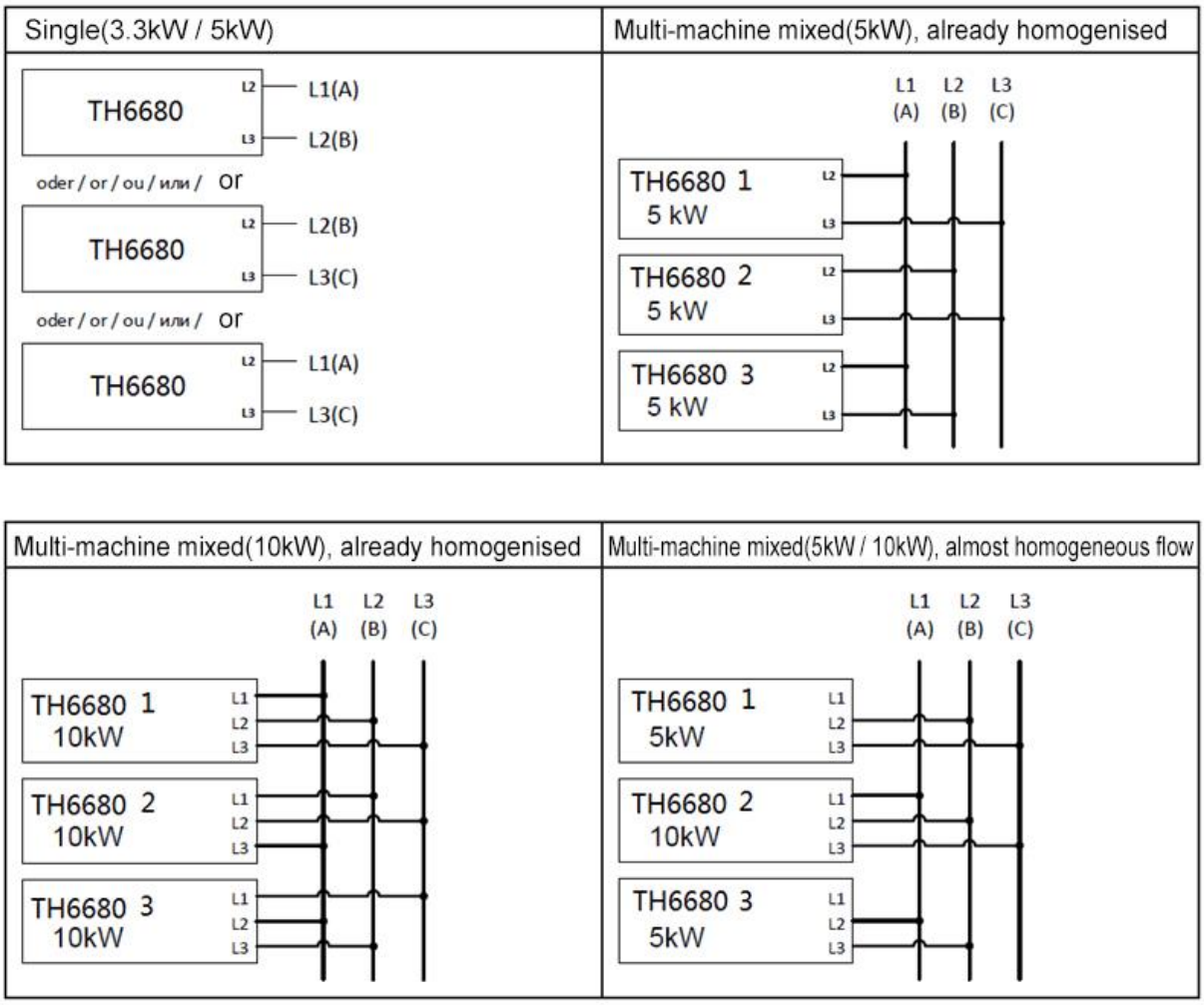


Depending on the maximum power rating of the specific model, the product must be connected to two or three phases of the three-phase power supply. If multiple 5 kW or 15 kW rated products are connected to the same AC power supply, care must be taken to balance the three-phase current.

The 15 kW models are already balanced for three-phase power. As long as this type is installed, there is no

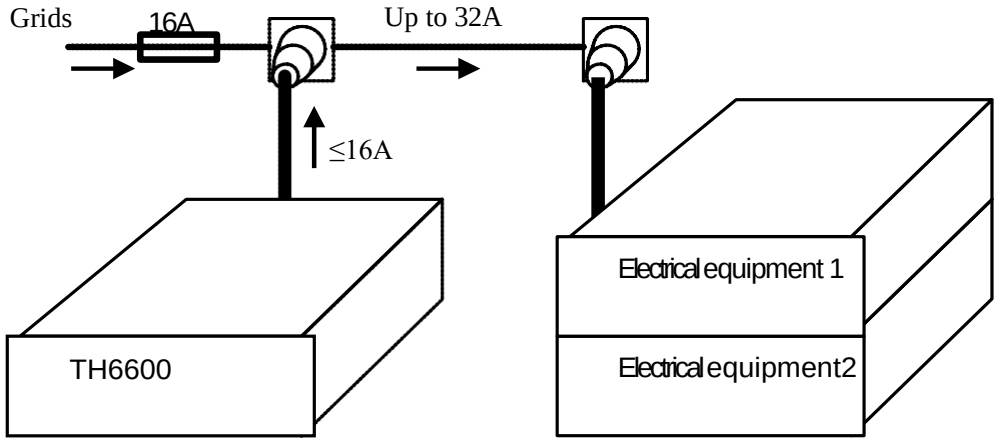
unbalanced AC load. Mixing products of different power ratings in a system will not automatically balance the current, but it is possible to calculate how many products will achieve current balance.

The recommended connection arrangement for each phase is shown in the figure below:



The TH6600 Series can also convert energy and return it to the local power grid. The returned current is added to the grid current, which can overload the existing installation. If the outlet is a two-outlet type, there is usually no additional fuse installed. If the AC portion of a load fails (e.g., due to a short circuit), or if multiple connected products can draw more current, all of the current will flow through the connection cable, which is not designed to handle such high currents. This may cause damage to the product or even cause the cable or terminals to catch fire.

To avoid such damage and accidents, the existing installation concept must be considered before installing such a regenerative device. The following diagram explains the principle of a regenerative device and a load device:



If multiple regenerative products, such as energy recovery products, are operated on the same pedestal as the installed product, the total current of each phase must be increased accordingly. The DC terminals are located at the rear of the product and are not fused. The cross section of the connecting cable is determined by the current loss, the length of the cable and the ambient temperature. We recommend using a cable with the following specifications, no longer than 1.5 m (5 ft), and an average ambient temperature of no more than 50 ℃ (122 ℉):

30 A or less:	6 mm ²	70 A or less:	16 mm ²
90 A or less:	25 mm ²	140 A or less:	50 mm ²
170 A or less:	70 mm ²	210 A or less:	95 mm ²
340 A or less:	2x70 mm ²	510 A or less:	2x120 mm ²

4.2 Settings

4.2.1 Setting VIPR Value

There are several ways to set the VIPR value for TH6600 series products.

① Use the knob to fine-tune the value in the [Measurement] interface: Select the item to be set, and a small cursor will be displayed below the set value; press the knob to move the small cursor to the position to be adjusted. Turn the knob to fine adjust the set value.

② Use the numeric keypad on the [Measurement] screen: Select the item to be adjusted, and a small cursor appears under the adjustment value. Click it again and the corresponding numeric keypad will appear, where you can enter the value.

③ On the [SET] screen, under the "PS_OUT" and "EL_IN" options, use the knob to fine-tune the value: select the item to be adjusted, a small cursor will appear below the adjusted value; press the knob to move the small cursor to the position to be adjusted, and rotate the knob to fine-tune the adjusted value.

④ Use the numeric keyboard under "PS_OUT" and "EL_IN" options in the [SET] interface: check the items that need to be set up, and then the numeric keyboard area on the right side will be enabled, and you can input.

4.2.2 Setting OCP/OVP/OPP Values

In the [SET] dialog box, use the rotary knob or the numeric keys to set the value under the [PS_PROT] and [EL_PROT] options.

This value is used to protect the product's output. If the set value is exceeded, the instrument will alarm (OVP/OCP/OPP).

4.2.3 Setting Limit Values

In the [SET] interface, use the knob or the numeric keypad to adjust the value under the "PS_LIMIT" and "EL_LIMIT" options.

This function is used to protect the product from being output with an excessively large or small value when the user is fine-tuning the product's output.

Note: If the user finds that some settings cannot be adjusted within the adjustable range when setting the VIPR value, check the limits of "PS_LIMIT" and "EL_ LIMIT".

4.3 Output

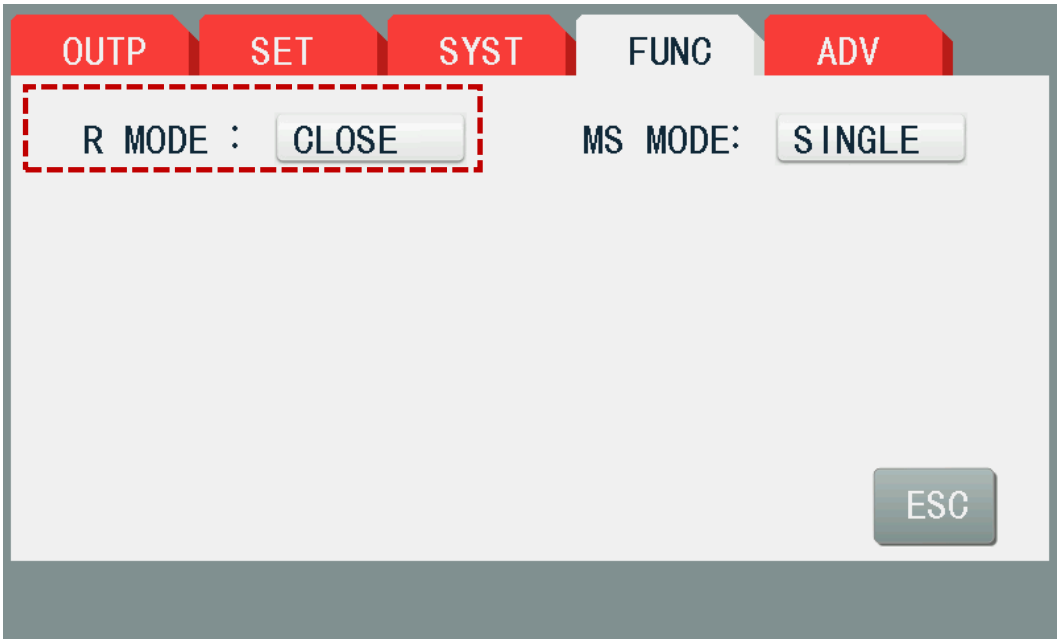
Press the metal button on the front panel to turn on the output, at which time the button's LED will also light up, and the "output time" in the upper right corner of the "OUTP" interface will also begin to change.

Note: The product can only be output under the "OUTP" interface.

Chapter 5 Additional Function

5.1 R Mode

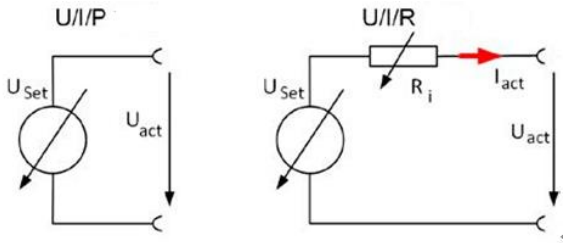
R mode is the virtual internal resistance/constant resistance mode. From the [FUNC]-> [Basic Set] interface, select <R MODE> and then 'turn on' to enable R mode.



5.1.1 Analog Internal Resistance Function in Source Mode

The power supply internal resistance (CR) control simulates a virtual internal resistance in series with the voltage source and therefore in series with the load. According to Ohm's law, this causes a voltage drop that results in a difference between the regulated output voltage and the actual output voltage. This works the same way in Constant Current and Constant Power modes, but the output voltage will be slightly different from the regulated voltage because Constant Voltage is not active.

The set voltage, which is related to the set internal resistance and output current, is calculated by the microprocessor chip, which is much slower than the other control chips in the control circuit. Illustration of the following diagram:



$$U_{act} = U_{set} - I_{act} * R_i$$

Uact = Uset-Iact*Ri

5.1.2 Constant Resistance Mode in Load Mode

When the product is operated in load mode with an electronic load, its operating

principle is based on variable internal resistance. Constant Resistance (CR) mode is essentially its inherent characteristic. The load attempts to set the internal resistance to a value defined by the user via the input current and voltage, based on Ohm's law Iin = Uin / Rset.

For the TH6600, the difference between the external supply voltage and the internal setpoint determines the actual current. There are two special cases:

a) When the DC input voltage is higher than the set voltage

In this case, the above formula is expanded to Iin = (Uin - Uset) / Rset.

Example: If the DC input supply voltage is 200 V, the resistance value RSET is set to 10 Ω, and the set voltage USET is set to 0 V. When the DC input is turned on, the current rises to 20 A, and the actual resistance value Rmon should show a value close to 10 Ω. If the set voltage USET is then set to 100 V, the actual resistance Rmon remains at 10 Ω, while the current drops to 10 A.

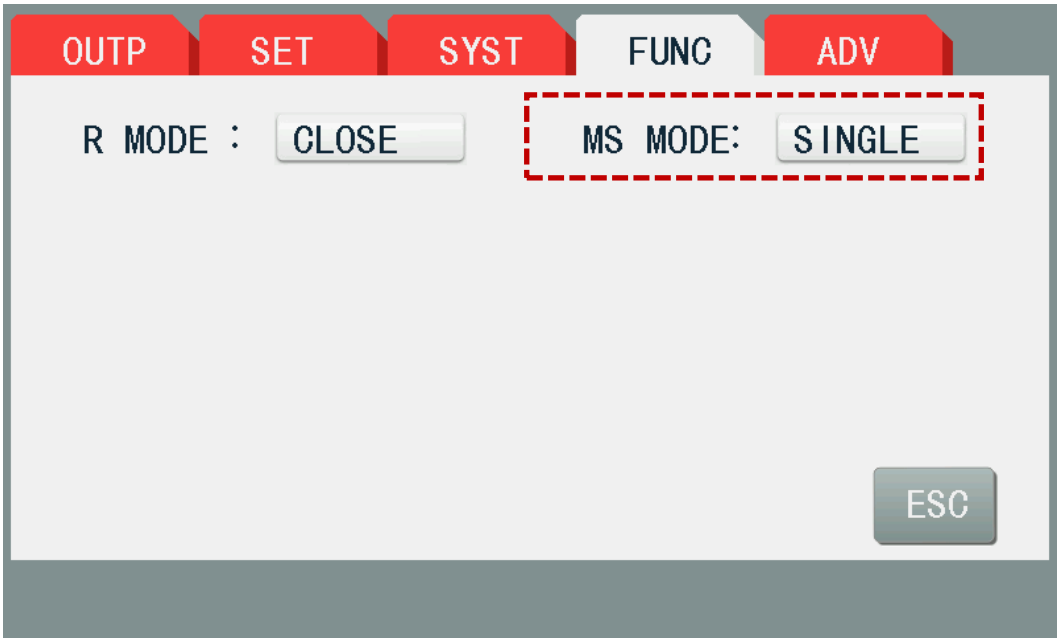
b) When the voltage at the DC input is equal to or less than the set voltage

TH6600 does not draw current and switches to CV mode. If the input voltage is close to or oscillates around the set voltage, the CV mode will switch between CV and CR mode. Therefore, it is not recommended to set the set voltage to the same level as the external supply voltage. The internal resistance is usually limited between zero and a maximum value (the resolution of the current control is too imprecise). Since internal resistance cannot be zero, a low value is defined as the minimum value that can be achieved. This ensures that the internal electronic load draws more input current from the supply at very low input voltages up to the maximum.

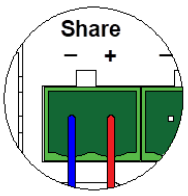
5.2 Master-single Mode

The TH6600 series products and multiple products of the same model can be connected in parallel to create a system with higher current and power. For parallel connection in master-slave operation, the products are usually connected through the DC terminals, the master-slave bus terminals, and the common bus terminals. The master-slave bus is a digital bus that can operate the setpoints, actual values, and status of the entire system as one large machine. The shared bus is designed to regulate the voltage balance on the DC side, i.e., in CV mode, which is particularly noticeable when the master unit performs functions such as sine waves. For this bus to work properly, at least the DC negative poles of all products should be connected together, as the DC negative pole is the reference point of the shared bus.

The master-slave mode can be selected from [FUNC] -> [Basic SET] screen <MS MODE> as 'Single', 'Master' or 'Slave'.



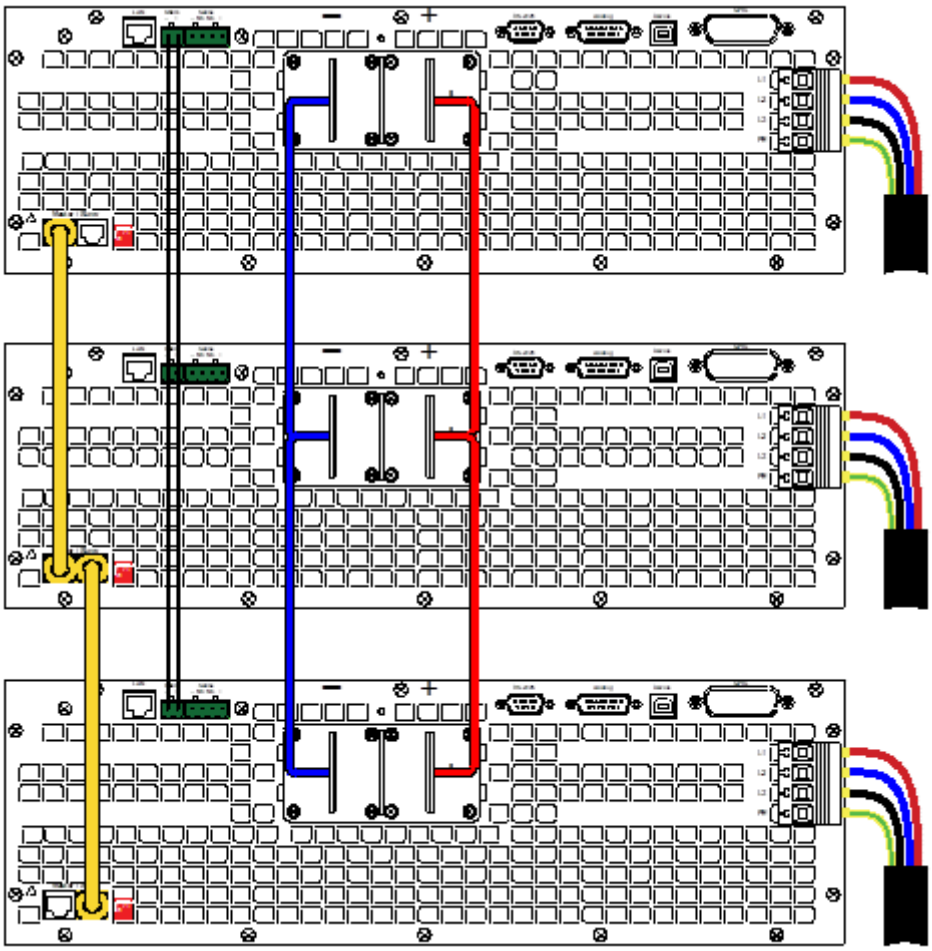
5.2.1 Connect Wire



Shared bus terminal

Master-slave bus terminal

Bus terminal



① DC Connection: When connected in parallel, the DC output terminals of each machine are connected together with a connecting wire or copper strip of a suitable diameter according to the total system current, and the wire is

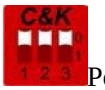
as short as possible.

② Common Bus Terminal Connection: The connection between the machines at the common bus terminal is generally made with an appropriate twisted pair, and the wire diameter does not matter. We generally recommend using a wire with a diameter of 0.5 mm ²to 1.0 mm ².

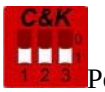
③ Connection and setting of the digital master-slave bus terminals: The master-slave bus terminals are built-in and can be connected using a network cable and then configured manually or remotely. The following applies:

- A maximum of 16 products can be connected via the master-slave bus: 1 master and 15 slaves.
- Only similar products, such as power supplies and power units, and the same model can be connected.
- The product at the end of the bus must be equipped with a terminating resistor.

④ DIP Switch Control (Terminal Compensation Resistor): Depending on the desired configuration, the DC terminals of the products are connected together. If longer connecting cables are used, the two units at the beginning and end of the connecting chain must be fitted with terminating resistors. This can be done using the 3-pin DIP switch next to the MS connector on the rear panel of the product.



Position: not terminated (standard status)



Position: Terminated

Each product in the master-slave system must now be configured. It is recommended that all Slaves be configured first, followed by the Master. If the order is reversed or a Slave is added later, the Master must be re-initialized to recognize all Slaves and configure itself.

5.2.2 Software Configuration

① Configure all Slaves: In the [FUNC]-> [Basic SET] interface, under <MS MODE>, select 'Slave'.

② Configure the Master: In the [FUNC]->[Basic SET] interface, under <MS MODE>, select 'Master'. The master will then start scanning for slaves and initializing. Finally, the number of scanned slaves, the system voltage, the total current and the total power are displayed. If the number of slaves is found to be incorrect, you can click 'Re-Initialize'. If there are still problems, check for connection or other problems. The icons 

or 

(representing the master/slave) are displayed in the lower right corner of the [Measurement] screen.

③ Operating the Master-Slave System: After the master and slave have been successfully configured and initialized, their status is shown on the display. Whether the slave can output or change the setpoint at this time depends on

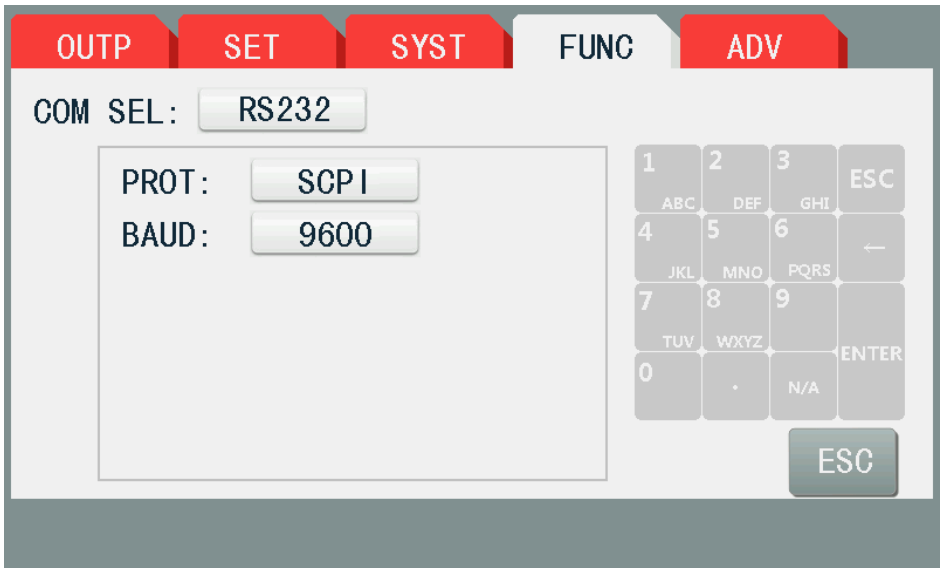
the master. The master always displays the voltage, current and power of the entire system.

5.2.3 Warning Message

If more than one slave reports an alarm, or if the master reports an error, the output of the entire system will stop. An MSP alarm means that there is an error in the communication between the master and the slave, and the operator must re-initialize the master. The slave must be initialized each time the machine is restarted.

5.3 Communication Interface

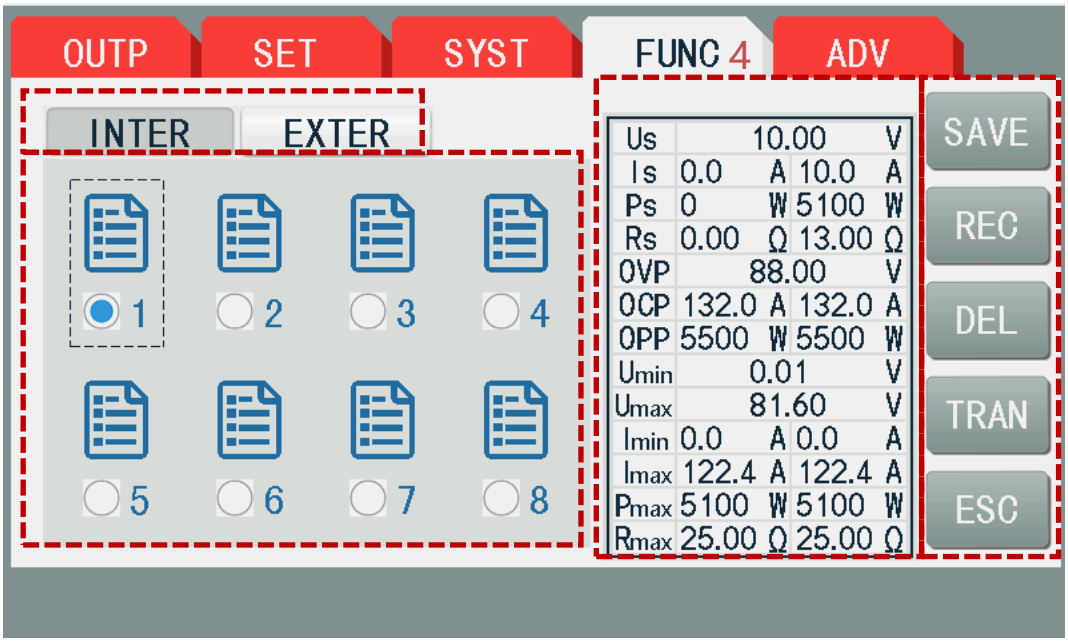
Communication interface: Under the [FUNC] - > [COM] screen, select a communication mode such as 'RS232' or 'GPIB'. For more information, please refer to Chapter 6.



5.4 File Management

The file management function is located under the [FUNC]->[File] screen.

This function allows users to store frequently used VIPR settings in the product's flash memory or on an external USB drive for later recall.



1. Select "Internal File" or "External File".
2. The file area can store up to 8 files
3. "SAVE": Save the current VIPR settings of the device
   "REC": Retrieve the file, where the settings of the instrument will become the values in the file.
   "DEL": Delete the file
   "TRAN": Save the file in the STA file on the USB flash drive.
   "ESC": Return to [FUNC] screen
4. File Details: VIPR and other data stored in the file

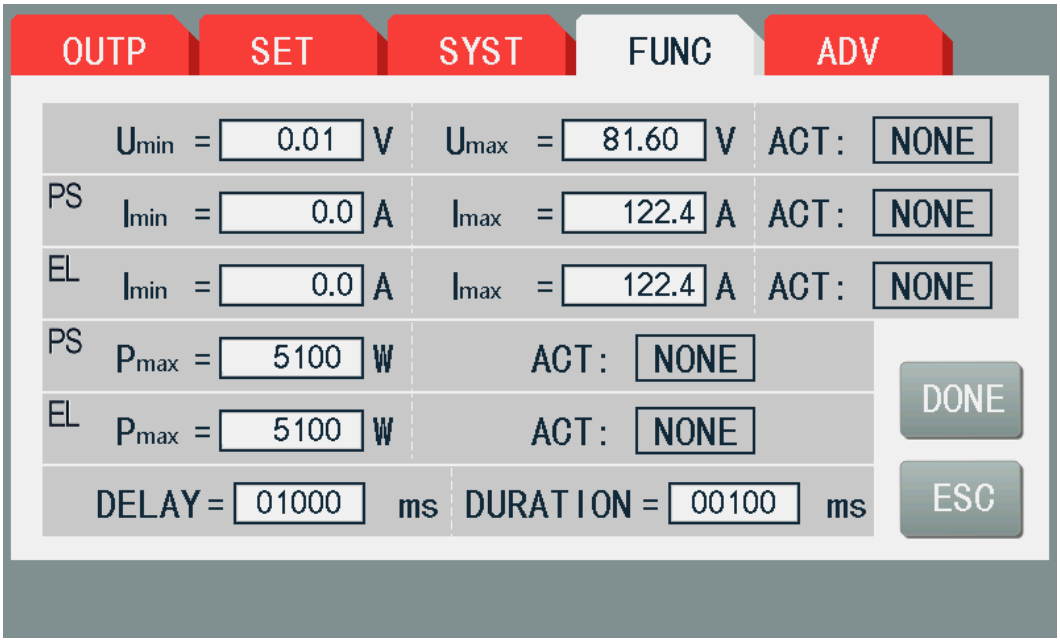
PS: If "User Parameters" is selected for "Startup Parameters" in the [System] screen, the data in "File 1" is automatically loaded when the unit is turned on.

1. Select "Internal Files" or "External Files".
2. File area, up to 8 files can be stored
3. "REC": Recall the file, then the various setting values of the instrument will change to the values in the file.
   "ESC": Return to the [FUNC] screen
4. File Details: Displays information such as the file name.

5.5 User Event

The user event function is located under the [FUNC]->[USER EVENT] interface.

The user can customize the settings for the DC terminal, such as OVP, UVP, etc. Note that there is a clear distinction between device alarms (such as OVP or OCP) and user-defined events (such as OVP). Device alarms are designed to protect the device, while user-defined events are designed to protect external devices based on the user's usage environment.



For example:

Umin is set to 13.3V, Umax is set to 15V, and act is set to ALARM. Set the custom delay time to 1000ms and duration to 100ms

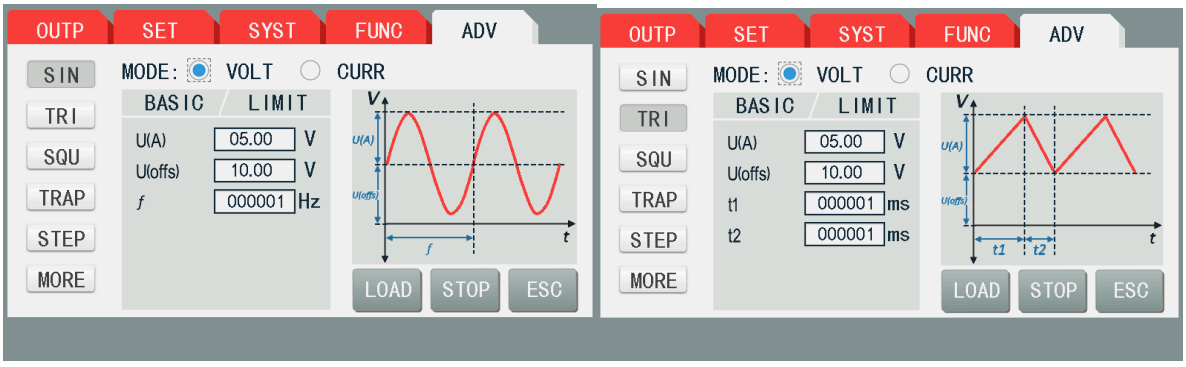
Delay time: The function will not start until 1000ms after the power supply starts to output. This is to avoid false alarms caused by supply voltage or current overshoot when the output is first started.

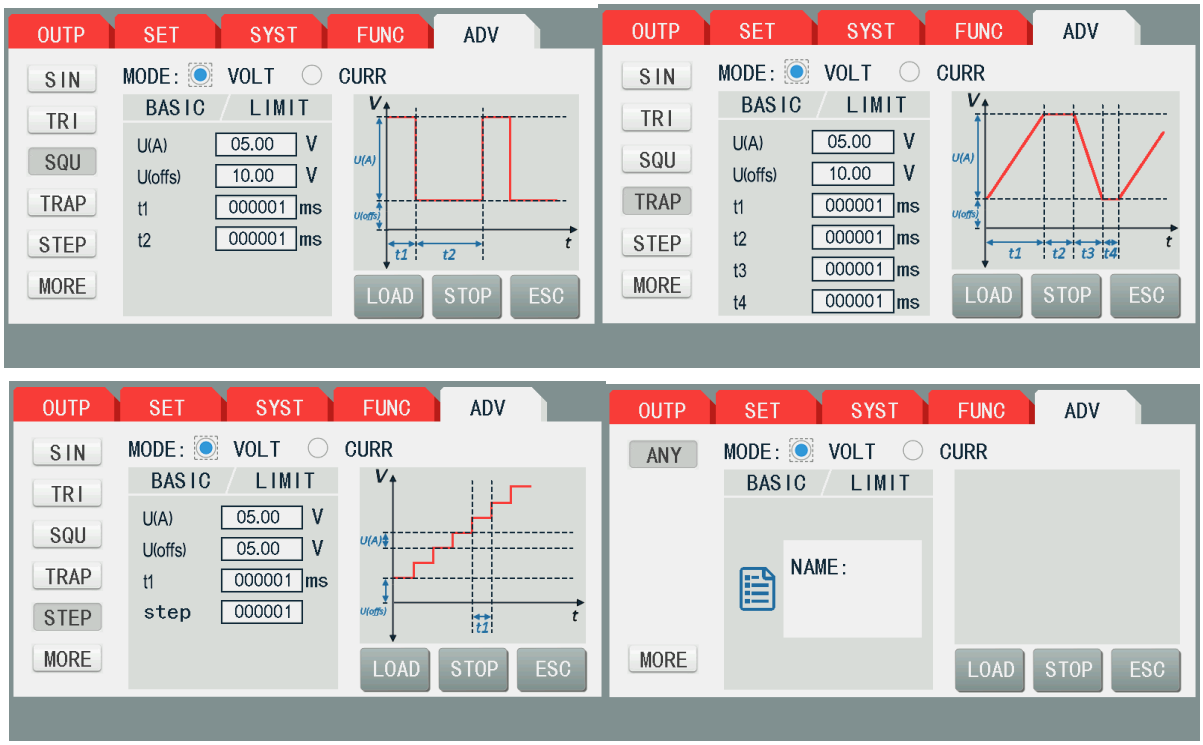
Duration: The power supply voltage and current must continuously exceed the limit for 100ms before an alarm is triggered.

In other words, if the output voltage is 15.3 V for 100 ms, the product will trigger an alarm.

5.6 Function Generator

The Function Generator function is available from the [Function] -> [FUNC GENE] screen.





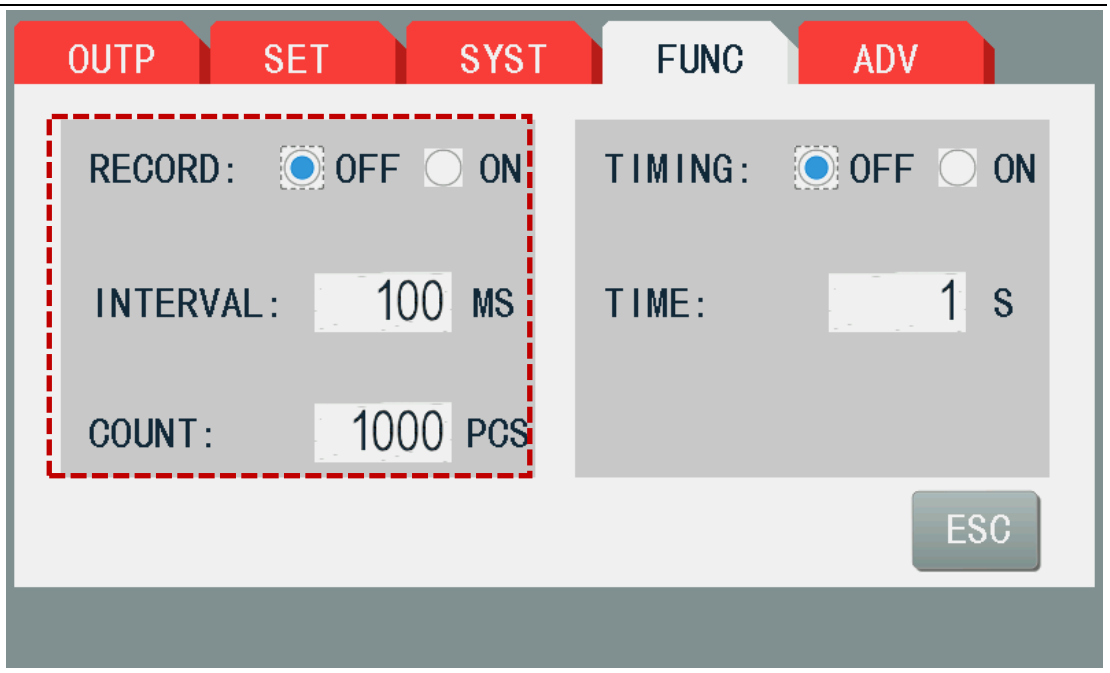
Basic operations with examples:

1. Select the "sin" function
2. Select "volt" mode
3. Set U(A) (amplitude), U(offs) (offset) and f (frequency) to "basic".
4. Set U(start), I_PS, I_EL, P_PS and P_EL to "limit". This section is the initial state of the function generator when it starts up, i.e. after the function generator is turned on, there is an initial state at the DC end of the power supply.
5. Click "Load" to enter the [Measure] page. At this time, the power supply is in the initial state and the icon  is displayed in the lower right corner.
6. Press the output switch on the front panel, and the function generator will begin to operate.
7. Pressing the output switch on the front panel again will turn off the function generator but will not completely turn off the output.
8. Enter the [FUNC GENE] interface and click "stop" to turn off the output.

5.7 Data Recording

The data recording function can be enabled by selecting [FUNC] -> [EXTRA FUNC] on the screen.

Users can use this function to save VIPR and other output data to a CSV file on a USB flash drive.



Basic operating steps:

1. Turn on the "RECORD" function and select the recording interval and number of data points required by the user (Interval: the time interval between data recording; Count: the number of data points to record).
2. Insert the USB flash drive into the USB host on the front panel.
3. Turn on the output, and the data will begin to be buffered on the product.
4. Turn off the output and the device will save the data to the USB flash drive.

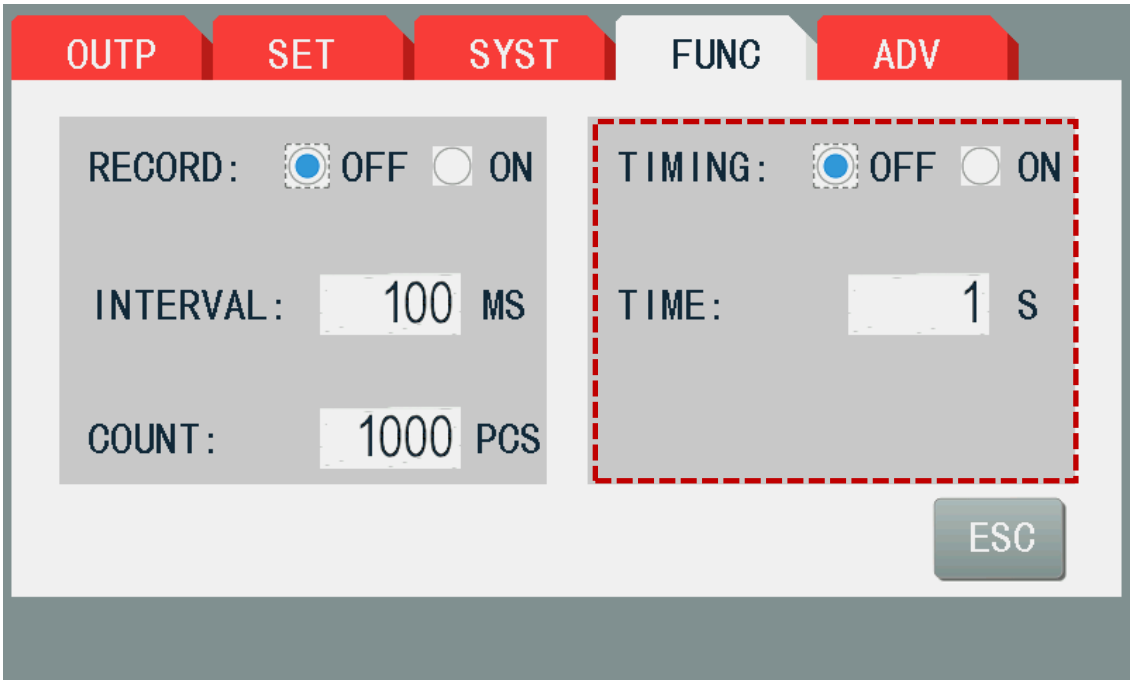
The CSV file format is shown in the following figure

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	U set	U actual	I set	I actual	P set	P actual	R set	R actual	R mode	Output/Input	Device mode	Error	Time
2	2,00V	11,92V	1,20A	1,20A	7344W	15W	N/A	N/A	OFF	ON	CC	NONE	00:00:00,942
3	2,00V	11,90V	1,20A	1,20A	7344W	15W	N/A	N/A	OFF	ON	CC	NONE	00:00:01,942
4	2,00V	11,89V	1,20A	1,20A	7344W	15W	N/A	N/A	OFF	ON	CC	NONE	00:00:02,942
5	2,00V	11,87V	1,20A	1,20A	7344W	15W	N/A	N/A	OFF	ON	CC	NONE	00:00:03,942

5.8 Timing

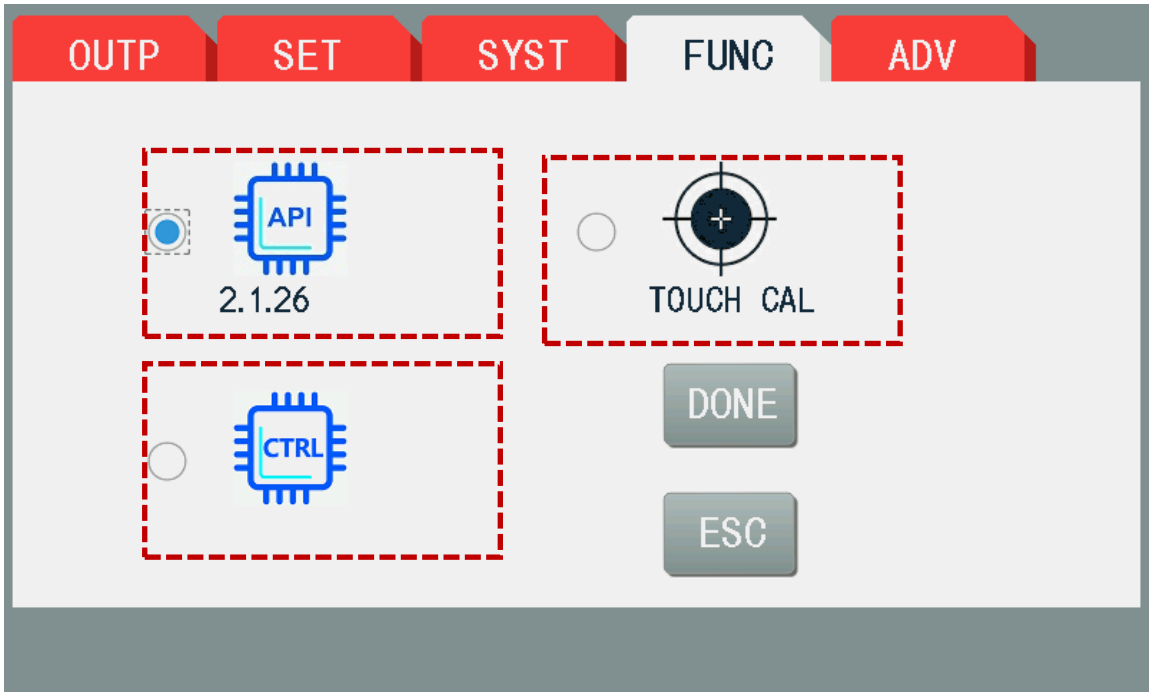
The timing function can be enabled in the [FUNC]-> [EXTRA FUNC] interface.

This function is used to time the DC output. For example, if the user sets the "TIME" to 10s, the output will be turned off 10s after it is turned on. At the same time, the time on the [Measure] page will count down: 00:00:10---00:00:00



5.9 Upgrade

The upgrade function is under the [FUNC] -> [UPDATE] interface. At this time, the user can choose to upgrade the front panel display CPU firmware, upgrade the control board CPU firmware, and calibrate the screen touch. As shown in the figure below



Basic operation steps:

Method 1: USB flash drive upgrade

1. Insert the upgrade file (.sec) provided by the developer into the USB flash drive. (Note: The USB flash drive should not be larger than 32GB and the file system

should be in FAT32 format)

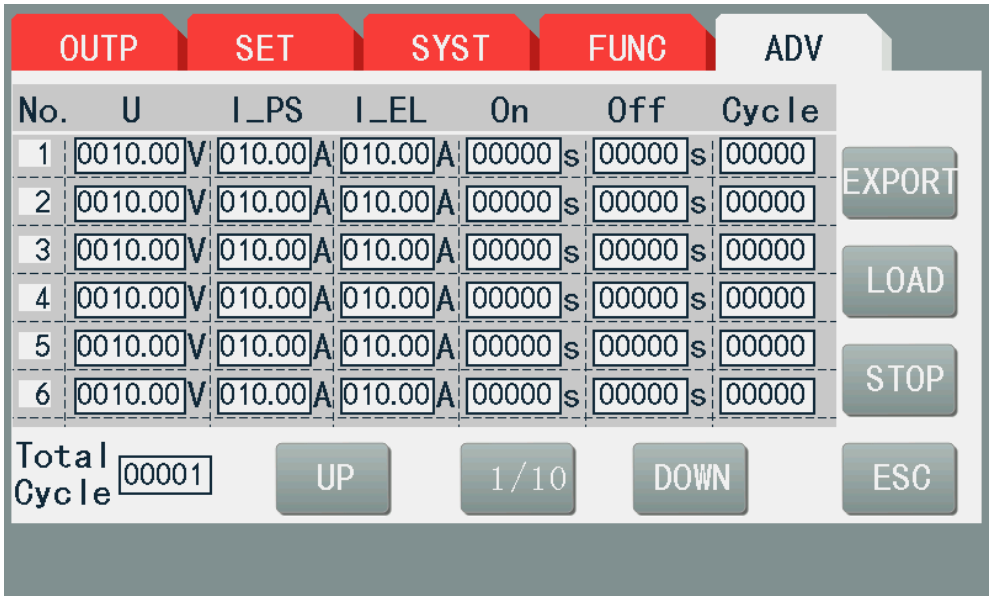
2. Insert the USB flash drive into the USB host on the front of the product.
3. Enter the [UPDATE] interface and select the object to be upgraded, "Display Board" or "Control Board".
4. Click "Done" to begin the upgrade. At this point, it should be noted that the upgrade process may be relatively slow, so please be patient and do not unplug the USB drive, otherwise unexpected errors may occur.
5. Once the upgrade is complete, you will need to power it off and then power on the entire product. At this point, the entire upgrade process is complete.

Method 2: Serial port upgrade

1. Insert the upgrade file (.sec) provided by the developer into your computer.
2. Connect the computer to the device via the serial port
3. Open the serial port debugging utility (provided by the developer or downloaded from the Internet).
4. Configure the serial port baud rate of the computer to 115200 and also change the baud rate of the instrument to 115200 (this will result in a faster transmission speed).
5. Refer to the upgrade command set in Chapter 7 SCPI Commands and send upgrade:rs232 api or upgrade:rs232 ctrl.
6. Then use the Serial Port Assistant's File Transfer function to send the appropriate sec file to the instrument and wait about 10 minutes. The instrument upgrade will be successful.
7. When the upgrade is complete, turn it off and then turn on the entire product. The entire upgrade process is now complete.

5.10 List

The list function is located under the [ADV] -> [LIST] screen. The list screen is shown below.

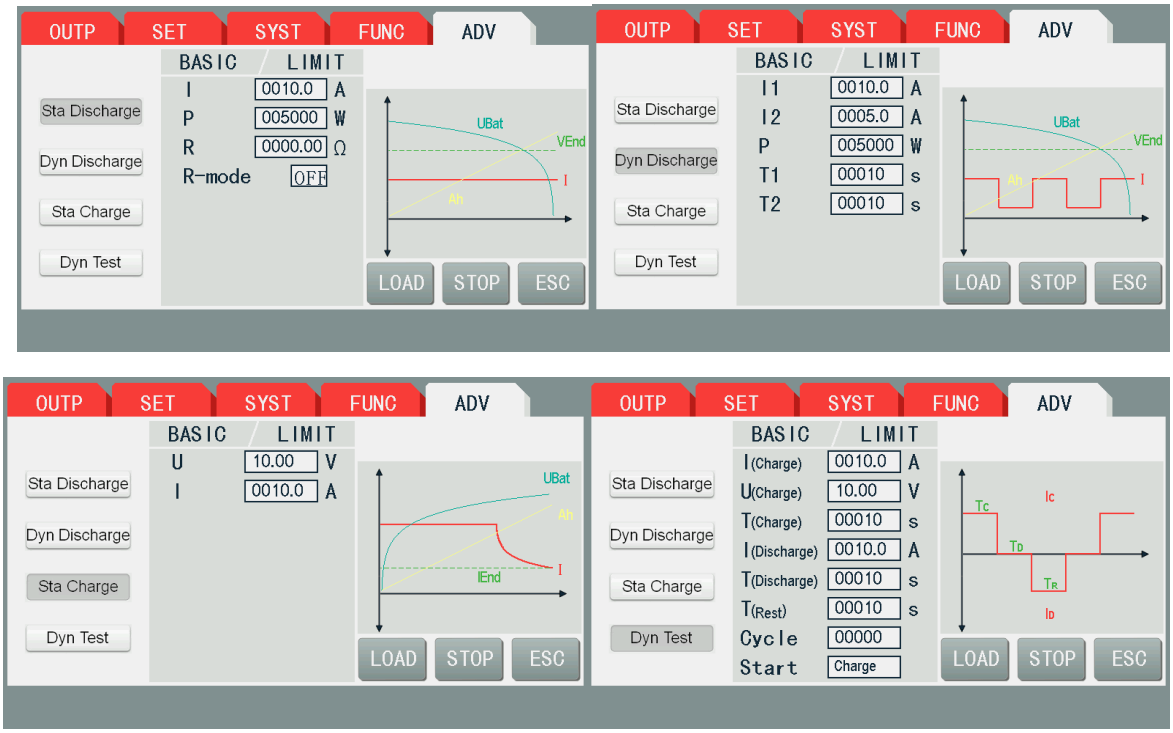


Basic operation steps:

1. Set the voltage
2. Set the source current I_PS
3. Set the load current I_EL
4. Set the duration
5. Click "Load" to enter the [Measure] page. At this point, the power supply is in its initial state.
6. Press the output switch on the front panel, and the list will start to function.
7. Press the output switch on the front panel again to turn off the function generator.
8. Enter the [List] interface and click "Stop" to turn off the output.

5.11 Battery Test

The battery test function is located under the [ADV] -> [Battery] interface. At this point, the user can perform four types of battery tests. As shown in the figure below



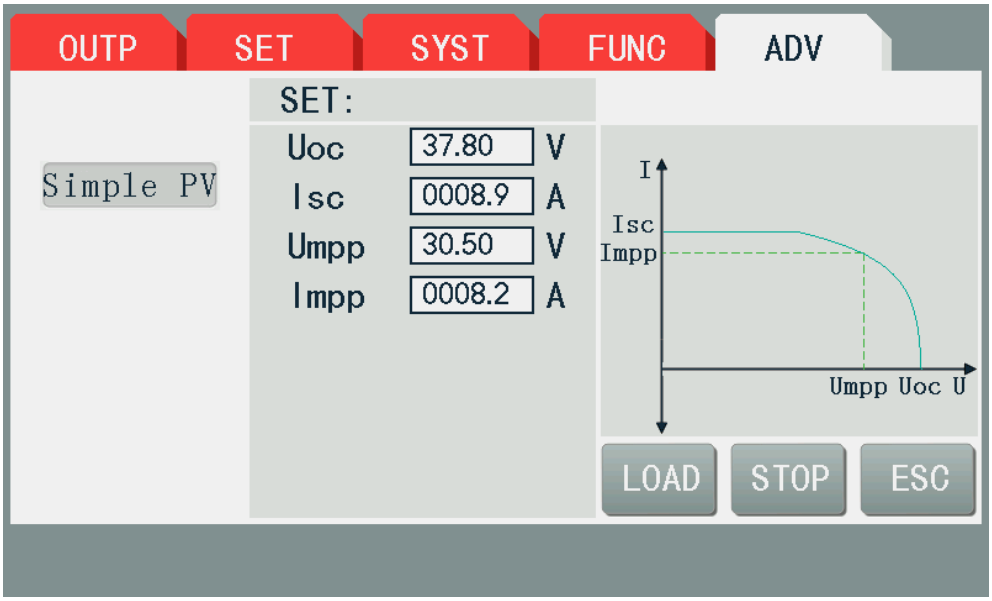
Basic operations with examples:

1. Select the Static Discharge function
2. Set I (current), P (power), R (resistance) and R-mode to "basic"; the resistance setting is effective only when R-mode is set to "on".
3. Set I (termination), U (termination), T (termination), CAP (termination), and ACT to "limit"; if ACT is set to none, there will be no prompt when the termination condition is reached. When ACT is set to signal, a prompt is given when the termination condition is reached, indicating the current termination condition. If ACT is set to stop, the output will be turned off upon reaching any termination condition (test mode will not be exited).
4. Click "Load" to display the [Measure] page. At this point, the power supply is in its initial state.

5. Press the output switch on the front panel, and the battery test officially starts.
6. Press the output switch on the front panel again to turn off the battery test.
7. Enter the [BATTERY] interface and click "Stop" to exit the test mode.

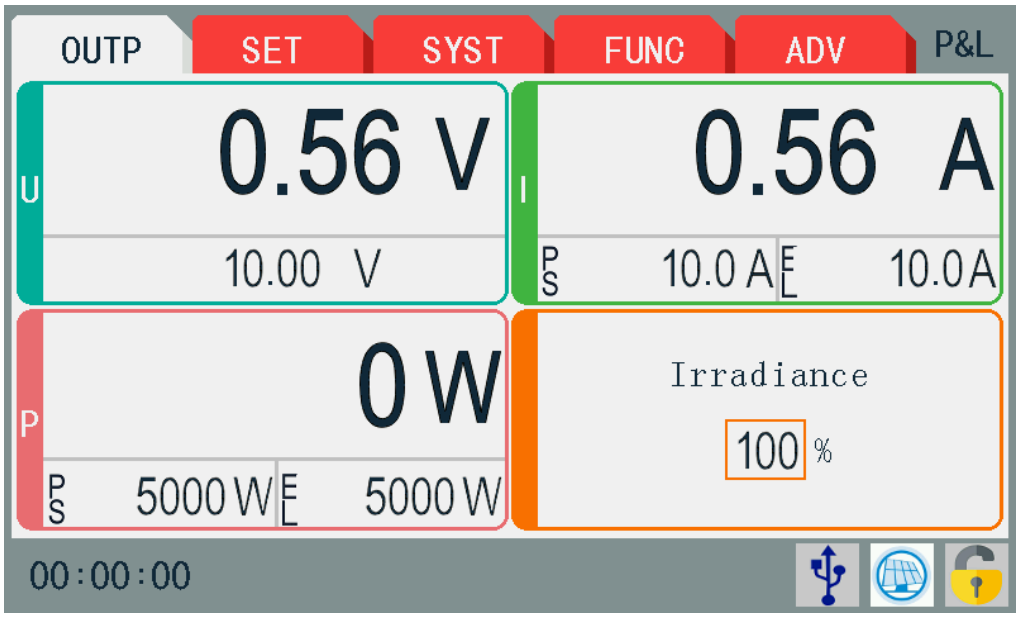
5.12 PV

The PV function is located under the [ADV] -> [PV] interface. At this point, the user can perform a simple PV test. As shown in the figure below



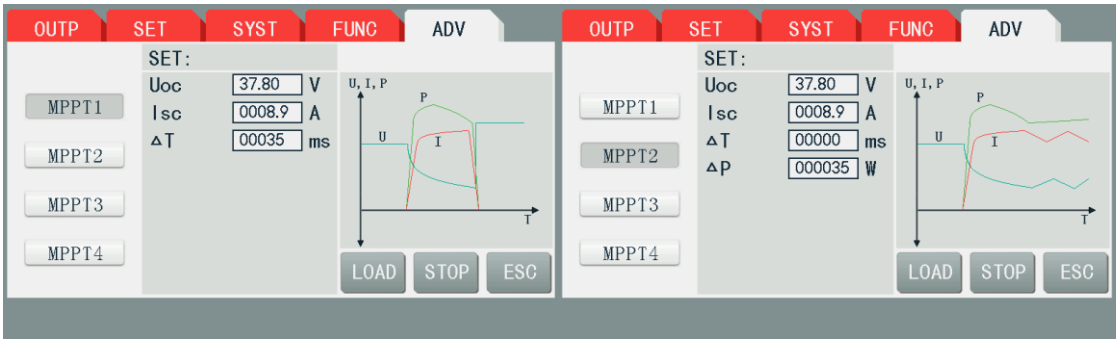
Basic operations with examples:

1. Set Uoc (open circuit voltage), Isc (short circuit current), Umpp (maximum power point voltage) and Impp (maximum power point current) in "Simple PV".
2. Click "Load" to display the [Measurement] page. The interface is shown in the figure below. The illuminance value can be changed at any time, and the output value will change accordingly after the change.
3. Press the output switch on the front panel, and the PV will start working.
4. Press the output switch on the front panel again and the PV will stop.
5. Enter the [PV] interface, click "Stop" to exit the PV.



5.13 MPPT

The MPPT function is under the [ADV] -> [MPPT] interface. At this time, users can use this function to find the maximum power point and achieve tracking. As shown in the figure below

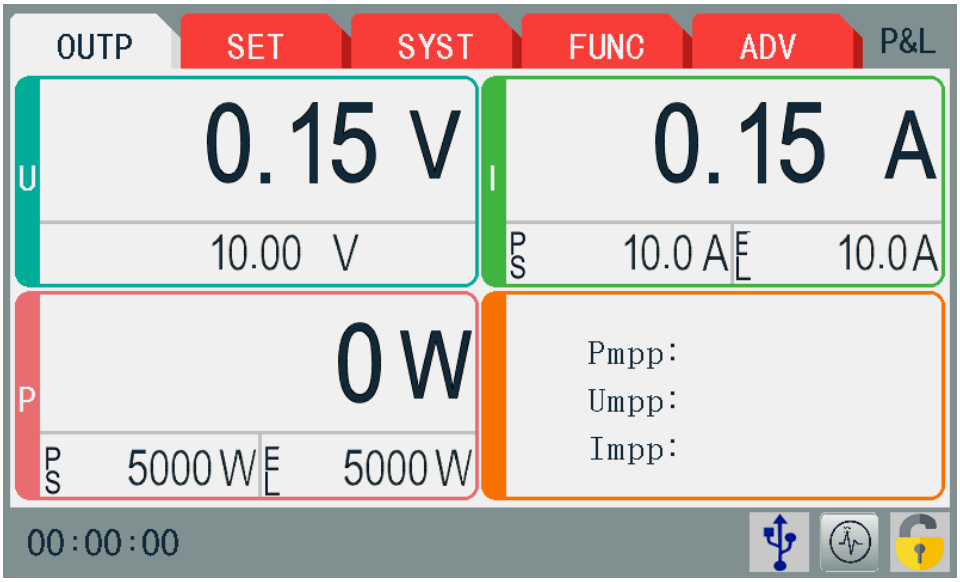


Basic operations with examples:

1. Select the "MPPT1" function (MPPT1 is to find the maximum power point, and it will stop after finding it; MPPT2 is to quickly find the maximum power point, and after finding it, it will track the maximum power point in real time according to the set value; MPPT3 tracks the maximum power point in real time according to the maximum power point input; MPPT4 finds the maximum power point in

the customer's set value by reading the corresponding .CSV file in the USB flash drive) 3.

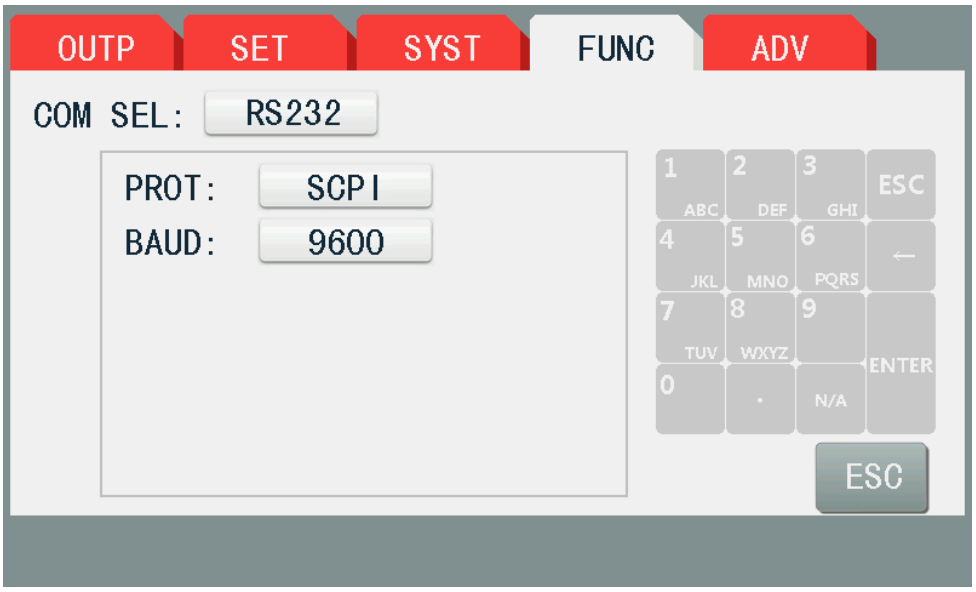
2. Set Uoc (open circuit voltage), Isc (short circuit current) and t (search rate, i.e. duration of each voltage).
3. Click "Load" to enter the [Measurement] page, as shown in the figure below.
4. Press the output switch on the front panel and the MPPT will start.
5. Press the output switch on the front panel again, and the MPPT will stop.
6. Enter the [MPPT] interface, click "Stop" to exit the mode.



Chapter 6 Remote Control

The TH6600 Series offers a variety of remote-control methods, including RS232, LAN, USB, and analog interfaces.

To change the method: Go to the <Communication> settings on the [FUNC] page, select the desired interface, and configure it as shown in the figure below.



6.1 RS232C Interface Description

The most widely used serial communications standard is the RS-232 standard, also known as the asynchronous serial communications standard. RS stands for "Recommended Standard" and 232 is the standard number. This standard was officially announced by the US Electronic Industries Association (EIA) in 1969 and specifies that one bit at a time is transmitted over a data line.

Like most serial ports in the world, this unit's serial interface is not strictly based on the RS-232 standard, but provides only a minimal subset. As shown in Table 6-1 below:

Code	Abridge	Connector pin number
Send data	TXD	2
Receive data	RXD	3
Grounding	GND	5

Table 6-1 Instrument RS232 Signal and Pin Comparison

The reason is that the operation of three lines is easier and more convenient than that of five or six lines, and it has strong compatibility and is widely used. This is the main advantage of using serial port communication.

The connection between the instrument and the computer is shown in Figure 6-2:

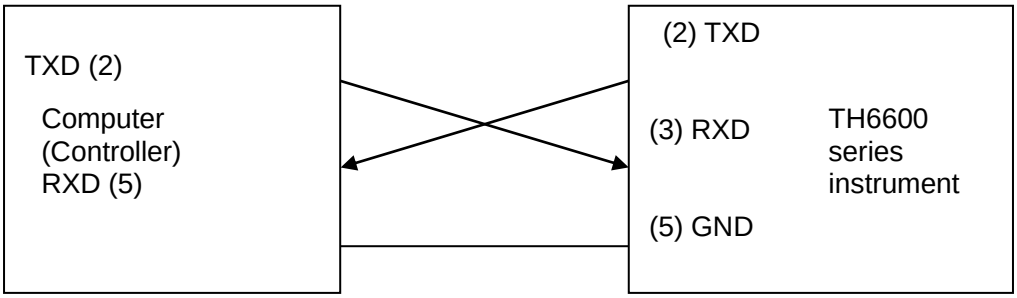


Figure 6-2 Schematic Diagram of Computer and Instrument Connection

As shown in Figure 6-1, the pin definitions of the instrument are different from the pin definitions of the serial interface of the 9-pin connector used by IMB AT-compatible machines. Users can purchase a serial interface cable from Changzhou Tonghui Electronics Co., Ltd. to connect the computer to the Tonghui instrument.

The baud rate of the RS232 interface can be selected from 9600 to 115200, no parity, 8 data bits and 1 stop bit.

The instrument commands conform to the SCPI standard. When sending the command string to the instrument, LF (hexadecimal: 0x0A, escape character'\n') must be sent as the terminating character. The maximum number of SCPI command string bytes that the instrument can receive at one time is 128 bytes.

The format of the result data sent from the instrument to the computer is described in the Command Reference section.

6.2 GPIB Interface Description

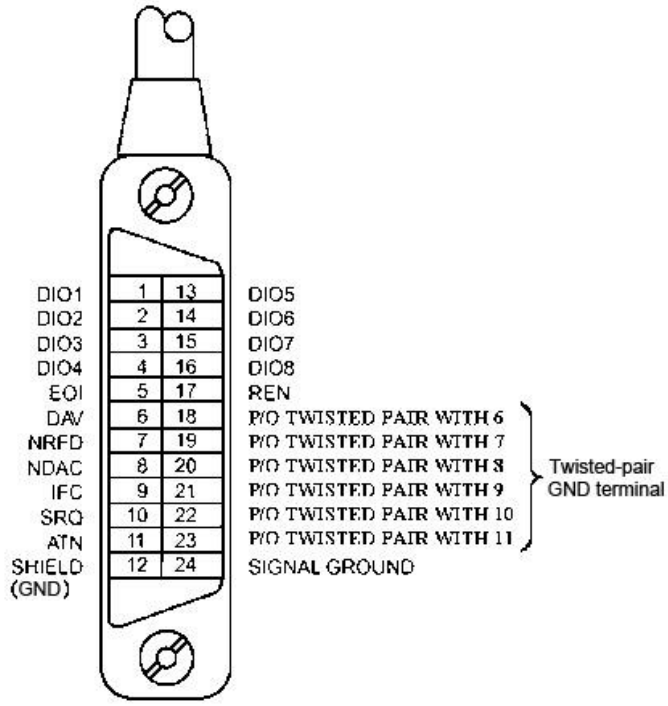
The IEEE 488 (GPIB) general-purpose parallel bus interface is an internationally recognized standard for intelligent instrument bus interfaces. IEEE is the acronym for the Institute of Electrical and Electronics Engineers, and 488 is the standard number. This interface allows communication with computers or other intelligent devices and can be easily combined with other test instruments to form an automated test system. Multiple test instruments can be connected to the same bus simultaneously. This instrument uses the IEEE488.2 standard, and the interface board is optional. The control command system is open, and the user can use the computer operating interface provided with the product or program according to the control command system to achieve the desired purpose. The control command system supports most of the functions of the instrument, which means that almost all the functions of the instrument can be operated on the controlling computer to achieve remote control of the instrument.

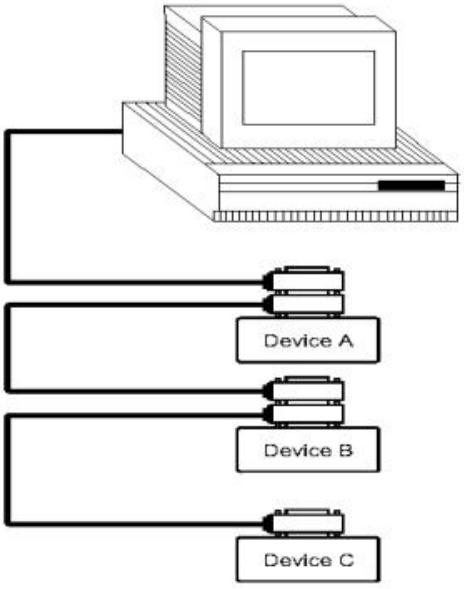
When using the GPIB system of this instrument, the following points should be observed:

The total cable length of the bus system should not exceed 2 meters times the total number of connected test instruments, and the total cable length should not exceed 20 meters.

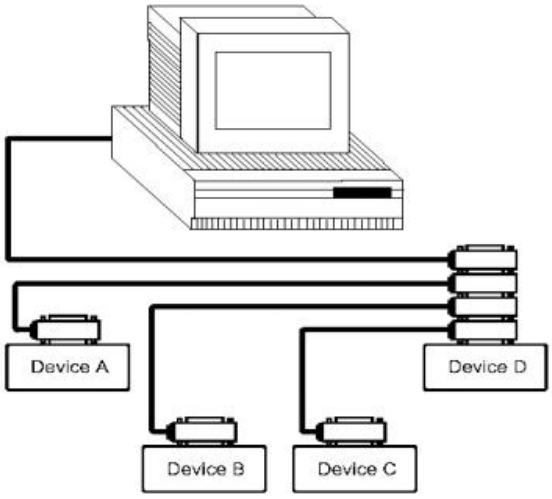
A maximum of 15 instruments can be connected to the same bus at the same time.

There are no restrictions on how the cables are connected to each other, but it is recommended that no more than 4 rear connectors be stacked on any one test instrument.





GPIB Cable Connection Method I



GPIB Cable Connection Method II

GPIB Interface Function

This instrument provides most of the GPIB common functions except for the controller. See Table 6-3 below:

Nicknames	Function
SH1	Supports contact capabilities for all data sources
AH1	Supports contact features for all trusted devices
T5	Basic talk function; talk only function; talk cancellation during MLA; no serial call
L4	Basic listener function; listener cancellation during MTA; no listener-only function
RL1	Remote control/local function
DC1	Device clear function
DT1	Device trigger function
C0	No control function
E1	Open collector drive

Table 6-3

GPIB address

The GPIB of this instrument is addressed in a single address mode, there is no subaddress, you can use 1-32 as the GPIB address, and the factory default address is 8.

6.3 USB Port

USB_CDC Virtual Serial Port

The USB interface can be configured as a virtual serial port (VCom) by selecting the "USBCDC" bus method.

System Configuration

Connect the USB port on the back of the TH6600 to the USB port on the host computer by using a USB cable.

Installation of Drivers

The method for installing the USBCDC driver is the same as for USBTMC, except for selecting the driver file.

Select the path where the usbVCom.inf file is located, as shown in Figure 6-4.

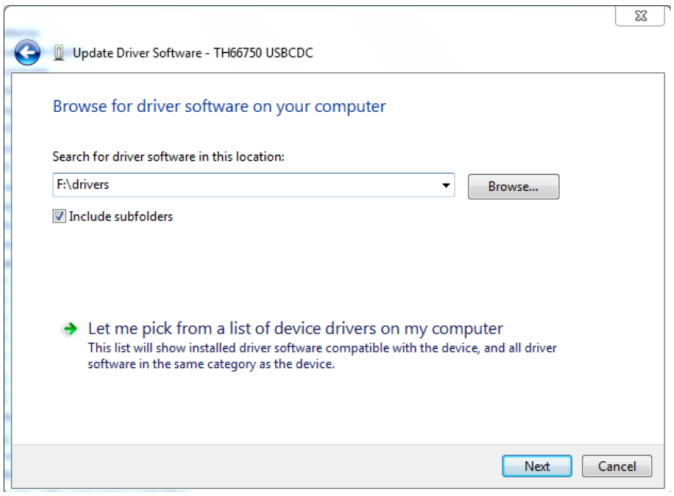


Figure 6-4 Specifying the Driver File Path

After the driver is installed, the user can see the "USB VCom Port" in the computer's Device Manager. As shown in Figure 6-5:

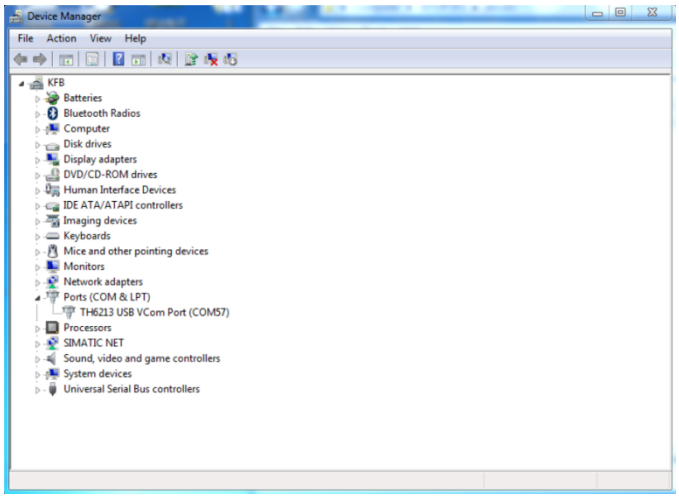


Figure 6-5 Device Manager Displaying VCom

At this point, the USB VCom port is equivalent to a serial port. If the PC does not have a serial port, the user's existing serial-based communication software can be used in this mode as if the USB port were a virtual serial port.

6.4 Analog Interface

6.4.1 Overview

The rear panel of the product has a built-in galvanically isolated 15-pin analog interface (abbreviation: AI), which has the following functions:

- Remote control of current, voltage, power, and resistance
- Remote status monitoring (CV, DC output)
- Remote monitoring of alarms (OT, OVP, PF)
- Remote monitoring of actual values
- Remote on/off of DC terminals

The settings for the three values of voltage, current, and power are generally made simultaneously for the analog interface. For example, you cannot set the voltage using the analog interface and then set the current and power using the rotary knob, or vice versa. The resistance setting can be adjusted separately. The analog interface does not allow additional power and current adjustments in source mode, unlike manual or digital adjustments.

The analog setpoints can be entered using an external voltage or a reference voltage generated by pin 3. When remote control via the analog interface is activated, the display value is the value provided by the interface. The analog interfaces can be operated in the usual voltage ranges of 0...5 V and 0...10 V, corresponding to 0...100% of the nominal value. The reference voltage from pin 3 (VREF) is used:

0-5 V: Reference voltage = 5 V, 0...5 V setpoints (VSEL, CSEL, PSEL, RSEL) correspond to 0...100% of the nominal value (exception: resistance values RMin...RMax), while the actual values at the output pins (CMON, VMON) correspond to 0...5 V for 0...100% of the actual value.

0-10 V: Reference voltage = 10 V, 0...10 V setpoints (VSEL, CSEL, PSEL, RSEL) correspond to 0...100% of the setpoint, while the actual value at the actual value output pins (CMON, VMON) corresponds to 0...10 V for 0...100% of the actual value.

The OVP setpoint and other monitoring functions (events) as well as the alarm limits cannot be set via the analog interface. Therefore, before controlling the product via the analog interface, it must be set appropriately according to known conditions.

Before connecting hardware that controls the analog interface, make sure that it does not apply voltages to the pins that exceed the specified values.

The setpoint input pins, such as VSEL, CSEL, PSEL, and RSEL (if R mode is enabled), must not be left open (i.e., unconnected) in analog remote-control mode. If no adjustment is required for any of the setpoints, they can be fixed at a defined level or connected to the VREF pin (with a soldering wire or in some other way) so that a value of 100% is output.

Switching between the source modes can only be done by the voltage level at the VSEL pin.

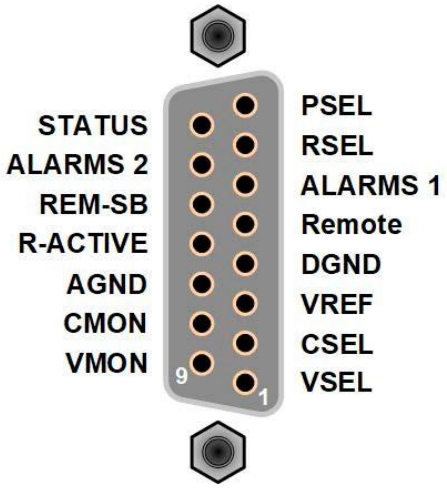
6.4.2 Resolution and Sampling

The analog interface is sampled and processed internally by a digital microprocessor. This results in a limited resolution for each analog step. When the operating voltage is in the 10 V range, the resolution is 26214 as for the setpoints (VSEL, etc.) and the actual values (VMON/CMON). In the 5V range, the resolution is halved. Due to errors, the actual achievable resolution is lower.

6.4.3 Acknowledgement of Equipment Alarms

If an instrument alarm occurs while remotely controlled via the analog interface, the DC terminal is turned off in the same manner as in manual control mode. The product will display the alarm on the front panel display and signal most alarms on the analog interface.

6.4.4 Analog Interface Specifications and Pinout

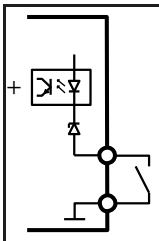
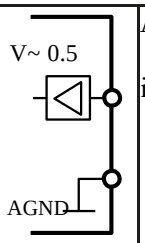
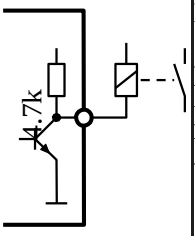
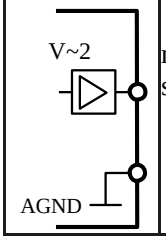


Pins	Name	Type	Description	Default Level	Electrical Performance
1	VSEL	AI	Set voltage	0...10V or 0... .5V corresponds to 0...100% U_{nom}	Accuracy in the 0-5 V range <0.4% **** Accuracy in the 0-10 V range <0.2% **** Input impedance R_i >40 k.... .100 k
2	CSEL	AI	Set current (Source & Load model)	0...10V or 0... .5V corresponds to 0...100% Inom	
3	VREF	AO	Reference voltage	10V or 5V	I_{max}= +5 mA, error < 0.2% Short-circuit protection to AGND
4	DGND	POT	All digital signal ground		For control and status signals
5	REMOTE	DI	Open internal control/remote control	Remote control = LOW, Ulow <1V Internal control = HIGH, Uhigh >4V Internal control = Open	Voltage range= 0...30 V IMax = -1 mA bei 5 V ULOW to HIGH typ. = 3 V Sender: open collector to DGND
6	ALARMS 1	DO	Overheating or power failure alarm	OT alarm = HIGH, U_{High} >4V No OT alarm = LOW, U_{Low} <1V	Quasi open collector pull-up to Vcc ** Current max + 1mA when this pin is 5 V; UCE = 0.3V when I_{max} = -10mA, Umax = 0.... .30V Short-circuit protection to DGND
7	RSEL	AI	Set the internal resistance value (Source & Load mode)	0...10 V or 0... .5 V corresponds to 0...100% of Rmin.... Rmax	Accuracy in the 0-5 V range <0.4% **** Accuracy in the 0-10 V range <0.2% **** Input impedance R_i >40 k.... .100 k
8	PSEL	AI	Set power (Source & Load mode)	0...10 V or 0... .5 V corresponds to 0...100% of Pnom	
9	VMON	AO	Actual voltage	0...10 V or 0... .5 V corresponds to 0...100% U_{nom}	Accuracy in the 0-5 V range <0.4% **** Accuracy in the 0-10V range <0.2% **** Imax = +2mA Short-circuit protection to AGND
10	CMON	AO	Actual current	0...10 V or 0... .5 V corresponds to 0...100% Inom	
11	AGND	POT	All analog signal grounds		For -SEL, -MON, VREF signals
12	R-ACTIVE	DI	R mode on/off	On = LOW, Ulow < 1V Off = HIGH, Uhigh > 4V Close = Open	Voltage range = 0...30V. With this pin at 5V, I_{max} = +1mA Ulow to high typ. = 3V Sender: open collector to DGND

13	REM-SB	DI	DC terminal off (DC terminals on) (Acknowledgement of alarms ****)	Off = LOW, Ulow < 1V On = HIGH, Uhigh > 4V Open = Open	Voltage range = 0...30V Imax = +1mA at 5V for this pin Sender: open collector to DGND
14	ALARMS 2	DO	Overvoltage alarm Overcurrent alarm Overpower alarm	OV Alarm = HIGH, Uhigh >4V No OV alarm = LOW, Ulow <1V	Quasi-collector open pull-up to Vcc Current max. +1mA when this pin is 5V $I_{(max.)}$ = -10mA when U_{CE} = 0.3V Umax = 0.... .30V short-circuit protection to DGND
15	STATUS	DO	Constant voltage adjustment activation	CV = LOW, Ulow <1V CC/CP/CR = HIGH, Uhigh >4V	
			DC output	On = LOW, Ulow <1V Off= HIGH, Uhigh >4V	

* AI = analog input pin, AO = analog output pin, DI = digital input pin, DO = digital output pin, POT = potentiometer pin

6.4.5 Simplified Schematic of Each Pin

	Digital Input (DI) Use a low-resistance switch (relay switch, circuit breaker, etc.) to send a clear signal to DGND.		Analog Input Pin (AI) OA circuit with high-impedance input pins (impedance >40k...100 kΩ).
	Digital Output Pin (DO) An open collector is treated as a high impedance pull-up to the internal power supply. It cannot carry a load under LOW conditions and can only be used as a switch, like a relay.		Analog Output Pin (AO) The output pins of the OA circuit must have minimal resistance, see specification table on previous page.

6.4.6 Application Examples

Step 1. Go to the <COM> setting on the <FUNC> page, select 'ANALOG' and configure as needed.

Step 2. Connect PIN5 REMOTE to low level to turn on the remote.

Step 3. Set the voltage, current, internal resistance and power of the unit by controlling the voltage of PIN1, PIN2, PIN7 and PIN8 (Note: To enable R mode, first connect PIN12 to low level).

Step 4. Connect PIN13 to high level to enable the output.

Step 5. By reading the voltage of PIN9 and PIN10, the output voltage and current of the device can be calculated.

Step 6. By reading the voltage levels of PIN6, PIN14 and PIN15, information such as the output status of the instrument can be obtained.

Step 7. Connect PIN13 to low to turn off the output.

Chapter 7 Commands and Protocols

The TH6600 Series has optional SCPI and ModBus command standards for communication commands. The ModBus command protocol applies only to the RS232C communication interface; the other communication interfaces parse only the SCPI standard commands.

7.1 SCPI Commands

It can be found on the company's Web site at www.tonghui.com.cn.

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based instrument command language for test and measurement instruments. SCPI commands are based on a hierarchical structure (also known as a tree system). In this system, related commands are grouped under a common node or root, which forms a subsystem.

According to the command syntax, most commands (and some parameters) are expressed in mixed case. Uppercase letters indicate abbreviated commands. For shorter program lines, you can send the abbreviated form of the command. To make the program easier to read, you can send the full form of the command.

Note: The TH6600 Series avoids misunderstandings about abbreviated commands by avoiding excessive abbreviation options in command descriptions. Most command descriptions are given directly in abbreviated form.

Syntax Conventions:

[SOURce[1|2]:]VOLTage:UNIT {VPP|VRMS|DBM}

[SOURce[1|2]:]FREQuency:CENTer {<frequency>|MINimum|MAXimum|
DEFault}

Note: Command syntax conventions:

The curly braces ({ }) enclose the parameter options for the given command string. The braces are not sent with command string.

The vertical bar (|) separates multiple parameter options for the given command string. For example, in the command above, {VPP|VRMS|DBM} means that you can specify "VPP", "VRMS", or "DBM". The vertical bar is not sent with the command string.

The angle brackets (<>) in the second example indicate that a value must be specified for the parameter in parentheses. For example, in the above syntax, the parameter in the angle brackets is <frequency>. The angle brackets are not sent with the command string. You must specify a value for the parameter (for example, "FREQ:CENT 1000") unless you select one of the other options shown in the syntax (for example, "FREQ:CENT MIN").

Some syntax elements (such as nodes and parameters) are enclosed in square

brackets ([ ]). This indicates that the element is optional and can be omitted. The angle brackets are not sent with the command string. If no value is specified for an optional parameter, the instrument selects the default value. In the example above, "SOURce[1|2]" means that you can use "SOURce" or "SOURce1" to refer to source channel 1, or "SOUR1" or "SOUR" to refer to source channel 1. Since the entire SOURce node is optional (in square brackets), you can also refer to channel 1 by omitting the SOURce node altogether. This is because channel 1 is the default channel for the SOURce language node. On the other hand, to refer to channel 2, you must use "SOURce2" or "SOUR2" in the command line.

^END: EOI (end) signal of IEEE-488 bus.

IEEE488.2 common commands

Standard SCPI commands:

●*IDN ●*TRG ●*RST

Note: This machine uses three common commands.

①*IDN?

DESCRIPTION: Read out product information.
Syntax: *IDN?
Result: {string1},{string2},{string3}@{string4}
Return data information as follows: "Manufacturer", "Product model", "Software version number", "Product serial number "
{string1} Manufacturer
{string2} Product model (TH6680_360_15)
{string3} Software version number (Ver:1.0.0)
{string4} Time
Example:
*IDN? ---- returns: like Tonghui, TH6680_360_15, Ver:1.0.0@2019.09.20

②*TRG

Description: Open output

③*RST

Description: Resets the device to the factory default state, including parameter settings. An automatic restart is performed after the reset is complete.

7.1.1 SYSTem Subsystem Command Set

Mainly related to commands for instrument systems

Lock Command Set	
SYSTem:LOCK ?	Query whether to remotely control
SYSTem:LOCK ON/1/OFF/0	Lock/unlock screen
Alarm Command Set	
SYSTem: Alarm off	Turn off the instrument's current alarm

Nominal Command Set	
SYSTem:NOMinal:VOLTage?	Query the maximum voltage of this instrument
SYSTem:NOMinal:CURRent?	Query the maximum current of this instrument
SYSTem:NOMinal:POWer?	Query the maximum power of this instrument
SYSTem:NOMinal:RESistance:MINimum?	Query the minimum set internal resistance of this instrument
SYSTem:NOMinal:RESistance:MAXimum?	Query the maximum set internal resistance of this instrument
Normal Command Set	
SYSTem:NORmal:DEVice:CLAss?	Query the model and software version number of the instrument
SYSTem:NORmal:LANGuage ENG/CHN	Set the language of the instrument
SYSTem:NORmal:LANGuage ?	Query the language of the instrument (0: Chinese, 1: English)
SYSTem:NORmal:TOUChvoice ON/OFF/1/0	Set the touch sound of the instrument
SYSTem:NORmal:TOUChvoice ?	Query the touch sound of the instrument (0: on, 1: off)
SYSTem:NORmal:WARningvoice ON/OFF/1/0	Set the alarm sound of the instrument
SYSTem:NORmal:WARningvoice ?	Query the alarm sound of the instrument (0: on, 1: off)
SYSTem:NORmal:POWerstatus ON/OFF/1/0	Set the power-on state
SYSTem:NORmal:POWerstatus ?	Query the power-on state (0: default, 1: user)
system:normal:bl on/off/1/0	Set the backlight state
SYSTem:NORmal:BL ?	Query the backlight state (0: always on, 1: turns off after 60s)
Config Command Set	
SYSTem:CONFig:UVD ?	Query user event – UVD setting value
SYSTem:CONFig:UVD <NRf> [Unit]	Set user event – UVD setting value
SYSTem:CONFig:OVD ?	Query user event – OVD setting value
SYSTem:CONFig:OVD <NRf> [Unit]	Set user event – OVD setting value
SYSTem:CONFig:UVD:ACTion ?	Query user event – UVD action
SYSTem:CONFig:UVD:ACTion {NONE | WARNING | ALARM}	Set user event – UVD action
SYSTem:CONFig:UCD ?	Query user event – source UCD setting value
SYSTem:CONFig:UCD <NRf>[Unit]	Set user event – source UCD setting value
SYSTem:CONFig:OCD ?	Query user event – source OCD setting value
SYSTem:CONFig:OCD <NRf>[Unit]	Set user event – source OCD setting value
SYSTem:CONFig:OCD:ACTion ?	Query user event – source OCD action
SYSTem:CONFig:OCD:ACTion {NONE | WARNING | ALARM}	Set user event – source OCD action
SYSTem:CONFig:OPD ?	Query user event – source OPD setting value
SYSTem:CONFig:OPD <NRf>[Unit]	Set user event – source OPD setting value
SYSTem:CONFig:OPD:ACTion ?	Query user event – source OPD action
SYSTem:CONFig:OPD:ACTion {NONE | WARNING | ALARM}	Set user event – source OPD action

SYSTem:CONFig:delay ?	Query user event – delay time
SYSTem:CONFig:delay <NRf>[Unit]	Set user event – delay time
SYSTem:CONFig:duration ?	Query user event – duration
SYSTem:CONFig:duration <NRf>[Unit]	Set user event – duration
SYSTem:SINK:CONFig:UCD ?	Query user event – load UCD setting value
SYSTem:SINK:CONFig:UCD <NRf>[Unit]	Set user event – load UCD setting value
SYSTem:SINK:CONFig:OCD ?	Query user event – load OCD setting value
SYSTem:SINK:CONFig:OCD <NRf>[Unit]	Set user event – load OCD setting value
SYSTem:SINK:CONFig:OCD:ACTion ?	Query user event – load OCD action
SYSTem:SINK:CONFig:OCD:ACTion {NONE | WARNING | ALARM}	Set user event – load OCD action
SYSTem:SINK:CONFig:OPD ?	Query user event – load OPD setting value
SYSTem:SINK:CONFig:OPD <NRf>[Unit]	Set user event – load OPD setting value
SYSTem:SINK:CONFig:OPD:ACTion ?	Query user event – load OPD action
SYSTem:SINK:CONFig:OPD:ACTion {NONE | WARNING | ALARM}	Set user event – load OPD action

7.1.2 FUNCtion Subsystem Command Set

It is mainly concerned with the setting of the various functions of the instrument.

Resistance Command Set	
FUNCtion: RESistance ON/1/OFF/0	Turn on/off R mode
FUNCtion: RESistance ?	Query whether R mode is on
Timing Command Set	
FUNCtion:TIMing ON/1/OFF/0	Turn on the timing function/timer function
FUNCtion:TIMing ?	Query whether the timing/timer function is turned on
FUNCtion:TIMing value <NRf>	Set the timing time
FUNCtion:TIMing value ?	Query the timing time
MS Command Set	
FUNCtion:MS master/slave/single	Set the master-slave or stand-alone machine
FUNCtion:MS scan	Scan for slaves, this command will have a return value, 1 for one slave, 2 for two
FUNCtion:MS init	Master-Slave data initialization
Generater Command Set	
FUNCtion:GENerator ON/1/OFF/0	Function Generator Load/Stop
FUNCtion:GENerator:SINe:VOLTage a b c d e f g h	The function generator is set to sin function, voltage mode. A:U(A);B:U(offs);C:f;D:U(start);E:Iset_PS;F:Iset_EL;G:Pset_PS;H:Pset_EL
FUNCtion:GENerator:SINe:CURRent a b c d e f g h	The function generator is set to sin function, current mode. A:I(A);B:I(offs);C:f;D:U(start);E:Iset_PS;F:Iset_EL;G:Pset_PS;H:Pset_EL
FUNCtion:GENerator:TRIangle:VOLTage a b c d e f g h	The function generator is set to tri function, voltage mode. The specific parameters can be found on the interface.
FUNCtion:GENerator:TRIangle:CURRent a b c d e f g h	The function generator is set to tri function, current mode. The specific parameters can be found on the interface.

FUNCtion:GENerator:SQUare:VOLTage a b c d e f g h	The function generator is set to squ function, voltage mode. The specific parameters can be found on the interface.
FUNCtion:GENerator: SQUare:CURRent a b c d e f g h	The function generator is set to squ function, current mode, with specific parameters visible in the interface
FUNCtion:GENerator:STEP:VOLTage a b c d e f g h	The function generator is set to STEP function, voltage mode. The specific parameters can be found on the interface.
FUNCtion:GENerator:STEP:CURRent a b c d e f g h	The function generator is set to STEP function, current mode. The specific parameters can be found on the interface.
Record Command Set	
FUNCtion:RECord ON/1/OFF/0	Turn on/off the data logging function
FUNCtion:RECord ?	Query whether the data logging function is turned on
FUNCtion:RECord amount <NRf>	Set the number of recording data
FUNCtion:RECord interval <NRf>	Set the time interval of the recording data

7.1.3 MEASure Subsystem Command Set

This is mainly a query of the instrument's output value.

MEASure:[SCALar:]VOLTage ?	Query sampling voltage
MEASure:[SCALar:]CURRent ?	Query sampling current
MEASure:[SCALar:]POWer ?	Query sampling power

7.1.4 OUTPut Subsystem Command Set

OUTPut ON/1/OFF/0	Turn on/off output
OUTPut ?	Query output status

7.1.5 SOURce Subsystem Command Set

Voltage Command Set	
[SOURce:]VOLTage <NRf>[Unit]	Set voltage
[SOURce:]VOLTage ?	Query voltage
[SOURce:]VOLTage:PROTection[:LEVel] <NRf>[Unit]	Set OVP
[SOURce:]VOLTage:PROTection[:LEVel]?	Query OVP setting value
[SOURce:]VOLTage:LIMit:LOW <NRf>[Unit]	Set voltage minimum limit
[SOURce:]VOLTage:LIMit:LOW ?	Query voltage minimum limit
[SOURce:]VOLTage:LIMit:HIGH <NRf>[Unit]	Set voltage maximum limit
[SOURce:]VOLTage:LIMit:HIGH ?	Query voltage maximum limit
Current Command Set	
[SOURce:]CURRent <NRf>[Unit]	Set source current
[SOURce:]CURRent ?	Query source current
[SOURce:]CURRent:PROTection[:LEVel] <NRf>[Unit]	Set source OCP
[SOURce:]CURRent:PROTection[:LEVel] ?	Query source OCP setting value
[SOURce:]CURRent:LIMit:LOW <NRf>[Unit]	Set source current minimum limit
[SOURce:]CURRent:LIMit:LOW?	Query source current minimum limit
[SOURce:]CURRent:LIMit:HIGH <NRf>[Unit]	Set source current maximum limit
[SOURce:]CURRent:LIMit:HIGH ?	Query source current maximum limit

Power Command Set	
[SOURce:]POWer <NRf>[Unit]	Set source power
[SOURce:]POWer ?	Query source power
[SOURce:]POWer:PROTection[:LEVel] <NRf>[Unit]	Set source OPP
[SOURce:]POWer:PROTection[:LEVel] ?	Query source OPP
[SOURce:]POWer:LIMit:HIGH <NRf>[Unit]	Set source power maximum limit
[SOURce:]POWer:LIMit:HIGH ?	Query source power maximum limit
Resistance Command Set	
[SOURce:]RESistance <NRf>[Unit]	Set source internal resistance
[SOURce:]RESistance ?	Query source internal resistance
[SOURce:]RESistance:LIMit:HIGH <NRf>[Unit]	Set source internal resistance maximum limit
[SOURce:]RESistance:LIMit:HIGH ?	Query source internal resistance maximum limit

7.1.6 SINK Subsystem Command Set

Current Command Set	
SINK:CURRent <NRf>[Unit]	Set output current
SINK:CURRent ?	Query setting current
SINK:CURRent:PROTection <NRf>[Unit]	Set load OCP
SINK:CURRent:PROTection ?	Query load OCP setting value
SINK:CURRent:LIMit:LOW <NRf>[Unit]	Set load current minimum limit
SINK:CURRent:LIMit:LOW ?	Query load current minimum limit
SINK:CURRent:LIMit:HIGH <NRf>[Unit]	Set load current maximum limit
SINK:CURRent:LIMit:HIGH ?	Query load current maximum limit
Power Command Set	
SINK:POWer␣<NRf>[Unit]	Set load power
SINK:POWer?	Query load power
SINK:POWer:PROTection[:LEVel]␣<NRf>[Unit]	Set load OPP
SINK:POWer:PROTection[:LEVel]?	Query load OPP
SINK:POWer:LIMit:HIGH <NRf>[Unit]	Set load power maximum limit
SINK:POWer:LIMit:HIGH ?	Query load power maximum limit
Resistence Command Set	
SINK:RESistance <NRf>[Unit]	Set load internal resistance
SINK:RESistance ?	Query load internal resistance
SINK:RESistance:LIMit:HIGH <NRf>[Unit]	Set load internal resistance maximum limit
SINK:RESistance:LIMit:HIGH ?	Query load internal resistance maximum limit

7.1.7 BATT Subsystem Command Set

BATT: OFF	Exit battery test
sd Command Set	
BATT:sd:set: a b c d	Set parameters related to sd mode
BATT:sd:end_bat: a b c d e	Set end condition of sd mode
BATT:sd:load	Load sd mode
dd Command Set	

BATT:dd:set: a b c d e	Set parameters related to dd mode
BATT:dd:end_bat: a b c d e	Set end condition of dd mode
BATT:dd:load	Load dd mode
sc Command Set	
BATT:sc:set: a b	Set parameters related to sc mode
BATT:sc:end_bat: a b c d e	Set end condition of sc mode
BATT:sc:load	Load sc mode
dt Command Set	
BATT:dt:set: a b c d e f g h	Set parameters related to dt mode
BATT:dt:end_bat: a b c d e	Set end condition of dt mode
BATT:dt:load	Load dt mode

7.1.8 UPGRADE Subsystem Command Set

Udisk Command Set	
UPgrade:udisk api	USB flash drive upgrade front panel
UPgrade:udisk ctrl	USB flash drive upgrade control board
RS232 Command Set	
UPgrade:rs232 api [.sec file]	Serial upgrade front panel
UPgrade:rs232 ctrl [.sec file]	Serial upgrade control board

7.1.9 PV Subsystem

PV off	Exit PV mode
PV:sp:set:a b c d	Set parameters of simple PV
PV:irr a	Set light value
PV:sp:load	Load simple PV

7.1.10 MPPT Subsystem Command Set

MPPT off	Exit MPPT mode
MPPT:save	Save values when running in mppt4 mode
MPPT:rec	Read files required for mppt4 mode
mppt1 Command Set	
MPPT:mppt1:set: a b c	Set parameters related to mppt1 mode
MPPT:mppt1:load	Load mppt1 mode
mppt2 Command Set	
MPPT:mppt2:set: a b c d	Set parameters related to mppt2 mode
MPPT:mppt2:load	Load mppt2 mode
mppt3 Command Set	
MPPT:mppt3:set: a b c d e	Set parameters related to mppt3 mode
MPPT:mppt3:load	Load mppt3 mode
mppt4 Command Set	
MPPT:mppt4:set: a b c d	Set parameters related to mppt4 mode
MPPT:mppt4:load	Load mppt4 mode

7.2 ModBus Commands

This unit supports the Modbus_RTU protocol.

7.2.1 Write Command Reference

Writing commands supports writing the values of multiple consecutive address registers at the same time.

① Send Format:

Instrument Address	Function Code	Address High	Address Low	Register Number High	Register Number Low	Total Bytes	Data Byte 1	.....	Data Byte N	CRC Low	CRC High

② Return Format:

Instrument Address	Function Code	Address High	Address Low	Register Number High	Register Number Low	CRC Low	CRC High

Instrument Address: This is the local address of the instrument, which can be set on the communication setting screen of the instrument. The value range is 1~32

Function Code: Code: 0x10/0x06

Address High, Address Low: This is the storage address of the data in the instrument, which can be selected according to the command table below.

Register Number High, Register Number Low: This indicates the number of registers to be written in this operation. Each register is 2 bytes in size.

Total Bytes: This indicates the total number of bytes that will be written in this operation.

Data Byte: the value of the parameter being written

CRC: CRC check code

③ Example:

Write Single Register: Set output voltage to 25.50V

(the address of this command is 0x10, 25.50 is a float data type totaling 4 bytes, which requires 2 registers to store)

Then the command to send is:

08 10 00 10 00 02 04 41 CC 00 00 00 08 3C

The return message is:

08 10 00 10 00 02 40 94

b. Write multiple registers: Set the output voltage to 25.50V, the source current to 88.5A, and the load current to 70.5A (the addresses must be consecutive).

Then the command to send is:

08 10 00 10 00 06 0C 41 CC 00 00 00 42 B1 00 00 42 8D 00 00 47 98

The return message is:

08 10 00 10 00 06 41 57

(PS: Float data is 4 bytes in total and requires 2 registers; U16 data is 2 bytes in total and requires 1 register. If the value does not change, please refer to xx.xx.xx)

7.2.2 Read Command Reference

Reading commands supports reading the values of multiple consecutive address registers at the same time.

① Send Format:

Instrument Address	Function Code	Address High	Address Low	Register Number High	Register Number Low	CRC Low	CRC High

② Return Format:

Instrument Address	Function Code	Total Bytes	Data Byte 1	.....	Data Byte N	CRC Low	CRC High

Instrument Address: This is the local address of the instrument, which can be set on the communication setting screen of the instrument. The value range is 1~32

Function Code: Code: 0x03

Address High, Address Low: This is the storage address of the data in the instrument, which can be selected according to the command table below.

Register Number High, Register Number Low: This indicates the number of registers to be written in this operation. Each register is 2 bytes in size.

CRC: CRC check code

Total Bytes: This indicates the total number of bytes that will be read in this operation.

Data Byte: the value of the parameter being read

③ Example:

Read Single Register: Query output voltage

(The address of this command is 0x03, and the return information has 1 float type, totaling 4 bytes, which requires 2 registers)

Then the command to send is:

08 03 00 03 00 02 34 92

The return message is:

08 03 04 42 c7 ff 30 87 52

b. Read Multiple Registers: Query output voltage, current, power

(The address of this command is 0x03, and the return information has 3 float types, totaling 12 bytes, which requires 6 registers)

Then the command to send is:

08 03 00 03 00 06 35 51

The return message is:

08 03 0C 42 C7 FF 30 43 D1 BE BF 47 23 DC 00 13 58

7.2.3 Modbus Command Table

register address	Status	Description	Data Type	Byte Count
0x02	R/W	Trigger output	U16	2
0x03	RO	Read sampling voltage	Float	4
0x04	RO	Read sampling current	Float	4
0x05	RO	Read sampling power	Float	4
0x10	R/W	Read/write voltage setting value	Float	4
0x11	R/W	Read/write source current setting value	Float	4
0x12	R/W	Read/write load current setting value	Float	4
0x13	R/W	Read/write source power setting value	Float	4
0x14	R/W	Read/write load power setting value	Float	4
0x15	R/W	Read/write source internal resistance setting value	Float	4

0x16	R/W	Read/write load internal resistance setting value	Float	4
0x17	R/W	Read/write OVP setting value		4
0x18	R/W	Read/write source OCP setting value	Float	4
0x19	R/W	Read/write load OCP setting value	Float	4
0x1A	R/W	Read/write source OPP setting value	Float	4
0x1B	R/W	Read/write load OPP setting values	Float	4
0x1C	R/W	Read/write voltage minimumlimit	Float	4
0x1D	R/W	Read/write voltage maximum limit	Float	4
0x1E	R/W	Read/write source current minimum limit	Float	4
0x1F	R/W	Read/write source current maximum limit	Float	4
0x20	R/W	Read/write load current minimum limit	Float	4
0x21	R/W	Read/write load current maximum limit	Float	4
0x22	R/W	Read/write source power maximum limit	Float	4
0x23	R/W	Read/write load power maximum limit	Float	4
0x24	R/W	Read/write source internal resistance maximum limit	Float	4
0x25	R/W	Read/write load internal resistance maximum limit	Float	4
0x27	R/W	Remote control or not	U16	2
0x28	RO	Read system maximum voltage	Float	4
0x29	RO	Read system maximum current	Float	4
0x2A	RO	Read system maximum power	Float	4
0x2B	RO	Read system minimum resistance	Float	4
0x2C	RO	Read system maximum resistance	Float	4
0x2E	WO	Set system language	U16	2
0x2F	WO	Set touch sound	U16	2
0x30	WO	Set alarm sound	U16	2
0x31	WO	Set power-on state	U16	2
0x32	WO	Set backlight status	U16	2
0x38	R/W	Read/write user event UVD settting value	Float	4
0x39	R/W	Read/write user event OVD settting value	Float	4
0x3A	R/W	Read/write user event voltage action	U16	2
0x3B	R/W	Read/write user event UCD_PS settting value	Float	4
0x3C	R/W	Read/write user event OCD_PS settting value	Float	4
0x3D	R/W	Read/write user event source current action	U16	2
0x3E	R/W	Read/write user event OPD_PS settting value	Float	4
0x3F	R/W	Read/write user event source power action	U16	2
0x40	R/W	Read/write user event delay time	U16	2
0x41	R/W	Read/write user event hold time	U16	2
0x42	R/W	Read/write user event UCD_EL settting value	Float	4
0x43	R/W	Read/write user event OCD_EL settting value	Float	4
0x44	R/W	Read/write user event load current action	U16	2
0x45	R/W	Read/write user event OPD_EL settting value	Float	4
0x46	R/W	Read/write user event load power action	U16	2

Chapter 8 Technical indicators

TH6680

Model		TH6680-120-05	TH6680-240-10	TH6680-360-15
Rated Output (Power Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-80V	0-80V	0-80V
	Current	0-120A	0-240A	0-360A
	Internal resistance	0.02-25Ω	0.01-13Ω	0.006-10Ω
Rated Input (Load Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-80V	0-80V	0-80V
	Current	0-120A	0-240A	0-360A
	Internal resistance	0.02-25Ω	0.01-13Ω	0.006-10Ω
Load regulation rate*1	Voltage	≤0.05%FS	≤0.05%FS	≤0.05%FS
	Current	≤0.15%FS	≤0.15%FS	≤0.15%FS
	Power	≤0.75%FS	≤0.75%FS	≤0.75%FS
Power regulation rate*2	Voltage	≤0.02%FS	≤0.02%FS	≤0.02%FS
	Current	≤0.15%FS	≤0.05%FS	≤0.05%FS
	Power	≤0.05%FS	≤0.05%FS	≤0.05%FS
Setting value minimum resolution	Power	10mV	10mV	10mV
	Voltage	0.1A	0.1A	0.1A
	Current	1W	1W	1W
	Internal resistance	0.001Ω	0.001Ω	0.001Ω
Readback value minimum resolution	Voltage	10mV	10mV	10mV
	Current	0.1A	0.1A	0.1A
	Power	1W	1W	1W
	Internal resistance	0.001Ω	0.001Ω	0.001Ω
Set value accuracy 12 months(25℃±5℃)	Voltage	≤0.1%FS	≤0.1%FS	≤0.1%FS
	Current	≤0.2%FS	≤0.2%FS	≤0.2%FS
	Power	≤1%FS	≤1%FS	≤1%FS
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		

Readback accuracy 12 months (25℃±5℃)	Voltage	≤0.2%FS	≤0.2%FS	≤0.2%FS
	Current	≤0.2%FS	≤0.2%FS	≤0.2%FS
	Power	≤1%FS	≤1%FS	≤1%FS
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Ripple and Noise (20Hz-2MHz)	Differential Mode Voltage	≤200mVp-p and 16mVrms	≤320mVp-p and 25mVrms	≤320mVp-p and 25mVrms
	Differential Mode Current	≤80mArms	≤160mArms	≤240mArms
Dynamic Recovery Time (50%-100% Load)		≤1.5ms（recovery to within 100mv）		
Remote Sensing Compensation		≤5% U_{Max}		
Power Supply Replacement Efficiency		≤93%		
Power Supply Replacement Efficiency		≤93%		
Volume and weight	Enclosure dimensions (mm)	430×133×703.5		
	Overall dimensions (mm)	483×133×793.5		

TH66200

Model		TH66200-70-05	TH66200-140-10	TH66200-210-15
Rated Output (Power Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-200V	0-200V	0-200V
	Current	0-70A	0-140A	0-210A
	Internal resistance	0.1-150Ω	0.05-75Ω	0.033-50Ω
Rated Input (Load Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-200V	0-200V	0-200V
	Current	0-70A	0-140A	0-210A
	Internal resistance	0.1-150Ω	0.05-75Ω	0.033-50Ω
Load regulation rate*1	Voltage	≤0.05% U_{Max}	≤0.05% U_{Max}	≤0.05% U_{Max}
	Current	≤0.15% I_{Max}	≤0.15% I_{Max}	≤0.15% I_{Max}
	Power	≤0.75% P_{Max}	≤0.75% P_{Max}	≤0.75% P_{Max}
Power regulation rate*2	Voltage	≤0.02% U_{Max}	≤0.02% U_{Max}	≤0.02% U_{Max}
	Current	≤0.05% I_{Max}	≤0.05% I_{Max}	≤0.05% I_{Max}
	Power	≤0.05% P_{Max}	≤0.05% P_{Max}	≤0.05% P_{Max}
Setting value minimum resolution	Power	10mV	10mV	10mV
	Voltage	0.01A	0.01A	0.01A
	Current	1W	1W	1W
	Internal resistance	0.01Ω	0.01Ω	0.01Ω
Readback value minimum resolution	Voltage	10mV	10mV	10mV
	Current	0.01A	0.01A	0.01A
	Power	1W	1W	1W
	Internal resistance	0.0001Ω	0.0001Ω	0.0001Ω
Set value accuracy 12	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Nom}	≤0.2% I_{Nom}	≤0.2% I_{Nom}

months(25℃ ±5℃)	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Readback accuracy 12 months (25℃ ±5℃)	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Max}	≤0.2% I_{Max}	≤0.2% I_{Max}
	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Ripple and Noise (20Hz-2MHz)	Differential Mode Voltage	≤320mVp-p and 45mVrms	≤320mVp-p and 45mVrms	≤320mVp-p and 45mVrms
	Differential Mode Current	≤22mArms	≤44mArms	≤66mArms
Dynamic Recovery Time (50%-100% Load)		≤1.5ms（recovery to within 100mv）		
Protection	Overvoltage OVP	0..220V	0..220V	0..220V
	OVP accuracy			
	Overcurrent OCP	0..77A	0..154A	0..231A
Remote Sensing Compensation		≤5% U_{Max}		
Power Supply Replacement Efficiency		≤93%		
Power Supply Replacement Efficiency		≤93%		
Volume and weight	Enclosure dimensions (mm)	430×133×703.5		
	Overall dimensions (mm)	483×133×793.5		

TH66360

Model		TH66360-40-05	TH66360-80-10	TH66360-120-15
Rated Output (Power Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-360V	0-360V	0-360V
	Current	0-40A	0-80A	0-120A
	Internal resistance	0.3-520Ω	0.15-260Ω	0.1-180Ω
Rated Input (Load Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-360V	0-360V	0-360V
	Current	0-40A	0-80A	0-120A
	Internal resistance	0.3-520Ω	0.15-260Ω	0.1-180Ω
Load regulation rate*1	Voltage	≤0.05% U_{Max}	≤0.05% U_{Max}	≤0.05% U_{Max}
	Current	≤0.15% I_{Max}	≤0.15% I_{Max}	≤0.15% I_{Max}
	Power	≤0.75% P_{Max}	≤0.75% P_{Max}	≤0.75% P_{Max}
Power regulation rate*2	Voltage	≤0.02% U_{Max}	≤0.02% U_{Max}	≤0.02% U_{Max}
	Current	≤0.05% I_{Max}	≤0.05% I_{Max}	≤0.05% I_{Max}
	Power	≤0.05% P_{Max}	≤0.05% P_{Max}	≤0.05% P_{Max}
Setting value minimum resolution	Power	10mV	10mV	10mV
	Voltage	0.01A	0.01A	0.01A
	Current	1W	1W	1W
	Internal resistance	0.01Ω	0.01Ω	0.01Ω
Readback value minimum resolution	Voltage	10mV	10mV	10mV
	Current	0.01A	0.01A	0.01A
	Power	1W	1W	1W
	Internal resistance	0.0001Ω	0.0001Ω	0.0001Ω
Set value accuracy 12	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Nom}	≤0.2% I_{Nom}	≤0.2% I_{Nom}

months(25℃ ±5℃)	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Readback accuracy 12 months (25℃ ±5℃)	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Max}	≤0.2% I_{Max}	≤0.2% I_{Max}
	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Ripple and Noise (20Hz-2MHz)	Differential Mode Voltage	≤320mVp-p and 55mVrms	≤320mVp-p and 55mVrms	≤320mVp-p and 55mVrms
	Differential Mode Current	≤18mArms	≤35mArms	≤50mArms
Dynamic Recovery Time (50%-100% Load)		≤1.5ms（recovery to within 100mv）		
Protection	Overvoltage OVP	0..396V	0..396V	0..396V
	Overcurrent OCP	0..44A	0..88A	0..132A
Remote Sensing Compensation		≤5% U_{Max}		
Power Supply Replacement Efficiency		≤93%		
Power Supply Replacement Efficiency		≤93%		
Volume and weight	Enclosure dimensions (mm)	430×133×703.5		
	Overall dimensions (mm)	483×133×793.5		

TH66500

Model		TH66500-30-05	TH66500-60-10	TH66500-90-15
Rated Output (Power Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-500V	0-500V	0-200V
	Current	0-30A	0-60A	0-90A
	Internal resistance	0.5-1000Ω	0.25-500Ω	0.16-340Ω
Rated Input (Load Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-500V	0-500V	0-200V
	Current	0-30A	0-60A	0-90A
	Internal resistance	0.5-1000Ω	0.25-500Ω	0.16-340Ω
Load regulation rate*1	Voltage	≤0.05% U_{Max}	≤0.05% U_{Max}	≤0.05% U_{Max}
	Current	≤0.15% I_{Max}	≤0.15% I_{Max}	≤0.15% I_{Max}
	Power	≤0.75% P_{Max}	≤0.75% P_{Max}	≤0.75% P_{Max}
Power regulation rate*2	Voltage	≤0.02% U_{Max}	≤0.02% U_{Max}	≤0.02% U_{Max}
	Current	≤0.05% I_{Max}	≤0.05% I_{Max}	≤0.05% I_{Max}
	Power	≤0.05% P_{Max}	≤0.05% P_{Max}	≤0.05% P_{Max}
Setting value minimum resolution	Power	10mV	10mV	10mV
	Voltage	0.01A	0.01A	0.01A
	Current	1W	1W	1W
	Internal resistance	0.01Ω	0.01Ω	0.01Ω
Readback value minimum resolution	Voltage	10mV	10mV	10mV
	Current	0.01A	0.01A	0.01A
	Power	1W	1W	1W
	Internal resistance	0.0001Ω	0.0001Ω	0.0001Ω
Set value accuracy 12 months(25℃ ±5℃)	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Nom}	≤0.2% I_{Nom}	≤0.2% I_{Nom}

	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Readback accuracy 12 months (25℃±5℃)	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Max}	≤0.2% I_{Max}	≤0.2% I_{Max}
	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Ripple and Noise (20Hz-2MHz)	Differential Mode Voltage	≤350mVp-p and 70mVrms	≤350mVp-p and 70mVrms	≤350mVp-p and 70mVrms
	Differential Mode Current	≤16mArms	≤32mArms	≤48mArms
Dynamic Recovery Time (50%-100% Load)		≤1.5ms（recovery to within 100mv）		
Protection	Overvoltage OVP	0..550V	0..550V	0..550V
	Overcurrent OCP	0..33A	0..66A	0..99A
Remote Sensing Compensation		≤5% U_{Max}		
Power Supply Replacement Efficiency		≤93%		
Power Supply Replacement Efficiency		≤93%		
Volume and weight	Enclosure dimensions (mm)	430×133×703.5		
	Overall dimensions (mm)	483×133×793.5		

TH66750

Model		TH66750-20-05	TH66750-40-10	TH66750-60-15
Rated Output (Power Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-750V	0-750V	0-750V
	Current	0-20A	0-40A	0-60A
	Internal resistance	1.2-2200Ω	0.6-1100Ω	0.4-740Ω
Rated Input (Load Mode)	Power	0-5kW	0-10kW	0-15kW
	Voltage	0-750V	0-750V	0-750V
	Current	0-20A	0-40A	0-60A
	Internal resistance	1.2-2200Ω	0.6-1100Ω	0.4-740Ω
Load regulation rate*1	Voltage	≤0.05% U_{Max}	≤0.05% U_{Max}	≤0.05% U_{Max}
	Current	≤0.15% I_{Max}	≤0.15% I_{Max}	≤0.15% I_{Max}
	Power	≤0.75% P_{Max}	≤0.75% P_{Max}	≤0.75% P_{Max}
Power regulation rate*2	Voltage	≤0.02% U_{Max}	≤0.02% U_{Max}	≤0.02% U_{Max}
	Current	≤0.05% I_{Max}	≤0.05% I_{Max}	≤0.05% I_{Max}
	Power	≤0.05% P_{Max}	≤0.05% P_{Max}	≤0.05% P_{Max}
Setting value minimum resolution	Power	10mV	10mV	10mV
	Voltage	0.01A	0.01A	0.01A
	Current	1W	1W	1W
	Internal resistance	0.01Ω	0.01Ω	0.01Ω
Readback value minimum resolution	Voltage	10mV	10mV	10mV
	Current	0.01A	0.01A	0.01A
	Power	1W	1W	1W
	Internal resistance	0.0001Ω	0.0001Ω	0.0001Ω
Set value accuracy 12	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Nom}	≤0.2% I_{Nom}	≤0.2% I_{Nom}

months(25℃ ±5℃)	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Readback accuracy 12 months (25℃ ±5℃)	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	≤0.1% U_{Max}
	Current	≤0.2% I_{Max}	≤0.2% I_{Max}	≤0.2% I_{Max}
	Power	≤1% P_{Max}	≤1% P_{Max}	≤1% P_{Max}
	Internal resistance	≤1% of maximum resistance ±1% of maximum current		
Ripple and Noise (20Hz-2MHz)	Differential Mode Voltage	≤800mVp-p and 200mVrms	≤800mVp-p and 200mVrms	≤800mVp-p and 200mVrms
	Differential Mode Current	≤16mArms	≤32mArms	≤48mArms
Dynamic Recovery Time (50%-100% Load)		≤1.5ms（recovery to within 100mv）		
Protection	Overvoltage OVP	0..825V	0..825V	0..825V
	Overcurrent OCP	0..22A	0..44A	0..66A
Remote Sensing Compensation		≤5% U_{Max}		
Power Supply Replacement Efficiency		≤93%		
Power Supply Replacement Efficiency		≤93%		
Volume and weight	Enclosure dimensions (mm)	430×133×703.5		
	Overall dimensions (mm)	483×133×793.5		

TH661000

Model		TH661000-40-15	TH661500-30-15	
Rated Output (Power Mode)	Power	0-15kW	0-15kW	
	Voltage	0-1000V	0-1500V	
	Current	0-40A	0-30A	
	Internal resistance	0.8-1300Ω	2.5-3000Ω	
Rated Input (Load Mode)	Power	0-15kW	0-15kW	
	Voltage	0-1000V	0-1500V	
	Current	0-40A	0-30A	
	Internal resistance	0.8-1300Ω	2.5-3000Ω	
Load regulation rate*1	Voltage	≤0.05% U_{Max}	≤0.05% U_{Max}	
	Current	≤0.15% I_{Max}	≤0.15% I_{Max}	
	Power	≤0.75% P_{Max}	≤0.75% P_{Max}	
Power regulation rate*2	Voltage	≤0.02% U_{Max}	≤0.02% U_{Max}	
	Current	≤0.05% I_{Max}	≤0.05% I_{Max}	
	Power	≤0.05% P_{Max}	≤0.05% P_{Max}	
Setting value minimum resolution	Power	100mV	100mV	
	Voltage	0.01A	0.01A	
	Current	1W	1W	
	Internal resistance	0.01Ω	0.01Ω	
Readback value minimum resolution	Voltage	10mV	10mV	
	Current	0.01A	0.01A	
	Power	1W	1W	
	Internal resistance	0.0001Ω	0.0001Ω	
Set value accuracy 12	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	
	Current	≤0.2% I_{Nom}	≤0.2% I_{Nom}	

months(25℃ ±5℃)	Power	≤1% P_{Max}	≤1% P_{Max}	
Readback accuracy 12 months (25℃ ±5℃)	Voltage	≤0.1% U_{Max}	≤0.1% U_{Max}	
	Current	≤0.2% I_{Max}	≤0.2% I_{Max}	
	Power	≤1% P_{Max}	≤1% P_{Max}	
Ripple and Noise (20Hz-2MHz)	Differential Mode Voltage	≤1600mVp-p and 300mVrms	≤2400mVp-p and 400mVrms	
	Differential Mode Current	≤16mArms	≤26mArms	
Protection	Overvoltage OVP	0..1100V	0..1650V	
	Overcurrent OCP	0..44A	0..33A	
Remote Sensing Compensation		≤5% U_{Max}		
Power Supply Replacement Efficiency		≤93%		
Power Supply Replacement Efficiency		≤93%		
Volume and weight	Enclosure dimensions (mm)	430×133×703.5		
	Overall dimensions (mm)	483×133×793.5		

Chapter 9 Kits & Warranty

9.1 Kits

The following items should be included with the instrument when it leaves the factory:

Serial number	Name	Quantities
1	TH6600 series instrument	1 unit
2	Quick guide	1 copy
3	Certificate of Conformity	1 sheet
4	Test report	1 copy
5	Warranty card	1 sheet

Upon receipt of the instrument, the user should check the above contents upon unpacking. If any item is missing, please contact our company or the sales department immediately.

9.2 Symbol

Each instrument has the following markings on the panel or nameplate:

Manufacturer's name or trademark;

Product name and model;

Product number and year of manufacture;

License plate and number for measuring instruments;

Test terminal mark;

9.3 Package

The instrument is generally packaged in a sturdy box that provides protection against dust, shock, and moisture. The box contains a plastic bag with accessories, spare parts, a user’s manual and product certificate.

9.4 Transport

The meter should be handled with care and protected from moisture and rain during transport.

9.5 Storage

Store the instrument in a ventilated room or outdoors at an ambient temperature of 5℃ to 40℃ and a relative humidity of 85% or less. The air must be free of harmful impurities that could corrode the instrument.

9.6 Warranty

Warranty Period: The warranty period is one year from the date of shipment from the company for users who purchased the instrument from the company, and from the date of shipment from the store for users who purchased the instrument from the store. The instrument's warranty card must be presented as a warranty service. If the instrument is damaged during the warranty period due to improper operation by the user, the user is responsible for the cost of repair. The company is responsible for repairing the instrument for the life of the instrument.

The repair of this instrument must be carried out by professional technicians; please do not replace the internal components of the instrument without authorization during the repair process; after the instrument is repaired, it must be remeasured and calibrated to avoid affecting the accuracy of the test. Damage to the instrument caused by blind repair or replacement of instrument parts by the user is not covered by the warranty and the user is responsible for the repair costs.

Chapter 10 Appendice

10.1 Appendix I: Error Alerts

Serial number	Alerts	Cause analysis	Solution
1	PF	PFC failed to turn on	Contact after-sales staff
2	PE	Instrument self-test failure	Contact after-sales staff
3	OVD	Overvoltage	Reset values
4	UVD	Undervoltage	
5	OCD	Overcurrent	
6	UCD	Undercurrent	
7	OPD	Overpower	
8	UPD	Underpower	
9	MSP	Master-slave mode error	User re-initializable master and slave
10	OTP	Temperature alarm	Contact after-sales staff

10.2 Appendix II: Record and Explanations of Anomalies

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Note: For other abnormal phenomena, refer to the appropriate chapter for an introduction. If you still cannot solve the problem after checking, please contact your service center for a solution.

Company Statement:

The description in this manual may not include all the contents of the product. Tonghui Company reserves the right to improve and enhance the performance, functions, internal structure, appearance, accessories, packaging, etc. of this product without prior notice! If there is any confusion between the manual and the instrument, please contact our company at the address on the cover.