

Faithtech

Programmable DC Power Supply

User Manual

(FTP Series)

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Version V3.0.4

Apr, 2024

Introduction

Dear users :

First of all, thank you for choosing shenzhen Faith technology co., LTD. (hereinafter referred to as the Faithtech), FTP series high power programming power system (hereinafter referred to as FTP series). This User manual (hereinafter referred to as the manual) is applicable to the FTP series and includes detailed information on installation, operation and specifications of the equipment.

In order to ensure safe and correct use of the equipment, please read this manual carefully before use, especially the safety precautions.

Please keep this manual for use in the process of inspection.

Notice

The copyright of this manual belongs to our company. The information contained in the manual is for the user's reference only and is subject to change without notice.

The Company is not responsible for errors that may be contained in this manual or damages caused by the provision, implementation and use of this manual.

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The company guarantees that the specifications and use characteristics of this instrument fully meet the technical indicators claimed in the manual, and the raw materials and manufacturing processes used in this product are strictly checked to ensure that the product is stable and reliable.

Since the acquisition date, one year warranty, the product in normal use and maintenance condition of what's going on fault, the company responsible for free maintenance. For free maintenance products, users need to prepay the one-way freight to the company's maintenance department, and the return freight shall be borne by the company. If the product is returned to the factory from another country for repair, all freight, duties and other taxes shall be borne by the customer.

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Safety Summary

In the process of operating and using the equipment, please strictly observe the following safety instructions. Failure to comply with the following precautions or specific warnings as indicated in other sections of this manual may impair the protection provided by the device.

The Company is not responsible for the consequences caused by the user's non-compliance with these precautions.

Safety instructions

Please ground it reliably	Before turning on the equipment, make sure the equipment is reliably grounded to prevent electric shock
2 phase 22VAC Input	The input wire meets the specified standards; Be sure to install a protective cover to prevent electric shock.
Output terminal cable connection	The input wire meets the specified standards; Be sure to install a protective cover to prevent electric shock.
Do not open the instrument housing	The operator shall not open the equipment shell; Non-professional personnel do not perform maintenance or adjustment.
Do not use in dangerous environment	Do not use the equipment in inflammable and explosive environment.

Safety mark

Please refer to the following table for the explanation of international symbols used in the case and user manual of this product.

Symbol	Meaning	Symbol	Meaning
	Direct current		Zero or neutral line
	AC current		Line of fire
	AC/DC current		Power on
	3 phase current		Power off
	Ground		Backup power supply
	Protective grounding		The button switch is pressed
	Connect the enclosure or chassis		Button switch popup
	Signal ground		Be careful with the shocks
WARNING	Sign of danger		High temperature Warning
Caution	be careful		Warning

Revised version record

date	version	Chapter of Revision
May, 2022	3.0	Complete this manual
Feb, 2023	3.01	Add 10V and 20V models
Mar, 2023	3.02	Revised external programming port signal definition
Nov, 2023	3.03	Adjust product accuracy
Apr, 2024	3.04	Add time measurement, linear stepping function, PV function

Contents

1. General Description	1
1.1 Overview	1
1.2 Main features	1
1.3 Dimension diagram(mm)	2
1.4 Model Naming	3
1.5 Specification sheet	3
2. Quick Guide	7
2.1 Checking Goods	7
2.2 Front Panel	8
2.3 Keyboard	8
2.4 Screen Display	10
2.4.1 Status prompt area introduction	10
2.4.2 Introduction of functional parameter setting area	11
2.5 Rear Panel	11
2.6 Installation	11
2.6.1 Ventilation and heat dissipation	11
2.6.2 Input requirements	12
2.6.3 Startup self-test	12
2.7 Connection mode	12
2.7.1 Input connection	12
2.7.2 output connection	13
2.7.3 Voltage compensation connection	13
2.7.4 Composite signal port	15
3.Function Description	17
3.1 Local & remote operation mode	17
3.1.1Local operation mode	17
3.1.2 Remote operation mode	17
3.2 Menu configuration	18
3.2.1 Set Menu	18
3.2.2 system menu	19
3.2.3 Edit Menu	20
3.2.4 About Menu	20
3.3 Steady state output function	21
3.3.1 VI function	21
3.3.2 Constant power function	22
3.3.3 Power Output mode	23
3.3.4 Limit parameter Settings	23
3.4 Voltage slope and current slope	24
3.5 CV/CC Priority	25
3.6 Output control	26
3.7 External monitoring functions	26
3.7.1 External control functions	26

3.7.2 Emergency stop control function	28
3.7.3 Simulation programming function	29
3.7.4 Voltage and current analog monitoring function	31
3.8 Protection	31
3.9 Save and Invoke	34
3.9.1 save	34
3.9.2 Quick Invocation	35
3.10 Save after power failure	36
3.11 Lock operations	36
3.12 Load timing function	36
3.13 Sequence output function(SEQ)	37
3.14 Simulate internal resistance function(RESI)	41
3.15 Voltage slow rise, slow fall function (RAMP)	42
3.16 Waveform function (Wave)	44
3.17 Voltage dynamic function (DYNA)	45
3.18. Battery charging test function (CHAR)	47
3.19. Time measurement	49
3.20. Linear stepping function (STEP)	51
3.21. Photovoltaic simulation(PV-SIM)	52
3.22. Master/Slave parallel function	56
3.22.1. Master/Slave Parallel Connection	56
3.22.2 Master/Slave parallel setting	57
3.22.3 Master/Slave parallel operation	59
4. Introduction to the Newsletter	61
4.1. Communication configuration	61
4.2. Voltage and current acquisition rate	62
4.3 Communication interface	63
4.3.1 RS232	63
4.3.2 LAN	63
4.3.3 RS485	63
4.3.4 CAN	64
4.3.5 GPIB	64
4.4 Communication protocol	65
4.4.1 SCPI protocol	65
4.4.2 Modbus protocol	66
4.4.3 CANopen protocol	67
5. Check for failure	68
Appendix	69

1. General Description

1.1 Overview

FTP series power supply is a wide range of DC switching power supply, with high power, high current, low ripple noise, fast transient response, high resolution, high precision advantages. It can be used in laboratory test, vehicle equipment test, solar inverter test, DC/DC converter and inverter test, engine start test, battery automatic charging, electronic product life cycle test and so on.

1.2 Main features

- standalone power output range: 1.6kW/2.0 kW / 3.2 kW /4.8kW/ 6.5 kW;
- voltage output range: 0 ~ 1500 V.
- single output current range: 0 ~ 1000A.
- 16-bit high-speed ADC precision measurement;
- high input power factor, low harmonic;
- support constant power output;
- Support master and slave parallel connection, the number of slave machines up to 5;
- simple sequence and complex waveform editor function;
- over-voltage protection, over-current protection, over power protection, over temperature protection, all-round protection function;
- support the output time setting, can control and record the output time;
- analog input programming function, can respectively control voltage, current and power;
- monitor support to monitor the output voltage and current output;
- support distal voltage compensation;
- TFT color LCD display, support display in both Chinese and English;
- standard RS232 and LAN communication interface, optional GPIB, RS485,CAN;
- Support standard SCPI and Modbus-RTU communication protocols;

1.3 Dimension diagram(mm)

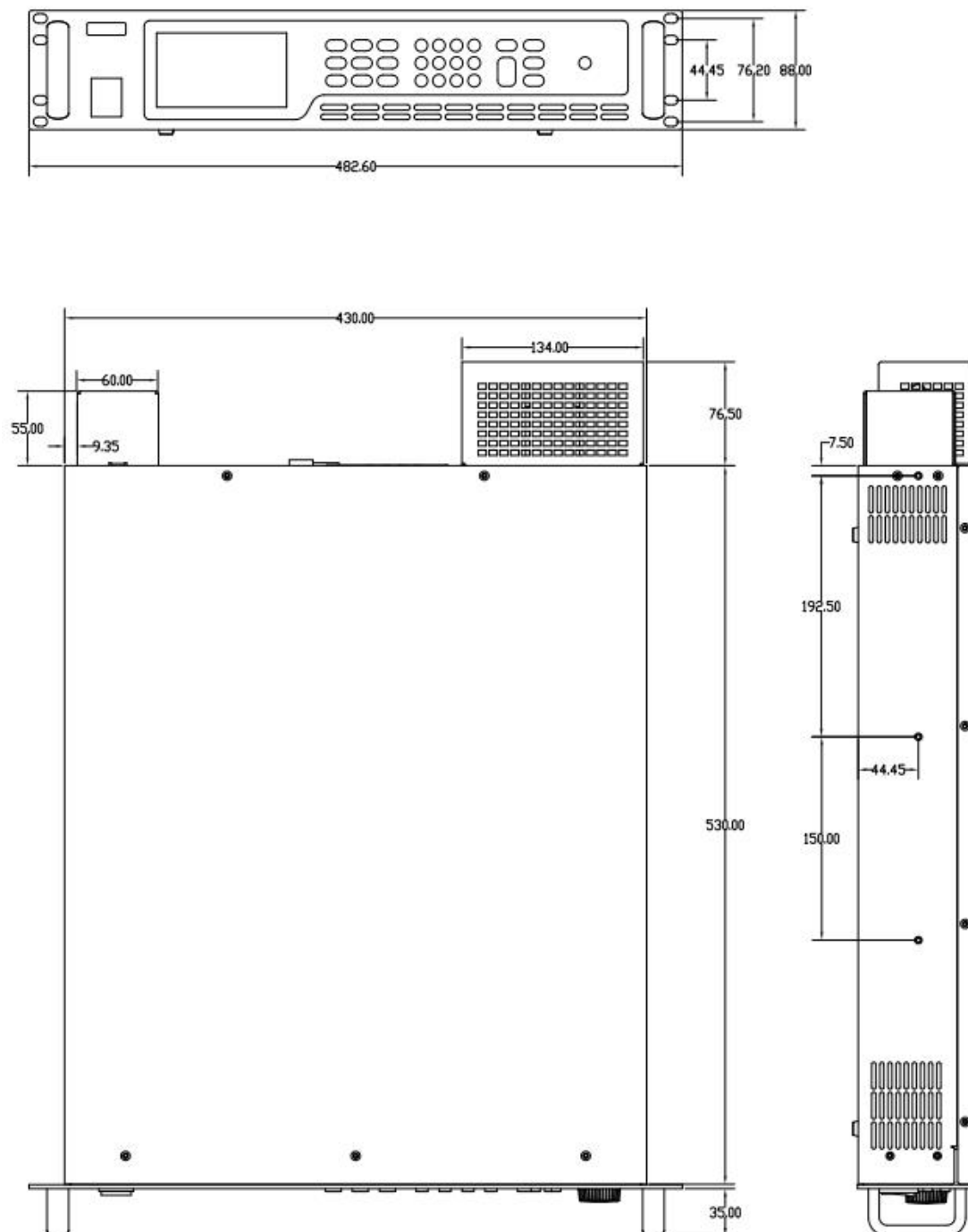


Figure 1-1-1 2kW/3.2kW chassis (10V&20V model)

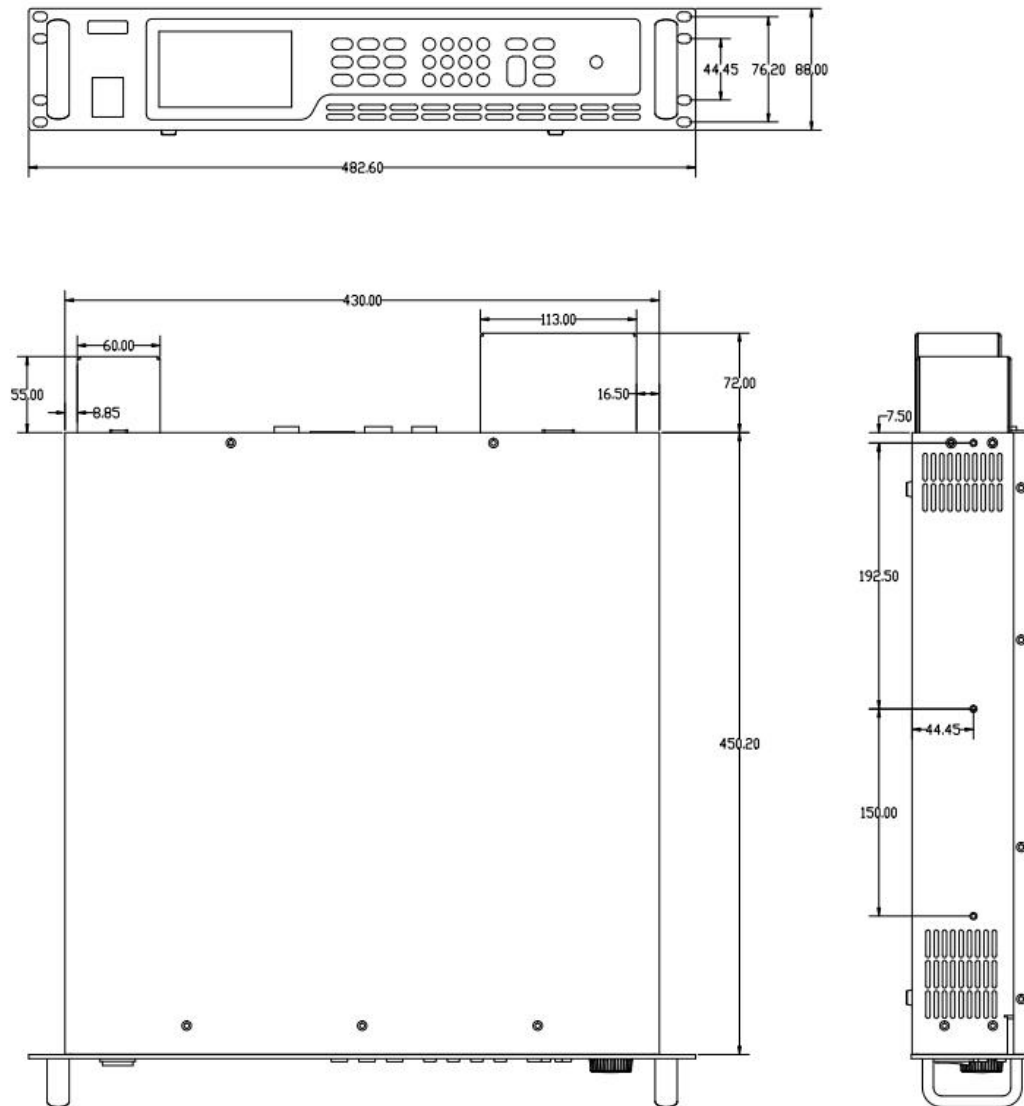


Figure 1-2-2 2kW/3.2kW chassis

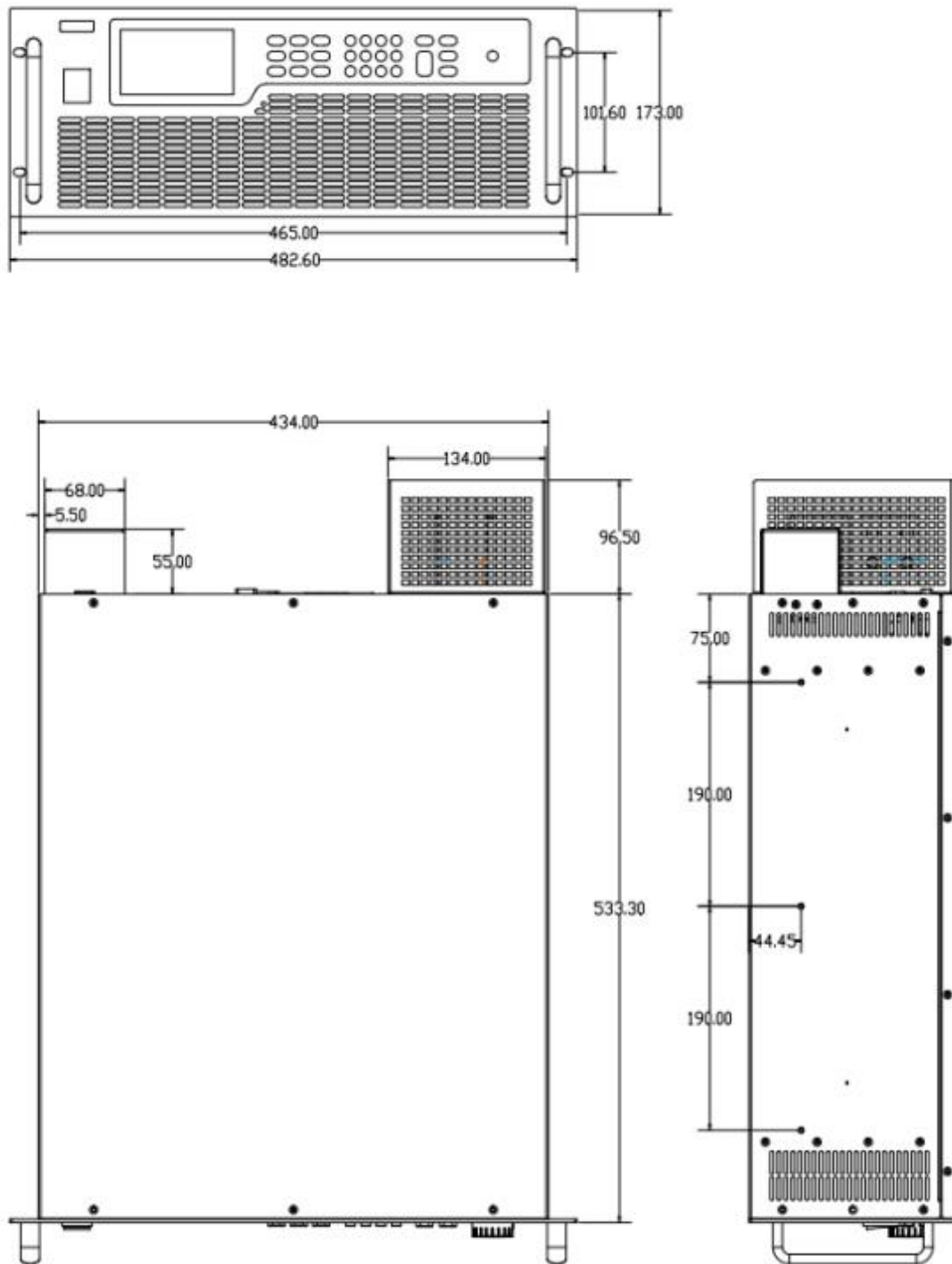


Figure 1-2-1 6.5kW chassis (10V&20V)

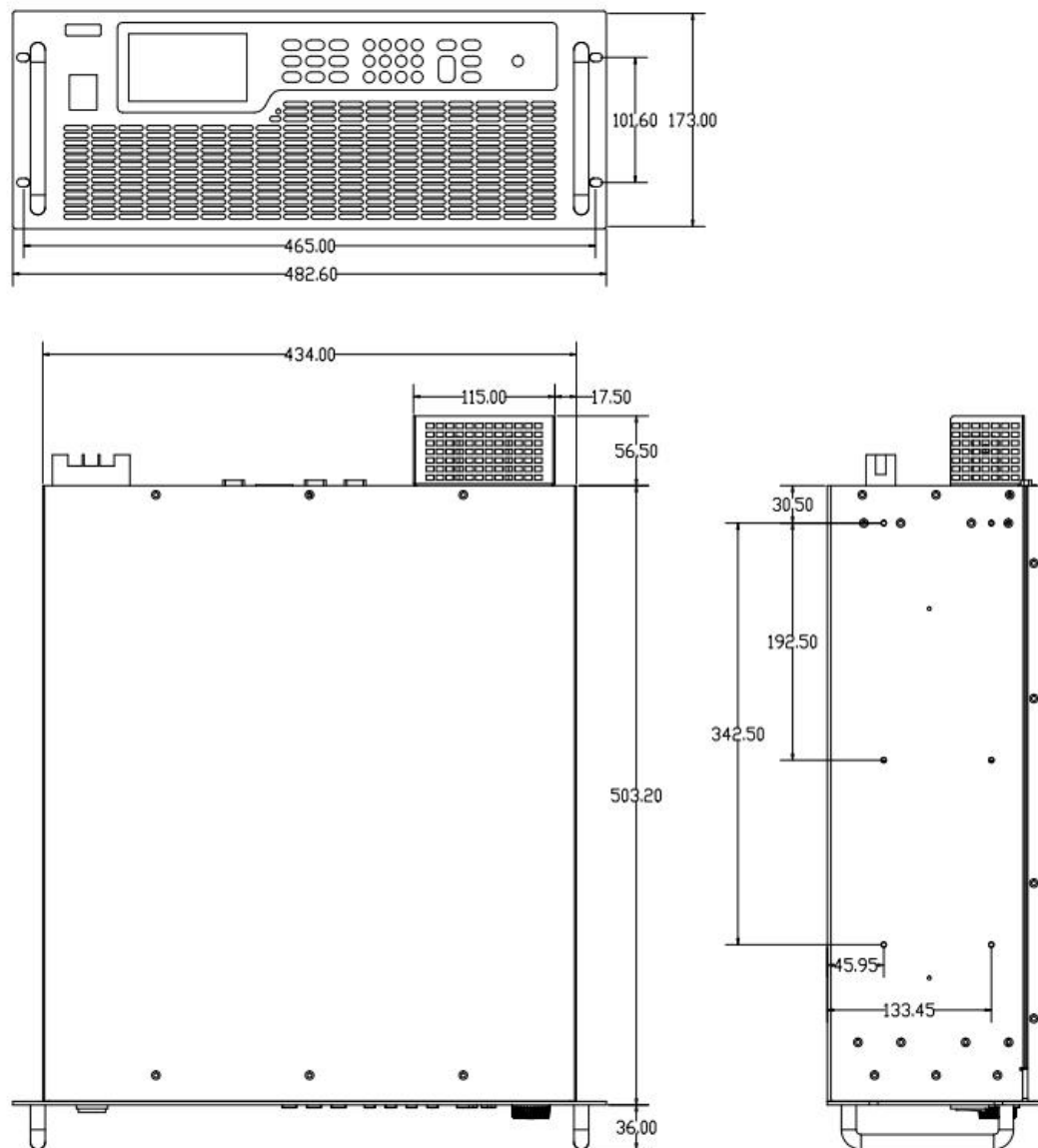
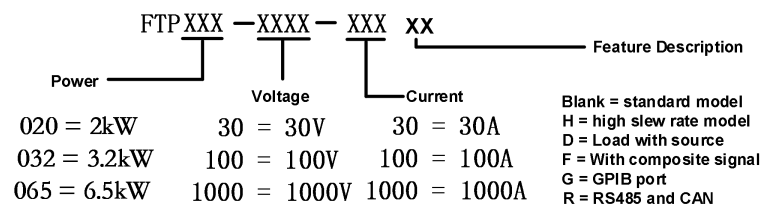


Figure 1-2-2 6.5kW chassis

1.4 Model Naming



1.5 Specification sheet

FTP DC power supply Specification table 1

Model	FTP016-10-200	\	\	\	\	\	\	\
Voltage	0~10V	\	\	\	\	\	\	\
Current	0~200A	\	\	\	\	\	\	\
Power	1600W							
Model	\	FTP020-20-250	FTP020-40-120	FTP020-50-110	FTP020-80-60	FTP020-120-40	FTP020-160-30	FTP020-180-30
Voltage	\	0~20V	0~40V	0~50V	0~80V	0~120V	0~160V	0~180V
Current	\	0~250A	0~120A	0~110A	0~60A	0~40A	0~30A	0~30A
Power	2000W							
Model	FTP032-10-400	FTP032-20-250	FTP032-40-120	FTP032-50-110	FTP032-80-60	FTP032-120-40	FTP032-160-30	FTP032-180-30
Voltage	0~10V	0~20V	0~40V	0~50V	0~80V	0~120V	0~160V	0~180V
Current	0~400A	0~250A	0~120A	0~110A	0~60A	0~40A	0~30A	0~30A
Power	3200W							
Model	FTP048-10-600	FTP048-20-375	\	\	\	\	\	\
Voltage	0~10V	0~20V	\	\	\	\	\	\
Current	0~600A	0~375A	\	\	\	\	\	\
Power	4800W							
Model	FTP065-10-800	FTP065-20-500	FTP065-40-240	FTP065-50-220	FTP065-80-120	FTP065-120-80	FTP065-160-60	FTP065-180-60
Voltage	0~10V	0~20V	0~40V	0~50V	0~80V	0~120V	0~160V	0~180V
Current	0~800A	0~500A	0~240A	0~220A	0~120A	0~80A	0~60A	0~60A
Power	6500W							
Voltage programming								
Resolution	16Bits							
Accuracy	0.05%F.S.							
Current programming								
Resolution	16Bits							
Accuracy	0.1%+0.1% F.S.							
External analog programming								
Control voltage	0~5V or 0~10V Correspond to 0~100%F.S.							
Voltage accuracy	0.2%F.S.							

Current accuracy		0.5%F.S.						
Analog output								
Output voltage		0~100%F.S Correspond to 0~10V.						
Voltage accuracy		0.5%F.S.						
Current accuracy		0.5%F.S.						
Linear adjustment rate								
voltage		0.01%+0.01%F.S.						
current		0.02%+0.01%F.S.						
Load adjustment rate								
voltage		0.01%+0.05%F.S.			0.01%+0.01%F.S.			
current		0.02%+0.1%F.S.						
Voltage measurement								
Resolution		16Bits						
Accuracy		0.05%F.S.						
Current measurement								
Resolution		16Bits						
Accuracy		0.1%+0.1%F.S.						
Output noise & ripple								
Ripple voltage (p-p)	60mV	60mV	60mV	70mV	80mV	80mV	100mV	100mV
Ripple voltage (rms)	10mV	20mV	20mV	20mV	20mV	20mV	40mV	40mV
Rising slope								
voltage		6V/ms(max)						
current		2A/ms(max)						
OVP setting								
Range	0~110%F.	accuracy				1%F.S.		
Transient	The typical value is 1mS, the load changes by 50%, and the time required for the voltage to return to the accuracy range							
Efficiency	0.9 (Typical)							
Parallel/Serial	Support power master-slave mode parallel, serial machine expansion							
Communication	RS232 and LAN, optional RS485, GPIB, CAN							
AC input	190VAC~265VAC, frequency 47HZ~63HZ, PF: 0.98(Typical)							
Operation temp	0℃~40℃							
Storage temp	-20℃~70℃							
Altitude	<2000m							

Dimension	430(W) X 88(H) X 530(D)mm (10-20V&2kW&3.2kW models); 430(W) X 177(H) X 533(D)mm (10-20V&6.5kW models) 430(W) X 88(H) X 453(D)mm (2kW&3.2kW models); 430(W) X 177(H) X 503(D)mm (6.5kW models)
Weight	15kg(2kW&3.2kW models); 29kg(6.5kW models)

FTP series Power supply specification Table 2

Model	FTP020-300-16	FTP020-400-12	FTP020-600-8	FTP020-800-8	FTP020-1000-5	FTP020-1200-5	FTP020-1500-3.5
Voltage	0~300V	0~400V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Current	0~16A	0~12A	0~8A	0~8A	0~5A	0~5A	0~3.5A
Power	2000W						
Model	FTP032-300-16	FTP032-400-12	FTP032-600-8	FTP032-800-8	FTP032-1000-5	FTP032-1200-5	FTP032-1500-3.5
Voltage	0~300V	0~400V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Current	0~16A	0~12A	0~8A	0~8A	0~5A	0~5A	0~3.5A
Power	3200W						
Model	FTP065-300-32	FTP065-400-24	FTP065-600-16	FTP065-800-16	FTP065-1000-10	FTP065-1200-10	FTP065-1500-7
Voltage	0~300V	0~400V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Current	0~32A	0~24A	0~16A	0~16A	0~10A	0~10A	0~7A
Power	6500W						
Voltage programming							
Resolution	16Bits						
Accuracy	0.05%F.S.						
Current programming							
Resolution	16Bits						
Accuracy	0.1%+0.1% F.S.						
External analog programming							
Control voltage	0~5V or 0~10V Correspond to 0~100%F.S.						
Voltage accuracy	0.2%F.S.						
Current accuracy	0.5%F.S.						
Analog output							
Output voltage	0~100%F.S Correspond to 0~10V.						
Voltage accuracy	0.5%F.S.						
Current accuracy	0.5%F.S.						
Linear adjustment rate							
voltage	0.01%+0.01%F.S.						
current	0.02%+0.01%F.S.						
Load adjustment rate							
voltage	0.01%+0.01%F.S.						
current	0.02%+0.1%F.S.						
Voltage measurement							
Resolution	16Bits						
Accuracy	0.05%F.S.						

Current measurement	
Resolution	16Bits
Accuracy	0.1%+0.1%F.S.
Output noise & ripple	

Ripple voltage (p-p)	100mV	300mV	300mV	500mV	450mV	500mV	700mV
Ripple voltage (rms)	40mV	60mV	60mV	80mV	80mV	120mV	150mV
Rising slope							
voltage	6V/ms(max)						
current	2A/ms(max)						
OVP setting							
Range	0~110%F.S.	accuracy			1%F.S.		
Transient	The typical value is 1mS, the load changes by 50%, and the time required for the voltage to return to the accuracy range						
Efficiency	0.9 (Typical)						
Parallel/Serial	Support power master-slave mode parallel, serial machine expansion						
Communication	RS232andLAN, optional RS485, GPIB, CAN						
AC input	190VAC~265VAC, frequency 47HZ~63HZ, PF: 0.98(Typical)						
Operation temp	0℃~40℃						
Storage temp	-20℃~70℃						
Altitude	<2000m						
Dimension	430(W) X 88(H) X 453(D)mm (2kW&3.2kW models); 430(W) X 177(H) X 503(D)mm (6.5kW models)						
Weight	15kg(2kW&3.2kW models); 29kg(6.5kW models)						

Note:

- ① Accuracy test conditions: +25℃±5℃;
- (2) Linear adjustment rate measurement conditions: input voltage change ±10%;
- (3) Load adjustment rate measurement conditions: load change 10 ~ 90%;
- (4) Ripple measurement conditions: bandwidth 20MHz, oscilloscope probe and connected with 10uF electrolytic capacitor +0.1uF ceramic capacitor.

2. Quick Guide

2.1 Checking Goods

Upon reception of the power supply, please examine the equipment according to procedures stipulated as below.

(1) Check if there is damage during transportation.

Contact authorized dealer or Faithtech after-sale service immediately if the packing or protective cushion is severely damaged.



Do not return the instrument without obtaining prior approval from Faithtech.

(2) Check for the accessories.

Make sure you have received the following accessories along with the power supply:

Table 2-1 Accessories Explanation

Accessory	Qty	Explanation
AC input power cable	1 PCS	* 10A(2kW) / 16A(3.2kW) 3-core power cable
Protective cover	1 PCS	For output protection
2PIN 3.81mm terminal	1 PCS	Voltage remote compensation terminal
RS232 Serial cable	1 PCS	For connecting PC and RS232 port
LAN connecting cable	1 PCS	For connecting PC and LAN port
User Manual	1 PCS	Installing and operation info
CD	1 PCS	Software and technical info
Certificate of conformity	1 PCS	Product conformity certificate

* 6.5kW model does not come with AC input cable.

Contact authorized dealer or Faithtech after-sale service immediately if there is damage or miss.

(3) Check for the power supply unit.

Contact authorized dealer or Faithtech after-sale service immediately if the power supply case is damaged or working abnormally.

(4) Cleaning.

If you need to clean the casing of the machine, please wipe it gently with a dry cloth or a slightly damp cloth. Do not wipe the inside of the machine.



Turn off the power supply before cleaning.

2.2 Front Panel

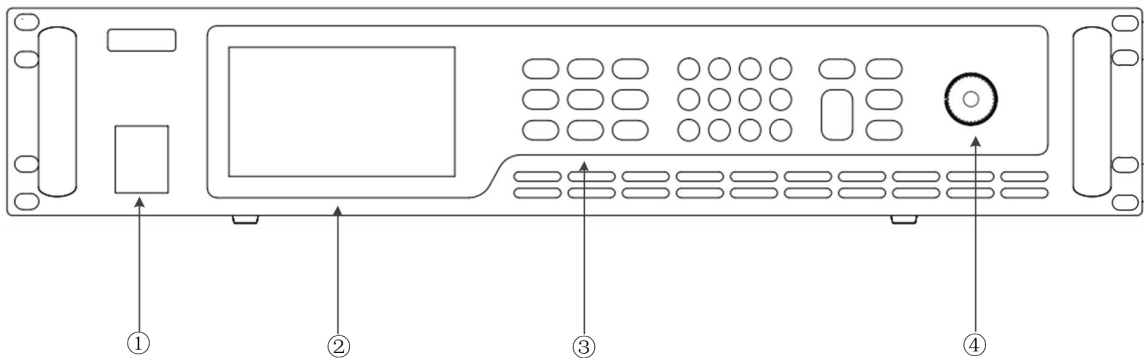


Figure2- 1 FTP Front Panel

- ① Power switch
- ② TFT color screen
- ③ Keyboard
- ④ Rotary knob

2.3 Keyboard

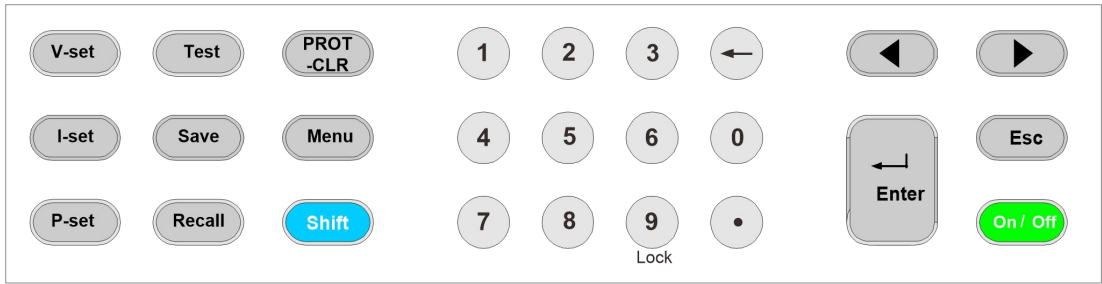
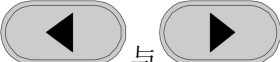
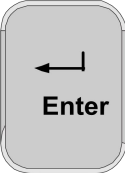
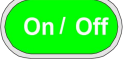


Figure 2- 2 FTP button

Basic key function

Table 2- 2Key Function Descriptions

Item	symbol	instructions
1		Voltage setting key. Press this key to switch from other functions to output setting function and enter the voltage editing state
2		Current setting key. Press this key to switch from other functions to output setting function and enter current editing state

3		Power setting key. Press this key to switch from other functions to output setting function and enter the power editing state
4		Advanced test function key
5		Save the current function parameters to a file
6		Call saved function parameters from a file
7		Protection Clear key. Press this key to clear faults and warning information
8		System menu key. Press this key to enter the system menu
9		Composite function key
10		Number key and decimal point key
11		Digital clear key
12		Used to move or select Settings in menu items. These two keys are used to move the cursor between digits when setting parameters
13		Used to enter Settings or confirm input and exit Settings.
14		Used to exit a setting item or menu
15		Turn the power output on or off

Composite function key

Combined with Shift key, to achieve the logo function under the key, the detailed function is described in the following table.

Table 2- 3Composite function key table

Item	symbol	instructions
------	--------	--------------

1	 + 	Used to lock and unlock keyboard functions. After the keyboard is locked, except the key  the key  can be operated, other keys and knobs are invalid and the screen indicates "keyboard lock".
---	---	---

2.4 Screen Display

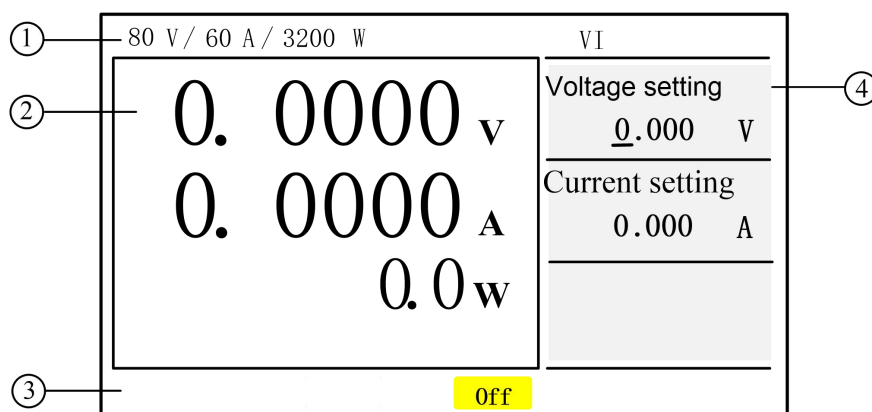


Figure 2- 3MAIN PAGE Display

- ① Specification parameters display area
- ② Voltage current and other parameters echo area
- ③ Status notification area
- ④ Function Parameter setting area

Specification parameters display area introduction

Display power output voltage, current, power range

Voltage current and other parameters display area introduction

Specification Parameter display area is used to display sampling voltage, current, power, measurement results and other information. In different functions, the echo parameters will be different, for example, in the V.I.P stationary function, the voltage, current and power will be displayed, while in the SEQ function, the voltage, current, sequence runs and sequence steps will be displayed.

2.4.1 Status prompt area introduction

- External programming: $\frac{1}{T}$ (U、I、U+I、P)
- Protection instructions: OVP、OCP、OPP、OTP、SHUT、FAULT、LVP、OP、OC、OV、RVP
- Output mode: CV、CC、CP、Off
- Operation Tips

2.4.2 Introduction of functional parameter setting area

Set the test parameters in this area.

1. Scroll the knob or press the arrow keys to move focus to the parameter to be edited.



2. press button to Enter the parameter editing mode;

3. Press the number key or scroll the knob to enter the value;;



4. Press button to Makes the input value valid and exits the edit state.。

2.5 Rear Panel

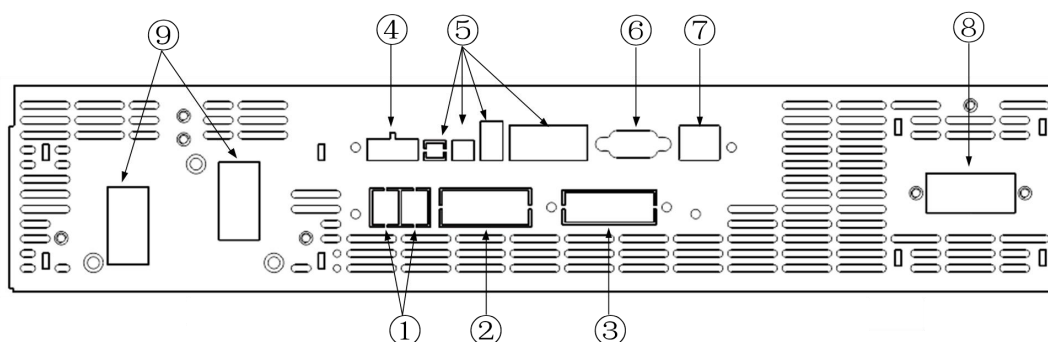


Figure 2- 4 FTP Rear Panel

- | | |
|--|--|
| ① CAN、RS485 Communication port | ⑥ RS232 Communication port |
| ② Programming Composite signal port | ⑦ LAN |
| ③ GPIB Communication port | ⑧ L、N、P 2-phase Eelectrical input port |
| ④ V-Sense Voltage remote sampling port | ⑨Power output port |
| ⑤ Share Master/slave parallel port | |

2.6 Installation

2.6.1 Ventilation and heat dissipation

The power supply dissipates heat through the fan. When installing, please ensure that the upper and surrounding parts of the power supply keep a gap of more than 20 cm with other objects for air circulation.

2.6.2 Input requirements

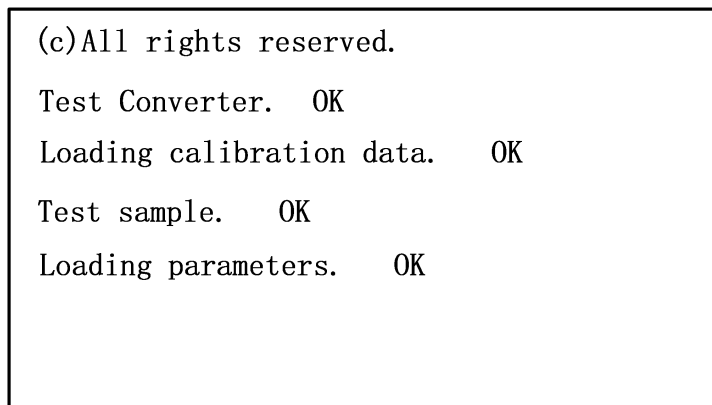
Note the following when connecting FTP series power input:

- ①. Ac input : 190VAC~265VAC, frequency :47Hz~63Hz;
- ②. Ensure reliable grounding
- ③. The power cord heat-resistant than 85℃。

⚠ Warning: Before operation, make sure that the power grounding terminal is well grounded.

2.6.3 Startup self-test

After power on, the power supply will first execute the self-test procedure, and the screen will display the self-test process and self-test results, as shown in the figure below.



```
(c)All rights reserved.  
Test Converter.  OK  
Loading calibration data.  OK  
Test sample.  OK  
Loading parameters.  OK
```

Figure 2- 5Power self-test screen

During the self-check, the self-check items and results are displayed on the screen. All check items are OK, enter the application interface immediately, otherwise, delay 5 seconds to enter the application interface.

Note: Refer to "Table 5-2 Boot Fault Self-Check Table" for self-check fault.

2.7 Connection mode

2.7.1 Input connection

Users can connect the input line L.N line and ground line equipped with the power supply to the power input terminal as shown in Figure 2-6.。

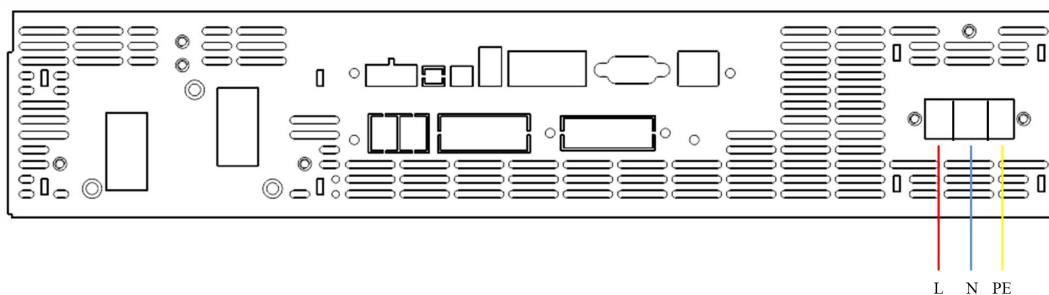


Figure 2-6 Power input connection

⚠ Warning: Before operation, make sure that the power grounding terminal is well grounded.

2.7.2 output connection

The output connection is connected to the device under test by the + and - ends of the power back panel. Note the diameter, length, and polarity of the output cable when connecting it. To avoid the impact of too small wire diameter on test accuracy and safety accidents caused by large heat generation, please refer to "Table 6-1 Recommended wire diameter Table" for wire diameter selection.

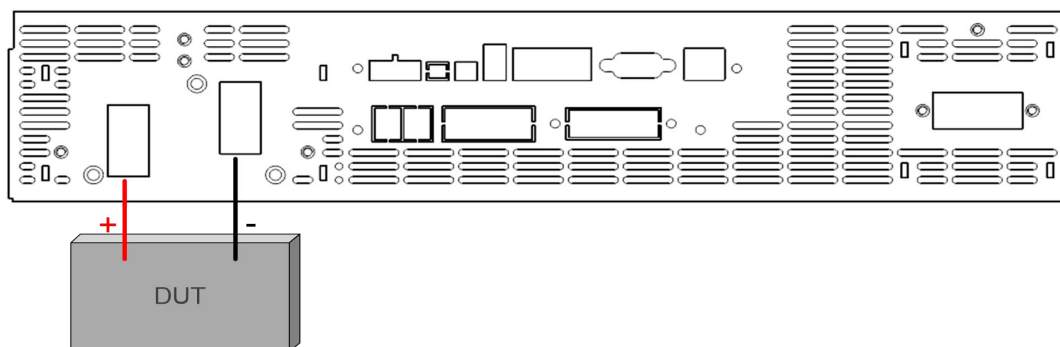


Figure 2- 7Power output connection

2.7.3 Voltage compensation connection

When the power supply is working, the output current will produce voltage drop on the connecting cable and contact surface, resulting in voltage error at the output end of the power supply. FTP series power supply has

Automatic line loss compensation capability for voltage drop due to cable and contact resistance.

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Automatic line loss compensation capability for voltage drop due to cable and contact resistance.

The "V SENSE" voltage compensation sampling terminal of the back panel is used to connect the positive and negative terminals to the positive and negative points to be compensated. The voltage difference between the point and the power output port will be compensated automatically when the power supply is output, and the "Sense" will be displayed in the status bar of the main interface.

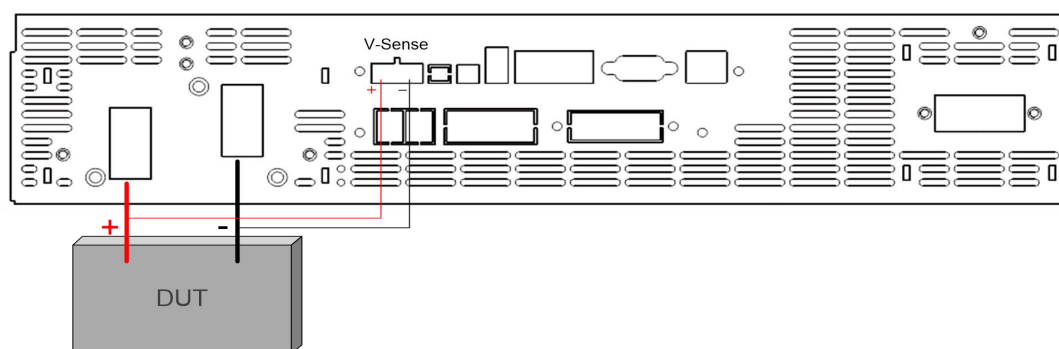


Figure 2- 8Voltage compensating connection

Note:

1. The voltage compensation line can use red and black $0.5\text{mm}^2 \sim 1\text{mm}^2$ cross-sectional wire, and as far as possible to double twisted.
2. The compensation voltage drop of FTP series 10V power supply model is less than 1.5V, and other models are less than 5V.

For special requirements, please consult the dealer or Faith Technology Department.

2.7.4 Composite signal port

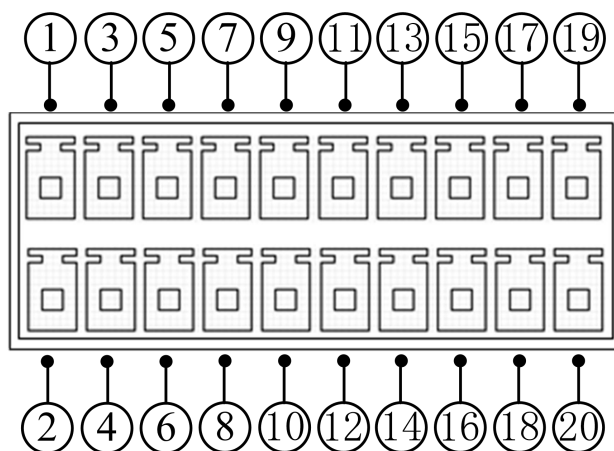


Figure 2- 9Voltage compensating connection

The rear panel of the power supply can be equipped with the composite signal terminal "Programming", which is used to connect the analog monitoring signal, the trigger input signal and the state output indicator signal.

Table 2- 1Composite signal function description

pin	Name	I/O	instructions
1/3	VMON+ / VMON-	Output	Power supply current output monitoring port. The output range is 0~5V。
2/4	IMON+ / IMON-	Output	Power supply current output monitoring port. The output range is 0~5V。
5/7	VSET+ / VSET-	Input	Power supply voltage programming input port, input range is 0~5V
6/8	ISET+ / ISET-	Input	Power supply voltage programming input port, input range is 0~5V
9	GND	-	Analog ground
10/12	TTL_OUT	Output	Digital signal output, 5 v TTL level, retained
11	MODE	Output	Power mode indication port. 5V TTL level, H: CC; L: CV
13	STOP_IN	Input	Emergency stop control input interface, 5V TTL level, H: reset, L emergency stop.
14/16/19	TTL_OUT	Input	Digital signal input port, 5V TTL level, reserved

15	READY	Output	Power status indicator output.
17	INHIBIT	Input	External control, can be used as a trigger signal or output switch control signal
18	DC_ON	Output	Power output voltage monitoring port
20	SGND	-	Digital ground

3.Function Description

This chapter describes the main functions and characteristics of the power supply. Reading this chapter, you will have a deeper understanding of FTP series power supplies.

3.1 Local & remote operation mode

The power supply provides two operation modes: local operation and remote operation. In the local operation mode, the user mainly operates through the keyboard and knob on the front panel, and checks the power status through the LCD display; in the remote operation mode, the user mainly performs settings and operations via the communication interface and programming commands.

3.1.1Local operation mode

After the power is powered on, the default operation mode is local. In local operation mode, the user operates the power supply through the front panel keyboard. The LCD screen provides users with display functions such as parameter viewing, measurement display and status indication.

Some parameters can be set only in local mode, including:

system language

serial port baud rate and check mode

keyboard sound

IP Address and subnet mask

communication protocol selection +

3.1.2 Remote operation mode

To enter remote operation mode, use the correct communication cable to connect the PC to the power supply. The communication configuration parameters must be consistent with those set on the control device. After receiving the programming command, the power supply will automatically enter the remote operation mode from the local control mode.

In the remote control mode, the power supply can only be controlled by programming commands. To return to local mode, press the



button.

3.2 Menu configuration

3.2.1 Set Menu

Press  to enter main menu, then select “Set” and press  to pop up sub menu as below:

Table 3- 1 Set Menu Layout

Application Settings	Sampling rate	Sample transmission rate setting, with 5 levels to choose from:1000Hz、500Hz、200Hz、100Hz、10Hz, default :1000HZ。
	Output first	Voltage or current priorities 。 default : Volt (voltage first)
	Voltage rise	Voltage rise slope configuration. Setting range: 0.0006V/s~6000V/s, Default: Maximum slope
	Voltage drop	Voltage drop slope configuration. Setting range: 0.0006V/s~6000V/s, Default: Maximum slope
	current rise	current rise slope configuration. Setting range: 0.0001A/s~2000A/s, Default: Maximum slope
	current drop	Current drop slope configuration. Setting range: 0.0001A/s~2000A/s, Default: Maximum slope
	Response speed	Output response speed Settings. Setting range: 1%~100%, default: 50%
Protection setting	Over voltage protection	Set OVP overvoltage protection point, set to 0 to close this protection
	Over current protection	Set the OCP overcurrent protection point to 0 to disable the protection
	Over power protection	Set the OPP overpower protection point, set to 0 to turn off the protection
	under voltage protection	Set LVP undervoltage protection point, set to 0 to turn off the protection
	Communication timeout	Set the communication failure timeout time, setting range: 0.0 ~ 60.0s, set to 0 to turn off the protection
	Detecting reverse connection	Turn on or off the output reverse RV prompt. Default: off。

	Loading time	Set the load time, the output is closed when the set point is reached. The value range is 0 to 999999s. The default value is 0
Limit Settings	Upper voltage limit	Limiting steady state sets the upper limit of voltage. Default: Maximum output voltage
	lower voltage limit	Limiting the steady state sets the lower limit of the voltage. Default: 0 is unlimited
	Upper current limit	Limit steady state sets the upper limit of voltage. Default: Maximum output current
	lower current limit	Limiting the steady state sets the lower limit of the voltage. Default: 0 is unlimited
	Upper power limit	Limiting steady state sets the upper limit of power. Default: Maximum output power
	lower power limit	Limiting the stationary state sets the lower limit of power. Default: 0 is unlimited
External programming	Voltage programming	Turn on or off the external voltage programming control, default: off
	Current programming	Turn on or off external current programming control, default: off
	Power programming	Turn on or off external power programming control, default: off
	External control	Set the behavior of the external input signal, Optional Trigger/Toggle/Hold; Default: Trigger
Parallel	Master slave setting	Configuring the local machine as a host or slave Def
	Number of slave machines	Configure the number of slave machines on the host. The value ranges from 1 to 9
	Master slave control	Enable the parallel function; Default is off

3.2.2 system menu

Press the  button to enter the menu setting interface, select the "System" item, and

press the  button to pop up the sub-menu as following :

Table 3- 2system menu :

Communication setting	IP address	Default: 192.168.1.123
	Subnet mask	Default :255.255.255.0
	Serial port rate	Optional :4800/9600/19200/38400/115200 , default : 9600。

	Check way	Optional no check/odd check/even check, default: no check.
	Device address	Device address in the MODBUS protocol frame, range1~247, default: 160
	GPIB address	Set the GPIB communication device address, range0~30, default: 5
	Communication protocol	Optional : SCPI or MODBUS ; default : MODBUS
Factory setting	Restore factory Settings	To restore the system parameters to the factory configuration, restart the device.
Other setting	System language	Optional: Simplified Chinese, Traditional Chinese, English. Default: Simplified Chinese
	Keyboard Sound	Optional on/off, default: on
	Power failure preservation	Optional on/off, default: on
	Quick call	Optional on/off, default: off

3.2.3 Edit Menu

Press “” to enter into main menu, then select “Edit” and press “” to pop up sub

menu, Edit items are used for sequence editing. For details, see "3.13 Sequence Output Function (SEQ)".

表格 3- 3Edit menu table

Sequence	Sequence	Select sequence file number, range 1~10
return	return	Exit the sequence file submenu

3.2.4 About Menu

Press “” to enter main menu, then select “About” and press “” to pop up sub

menu such as HMI, MAIN, COMM program version information etc..

3.3 Steady state output function

3.3.1 VI function

FTP series power supply voltage, current stable output within the rated power range, voltage, current set range of 0 ~ 102% rated output.

press **V-set** 、 **I-set** button , The power supply enters the VI steady-state output

function. The display interface is shown below.

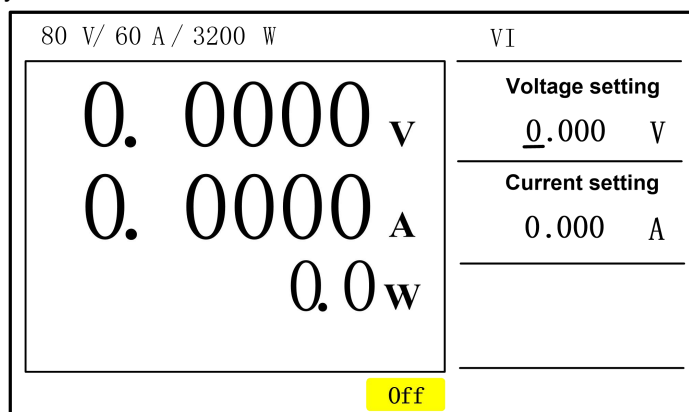


Figure 3- 1 VI function interface

Voltage setting

Under the stationary output function interface , press **V-set** button to Enter the "Voltage

Setting" editing state. The user can also turn the knob to move the cursor to "Voltage setting".press again **V-set** or **Enter** button to enter the edit state.

In the edit state, turn the knob to change the voltage value, or press the number key to enter the voltage value, press again **V-set** or **Enter** button to Make the input value valid.

After restoring the factory Settings, the voltage setting value is default: 0V.

Current setting

Under the steady-state output function interface , press **I-set** button to Enter the editing state of "Current Setting". The user can also turn the knob to move the cursor to

"Current Settings", press again **I-set** or **Enter** button to enter the edit state.

In the edit state, turn the knob to change the current value, or press the number key to

input the current value, press again **I-set** or **Enter** button to Make the input value valid.

After restoring factory Settings, the current setting is default: maximum output current.

3.3.2 Constant power function

press **P-set** button to Enter the "constant power" function edit state. As shown below

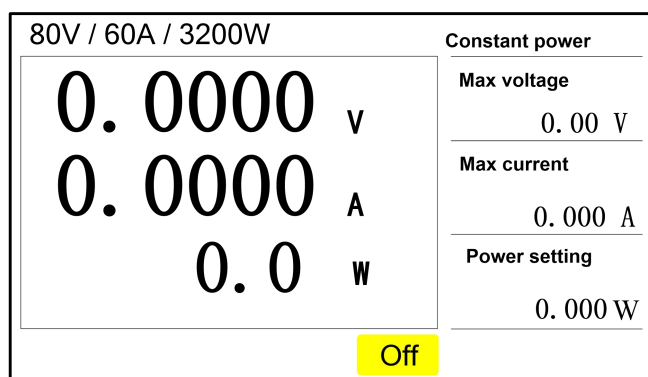


Figure 3- 2Constant power functional interface

The "constant power" function follows the following relationship

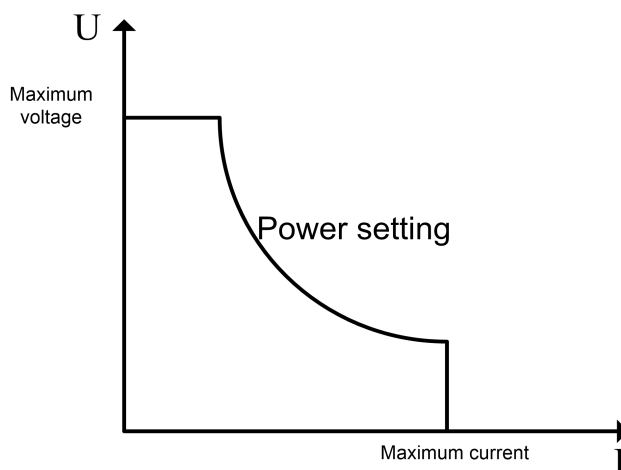


Figure 3- 3Constant power output waveform

The user can turn the knob to move the cursor to various parameters under the "constant

power" function, press again **Enter** button to enter editing state

In the edit state, turn the knob to change the power value, or press the number key to



enter the power value, press again button to make input value valid.

The maximum voltage, maximum current and power Settings range from 0 to 102% of the rated output.

After restoring the factory Settings, the power setting value is default: 0W.

3.3.3 Power Output mode

The FTP series power supply has three output modes: CV (Constant voltage model)、CC (Constant current model)、CP (Constant power model)。

The output value of power supply voltage will generally be output according to the set value, and the status bar of the main interface will display "CV"; When the output current exceeds the set current value, the power supply will enter CC (constant current mode), the output current can be changed by adjusting the set current value, and the status bar displays "CC"; When the output power exceeds the set power value, the power supply automatically enters the CP (constant power mode), the output power can be changed by adjusting the set power value of the power supply, and the status bar displays "CP".

3.3.4 Limit parameter Settings

The power supply provides voltage, current, power set point upper and lower limit function. When the upper and lower limits are set to non-0, the voltage, current and power parameters under the steady-state output function can be set between the upper and lower limits. If the input number exceeds the limit range, it will be invalid and "input out of range" will be prompted on the screen. This function has a good effect on preventing the user's device from being damaged by incorrect operation. If the upper and lower limit is set to 0, the limit is removed.

press  button, Enter the menu setting interface;

Select "Settings" -> "Limit Settings" submenu, press  button to Enter the output setting page, as shown below

Setting	System	Edit	About
Upper limit of voltage	0.000	V	
Lower limit of voltage	0.000	V	
Upper limit of current	0.000	A	
Lower limit of current	0.000	A	

Photo 3- 4Setting the upper and lower limits of voltage and current

Select "Voltage upper limit", "voltage lower limit", "current upper limit" and "current lower limit" to set.

3.4 Voltage slope and current slope

FTP series power supply supports voltage slope and current slope Settings. The adjustable slope can better adapt to the user's requirements for smooth voltage and current waveform, and can effectively avoid the impact of the output on the measurement object.

press  button, to enter menu setting interface:

Select "Settings" -> "Application Settings" submenu , press  button, Enter the application Settings page, as shown below;;

Setting	System	Edit	About
Sampling rate	10Hz		Response speed 50%
Output first	Volt		
Voltage rise	6000.0	V/s	
Voltage drop	6000.0	V/s	
Current rise	2000.0	A/s	
Current drop	2000.0	A/s	

Figure 3- 5Voltage slope and current slope setting interface

Select "voltage rise" "voltage drops" and "current up" "current" set, voltage V/s slope unit, current slope unit for A/s.

3.5 CV/CC Priority

The FTP series power supply has CV, CC, and CP output modes, which are sufficient to meet the general needs of the market. In the face of more stringent application fields, to meet the special requirements of customers, the FTP series power supply provides CV priority and CC priority mode selection, so that the power supply can be forced to run in CC mode or CV mode at the moment of output opening. In order to avoid the current or voltage spikes caused by the user when the capacitive or inductive load is applied.

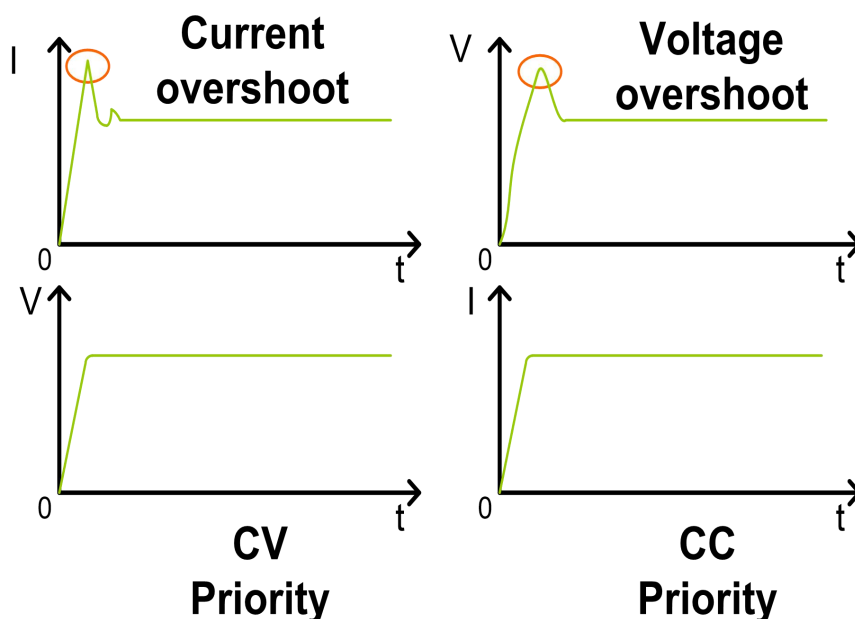


Photo 3- 6 CV priority and CC priority output voltage and current waveform

press  button, Enter the menu setting interface;

Select "Settings" -> "Application Settings" submenu , press  button to Enter the application setting page, as shown below;

Setting	System	Edit	About
Sampling rate	10Hz		Response speed 50%
Output first	Volt		
Voltage rise	6000.0	V/s	
Voltage drop	6000.0	V/s	
Current rise	2000.0	A/s	
Current drop	2000.0	A/s	

Figure 3- 7 CV & CC Priority setting interface

1. Select "Output Priority" to set, "Volt" for voltage priority, "Curr" for current priority.。

3.6 Output control

2. 。 The power supply is in the output off state after power on, and the output can be controlled by the key  in the front panel
3.  button, The indicator light is on, indicating that the output is turned on, and the screen displays real-time voltage, current, power, mode and other information.
4.  button, The indicator light is Off, indicating that the output is off, and the screen displays the OFF status.
- 5.
6. The screen shows the status of the output switch, and the user can also observe whether the output is turned on by pressing the indicator light.

3.7 External monitoring functions

3.7.1 External control functions

7. The FTP composite signal port provides a trigger signal input port "Programming", which is connected as shown below::

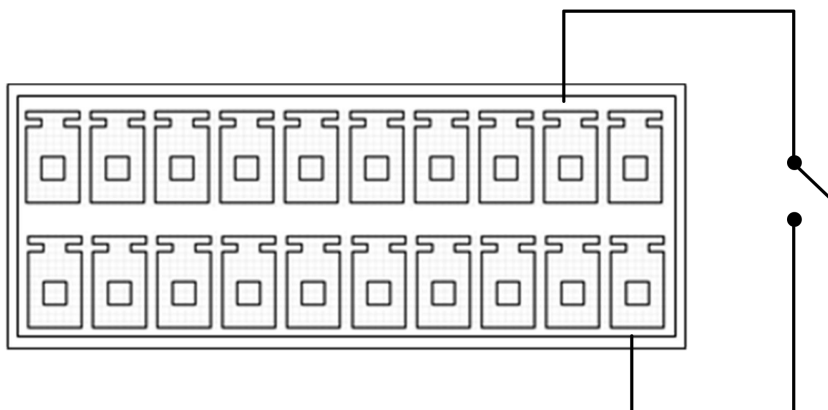


Figure 3- 8External control wiring mode 1

This port receives a 5V TTL level signal, which is effective at low levels. It can be triggered by a physical switch or a 0-5V signal source such as "Figure 3-8 External control Wiring mode 1". Closed or 0V is a low level and disconnected or 5V is a high level. The response time of the port is about 20 milliseconds, which can be set to Trigger, Toggle and Hold.

8. Trigger: It is used as a trigger signal by default. The input port detects a valid low level pulse, that is, it receives a trigger signal;
9. Toggle: As the power output switch control signal. The input port detects a valid low level pulse, that is, the output switch is switched once, which has the same function as the front panel  button;
10. Hold: As the power output switch control signal. The input digital signal port detects a valid low level, that is, the power output is turned on, and a valid high level is detected, the power output is turned off.

11. Note: the keyboard control and external control and bus control effect at the same time, work together.

Operation steps:

12. press  button, enter menu setting interface;
13. Select the "Settings" -> "external programming" submenu , press  button to Enter the external programming page, as shown in figure 3 to 9.。



14. select "external control", press  button, can select "Trigger" or "Toggle" or "Hold".

Setting	System	Edit	About
Voltage programming		Off	
External control		Trigger	

Figure 3- 9 External programming interface

3.7.2 Emergency stop control function

FTP series power supply provides emergency stop control interface, can control the power output shutdown. The wiring mode is as follows:

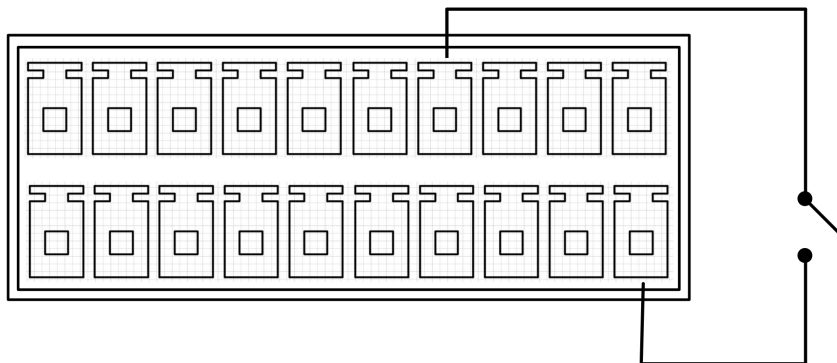


Figure 3- 10 Wiring mode of emergency stop switch

When the external emergency STOP control switch is closed, the power supply is turned off and the LCD screen prompts "STOP". When the external emergency STOP

control switch is turned on and the "STOP" can be cleared by pressing the



button, the power supply output is normal.

3.7.3 Simulation programming function

The output rated voltage, rated current and rated power of the power supply can be controlled by external 0 ~ 5V DC voltage signal, as shown in the following figure.

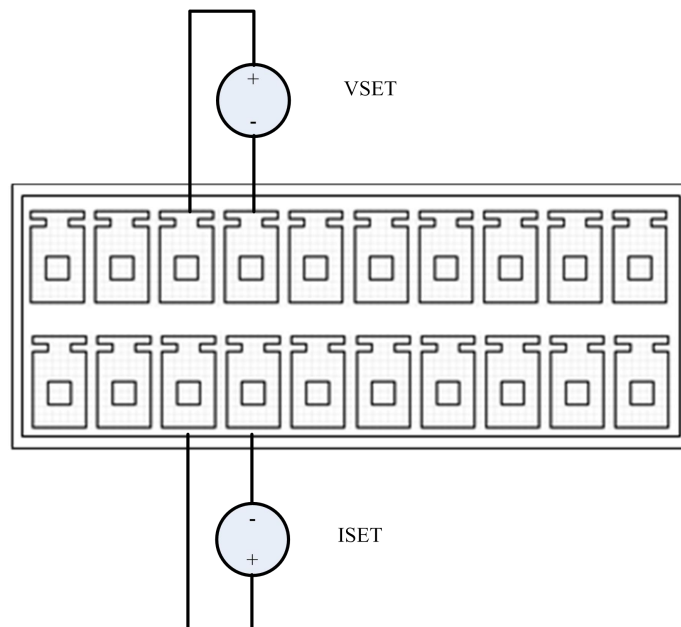


Figure 3-11 Cable connections for analog programming of composite ports

The simulation programming function controls the rate at 1000 points per second. After turning on, the relationship between output voltage, current, power and programming input signal is shown in the following figure.。

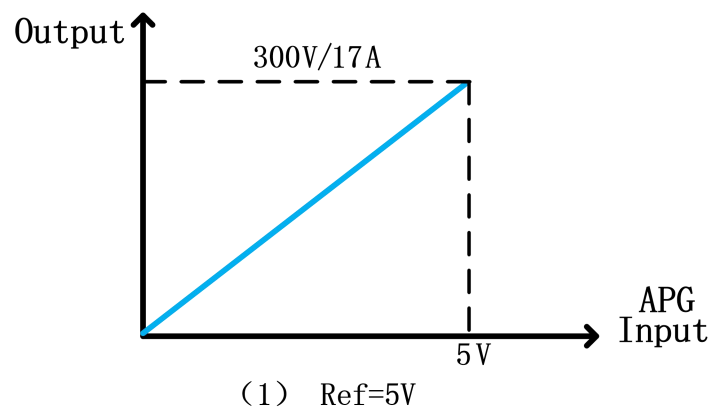


Figure 3-12 Relationship between input programming signal and output

Operation steps :

press  button, to enter menu setting interface;

Select the "Settings" -> "external programming" submenu, press  button to Enter the external programming page, as shown below;;

Setting	System	Edit	About
Voltage programming		Off	
External control		Trigger	

Figure 3-13 External programming Settings screen

You can choose "voltage programming", "current programming" to open or close the setting; Three analog programming input switches can be selected arbitrarily, after opening, the main interface has a "⚡" prompt.

press  button to Open the output。

Table 3 - 4 simulation programming parameters

Select	Port	instructions
Off	NO	Close the APG function
U	Signal port VSET+、VSET-	Turn on voltage programming control
I	Signal port ISET+、ISET-	Turn on current programming control
U+I	VSET+、VSET-与 ISET+、ISET-	Voltage and current programming control is turned on at the same time
P	Signal port VSET+、VSET-	Under constant power output function, power programming control is enabled

Note:

- 1. Change the Analog Programming setting only when output is off.
- 2. External analog programming is only determined by external signals when corresponding function items are opened. Otherwise, power output can still be controlled by human-machine interface or remote communication.

3.7.4 Voltage and current analog monitoring function

The FTP composite port provides the analog monitoring output function of output voltage and output current. The power supply output is 0 ~ rated value, corresponding to the monitoring output port voltage of 0 ~ 5V, and this function is always effective after the power supply is started.

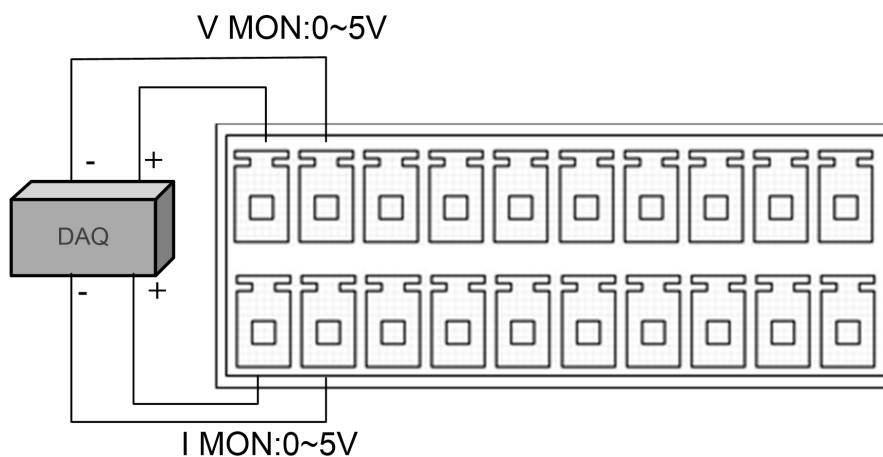


Figure 3-14 Voltage and current analog monitoring connections

The relationship between analog monitoring output and power supply voltage and current output is shown in the following figure:

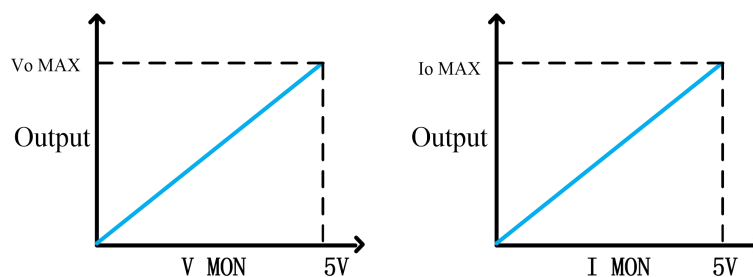


Figure 3-15 Relationship between monitoring output signals and output voltage and current

3.8 Protection

The FTP series power supply provides the following protection functions:

- overvoltage protection
- overcurrent protection
- overpower protection
- undervoltage protection

Output reverse connection warning

communication timeout

over temperature protection

Loading time

When the protection occurs, the power supply automatically shuts down the output.

The screen shows the specific protection content, and the buzzer emits an alarm.

press  button, enter menu setting interface;

Select "Settings" -> "Protection Settings" submenu, press  button, Enter the protection Settings page, as shown below;

Setting	System	Edit	About
Over voltage protection	0.000	V	Loading time 10 s
Over current protection	0.000	A	
Over power protection	0.000	W	
Under voltage protection	0.000	V	
Communication timeout	0.0	s	
Detecting reverse connection	Close		

Figure 3-16 Protection Settings page

Select various protection parameters to set

After protection occurs, press  button, Can clear the protection status.

Over voltage protection

The power supply has two types of overvoltage protection: hardware overvoltage and software overvoltage.。

Hardware overvoltage protection: when the output voltage exceeds 105% of the rated voltage of the power supply, the hardware overvoltage protection will be triggered, and the screen prompts "OV".

Software overvoltage protection: The power supply provides the option of "overvoltage protection" for users to set. The relevant configuration items refer to the protection Settings in "Menu Configuration". When the input voltage exceeds the "overvoltage protection" setting, the software overvoltage protection will be triggered, and the screen will prompt "OVP".

Over current protection

The power supply has two kinds of overcurrent protection: hardware overcurrent and software overcurrent.

Hardware overcurrent protection: when the output current exceeds 105% of the rated current of the power supply, hardware overcurrent protection will be triggered, and the screen prompts "OC".

Software overcurrent protection: The power supply provides "overcurrent protection" option for users to set. The related configuration items refer to the protection Settings of "Menu Configuration". Set to 0 means to turn off software overcurrent protection. When the output current exceeds the "overcurrent protection" setting, the software overcurrent protection will be triggered, and the screen will prompt "OCP"

Over power protection

The power supply has two kinds of overpower protection: hardware overpower and software overpower.

Hardware overpower protection: when the output power exceeds 110% of the rated power of the power supply, the hardware overpower protection will be triggered, and the screen prompts "OP".

Software overpower protection: The power supply provides "power protection" option for users to set, the relevant configuration items refer to the "Menu configuration" protection Settings, set to 0 to turn off software overpower protection. When the output power exceeds the "Power protection" setting, the software overpower protection will be triggered, and the screen will prompt "OPP".

Under voltage protection

The power supply provides "undervoltage protection" option for users to set. The related configuration items refer to the protection Settings of "Menu Configuration". Set to 0 means to turn off the undervoltage protection. When the output voltage is lower than the "Undervoltage protection" setting, the undervoltage protection will be triggered and the screen will prompt "LVP".

Output reverse connection warning

When the polarity of the output voltage (such as battery load) is reversed, a reverse warning will be triggered, and the screen will indicate "RVP".

Communication timeout

When the power supply is under remote control, the communication timeout protection function can be turned on. If the host computer does not send the communication command to the power supply for a period of time, the communication timeout protection will be triggered, the power supply will automatically shut down the output, and the screen will display "CMF". The timeout time can be set in the "Menu Configuration", ranging from 0.0 to 60.0s.

Over temperature protection

When the temperature of the power device inside the power supply exceeds the allowable temperature range, the over-temperature protection will be triggered, and the screen will prompt "OTP".

Loading time

When the on-load time reaches, the power supply shuts down the output.

3.9 Save and Invoke

The power supply provides 20 sets of storage locations for users to save the steady-state output function parameters, such as: voltage setting, current setting, power setting, voltage slope, current slope to the specified location, for users to quickly and conveniently call out the use. If the quick call function is enabled, simply press a number key to bring up the saved parameter. This feature can significantly reduce user operations and improve test efficiency.

3.9.1 save

Here's an example of how to save it:

Switch to the steady-state output function, set the voltage to 12V, and the current to 10A.

press  button, to enter Save screen.;

Input number 1, press  key to take it effect, Save the parameters to the storage location 1;

Change the steady-state output function parameters, set the voltage to 24V, and the current to 20A

press  key to enter Save screen.;

Input number2, 按  key to take it effect, , Save the parameters to the storage location 2;

press  key to Enter the call interface;

Input number 1, press  key to take it effect, , The parameter of position 1 will be called, and the power supply will be switched to the steady-state output function, whose voltage is set to 12V and current is set to 10A

press  key to Enter the call interface;

Input number 2, press  key to take it effect, The parameter of position 2 will be invoked and the power supply will be switched to the steady-state output function, whose voltage is set to 24V and current is set to 20A

3.9.2 Quick Invocation

Here's an example of a quick call:

press  key to enter menu setting interface;

select“setting”->“system”, press  key, select“other setting”, press  key again;

Set the "Quick call" option to on, that is, the quick call function takes effect;

press  key to return main interface;

On the main interface and not in the state of parameter editing, press the number key to call up the parameters at positions 1-10, where the key  ~  corresponds to storage positions 1-9, and the key  corresponds to storage positions 10.

3.10 Save after power failure

The FTP series power supply provides the power failure saving function. After power down saving is turned on, the power supply will restore the parameters of the last shutdown when it is powered on, otherwise the power supply will be initialized to the default parameters.

press  key to enter menu setting interface;

select "setting" -> "system", press  key, select "other setting", press  key again;

Set the "power-down save" option to enable power-down save function.

3.11 Lock operations

Press the  +  key to lock the power supply. In the locked state, only open output (close output) and unlock operations are supported, other key actions will be blocked, the main interface will prompt "keyboard lock". At the same time, the operation Settings area of the screen will be displayed in grayscale color to distinguish the normal unlocked state.

To exit the locked state, press the  +  key again.

3.12 Load timing function

Press  +  key to Call up the loading timing interface, as shown in the figure below::

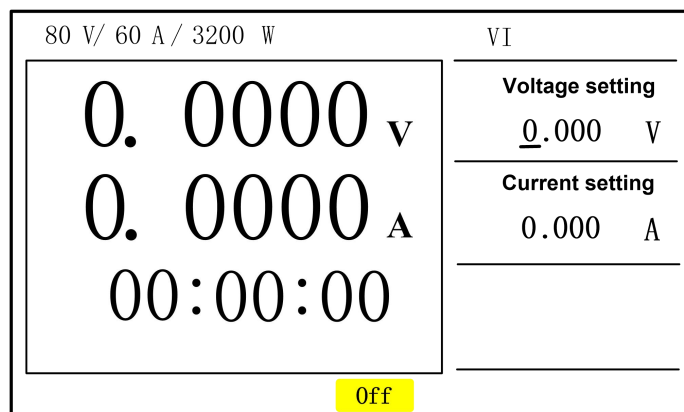


Figure 3-17 Load timing display page

After press  key, Power "ON" output starts timing. When the power supply "OFF" timer ends.

3.13 Sequence output function(SEQ)

Sequence output function, the menu option is "SEQ", allowing the user to edit the voltage and current waveform. The FTP series power supply provides 10 sequence files, each supporting up to 100 running steps. In the running step, voltage setting, current setting and single-step delay can be set. Supports the "run Times" and "link file" attributes. "Run times" can control the sequence cycle running, set to 0 means infinite cycle. "Link file" can increase the file running steps, set to 0 means no link.

When the sequence is run, the highest voltage and current slope are used by default.

Table 3-5 Sequence parameter description table

parameter	Parameter Description
File length	SEQ file running steps, ranging from 1 to 100
Running times	Set the number of sequence file loop runs, ranging from 0 to 60000, set to 0 for infinite loop, default to 1
Link files	Range 0 ~ 10, call different sequence files to this step run, set to 0 means no link.
Edit step	Controls the current edit step in the file, ranging from 1 to 100
Voltage setting	Output voltage of the current step, ranging from 0 to maximum output voltage
Current setting	The output current of the current step, ranging from 0 to maximum output current
Single step delay	The delay of the current step, ranging from 0.001 to 86400s. The delay starts from the moment when the voltage and current of the current step reach the set value.

Edit sequence files

1. Press  key, to enter menu setting interface;
2. Select "Edit"-"Sequence file", press  key to Enter the sequence file selection screen;
3. Rotate the knob or enter a number to select the file number you want to edit, press  key to Enter the Edit file screen;

Setting	System	Edit	About
Edit step	100	File length	100
Voltage setting 0.000	V	Running times	60000
Current setting 0.000	A	Link sequence	10
Single step 86400.0	s		
delay			

Figure 3-18 Sequence file editing screen

4. Set "file length", press  key to confirm, Edit focus automatically moves to the next item "run times";;
5. Set "running times", press  key to confirm, Edit focus automatically moves to the next item "link file";
6. Set "link file", press  key to confirm, Edit focus automatically moves to the next item "edit steps";
7. set "edit step", press  key to confirm, Edit focus automatically moves to the next item "voltage setting";
8. Set "voltage setting", press  key to confirm, Edit focus automatically moves to the next item "current setting";



9. Set "current setting", press  key to confirm, Edit focus automatically moves to the next item "single step delay";



10. Set the "voltage slope", press  key to confirm, and the editing focus will automatically move to the next "current slope";



11. Set the "current slope", press  key to confirm, and the editing focus will automatically move to the next "single step delay";



12. Set "single step delay", press  key to confirm, Edit focus automatically moves to "Edit Step", and add 1 to edit step;

13. Repeat 7 to 12 steps until all steps have been programmed;



14. Press  key, Save the sequence file you just edited;



15. Press  key, Exit the sequence file editing screen.

Note: Edit sequence files is not allowed when output is turned on.

Running sequence files



1. Press  key to Enter the Test function selection screen;



2. Rotate the knob, select "SEQ", press  key to Enable the sequence test function, the screen displays the sequence test running screen;

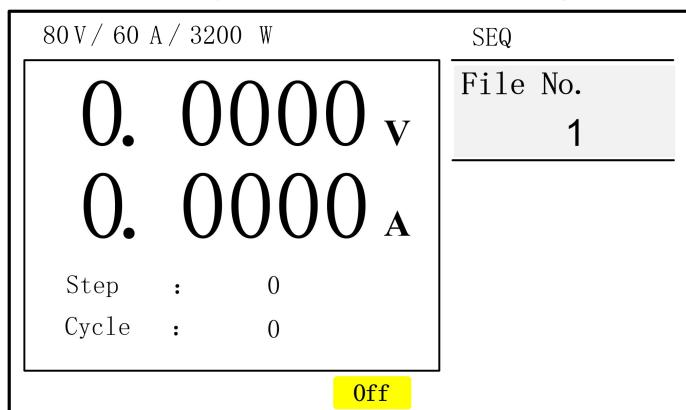
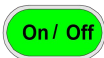


Figure 3-19 Sequence test running screen



3. Set "File No.", press key to take it effect;



4. Press key to Start sequence test.

The interface "Step:" shows the data as the current running step of the sequence, and "Cycle:" shows the data as the number of runs of the sequence cycle.

The SEQ output function allows for more complex waveforms, such as the one described below, which can be easily implemented using the sequence function.

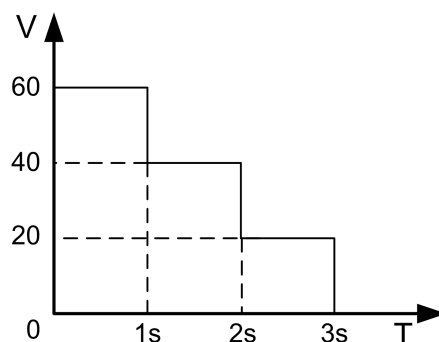


Figure 3-20 Sequence function Output waveform

Edit steps :



1. Press key, to enter menu setting interface.



2. Select "Edit"->"Sequence file", press key to Enter the sequence file selection screen.

3. Turn the knob or enter a number to select the file number you want to edit,



press key to Enter the Edit file screen.



4. After entering the editing interface, set the "file length" to 3, press key to confirm, Automatically enter the "run times" setting, set the "run times" to 1,



press key to confirm, Automatically enter the "link sequence" setting, set



the "link sequence" to 0,press key to confirm, Automatically enter the "Edit Step".

5. Set "Edit" to 1, press  key to confirm, Automatically enter "Voltage setting" and set the value of "voltage setting" to 60V, press  key to confirm. Set the "Current setting" value to the maximum output current value of the power supply and the "single step delay" value to 1s as described above. After completion, it will automatically jump to the "Edit step" and the step number will automatically add 1 to enter the second step of editing.
6. Set "voltage setting", "current setting" and "single step delay" in step 2 to 40V and the maximum output current of the power supply to 1s. After completion, it will automatically jump to "Edit step" and the number of steps will be automatically increased by 1 to enter the third step of editing.
7. Set "Voltage setting", "current setting" and "single step delay" in step 3 to 20V and the maximum output current of the power supply to 1s.
8. After the waveform editing is complete, press  key to Save the sequence file.
9. According to the above "Run sequence file" introduction, call the sequence file to run.

3.14 Simulate internal resistance function(RESI)

Since the battery has a certain internal resistance, when supplied externally, the output voltage will decrease with the increase of the current. The FTP series power supply provides a simulated internal resistance output function. The menu option is "RESI", which can simulate a battery-powered scenario. The output of the power supply satisfies the following formula.

$$V_o = V_{set} - I_o \cdot R$$

V_o : Actual output voltage, V_{set} : set voltage of power supply, I_o : output current, R : set internal resistance

Operation steps :

1. press  key to Enter the Test function selection screen;
2. Turn the knob, select "RESI", press  key to Enable the RESI output function, the screen displays the RESI output screen;

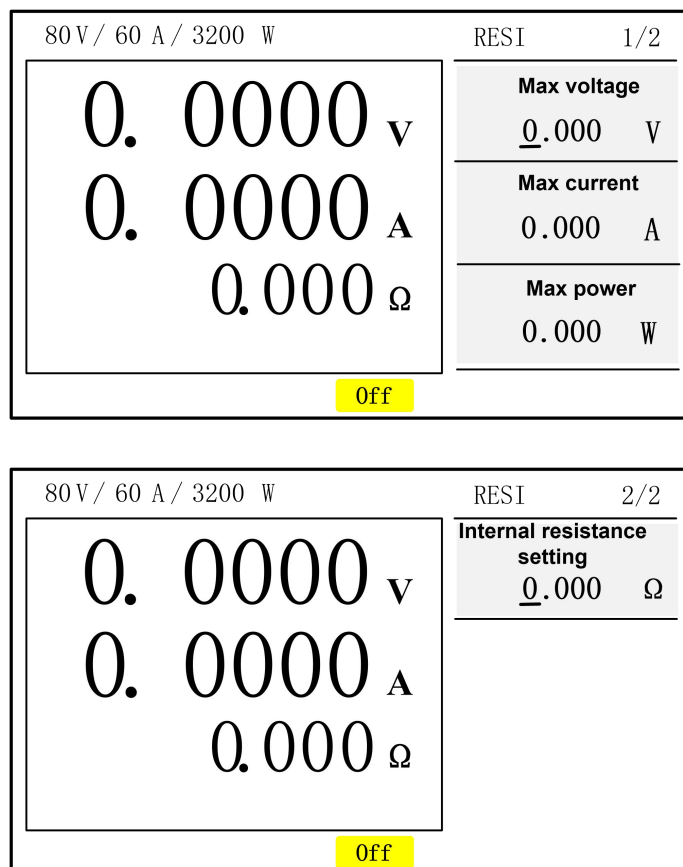


Figure 3-21 Simulation battery output test screen

3. Set RESI test parameters

4. press  key to start RESI output.

Table 3-6 Simulated internal resistance function parameter description table

5. Parameter name	6. Parameter Description
7. Max voltage	8. RESI function output maximum voltage, set range 0 ~ maximum voltage
9. Max current	10. RESI function output maximum current, set range 0 ~ maximum current
11. Max power	12. RESI function output maximum power, set range 0 ~ maximum power
13. Internal battery resistance	14. RESI function simulates battery internal resistance, setting range: different specifications are different

3.15 Voltage slow rise, slow fall function (RAMP)

FTP series power supply supports the function of voltage slow rise and slow fall, which can realize the output voltage rise and fall according to the set slope.

Operation steps :

1. Press  key to Enter the Test function selection screen;
2. Turn the knob, select "RAMP", press  key to Enter the "RAMP" function parameter setting screen as following :

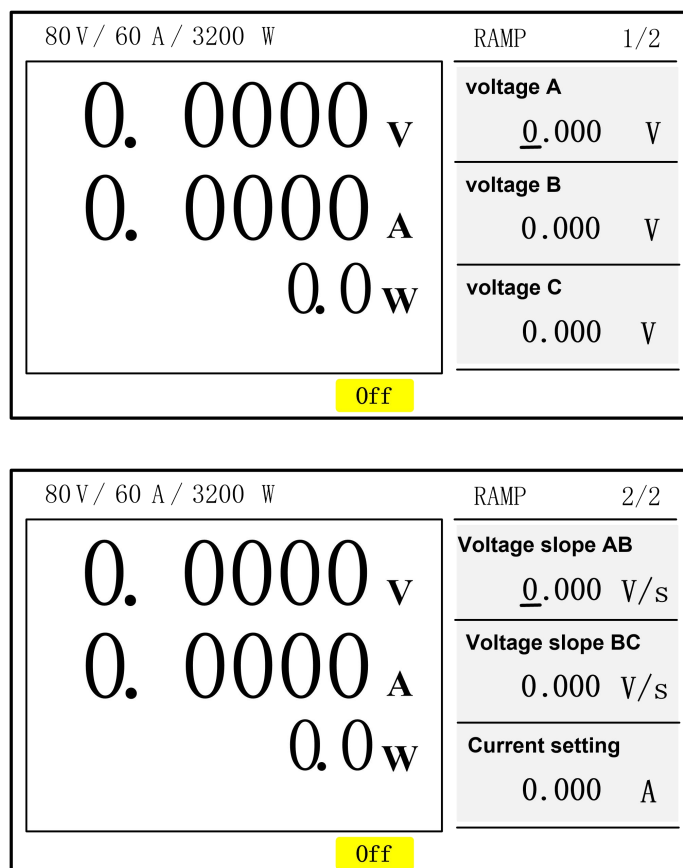


Figure 3-22 RAMP function parameter setting

3. Set the "RAMP" function parameters, the parameters are described in Table 3-7 voltage slow rise and slow fall function parameter description table;
4. Press  key to start "RAMP" function output.

Table 3-7 Voltage slow rise and slow fall function parameter description table

Parameter name	Parameter Description
voltage A	Set point A voltage value, range: 0 to the maximum output voltage
voltage B	Set point B voltage value, range: 0 to the maximum output voltage

Voltage C	Set point C voltage value, range: 0 to the maximum output voltage
Voltage AB slope	Set slope value from point A voltage to point B voltage, range: 0.0006V/s ~ 6000V/s, default: 50% maximum slope
Voltage BC slope	Set slope value from point B voltage to point C voltage, range: 0.0006V/s ~ 6000V/s, default: 50% maximum slope
Current setting	Output current set value, range: 0 ~ maximum output current

For example, to achieve a slow fall and slow rise waveform as shown below,

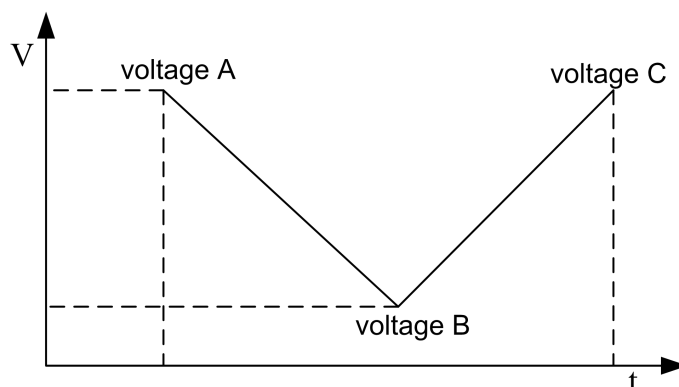


Figure 3.23 RAMP function parameter setting

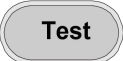
Follow the above RAMP function operation steps to enter the parameter setting interface. Complete the configuration of the required slope value of each point

voltage and voltage segment, and then press the  key to execute.

3.16 Waveform function (Wave)

The waveform function can realize complex waveforms by calling the file of the host computer.

Operation steps :

1. Press  button, Enter the Test function selection screen;
2. Scroll the knob, select "Wave", press  button Enter the "Wave" function parameter setting screen as follows;

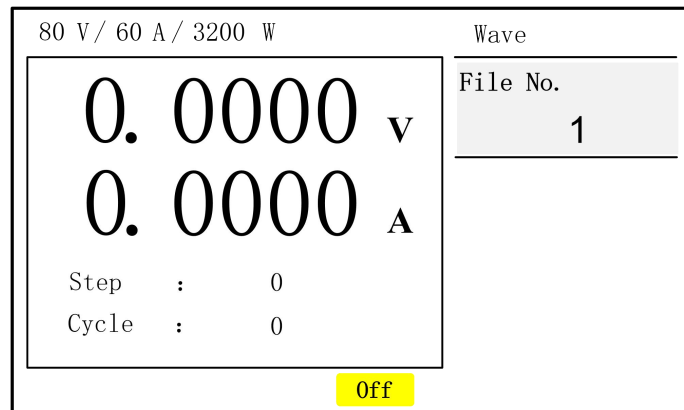


Figure 3-24 WAVE function page

3.17 Voltage dynamic function (DYNA)

FTP series power supply provides voltage dynamic function, so that the output voltage of the power supply presents dynamic change;;

Operation steps :

1. Press  button, Enter the Test function selection screen; ;
2. Scroll the knob , select "DYNA" , press  button, Enter the "DYNA" function parameter setting screen as follows;
 - 1.

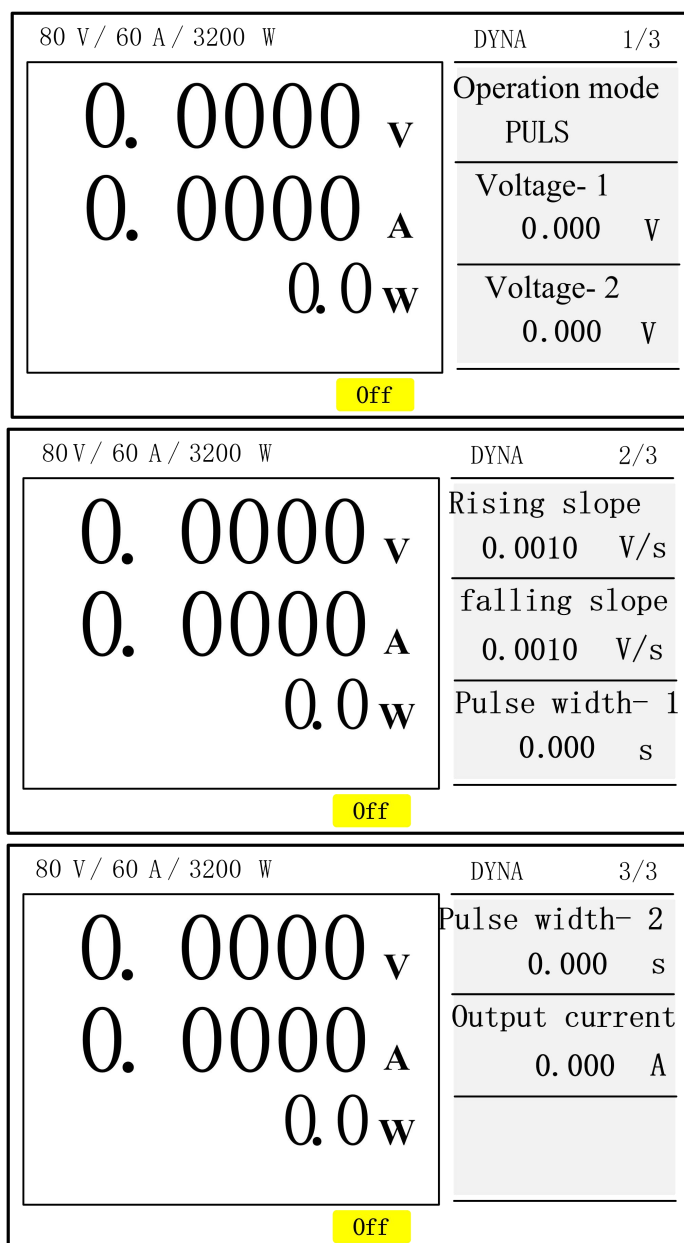


Figure 3-25 Setting DYNA function parameters

3. Set the "DYNA" function parameters, describing such as table 3-7 voltage rise slowly slow down function parameters description table;

4. press  key to Start "Voltage dynamic" function output.

Table 3-8 Voltage dynamic functional parameter description table

Parameter name	Parameter Description
Operation mode	CONT: continuous mode; PLUS: Trigger mode, run one step each time receiving trigger signal; TOGG: trigger mode, every time received the trigger signal to run a full dynamic.
voltage-1	Set voltage value 1, range: 0 ~ maximum output voltage
voltage-2	Set voltage value 2, range: 0 ~ maximum output voltage
Rising slope	Set voltage 1 to voltage 2 slope value, range: 0.001V/s ~

	100V/s, default: 0.0010V/s
Falling slope	Set voltage 2 to voltage 1 slope value, range: 0.001V/s ~ 100V/s, default: 0.0010V/s
Pulse width-1	Set voltage 1 pulse width, range: 0.5s~60000s, default: 1s
Pulse width-2	Set voltage 2 pulse width, range: 0.5s~60000s, default: 1s
Current setting	Output current setting, range: 0 ~ maximum output current, default: 50% maximum current

For example, to achieve voltage dynamic waveform as shown below

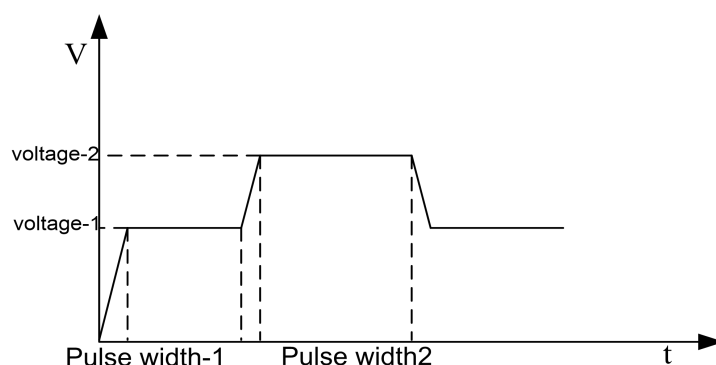


Figure 3.26 DYNA function parameter Settings

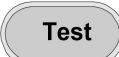
Follow the above DYNA function operation steps to enter the parameter setting interface. Complete the configuration of the voltage at each point and the slope value

required by the voltage section, press  to execute.

3.18. Battery charging test function (CHAR)

FTP series power supply provides battery charging function, which can adjust the electrical parameters of battery charging and test the battery performance;

Operation steps

1. Press  button, Enter the Test function selection screen;
2. Rotate the knob, select "CHG", press  Enter the battery charging function parameter Settings, the screen is as follows;;

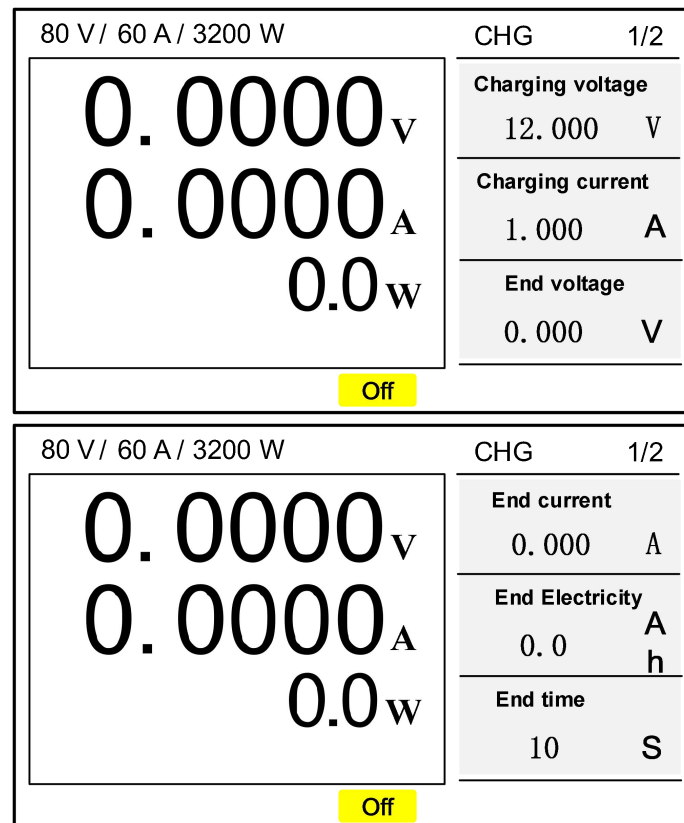


Figure 3-27 CHAR function parameters

- Set the "CHG" function parameter, the parameter description is shown in Table 3-7 voltage slow rise and slow fall function parameter description table;
- Press  key to Start "Voltage dynamic" function output.

Table 3-9 Battery charging test function parameter description table

parameter	Parameter Description
Charging voltage	Charging voltage setting, range 0~ rated voltage, default 0V
Charging current	Charging current setting, range 0~ rated current, default 0A
End voltage	Charge termination voltage, charging end after he arrived, output the power was turned off. Range 0~ rated voltage, default 0V
End current	Charge termination of current, charging end after he arrived, output the power was turned off. Range 0~ rated current, default 0A
End electricity	Charge termination power, charging ends after arrival, power off output. Range 0-999999AH; default 0Ah

End time	After charging termination of electricity to the end of the charging, output the power was turned off. Range 0-360000s, default 0s
----------	--

3.19. Time measurement

The time measurement function is used to measure the time between the start signal point and the end signal point. The measurement signal can be selected from external input voltage, external input current, and external level signal. The direction of the measurement signal can also be selected as rising or falling.

The principle of time measurement is: starting from the initiation of time measurement, the load continuously detects the input signal. When the signal satisfies the two conditions of direction and trigger threshold, the time at that moment is recorded. The time difference between the end point and the starting point is the time measurement result. The time measurement range is 0.1ms-20h, with a resolution of 0.1ms.

The time measurement function can be used for power module startup time measurement, shutdown time measurement, hold time measurement, rising edge and falling edge measurement, as well as fuse blowout time and circuit breaker response time measurement.

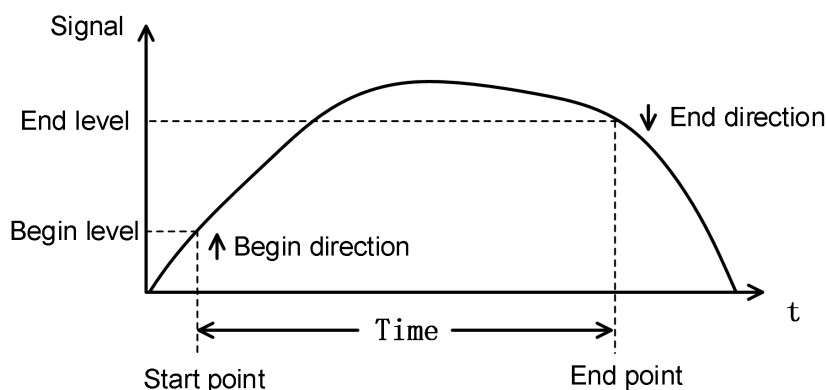


Figure 3-28 time measurement function

Operation steps

1. Press  to Menu setting interface;
2. Select "Set" -> "Time measurement", press  to time measurement setting

interface;

Set	System	Edit	About
Beg TRIG	Volt		
Beg DIRE	Rise		
Beg LEVL	5.000 v		
End TRIG	Volt		
End DIRE	Rise v		
End LEVL	100.0 v		

Figure 3-29 Time measurement function parameter setting interface

3. Beg TRIG(Begin signal) and End TRIG (End signal) can be selected Volt (voltage) 、 Curr (current) ;
4. Signal direction can be selected Rise or Fall;
5. Set the begin and end level, which represent the signal trigger threshold;
6. Press  to return to the main interface after setting;
7. Take the steady state VI function as an example (the same operation method is used for other functions),press  +  several times to change to time measurement display interface;

100V/150A/15000W		VI	
0.0000 V 0.0000 A SUCCESS 00:00:00.000.00		V-Set	
		5.000	V
		I-Set	
		1.000	A
		Off	

Figure 3-30 Time measurement function interface

8. Start a time measurement by external trigger;
9. After the load detects a complete start signal and end signal, the time measurement is over, the screen prompts "SUCCESS", and the measured time is displayed, in ms.

Note: The turning on time measurement is not directly related to the turning on input.

3.20. Linear stepping function (STEP)

FTG series power supply provides linear step function, CV, CC, CP three modes, users can edit the voltage, current, function linear step output;

Operation steps

1. Press  key to Test function selection interface;

2. Rotate the knob, select "STEP", press  key to linear stepping function setting interface as below;

100V / 150A / 15000W		STEP	1/3
0.0000V 0.0000A 0.0W		Run mode	CV
		Output current	61.200 A
		Start voltage	0.000 V
Off			

100V / 150A / 15000W		STEP	2/3
0.0000V 0.0000A 0.0W		Step voltage	0.000 V
		End voltage	0.000 V
		Step mode	Time
Off			

100V / 150A / 15000W		STEP	3/3
0.0000V 0.0000A 0.0W		Step time	1.00 s
Off			

Figure 3-31 STEP function parameter setting

3. Set the "STEP" function parameters. The parameter description is shown in

Table 3-10 Description of Linear Step Function Parameters;

4. Press  key to start the "Linear Step" function output.

Table 3-9 Description of Linear Step Function Parameters

Parameter Name	Parameter Description
Operation mode	Step by step operation mode; CV, CC, CP;
Output current	Maximum output current setting under stepping CV mode
Output voltage	Setting of maximum output voltage value in step CC mode;
voltage/current upper limit	Maximum output voltage and current setting in step CP mode;
Start voltage /current /power	Setting of voltage, current and power values for starting operation of step mode;
Step voltage /current /power	Increasing voltage, current and power value in each step;
End voltage /current /power	The output voltage, current and power of the power supply reach the end point, the work of the step mode ends, and the power supply is turned of the output;
Step mode	Incremental trigger mode in each step; Time: run automatically according to step time; Trigger: run by external trigger;
Step time	Running time of each step; Range: 0.5S~99999S;

3.21. Photovoltaic simulation(PV-SIM)

PV photovoltaic simulation function, which can simulate the I-V characteristic curve of solar panel output, is mainly used for the research and development and production testing of photovoltaic inverter. Built in Sandia, EN50530 and other standards and regulations, it can test the static MPPT and dynamic MPPT of photovoltaic inverter. The PV function of the equipment only supports static curve testing, and more testing functions can be realized with the upper computer software, such as dynamic MPPT, typical weather data, customized light/temperature change curve, reports, etc.

The advantages of high precision and fast speed of FTB9000 can improve the simulation accuracy of I-V curve and the accuracy of MPPT measurement. The upper computer software can edit up to 100 photovoltaic files, and each file supports the

maximum power point voltage V_{mp} , maximum power point P_{mp} , and fill factor parameters. The user can also edit the IV curve by defining the open circuit voltage V_{oc} , short circuit current I_{sc} , maximum power point voltage V_{mp} and maximum power point current I_{mp} . Built in a variety of typical weather data, such as Cloud day, Cold day, Hot day, etc. With data recording function, it can store the data of inverter tracking process for easy calculation and analysis.

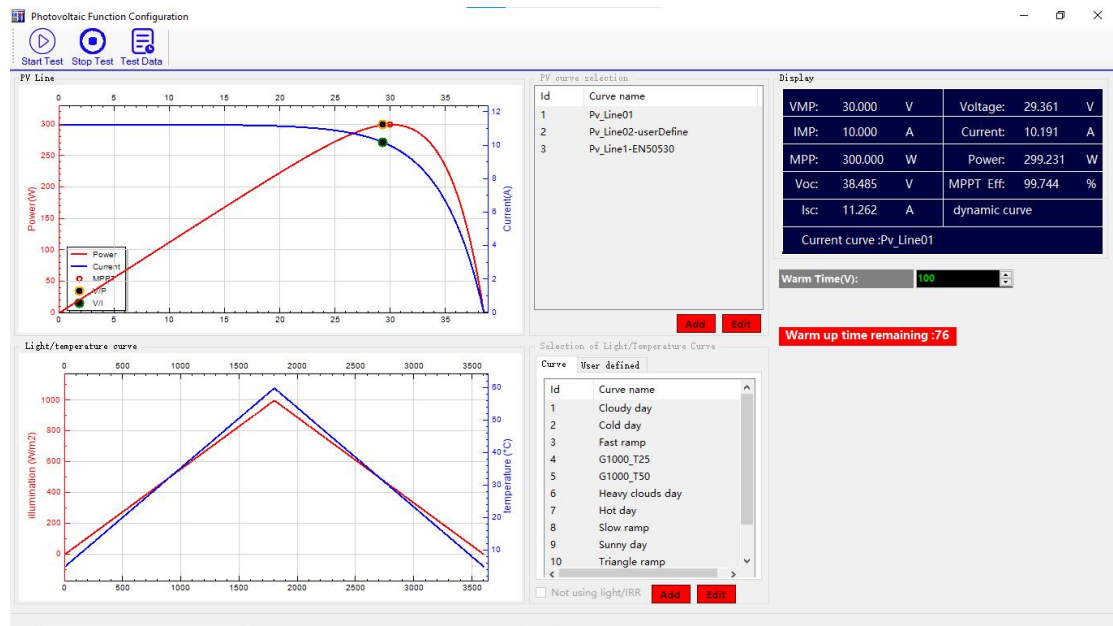


Figure 3- 32 Upper computer photovoltaic interface

Table 3- 10 Photovoltaic Curve Parameters

Parameter	Description
File number	File number for photovoltaic running, range 1~20.
PMP	Max power of photovoltaic curve, range 0~Max source power.
VMP	Voltage for Max power of photovoltaic curve, range 0~Max voltage.
Raw	Support SANDIA and EN50530.
Material	SANDIA option material include TF,SCMC,HEC; EN50530 option material include TF,CSI.

Edit photovoltaic file

- Press button  , enter menu set,

2. Select "Edit" -> "photovoltaic file", press button  to enter option interface of photovoltaic file;

3. Rotate the knob or press digital key, select edited file number you want, press

button  to enter the edit file interface;

Set	System	Edit	About
PMP	0 W	VMP	60000 V
Law	SANDIA		
Material	TF		

Figure 3- 33 Edit interface for photovoltaic file

4. Set "PMP", press button  to confirm, move the edit cursor to next "VMP";

5. Set "VMP", press button  to confirm, move the edit cursor to next "Law";

6. Set "Law", press button  to confirm, move the edit cursor to next "Material";

7. Press button , save the photovoltaic curve file edited;

8. Press button , exit edit interface of photovoltaic file.

Caution: Don't allow to edit photovoltaic file when device is turning on.

Running photovoltaic simulation mode

Menu setting and Operating setting of photovoltaic simulation mode:

Select user photovoltaic running type as below:

1. Press button  to enter Menu setting interface, select application setup of set option;

2. Application setup->photovoltaic mode, press button  and scroll the knob to select configuration option you need, Curve or user Define.

Operating step

1. Press button  to enter test option interface;

2. Scroll the knob, select "PV", press button  to enter "PV" User defined function parameter settings interface as below:

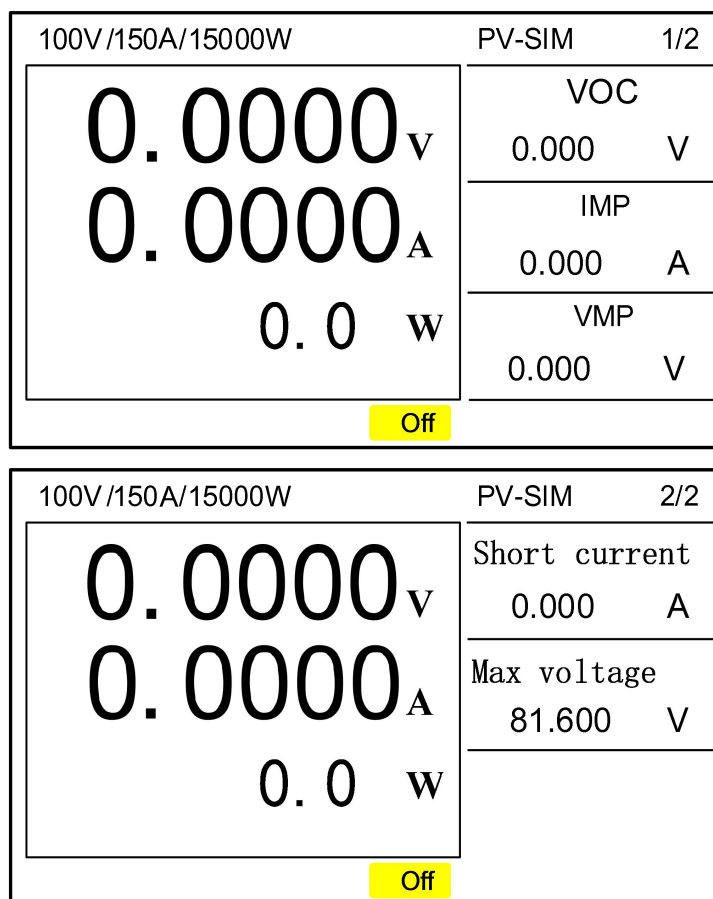


Figure 3- 34 Customized edit interface for photovoltaic file

3. Set "PV-SIM" function parameters, detail as figure 3-24;

4. Press button  to start charging, press button  again to stop

discharge,clear capacity and time meantime.

Table 3-11 Customized parameter list of photovoltaic function

Parameter	Description
VOC	Setup value of open circuit voltage,range:0 ~ max voltage
IMP	Current set value for Max power,range:0~Max current
VMP	Voltage set value for Max power,range:0~Max voltage
Short-circuit current	range: 0~Max current
Max voltage	range: 0~Max voltage

Table 3-12 Curve mode parameter list of photovoltaic function

Parameters	Description
File number	Running file number,range:1~20
Max voltage	Range:0~Max voltage

3.22. Master/Slave parallel function

3.22.1. Master/Slave Parallel Connection

FTP series power supply provides master-slave parallel mode, so that users can achieve greater power expansion of the same model.

The user uses the wire to connect the "PAR" signal interface, the "RS485" parallel machine communication interface, and the output positive and negative electrodes in the back panel, according to the "Figure 3-28 master-slave parallel machine connection", and then makes the corresponding configuration of the power supply to realize the master-slave parallel machine function, and the power operation after the master-slave parallel machine is as single machine use effect.

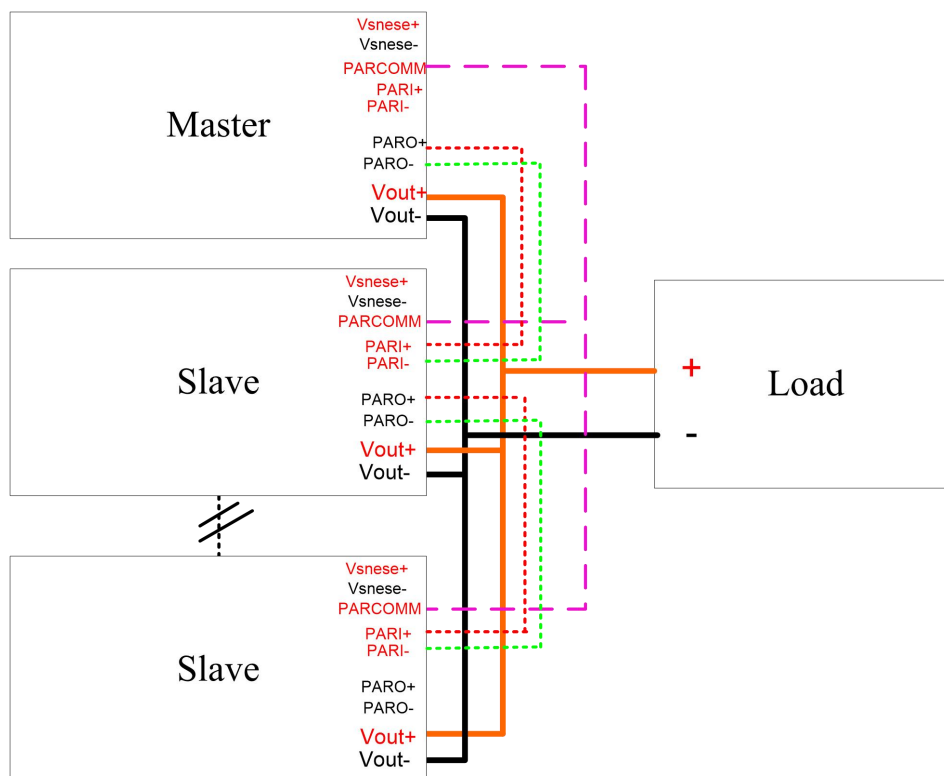


Figure 3-28 Master/slave parallel connection

Master and slave parallel signal line requirements

Composite signal port parallel communication line RS485, parallel interface line PAR: can use $0.5\text{mm}^2 \sim 1\text{mm}^2$ cross-sectional area, twisted pair.

Master/slave parallel connection Note:

1. The master and slave parallel machines only support parallel power supply of the same voltage model.
2. The maximum number of parallel machines is 10.
3. If you need to use the voltage compensation line loss function after the master and slave are parallel, just operate the Vsense port of the host.
4. The master/slave series is not supported.

3.22.2 Master/Slave parallel setting

Slave setting

1. press  button, to enter menu setting interface;
2. select "setting" -> "Parallel machine", press  button, Pop up the master and slave parallel machine setting interface;
3. Set the "Master/slave Setting" option to "Slave1" or "Slave2" etc. Each number corresponds to one slave power source and cannot be repeated. If there is only one slave, the slave number must be set as "Slave1"; if there are two slaves, one slave must be set as "Slave1" and the other one as "Slave2" and so on; otherwise, the communication failure will be caused;
4. When the power supply is set to slave, the screen automatically hides unnecessary configuration items after you return to the home screen.

Master Settings

Setting	System	Edit	About
Master slave setting		Master	
Number of slave machines		1	
Master slave control		Close	

Figure 3-29 Master-slave parallel machine setup

5. press  button, to enter menu setting interface;
6. select "setting" -> "Parallel machine", press  button, Pop up the master and slave parallel machine setting interface;
7. Set the "Master/Slave Settings" option to "Master";
8. The "number of slave" option is set to the actual number of slave sources;
9. Set the "Master/Slave Control" option to "On"

After setting parallel parameters, press  button to return to main interface. At this time, the host model and parameters will be updated to the new model after the parallel machine.

3.22.3 Master/Slave parallel operation

After the FTP series power master and slave parallel machine function is set up, the control of the whole machine only needs to operate the host.

After the master-slave parallel machine is enabled, the protection functions are still effective. When one of them is protected, the system will automatically shut down all power outputs. The slave displays the specific fault information, and the host displays the fault information of the host and the fault slave code, as shown in the following figure:

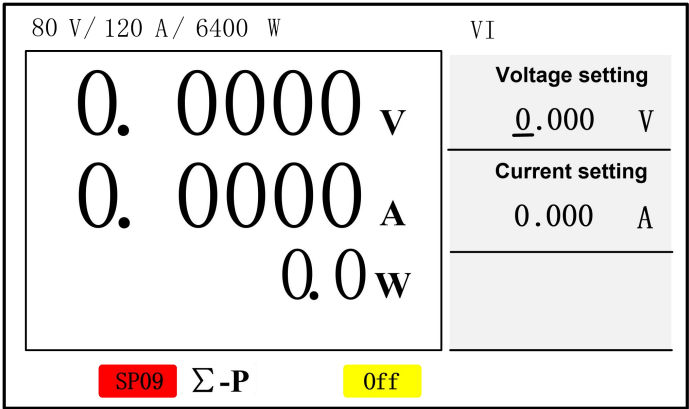


Figure 3-30 Master display screen

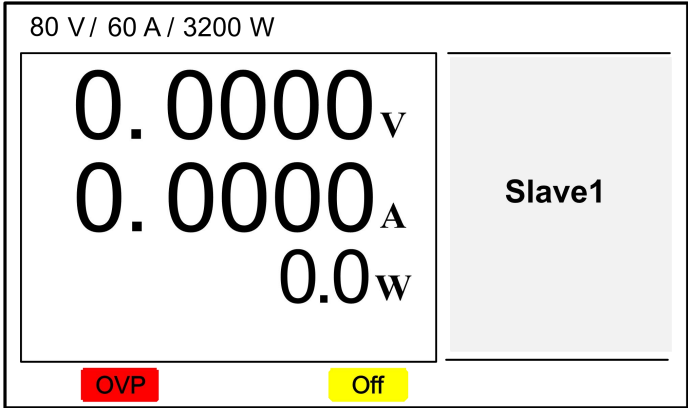


Figure 3-31 Slave display screen

When the slave protection occurs, it is necessary to clear the fault by pressing the  keys on the corresponding slave and the host. If only the host is faulty, just press the  key on the host to clear the fault. The following table lists the protection and failure situations that can occur in master-slave parallel applications.。

Table 3 - 10 master-slave weaver protection

Protection	instructions
------------	--------------

display	
Σ -P	Parallel communication is normal, and there is no flashing black characters on white background in the host interface
Σ -P	The parallel communication is abnormal. Black characters with red background are blinking on the host screen
SP01 ~ SP09	Indicates the slave number where the fault occurs, and the operate  key to clear the fault.

Notes for master-slave parallel operation:

1. Set the parameters on the slave computer first and then on the host to avoid host communication faults.
 2. If multiple power supplies are configured as hosts and the parallel function is enabled, the parallel fails.
 3. If the signal cable of the "PAR" port of the slave machine is not connected or falls off, the model and parameters will be updated according to the number of slave machines after the parallel function is enabled, but the actual output will be inconsistent with the Settings of the host due to the fault of the "PAR" signal cable.
 4. The external programming function of the host is effective for the whole machine.
 5. After the power supply is set to slave, the protection value in the original Protection Setting item will be deleted. The user needs to reset the Settings during restoration.
 6. Do not allow the power supply of different voltage models to be parallel, otherwise it will cause damage.
-

4. Introduction to the Newsletter

The FTP series power supply provides 4 kinds of communication interfaces for users. Standard RS232 (serial port), LAN (Ethernet), GPIB, RS485 or CAN communication interface can be configured. The communication protocol supports standard Modbus and SCPI, and the default Modbus. Users can select communication interfaces and protocols as required.

4.1. Communication configuration

1. press  key, to enter menu setting interface;
2. select“setting”->“system”->“Communication setting”, press  key to Pop-up system parameter Settings interface;

Setting	System	Edit	About
IP address	192. 168. 1. 123		
Subnet mask	255. 255. 255. 0		
Serial port speed	9600		
Check way	No check	Communication protocol	Modb
Device address	160		
GPIB address	5		

Figure 4-1 Communication parameter setting interface

3. For LAN communication, set IP Address to 192.168.1.123 and Subnet Mask to 255.255.255.0. Secondly, set the IP address of the computer network to be in the same network segment as the IP address of the power supply. Otherwise, the communication fails. For example, set the computer network IP address to 198.168.1.100.
4. For RS232 serial port communication, set Serial Port Rate to 9600 by default. You can set the rate to 4800, 9600, 19200, 38400, and 115200. The default value of Verification Mode is None.
5. Set Serial Port Rate for the RS485 communications. The default value is 9600.

You can set it to 4800, 9600, 19200, 38400, and 115200. The default value of Verification Mode is None. The default value of Device Address is 160, ranging from 1 to 247.

6. For GPIB communication, set GPIB Address. The default value is 5, ranging from 0 to 30.
7. The communication protocol can be set, supporting Modbus or SCPI.

8. Note: After modifying the communication configuration, restart the power supply for the modification to take effect.

4.2. Voltage and current acquisition rate

9. After the above communication configuration is completed, if the user needs to improve the speed of communication and acquisition of device parameters, the configuration can be as follows:

10. press  key, to enter menu setting interface;

11. select "setting" -> "application setting", press  key to Pop-up application interface;

Setting	System	Edit	About
Sampling rate	10Hz	Response speed	50%
Output priority	Volt		
Voltage rise	6000.0	V/s	
Voltage drop	6000.0	V/s	
Current rise	2000.0	A/s	
Current drop	2000.0	A/s	

Figure 4-2 Application Settings screen

12. Select the required communication acquisition rate in the "Sampling rate" item, and 5 blocks are optional. The default value is 10Hz.

4.3 Communication interface

4.3.1 RS232

The default baud rate of FTP series is 9600BPS, the check mode is None, and the flow control mode is not supported. For the RS232 interface, only TxD and RxD signals can transmit data, whose pin signals are described in the table below:

Table 4 - 1 RS232 interface

Pin NO.	Input/Output	Description
1	---	N.C.
2	Input	RxD
3	Output	TxD
4	---	DSR
5	GND	GND
6	---	DTR
7	---	CTS
8	---	RTS

4.3.2 LAN

The FTP series power supply has an Ethernet communication interface and can use UDP and TCP/IP communication modes. The default IP address is 192.168.1.123, the default subnet mask is 255.255.255.0, the default port number is 7000 in UDP mode, and the default port number is 7001 in TCP/IP mode.

Note: Before the communication, ensure that the PC and the power supply are on the same network segment, and ensure that the PC and the power supply do not have the same IP address on the network segment. Otherwise, the PC cannot be correctly connected.

4.3.3 RS485

The configuration of the RS485 communication port is the same as that of the RS232, including baud rate and verification mode. The default baud rate is 9600BPS, and its pin

signals are described in the table below.

Table 4 - 2 CAN interface signals

Pin NO.	Input/Output	Description
1	---	A.
2	---	B
3	---	GND

4.3.4 CAN

The CAN interface adopts a fixed communication speed of 250Kbps, and the communication address can be set on the interface board.

Note: The CAN interface uses the CANOpen communication protocol.

Table 4 - 3 CAN interface signals

Pin NO.	Input/Output	Description
1	---	H.
2	---	L
3	---	GND

4.3.5 GPIB

GPIB (Universal Instrumentation Interface Bus) is an interface standard for connecting computers and peripheral devices. It supports the following international standards: IEEE488.1, IEC-625, IEEE488.2. The GPIB interface allows the power supply to be controlled by an external computer via the GPIB bus.

If the GPIB bus interface is used to connect to the power supply, purchase the GPIB interface card. The power supply provides an optional GPIB interface card accessory. Using the GPIB interface card and related software provided by Faith Technology, you can easily establish the GPIB remote control system on a PC.

GPIB interface card and IEEE488.2 GPIB cable are optional accessories, please

contact Faith Technology to order this accessory.

4.4 Communication protocol

FTP series power supplies support SCPI, Modbus, and CANopen communication protocols. For LAN, USB serial port, RS485 port, you can select SCPI or D. GPIB supports only SCPI, and CAN supports only CANopen.

4.4.1 SCPI protocol

Standard Commands for Programmable Instruments Standard Commands for Programmable Instruments SCPI is a standardized instrument programming language based on the existing standards IEEE488.1 and IEEE 488.2, and follows the floating point arithmetic rules in IEEE754 standard, ISO646 information exchange 7-bit coding symbol (equivalent to ASCII programming) and other standards. It adopts a set of tree-like hierarchical command set, proposes a universal instrument model, and uses signal oriented measurement. Its mnemonic generation rule is simple, clear, and easy to remember.

Power commands are classified into two types: IEEE488.2 common commands and device-related SCPI commands.

IEEE 488.2 Common Commands define a number of control and query commands common to instrumentation. You can use public commands to perform basic operations on the power supply, such as reset and status query. All IEEE 488.2 public commands consist of "*" and three-letter mnemonics, such as: *RST, *IDN? , * ESE? And so on.

SCPI commands are used to test, set, calibrate, and measure power supplies. Such commands are organized as command trees. Each command can contain multiple mnemonics. Nodes of the command tree are separated by a hyphen (:), as shown in the following figure. The top ROOT of the command tree is called the root. The full path from the root to the leaf is a complete programming command.

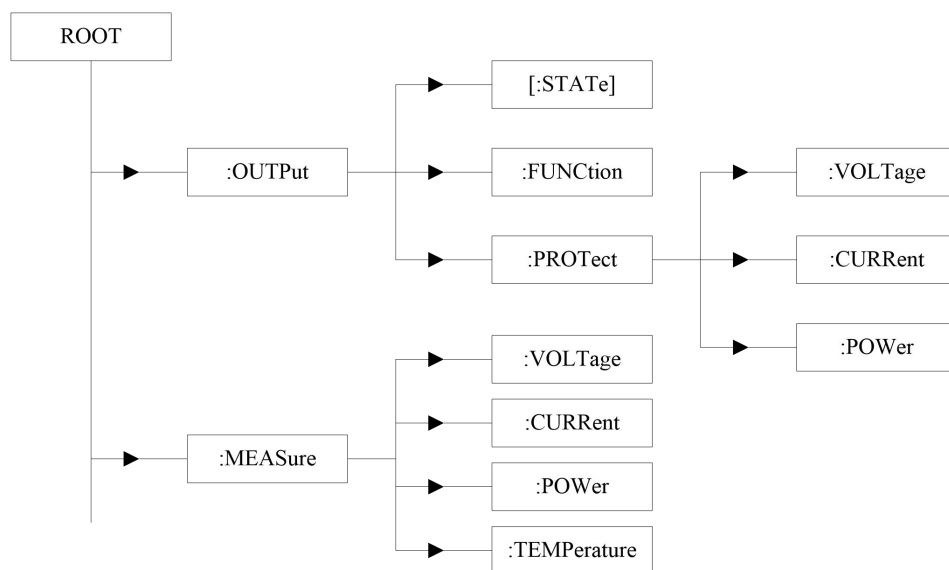


Figure 4-3 SCPI command tree

SCPI protocol specific content, please refer to 《FTP programming manual SCPI edition》.

4.4.2 Modbus protocol

Modbus is a serial communication protocol that was published by Modicon (now Schneider Electric) in 1979 for communication using Programmable logic controllers (PLC). Modbus has become the De facto standard for industrial communication protocols and is a common connection method between industrial electronic devices. Modbus is a master/slave protocol. One node is a master node, and the other nodes that participate in communication using Modbus protocol are slave nodes. Each slave device has a unique address. Only the node designated as the master node can start a command.

A Modbus command contains the Modbus address of the device to be executed. All devices receive the command, but only the device at the specified address executes and responds to the command. (The exception is address 255, where the command at address 255 is a broadcast command, and all devices receiving the command run but do not respond to the command.) All Modbus commands contain a checksum to ensure that the incoming command is not broken. Basic Modbus commands can direct a device to change its register values, control or read an I/O port, and direct the device to send back data in one or more registers.

Note: FTP series power supplies only support RTU communication mode.

Modbus protocol specific content, please refer to 《FTP programming manual Modbus edition》

4.4.3 CANopen protocol

CANopen is a kind of high-level communication protocol on Controller Area Network (CAN), including communication sub-protocol and equipment sub-protocol, and is a field bus commonly used in industrial control. CANopen implements protocols above the network layer in the OSI model, including the network layer. The CANopen standard includes an addressing scheme, several small communication subprotocols, and an application layer defined by the device subprotocols. CANopen supports network management, device monitoring and internode communication, including a simple transport layer that handles segmented transfer and combination of data. Generally speaking, the data link layer and physical layer will be implemented by CAN.

Note: The CANopen protocol is optional

CANopen protocol specific content, please refer to 《FTP programming manual CANopen edition》

5. Check for failure

When the power supply does not work properly, please check and eliminate according to the description in this section. If the problem still cannot be solved, please contact the agent or Faith technology after-sales service.

Table 5-1 Fault self-check Table

problem	Possible causes	solution
The measurement accuracy is not within the specification range	Device aging results in characteristic deviation	Recalibration
The output accuracy is not within the specification range	Device aging results in characteristic deviation	Recalibration
PMFfault	1. The power supply of the grid is lower than the power supply requirement 2. The PMF is triggered by a power failure	1. Check whether the power supply is normal 2. The PMF fault triggered by power failure can be ignored
Over temperature protection OTP1、OTP2	1. The ambient temperature is too high 2. Poor ventilation 3. The fan is damaged	1. Place the machine in 0 ~ 40℃ environment 2. Improve the ventilation of the machine 3. press  key to clear the fault
Over power protection OPP、OP	The output power exceeds the set value	1.Reduce load or increase OPP setting 2. press  key to clear the fault
Over current protection OCP、OC	The output current exceeds the set value	1.Reduce load or increase OCP setting 2. press  key to clear the fault
Over voltage protection OVP、OV	The output voltage exceeds the set value	1.Reduce the output or increase the OVP Settings 2. press  key to clear the fault

Table 5-2 Power-on fault self-check table

problem	Possible causes	solution
Test Converter...Error !	Abnormal power module	Please consult Faith Technology after-sales service
Test sample.Error !	Abnormal sampling data	
Loading calibration data. Error !	Calibration data failed to load	
Loading parameters. Error !	Failed to load system parameters	

Appendix

Table 6-1 Recommended cable size Table

model	Cross section area	Different temperature conditions			
AWG	mm ²	60℃	75℃	85℃	90℃
		Wire type: RUW,T ,UF	Wire type: RHW,RH	Wire type: V,MI	Wire type: TA,TBS,SA,AV
		Rate current(unit: A)			
14	2.08	20	20	20	20
12	3.31	25	25	30	30
10	5.26	30	35	40	40
8	8.36	40	50	55	55
6	13.3	55	65	70	75
4	21.1	70	85	95	95
3	26.7	85	100	110	110
2	33.6	95	115	125	130
1	42.4	110	130	145	150
0	53.5	125	150	165	170
00	67.4	145	175	190	195
000	85	165	200	215	225
0000	107	195	230	250	260