

Faithtech

Modular ultra high power programmable
DC power supply

User Manual

(FTG Series)

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Introduction

Dear users :

First of all, thank you for choosing Shenzhen Faith technology co., LTD. (hereinafter referred to as the Faithtech), FTG series ultra high power programming DC power supply (hereinafter referred to as FTG series). This User manual (hereinafter referred to as the manual) is applicable to FTG 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.

The warranty service

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
3 phase 380VAC 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

Version Revision Record

Date	Version	Revised chapter
Dec, 2021	3.00	Complete the user manual
Mar, 2023	3.01	Revised external programming signal definitions
Nov,2023	3.02	Update some specification parameters
Apr,2024	3.03	Add time measurement, linear stepping function, PV function
Oct,2024	3.04	Apply menu functionality modifications

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1. Overview

1.1. Introduction

FTG Series power supply is high-power DC switch power supply, which has the advantages of high power, high current, low ripple noise, fast transient response, high resolution and high precision. It can be applied to 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. Key Features

- Power output range of single machine: 4kW~600kW;
- Voltage output range: 0~1500V;
- Current output range of a single machine: 0~12000A;
- Precise measurement by a 16-bit high-speed ADC;
- Stable output, small ripple, and low noise;
- Supports constant power output;
- Supports master and slave connection, slave quantity up to 5 ;
- Simple sequences and complex waveform editing functions;
- Overvoltage protection, overcurrent protection, overpower protection, overtemperature protection, and so on;
- Supports output time setting, allowing you to control and record the output time;
- Simulatedly input programming functions that control voltage, current, and power, separately;
- Supports voltage monitoring output and current monitoring output;
- Supports voltage remote compensation;
- TFT Color screen, support Chinese and English;
- Standard RS232 communicates with LAN, optionally GPIB, RS485, or CAN;
- Supports standard SCPI and Modbus-RTU communication protocols;

1.3. Overall dimensions (mm)

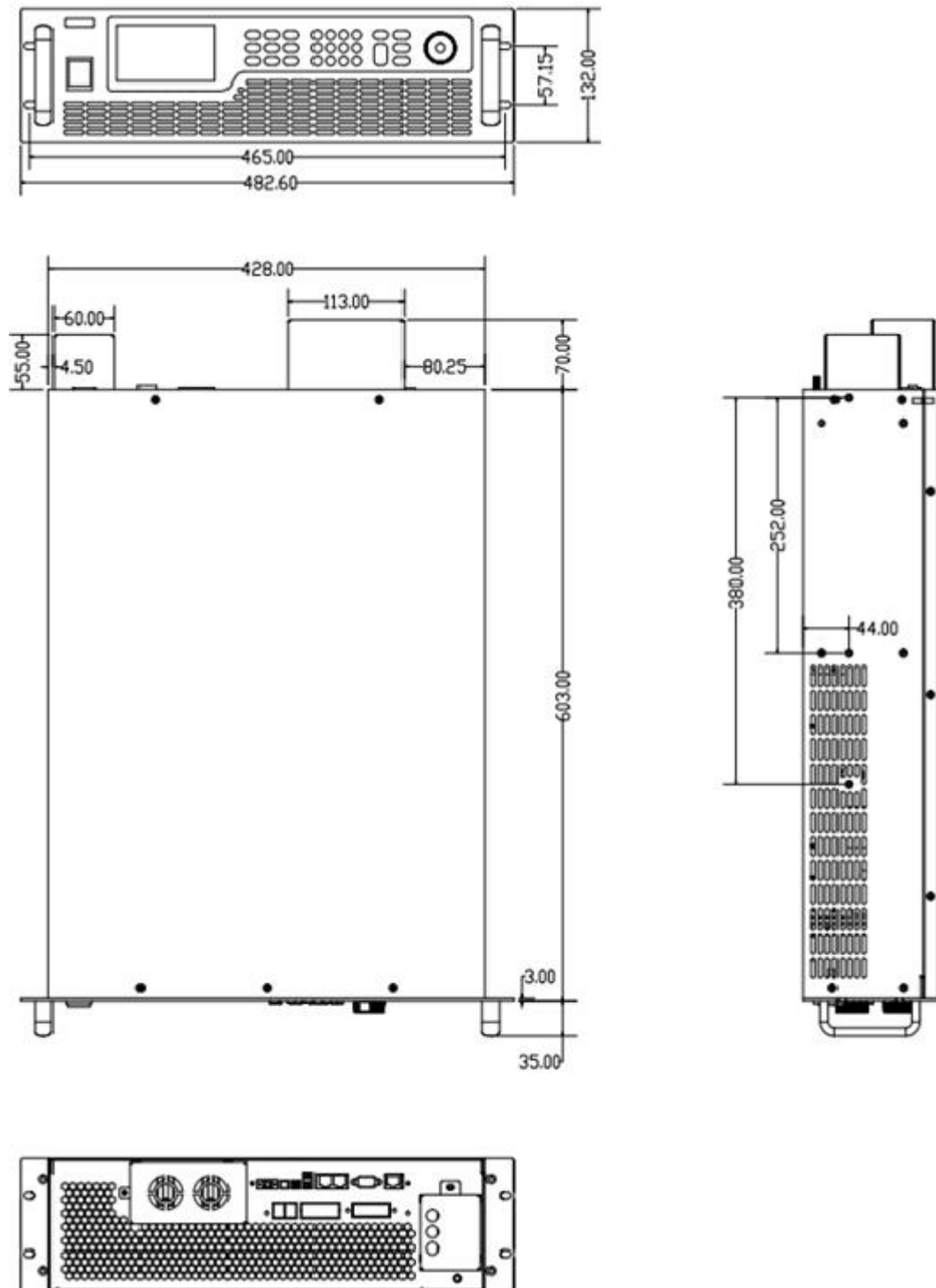


Figure 1-1 15kW or less model with Single-layer case (40V to 1500V output voltage)

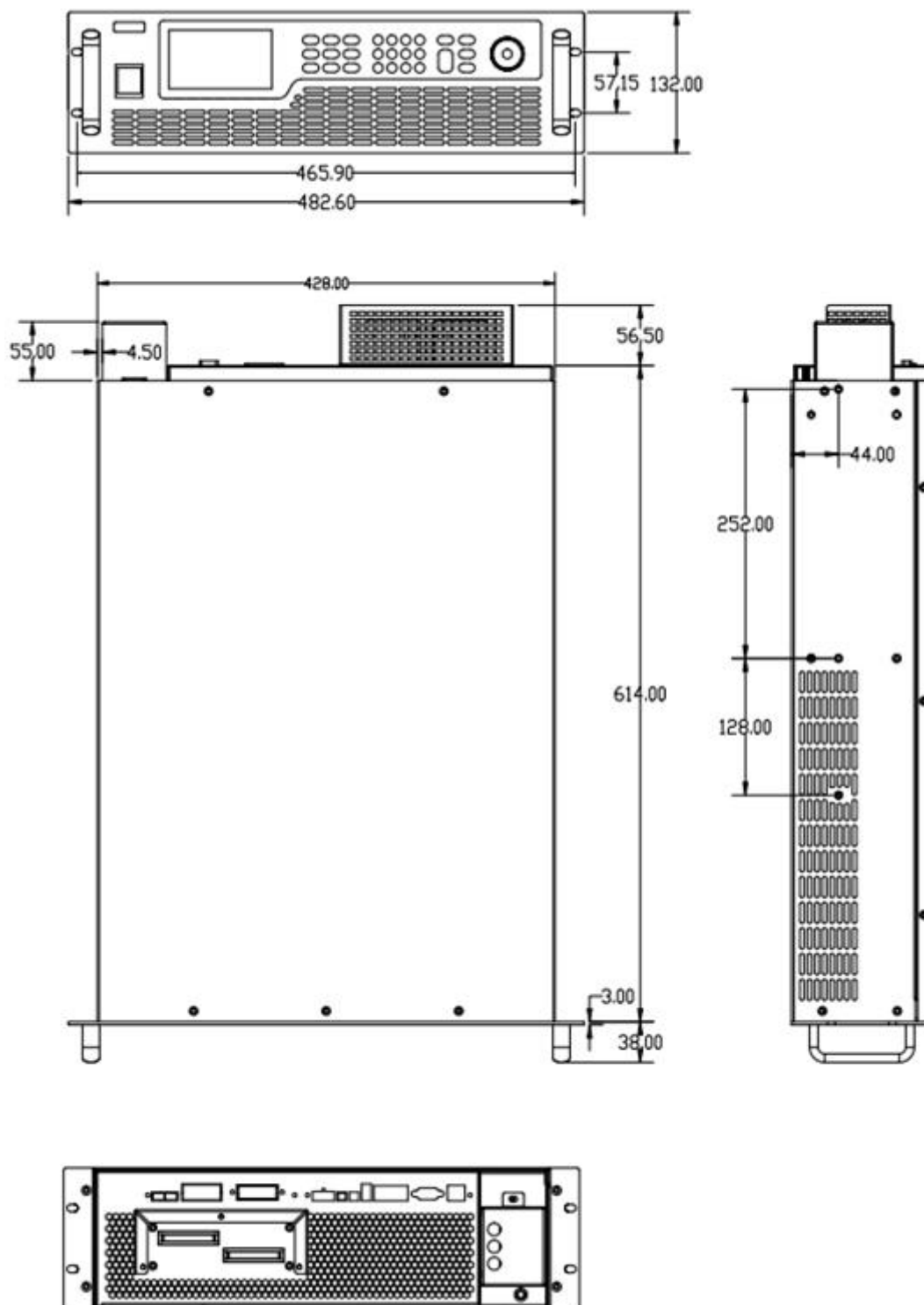


Figure 1-2 15kW or less model with Single-layer case (10V to 30V output voltage)

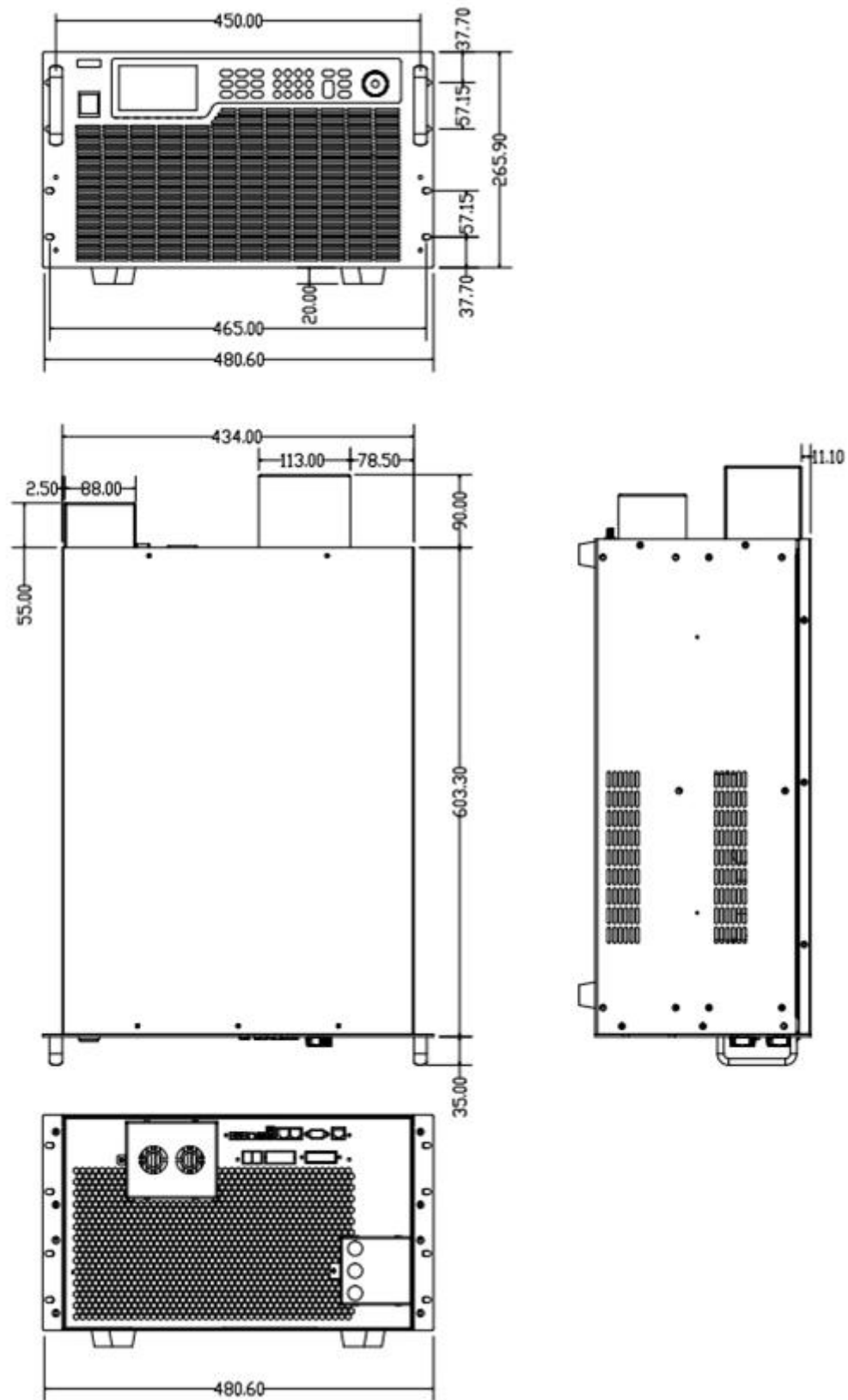


Figure 1-3 20kW to 30kW model double-layer case(40V to 1500V output voltage)

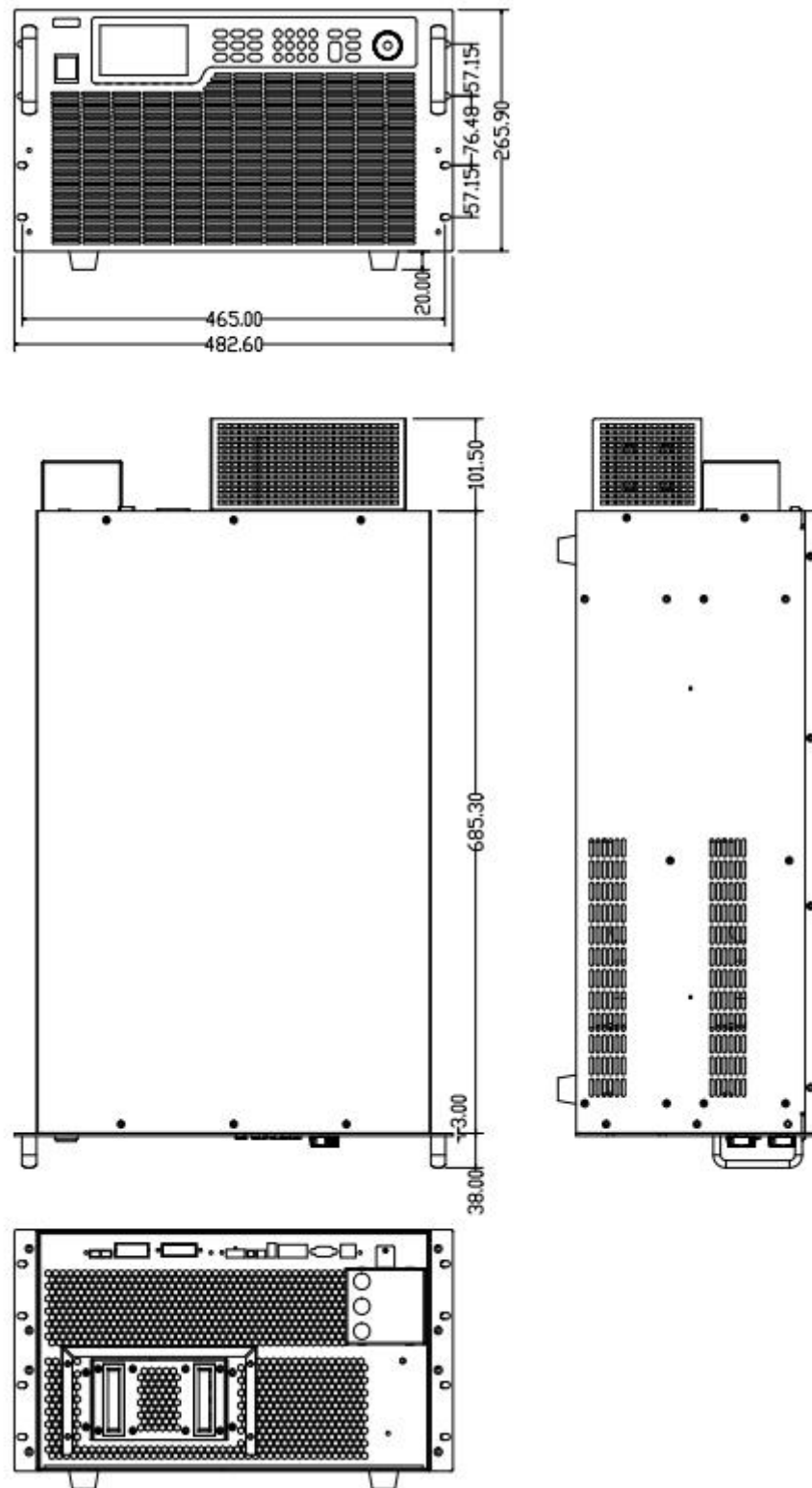


Figure 1-4 16kW to 30kW model with double-layer case (10V to 30V output voltage)

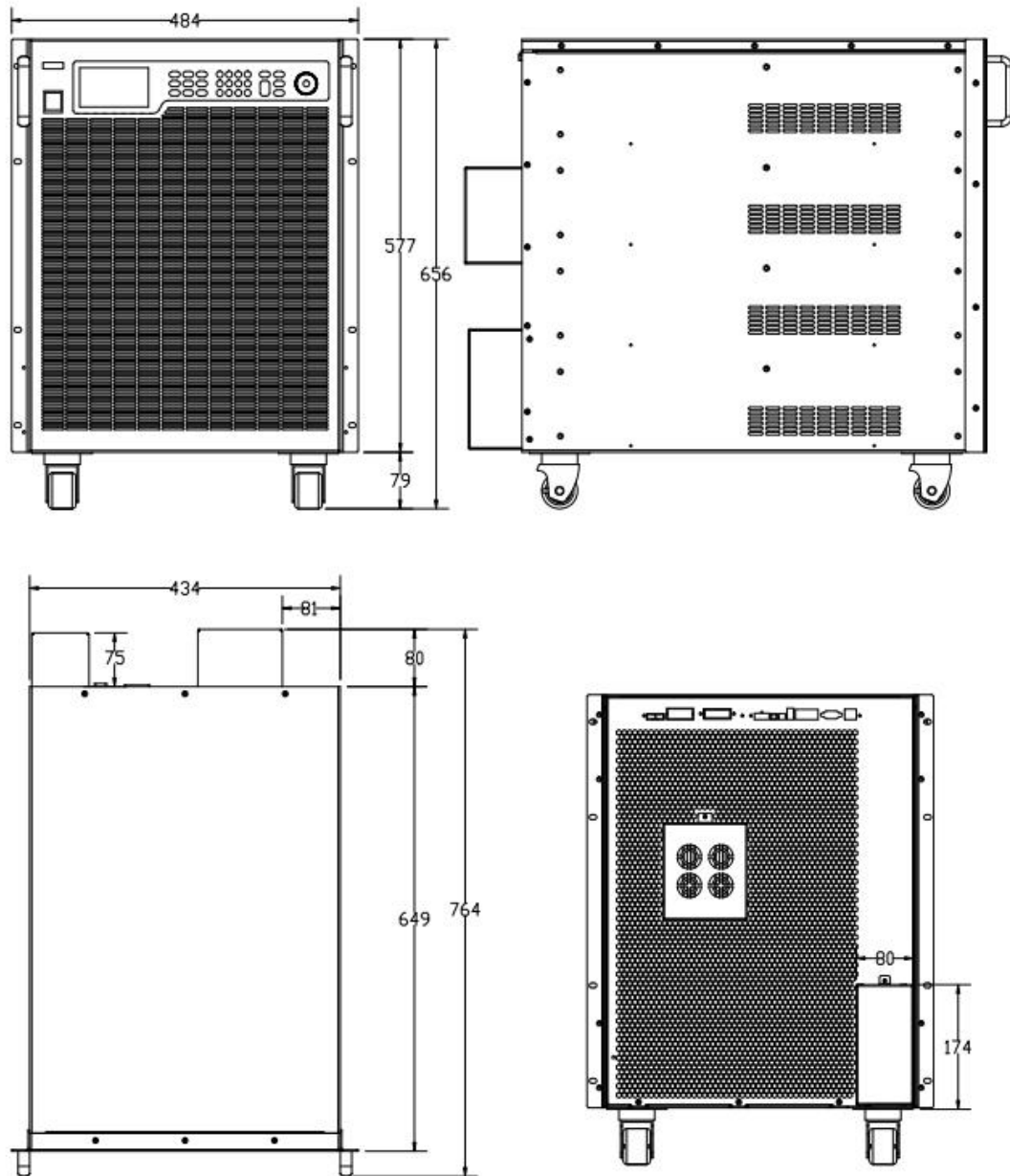


Figure 1-5 35kW to 60kW model with four-layer case (40V to 1500V output voltage)

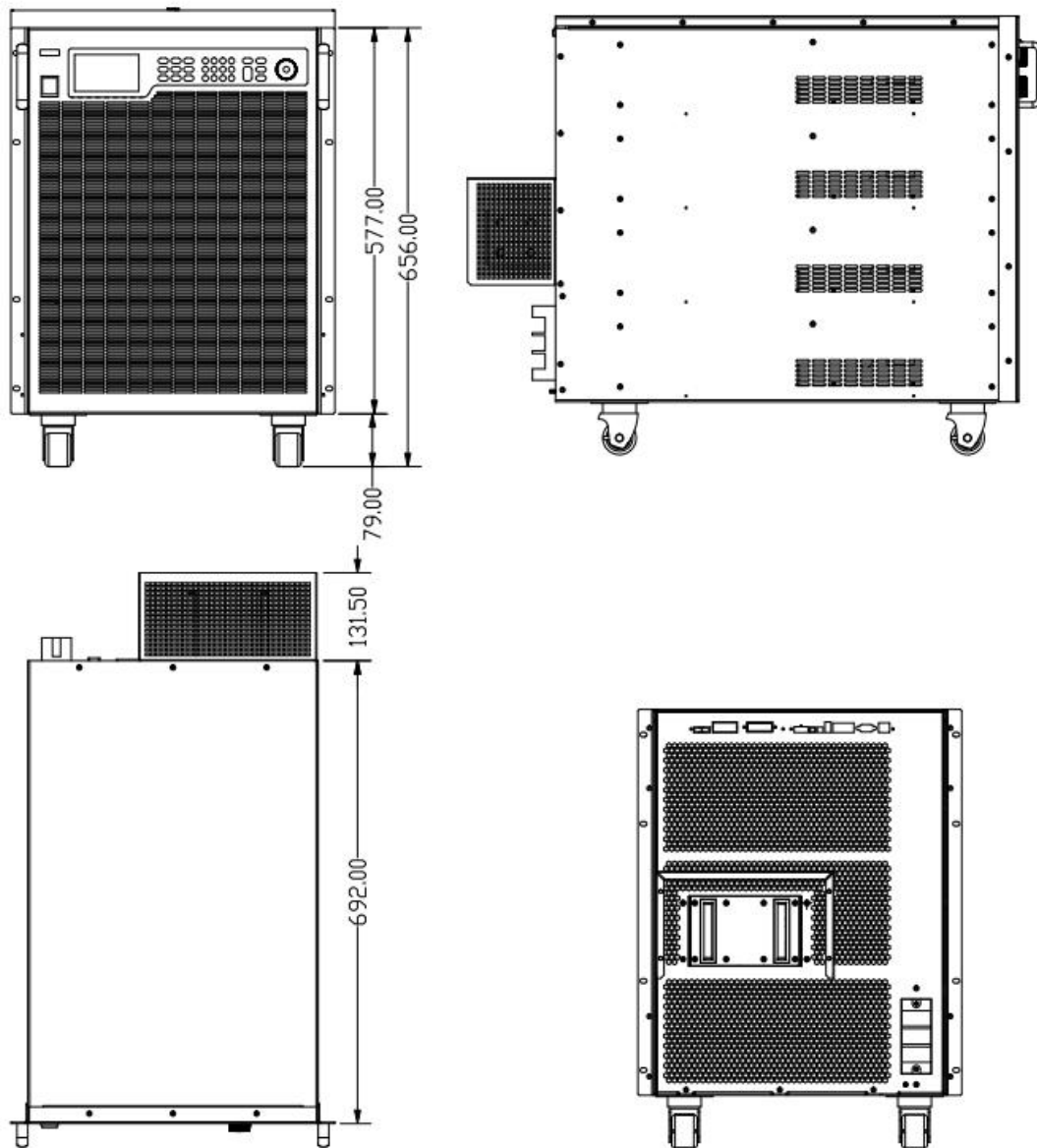
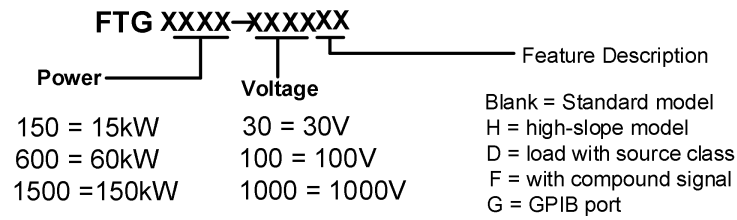


Figure 1-6 28kW to 60kW model with four-tier case (10V to 30V output voltage)

1.4. Model name



1.5. Specification

Table 1-1 FTG Series power supply specification Table 1

Model	FTG040-010	FTG045-015	FTG050-020	FTG050-030	FTG050-040	FTG050-050	FTG050-060	FTG050-100	FTG050-160
Output voltage	0~10V	0~15V	0~20V	0~30V	0~40V	0~50V	0~60V	0~100V	0~160V
Output current	0~400A	0~300A	0~250A	0~167A	0~125A	0~100A	0~83.5A	0~50A	0~31.5A
Output power	4kW	4.5kW	5kW						
Model	FTG080-010	FTG090-015	FTG100-020	FTG100-030	FTG100-040	FTG100-050	FTG100-060	FTG100-100	FTG100-160
Output voltage	0~10V	0~15V	0~20V	0~30V	0~40V	0~50V	0~60V	0~100V	0~160V
Output current	0~800A	0~600A	0~500A	0~334A	0~250A	0~200A	0~167A	0~100A	0~62.5A
Output power	8kW	9kW	10kW						
Model	FTG120-010	FTG135-015	FTG150-020	FTG150-030	FTG150-040	FTG150-050	FTG150-060	FTG150-100	FTG150-160
Output voltage	0~10V	0~15V	0~20V	0~30V	0~40V	0~50V	0~60V	0~100V	0~160V
Output current	0~1200A	0~900A	0~750A	0~500A	0~375A	0~300A	0~250A	0~150A	0~94A
Output power	12kW	13.5kW	15kW						
Model	FTG240-010	FTG270-015	FTG300-020	FTG300-030	FTG300-040	FTG300-050	FTG300-060	FTG300-100	FTG300-160
Output voltage	0~10V	0~15V	0~20V	0~30V	0~40V	0~50V	0~60V	0~100V	0~160V
Output current	0~2400A	0~1800A	0~1500A	0~1000A	0~750A	0~600A	0~500A	0~300A	0~188A
Output power	24kW	27kW	30kW						
Model	FTG480-010	FTG540-015	FTG600-020	FTG600-030	FTG600-040	FTG600-050	FTG600-060	FTG600-100	FTG600-160
Output voltage	0~10V	0~15V	0~20V	0~30V	0~40V	0~50V	0~60V	0~100V	0~160V
Output current	0~4800A	0~3600A	0~3000A	0~2000A	0~1500A	0~1200A	0~1000A	0~600A	0~375A
Output power	48kW	54kW	60kW						
Model	◆	◆	◆	◆	FTG1200-040	FTG1200-050	FTG1200-060	FTG1200-100	FTG1200-160
Output voltage	◆	◆	◆	◆	0~40V	0~50V	0~60V	0~100V	0~160V
Output current	◆	◆	◆	◆	0~3000A	0~2400A	0~2000A	0~1200A	0~750A
Output power	◆	◆	◆	◆	120kW				
Model	◆	◆	◆	◆	◆	◆	FTG1500-060	FTG1500-100	FTG1500-160
Output voltage	◆	◆	◆	◆	◆	◆	0~60V	0~100V	0~160V
Output current	◆	◆	◆	◆	◆	◆	0~2500A	0~1500A	0~940A
Output power	◆	◆	◆	◆	◆	◆	150kW		
Model	◆	◆	◆	◆	◆	◆	◆	FTG2100-	FTG2100-

								100	160
Output voltage	◆	◆	◆	◆	◆	◆	◆	0~100V	0~160V
Output current	◆	◆	◆	◆	◆	◆	◆	0~2100A	0~1313A
Output power	◆	◆	◆	◆	◆	◆	◆	210kW	
Voltage output ripple ⑥									
V(p-p)	55mV	60mV	60mV	65mV	75mV	75mV	115mV	135mV	175mV
V(rms)	20mV	20mV	20mV	20mV	20mV	20mV	25mV	25mV	25mV
Voltage programming									
resolution	16Bits								
precision	0.05%F.S.								
Current programming									
resolution	16Bits								
precision	0.1%+0.1%F.S.								
External simulating programming									
control voltage	0~5V or 0~10V corresponds to 0~100%F.S.								
Voltage accuracy ①	0.2%F.S.								
Current accuracy ①	0.5%F.S.								
Outputprecision	0.5%F.S.								
Rate of linear adjustment ⑥									
Volatage	0.05%F.S.				0.01%F.S.				
Current	0.05%F.S.								
Load adjustment rate ⑥									
Volatage	0.05%F.S.				0.02%F.S.				
Current	0.1%F.S.								
Voltage measurement									
resolution	16Bits								
precision	0.05%F.S.								
Current measurement									
resolution	16Bits								
precision	0.1%+0.2%F.S.		0.1%+0.1%F.S.						
OVP setting									
Range	0~110%F.S.								
Precision accuracy	1%F.S.								
transient response time	The typical value is 1ms, the load changes by 50%, and the time required for the voltage to recover to 0.75% of the set value								
efficiency	0.87 (Typical)								
Voltage	20PPM/℃								
Voltage	40PPM/℃								

Communication interface	RS232 and LAN
INPUT	Three-phase input ,340VAC~420VAC,frequency 47Hz~63Hz
Working	0℃~40℃
Storage	-20℃~70℃
Altitude	<2000m
size WxHxD	(≤15kW) - 482.6mm x 132.0mm x 694.5mm; (20kW ~30kW) - 482.6mm* 265.9mm x 694.5mm ; (35kW~60kW) – 482.6mm x 656mm x 710.5mm ; >60kW – adopt 600mm x XXXmm x 800mmStandard cabinet
WEIGHT	18.5kg/5kW;25kg/10kW;31.5kg/15kW;62kg/30kW;123kg/60kW; Other models will be subject to actual weight

Table1-2 FTG Series power supply specifications Table 2

Model	FTG050-250	FTG050-300	FTG050-400	FTG050-500	FTG050-600	FTG050-800	FTG050-1000	FTG050-1200	FTG050-1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~20A	0~17A	0~12.5A	0~10A	0~8.5A	0~6.5A	0~5A	0~4A	0~3.5A
Output power	5kW								
Model	FTG100-250	FTG100-300	FTG100-400	FTG100-500	FTG100-600	FTG100-800	FTG100-1000	FTG100-1200	FTG100-1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~40A	0~33.5A	0~25A	0~20A	0~17A	0~12.5A	0~10A	0~8.5A	0~7A
Output power	10kW								
Model	FTG150-250	FTG150-300	FTG150-400	FTG150-500	FTG150-600	FTG150-800	FTG150-1000	FTG150-1200	FTG150-1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~60A	0~50A	0~37.5A	0~30A	0~25A	0~19A	0~15A	0~12.5A	0~10A
Output power	15kW								
Model	FTG300-250	FTG300-300	FTG300-400	FTG300-500	FTG300-600	FTG300-800	FTG300-1000	FTG300-1200	FTG300-1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~120A	0~100A	0~75A	0~60A	0~50A	0~37.5A	0~30A	0~25A	0~20A
Output power	30kW								
Model	FTG600-250	FTG600-300	FTG600-400	FTG600-500	FTG600-600	FTG600-800	FTG600-1000	FTG600-1200	FTG600-1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~240A	0~200A	0~150A	0~120A	0~100A	0~75A	0~60A	0~50A	0~40A
Output power	60kW								
Model	FTG1200-250	FTG1200-300	FTG1200-400	FTG1200-500	FTG1200-600	FTG1200-800	FTG1200-1000	FTG1200-1200	FTG1200-1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~480A	0~400A	0~300A	0~240A	0~200A	0~150A	0~120A	0~100A	0~80A
Output power	120kW								
Model	FTG2100-	FTG2100-	FTG2100-	FTG2100-	FTG2100-	FTG2100-	FTG2100-	FTG2100-	FTG2100-

	250	300	400	500	600	800	1000	1200	1500
Output voltage	0~250V	0~300V	0~400V	0~500V	0~600V	0~800V	0~1000V	0~1200V	0~1500V
Output current	0~840A	0~700A	0~525A	0~420A	0~350A	0~262A	0~210A	0~175A	0~140A
Output power	210kW								
Voltage output ripple®									
V(p-p)	185mV	200mV	300mV	350mV	350mV	500mV	650mV	750mV	850mV
V(rms)	35mV	40mV	50mV	50mV	60mV	80mV	100mV	120mV	140mV
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 corresponds to 0~100%F.S.								
Voltage accuracy	0.2%F.S.								
Current accuracy	0.5%F.S.								
Output accuracy	0.5%F.S.								
Linear adjustment rate									
voltage	0.01%F.S.								
current	0.05%F.S.								
Load adjustment rate®									
voltage	0.02%F.S.								
current	0.1%F.S.								
Voltage measurement									
resolution	16Bits								
Accuracy	0.05%F.S.								
Current measurement									
resolution	16Bits								
Accuracy	0.1%+0.1%F.S.								
OVP setting									
scope	0~110%F.S.								
precision	1%F.S.								
Transient response time	The typical value is 1ms, the load changes by 50%, and the time required for the voltage to recover to 0.75% of the set value								
efficiency	0.87 (Typical)								
Voltage temperature	20PPM/℃								

drift	
Voltage temperature drift	40PPM/°C
cascade	A maximum of 5 power supplies can be connected in parallel, and can be controlled and echoed simultaneously through a shared bus
Communication interface	Standard RS232 and LAN, optional CAN, RS485, GPIB
input	Three-phase input, 340VAC~420VAC, frequency 47Hz~63Hz
Working temperature	0°C~40°C
Storage temperature	-20°C~70°C
altitude	<2000m
SIZE WxHxD	(≤15kW) - 482.6mm x 132.0mm x 694.5mm; (20kW ~30kW) - 482.6mm* 265.9mm x 694.5mm ; (35kW~60kW) – 482.6mm x 656mm x 710.5mm ; >60kW – adopt 600mm x XXXmm x 800mmStandard cabinet
Weight	18.5kg/5kW;25kg/10kW;31.5kg/15kW;62kg/30kW;123kg/60kW;Other models are subject to actual weight

Table1-3 FTG Series power supply current high slope specification Table 3

Model	FTG040-010H	FTG045-015H	FTG050-020H	FTG050-030H
Output voltage	0~10V	0~15V	0~20V	0~30V
Output current	0~400A	0~300A	0~250A	0~167A
Output power	4kW	4.5kW	5kW	5kW
Model	FTG080-010H	FTG090-015H	FTG100-020H	FTG100-030H
Output voltage	0~10V	0~15V	0~20V	0~30V
Output current	0~800A	0~600A	0~500A	0~334A
Output power	8kW	9kW	10kW	10kW
Model	FTG120-010H	FTG135-015H	FTG150-020H	FTG150-030H
Output voltage	0~10V	0~15V	0~20V	0~30V
Output current	0~1200A	0~900A	0~750A	0~500A
Output power	12kW	13.5kW	15kW	15kW
Model	FTG240-010H	FTG270-015H	FTG300-020H	FTG300-030H
Output voltage	0~10V	0~15V	0~20V	0~30V
Output current	0~2400A	0~1800A	0~1500A	0~1000A
Output power	24kW	27kW	30kW	30kW
Model	FTG480-010H	FTG540-015H	FTG600-020H	FTG600-030H
Output voltage	0~10V	0~15V	0~20V	0~30V
Output current	0~4800A	0~3600A	0~3000A	0~2000A
Output power	48kW	54kW	60kW	60kW

Voltage slope	0.001V/ms - 5V/ms			
Current slope	0.001A/ms - 150A/ms			
Voltage output ripple④				
V(p-p)	55mV	60mV	60mV	65mV
V(rms)	20mV	20mV	20mV	20mV
Voltage programming				
resolution	16Bits			
Current accuracy	0.05%F.S.			
Current programming				
resolution	16Bits			
accuracy ^①	0.1%+0.2%F.S.			
External analog programming				
control voltage	0~5V or 0~10V corresponds to 0~100%F.S.			
Voltage accuracy	0.2%F.S.			
Current accuracy	0.5%F.S.			
Output accuracy	0.5%F.S.			
Rate of linear adjustment [®]				
VOLTAGE	0.05%F.S.			
CURRENT	0.05%F.S.			
Load adjustment rate [®]				
VOLTAGE	0.05%F.S.			
Current	0.1%F.S.			
Voltage measurement				
Resolution	16Bits			
Accuracy	0.05%F.S.			
Current measurement				
Resolution	16Bits			
Accuracy	0.1%+0.2%F.S.			
OVP setting				
RANGE	0~110%F.S.			
Accuracy	1%			
The transient response time	The typical value is 1ms, the load changes by 50%, and the time required for the voltage to recover to 0.75% of the set value			
efficiency	0.87 (Typical)			
Voltage temperature drift	20ppm/°C			
Current temperature drift	40ppm/°C			
cascade	A maximum of 5 power supplies can be connected in parallel, and can be controlled and echoed simultaneously through a shared bus			
Communication interface	Standard RS232 and LAN, optional CAN, RS485, GPIB			

Input	Three-phase input ,340VAC~420VAC,frequency 47Hz~63Hz
Working temperature	0℃~40℃
Storage temperature	-20℃~70℃
altitude	<2000m
Size (mm)	(≤15kW) - 482.6mm x 132.0mm x 694.5mm; (20kW ~30kW) - 482.6mm* 265.9mm x 694.5mm ; (35kW~60kW) – 482.6mm x 656mm x 710.5mm
weight	18.5kg/5kW;25kg/10kW;31.5kg/15kW;62kg/30kW;123kg/60kW

Table1-4 FTG Series supply voltage high slope specification Table 4

Model		FTG050-600H	FTG050-1000H
Output voltage		0~600V	0~1000V
Output current		0~8.5A	0~5A
Output power		5kW	5kW
model		FTG100-600H	FTG100-1000H
Output voltage		0~600V	0~1000V
Output current		0~17A	0~10A
Output power		10kW	10kW
Model		FTG150-600H	FTG150-1000H
Output voltage		0~600V	0~1000V
Output current		0~25A	0~15A
Output power		15kW	15kW
Model		FTG300-600H	FTG300-1000H
Output voltage		0~600V	0~1000V
Output current		0~50A	0~30A
Output power		30kW	30kW
Model		FTG600-600H	FTG600-1000H
Output voltage		0~600V	0~1000V
Output current		0~100A	0~60A
Output power		60kW	60kW
Rise time	50%F.S. CC Load	30ms	25ms
	No Load	30ms	25ms
Fall time	50%F.S. CC Load	30ms	25ms
	10%F.S. CC Load	100ms	80ms
	No Load	1.2s	3s

Voltage slope		0.001V/ms - 20V/ms	0.001V/ms - 40V/ms
Current slope		0.001A/ms - 2A/ms	0.001A/ms - 2A/ms
Voltage output ripple			
V(p-p)		1500mV	2550mV
V(rms)		650mV	1950mV
Voltage programming			
Resolution		16Bits	
Precision 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.		
Output accuracy	0.5%F.S.		
Linear adjustment rate®			
Voltage		0.01%F.S.	
Current		0.05%F.S.	
Load adjustment rate®			
Voltage		0.02%F.S.	
Current		0.1%F.S.	
Voltage measurement			
Resolution		16Bits	
Precision Accuracy		0.05%F.S.	
Current measurement			
Resolution		16Bits	
Precision Accuracy		0.1%+0.1%F.S.	
OVP setting			
Range		0~110%F.S.	
Precision Accuracy		1%	
Transient response time		The typical value is 1ms, the load changes by 50%, and the time required for the voltage to recover to 0.75% of the set value	
Efficiency		0.87 (Typical)	
Voltage temperature drift		20ppm/℃	
Current temperature drift		40ppm/℃	
Cascade		A maximum of 5 power supplies can be connected in parallel, and can be controlled and echoed simultaneously through a shared bus	
Communication interface		Standard RS232 and LAN,Optional CAN、RS485、GPIB	
Input		three-phase input,340VAC~420VAC,frequency 47Hz~63Hz	
Working temperature		0℃~40℃	

Storage temperature	-20℃~70℃
Altitude	<2000m
Size (mm)	(≤15kW) - 482.6mm x 132.0mm x 694.5mm; (20kW~30kW) - 482.6mm* 265.9mm x 694.5mm ; (35kW~60kW) – 482.6mm x 656mm x 710.5mm
Weight	18.5kg/5kW;25kg/10kW;31.5kg/15kW;62kg/30kW;123kg/60kW

Note:

- (1) Accuracy measurement 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 connected with 10uF electrolytic capacitor +0.1uF ceramic capacitor.

2. Quick Start

2.1. Inspection

After receiving the power supply, perform the following steps to check the device:

- Check if any damage in transit

If the packing case or protective pad is seriously damaged, please contact our authorized distributor or after-sales service department immediately.

Note: Do not send the equipment back without receiving a positive response.

- Check the attachment

Confirm that you receive the following attachments along with the equipment :

Form 2- 1 The attachment shows

Attachment	Quantity	instruction
Shield	1 set	Input and output protection
2PIN 3.81mm terminal	1pcs	Voltage remote compensation terminal
RS232 Serial port cable	1pcs	CONNECT PC-RS232
LAN connection cable	1pcs	CONNECT PC-LAN
User manual	1pcs	Includes installation and operation information
CD	1pcs	Software and technical information
Certificate of approval	1pcs	Certificate of product inspection

If there is any loss or damage, please contact our authorized distributor or after-sales service department immediately.

■Check the machine

If the case is damaged or works abnormally, contact the authorized distributor or after-sales service department of the company immediately.

■Clean

If you need to clean the shell of the machine, please use a dry cloth or a slightly wet cloth to wipe gently, do not wipe the inside of the machine.

 **Warning: Disconnect the power supply before cleaning!**

2.2. Introduction to the Front Panel

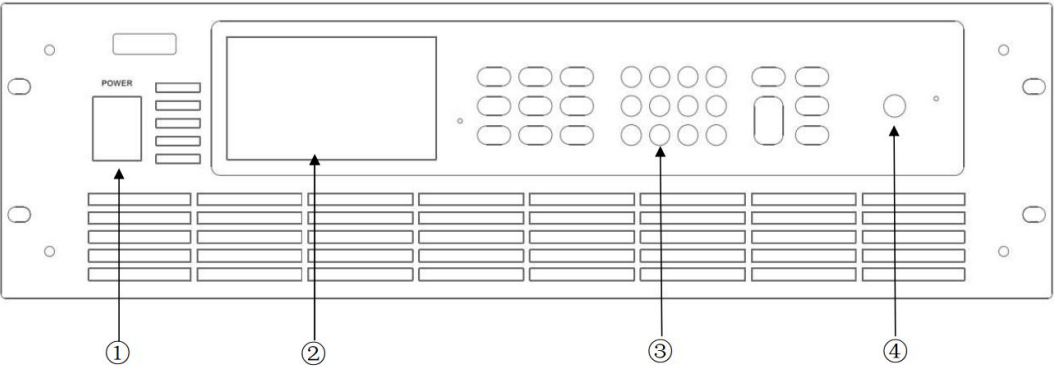


Figure 2- 1 FTG Front panel

- ①Power switch
- ② TFT Color display screen
- ③Function and digital keys
- ④knob

2.3. Keyboard introduction

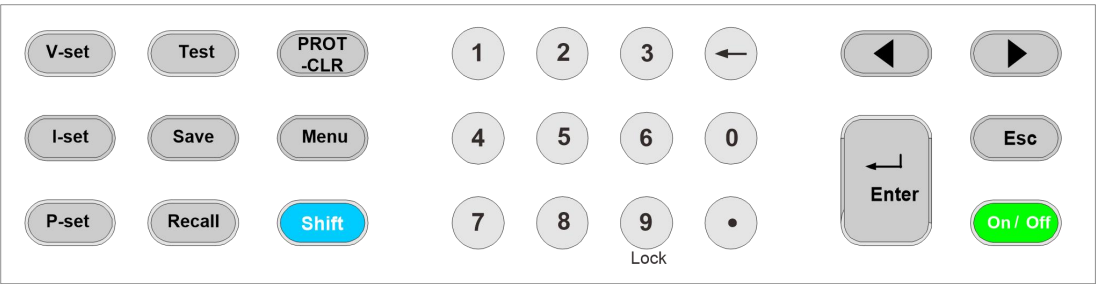
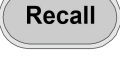
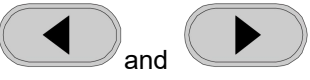
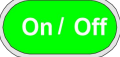


Figure 2- 2 FTG button

Basic key function

Form 2- 2Key function table

Project	symbol	instruction
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 keys
5		Save the current function parameters to a file
6		Calls function parameters saved 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 button
10		Number key and decimal point key
11		Digital clear key
12		Used to move or select Settings from menu items. These two keys are used to move the cursor between digits when setting parameters
13		Used to enter Settings or to confirm input and exit Settings
14		Used to exit a setting item or menu
15		Turn on or off the power output

Composite function key

When used in combination with Shift key, the logo function below the key is realized. The

detailed function is shown in the following table.

Form2- 3 **Composite function key**

item	symbol	Functional instruction
1	 +  Lock	Used to lock and unlock keyboard functions 。 After keyboard is locked,except for  ,  , . Other key and knob operations are invalid and "Keyboard lock" is displayed on the screen

2.4. Screen introduction

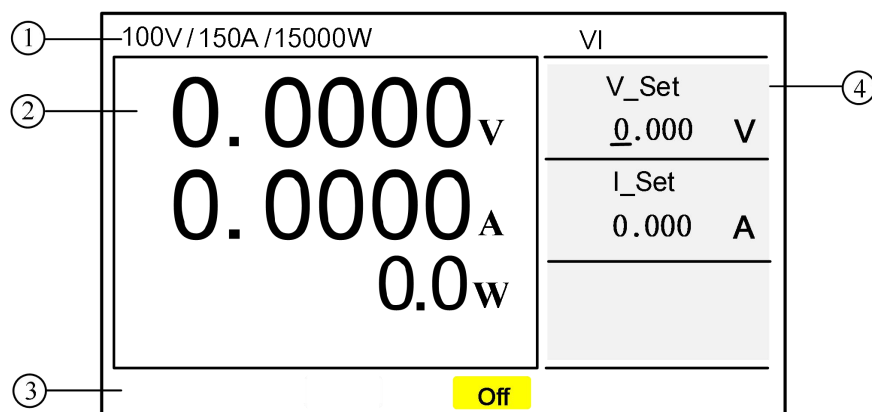


Figure 2- 3 Main screen

- ①Spec parameter display area
- ②voltage and current Output area
- ③Status notification area
- ④Function Parameter setting area

Spec parameters display area Introduction

Display the output voltage, current, and power range

Voltage and current parameters display area Introduction

Spec & parameters Display area is used to display the sampled voltage, current, power, and measurement results. The output parameters will be different in different functions, ,For example, in the V.I.P stationary function, voltage, current, and power are displayed, while in the SEQ function, voltage, current, number of sequence runs, and step numbers of sequence runs are displayed.

Status notification area Introduction

- External programming: $\frac{1}{T}$ (U、I、U+I、 P)
- Protection indication: OVP、 OCP、 OPP、 OTP、 SHUT、 FAULT、 LVP、 OP、 OC、 OV、 RVP

- Output mode: CV、CC、CP、Off
- Operation Tips

Function¶meters setting areas Introduction

Set test parameters in this area

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



2. Press  to enter the parameter editing mode
3. Press a number key or the scroll button to enter a value



4. Press  to make the entered value effective and exit the editing state.

2.5. Rear Panel Introduction

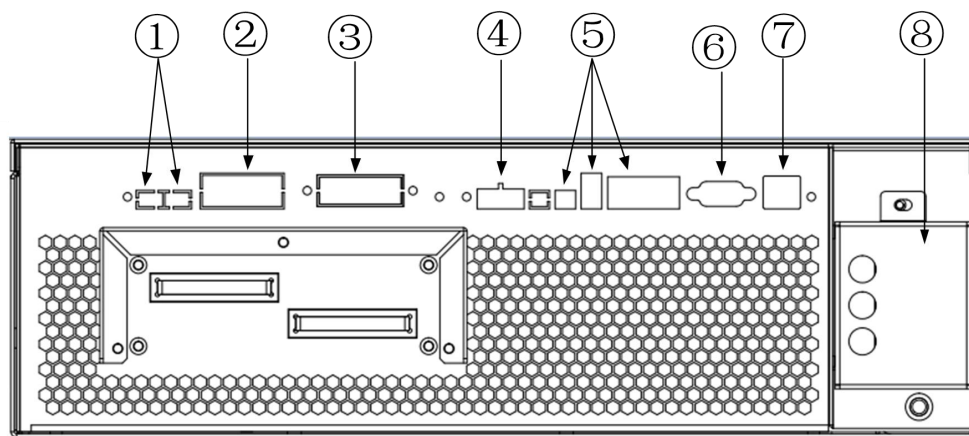


Figure 2- 4 FTG Rear Panel

- | | |
|--|--|
| ① CAN、RS485 Communication port | ⑥ RS232 Communications port |
| ② PRO-INT Composite signal port | ⑦ LAN |
| ③ GPIB Communication port | ⑧ L1、L2、L3、PE Three-phase power input port |
| ④ V Sense Voltage remote sampling port | |
| ⑤ Parallel Master/slave parallel port | |

2.6. Installation

2.6.1. Ventilation and heat dissipation

The power supply is dissipated by fans. When installing the power supply, ensure that the upper and surrounding parts of the power supply are at least 20 centimeters apart from other objects to facilitate air circulation

2.6.2. Input requirements

FTG series power input connection, Note the following:

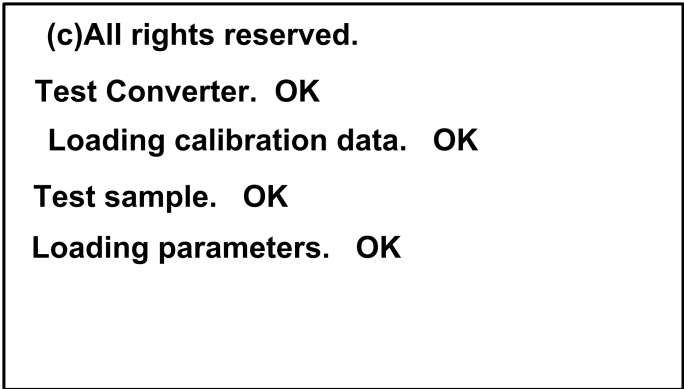
Three-phase input: 340VAC~460VAC, 47~63Hz;

- ①. Ensure reliable grounding
- ②. Connect to L1, L2, L3, and ground terminals
- ③. For details about the input cable diameter, see Table 6-1 Recommended Cable diameters to avoid potential security risks.

 **Warning: Before operation, ensure that the grounding terminal of the power supply is properly grounded.**

2.6.3. Startup & self-test

After power-on, the power supply first performs the self-test program, and the screen will display the self-test process and self-test results, as shown in the picture below.



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

Figure 2- 5 Power self-test screen

During the self-test, the screen will display the self-test items and results. If all checking items are OK, enter the application screen immediately. Otherwise, wait 5 seconds before entering the application screen.

Note: self-test faults description, see "Table 5-2 Self-check Table for Startup Faults".

2.7. Connection mode

2.7.1. Input connection

Connect the three-phase and ground cables to the power input terminals as shown in Figure 2-6. For details, see Table 6-1 Recommended Cable Diameters.

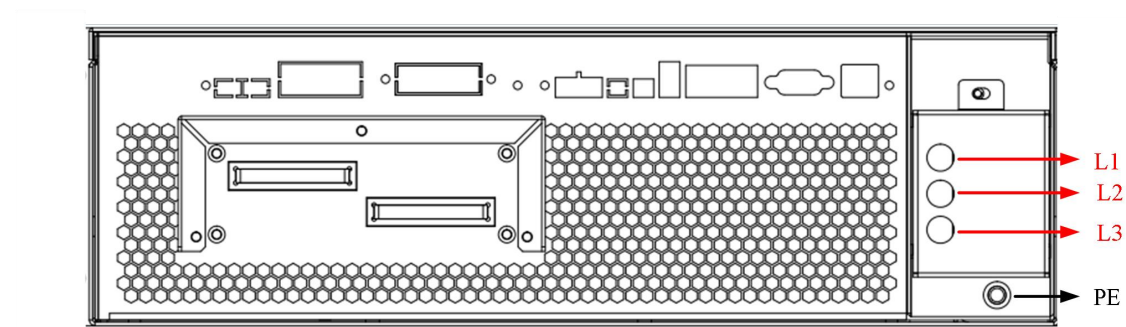


Figure 2- 6 Power input connection

 **Warning:** Before operation, ensure that the power grounding terminal is properly grounded

2.7.2. Output connection

The output connection is connected to the device under test by the + and - ends of the power supply rear panel. When connecting the cables, pay attention to the diameter, length, and polarity of the output cables. To avoid test accuracy and safety accidents caused by large heat generation, a small cable diameter can be selected by referring to Table 6-1 Recommended Cable Diameters.

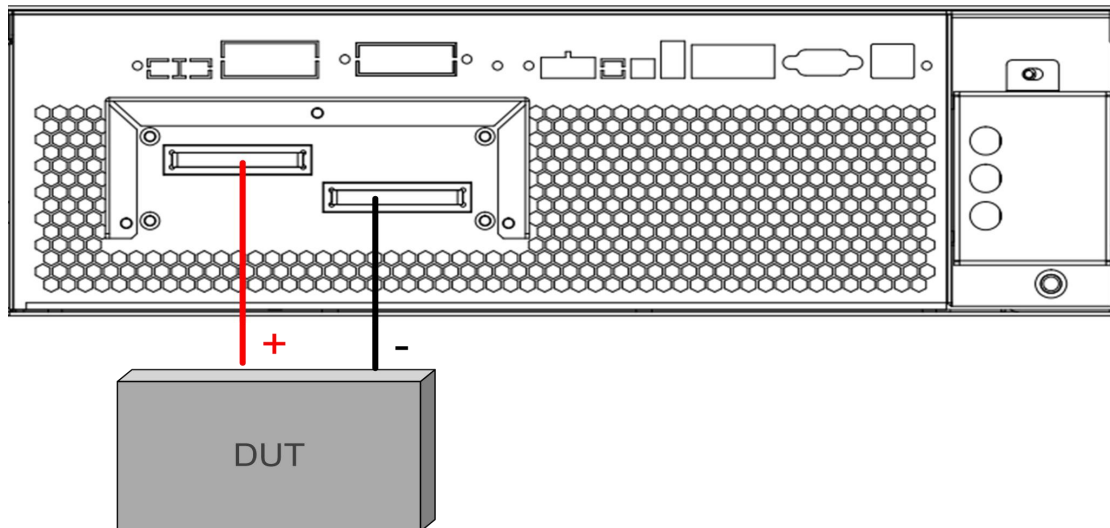


Figure 2- 7 Power output connection

2.7.3. Voltage compensation connection

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

Automatic line loss compensation capability to compensate for voltage drops caused by cables and contact resistors.

Use the "V-SENSE" voltage compensation sampling terminal on the rear panel to connect the positive and negative terminals to the positive and negative terminals to be compensated. The voltage difference between this point and the power output port will be automatically compensated during power output. "Sense" is displayed in the status bar of the main interface.

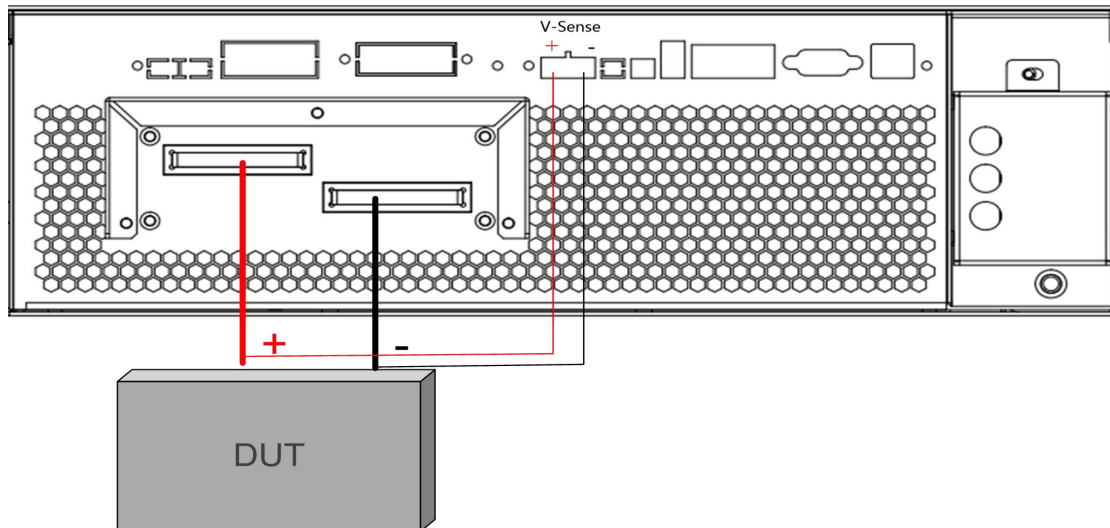


Figure 2- 8 Voltage compensated connection

Note:

1. The voltage compensation wire can be made of red and black $0.5\text{mm}^2 \sim 1\text{mm}^2$ cross-sectional area wire, and as far as possible to its twisted pair.

2. FTG series 10V power supply model compensation voltage drop less than 1.5V, other models less than 5V.

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

2.7.4. Composite signal port

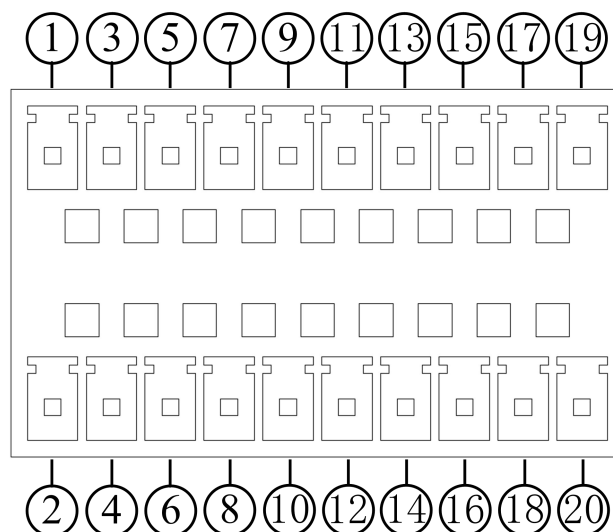


Figure 2- 9 Voltage compensated connection

The rear panel of the power supply can be configured with a composite signal terminal "Programming" for connecting simulating monitoring signals, trigger input signals, and status output indicator signals.

Form 2- 1 Compound signal function description :

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

			reserved
15	READY	Output	Power status indicates output。
17	INHIBIT	Input	External control ,can be used as 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 functions and features of the power supply. Read this chapter, you will have a deeper understanding of FTG series power supply

3.1. Local/Remote operation mode

The power supply provides two operation modes: local operation and remote operation. In local operation mode, users can operate through the keyboard and knob on the front panel, and check the power status through the LCD screen. In remote operation mode, the user performs Settings and operations mainly through the communication interface and programming commands provided by the power supply.

Local Operation Mode

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

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

- system language
- Serial port baud rate and parity mode
- Keyboard sound
- IP address and subnet mask
- Communication protocol selection

Remote operation mode

To enter remote mode, connect the PC to the power supply using the correct communication cable. The communication configuration parameters must be consistent with those of the control device. Upon receiving the programming command, the power supply automatically enters the remote operation mode from the local control mode.

In remote control mode, the power supply can be controlled only by programming commands.



To return to local mode, press  key,

3.2. Menu configuration

3.2.1. Set item Setting



Press the  key to enter the menu setting interface, select "Set" item, press



the  key to pop up the sub-menu. The following table:

Table 3- 1 Set item menu

App Set	SampRate	Sampling transmission rate setting, with 5 optional levels :1000Hz, 500Hz, 200Hz, 100Hz, 10Hz, default 1000Hz.
	Prio SLT	Voltage or current is preferred. Default: Volt (voltage first)
	VSlew-UP	Voltage rise slope configuration. Value range: 0.0006V/s to 6000V/s. Default: Maximum slope
	VSlew-DN	Voltage fall slope configuration. Value range: 0.0006V/s to 6000V/s. Default: Maximum slope
	ISlew-UP	Current rise slope configuration. Value range: 0.0001A/s to 2000A/s. Default: maximum slope
	ISlew-DN	Current fall slope configuration. Value range: 0.0001A/s to 2000A/s. Default: maximum slope
	Response	Output response speed setting. Setting range: 1%-100%, Default: 50%
	PV mode	Set the operation mode of PV mode, optional: Curve and Define
Protect	OVP	Set the OVP overvoltage protection point and set it to 0 to disable the protection
	OCP	Set the OCP overcurrent protection point and set it to 0 to disable the protection
	OPP	Set the OPP overpower protection point and set it to 0

		to disable the protection
	LVP	Set the LVP low voltage protection point to 0 to disable this protection
	Over time	Set the communication failure timeout period. The value ranges from 0.0 to 60.0s. Set this parameter to 0 to disable the protection
	OnTime	Set the load time, and the output is turned off when the setting point is reached. The value range is 0 to 999999s. The default value is 0
	Foldback	Turn OFF output when the output mode changes, set to OFF to turn off this function, default: OFF
	F-Time	Set mode to change the protection delay time, the setting range is 0.1S~600S
	PROT_Delay	
Limit	V_MAX	Limit stationary state sets the voltage upper limit. Default: Maximum output voltage
	V_MIN	Limit stationary state sets the voltage lower limit. Default: 0 is unrestricted
	I_MAX	Limit stationary state sets the current upper limit. Default: Maximum output current
	I_MIN	Limit stationary state sets the current lower limit. Default: 0 is unrestricted
Ext Prog	APG	Analog programming. Default: Off
	EXT-S	Set the behavior of the external input signal, Optional Trigger/Toggle/Hold; default: Trigger
Timing	Beg TRIG	Optional Volt、Curr
	Beg DIRE	Optional Rise、Fall
	Beg LEVL	Starting signal trigger threshold
	End TRIG	Optional Volt、Curr
	End DIRE	Optional Rise、Fall
	End LEVL	Ending signal trigger threshold
Parallel	M-or-S	Configure the local device as a master or slave

		device; Default: Master
	S.NUM	Configure the number of slave servers on the host. The value ranges from 1 to 9
	MS_CTRL	Enable parallel machine function; default:off

3.2.2. System Item menu

Press the  key to enter the menu setting interface, select "System" item, press

the  key to pop up the sub-menu. The following table:

Table 3- 2 system item menu

Communication	IP	IP address, default :192.168.1.123
	S-Mask	Subnet mask, default :255.255.255.0
	Baud	serial baud rate, optional:4800/9600/19200 /38400/115200,default: 9600。
	Parity	Optional None Parity, odd parity, and even parity. Default: None.
	DEVI-ADDR	Device address in the MODBUS frame. The value ranges from 1 to 247. Default: 160
	GPIB	GPIB address,The value ranges from 0 to 30. The default value is 5
	Protocol	Communication protocol, SCPI or MODBUS is optional. Default:the MODBUS
Factory	Restore factory Setting	To restore system parameters to factory Settings, restart the device for the Settings to take effect.
Others	Language	System language, it can be simplified Chinese, traditional Chinese, or English. The default: Simplified Chinese
	Sound	Keypad sound, enable or disable this function. The default:on
	Power save	enable or disable this function. The default:on
	Shortcut	enable or disable this function. The default:on

3.2.3. Edit Item menu

Press the  key to enter the menu setting interface, select "Edit" item, press the  key to pop up the submenu. Edit items are used to edit sequences. For details, see 3.13 Sequence Output Function (SEQ).

Table 3- 3 Edit item menu table

Sequence	SEQ file	sequence file, The value ranges from 1 to 10
Back	Back	Exit the Sequence file submenu

3.2.4 About menu

Press  to enter the menu setting screen. Select "About", and press  to display the version numbers and kernel versions of HMI, MAIN, and COMM programs.

3.3. Stationary output function

3.3.1. VI function

FTG series power supply: voltage and current output stably within rated power range, voltage and current setting range is 0 ~ 102% rated output.

Press  .  function key, and the power supply enters the VI steady state output function. The following page is displayed.

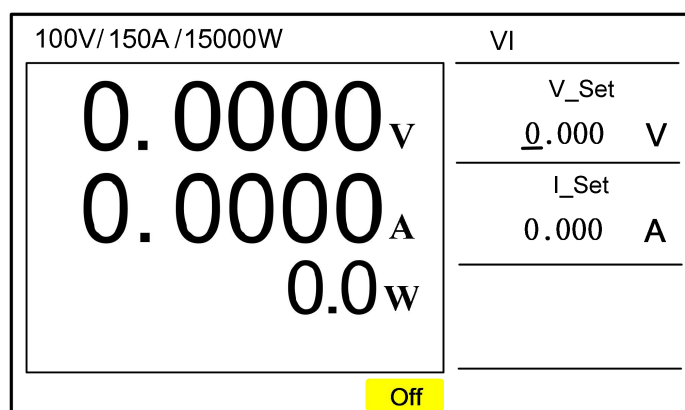
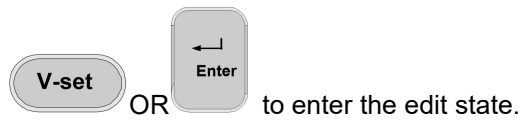


Figure 3- 1 VI Functional interface

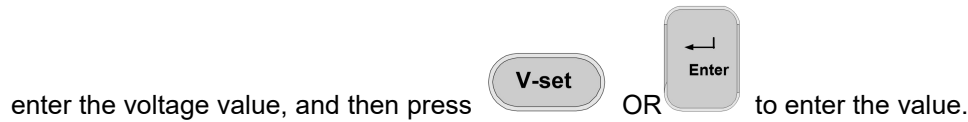
Voltage setting:

In the steady output function interface, press  key to enter the "voltage setting"

editing state. Users can also rotate the rotary knob to move the cursor to **V_Set** and press



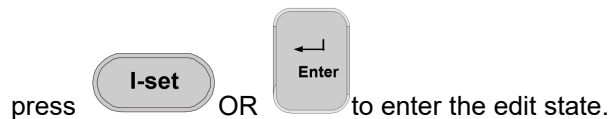
In the edit state, turn the knob to change the voltage value, or press the number key to



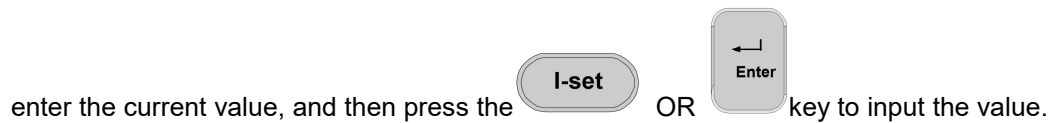
After the factory Settings are restored, the default voltage set value is 0V.

Current setting :

In the steady output function interface, press the **I-set** key to enter the editing state of "current Setting". Users can also turn the knob to move the cursor to Current Settings and



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



After the factory Settings are restored, the default current setting value is the maximum output current

3.3.2. Constant power function

Press the **P-set** key to enter the "constant power" function editing state. As following figure :

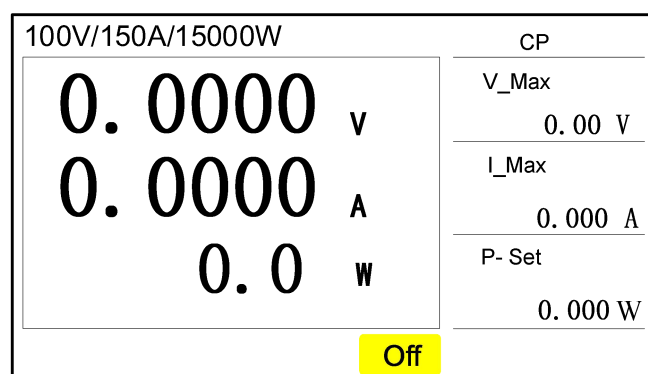


Figure 3- 2 Constant power function interface

The "constant power" function follows the following rules :

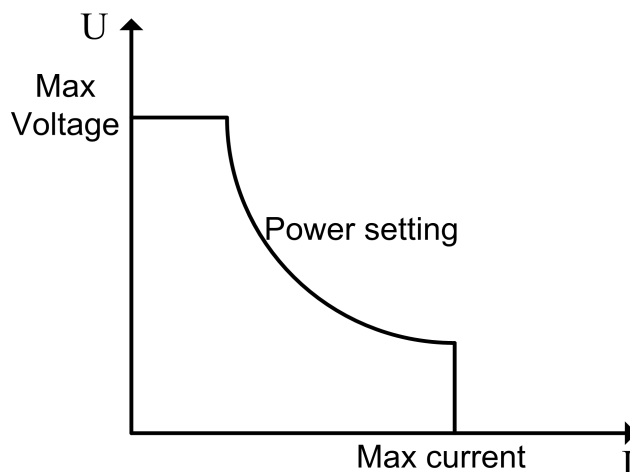


Figure 3- 3 Constant power output waveform

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

power" function, and then press the  key to enter the editing state.

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

enter the power value, and then press the  key to enter the value

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

After the factory Settings are restored, the default power setting value is 0W.

3.3.3. Output mode

FTG series power supply has three output modes: CV (constant voltage mode), CC (constant current mode), CP (constant power mode).

The output value of the power supply voltage is generally output according to the set value, and "CV" will be displayed in the status bar of the main interface. 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 CP (constant power mode). The output power can be changed by adjusting the set power value of the power supply. CP is displayed in the status bar.

3.3.4. Limit parameter Settings

1. The power supply provides the function of limiting voltage, current and power set points. When the upper and lower limits are set to non-0, the parameters of voltage, current and power under the stationary output function can be set within the upper and lower limits. If the input number exceeds the limit value range, the input out of range is invalid and the message "Input out of range" is displayed on the screen. This function has a good effect on preventing misoperations from damaging the user's device. If the upper limit is set to 0, the upper limit is cancelled.

1. Press the  key to enter the menu setting screen.

2. Choose "Set" -> "Limit " sub-menu, and press the  key to enter the output setting page, as shown in the picture below;

Set	System	Edit	About
V_MAX			0.000 V
V_MIN			0.000 V
I_MAX			0.000A
I_MIN			0.000 A

Figure 3- 4 Voltage, current upper and lower limits setting

2. Select "V_MAX"(Voltage upper limit), "V_MIN"(voltage lower limit), "I_MAX" (current upper limit) and "I_MIN" (current lower limit) to set.

3.4. Voltage slope and current slope

FTG series power supply supports voltage slope and current slope setting. 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.

1. Press  key to Enter the menu setting interface;

2. Select "Set" -> "App Set" sub-menu, press  key to Enter the application

Settings page, as shown below;

Set	System	Edit	About
SampRate	10Hz	Response	50%
Prio SLT	Volt		
VSlew-UP	6000.0	V/s	
VSlew_DN	6000.0	V/s	
ISlew_UP	2000.0	A/s	
ISlew_DN	2000.0	A/s	

Figure 3- 5 Voltage slew rate and current slew rate setting screen

3. Select "VSlew-UP"(voltage rise slew rate), "VSlew-DN"(voltage fall slew rate), "ISlew_UP"(current rise slew rate) and "ISlew_DN"(current fall slew rate) for setting.

The unit of voltage slew rate is V/s, and the unit of current slew rate is A/s.

3.5. CV/CC priority

FTG series power supplies have CV, CC, and CP output modes, which are sufficient to meet the general needs of the market. In the face of more stringent applications, to meet the special requirements of customers, FTG 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 turn-on. To avoid current or voltage spikes caused by capacitive or inductive loads.

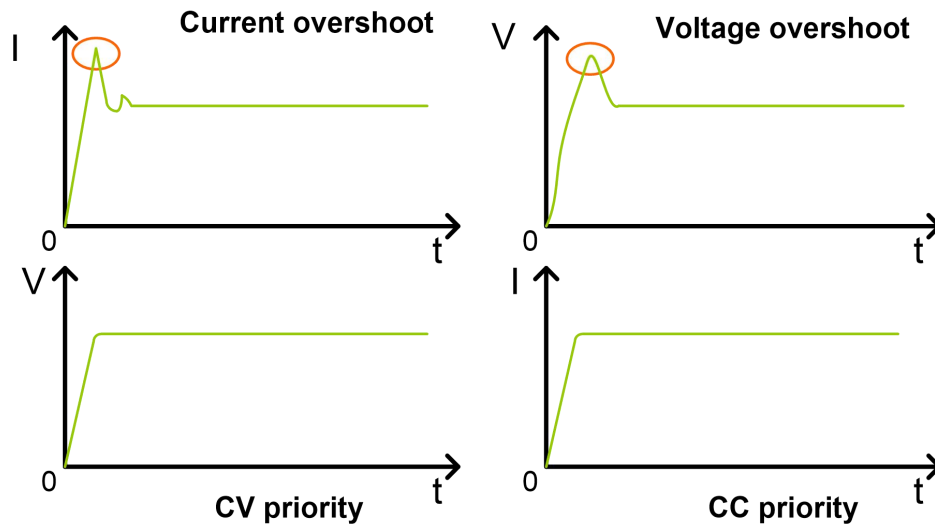


Figure 3- 6 CV priority and CC priority output voltage and current waveform

1. Press  key, Enter the menu setting interface;
2. Select "Set" -> "App Set" sub-menu, press  key to Enter the application Settings page, as shown below;

Set	System	Edit	About
SampRate	10Hz	Response	50%
Prio SLT	Volt		
VSlew-UP	6000.0	V/s	
VSlew_DN	6000.0	V/s	
ISlew_UP	2000.0	A/s	
Islew_DN	2000.0	A/s	

Figure 3- 7 CV and CC priority Settings screen

3. Select "Prio SLT" (Output priority) to set, "Volt" for voltage priority, "Curr" for current priority.

3.6. Output control

After the power supply is powered on, the output is off, and the output can be controlled by the key  on the front panel.

- The  key indicator light is on, indicating that the output is turned on, and the screen displays real-time voltage, current, power, mode and other information.
- The  key indicator light is Off, indicating that the output is off, and the screen shows the OFF state.

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. Introduction of external monitoring functions

3.7.1. External control functions

FTG composite signal port provides a trigger signal input port "Programming", below link:

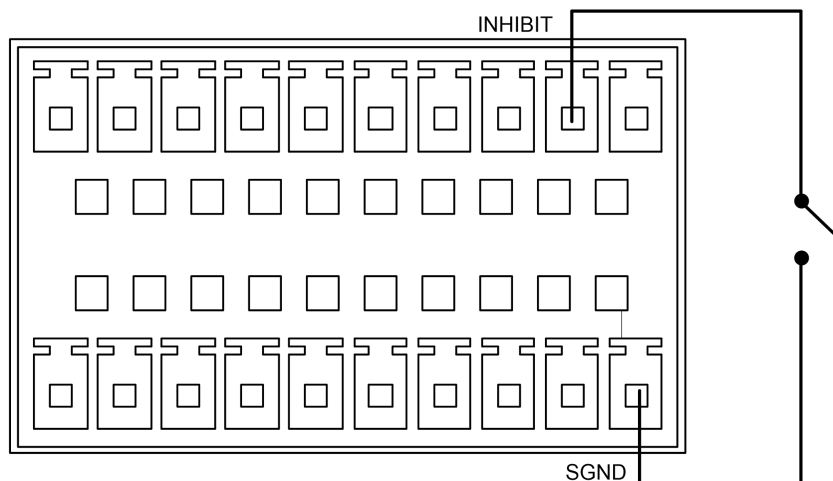
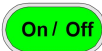


Figure 3- 8 External control wiring mode 1

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 for low level 0 v, disconnect or 5 v to high level. The response time of the port is about 20 milliseconds, which can be set to Trigger, Toggle and Hold.

- **Trigger:** It is used as a trigger signal by default. The input port detected an effective low level pulse, that is, received a trigger signal;
- **Toggle:** As a power output switch control signal. The input port detects an effective low level pulse, that is, switch the output switch once, which has the same function as pressing a key  on the front panel;
- **Hold:** As a 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.

Note: Keyboard control, external control and bus control take effect at the same time and work together.

Operation procedure

1. press  key, Enter the menu setting interface;
2. Select "Set" -> "Ext Prog" submenu,press  key to Enter the page of external programming, as shown in figure 3-9.。
3. Select "Ext-S"(external signal), press  key ,You can select "Trigger" or "Toggle" or "Hold".

Set	System	Edit	About
APG		Off	
Ext-S		Trigger	

Figure 3- 9 External programming interface

3.7.2. Emergency stop control function

FTG series power supply provides emergency stop control interface, can control power output shutdown. The connection mode is as follows:

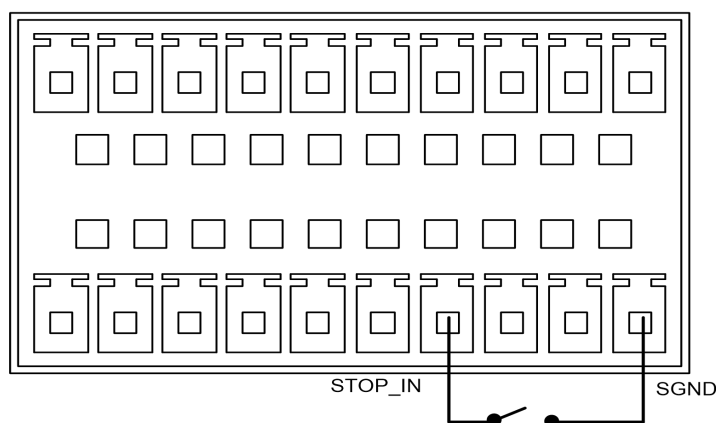


Figure 3- 10 Emergency stop switch connection mode

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 on and the button  can be used to clear "Stop", the power output is normal.

3.7.3. Analog 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, which is connected as shown below.

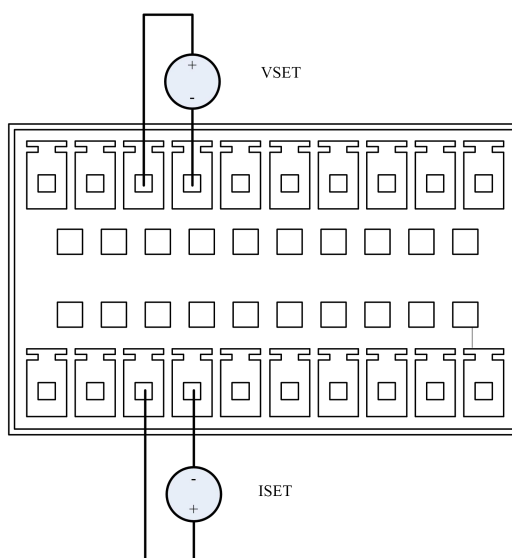


Figure 3- 11 Composite port simulation programming wiring mode

he analog programming function controls the rate at 1000 points per second. After it is turned on, the relationship between output voltage, current, power and programming input

signal is shown in the figure below.

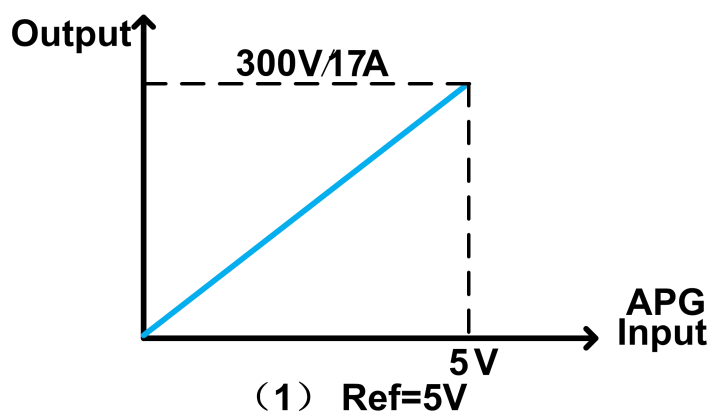


Figure 3- 12 Relationship between input programming signal and output

Operation steps :

1. Press the  key to enter the menu setting screen.

2. Choose "Set" -> "Ext Prog" sub-menu, and press the  key to enter the external programming page, as shown in the picture below;

Set	System	Edit	About
APG		Off	
Ext-S		Trigger	

Figure 3- 13 External programming setting interface

3. Select " U " (Voltage programming), " I " (Current programming) and " P " (power programming) in APG item to enable or disable the Settings; Three analog programming input

switches can be arbitrarily selected, after enable it, the main screen will prompt "  " .

4. Press the  key to start output.

Table 3- 1 Analog programming parameters

SELECT	PORT	description
Off	NO	Close the APG function

U	Signal port VSET+, VSET-	Turn on voltage programming control
I	Signal port ISET+, ISET-	Enable current programming control
U+I	VSET+、VSET-and 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 turned on

Note:

1. You are only allowed to change the Analog Programming setting when the output is turned off.

2. External simulation programming only determines the output related quantity by external signal when the corresponding function item is opened, otherwise the power output can still be controlled by man-machine interface or remote communication.

3.7.4. Voltage and current simulation monitoring function

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

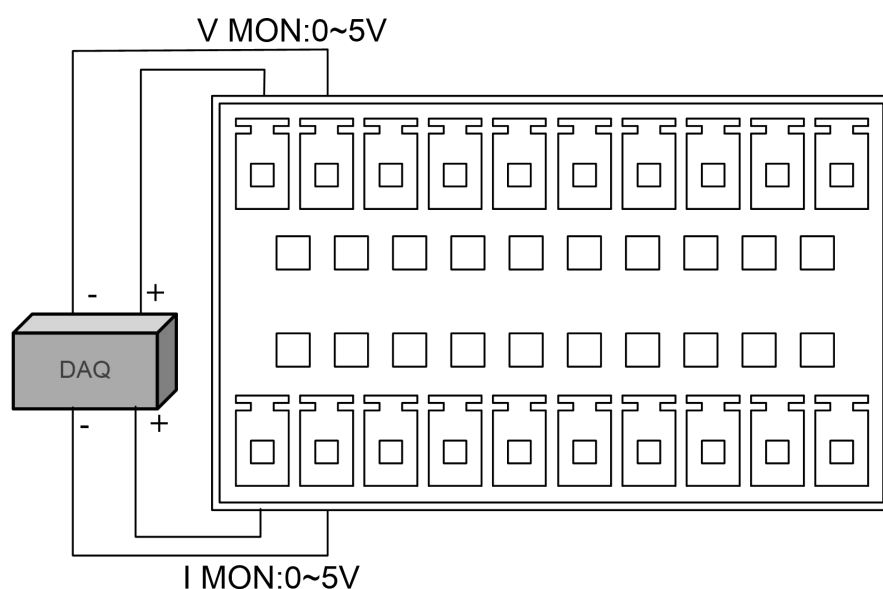


Figure 3- 14 Voltage and current analog monitoring connection

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

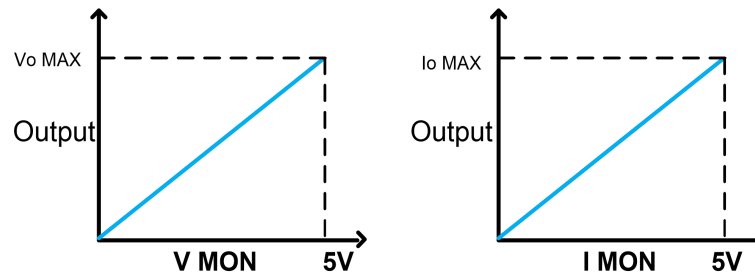


Figure 3- 15 Monitoring the output signal and the output voltage current relationship

3.8. Protection

FTG series of power supply has the following protection functions::

- Overvoltage protection
- Overcurrent protection
- Overpower protection
- Low voltage protection
- Output reverse connection warning
- Communication time out
- Over temperature protection
- Loading time

When the protection condition occurs, the power supply automatically shuts down the output. The screen displays the specific protection content, and the buzzer emits an alarm.

1. Press the  key to enter the menu setting screen.

2. Choose "Set" -> "Protection" sub-menu, press the  key to enter the protection Settings page, as shown in the picture below;

Set	System	Edit	About
OVP		0.000 V	Load time 10s
OCP		0.000 A	
OPP		0.000 W	
LVP		0.000 V	
Over time		0.0 s	
Reverse detect		OFF	

Figure 3- 16 Protection Settings Screen

3. Set protection parameters.

4. After the protection occurs, press  to clear the protection status.

OVP---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 is triggered, and the screen prompts OV.
- Software overvoltage protection: The power supply provides an overvoltage protection option for the user to set. Refer to the protection setting in the "Menu Configuration" for relevant configuration items. Setting 0 means turning off software overvoltage protection. When the input voltage exceeds the setting of "overvoltage Protection", the software overvoltage protection will be triggered, and the screen will prompt "OVP".

OCP---Over current protection

The power supply has two types 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 is triggered and OC is displayed.
- Software overcurrent protection: The power supply provides an overcurrent protection option for the user to set, and refer to the protection setting in the "Menu Configuration" for relevant configuration items. Setting 0 means disabling software

overcurrent protection. When the output current exceeds the value of overcurrent protection, the software overcurrent protection is triggered and OCP is displayed on the screen.

OPP---Over power protection

The power supply provides two types 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 is triggered, and the screen prompts OP.
- Software overpower protection: The power supply provides a "power protection" option for the user to set, and refer to the protection setting in the "Menu Configuration" for relevant configuration items. Setting 0 means turning off software overpower protection. When the output power exceeds the value of Power Protection, the software overpower protection is triggered, and the screen prompts OPP.

LVP---Low voltage protection

The power supply provides the "undervoltage protection" option for users to set. For related configuration items, refer to the protection Settings in the "Menu Configuration". If the value is set to 0, the undervoltage protection is disabled. When the output voltage is lower than undervoltage protection, undervoltage protection is triggered, and LVP is displayed on the screen.

Output reverse connection warning

When the output voltage polarity (such as connected to the battery load) is reversed, the reverse connection warning will be triggered, and the screen will prompt "RVP".

Over time

When the power supply is under remote control, you can enable communication timeout protection. If the upper computer does not send the communication command to the power supply for a period of time, the communication timeout protection will be triggered, and the power supply will automatically shut down the output, and the screen displays "CMF". You can set the timeout period in Menu Configuration. The value ranges from 0.0 to 60.0 seconds.

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".

Load time

When the load time is up, the power supply turns off the output.

3.9. Save and Recall

The power supply provides 20 groups of storage positions for users to save the stationary output function parameters, such as: voltage setting, current setting, power setting, voltage slope, current slope saved to the specified position, for users to quickly switch out of the use. If the quick call function is enabled, you can press a numeric key to bring up the saved parameters. This function can significantly reduce user operations and improve testing efficiency.

3.9.1. Save

Here is an example of how to save:

1. Switch to stationary output function, set voltage to 12V, current to 10A.
2. Press  to enter the save screen.
3. Enter the number 1 and press the  key for the setting to take effect.
4. Change the parameters of the stationary output function, set the voltage to 24V and the current to 20A
5. Press the  key to enter the save screen
6. Enter the number 2 and press the  key for the setting to take effect.
7. Press the  key to enter the call interface;
8. Input the number 1, press the  key to make it effective, will call position parameter 1, the power will switch to the stationary output function, its voltage is set to 12V, the current is set to 10A

9. Press the  key to enter the call interface;

10. Input the number 2, press the key  to make it effective, will call the 2 position parameter, the power will switch to the stationary output function, the voltage is set to 24V, the current is set to 20A.

3.9.2. Quick invocation

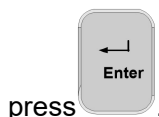
The following is a quick invocation:

1. Press the  key to enter the menu setting screen.
2. Choose "Set" > "System", press the  key, select "Others", and press the  key.
3. Set "shortcut" to enable, that is, the quick call function takes effect.
4. Press the  key to return to the main screen.
5. On the main screen without parameter editing, press the number key to bring up parameters in positions 1 to 10, where the key  ~  corresponds to storage position 1 to 9, and the  key corresponds to storage position 10.

3.10. Power-down saving

FTG series power supply provides power failure saving function. Power off Save After the power supply is enabled, 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.

1. Press the  key to enter the menu setting screen.
2. Choose "Settings" > "System", press , select "Other Settings", and



press

3. Set "Save after power Failure" options to enable, even if the power failure save function is enabled.

3.11. Lock operation

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

To exit the locked state, press the  +  key once more.

3.12. Loading timing function

Press  +  key, The loading timing screen can be pulled out, as shown below:

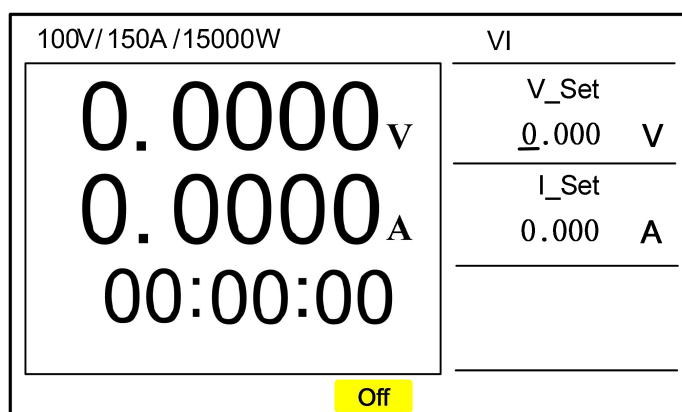


Figure 3- 17 Loading timing screen

When the key  is pressed, the power "ON", the output starts to timing. When the power "OFF" , the timing ends.

3.13. Sequence output function (SEQ)

Sequence output function, menu option is "SEQ", allows users to edit voltage, current waveform. FTG series power supplies provide 10 sequence files, each of which supports up to 100 run steps. In the running step, you can set voltage setting, current setting and single step delay. Runs and Linked files properties are supported. "Run Times" can control the cyclic running of the sequence, set to 0 to indicate infinite loop. Link File adds file running steps. Set this parameter to 0, indicating that there is no link.

When the sequence runs, the highest voltage and current slopes are used by default.

Table 3- 4 Sequence parameter description

Parameter name	Parameters description
Length	Sequence file operation steps, range 1 ~ 100.
Cycle	Sequence file cycle, the range from 0 to 60000. The value 0 indicates infinite loop. The default value is 1.
Link	Link files, The value ranges from 0 to 10. Different sequence files are recalled to run in this step. The value 0 indicates that there is no link.
SEQ Step	Controls which step of the file is currently edited, range 1 ~ 100
V_Set	Set output voltage of the present step, ranging 0 ~ maximum output voltage
I_Set	Set output current of the present step. ranges from 0 ~ maximum output current
V_Slew	Voltage slew rate setting for present step, range 0.001 ~ 10000V/S
I_Slew	Current slew rate setting for present step, range 0.001 ~ 2000A/S
Step-Time	Set the present step delay, range 0.001 ~ 86400s. The delay time starts when the voltage and current of the present step reach to the set value.

Edit sequence file

1. Press  key, Enter menu setting page

2. Choose **Edit > Sequence File**, Press  key to 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 file Editing screen :

Set	System	Edit	About
SEQ step	100	Length	100
V_Set	0.000 V	Cycle	60000
I_Set	0.000 A	Link	10
V_Slew	3000.0 V/s		
I_Slew	80000.0 A/s		
Step-Time	1.000 s		

Figure 3- 18 Sequence file editing screen

4. Set "Length"(File Length), Press  key to confirm, the editing cursor automatically moves to the next item "Cycle";

5. Set "Cycle", Press  confirm, the editing cursor automatically moves to the next item "Link"(link file);

6. Set "Link", Press  confirm, the editing cursor automatically moves to the next item "SEQ step";

7. Set "**SEQ step**", Press  confirm, the editing cursor automatically moves to the next item "**V_Set**"(voltage setting);

8. Set "**V_Set**", Press  confirm, the editing cursor automatically moves to the next item "**I_Set**"(current setting);

9. Set "**I_Set**", Press  confirm, the editing cursor automatically moves to the

next item "**V_Slew**"(voltage slew rate);



10. Set "**V_Slew**", Press  confirm, the editing cursor automatically moves to the next item "**I_Slew**"(current slew rate);



11. Set "**I_Slew**", Press  confirm, the editing cursor automatically moves to the next item "**Step-Time**"(single step delay);



12. Set "**Step-Time**"(single step delay), press  confirm, the editing cursor automatically moves to "**SEQ Step**", and the edit step is increased by 1.

13. Repeat steps 7-10 until all steps are completed.



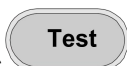
14. Press  key, Save the edited sequence file;

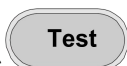


15. Press  key, Exit the sequence file editing screen.

Note: Editing sequence files is not allowed while output is on.

Run sequence file



1. Press  key, Enter the Test function selection screen



2. Turn the knob, select "SEQ", Press , Enable sequence test function, display sequence test running screen;

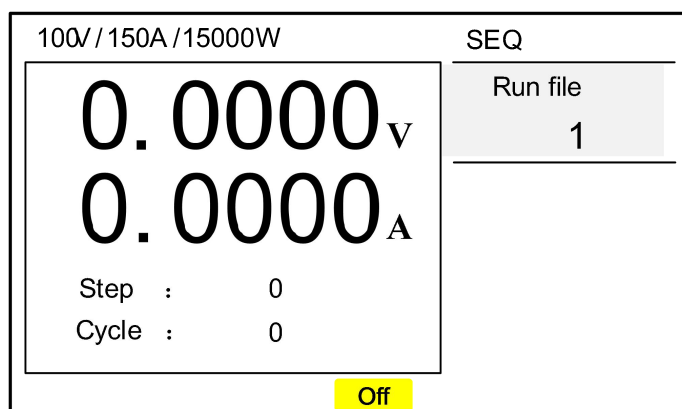


Figure 3- 19 Sequence test run screen



3. Set "File Number" and press  to take effect

4. Press  Start sequence test.

interface "Step: "Displays data for the current run step of the sequence, "Cycle: " The display data is the number of sequence loop runs.

SEQ output function can achieve more complex waveforms, such as the waveform described in the following figure, which can be easily achieved by using the sequence function.

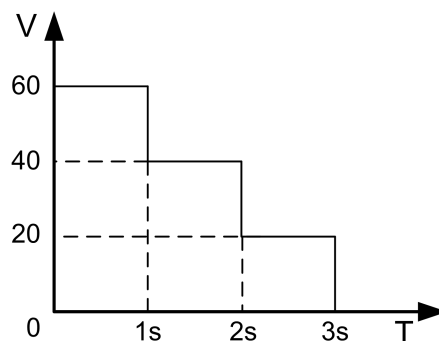


Figure 3- 20 Sequence function Output waveform

Editing steps:

1. Press  key to menu setting screen,
2. Choose **Edit > Sequence File**, Press  to enter Sequence file selection interface,
3. Turn the knob or enter a number to select the file number you want to edit, Press  key to enter edit file interface.
4. On the editing page, set File Length to 3, Press  confirm, Automatically enter "Run Times" setting, set "Run times" to 1, Press  confirm, Automatically enter "Link Sequence" setting, set "Link sequence" to 0, Press  confirm, enter "Edit step" automatically.
5. Set "Edit Step" to 1, Press  confirm, Automatically enter the "Voltage Setting", set the value of "Voltage setting" to 60V,, Press  confirm. Set the value of Current Setting to the maximum output current of the power supply and the value of single step delay to 1s. After that, it automatically jumps to "Edit

Step" and the number of steps is automatically increased by 1 to enter the second step.

6. Set the "Voltage Setting", "Current Setting" and "single-step delay" in step 2 to 40V, and the maximum output current of the power supply, 1s. After that, it automatically jumps to "Edit Step" and the step number is automatically increased by 1 to enter the third step.
7. Set the "Voltage Setting", "Current Setting" and "single-step delay" in step 3 to 20V, and the maximum output current of the power supply, 1s.
8. After editing the waveform, press the  key to save the sequence file.
9. Invoke the sequence file to run according to the introduction of "Running Sequence file".

3.14. Simulated internal resistance function (RESI)

Because the battery has a certain internal resistance, the output voltage will decrease with the increase of the current when the external power supply. The FTG series power supply provides an analog internal resistance output function with the menu option "RESI" to simulate battery powered scenarios. 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} : power supply set voltage, I_o : output current, R : set internal resistance

Operation steps :

1. Press , Enter the Test function selection interface
2. Roll the knob, select "RESI", Press  key, RESI output function is enabled, and the RESI output screen is displayed.

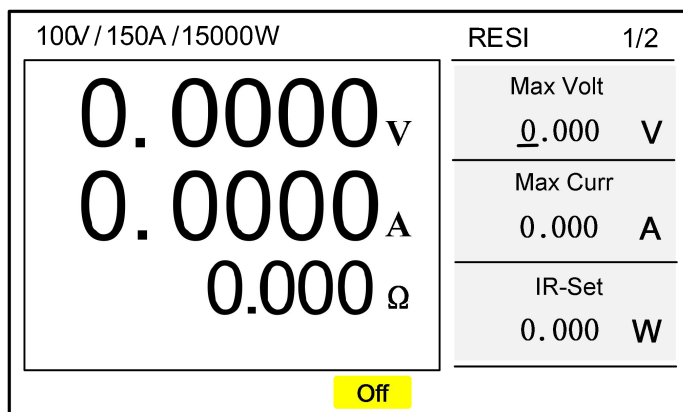


Figure 3- 21 Simulation battery output test screen

3. Set RESI test parameters
4. Press  key, RESI output starts.

Table 3-5 Simulated internal resistance function parameters

Parameter name	Parameters instruction
Max Volt	RESI function output the highest voltage, set range 0 to the maximum voltage
Max Curr	Maximum current output of RESI function. The setting range is 0 ~ maximum current
Max Pow	Maximum power output of the RESI function. The value ranges from 0 to the maximum power
IR-Set	RESI function simulates battery internal resistance, setting range: different specifications vary

3.15. Slow rise and slow fall of voltage function (RAMP)

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

Operation steps :

1. Press  key, Enter the Test function selection screen

2. Roll the knob,select "RAMP",Press  key, Enter "RAMP" function parameter setting screen as following :

100V / 150A / 15000W		RAMP 1/2	
0.0000 V		Voltage A 0.000 V	
0.0000 A		Voltage B 0.000 V	
0.0 W		Voltage C 0.000 V	
Off			

100V / 150A / 15000W		RAMP 2/2	
0.0000 V		Slew AB 0.000 V/s	
0.0000 A		Slew BC 0.000 V/s	
0.0 W		I_Set 0.000 A	
Off			

Figure 3- 22 RAMP Function parameter setting

Set “RAMP”function parameters. For details about the parameters, see Table 3-6.

3. Press  key, start “RAMP” Function of the output

Form 3- 6 voltage slow rise and slow fall function parameters instruction form

Parameter name	Parameters instruction
Voltage A	Set the voltage value at point A. Range: 0 ~ maximum output voltage
Voltage B	Set the voltage value at point B. Range: 0 ~ maximum output voltage
Voltage C	Set the voltage value at point C. Range: 0 ~ maximum output voltage
Slew AB	Set the voltage slew rate from point A to point B, range: 0.0006V/s to 6000V/s, default:50% maximum slew rate
Slew BC	Set the voltage slew rate from point B to point C, range: 0.0006V/s to 6000V/s, default:50% maximum slew rate
I_Set	Output current set value,range:0 to the maximum output current

For example, to achieve the slow falling and slow rising waveforms as shown in the

following figure,

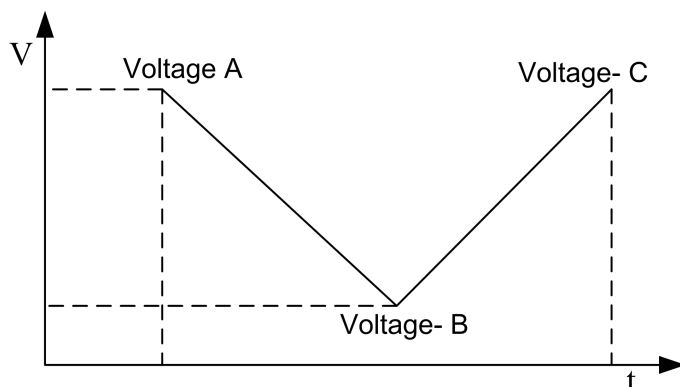


Figure 3- 23 RAMP Function parameter setting

Follow the preceding RAMP steps to enter the parameter setting page. After completing the configuration of the required slope value for each point and voltage section, press the  key to execute the configuration.

3. 16 Waveform Function (Wave)

Waveform function can achieve complex waveform by calling the upper computer file

Operation steps :

1. Press  key, Enter the Test function selection screen

2. Roll the knob,select "Wave",Press  key, Enter the "Wave" function parameter setting screen as following :

100V / 150A / 15000W		Wave
0.0000 V 0.0000 A Step : 0 Cycle : 0		Run File
		1
		

Figure 3- 24 Wave function screen

3. Select the file number and press  to confirm, then press  to

start running.

4. The waveform file is edited by the host computer, including voltage, voltage slope, current, current slope, running time, jump, delay; For details, see the User Manual of FTG Series Host Computer.

3. 17 Dynamic voltage function (DYNA)

FTG series power supply provides voltage dynamic function, so that the output voltage of the power supply shows dynamic change;

Operation steps :

1. Press  key, Enter the Test function selection screen
2. Roll the knob,select "DYNA",Press  key, Enter the "DYNA" function parameter setting screen as following :

100V / 150A / 15000W		DYNA	1/3
0.0000 V 0.0000 A 0.0 W		Way	CONT
		CV- 1	0.000 V
		CV- 2	0.000 V
Off			

100V / 150A / 15000W		DYNA	2/3
0.0000 V 0.0000 A 0.0 W		Slew-UP	0.0010 V/s
		Slew-DN	0.0010 V/s
		Width-1	0.000 s
Off			

100V / 150A / 15000W		DYNA	3/3
0.0000 V 0.0000 A 0.0 W		Width- 2	0.000 s
		CC	0.000 A
Off			

Figure 3- 25 DYNA Function parameter setting

- Set the “DYNA” functional parameters. For details about the parameters, see Table 3-7

- Press  key, Start Voltage Dynamic output function

Form 3- 7 Voltage dynamic function parameter instruction form :

parameter name	parameter instruction
Way	Operation mode, CONT: continuous mode; PLUS: Trigger mode, run one step each time the trigger signal is received; TOGG: Trigger mode that runs a full dynamic every time a trigger signal is received.
CV-1	Set voltage value 1, range:0~maximum output voltage

CV-2	Set voltage value 2, range:0~maximum output voltage
Slew-UP	Set the rise slew rate from voltage 1 to voltage 2, range: 0.001V/s to 100V/s, default: 0.0010V/s
Slew-DN	Set the fall slew rate from voltage 2 to voltage 1, range: 0.001V/s to 100V/s, default: 0.0010V/s
Width -1	Set Voltage 1 Pulse width. ranges :0.5S ~ 60000S. The default value is 1s
Width -2	Set voltage 2 Pulse width. The value ranges: 0.5S ~60000S. The default value is 1s
CC	Output current setting, Range:0~Maximum output current. Default: 50% maximum output current

For example, to achieve the voltage dynamic waveform shown below,

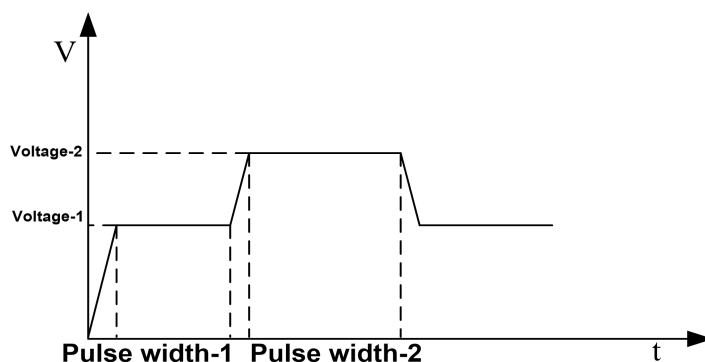


Figure 3- 26 DYN function parameter setting

Follow the preceding steps to enter the parameter setting page. After completing the configuration of the required slope value for each point and voltage section, press the



key to execute the configuration.

3.18. Battery charging test function (CHG)

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

Operation steps :

1. Press  key, Enter the Test function selection screen



2. Roll the knob,select "CHG",Press  key;Enter the battery charging function parameter setting, the screen is as following;

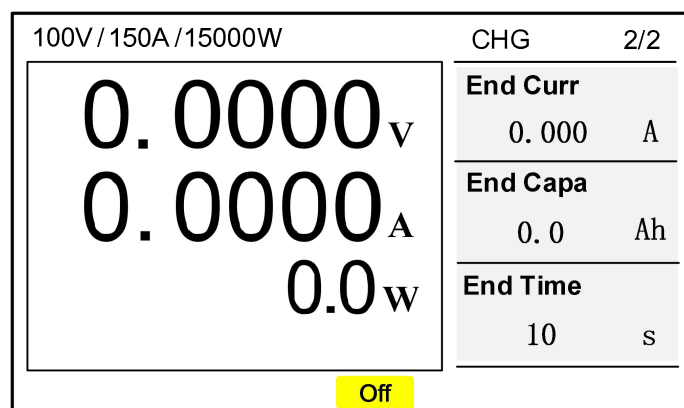
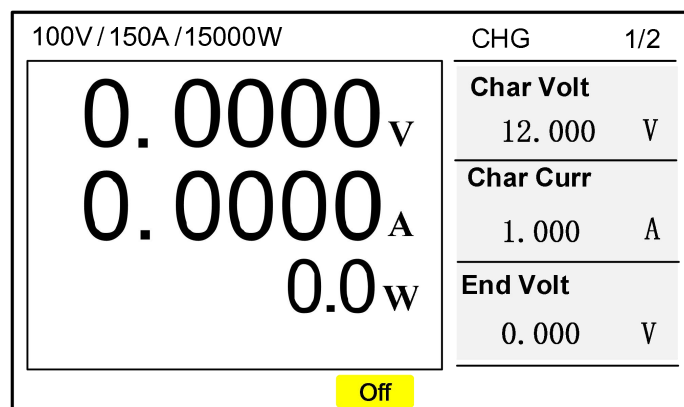


Figure 3- 27 CHG Function parameter setting

3. Set "CHG" Function parameters, battery charging test parameters as Table 3-8.

4. Press  key, start "battery charging" function output

Form3- 8 Battery charging test function parameter instruction Table

parameter name	Parameter instruction
Char volt	Set the charging voltage, the value ranges from 0 ~ rated voltage. The default value is 0V
Char curr	Set charging current, the value ranges from 0 ~rated current. The default value is 0A.
End volt	Charge termination voltage, after the end of charging, power off output. The value ranges from 0 to rated voltage. The default value is 0V
End Curr	After reach up to Charge termination current , charging

	end and Power off output. The value ranges from 0 to rated current. The default value is 0A
End Capa	After the charging reach up to terminated electricity, the power supply is turned off. The value ranges from 0 to 999999Ah. The default value is 0 AH
End time	Charging end time, after the end of charging, power off output. The value ranges from 0 to 360000s. The default value is 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.

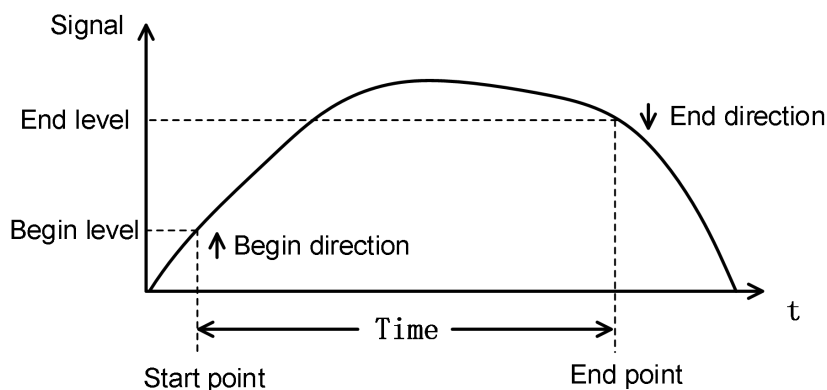


Figure 3-28 time measurement function

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		

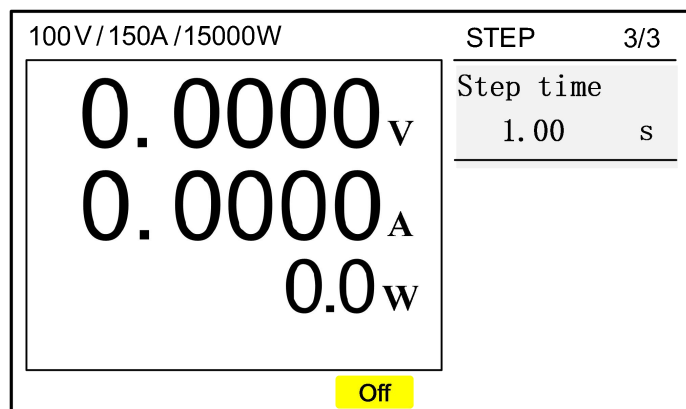


Figure 3-31 STEP function parameter setting

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.

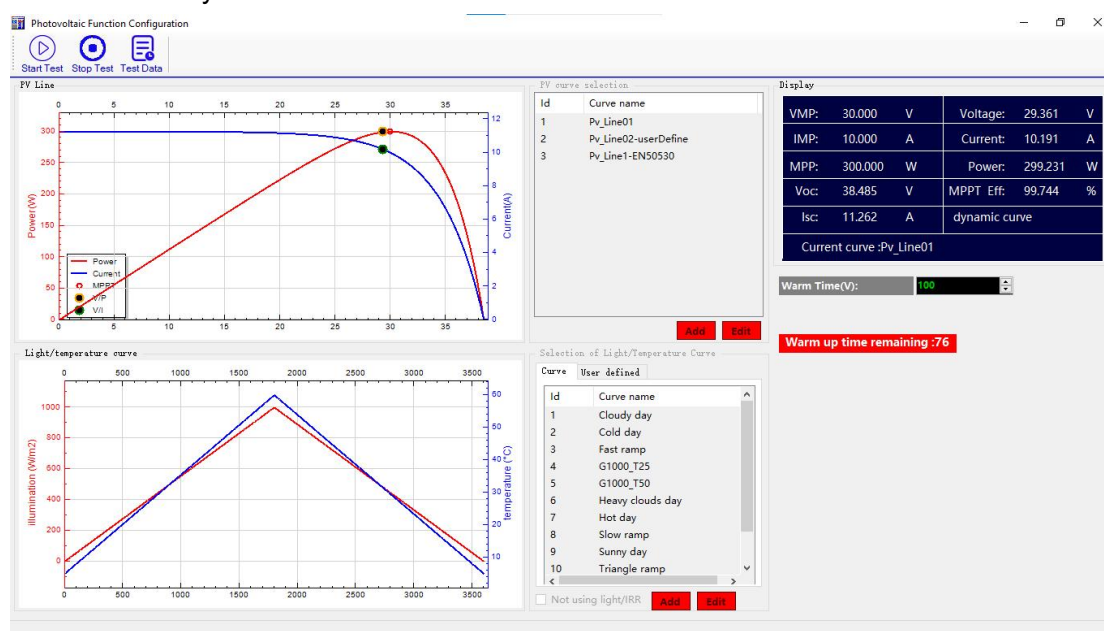


Figure 3- 32 Upper computer photovoltaic interface

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

1. 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	0W	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:

100V/150A/15000W		PV-SIM	1/2
0.0000 V 0.0000 A 0.0 W		VOC	0.000 V
		IMP	0.000 A
		VMP	0.000 V
		Off	

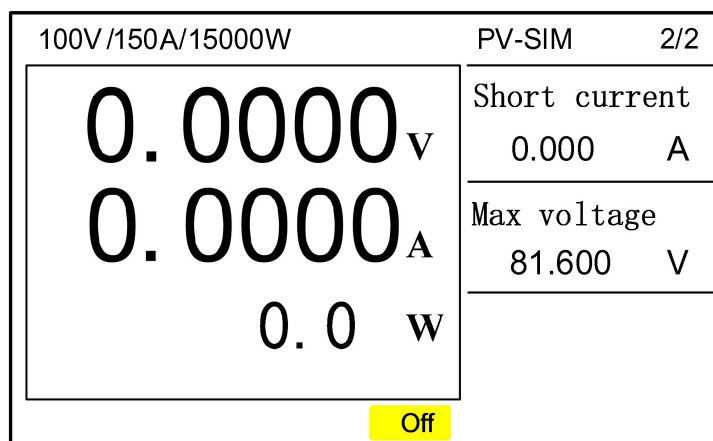


Figure 3- 34 Customized edit interface for photovoltaic file

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 and slave parallel function

3.22.1. Master/Slave Parallel Connection

FTG series power supply provides master and slave parallel mode, so that users

can achieve more power expansion of the same model.

The user connects the "PAR" signal interface(PARIN,PAROUT), the "RS485" parallel communication interface(PARCOMM), and the positive and negative output poles in the back panel with the wire, as shown in "Figure 3-28 master-slave Parallel Connection", and then performs the corresponding configuration of the power supply to achieve the master-slave parallel function. The power operation after master-slave parallel connection is just like that of a single device.

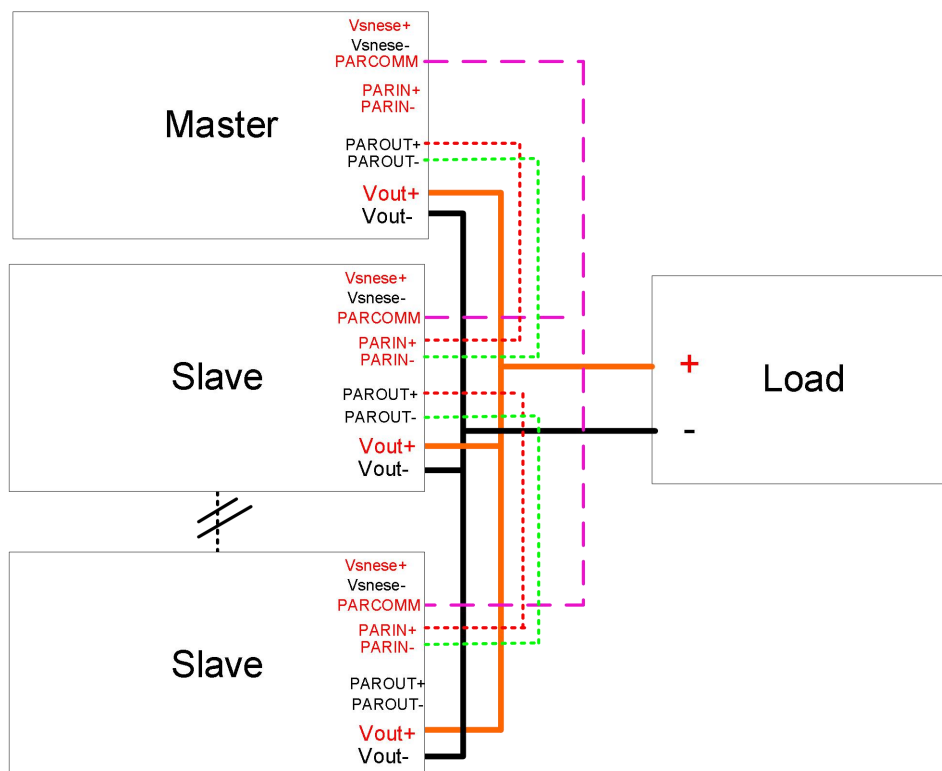


Figure 3- 28 Master/slave parallel connection

Master/slave parallel signal cable requirements

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

Master/slave parallel connection Note:

1. Only the power supplies models with same voltage model can be connected in parallel.
 2. A maximum of 10 parallel servers are supported.
 3. If you need to use the line loss compensation function after the master and slave are connected, you only need to operate the Vsense port on the host.
 4. The master/slave series connction is not supported.
-

3.22.2. Master/Slave Parallel setting

Slave device setting :

1. Press  key, enter menu setting screen,
2. Choose "Settings" > "Parallel", and press  to pop-up the master/slave parallel setting screen.
3. Set "Master/Slave Settings" to "Slave1" or "Slave2." Each number corresponds to one slave power source and cannot be the same. If there is only one slave machine, the slave machine number must be set to "Slave1", one slave machine must be set to "Slave1", the other slave machine must be set to "Slave2", and so on, otherwise the communication will fail.
4. If the power supply is set to slave, the screen automatically hides unnecessary configuration items when you return to the main screen.

Master setting

Set	System	Edit	About
M_or_S			Master
S.NUM			1
MS_CTRL			Close

Figure 3- 29 Master/slave parallel setting

1. Press  key to menu setting screen
2. Select "**Set**"->"**parallel**",press  key to pop-up master/slave parallel setting screen;
3. Set "**M_or_S**" (Master-Slave Settings) option to "Master";
4. Set "**S.NUM**" (Number of slaves) options to set the actual number of slaves.
5. Set the "**MS_CTRL**" (Master Slave Control) option to "On".

After setting parallel parameters, press the  key to return to the main screen. In this case, the master model and parameters are updated to the new model.

3.22.3. Master/Slave parallel operation

After the master/slave parallel function of FTG series power supply is set, the control of the whole machines only needs to operate the host machine.

After both master and slave systems are enabled, all protection functions still take effect. When one of them is protected, the system will automatically shut down all power output. The slave machine displays the specific fault information, and the host machine displays the fault information and the code of the slave machine, as shown in the figure below:

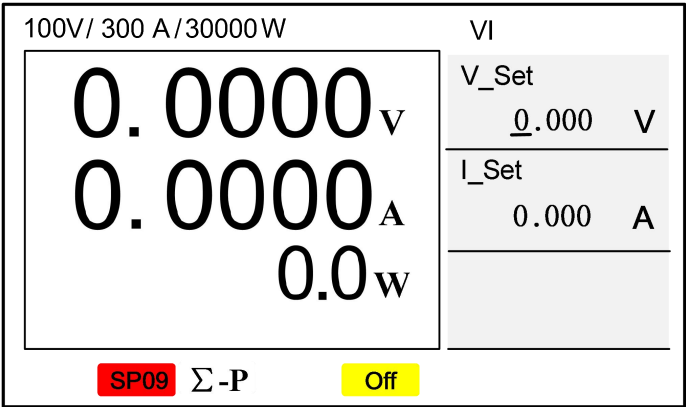


Figure 3-30 Master machine screen

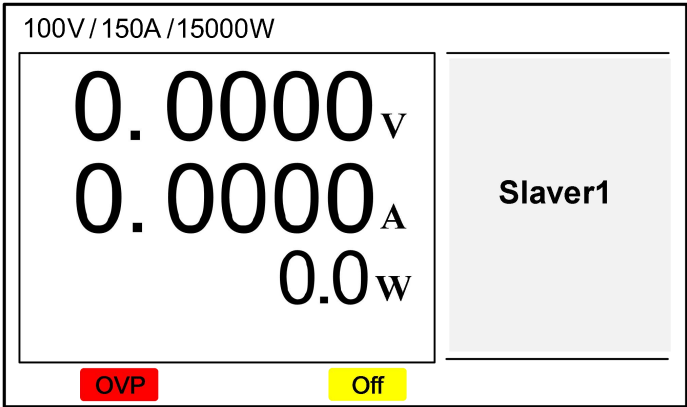


Figure 3- 31 Slave machine screen

When the slave machine is protected, press the  key on the slave machine and the host machine to clear the fault. If only the host is faulty, press  on the host to rectify the fault. The following table lists possible protection and failure situations in

master-slave parallel applications.

Form 3-7 master/slave parallel protection instruction

Protection display	instruction
Σ -P	Parallel communication is normal, with black characters with white background are not flashing on the host screen
Σ -P	The parallel communication is abnormal, with black characters with a red background are flashing on the host screen
SP01 ~ SP09	Indicates the number of the slave machine where the fault occurs. Operation  key is required to clear the fault.

Master-slave parallel operation notes:

1. Set the Settings on the slave machine first and then the host to avoid communication failures on the host.
 2. If multiple power supplies are set as hosts and the parallel function is enabled, the parallel operation will fail.
 3. If the signal cable of "PAR" port of the slave machine is not connected or falls off during the parallel machine, 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 setting of the host machine due to the fault of "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 Protection Settings will be cancelled. During recovery, the user needs to reset.
 6. Do not combine power supplies of different voltage models. Otherwise, damage may occur.
-

4.Communication introduction

FTG series power supply provides users with four kinds of communication interfaces. Standard RS232 (serial port), LAN (Ethernet), optional GPIB, RS485 or CAN communication interface. The communication protocol supports standard Modbus and SCPI. The default is Modbus. Users can select communication interfaces and protocols as required.

4.1.Communication configuration

1. Press  key, enter menu setting interface
2. Choose Settings > “System” > “Communication Settings”, and press the  key to pop-up the system parameter setting screen.

Set	System	Edit	About
IP	192. 168. 1. 123		
S-mask	255. 255. 255. 0		
Baud	9600	Protocol	Modbus
Parity	None		
DEVI-ADDR	160		
GPIB	5		

Figure 4- 1 Communications parameters setting Inter

2. Set IP Address to 192.168.1.123 and Subnet Mask to 255.255.255.0 by default. Secondly, set the IP address of the computer network connected to it and the IP address of the power supply to be in the same network segment, but different IP addresses; otherwise, the communication will fail. For example, the computer network IP address is set to 198.168.1.100.
3. You need to set baud rate for RS232 serial port communication. The default value is 9600, which supports Settings of 4800, 9600, 19200, 38400, and 115200.

The default value of Verification Mode is None.

4. Set Serial Port Rate for the RS485 communication. The default value is 9600, which supports 4800, 9600, 19200, 38400, and 115200. The default value of Verification Mode is None. The default Device address is 160. The value ranges from 1 to 247.

5. Set GPIB Address for GPIB communication. The default value is 5, ranging from 0 to 30.

6. The default baud rate of the CAN interface is 250K.

7. Communication protocol can be set, supporting Modbus or SCPI.

Note: The modification takes effect only after the power supply is restarted.

4.2. Voltage and current acquisition rate

1. After the communication configuration is complete, you can configure the parameters as following to increase the speed of obtaining device parameters through communication:

2. 1. Press the  key to enter the menu setting screen.

3. 2. Choose “Set” > “App Set”, and press key  to pop-up the application Settings screen.

Set	System	Edit	About
SampRate	10Hz	Response	50%
Prio SLT	Volt		
VSlew-UP	6000.0	V/s	
VSlew-DN	6000.0	V/s	
ISlew-UP	2000.0	A/s	
ISlew-DN	2000.0	A/s	

Figure 4- 2 Application Setting screen

4. In “SampRate” options, select the required communication rate, 5 value available. The default value is 10Hz.

4.3. Communication interface

4.3.1. RS232

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

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 FTG series power supplies have Ethernet communication ports and can use UDP and TCP/IP communication modes. The default IP address is 192.168.1.123 and the default subnet mask is 255.255.255.0. The default port number in UDP mode is 7000 and the default port number in TCP/IP mode is 7001.

Note: Before communication, ensure that the IP addresses of the PC and the power supply are in the same network segment, and ensure that there is no duplicate IP address with the power supply in the network segment; otherwise, the connection will fail.

4.3.3. RS485

The configuration of the RS485 communication interface is the same as that of the RS232, such as the baud rate and verification mode. The default baud rate of 9600BPS is used,

and its pin signal is described in the following table.

Table 4-2 Signal of the RS485 interface

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

4.3.4. CAN

CAN interface fixed with 250Kbps communication speed, communication address CAN be set on the interface board.

Note: CAN interface is fixed using CANOpen communication protocol.

Table 4-3 CAN Interface signal

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

4.3.5. GPIB

GPIB (General Instrument 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 through the GPIB bus.

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

The GPIB interface card and IEEE488.2 GPIB cable are optional accessories. Please contact Faith Technology to order the accessories.

4.4. Communication protocol

FTG power supplies support SCPI, Modbus and CANopen communication protocols. For LAN, USB serial port, and RS485 port, you can select SCPI or D. The GPIB interface supports only SCPI protocol, and the CAN interface supports only CANopen protocol.

4.4.1. SCPI protocol

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

There are two types of power supply commands: IEEE488.2 common commands and device-related SCPI commands.

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

SCPI command to achieve most of the power supply test, setting, calibration and measurement functions. Such commands are organized in a command tree. Each command can contain multiple mnemonics. Nodes in the command tree are separated by characters (:), as shown in the following figure. The ROOT at the top of the command tree is called the ROOT. The full path from the root to the leaf is a complete programming command.

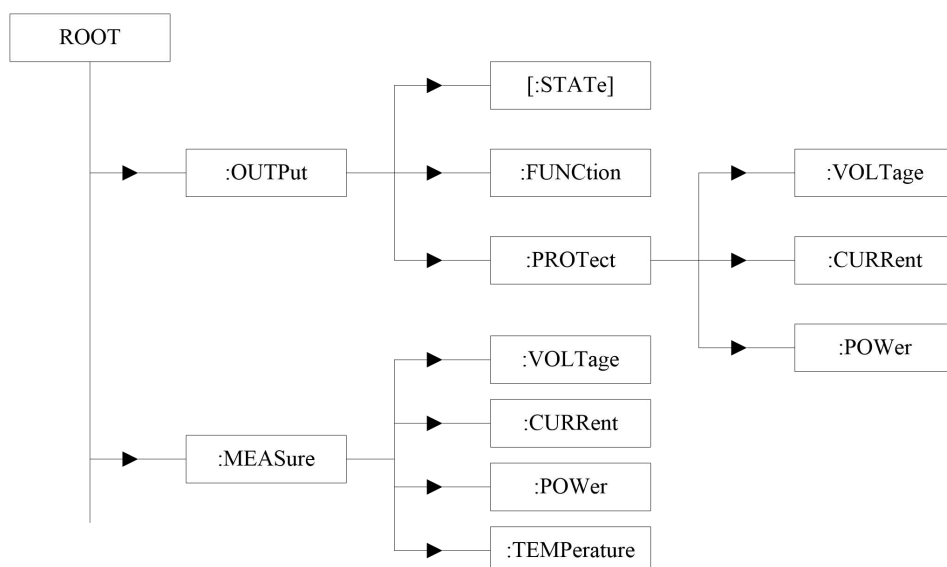


Figure 4- 3 SCP command tree

For details about SCPI protocol, please refer to 《FTG 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 an industry standard (De facto) for communication protocols in the industrial field and is the common way to connect industrial electronic devices. Modbus protocol is a master/slave architecture protocol. One node is the master node, and the other nodes that use Modbus protocol to participate in communication are slave nodes. Each slave device has a unique address. Only nodes designated as master nodes can start a command.

A Modbus command contains the Modbus address of the device to be executed. All devices will receive the command, but only the device with the specified address will execute and respond to the command (except for address 255, where the command is broadcast and all devices that receive the command will run, but do not respond to the command). All Modbus commands include a check code to ensure that the arriving command is not corrupted. Basic Modbus commands can direct a device to change its register value, control or read an I/O port, and direct the device to send back data from one or more registers.

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

For details of Modbus protocol, please refer to 《FTG Programming Manual Modbus Edition》.

4.4.3. CANopen protocol

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

Note: The CANopen protocol is optional.

For details of CANopen protocol, please refer to 《FTG Programming Manual CANopen Edition》.

5. Check the fault

If the power supply fails to work properly, check and rectify the fault 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-inspection table

Question	Reasons	Solution
The measurement accuracy is not within the specification range	Device aging causes characteristic deviation	Recalibrate
The output accuracy is not within the specification range	Device aging causes characteristic deviation	Recalibrate
PMF fault	1. the power grid voltage is lower than the requirement of power supply 2. A power failure triggers the PMF	1. Check whether the power grid 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 the environment of 0 ~ 40℃ 2. Improve ventilation of the machine 3. Press  to clear the fault
Over Power protection OPP、OP	output power exceeds the setting	1. Reduce the load or increase the OPP setting 2. Press  to clear the fault
Over Current protection OCP、OC	output current exceeds the setting	1. Reduce the load or increase the OCP setting 2. Press  to clear the fault
Over Voltage protection OVP、OV	output voltage exceeds the setting	1. Reduce output or increase OVP Settings 2. Press  to clear the fault

Table 5- 2 Startup fault self-check table

Problem	Possible reasons	Solution
Test Converter...Error !	The power module is abnormal	Please consult Faith Technology after –sales service
Test sample.Error !	Abnormal sampled data	
Loading calibration data. Error !	Failed to load calibration data	
Loading parameters. Error !	Failed to load system parameters	

6. Appendix

Table 6- 1 Recommended cable diameter table

MODEL	Cross-sectional 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
		Rated 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