TEXIO
Test and Measurement Solutions

INSTRUCTION MANUAL

DC POWER SUPPLY
PPE SERIES

PPE20-5 **PPE32-3**

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The latest version of the instruction manual is posted on our website (https://www.texio.co.jp/download/).

In order to be environmentally friendly and reduce waste, we are gradually discontinuing the use of paper or CD manuals that come with our products. Even if there is a description in the instruction manual that the product is included, it may not be included.

■ **About the Firmware version**

This instruction manual is compatible with firmware version 1.22.

Table of Contents

1. SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow during operation and storage. Read the following before any operation to insure your safety and to keep the instrument in the best possible condition.

1.1. Safety Symbols

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the PPE or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal
	Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

1.2. Safety Guidelines

General Guideline

CAUTION

- Do not place any heavy object on the PPE.
- Avoid severe impact or rough handling that leads to damaging the PPE.
- Do not discharge static electricity to the PPE.
- Use only mating connectors, not bare wires, for the terminals.
- Do not disassemble the PPE unless you are qualified.

Power Supply

CAUTION

- AC Input Voltage: 100Vac/120Vac/220Vac/240Vac ±10%, 50Hz/60Hz, single phase
- Frequency: 47Hz to 63Hz
- Before connecting the power plug to an AC line outlet, make sure the voltage selector switches of the bottom panel in the correct position.

WARNING

- Disconnect power cord and test leads before replacing fuse.
- The fuse specification is as following:

FUSE	LINE
250V T3.15A	100V~ 120V~
250V T1.6A	220V~ 240V~

- To avoid electrical shock connect the protective grounding conductor of the AC power cord to an earth ground.

Cleaning the PPE

- Disconnect the power cord before cleaning.
- Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid.
- Do not use chemicals containing harsh material such as benzene, toluene, xylene, and acetone.

Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: 20%~ 80% (no condensation) • Altitude: < 2000m • Temperature: 0°C to 40°C (Pollution Degree) EN61010-1:2010 specifies the pollution degrees and their requirements as follows. The PPE falls under degree 2. Pollution refers to “addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity”. • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage environment	• Location: Indoor • Temperature: -20°C to 70°C • Relative Humidity: 20 to 85%(no condensation)
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

2. GETTING STARTED

This chapter describes the power supply in a nutshell, including its main features and front / rear panel introduction. After going through the overview, please read the theory of operation to become familiar with the operating modes, protection modes and other safety considerations.

2.1. PPE Series Overview

2.1.1. Series lineup

The PPE Series consists of 2 models: PPE20-5 and PPE32-3. Note that throughout the user manual, the term “PPE” refers to all the models in the PPE Series lineup, unless stated otherwise.

Model	Operation Voltage	Operation Current	Rated Power
PPE20-5	0-20V	0-5A	100W
PPE32-3	0-32V	0-3A	96W

2.1.2. Main Features

Performance	2.4-inch TFT-LCD Panel. Low noise: Temperature controlled cooling fan Remote sensing to compensate for voltage drop in load leads Set resolution : 1 mV / 0.1 mA Read back resolution : 0.1 mV / 10 uA
Operation	Constant voltage/Constant current operation Output On/Off control Function for locking the setting
Protection	OVP: Over Voltage Protection OCP: Over Current Protection OTP: Over Temperature Protection Key miss operation protection (Lock) Reverse polarity protection

2.1.3. Accessories

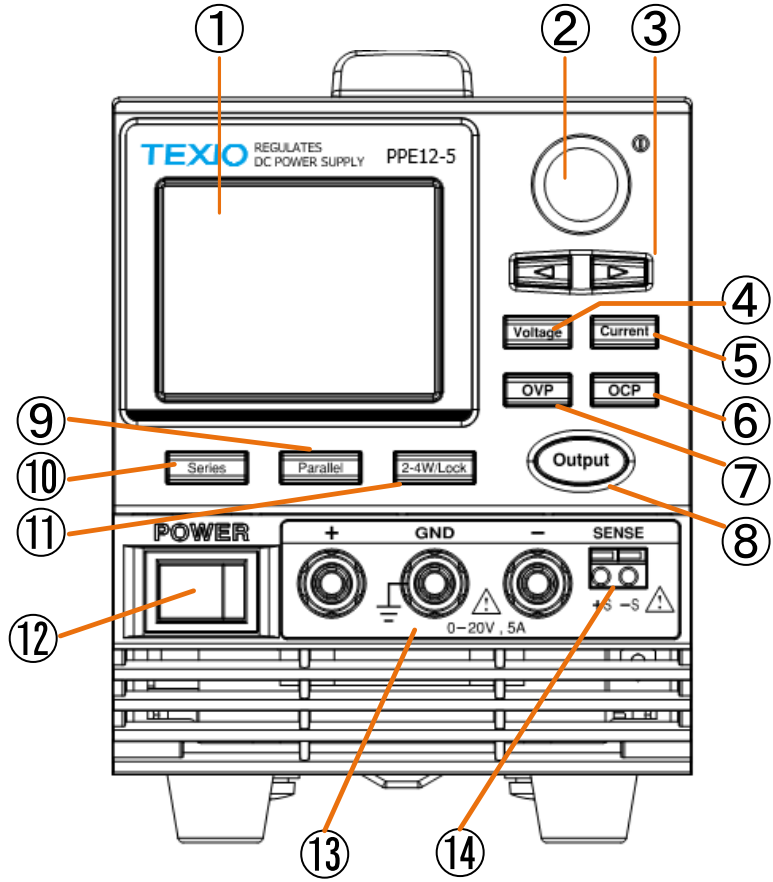
Before using the PPE power supply unit, check the package contents to make sure all the standard accessories are included.

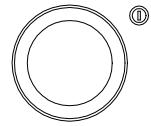
Standard Accessories	Part number	Description	Qty.
	GTL-104A	Test leads 1m, 10A	1
		Short Bar (Binding Posts Terminal)	1
		Power Cord	1

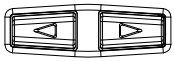
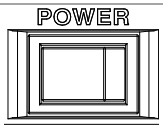
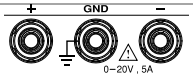
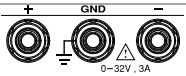
Optional Accessories	Part number	Description
	GRA-441-J	Rack for PPE (JIS)
	GRA-441-E	Rack for PPE (EIA)

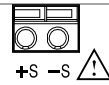
2.2. Appearance

2.2.1. Front Panel



1.	Display area		The display area shows set values, output values and parameter settings.
2.	Knob Key		Used to configure or confirm voltage/current, etc. Holding the Knob key will clear any protection alarms.

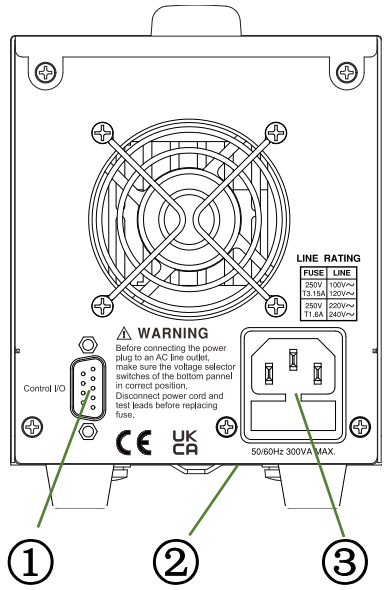
3.	Left/Right Arrow Keys		Used to select a parameter number in the Function settings.
4.	Voltage		Sets the constant voltage level.
5.	Current		Sets the constant current level.
6.	OCP		Sets the over current protection level.
7.	OVP		Sets the over voltage protection level.
8.	Output Button		Used to turn the output on or off.
9.	Parallel Key		Activates parallel tracking operation. (Currently unavailable.)
10.	Series Key		Activates series tracking operation. (Currently unavailable.)
11.	2-wire/4-wire setting & lock/unlock		Used to 2-wire/4-wire setting. Holding the key will Locks/Unlocks the front panel keys to prevent accidentally changing panel settings. Note: The output can still be turned off when the key lock in active.
12.	Power Switch		Turns on the mains power.
13.	Output terminal		DC output terminal of the PPE20-5, The max. output is 20 V / 5 A / 100 W
			DC output terminal of the PPE32-3, The max. output is 32 V / 3 A / 96 W

14.	Sensing Terminal		Terminal to connect the sensing cables, which compensate voltage drop occurred in load leads.

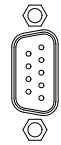
2.2.2. Display Area

2w	2-wire indicator.	4w	4-wire indicator.
	When the lock mode is activated, the icon will be shown.	OTP	Over temperature protection functions is tripped.
OVP	Over voltage protection functions is tripped.	OCP	Over current protection functions is tripped.
OFF	Indicates if the output is OFF.	CC	Indicates that the output is in CC mode.
CV	Indicates that the output is in CV mode.	SM	Master Series
SS	Slave Series	PM	Master Parallel
PS	Slave Parallel		

2.2.3. Rear Panel Overview

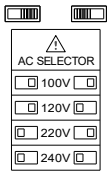


1. I/O Ports



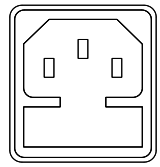
The Connector is used for parallel/series control. Currently unavailable.

2. AC Select Switch



The AC selector is located at the bottom side of the unit. Switch Voltage to 100 V, 120 V, 220 V or 240 V.

3. Power Cord / Fuse Socket



The power cord socket accepts the AC mains. The fuse holder contains the AC mains fuse.

2.3. Theory of Operation

The theory of operation chapter describes the basic principles of operation, protection modes and important considerations that must be taken into account before use.

2.3.1. CC and CV Mode

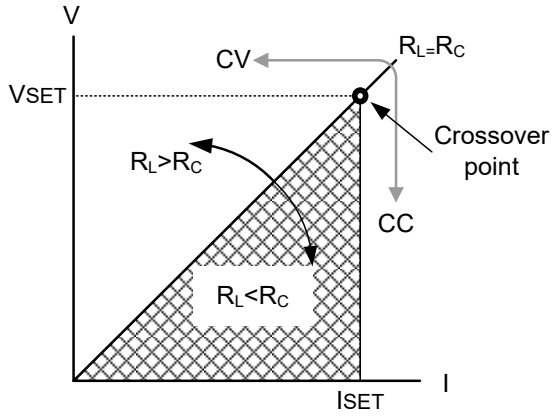
CC and CV mode Description

When the power supply is operating in constant current mode (CC) a constant current will be supplied to the load. When in constant current mode the voltage output can vary, whilst the current remains constant. When the load resistance increases to the point where the set current limit (I_{SET}) can no longer be sustained the power supply switches to CV mode. The point where the power supply switches modes is the crossover point.

When the power supply is operating in CV mode, a constant voltage will be supplied to the load, whilst the current will vary as the load varies. At the point that the load resistance is too low to maintain a constant voltage, the power supply will switch to CC mode and maintain the set current limit.

The conditions that determine whether the power supply operates in CC or CV (V_{SET}), the load resistance (R_L) and the critical resistance (R_C). The critical resistance is determined by V_{SET}/I_{SET}. The power supply will operate in CV mode when the load resistance is greater than the critical resistance. This means that the voltage output will be equal to the V_{SET} voltage but the current will be less than I_{SET}. If the load resistance is reduced to the point that the current output reaches the I_{SET} level, the power supply switches to CC mode.

Conversely the power supply will operate in CC mode when the load resistance is less than the critical resistance. In CC mode the current output is equal to I_{SET} and the voltage output is less than V_{SET}.



2.3.2. Alarms

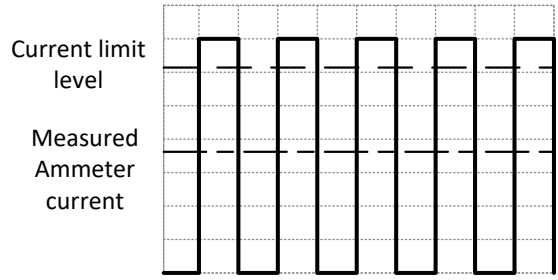
The PPE power supplies have a number of protection features. When one of the protection alarms is set, the ALM icon on the display will be lit. For details on how to set the protection modes.

OVP	Over voltage protection (OVP) prevents a high voltage from damaging the load. This alarm can be set by the user.
OCP	Over current protection prevents high current from damaging the load. This alarm can be set by the user.
OTP	Over temperature protection protect the instrument from overheating

2.3.3. Considerations

The following situations should be taken into consideration when using the power supply.

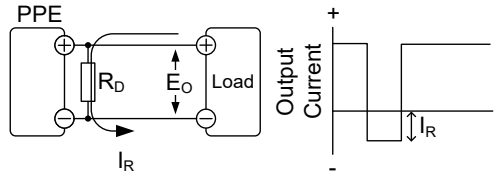
Inrush current	When the power supply switch is first turned on, an inrush current is generated. Ensure there is enough power available for the power supply when first turned on, especially if a number of units are turned on at the same time.
⚠ Caution	Cycling the power on and off quickly can cause the inrush current limiting circuit to fail as well as reduce the working life of the input fuse and power switch.
Pulsed or Peaked loads	When the load has current peaks or is pulsed, it is possible for the maximum current to exceed the mean current value. The PPE power supply ammeter only indicates mean current values, which means for pulsed current loads, the actual current can exceed the indicated value. For pulsed loads, the current limit must be increased, or a power supply with a greater capacity must be chosen. As shown below, a pulsed load may exceed the current limit and the indicated current on the power supply ammeter.



Reverse Current: Regenerative load

When the power supply is connected to a regenerative load such as a transformer or inverter, reverse current will feed back to the power supply. The PPE power supply cannot absorb reverse current. For loads that create reverse current, connect a resistor in parallel (dummy load) to the power supply to bypass the reverse current. To calculate the resistance for the dummy resistor, R_D, first determine the maximum reverse current, I_R, and determine what the output voltage, E_O, will be.

$R_D(\Omega) \leq E_O(V) \div I_R(A)$



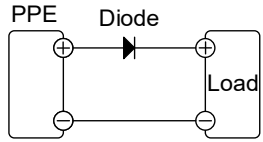
Note

The current output will decrease by the amount of current absorbed by the resistor.

Ensure the resistor used can withstand the power capacity of the power supply/load.

Reverse Current: Accumulative energy.

When the power supply is connected to a load such as a battery, reverse current may flow back to the power supply. To prevent damage to the power supply, use a reverse-current-protection diode in series between the power supply and load.

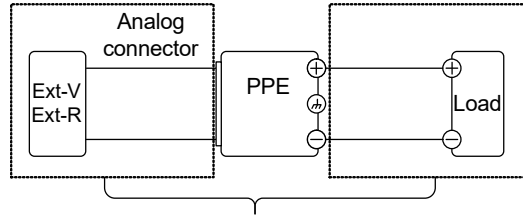


⚠ CAUTION	Ensure the reverse withstand voltage of the diode is able to withstand 2 times the rated output voltage of the power supply and the forward current capacity can withstand 3 to 10 times the rated output current of the power supply. Ensure the diode is able to withstand the heat generated in the following scenarios. When the diode is used to limit reverse voltage, remote sensing cannot be used.

2.3.4. Grounding

The output terminals of the PPE power supplies are isolated with respect to the protective grounding terminal. The insulation capacity of the load, the load cables and other connected devices must be taken into consideration when connected to the protective ground or when floating.

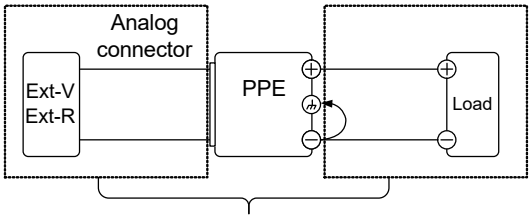
Floating	As the output terminals are floating, the load and all load cables must have an insulation capacity that is greater than the isolation voltage of the power supply.



(----------) Insulation capacity ≥ isolation voltage of power supply

⚠ WARNING	If the insulation capacity of the load and load cables are not greater than the isolation voltage of the power supply, electric shock may occur.

Grounded output terminal	If the positive or negative terminal is connected to the protective ground terminal, the insulation capacity needed for the load and load cables is greatly reduced. The insulation capacity only needs to be greater than the maximum output voltage of the power supply with respect to ground.

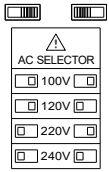
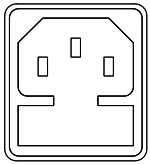


(┈┈┈) Insulation capacity ≥ voltage of power supply with respect to ground

⚠ CAUTION	If using external voltage control, do not ground the external voltage terminal as this will create a short circuit.

2.4. Set Up

2.4.1. Power Up

Select AC voltage	Before powering up the power supply, select the AC input voltage from the rear panel.	
Connect AC power cord	Connect the AC power cord to the rear panel socket.	
Power On	Press the power switch to turn on the power. The machine starts to initialize Display, it will display the voltage, current, set value, and status.	
Power Off	Press the power switch again to turn off the power.	

2.4.2. Wire Gauge Considerations

Background

Before connecting the output terminals to a load, the wire gauge of the cables should be considered. It is essential that the current capacity of the load cables is adequate. The rating of the cables must equal or exceed the maximum current rated output of the instrument.

Recommended wire gauge

Wire Gauge	Nominal Cross Section	Maximum Current
28	0.10	3
26	0.15	4
24	0.25	5
22	0.35	7
20	0.55	9
18	1	12

The maximum temperature rise can only be 60 degrees above the ambient temperature. The ambient temperature must be less than 30 degrees.

2.4.3. Output Terminals

Background

Before connecting the output terminals to the load, first consider whether voltage sense will be used, the gauge of the cable wiring and the withstand voltage of the cables and load.

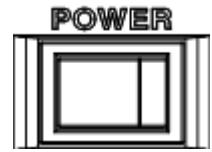
⚠WARNING

Dangerous voltages. Ensure that the power to the instrument is disabled before handling the power supply output terminals. Failing to do so may lead to electric shock.

2.4.4. Connection with the front panel output terminal

Steps

1. Turn the power switch off.

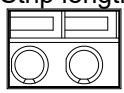
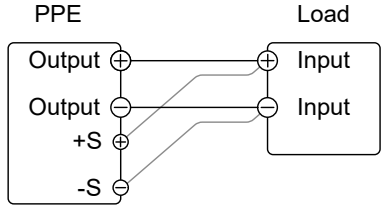


2. Connect the test lead includes in the accessory parts to front panel output terminal.

3. Fix the load cables firmly to eliminate loose connections from the front output terminals and load cables.

2.4.5. Remote Sensing

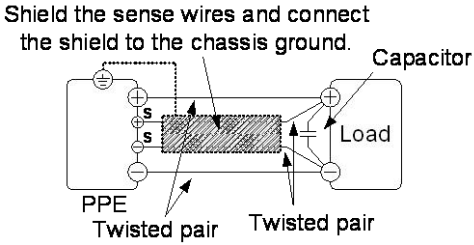
Remote sense is used to compensate for the voltage drop seen across load cables due to the resistance inherent in the load cables. The remote sense terminals are connected to the load terminals to determine the voltage drop across the load cables. Remote sense can compensate up to 1 volt for PPE. Load cables should be chosen with a voltage drop less than the compensation voltage.

⚠ WARNING	Ensure the output is off before handling the remote sense connector.Use sense cables with a voltage rating exceeding the isolation voltage of the power supply. Never connect sensing cables when the output is on. Electric shock or damage to the power supply could result.
Output terminal Connector Overview	When using the remote sensing, make sure the wires that are used follow the following guidelines: Wire gauge: AWG 20 to AWG 14 Strip length: 6.5mm // 0.26 in. +S: +Sense terminal -S: -Sense terminal  −S +S
⚠ Note	Be sure to remove the Sense joining cables so the units are not using local sensing.
Single Load	1. Connect the +S terminal to the positive potential of the load. Connect the -S terminal to the negative potential of the load. 

2. Operate the instrument as normal. See the Basic Operation chapter for details.

Wire Shielding and Load line impedance

To help to minimize the oscillation due to the inductance and capacitance of the load cables, use an electrolytic capacitor in parallel with the load terminals.
To minimize the effect of load line impedance use twisted wire pairing.

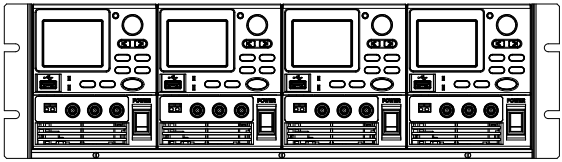


2.4.6. Using the Rack Mount Kit

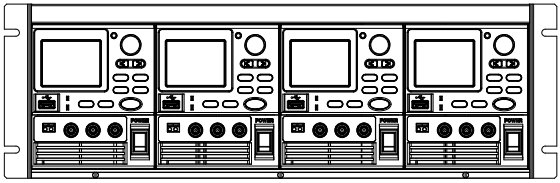
Background

The PPE series has an optional Rack Mount Kit (TEXIO part number: GRA-441-J [JIS], GRA-441-E [EIA]) that can be used to hold up to 4 PPE units into rack.

GRA-441-E [EIA] Rack mount diagram



GRA-441-J [JIS] Rack mount diagram



3. Basic Operation

3.1. Setting the Output Voltage Level

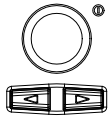
Background

The voltage setting sets the voltage level of the power supply.

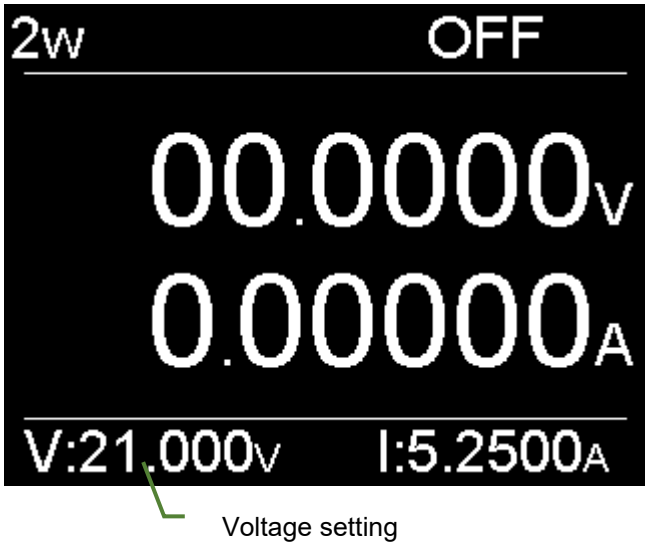
Steps

1. Press the Voltage key to enter voltage editing mode, and the digit to be changed will flash.

2. Use the arrow keys to select the digit and the knob to change the value. Changes to the setting value are reflected directly in the output.
   The setting range is 0 to 105% of the rated voltage.



3. Press the knob to exit editing mode.



Voltage setting

3.2. Setting the Output Current Level

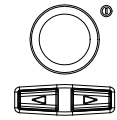
Background

The current setting sets the current level of the power supply.

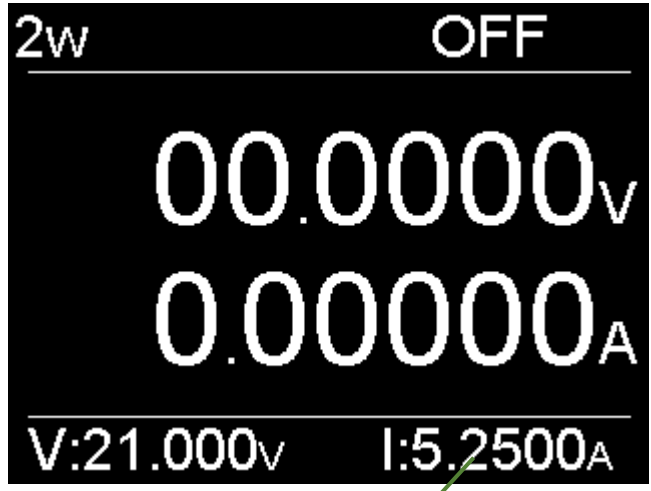
Steps

1. Press the Current key to enter current editing mode, and the digit to be changed will flash.

2. Use the arrow keys to select the digit and the knob to change the value. Changes to the set value are reflected directly in the output. The setting range is 0 to 105% of the rated voltage.



3. Press the knob to exit editing mode.



Current setting

3.3. Setting the OVP Level

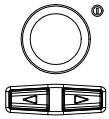
Background

The over voltage protection (OVP) protects the unit from overvoltage. When the voltage level crosses the OVP threshold, the output is automatically turned off.

Steps

1. Press the OVP key to enter editing mode for the protection voltage value, and the digit to be changed will flash.

2. Use the arrow keys to select a digit and use the knob to change the value.



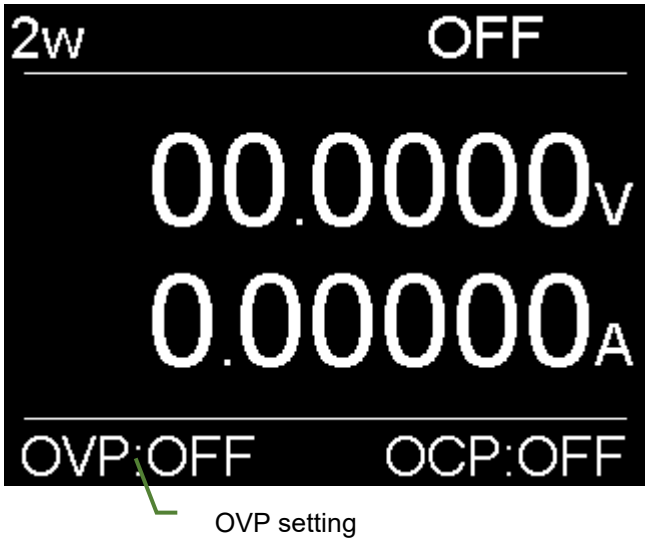
The setting range is 0–110% of the rated voltage.

Setting the maximum value will turn it OFF.

3. Press the knob to exit editing mode, confirm the value, and change the protection voltage.

Note

The output will turn off if the output voltage exceeds the OVP voltage.



3.4. Setting the OCP Level

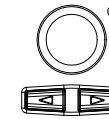
Background

The over current protection (OCP) protects the unit from overcurrent. When the current level crosses the OCP threshold level, the output is automatically turned off.

Steps

1. Press the OCP key to enter editing mode for the protection current value, and the digit to be changed will flash.

2. Use the arrow keys to select the digit and use the knob to change the value.

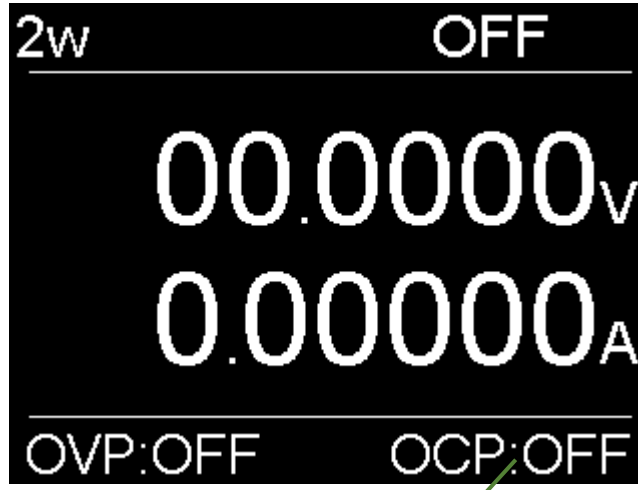


The setting range is 0–110% of the rated current.

Setting the maximum value will turn it OFF.

3. Press the knob to exit editing mode, confirm the value, and change the protection current value.

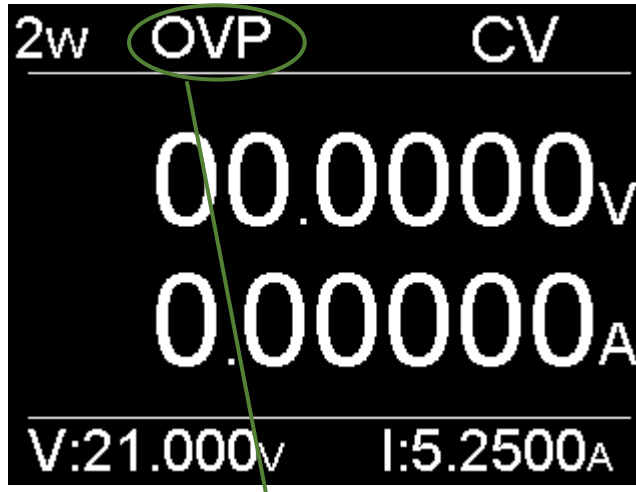
The output will turn off if the output current exceeds the OVP current.



OCP setting

3.5. Alarm Clear

Background	The CLR_PROT (Clear Protection) function will clear any protection alarms.
Applicable Alarms	OVP, OCP, OTP
Steps	1. Press and hold the knob key to clear any alarms.



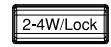
Alarm message

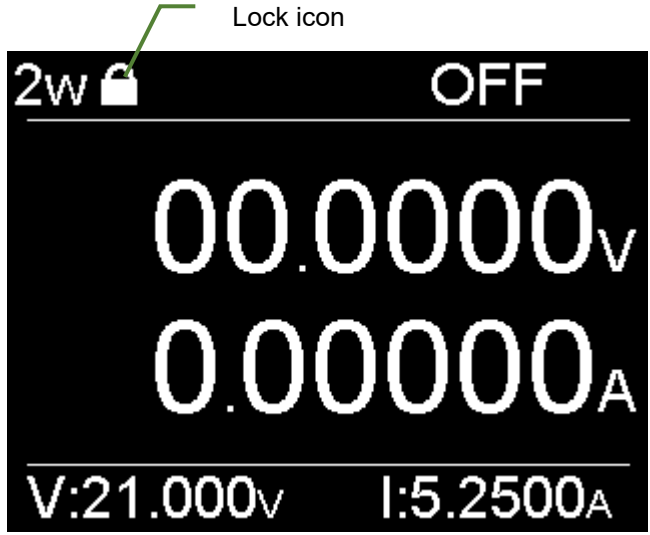
3.6. Sense Control

2 Wire	Press the 2-4W/Lock key. The 2W will be displayed in the status bar to indicate that the 2 wire is Activate.	 
4 Wire	Press the 2-4W/Lock key. The 4W will be displayed in the status bar to indicate that the 4 wire is Activate.	 

3.7. Panel Lock

The panel lock feature prevents settings from being changed accidentally. When activated, all keys and knobs except the Lock/Unlock key and the Output key will be disabled.

Activate the panel lock	Press and hold the Lock key to active the panel lock. The padlock icon at the top of the display will become “locked” when the panel keys are locked.	 
Disable the panel lock	Press and hold the Lock key to turn off the panel lock. the padlock icon will disappear.	



3.8. Turning the Output On

Turn Output On	Press the *Output* key. The Output key will turn green and CC or CV will be displayed in the status bar to indicate that the output is on.	 
Turn Output Off	Press the *Output* key. The Output key light will go out and OFF will be displayed in the status bar to indicate that the output is off.	 

3.9. Master-Slave operation

Operation

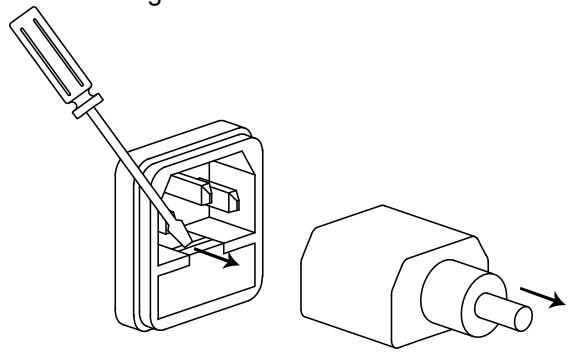
The current version does not support master-slave operation using two PPE series units. The Series key and Parallel key operations will be disabled.

4. APPENDIX

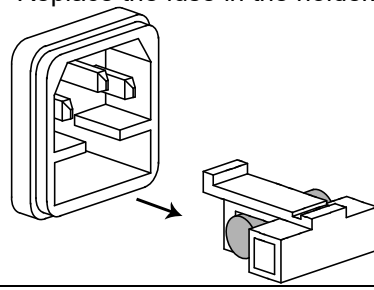
4.1. Fuse Replacement

Steps

1. Take off the power cord and remove the fuse socket using a minus driver.



2. Replace the fuse in the holder.



Rating

- 100 V / 120 V:T3.15 A / 250 V
- 220 V / 240 V:T1.6 A / 250 V

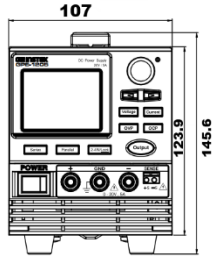
4.2. PPE Specifications

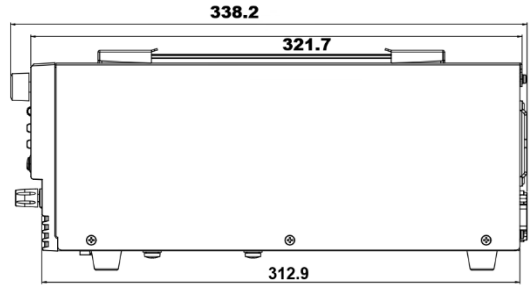
The specifications apply when the PPE is powered on for at least 30 minutes under +20 °C – +30 °C.

Output Ratings	Independent	0 ~ 32 V , 0 ~ 3 A (PPE32-3) 0 ~ 20 V , 0 ~ 5 A (PPE20-5)
Voltage Regulation	Line Regulation	≤ 0.01% + 3 mV
	Load Regulation	≤ 0.01% + 3 mV ≤ 0.01% + 5 mV (≥ 3 A)
	Ripple & Noise	≤ 0.5 mVrms (5 Hz ~ 1 MHz)
	Setting range	0 V - 33.6 V (PPE32-3) 0 V - 21 V (PPE20-5)
	Setting/Read back Accuracy	± (0.03 % of reading + 10 mV)
	Setting/Read back Resolution	programming 5 digits, readback 6 digits
	Maximum remote sensing compensation voltage	0.5V
	Recovery Time	≤ 100 μs (50 % load change, minimum load 0.5 A)
	Temperature Coefficient	≤ 300ppm/°C
Current Regulation	Line Regulation	≤ 0.2 % + 3 mA
	Load Regulation	≤ 0.2 % + 3 mA
	Ripple & Noise	≤ 2 mArms
	Setting range	0 A - 3.15 A (PPE32-3) 0 A - 5.25 A (PPE20-5)
	Setting/Read back Accuracy	± (0.3 % of reading + 10 mA)
	Setting/Read back Resolution	programming 5 digits, readback 6 digits
	Temperature Coefficient	≤ 300 ppm/°C
OVP	Range	OFF,ON(1.8 V - 35.2 V) (PPE32-3) OFF,ON(1.0 V - 22.0 V) (PPE20-5)
	Resolution	100 mV
	Accuracy	≤ ±100 mV
OCP	Range	OFF, ON (0.15 A - 3.3 A) (PPE32-3) OFF, ON (0.25 A - 5.5 A) (PPE20-5)
	Resolution	10 mA
	Accuracy	≤ ±20 mA

Insulation	Chassis and Terminal	20 MΩ or above (DC 500 V)
	Chassis and AC cord	30 MΩ or above (DC 500 V)
EMC	Complies with the European EMC directive 2014/30/EU for Class A test and measurement products.	
Safety	Complies with the European Low Voltage Directive 2014/35/EU and carries the CE-marking.	
Operation Environment	Indoor use, Altitude: ≤ 2000 m Ambient temperature: 0 ~ 40 °C Relative humidity: ≤ 80 % Installation category: II Pollution degree: 2	
Storage Environment	Ambient temperature: -10 °C ~ 70 °C Relative humidity: ≤ 70 %	
Power Source	AC 100 V/120 V/220 V/240 V ± 10 %, 50/60 Hz	
Power consumption	300 VA	
Accessories	Power Cord x1 Packing List x1 Short bar x1 Test lead: GTL-104A x1	
Dimensions	107 mm(W) x 124 mm (H) x 313 mm (D)	
Weight	Approx. 5.2 kg	

4.3. Dimensions





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