DC Power Supply Users Manual

T3PS11230

T3PS12415

T3PS16006

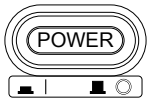
Table of Contents

SAFETY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating the T3PS power supply and when keeping it in storage. Read the following before any operation to insure your safety and to keep the power supply in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the T3PS.

 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 power supply or to other objects or property.
	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.
	I Power On; connected to AC mains. O Power Off; disconnected from AC mains.

Safety Guidelines

General Guideline

⚠ CAUTION

- Do not place heavy objects on the power supply.
- Avoid severe impact or rough handling that may damage the power supply.
- Avoid discharges of static electricity on or near the power supply.
- Use only mating connectors, not bare wires, for the terminals.
- Do not block the cooling fan vent.
- The power supply should only be disassembled by a qualified technician.

(Measurement categories) EN 61010-1:2010 specifies the measurement categories and their requirements as follows. The T3PS falls under category II.

- Measurement category IV is for measurement performed at the source of a low-voltage installation.
- Measurement category III is for measurement performed in a building installation.
- Measurement category II is for measurement performed on circuits directly connected to a low voltage installation.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power Supply

⚠ WARNING

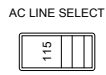
- AC Input voltage: 115V / 230V ±15%
- 47 ~ 63Hz
- Connect the protective grounding conductor of the AC power cord to an earth ground

---

Fuse

⚠ WARNING

- Fuse type: 115V input: T 10A 250V; 230V input: T 6.3A 250V
- To ensure fire protection, replace the fuse only with the specified type and rating.
- Disconnect the power cord before replacing the fuse.
- Make sure the cause of fuse blowout is fixed

	before replacing the fuse.
Cleaning the power supply	• Disconnect the power cord before cleaning the power supply. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into the power supply. • Do not use chemicals containing harsh products such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: < 80% • Altitude: < 2000m • Temperature: 0°C to 40°C
	(Pollution Degree) EN 61010-1:2010 specifies pollution degrees and their requirements as follows. The power supply 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 • Relative Humidity: < 70% • Temperature: -10°C to 70°C
Select AC Voltage ⚠ CAUTION	Before powering up the power supply, select the AC input voltage from the rear panel. 

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.

Power cord for the United Kingdom

When using the T3PS in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

⚠WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

OVERVIEW

This chapter describes the T3PS series of power supplies, including their main features and front / rear panel introduction. After going through the overview, follow the Setup chapter (page 17) to properly power up and set operation environment.

For initial inspection, refer to the Performance adjustment chapter (page27).

Main Features

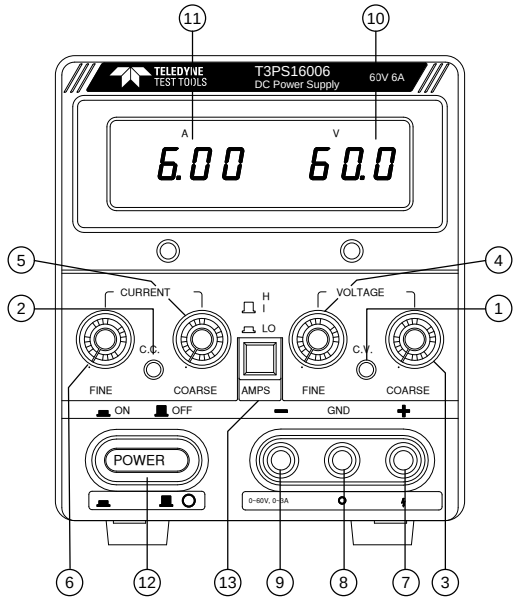
Features

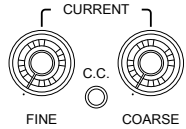
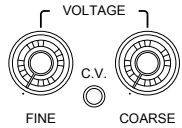
- Broad input power range: For 115V (97~133V), for 230V (195V~265V)
- High frequency switching power
- High power Density
- High efficiency (70%)
- Constant voltage and constant current operation
- Remote output control (on/off)

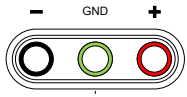
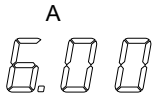
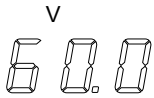
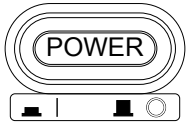
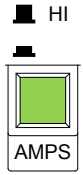
Model Differences

Model name	Voltage	Current	Watts
T3PS11230	12V	30A	360
T3PS12415	24V	15A	360
T3PS16006	60V	6A	360

Front Panel Overview



(1) Constant voltage indicator	C.V. 	The constant voltage indicator lights up when the power supply is in constant voltage mode.
(2) Constant current indicator	C.C. 	The constant current indicator lights up when the power supply is in constant current mode.
(3) Course current knob		Used for coarse adjustment of the current output.
(4) Course current knob		Used for fine adjustment of the current output.
(5) Course voltage knob		Used for coarse adjustment of the voltage output.
(6) Fine voltage knob		Used for fine adjustment of the voltage output.

7	Positive output terminal		Positive polarity terminal
8	Ground terminal		Ground terminal
9	Negative output terminal		Negative polarity terminal
10	Current Display		Displays the current output
11	Voltage display		Displays the voltage output
12	Power switch		
13	Range selector		Selects high or low current range.

CV/CC Crossover Characteristics

Background

T3PS power supplies automatically switch between constant voltage mode (CV) and constant current mode (CC), according to the load conditions.

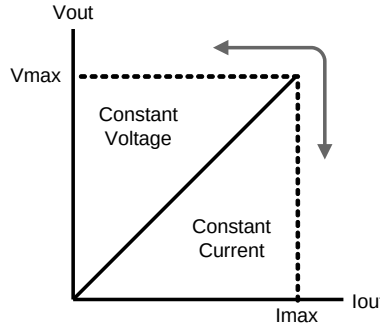
When **the current level is smaller than the output setting**, T3PS operates in **Constant Voltage mode**. The C.V. indicator on the front panel turns green. The Voltage level is kept at the setting and the Current level fluctuates according to the load condition until it reaches the output current setting.

C.V.

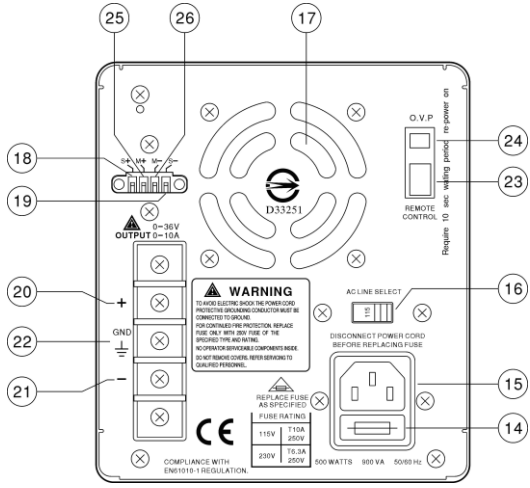
When **the current level reaches the output setting**, T3PS starts operating in **Constant Current mode**. The indicator on the front panel turns red (C.C.) The Current level is kept at the setting but the Voltage level becomes lower than the setting, in order to suppress the output power level from overload. When the current level becomes lower than the setting, T3PS goes back to the Constant Voltage mode.

C.C.

Diagram



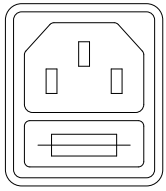
Rear Panel Overview



(14) Fuse holder

(15) Power Socket

DISCONNECT POWER CORD
BEFORE REPLACING FUSE



115V input: T 10A 250V; 230V input: T 6.3A 250V

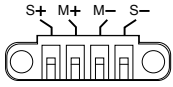
(16) AC line select

AC LINE SELECT

115V / 230V AC line select

(17) Fan

(18) S+ sense terminal



A positive input voltage remote sense terminal.

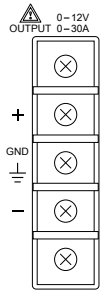
(19) S- sense terminal

A negative input voltage remote sense terminal.

20 Positive output terminal

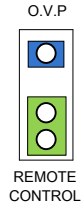
21 Ground

22 Negative output terminal



23 OVP adjuster

Overvoltage protection adjustment



24 Remote control terminal

Remote control jumper.

Open = Remote output off

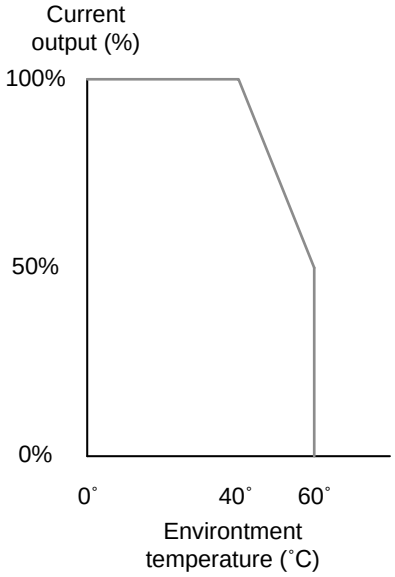
Short = remote output on

Output Current/Temperature Characteristics

Background

The chart below shows the current output characteristics versus temperature.

Diagram



SETUP

This chapter describes how to properly power up and configure T3PS before operation. For checking the functionality, refer to the Performance verification chapter, page 27.

Installation Location

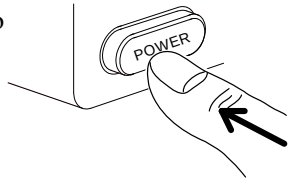
Ventilation and cooling fan clearance

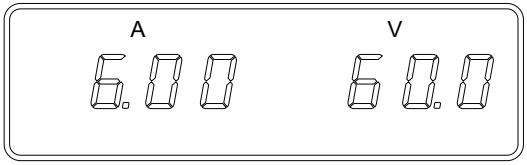
Please ensure there is adequate ventilation and that the cooling fan has enough clearance to allow adequate airflow.

Power Up

Power On

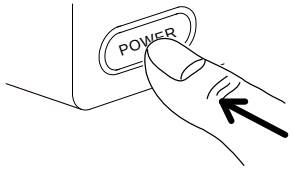
Press the Power switch to turn on the power. The current and voltage display will light up.





Power Off

Press the Power switch again to turn off the power. After two seconds, the meters and indicators turn off.

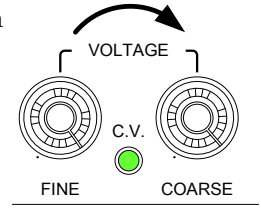


Over Voltage Protection Set Up

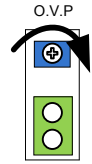
OVP setup Background

Over Voltage Protection (OVP) protects T3PS and DUT from excessive output Voltage. The user sets the maximum output voltage limit before operation. When the output voltage exceeds this limit, the output is shut off immediately.

1. With the machine off, turn the voltage output to maximum.

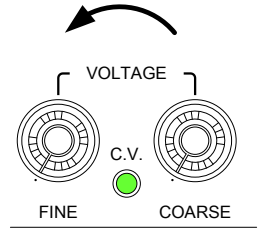


2. Turn the OVP adjuster to maximum (fully clockwise)

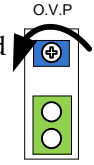


3. Turn on the T3PS.

4. Adjust the voltage output to slightly above the desired OVP level.



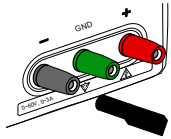
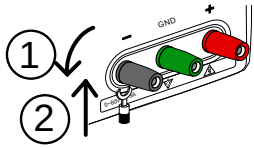
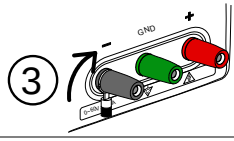
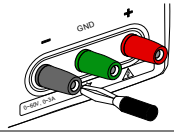
5. Turn the OVP adjuster until the voltage displayed on the meter starts to drop. This sets the OVP level.



Setting range	5% rating to rating +5.5%.

Note	Over voltage protection is always on and cannot be disabled. The OVP voltage however, can be set to the rating voltage +5.5%.

Load Cable Connection

Standard accessory	Insert the plug into the socket.	
Test lead	1. Turn the terminal counterclockwise and loose the screw. 2. Insert the cable terminal. 3. Turn the terminal clockwise and tighten the screw.	 
Banana plug	Insert the plug into the socket.	
Wire type	When using load cables other than the attached, make sure they have enough current capacity for minimizing cable loss and load line impedance. Use the table below to choose an adequate test lead for a given application.	

UL (CSA) Model	1015 TEW Twisted wire							
AWG	24	22	20	18	16	14	12	10
Component pc/mm	11/0.16	17/0.16	21/0.18	34/0.18	26/0.254	41/0.254	65/0.254	65/0.32
Cross sectional area (mm^2)	0.22	0.34	0.53	0.87	1.32	2.08	3.29	5.23
Outer diameter	0.64	0.78	0.95	1.21	1.53	2.03	2.35	3.00
Maximum conductive resistance	88.6	62.5	39.5	24.4	15.6	9.90	6.24	3.90
Permissible current (A)	7.64	10.0	13.1	17.2	22.6	30.4	40.6	55.3

Note

The ambient temperature of "Permissible Current" is at 40°C. The withstanding temperature of a conductor is at 105°C according to the condition of the distributed single wire.

The permissible current listed as above is recommended to be used at under 70%.

If sense wires are are needed, any wire gauge above UL (CSA) AWG 20 is permissible (18~10). When using a capacitive load, please twist the +output test lead with the (S+) sense wire. Similarly, twist the – output wire with the –S sense wire.

If the current value exceeds those shown above, wires can be used in parallel to increase the permissible current draw.

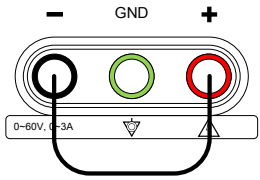
Setting the Current Level

Background

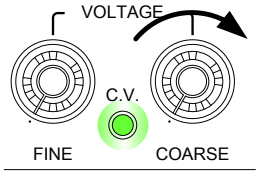
The current level must be set each time a new current level is needed.

Panel operation

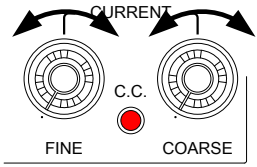
1. Determine the maximum safe current for the EUT.
2. Short the positive (+) and negative (-) terminals.



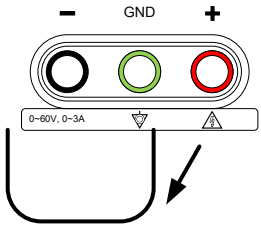
3. Turn the coarse voltage knob away from the zero position until the C.C. knob becomes lit.



4. Adjust the current knobs to the desired current limit. The current will be shown in the ammeter display.



5. The current limit has now been preset. Do not change the current values.
6. Remove the short from the terminals.



7. The power supply is now ready for constant current operation.

Setting the Remote Control

Background — The T3PS output can be controlled remotely using the remote control pins on the rear panel.

Output Off — Remote control pins open.

Output On — Remote control pins shorted.

OPERATION

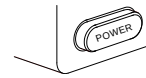
Constant Voltage Mode

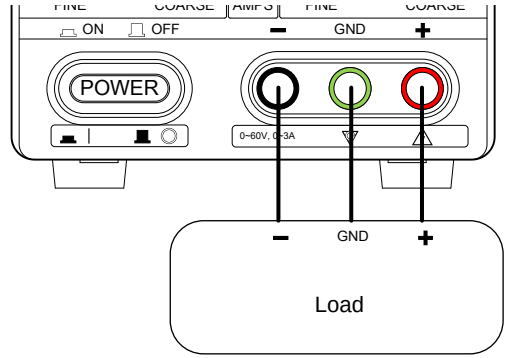
Background

Before voltage can be output, please see page 22 to set the current level.

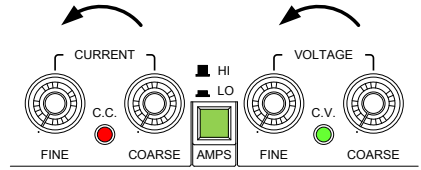
Setting step

1. Connect the test leads to the EUT with the power off.

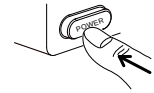




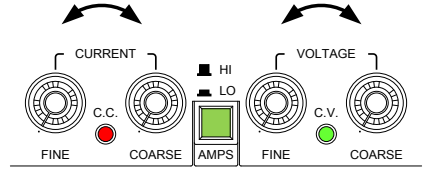
2. Set the current and voltage knobs to the left most position (0A, 0V).



3. Turn the instrument power on.



4. Adjust the current and voltage knobs to the desired values.



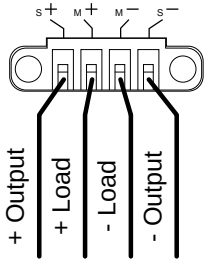
Using the Sense Terminals

Background

The sense terminals are used to compensate for the voltage drop seen across the test leads during quick changes in current output.

M+, M-

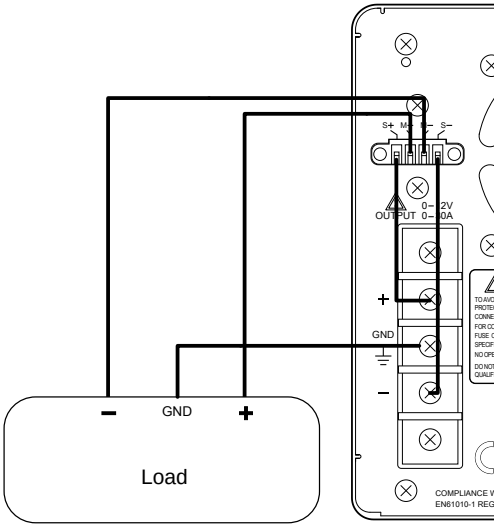
Meter side sense terminals. Connect the M+ terminal to the + positive output terminal of the power supply. Connect the M- terminal to the – negative terminal of the power supply output.



S+, S-

Sense terminals. Connect the S+ terminal to the + positive terminal of the load. Connect the S- terminal to the – negative terminal of the load.

Connection



PERFORMANCE ADJUSTMENT

Overview

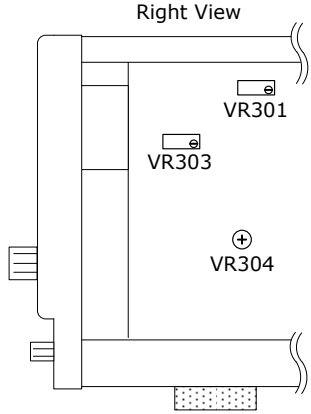
Background	Performance adjustment checks that the T3PS power supply is performing at the correct specification level.
Verification item	• Rating Voltage • Voltage coarse/fine level • Rating Current • Current coarse/fine level

Equipment

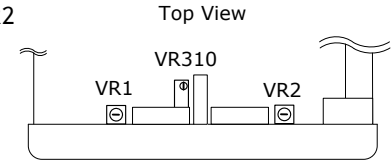
Digital Multimeter	• DCV Accuracy < 0.1% • DCA Accuracy < 0.1% • DCA range: 32A
Philips screw driver	• < 3mm for adjustment points

Adjustment Points

VR301, VR303, VR304

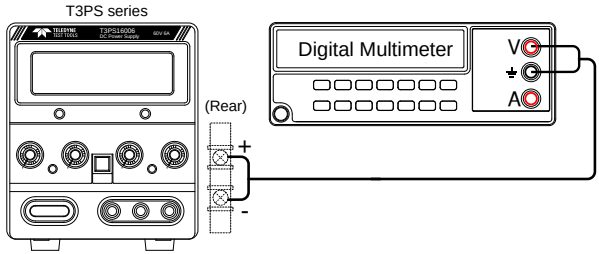


VR1, VR310, VR2



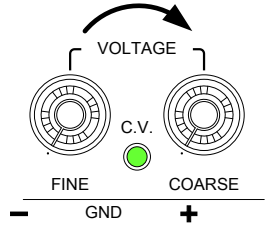
Rating Voltage Adjustment

Connection

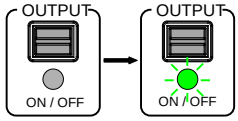


Verification step

1. Connect a multimeter as shown to the output terminals.
2. Turn the voltage coarse and fine knobs fully clockwise to the maximum positions.



3. Adjust VR301 so that the multimeter matches the following values

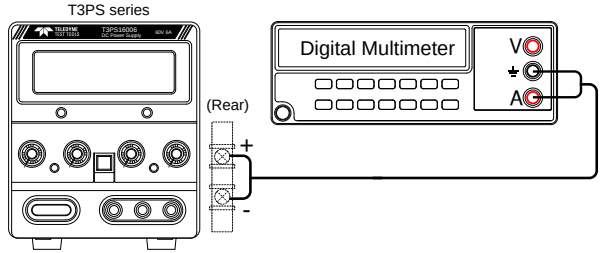


T3PS11230	12.5V
T3PS12415	24.5V
T3PS16006	60.50V

4. Adjust VR2 so that the voltage value of the voltage display matches the voltage shown in the multimeter.

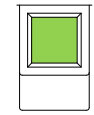
Rating Current Adjustment

Connection

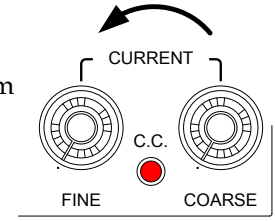


Verification step

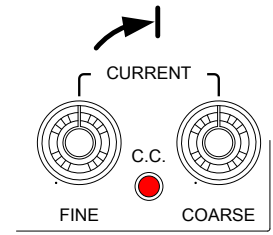
1. Press the AMPS key to set the current range to high.



2. Turn the current coarse and fine knobs fully ant-clockwise to the minimum positions.

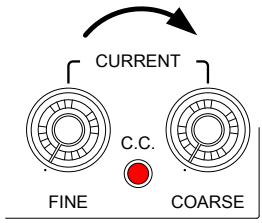


3. Turn the current coarse and fine knobs to the centered position

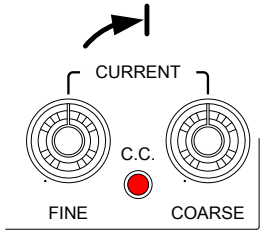


4. Connect a multimeter as shown in the connection diagram above.
5. Adjust VR304 so that the multimeter displays 0.00A.

6. Turn the current coarse and fine knobs fully clockwise to the maximum positions.



7. Turn the current coarse and fine knobs to the centered position

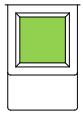


8. Adjust VR303 so that the multimeter displays the following values.

T3PS11230	30.1A
T3PS12415	15.1A
T3PS16006	6.10A

9. Adjust VR2 so that the current value of the ammeter display matches the current shown in the multimeter.

10. Press the AMPS key to set the current range to low.



11. Adjust VR310 so that the multimeter displays the following values. (half of the rating current)

T3PS11230	15.0A
T3PS12415	7.5A
T3PS16006	3.0A

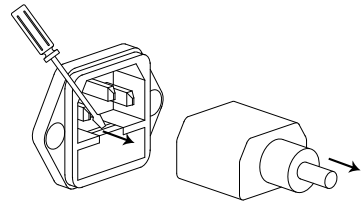
12. Adjust VR401 to set the OVP value.

APPENDIX

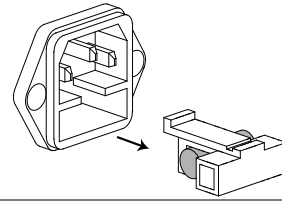
Fuse Replacement

Step

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



2. Replace the fuse in the holder.



Rating

Line Voltage 230V T 10A 250V
Line Voltage 115V T 6.3A 250V

Specification

T3PS		11230	12415	16006
Max rating	Max Voltage	12V	24V	60V
	Max Current	30A	15A	6A
Input rating	Watts		500	
	VA		900	
Fuse	230V		T 10A 250V	
	115V		T 6.3A 250V	
Weight			3.3 kg	
Dimensions	128(W)x145(H)x285(D)mm			
Operation Environment	Indoor, Altitude up to 2000m, Installation Category II, Pollution degree 2			
Operation Temperature & Humidity	0˚ C to 40˚ C, <80%			
Storage Temperature & Humidity	-10˚ C to 70˚ C, <70%.			
Accessories	Test Lead (current < 4A) × 1 Quick Start Guide x 1 Power Cord x 3			
Constant voltage Operation	Output voltage	0 to rating voltage (adjustable)		
Voltage Regulation	Line Regulation	≤ 5mV		
	Load regulation	≤ 5mV		
	Recovery time	≤ 500us (50% load change, minimum load 0.5A)		
	Ripple and noise	≤ 5mVrms, 100mVp-p		
	Temperature coefficient	≤ 100ppm/˚C		

Constant Current	Output current	0 to rating current (adjustable)
	Line regulation	≤ 3mA
	Load regulation	≤ 10mA
	Ripple and Noise	≤ 30m Arms ≤ 10m Arms ≤ 3mA rms
Indicator Meter	Voltage display	3 1/2 Digits 0.39″ Green LED display
	Voltage Accuracy	±(0.5% of rdg + 2 digits)
	Current display	3 1/2 Digits 0.39″ Red LED display
	Current accuracy	±(0.5% of rdg + 2 digits)
Over voltage protection	range	5% rating to rating +5.5%
	accuracy	±(Vset 1%+0.6V)
Insulation	Between chassis and terminal	≥ 20MΩ (DC500V)
	Between chassis and AC cord	≥ 30MΩ (DC500V)

INDEX

ABOUT TELEDYNE TEST TOOLS

TELEDYNE TEST TOOLS
Everywhereyoulook™

Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

Distributed by:

T3 stands for Teledyne Test Tools.