

User Manual

Tektronix

CPS250
Triple Output Power Supply
070-6740-03



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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse

To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Use Proper Voltage Setting

Before applying power, ensure that the line selector is in the proper position for the power source being used.

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:



DANGER
High Voltage



Protective Ground
(Earth) Terminal



ATTENTION
Refer to
Manual



Double
Insulated

Certifications and Compliances

CSA Certified Power Cords

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.



Getting Started

The Tektronix CPS250 Triple Output Power Supply is a multifunction bench or portable instrument. The fixed 5 volt output is available for use in transistor-transistor-logic (TTL) applications. Two 0 V to 20 volt, 500 mA, variable outputs meet the needs of most semiconductor test or experimental applications. Two or three of the output voltages may be externally wired to produce voltages different than the standard front panel voltages.

The Tektronix CPS250 Triple Output Power Supply has a locking, multiposition handle that folds under the instrument to allow stacking with other instruments of the same series. The power supply is delivered with a set of test leads, a 115 V power cord, an installed fuse for 115 V operation, and this manual.

Preparing the Power Supply for Use

Check the following items prior to operating the CPS250 Triple Output Power Supply for the first time (see Figure 1 for locations of items 1 through 3):

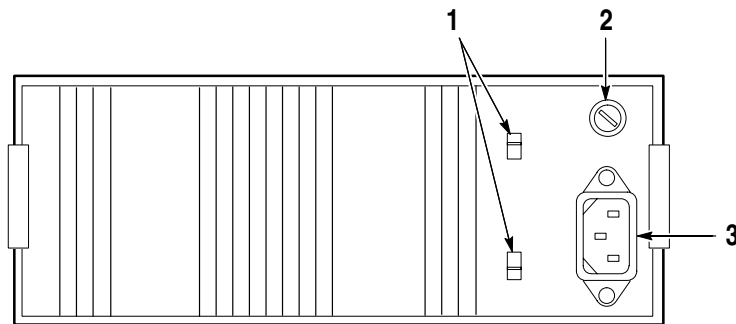


Figure 1: Line Voltage Selectors, Power Input, and Fuse Locations



CAUTION. To prevent damage to the instrument, set the line voltage selectors to the proper voltage setting and install the correct line voltage fuse before operating the equipment.

1. Set the line voltage selectors to the input line voltage. These selectors connect internal wiring for various line voltages. This product is intended to operate from a power source that does not supply more than 250 V_{RMS} between the supply conductors or between either supply conductor and ground. For line voltage ranges, refer to *Appendix A: Specifications* on page 17.



WARNING. To prevent electrical shock, unplug the power cord and disconnect the test leads from the circuit before checking or replacing the fuse.

2. Check that the correct line fuse is installed. The line fuse provides protection if the equipment malfunctions or an overload occurs. Refer to *Appendix C: Replaceable Parts* on page 23 for fuse part numbers.



WARNING. *To prevent electrical shock, connect the power cord to a properly grounded power source. The outside (ground) of this connector is connected through the equipment to the power source ground. Do not remove the ground lug from the power cord for any reason.*

3. Connect the input power cord. Use only the power cords specified for this equipment. Refer to *Appendix C: Replaceable Parts* on page 23 for power cord part numbers.

NOTE. *The center connector blade is connected to the green GND binding post on the front panel.*

4. Check the V and mA meters for mechanical zero. Adjustment may be corrected with the mechanical zero adjust disk located below the center of each meter. (Refer to Figure 2, item 4.)



CAUTION. *To prevent power supply damage, observe the mA meter and OVERLOAD indicators frequently during operation. The red areas of the meter scales indicate values in excess of equipment specifications.*

To prevent damage to the circuit(s) powered by the CPS250 Triple Output Power Supply, check the polarity of the circuit(s) before connecting them to the power supply.

Front Panel

Figure 2 shows the front-panel controls, connectors, and indicators with brief descriptions of the items following the figure.

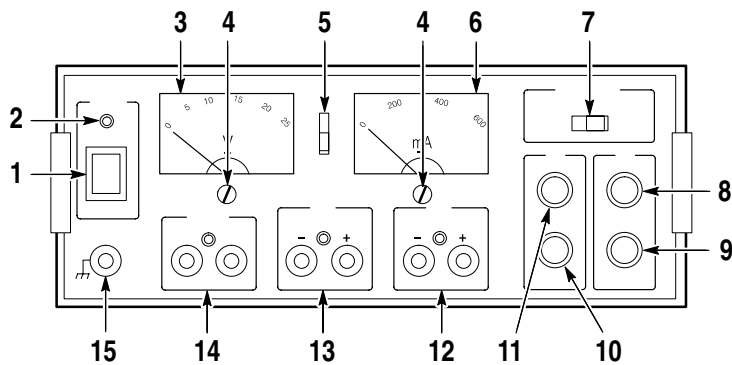


Figure 2: Front Panel

1. **POWER Button.** Push top of switch to the ON position to turn power supply on. Push bottom of switch to the OFF position to turn equipment off.
2. **POWER ON Indicator.** When lighted, LED indicates a power-on condition.
3. **Voltage Meter.** This meter indicates the voltage level of A or B output, depending on the position of the A/B meter switch. The meter may be mechanically set for zero with the slotted mechanical zero adjust disk below the center of the meter.
4. **Mechanical Meter Adjustment.** These slotted, plastic disks allow mechanical zero adjustment of the V and mA meters. Always rotate the adjustment in a clockwise direction for optimum results.
5. **A/B Meter Switch.** This switch connects the V and mA meters to the A or B output circuit.

6. Milliampere Current Meter. This meter indicates the current level of A or B output, depending on the position of the A/B meter switch. The meter may be mechanically set for zero with the slotted mechanical zero adjust disk below the center of the meter.
7. A/B Output Switch. Switches A and B outputs from INDEPENDENT to TRACKING PARALLEL or TRACKING SERIES operation. When the switch is in the TRACKING position, A VOLTAGE and A CURRENT controls set the level of both A and B outputs. B VOLTAGE and B CURRENT controls are inoperative when the A/B OUTPUTS switch is set to the TRACKING position.
8. B Voltage Control. Rotate to set voltage at B output terminals when A/B OUTPUTS switch is in the INDEPENDENT position. This control is inoperative when A/B OUTPUTS switch is in the TRACKING position.
9. B CURRENT Control. Rotate to set current level available at B output when A/B OUTPUTS switch is in INDEPENDENT position. Control is inoperative when A/B OUTPUTS switch is in the TRACKING position.
10. A CURRENT Control. Rotate to set current level available at A output when A/B OUTPUTS switch is in the INDEPENDENT position.
11. A VOLTAGE Control. Rotate to set voltage at A output terminals when A/B OUTPUTS switch is in the INDEPENDENT position.
12. A Output. Positive (red) and negative (black) output for independent 0 to 20 VDC, 0.5 A maximum. LED lights when OVERLOAD current limit is reached or exceeded.
13. B Output. Positive (red) and negative (black) output for independent 0 to 20 VDC, 0.5 A maximum. LED lights when OVERLOAD current limit is reached or exceeded.
14. 5 V 2 A Output. Positive (red) and negative (black) output for fixed 5 volts DC, 2 A maximum. LED lights when OVERLOAD current limit is reached or exceeded.
15. Chassis Ground Connector. The green binding post is connected through the power cord to the power receptacle ground.

Getting Started

Reference

This section of the manual includes examples of how to use the CPS250 Triple Output Power Supply. The number of possible applications is extensive, so only a few examples are given.



CAUTION. *Heat buildup may occur on the rear-panel heat sink during operation. To prevent equipment damage, ensure that the power supply has adequate air space for heat dissipation. Do not place hands or other objects on the heat sink during or after extended operation.*

Independent Mode Applications

When in INDEPENDENT mode, any one output of each supply may be connected to any one terminal of another supply or to ground. Variable supplies are independently controlled by front panel voltage and current controls. Ground reference is recommended for safety.

There are two types of independent mode operation:

- Series Operation. A and B supplies (outputs) can be set to give 0 V to 40 V output with the A/B OUTPUTS switch.
- Parallel Operation. A and B supplies (outputs) may be set to parallel operation with the A/B OUTPUTS switch. A and B supplies may be operated in parallel to increase current. Refer to *Parallel Tracking* on page 14.

Independent Floating

Figure 3 on page 8 shows each of the three power supply outputs connected to separate loads. In this example the A/B OUTPUTS switch is set to INDEPENDENT. The green coded A VOLTAGE and A CURRENT controls set the level of output A. The brown coded controls set the level for output B. The three outputs are electrically independent. The V and mA meters read A or B output values (selected with the A/B meter switch).

To configure the power supply for independent floating, do the following:

1. With the CPS250 Triple Output Power Supply on and the outputs disconnected from loads, set the **A** and **B VOLTAGE** controls to the values needed (read on the **V** meter). Set the **A** and **B CURRENT** controls to midrange.
2. Turn **POWER** to **OFF**, and connect the load(s).
3. Turn **POWER** to **ON**, and readjust voltages if necessary.

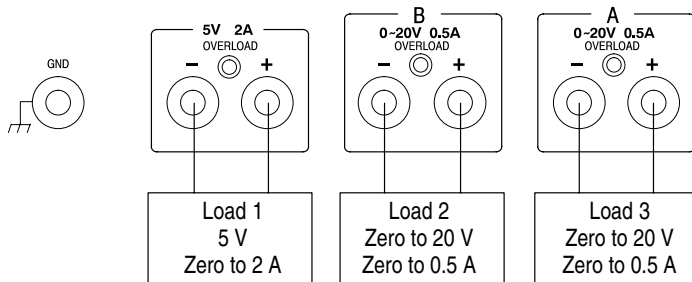


Figure 3: Independent Floating Application

Independent Ground-Referenced



CAUTION. To prevent damage to the equipment when using any ground-referenced output configuration from the CPS250, the circuit or equipment being powered must be isolated from the CPS250's line voltage power source.

Any one of each pair of output terminals, positive (+) or negative (-), may be connected to ground in any combination. Table 1 shows many of the possible voltage combinations using the chassis ground as a reference.



CAUTION. To prevent electric shock, do not elevate any power supply output terminals with any external voltage source or power supply.

Table 1: Independent Ground-Referenced Voltage Combinations

5-Volt Supply	A-Supply	B-Supply
+5 V, fixed	0 to +20 V	0 to +20 V
+5 V, fixed	0 to +20 V	0 to -20 V
+5 V, fixed	0 to -20 V	0 to +20 V
+5 V, fixed	0 to -20 V	0 to -20 V
-5 V, fixed	0 to +20 V	0 to +20 V
-5 V, fixed	0 to +20 V	0 to -20 V
-5 V, fixed	0 to -20 V	0 to +20 V
-5 V, fixed	0 to -20 V	0 to -20 V

Figure 4 on page 10 shows an example of a circuit with the +5 volt terminal referenced to ground and both the A and B supplies referenced to -5 V. In this configuration, each of the positive-going 20 V supplies can be varied from -5 V to +15 V (+20 V overall). The GND post becomes the negative terminal for the A and B outputs. The V meter will indicate 0 V when the output is -5 V, 5 V when the output is zero, and 20 V when the output is 15 V. Negative 5 V is taken between GND and the black (-) post of the 5 V, 2 A output. To set up this configuration, proceed as follows:

1. Turn the CPS250 **POWER** to **OFF**. Connect the outputs as shown in Figure 4 on page 10.
2. Set the **A** and **B VOLTAGE** controls to **MIN** and the **A** and **B CURRENT** controls to midrange.
3. Turn **POWER** to **ON**. The V meter should read 0 V in both the A and B position. An external meter connected across the load or load terminals should read -5 V.
4. Turn **POWER** to **OFF**, and connect the load(s).
5. Turn **POWER** to **ON**, and readjust voltages if necessary.

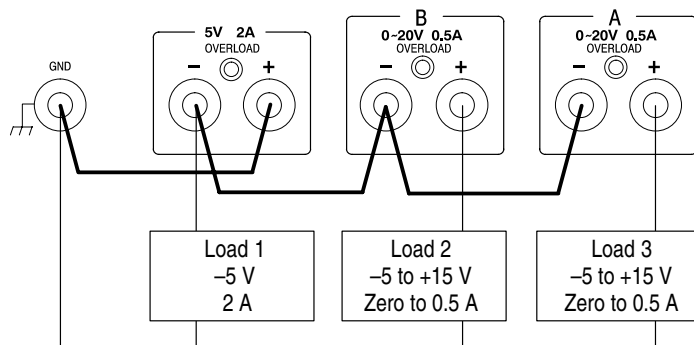


Figure 4: Independent Ground-Referenced Applications (A)

Figure 5 shows the power supply connected to produce separate outputs of +5 V, 0 V to +20 V from the B supply, and 0 V to -20 V from the A supply. In this configuration the red terminal of output A is the relative negative terminal because it is connected directly to GND. To set up this configuration, proceed as follows:

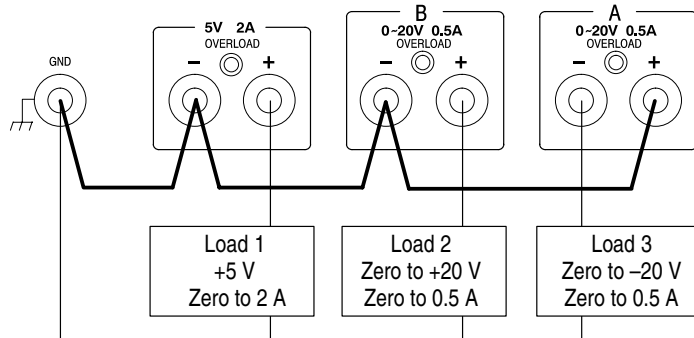


Figure 5: Independent Ground-Referenced Applications (B)

1. Turn the CPS250 **POWER** to **OFF**. Connect the outputs as shown in Figure 5.

2. Set the **A** and **B VOLTAGE** controls to **MIN** and the **A** and **B CURRENT** controls to midrange.
3. Turn **POWER** to **ON**, and set the desired A and B voltages.
4. Turn **POWER** to **OFF**, and connect the load(s).
5. Turn **POWER** to **ON**, and readjust voltages if necessary.

Figure 6 shows the power supply connected in series to produce a variable output of 0 + 40 V, ground referenced, and -5 V, ground referenced. The **VOLTAGE** and **CURRENT** controls are in series. The **V** meter reads only one supply at a time and the **mA** meter reads total current in either position. To read the total voltage the readings from the **A** position and **B** position must be added. To set up this configuration, proceed as follows:

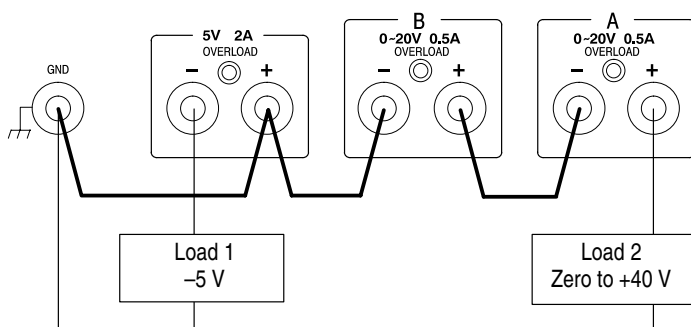


Figure 6: Connecting the Two 0–20 V Supplies in Series to Product 0 to +40 V

1. Turn **POWER** to **OFF**, and connect the outputs as shown in Figure 6.
2. Set the **A** and **B VOLTAGE** controls to **MIN** and the **A** and **B CURRENT** controls to midrange.
3. Turn **POWER** to **ON**, and observe the **V** meter in the **A** and **B** positions to set the desired voltage. Remember, the total output is the sum of the two readings.
4. Turn **tPOWER** to **OFF**, and connect the loads.

5. Turn **POWER** to **ON**, and readjust voltages if necessary.

Zero to -40 V and fixed $+5\text{ V}$ outputs are shown in Figure 7. Follow the procedures outlined above to operate this configuration.

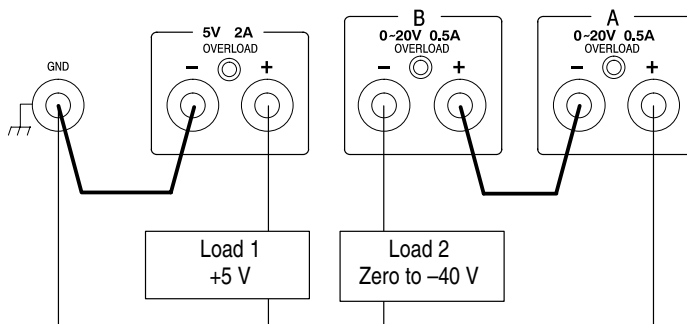


Figure 7: Connections to Provide Fixed $+5\text{ V}$ and 0 to -40 V

Figure 8 shows the configuration for three, ground referenced, negative supplies.

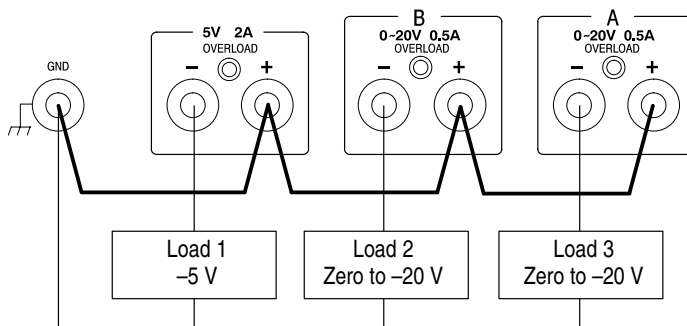


Figure 8: Independent Ground-Referenced Applications (negative output)

Figure 9 shows the connections for three ground referenced, positive supplies.

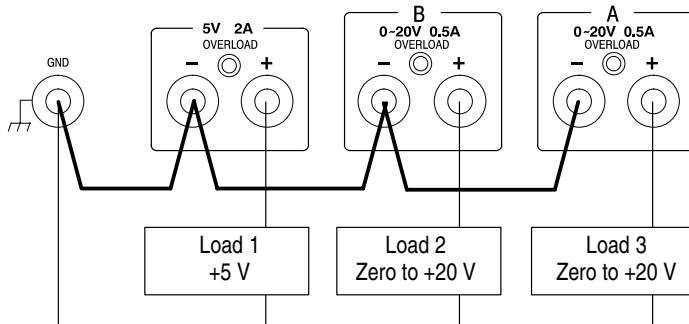


Figure 9: Independent Ground-Referenced Applications (positive output)

Tracking Mode Applications

Series Tracking

When the A/B OUTPUTS selector is set to SERIES TRACKING, the -output of the A variable supply is connected internally to the +output of the B variable supply. When set to the SERIES TRACKING mode, the output may be floating or ground referenced. However, only one terminal of the two variable supplies may be grounded. These options are shown in Figure 10 on page 14. The output voltage and current are controlled by the A VOLTAGE and A CURRENT controls. For convenience, set the B VOLTAGE and B CURRENT controls fully clockwise to avoid the B supply shutting down.

The 5 V fixed supply may be independently grounded or allowed to float.

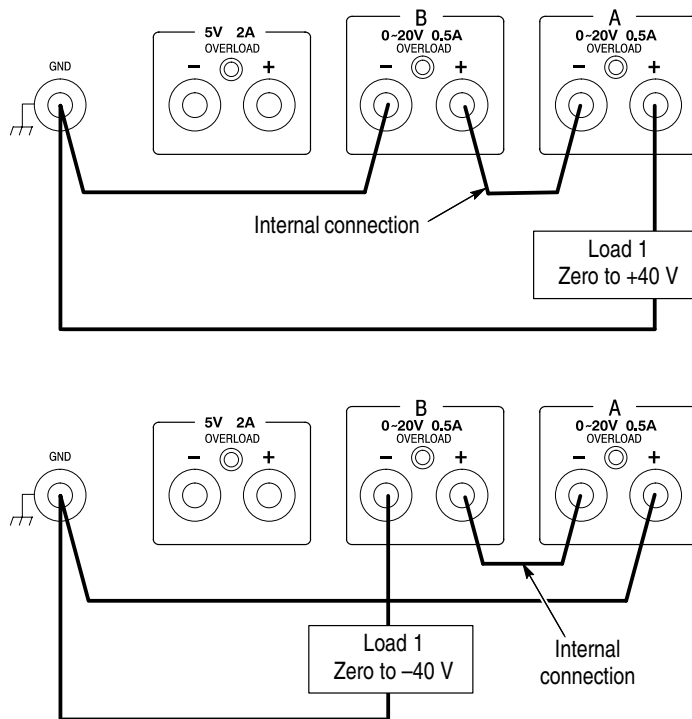


Figure 10: Series-Tracking Applications

Parallel Tracking

When the A/B OUTPUTS selector is set to PARALLEL TRACKING, the + outputs of the A and B variable supplies are connected and the - outputs of the A and B variable supplies are connected. The resulting combination is a single supply capable of providing 0 V to 20 V and up to 1.2 A. Control is provided by the A VOLTAGE and A CURRENT controls. The B VOLTAGE and B CURRENT controls should be set fully clockwise. The parallel output may be floating or ground referenced, but only one terminal (+ or -) may be at ground reference. Those options are shown in Figure 11.

The 5 V fixed supply may be independently grounded or allowed to float.

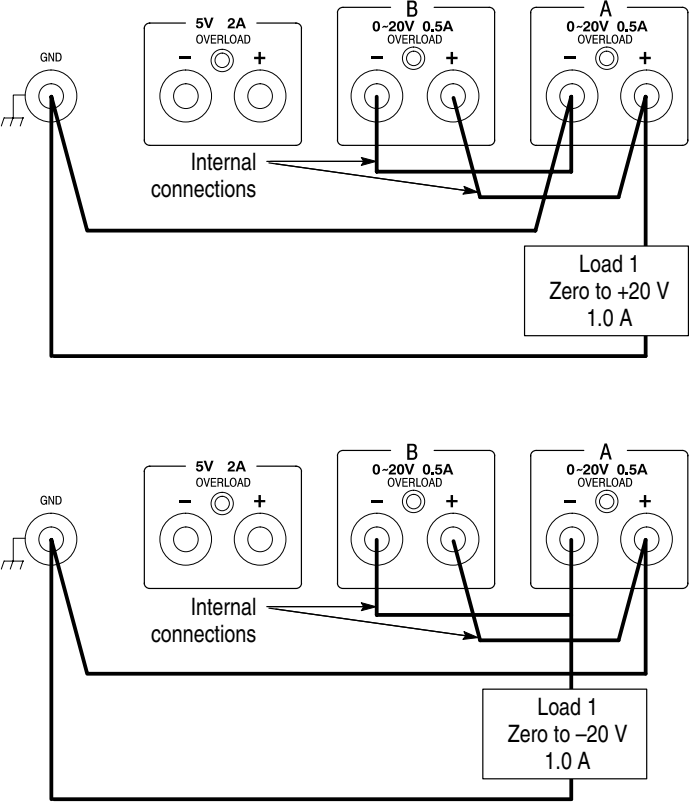


Figure 11: Parallel-Tracking Applications

Reference

Appendix A: Specifications

The following tables list the physical, environmental, operational, and electrical characteristics of the CPS250 Triple Output Power Supply:

Table 2: Certifications and Compliances

EC Declaration of Conformity – EMC	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EN 55011 Class A Radiated and Conducted Emissions</p> <p>EN 50081-1 Emissions: EN 60555-2 AC Power Line Harmonic Emissions</p> <p>EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity IEC 801-5 Power Line Surge Immunity</p>
EC Declaration of Conformity – Low Voltage	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC, amended by 93/68/EEC: HD401S1 Safety requirements for electronic measuring apparatus</p>

Table 3: Physical Characteristics

Width	240 mm (9.46 in)
Height	100 mm (3.94 in)
Depth	230 mm (9.0 in)
Weight	5.1 kg (11.2 lb)

Appendix A: Specifications

Table 4: Environmental Characteristics

Storage Temperature	-10° C to 60° C, 80% RH
Operating Temperature	10° C to 40° C, 75% RH

Table 5: Operational Characteristics

Outputs	0 to 20 VDC (two), 5 VDC
Voltage (5 V)	5.0 ±0.1 VDC at 2.0 A maximum
Voltage (0–20 V)	0–20 VDC at 0.5 A maximum
Load Regulation (5 V)	0.1% +5 mV
Load Regulation (0–20 V)	0.01% +3 mV
Ripple/Noise	2 m V _{RMS} , 5 Hz–1 MHz
Tracking Error	±0.2% ±20 mV
Indicator	Analog type front panel meter
Meter Indicators	0–25 VDC ±2.5% of full scale 0–600 mA ±2.5% of full scale

Table 6: Electrical Characteristics

Line Voltage Range	90 to 110, 108 to 132, 198 to 242, and 216 to 250 VAC at 50–60 Hz
Power Consumption	175 VA, 160 W maximum

Appendix B: Maintenance

This appendix provides information for the basic maintenance of the CPS250 Triple Output Power Supply.

Cleaning

To clean the power supply, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.

Do not use chemicals containing benzine, benzene, toluene, xylene, acetone, or similar solvents.

Do not use abrasive cleaners on any portion of the power supply.

Preparing for Shipment

If the original packaging is unfit for use or not available, use the following packaging guidelines:

1. Use a corrugated cardboard shipping carton having inside dimensions at least three inches greater than the instrument dimensions.
2. Put the instrument into a plastic bag or wrap to protect it from dampness and loose packing material.
3. Place the instrument into the box and firmly stabilize it with packing material.
4. Seal the carton with shipping tape.

Troubleshooting

Electronic maintenance on the CPS250 Triple Output Power Supply must be performed by a trained technician. However, an operator can perform some basic and routine maintenance. The power supply will give some indications of problems to aid the operator.

Power Switch is On but Power-On LED not Lighted

NOTE. *The power indicator light is in the secondary of the 5 volt power supply circuit and may be inoperative even when voltages are present at the outputs of the supplies.*

1. Check all outputs with a voltmeter. If the variable supplies are working, but the 5 V supply is not, the problem is in the 5 V supply. Contact your nearest Tektronix service center for servicing.
2. If all supplies are working and the power indicator is off, contact your nearest Tektronix service center for servicing.



WARNING. *To prevent electrical shock, unplug the power cord and disconnect the test leads from any circuit before checking or replacing the fuse.*

3. If none of the supplies are working, check the line fuse. If the fuse is open, replace it.
4. If the line fuse is good, check the power outlet for proper voltage. If the outlet voltage is incorrect, call service personnel.



WARNING. *To prevent electrical shock, be sure the power cord is disconnected at both ends before checking for continuity.*

5. If outlet voltage is correct, check power cord continuity. If the power cord fails the continuity check, replace the power cord.

POWER Light ON, but No Output from A or B Supplies with Power Supply connected to Circuit

1. Disconnect the CPS250 outputs from the circuit being tested. Check **A** and **B VOLTAGE** and **CURRENT** controls.
2. If the outputs are good, check the circuit under test for a short or low resistance.

POWER Light ON, but No Output from Any Supplies with Power Supply Not Connected to Circuit

Contact your nearest Tektronix service center for servicing.

Appendix B: Maintenance

Appendix C: Replaceable Parts

Replaceable parts may be ordered directly from your authorized Tektronix dealer.

Standard Accessories

The following items are shipped with the CPS250 Triple Output Power Supply:

Table 7: Standard Accessories

Accessory	Tektronix Part Number
Fuse, 3AG, 2A, 250V, SB (90 – 132 V Operation)	159-0023-00
CPS250 User Manual	070-6740-XX
115V Power Cord	Refer to Table 9
Lead Set	196-3384-XX

Optional Accessories

The following items are available as optional accessories:

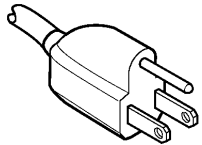
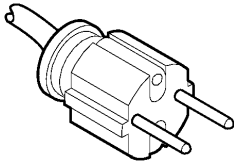
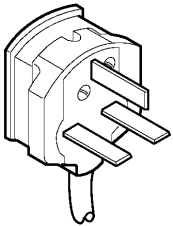
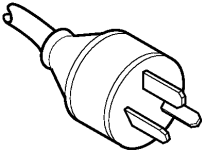
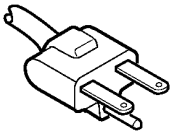
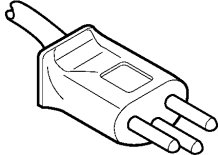
Table 8: Optional Accessories

Accessory	Tektronix Part Number
Fuse, 3AG, 1A, 250V, SB (198 – 250 V operation)	159-0019-00
230V Power Cords	Refer to Table 9

Appendix C: Replaceable Parts

The following power cords are available.

Table 9: Accessory Power Cords

Plug Configuration	Normal Usage	Tektronix Part Number
	North America 115 V	161-0104-00
	Europe 230 V	161-0104-06
	United Kingdom 230 V	161-0104-07
	Australia 230 V	161-0104-05
	North America 230 V	161-0104-08
	Switzerland 230 V	161-0167-00