



CERTIFICATION

Agilent Technologies certifies that this product met its published specifications at time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (formerly National Bureau of Standards), to the extent allowed by that organization's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Agilent Technologies hardware product is warranted against defects in material and workmanship for a period of three years from date of delivery. Agilent software and firmware products, which are designated by Agilent for use with a hardware product and when properly installed on that hardware product, are warranted not to fail to execute their programming instructions due to defects in material and workmanship for a period of 90 days from date of delivery. During the warranty period, either Agilent or Agilent Technologies will, at its option, either repair or replace products which prove to be defective. Agilent does not warrant that operation the software, firmware, or hardware shall be uninterrupted or error free.

For warranty service, with the exception of warranty options, this product must be returned to a service facility designated by Agilent. Return to Englewood Colorado Service Center for repair in United States(1-800-258-5165). Customer shall prepay shipping charges by (and shall pay all duty and taxes) for products returned to Agilent for warranty service. Except for the products returned to Customer from another country, Agilent shall pay for return of products to Customer.

Warranty services outside the country of initial purchase are included in Agilent's product price, only if Customer pays Agilent international prices (defined as destination local currency price, or U.S. or Geneva Export price).

If Agilent is unable, within a reasonable time, to repair or replace any product to condition as warranted, the Customer shall be entitled to a refund of the purchase price upon return of the product to Agilent.

The warranty period begins on the date of delivery or on the date of installation if installed by Agilent.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation and maintenance. **TO THE EXTENT ALLOWED BY LOCAL LAW, NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. AND AGILENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

For consumer transactions in Australia and New Zealand:

The warranty terms contained in this statement, except to the extent lawfully permitted, do not exclude, restrict or modify and are in addition to the mandatory rights applicable to the sale of this product to you.

EXCLUSIVE REMEDIES

TO THE EXTENT ALLOWED BY LOCAL LAW, THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. AGILENT SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

The above statements apply only to the standard product warranty. Warranty options, extended support contacts, product maintenance agreements and customer assistance agreements are also available. Contact your nearest Agilent Technologies Sales and Service office for further information on Agilent's full line of Support Programs.



Manufacturer's Name and Address

Responsible Party

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Alternate Manufacturing Site

Agilent Technologies (Malaysia) Sdn. Bhd
Malaysia Manufacturing
Bayan Lepas Free Industrial Zone, PH III
11900 Penang,
Malaysia

Declares under sole responsibility that the product as originally delivered

Product Name: a) Single Output dc Power Supply (dual range)
b) Single Output dc Power Supply (single range)
c) Single Output System Power Supply
d) Multiple Output dc Power Supply
e) Multiple Output System dc Power Supply

Model Number: a) E3610A, E3611A, E3612A
b) E3614A, E3615A, E3616A, E3617A
c) E3632A
d) E3620A, E3630A
e) E3631A

Product Options: This declaration covers all options of the above product(s).

Complies with the essential requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly.

EMC Information ISM Group 1 Class A Emissions

As detailed in Electromagnetic Compatibility (EMC), Certificate of Conformance Number CC/TCF/00/102 based on Technical Construction File (TCF) ANJ12, dated Dec.20, 2000.

Assessed by: Celestica Ltd, Appointed Competent Body
Westfields House, West Avenue
Kidsgrove, Stoke-on-Trent
Staffordshire, ST7 1TL
United Kingdom

Safety Information and Conforms to the following safety standards.

IEC 61010-1:2001 / EN 61010-1:2001
CSA C22.2 No. 1010.1:1992

This DoC applies to above-listed products placed on the EU market after:

January 1, 2004

Date

Bill Darcy/ Regulations Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor, or *Agilent Technologies Deutschland GmbH, Herrenberger StraÙe 130, D71034 Böblingen, Germany*

**TRIPLE OUTPUT POWER SUPPLY
Agilent MODEL E3630A**

OPERATING AND SERVICE MANUAL

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER.

Verify that the product is set to match the available line voltage and that the correct fuse is installed.

GROUND THE INSTRUMENT.

This product is a Safety Class I instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the ac power supply mains through a three-conductor power cable, with the third wire firmly connected to an electrical ground(safety ground) at the power outlet. Any interruption of the protective(grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury. If the instrument is to be energized via an external autotransformer for voltage reduction, be certain that the autotransformer common terminal is connected to the neutral(earthed pole) of the ac power lines (supply mains).

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

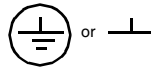
DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

SAFETY SYMBOLS



Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



Indicate earth(ground) terminal.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond CAUTION sign until the indicated conditions are fully understood and met.

NOTE

The NOTE sign denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

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GENERAL INFORMATION

INTRODUCTION

This section contains general information concerning the E3630A triple output power supply. Included are safety considerations, safety and EMC requirements, instrument and manual identification, option and accessory information, instrument description, and specifications.

SAFETY CONSIDERATIONS

This product is a Safety Class I instrument, which means that it is provided with a protective earth ground terminal. This terminal must be connected to an ac source that has a 3-wire ground receptacle. Review the instrument rear panel and this manual for safety markings and instructions before operating the instrument. Refer to the Safety Summary page at the beginning of this manual for a summary of general safety information. Specific safety information is located at the appropriate places in this manual.

SAFETY AND EMC REQUIREMENTS

This power supply is designed to comply with the following safety and EMC(Electromagnetic Compatibility) requirements

- IEC 1010-1(1990)/EN 61010 (1993): Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
- CSA C22.2 No.231: Safety Requirements for Electrical and Electronic Measuring and Test Equipment
- UL 1244: Electrical and Electronic Measuring and Testing Equipment
- EMC Directive 89/336/EEC: Council Directive entitled Approximation of the Laws of the Member States relating to Electromagnetic Compatibility
- EN 55011(1991) Group 1, Class B/CISPR 11 (1990): Limits and Methods of Radio Interference Characteristics of Industrial, Scientific, and Medical(ISM) Radio - Frequency Equipment
- EN 50082-1(1992) /
 - IEC 801-2(1991): Electrostatic Discharge Requirements
 - IEC 801-3(1984): Radiated Electromagnetic Field Requirements
 - IEC 801-4(1988): Electrical Fast Transient/Burst Requirements
- ICES/NMB-001
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

INSTRUMENT AND MANUAL IDENTIFICATION

A serial number identifies your power supply. The serial number encodes the country of manufacture, the week of the latest significant design change, and a unique sequential number. The letter "KR" designates Korea as the country of manufacture, the first one digit indicates the year (3=1993, 4=1994, and so forth), and the second two digits indicate the week. The remaining digits of the serial number are a unique, five-digit number assigned sequentially.

If a yellow Change Sheet is supplied with this manual, its purpose is to explain any differences between your instrument and the instrument described in this manual.

The Change Sheet may also contain information for correcting errors in the manual.

OPTIONS

Options 0EM, 0E3, and 0E9 determine which line voltage is selected at the factory. The standard unit is configured for 115 Vac \pm 10%, 47-63 Hz input.

Option No.	Description
0EM:	115 Vac \pm 10%, 47-63 Hz Input
0E3:	230 Vac \pm 10%, 47-63 Hz Input
0E9:	100 Vac \pm 10%, 47-63 Hz Input
0L2:	One additional operating and service manual shipped with the power supply

ACCESSORY

The accessory listed below may be ordered from your local Agilent Technologies Sales Office either with the power supply or separately. (Refer to the list at the rear of the manual for address.)

Agilent Part No. Description

5063-9767	Rack Kit for mounting one or two 3 1/2" high supplies in a standard 19" rack
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The rack mount kit is needed for rack mounting of the E3630A power supply.

DESCRIPTION

This constant-voltage/current-limiting triple output power supply combines two 0 to \pm 20V tracking outputs rated at 0.5 amps with an additional single output that is rated at 0 to 6 volts and 2.5 amps. The +20V and -20V tracking outputs can also be used in series as a single 0 to 40V 0.5-amp output. Connections to the supply's output and to chassis ground are made to binding posts on the front panel. The supply's three outputs share a common output terminal, which is isolated from chassis ground so that any one output terminal can be grounded.

All outputs are protected against overload and short-circuit damage. The \pm 20V outputs are protected by circuits that limit the output current to 110% of its nominal maximum. The overload protection circuit for the +6V output has a current foldback characteristic that reduces the output current as an overload increases until only 1 amp flows through a short circuit. The 6V output current limit depends on the output terminal voltage and varies linearly between 2.75 amps at 6 volts and 1 amp at zero volts.

All controls, digital meter, and output terminals are located on the front panel. One voltage control sets the 0 to 6V and another sets the voltages of the 0 to +20V and 0 to -20V outputs simultaneously. These dual tracking outputs are made more versatile by providing a tracking ratio control in addition to the usual voltage control. With the tracking ratio control turned fully clockwise to its "fixed" position, the dual outputs have a fixed 1:1 tracking ratio. As the \pm 20V voltage control is adjusted, the voltage of the negative supply tracks the positive output within \pm 1%. Turning the tracking ratio control away from its fully clockwise position switches the dual tracking outputs into a variable tracking ratio

mode. In this mode the voltage of the negative output can be set lower than that of the positive output. The tracking ratio control allows the negative supply's output to be set to any value between a maximum that is within $\pm 5\%$ of the positive supply's output and a minimum that is less than 0.5 volts. Once a ratio is established by the tracking ratio control, the ratio of the positive output voltage to the negative output voltage remains constant as the $\pm 20\text{V}$ voltage control varies the 0 to +20V output over its range.

The front panel also contains a line switch, three overload indicators for +6V output, +20V output, and -20V output, a voltmeter and an ammeter, and three push-button meter switches. The push buttons select one of the supply's three outputs for display. The voltmeter and ammeter always monitor any one supply simultaneously. In addition to the standard 115 Vac $\pm 10\%$ 47 to 63 Hz input, two other line voltage options

are available for nominal inputs of 100 and 230 Vac. The supply is furnished with a detachable 3-wire grounding type line cord. The ac line fuse is in an extractor type fuseholder on the rear heat sink.

LINE FUSE

The line fuse is located by the ac line receptacle. Check the rating of the line fuse and replace it with the correct fuse if necessary as indicated below. These are slow-blow fuses.

Line Voltage	Fuse	Agilent Part No.
100/115 Vac	1.6 A	2110-0918
230 Vac	1.0 A	2110-0599

SPECIFICATIONS

Table 1 lists detailed specifications for the power supply.

Table 1. Specifications

<p>AC INPUT</p> <p><u>OEM:</u> 115 Vac $\pm 10\%$, 47-63 Hz, 115 VA, 84 W <u>OE9:</u> 100 Vac $\pm 10\%$, 47-63 Hz, 115 VA, 84 W <u>OE3:</u> 230 Vac $\pm 10\%$, 47-63 Hz, 115 VA, 84 W</p> <p>DC OUTPUT and OVERLOAD PROTECTION</p> <p><u>0 to +20 V Outputs:</u> Maximum rated output current is 0.5 A. Short circuit output current is 0.55 A $\pm 5\%$ and a fixed current limit circuit limits the output of each supply to this maximum at any output voltage setting. Unbalanced loads within current rating are permitted.</p> <p><u>0 to +6 V Output:</u> Maximum rated output current is 2.5 A at 6 V. The maximum available output current decreases with the output voltage setting. A current foldback circuit limits the output to 2.75 A $\pm 5\%$ at 6 volts and, with decreasing voltage, reduces the current limit linearly to 1 A $\pm 15\%$ at zero volts (short circuited).</p> <p>TRACKING ACCURACY</p> <p>The +20 V and -20 V outputs track within 1% with the TRACKING ratio control in the Fixed position. (In variable tracking ratio mode, the negative tracking output can be adjusted from less than 0.5 V to within $\pm 5\%$ of the setting of the positive output.)</p> <p>LOAD REGULATION</p> <p><u>All Outputs:</u> Less than 0.01% plus 2 mV for a full load to no load change in output current.</p> <p>LINE REGULATION</p> <p><u>All Outputs:</u> Less than 0.01% plus 2 mV for any line voltage change within rating.</p> <p>PARD (Ripple and Noise)</p> <p><u>All Outputs:</u> Less than 0.35 mV rms/1.5 mV p-p (20 Hz-20 MHz). <u>Common Mode Current (CMI):</u> Less than 1 μA for all outputs (20 Hz-20 MHz).</p>	<p>OPERATING TEMPERATURE RANGE</p> <p>0 to 40 °C for full rated output. At higher temperatures, output current is derated linearly to 50% at 55 °C maximum temperature.</p> <p>TEMPERATURE COEFFICIENT</p> <p><u>All Outputs:</u> Less than 0.02% plus 1 mV voltage change per °C over the operating range from 0 to 40 °C after 30 minutes warm-up.</p> <p>STABILITY (OUTPUT DRIFT)</p> <p><u>All Outputs:</u> Less than 0.1% plus 5 mV (dc to 20 Hz) during 8 hours at constant line, load and ambient after an initial warm-up time of 30 minutes.</p> <p>LOAD TRANSIENT RESPONSE TIME</p> <p><u>All Outputs:</u> Less than 50 μsec for output recovery to within 15 mV of nominal output voltage following a load change from full load to half load, or vice versa.</p> <p>OUTPUT VOLTAGE OVERSHOOT</p> <p><u>All Outputs:</u> During turn-on or turn-off of ac power, output plus overshoot will not exceed 1 V if the output control is set for less than 1 V. If the control is set for 1 V or higher, there is no overshoot.</p> <p>METER ACCURACY: $\pm(0.5\%$ of output + 2 counts) at 25°C$\pm 5^\circ\text{C}$</p> <p>METER RESOLUTION</p> <p><u>All Output:</u> <u>Voltage</u> 10 mV <u>Current</u> 10 mA</p> <p>DIMENSIONS</p> <p>212.3 mmW x 88.1 mmH x 269.2 mmD (8.354 inW x 3.469 inH x 10.591 inD)</p> <p>WEIGHT: 3.8 kg(8.4 lbs) net, 5.1 kg(11.3 lbs) shipping</p>
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INSTALLATION

INITIAL INSPECTION

Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials until the inspection is completed. If damage is found, a claim should be filed with the carrier. The Agilent Technologies Sales and Service office should be notified as soon as possible.

Mechanical Check

This check should confirm that there are no broken knobs or connectors, that the cabinet and panel surfaces are free of dents and scratches, and that the meter is not scratched or cracked.

Electrical Check

Perform the TURN-ON CHECKOUT PROCEDURE in the following paragraph to confirm that the supply is operational. Alternately, check the supply more fully using the PERFORMANCE TEST in the service information section.

INSTALLATION DATA

The instrument is shipped ready for bench operation. Before applying power to the supply, please read the INPUT POWER REQUIREMENTS paragraph.

Location and Cooling

This instrument is air cooled. Sufficient space should be allowed so that a free flow of cooling air can reach the sides and rear of the instrument when it is in operation. It should be used in an area where the ambient temperature does not exceed 40°C.

Outline Diagram

Figure 1 illustrates the outline shape and dimensions of the supply.

Rack Mounting

This supply may be rack mounted in a standard 19-inch rack panel either by itself or alongside a similar unit. Please see the ACCESSORY, page 1-4, for available rack mounting accessory. The rack-mounting kit includes complete installation instructions.

INPUT POWER REQUIREMENTS

Depending on the line voltage option ordered, the supply is ready to be operated from one of the power sources listed in Table 1. A label on the rear heat sink shows the nominal input voltage set for the supply at the factory.

Power Cable

To protect operating personnel, the supply should be grounded. This supply is equipped with a three conductor power cable. The third conductor is the ground conductor and when the cable is plugged into an appropriate receptacle, the supply is grounded.

The power supply is equipped at the factory with a power

cord plug appropriate for the user's location. Notify the nearest Agilent Sales and Service Office if the appropriate power cord is not included with the supply.

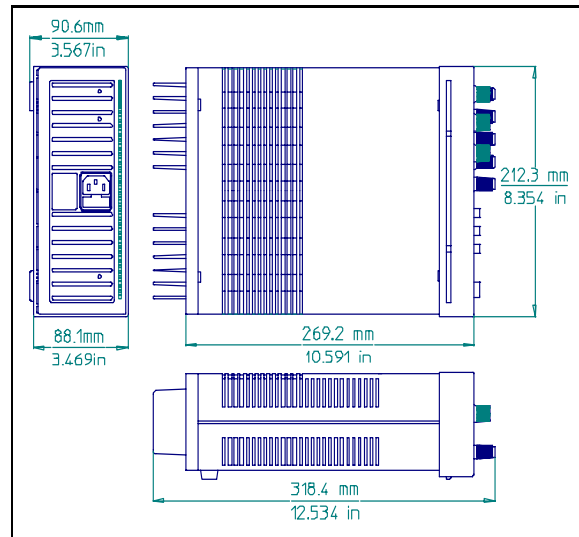


Figure 1. Outline Diagram

OPERATING INSTRUCTIONS

INTRODUCTION

The following steps describe the use of the front panel controls and indicators illustrated in Figure 2 and serve as a brief check that the supply is operational. Follow this checkout procedure or the more detailed performance test of service information section when the instrument is received and before it is connected to any load equipment.

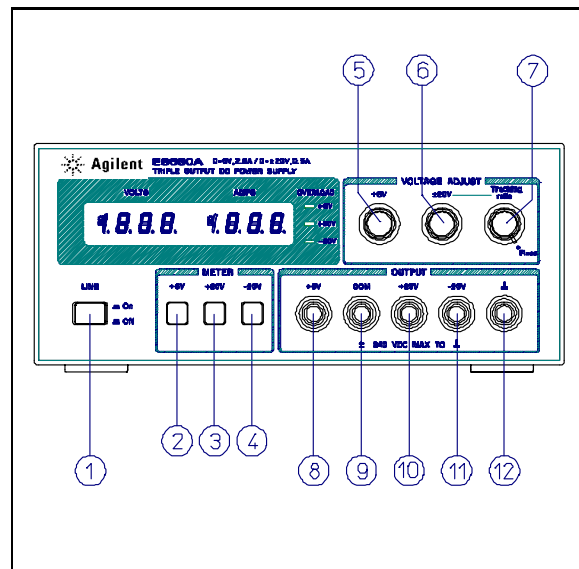


Figure 2. Front-Panel Controls and Indicators

CAUTION

Before applying power to the supply, check the label on the heat sink to make certain that the supply's line voltage option agrees with the line voltage to be used. If the option does not correspond to your line voltage, refer to paragraph "LINE VOLTAGE OPTION CONVERSION" in the service section before applying power.

TURN -ON CHECKOUT PROCEDURE

- Connect line cord to power source and turn LINE switch ① on.
- Push +6V METER switch ② and, with no load connected, vary +6V VOLTAGE control ⑤ over its range and check that the voltmeter responds to the control setting and the ammeter indicates zero.
- Set the +6V VOLTAGE control to 6 volts and short the +6V output terminal ⑧ to COM (common) terminal ⑨ with an insulated test lead. The ammeter should indicate a short-circuit output current of approximately 1.0 A. Remove the short from the output terminals.
- Push the +20V METER switch ③ and turn Tracking Ratio control ⑦ fully clockwise to the Fixed position. With no load connected, vary $\pm 20V$ VOLTAGE control ⑥ over its range and check that the voltmeter responds to the control setting and the ammeter indicates zero.
- Set the $\pm 20V$ VOLTAGE control ⑥ to 20 volts and short the +20V output terminal ⑩ to the COM terminal ⑨ with an insulated test lead. The ammeter should indicate a short-circuit output current of 0.55 A \pm 5%. Remove the short from the output terminals.
- Repeat steps (d) and (e) for -20 V output.
- Adjust the +20V output to 20 volts. Then push -20V METER switch and check the effect of the Tracking Ratio control on the voltage of the -20V output. The -20V output should be adjustable from less than 0.5 volts to a maximum of 19 to 21 volts.

If this brief checkout procedure or later use of the supply reveals a possible malfunction, see the service information section for detailed test, troubleshooting, and adjustment procedures.

OPERATION

This power supply can be operated individually or in parallel or series with another supply (see Parallel and Series Operation paragraphs). All output terminals are isolated from ground. The $\pm 20V$ and +6V outputs use a single common output terminal. This common (COM) terminal or any one of the other output terminals may be grounded to the chassis at the front panel ground terminal (⑫ in Figure 2), or all outputs may be left floating. Loads can be connected separately between each of the 0 to $\pm 20V$ output terminals and the COM terminal, or between the -20V and the +20V terminals for a 0 to 40V output. Each output voltage or current can be quickly selected for monitoring with the push-button meter switches. To moni-

tor the 0 to 40V output voltage, add the voltmeter readings of the +20V and -20V output and use either the +20V or the -20V meter to measure the current.

Tracking Ratio Control

With the Tracking Ratio control in the Fixed position, the voltage of the -20V supply tracks that of the +20V supply within 1% for convenience in varying the symmetrical voltages needed by operational amplifiers and other circuits using balanced positive and negative inputs.

Turn the Tracking Ratio control counter clockwise out of the Fixed position to set the voltage of the -20V supply lower than that of the +20V supply. The negative supply can be set from a minimum of less than 0.5 volts to a maximum within 5% of the +20V supply's output. Once this is done, the $\pm 20V$ voltage control still controls both outputs and maintains a constant ratio between their voltages.

Overload Protection Circuits

$\pm 20V$ -Volt Current Limit. The +20V and -20V outputs are individually protected against overload or short circuit damage by separate current limit circuits to limit the output current to 0.55 A \pm 5%. (This is 110% of the maximum rated output.) If a single load is connected between the +20V and -20V outputs, the circuit set for the lesser current limit will limit the output. No deterioration of supply performance occurs if the output current remains below the current limit setting.

+6V Current Foldback. The overload and short-circuit protection circuit for the +6V output reduces the output current limit as the output terminal voltage decreases. (The operating region of the +6V output is enclosed by heavy lines in Figure 4.) The maximum rated output current is 2.5 A and the current limit is factory-adjusted to operate at 2.75 A \pm 5% when the output is 6 volts. At lower output voltages, the circuit reduces the maximum obtainable output current linearly until 1 A \pm 15% flows when the output is shorted. The short-circuit current can not be adjusted.

NOTE

During the actual operation of the $\pm 20V$ and +6V outputs, if a load change causes the current limit to be exceeded, the OL LED is lighted. If overload conditions occur, the $\pm 20V$ supplies will protect the load by limiting the current to 0.55 A and the +6V supply will protect the load by reducing both voltage and current simultaneously along the foldback locus as shown in Figure 4. The $\pm 20V$ and +6V supplies are self restoring; that is, when the overload is removed or corrected, the output voltage is automatically restored to the previously set value.

Operation Beyond Rated Output

The supply may be able to provide voltages and currents greater than its rated maximum outputs if the line voltage is at or above its nominal value. Operation can be extended up to 5% over the rated output without damage to the supply, but performance can not be guaranteed to meet specifications in

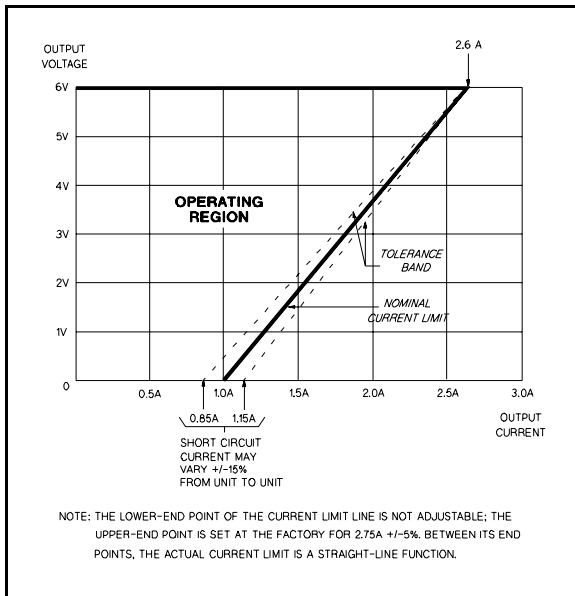


Figure 3. Current Limit Characteristic of the 6V Supply

this region. If the line voltage is maintained in the upper end of the input voltage range, however, the supply probably will operate within its specifications

Connecting Load

Each load should be connected to the power supply output terminals using separate pairs of connecting wires. This will minimize mutual coupling effects between loads and takes full advantage of the low output impedance of the supply. Load wires must be of adequately heavy gauge to maintain satisfactory regulation at the load.

Each pair of connecting wires should be as short as possible and twisted or shielded to reduce noise pick-up. If a shield is used, connect one end to the supply ground terminal and leave the other end unconnected.

If load considerations require locating output power distribution terminals at a distance from the power supply, then the power supply output terminals should be connected to the remote distribution terminals by a pair of twisted or shielded wires and each load should be connected to the remote distribution terminals separately.

Parallel Operation

Two or more supplies can be connected in parallel to obtain a total output current greater than that available from one supply. The total output current is the sum of the output currents of the individual supplies. The output voltage controls of one power supply should be set to the desired output voltage, and the other supply set for a slightly larger output voltage. The supply set to the lower output voltage will act as a constant voltage source, while the supply set to the higher output will act as a current-limited source, dropping its output voltage until it equals that of the other supply. The constant voltage source will deliver only that fraction of its rated output current

necessary to fulfill the total current demand.

Series Operation

Series operation of two or more power supplies can be accomplished up to the output isolation rating of any one supply to obtain a higher voltage than that available from a single supply. Series connected supplies can be operated with one load across both supplies or with a separate load for each supply. The power supply has a reverse polarity diode connected across the output terminals so that if operated in series with other supplies, damage will not occur if the load is short-circuited or if one supply is turned on separately from its series partners. When this connection is used, the output voltage is the sum of the voltages of the individual supplies. Each of the individual supplies must be adjusted in order to obtain the total output voltage.

LOAD CONSIDERATIONS

This section provides information on operating your supply with various types of loads connected to its output.

PULSE LOADING

The power supply will automatically cross over from constant-voltage to current-limit operation in response to an increase in the output current over the preset limit. Although the preset limit may be set higher than the average output current, high peak currents (as occur in pulse loading) may exceed the preset current limit and cause crossover to occur and degrade performance.

REVERSE CURRENT LOADING

An active load connected to the supply may actually deliver a reverse current to the supply during a portion of its operating cycle. An external source can not be allowed to pump current into the supply without risking loss of regulation and possible damage to the output capacitor of the supply. To avoid these effects, it is necessary to preload the supply with a dummy load resistor so that the supply delivers current through the entire operating cycle of the load devices.

OUTPUT CAPACITANCE

An internal capacitor across the output terminals of the supply helps to supply high-current pulses of short duration during constant-voltage operation. Any capacitance added externally will improve the pulse current capability, but will decrease the load protection provided by the current limiting circuit. A high-current pulse may damage load components before the average output current is large enough to cause the current limiting circuit to operate.

REVERSE VOLTAGE PROTECTION

A diode is connected across the output terminals with reverse polarity. This diode protects the output electrolytic capacitors and the series regulator transistors from the effects of a reverse voltage applied across the output terminals. Since series regulator transistors can not withstand reverse voltage either, diodes are also connected across them. When operating supplies in parallel, these diodes protect an unenergized supply that is in parallel with an energized supply.

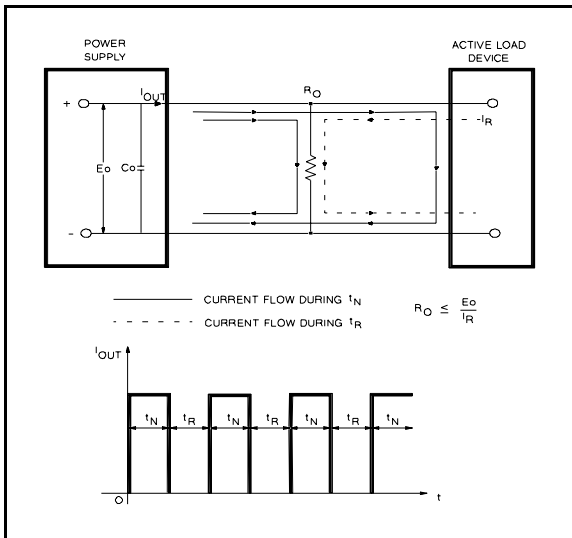


Figure 4. Reverse Current Loading Solution