HEWLETT® PACKARD

HP E361XA 30W BENCH SERIES DC POWER SUPPLIES

OPERATING MANUAL FOR MODELS:

HP E3610A, Serials KR83020046 and above
HP E3611A, Serials KR83013830 and above
HP E3612A, Serials KR83006181 and above

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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. Hewlett-Packard Company 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.

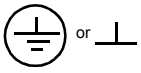
Ground The Instrument.
This product is a Safety Class I instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the ac power supply mains through a three-conductor 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.

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 inpersonal 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.

GENERAL INFORMATION

Description

This operating and service manual covers three dual range HP power supplies, E3610A, E3611A, and E3612A. All models are compact, general purpose bench supplies that are particularly useful for powering developmental IC circuits, both linear and digital. Unless stated otherwise, all information in this manual applies equally to all three models. The desired output range is selected by the front panel RANGE push button. The output can be continuously adjusted for voltage and current throughout either output range.

The front panel VOLTAGE control can be used to establish the voltage limit when the supply is used as a constant current source and the CURRENT control can be used to establish the output current limit when the supply is used as a constant voltage source. The CC SET push button allows the current limit value to be conveniently set using the CURRENT control without shorting the output.

The front panel includes a digital voltmeter/ammeter. A 3 1/2 digit (E3611A 3 digit) voltage display and 3 digit current display accurately show the output voltage and current respectively. The output ratings for each model are shown in the Specifications Table.

Specifications and Supplemental Characteristics

INPUT: 115 Vac ± 10%, 47-63 Hz, 0.8 A, 70 W
100 Vec ± 10%, 47-63 Hz, 0.8 A, 70 W
230 Vac ± 10%, 47-63 Hz, 0.4 A, 70 W

OUTPUT: E3610A: 0 to 8 V, 0 to 3 A or 0 to 15 V, 0 to 2 A
E3611A: 0 to 20 V, 0 to 1.5 A or 0 to 35 V, 0 to 0.85 A
E3612A: 0 to 60 V, 0 to 0.5 A or 0 to 12OV, to 0.25 A

LOAD REGULATION:
Constant Voltage - Less than 0.01% plus 2 mV for a full load to no load change in output current.
Constant Current - Less than 0.01% plus 1 mA for a zero to maximum change in output voltage.

LINE REGULATION:
Constant Voltage - Less than 0.01% plus 2 mV for any line voltage change within the input rating.
Constant Current - Less than 0.01% plus 1 mA for any line voltage change within the input rating.

RIPPLE AND NOISE:
Constant Voltage - Less than 200 uV rms and 2 mV peak to peak(20 Hz - 20 MHz)
Constant Current - Less than 200 uA rms and 1 mA peak to peak(20 Hz - 20 MHz)

TEMPERATURE RANGE: 0 to 40°C for full rated output. Derate current 1% per degree C between 40°C-55°C

***TEMPERATURE COEFFICIENT:**
Constant Voltage - Less than 0.02% plus 1 mV per degree C.
Constant Current - Less than 0.02% plus 2 mA per degree C.

TRANSIENT RESPONSE TIME:
Less than 50 usec for output recovery to within 10 mV following a change in output current from full load to half load, or vice versa.

ISOLATION: ± 240 Vdc

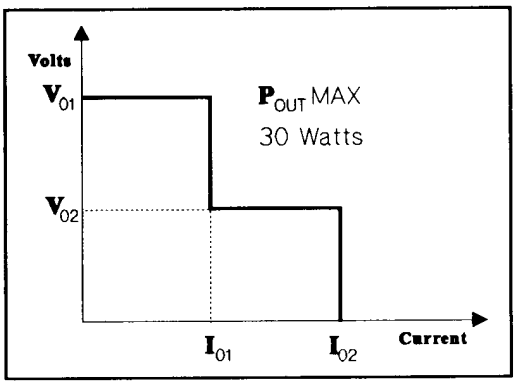
***OUTPUT DRIFT:**
Constant Voltage - Less than 0.1% plus 5 mV total drift for 8 hours after an initial warm-up of 30 minutes.
Constant Current - Less than 0.1% plus 10 mA total drift for 8 hours after an initial warm-up of 30 minutes.

METER ACCURACY: ±0.5% + 2 counts at 25°C ± 5°C

***OVERLOAD PROTECTION:**
A continuously acting constant current circuit protects the power supply for all overloads including a direct short placed across the terminals. The constant voltage circuit limits the output voltage in constant current operation.

***OUTPUT TERMINALS:**
Three output terminals are provided on the front panel. They are isolated from the chassis and either the positive or negative terminal may be connected to the ground terminal.

***OUTPUT CHARACTERISTICS**



NOTE: Output voltages higher than V_{02} are possible at low current when the high current range is selected.
E3610A: V_{01} = 15 V V_{02} = 8 V I_{01} = 2 A I_{02} = 3 A
E3611A: V_{01} = 35 V V_{02} = 20 V I_{01} = 0.85 A I_{02} = 1.5 A
E3612A: V_{01} = 120 V V_{02} = 60 V I_{01} = 0.25 A I_{02} = 0.5 A

***METER RESOLUTION**
Voltage: E3610A 10 mV
E3611A 100 mV
E3612A 100 mV
Current: E3610A 10 mA
E3611A 10 mA
E3612A 1 mA

***DOWN PROGRAMMING SPEED:** Maximum time for output voltage to change between 100% to 0.1% of maximum rated output voltage at NO LOAD condition.
E3610A: maximum 2.5 sec
E3611A: maximum 1.0 sec
E3612A: maximum 1.5 sec

***RESOLUTION:** Minimum output voltage or current change that can be obtained using panel controls.
E3610A: Voltage 10 mV Current 5 mA
E3611A: Voltage 10 mV Current 5 mA
E3612A: Voltage 100 mV Current 0.5 mA

COOLING: Convection cooling is employed.

WEIGHT: 8.4 lbs/3.8 Kg net, 9.3 lbs/4.2 Kg shipping.

(NOTE) * SUPPLEMENTAL CHARACTERISTICS

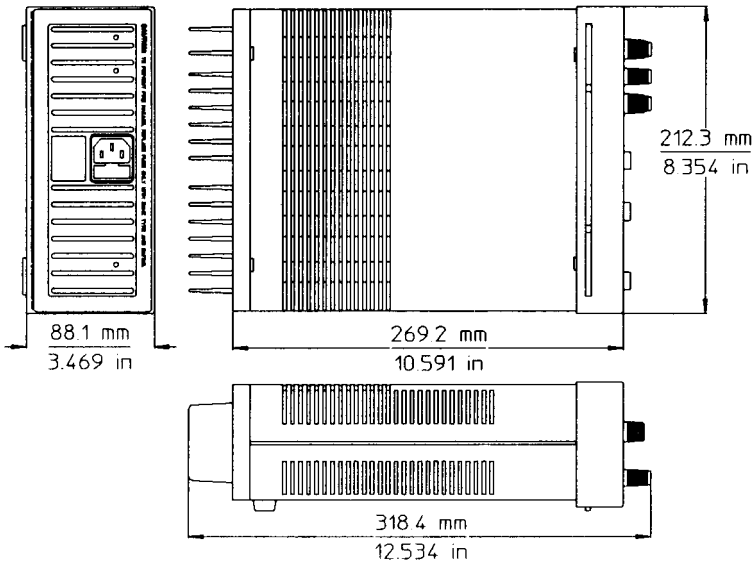


Figure 1: OUTLINE DIAGRAM

Options
The following factory installed options are available with this instrument.

Option	Description
OE3	Input Power: 230 Vac +/-10%, 47-63 Hz, Single Phase
OE9	Input Power: 100 Vac +/-10%, 47-63 Hz, Single Phase

Instrument Identification
Hewlett-Packard power supplies are identified by one serial number. The letter "KR" designates Korea as the country of manufacture, the first digit indicates the year (1 = 91, 2 = 92, etc), the second two digits indicate the week, and the last five digits of the serial number are a different sequential number assigned to each power supply.

If the serial number on your instrument does not agree with those on the title page of this manual, a yellow change sheet may be included if a design change has affected the contents of this manual.

INSTALLATION

Inspection
When you receive your power supply, inspect it for any obvious damage that may have occurred during shipment. If there is damage, notify the carrier and the nearest HP Sales Office immediately. Warranty information is printed on the inside front cover of this manual. Save the shipping carton and packing materials in case the supply has to be returned to Hewlett-Packard in the future. If you return the supply for service, attach a tag identifying the owner and model number. Also include e brief description of the problem.

The "Turn-On Checkout Procedure" in this manual can be used as an incoming inspection check to verify that the supply is operational. See the appendix for tests that verify the supply's specifications.

Location And Cooling
Figure 1 shows the outline shape and dimensions of the unit. It is shipped ready for bench operation after connection to an ac power source. The supply is air cooled. Sufficient space should be allotted so that a free flow of cooling air can reach the rear of the instrument when it is in operation. It should be used in an area where the ambient temperature does not exceed 40 degrees C. The current derates 1% per degree C between 40°C-55°C.

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 the Specification Table. The input voltage range, and the input current and power at high line voltage and full load is listed for each option.

Power Cord
This instrument 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 instrument is grounded. The offset pin on the power cable three prong connector is the ground connection. In no event should this instrument be operated without an adequate cabinet ground connection.

The power supply was shipped with a power cord for the type of outlet used at your location. If the appropriate cord was not included, contact your nearest HP Sales Office to obtain the correct cord.

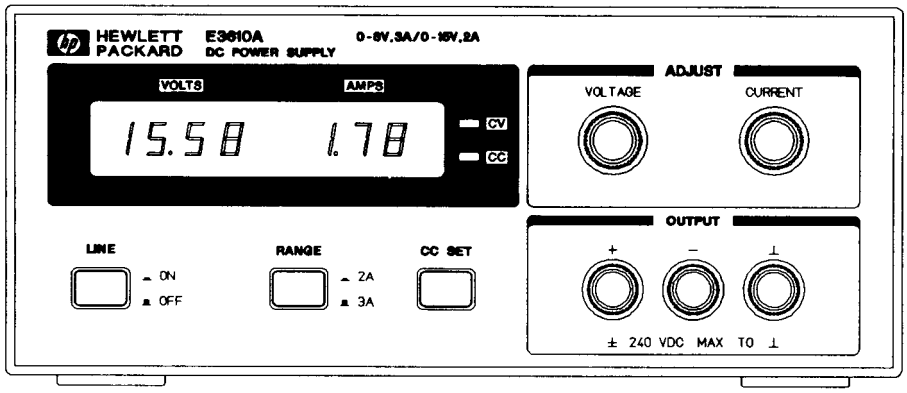


Figure 2: FRONT PANEL CONTROLS AND INDICATORS

OPERATION

Turn-On Checkout Procedure

The following checkout procedure describes the use of the front panel controls and indicators illustrated in Figure 2 and ensures that the supply is operational:

a. Push LINE button to ON.
b. Set RANGE push button to desired range.
c. Turn VOLTAGE control fully counter clockwise to ensure that output decreases to 0 Vdc than fully clockwise to ensure that output voltage increases to the maximum output voltage.
d. While depressing CC SET push button, turn the CURRENT control fully counter clockwise and than fully clockwise to ensure that the current limit value can be set from zero to maximum rated value.
e. Connect load to output terminals.

WARNING

Shock Hazard
Disconnect ac power before making output terminal connections.

Constant Voltage Operation

To set up a power supply for a constant voltage operation, proceed as follows:

a. Turn on power supply and adjust 10-turn VOLTAGE control for desired output voltage(output terminals open). CV LED should light.
b. While depressing CC SET push button, adjust 10-turn CURRENT control for maximum output current allowable(current limit). During actual operation, if a load change causes the current limit to be exceeded, the power supply will automatically crossover to constant current mode and output voltage will drop proportionately.

Constant Current Operation

To set up a power supply for a constant current operation, proceed as follows:

a. Turn CURRENT control fully counter clockwise to ensure that output decreases to 0 A, and than turn on power supply.
b. Adjust VOLTAGE control(no load connected) for maximum output voltage allowable(voltage limit), as determined by load conditions. During actual operation, if a load change causes the voltage limit to be exceeded, the power supply will automatically cross- over to constant voltage operation at the preset voltage limit and output current will drop proportionately.
c. Adjust CURRENT control for desired output current while depressing CC SET button(CC LED will not light until the supply is loaded)

Connecting Loads

The output of the supply is isolated from earth ground. Either output terminal may be grounded or the output can be floated up to 240 volts off ground.

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 will retain full advantage of the low output impedance of the power supply. Each pair of connecting wires should be as short as possible and twisted or shielded to reduce noise pickup(If a shield is used, connect one end to the power supply ground terminal and leave the other end unconnected.).

Operation Beyond Rated Output

The output controls can adjust the voltage or current to values above(up to 5%) the rated output as indicated on the front panel display. Although the supply can be operated in the 5% overrange region without being damaged, it can not be guaranteed to meet all of its performance specifications in this region.

Pulse Loading Considerations

The power supply will automatically cross over from constant-voltage to constant-current operation in response to an increase(over the preset limit) in the output current. 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. If this crossover limiting is not desired, set the preset limit for the peak requirement and not the average.

Capacitive Loads

An internal capacitor, across the output terminals of the power 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 safety 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 Current Loading

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

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Company
Korea Instrument Operation

Manufacturer's Address: 345-15, Kasan-dong
Kumchon-ku, Seoul 153-023 Korea

declares, the product

Product Name: Lab Bench DC Power Supply

Model Number: HP E3610A, E3611A, and E3612A

Product Options: All Options

conforms to the following Product Specifications

Safety: IEC 1010-1 (1990) / EN 61010-1 (1993)

EMC: CISPR 11:1990/EN 55011 (1991) - Group 1 Class A[1)]
IEC 801-2:1991/EN 50082-1 (1992): 4 kV CD, 8 kV AD
IEC 801-3:1984/EN 50082-1 (1992): 3 V/m
IEC 801-4:1988/EN 50082-1 (1992): 1 kV Power Lines
0.5 kV Signal Lines

Supplementary Information: The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (inclusive 93/68/ EEC) and carries the "CE" mark accordingly.

[1)]The product was tested in a typical configuration with Hewlett-Packard Test Systems.

Seoul, Korea October 23, 1996

Young Sook Lee, Quality Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ / Standards Europe, Herrenberger Straße 130, D-71034 Böblingen (FAX: +49-7031-143143).

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Herstellerbescheinigung

Hiermit wird bescheinigt, daß das Gerät/System HP E3610A, E3611A, E3612A in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.
Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation fur Meß- und Testgeräte

Werden Meß- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Meßaufbauten verwendet, so ist vom Betreiber sicherzustellen, daß die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Manufacturer's declaration

This is to certify that the equipments HP E3610A, E3611A, E3612A are in accordance with the Radio Interference Requirements of Directive FTZ 1046/84. The German Bundespost was notified that this equipment was put into circulation, the right to check the series for compliance with the requirements was granted.

Additional Information for Test- and Measurement Equipment

If Test- and Measurement Equipment is operated with unscreened cables and/or used for measurements on open set-up, the user has to assure that under operating conditions the Radio Interference Limits are still met at the border of his premises.

Operating instructions in the following languages appear on the pages indicated below.

HEWLETT® PACKARD

CERTIFICATION

Hewlett-Packard (HP) Company certifies that this product met its published specifications at time of shipment from the factory. Hewlett-Packard 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 Hewlett-Packard hardware product is warranted against defects in material and workmanship for a period of three years from date of delivery. HP software and firmware products, which are designated by HP 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 HP or Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective. HP 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 HP. 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 HP for warranty service. Except for the products returned to Customer from another country, HP shall pay for return of products to Customer.

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

If HP 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 HP.

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

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 HP 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. HP 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 Hewlett-Packard Sales and Service office for further information on HP's full line of Support Programs.