SECTION I
GENERAL INFORMATION

1-1 DESCRIPTION

1-2 The Model 6012A Autoranging Power Supply provides laboratory-grade performance with the high efficiency of switching regulation techniques. Autoranging allows the supply to provide at least 1000 watts output power over a wide range of output voltage and current combinations without the user having to select the proper output range. The output is adjustable through the entire operating range of 0 to 60 volts and 0 to 50 amperes by 10-turn front-panel controls.

1-3 The supply is of the Constant Voltage/Constant Current (CV/CC) type, with green front-panel LEDs to indicate whether the unit is operating in CV or CC mode. Output voltage and current are continuously indicated on individual front-panel meters. A secondary scale on the voltmeter indicates Amperes Available within the maximum output-power range; a secondary scale on the ammeter indicates Volts Available.

1-4 Overvoltage protection (OVP) protects the user's load by quickly and automatically interrupting energy transfer if a preset trip voltage is exceeded. A screwdriver control on the front panel sets the OVP trip point between 2V and 63V. A red LED on the front panel indicates that OVP has tripped.

1-5 Output connections are made to bus bars on the rear panel. Either the positive or negative output terminal may be grounded, or the output may be floated up to ±240Vdc (including output voltage) from ground.

1-6 Remote programming, remote or local voltage sensing, and several methods of operating multiple-supply combinations for increased output voltage or current capability are possible by making connections to rear-panel terminals. These capabilities are more fully described in Section III.

1-7 The 6012A is considerably smaller, lighter, and dissipates less power than older-design supplies with similar output-power capability. The unit is fan cooled and is packaged in a Hewlett-Packard System II-compatible modular enclosure, which is sturdy, attractive, and provides easy access for servicing.

1-8 SAFETY CONSIDERATIONS

1-9 This product is a Safety Class 1 instrument (provided with a protective earth terminal). The instrument and this manual should be reviewed for safety markings and instructions before operation.

1-10 SPECIFICATIONS

1-11 Detailed specifications for the power supply are given in Table 1-1.

1-12 INSTRUMENT AND MANUAL IDENTIFICATION

1-13 Hewlett-Packard power supplies are identified by a two-part serial number. The first part is the serial number prefix, a number-letter combination that denotes the date of a significant design change and the country of manufacture. The first two digits of the prefix indicate the year (20 = 80, 21 = 81, etc.), the second two digits indicate the week, and the letter "A" designates the USA as the country of manufacture. The second part of the serial number is a different sequential number assigned to each power supply, starting with 00101.

1-14 If the serial number on your instrument does not agree with those on the title page of this manual, a yellow Manual Changes sheet supplied with the manual defines the difference between your instrument and the instrument described by this manual.

1-15 OPTIONS

1-16 Options are standard factory modifications that are requested by the customer. The following options are available with this instrument. Option 002 is described in Appendix A, Option 100 is described in Appendix B.

Option No.	Description
002	Systems Option allows the supply to operate automatically in system applications. Provides resistance, voltage, and current programming of output voltage and current; six isolated status lines; three isolated control lines; +5V and ±15V bias voltages. This option is mounted on a single additional printed-circuit board, which includes a rear-panel connector.
100	Input Power: 87 to 106 Vac, 48 to 63 Hz, single phase. Output: 675 W, 50 V, 50 A.
220	Input Power: 191 to 233 Vac, 48 to 63 Hz, single phase.
240	Input Power: 208 to 250 Vac, 48 to 63 Hz, single phase.
910	One additional operating and service manual shipped with the power supply for each Option 910 ordered.

1-17 ACCESSORIES

1-18 The System II Cabinet accessories listed below may be ordered with the power supply or separately from your local Hewlett-Packard Sales and Service Office (see list of addresses at the rear of this manual).

HP Part No.	Description
5061-0069	Front handle kit for 5-1/4 inch high cabinets.
1400-1345	Tilt stand (1) snaps into standard foot supplied with instrument, must be used in pairs.
5061-0077	Rack flange kit for 5-1/4 inch high cabinets (will be shipped with instrument if ordered as Option 908).
5061-0083	Rack flange/front handle kit for 5-1/4 inch high cabinets (will be shipped with instrument if ordered as Option 909).
1494-0018	Slide kit for installing 17-inch deep cabinet in HP rack enclosure.
494-0025	Tilt slide kit, same as 1494-0018 plus permits tilting instrument up or down 90°.
1494-0023	Slide adapter kit, permits use of 1494-0018 kit in non-HP rack enclosure of adequate depth.
5060-2800	Control Board Extender card.

1-19 ORDERING ADDITIONAL MANUALS

1-20 One manual is shipped with each power supply. Additional manuals may be purchased directly from your local Hewlett-Packard Sales office. Specify the model number, instrument serial number prefix, and the manual part number provided on the title page. (When ordered at the same time as the power supply, additional manuals may be purchased by adding Option 910 to the order and specifying the number of additional manuals desired.)

Table 1-1. Specifications, Model 6012A

All performance specifications are at rear terminals with a resistive load.

INPUT POWER

Two internal switches and two internal jumpers permit operation from 120, 220, or 240 Vac (−13%, +6%); 48-63 Hz. Maximum input current is 24 A rms for 120 Vac, 15 A rms for 220 Vac, and 14 A rms for 240 Vac.

EFFICIENCY (Typical):

80% on maximum output power boundary.

INPUT PROTECTION:

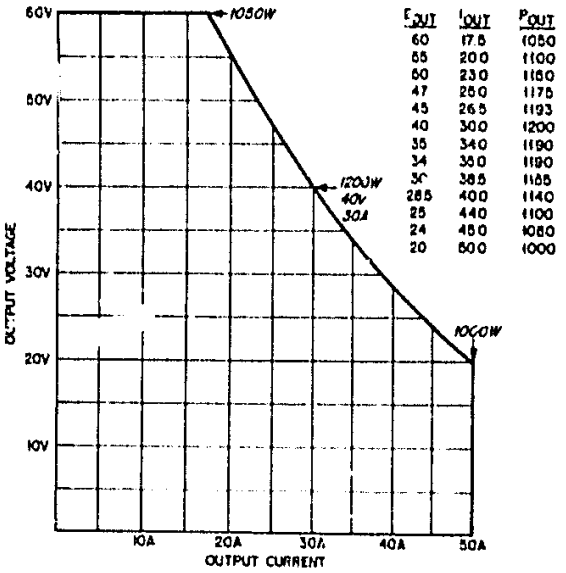
The ac input is protected by a rear-panel mounted 25 A circuit breaker.

PEAK INRUSH CURRENT (Maximum)

120 Vac, 31.5 A
220 Vac, 13.3 A
240 Vac, 14.5 A

DC OUTPUT:

Adjustable from 0 to 60V and 0 to 50 A. Maximum output power is 1000 W at 50A, 1050 W at 60V, and approximately 1200 W at mid-range. See graph.



LOAD EFFECT (LOAD REGULATION):

Constant Voltage - Less than 0.01% of output voltage plus 5 mV for a load change equal to the maximum available current rating of the supply at the set voltage.

Constant Current - Less than 0.01% of output current plus 5 mA for a load change equal to the maximum available voltage rating of the supply at the set current.

Table 1-1. Specifications, Model 6012A (continued)

SOURCE EFFECT (LINE REGULATION):
Constant Voltage - Less than 0.01% of output voltage plus 3 mV for any line voltage change within rating.
Constant Current - Less than 0.01% of output current plus 5 mA for any line voltage change within rating.

PARD (Ripple and Noise), 20 Hz to 20 MHz:
Constant Voltage - Less than 5 mV rms and 50 mV p-p.
Constant Current - Less than 25 mA rms.

TEMPERATURE COEFFICIENT:
Constant Voltage - Less than 0.01% plus 2 mV change in output per degree Celsius change in ambient after 30-minute warmup.

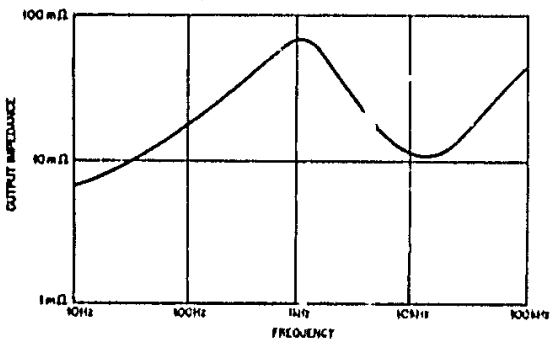
Constant Current - Less than 0.01% plus 4 mA change in output per degree Celsius change in ambient after 30-minute warmup.

DRIFT (Stability):
(Change in output over an 8-hour interval under constant line, load, and ambient temperature after 30-minute warmup).
Constant Voltage - Less than 0.03% of output plus 5 mV.
Constant Current - Less than 0.03% of output plus 5 mA.

LOAD TRANSIENT RECOVERY TIME:
Less than 2 ms is required for output voltage recovery (in constant voltage operation) to within 100 mV of the nominal output following a change in output current of 10% of maximum current rating at any output voltage (output current ≥5A).

RESOLUTION:
(Minimum output voltage or current change that can be obtained using the 10-turn front-panel controls).
Constant Voltage - 20 mV
Constant Current - 20 mA

OUTPUT IMPEDANCE (Typical):
0.2 mΩ @ dc. See graph:



DC OUTPUT ISOLATION:
Either output terminal may be floated up to ±240 Vdc (including output voltage) from ground.

OVERVOLTAGE PROTECTION:
Trip voltage adjustable from 2 V to 63 V. Minimum setting above output voltage to avoid false tripping is 1.5 V + 1% of V_{OUT}.

REVERSE VOLTAGE PROTECTION:
(Maximum permissible current caused by reverse voltage impressed across output terminals) 50 A continuous, 20 A continuous with ac power off.

REMOTE SENSING:
Maintains nominal voltage at load by correcting for load-lead voltage drop of up to 0.5V per lead.

REMOTE PROGRAMMING:
Resistance Programming - 0 to 2.5 k provides zero to maximum rated voltage or current output.
Accuracy: CV; 1% + 3 mV CC; 2.5% +15 mA
Voltage Programming - 0 to 5V provides zero to maximum rated voltage or current output.
Accuracy: CV; 0.3% + 3 mV CC; 1% +15 mA
Current Programming - 2 mA to 0 mA current sink provides zero to maximum rated voltage or current output (with user-provided 2.5k resistor).
Accuracy: CV; 0.3% + 0.42V + accuracy of resistor
CC; 1% + 0.8A + accuracy of resistor

PROGRAMMING RESPONSE TIME:
Maximum time for output voltage to change from 0 V to 60 V or 60 V to 2 V and settle within 200 mV band.

Up: Full load (3.4Ω)	120 ms
No Load	120 ms
Down: Full Load (3.4Ω)	400 ms
No Load	1.2 s

Typical response time to settle within 200 mV band, for excursions other than full-scale.
Down: On graph, read difference in time between initial output voltage and final output voltage; add settling time of 200 ms @ full load or 330 ms @ no load.

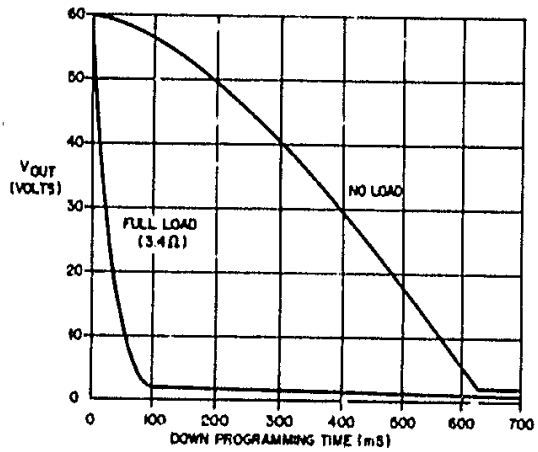
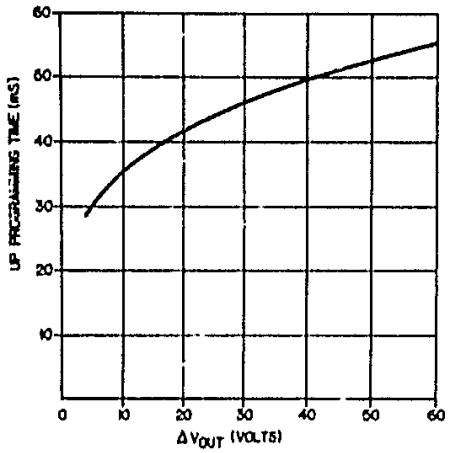


Table 1-1. Specifications, Model 6012A (continued)

Up: On graph, read time for change in output voltage.



CURRENT MONITORING OUTPUT:

0 to 5 V output from rear-panel terminal indicates zero to maximum rated current output; accuracy, 1% + 10 mV; output impedance, 10k.

METERS AND INDICATORS:

Voltmeter - Continuously reading 70 V scale with secondary scale indicating amperes available; accuracy, ± 3% of full scale.

Ammeter - Continuously reading 60 A scale with secondary scale indicating volts available; accuracy, ± 3% of full scale.

VOLTAGE Indicator - Green LED indicates Constant Voltage operation.

CURRENT Indicator - Green LED indicates Constant Current operation.

OUTPUT UNREGULATED Indicator - Red LED indicates that output is unregulated because of any of the following conditions: overrange operation, overvoltage, over temperature, or low-input-power shutdown.

OVP Indicator - Red LED indicates shutdown caused by voltage at output terminals exceeding preset limit.

OVERTEMPERATURE Indicator - Red LED indicates shutdown because of FET or output diode overtemperature.

MULTIPLE UNIT OPERATION:

Auto Parallel - Any number of units may be connected in parallel to increase total output current capability while maintaining control from a single unit.

Auto-Series - Up to four units (eight if center-tapped to ground) may be connected in series to increase total output voltage to 240 Vdc (480 Vdc if center-tapped to ground) while maintaining control from a single unit.

Auto-Tracking - Any number of units may have either one of their output terminals connected to a common bus so that all outputs track, at some fraction, the output of a single, controlled, unit.

TEMPERATURE RATINGS:

Operating: 0 to +50°C Storage: −40 to +75°C

Unit is fan cooled. Thermostats turn off unit if FET or output diode temperatures rise above a critical level; reset automatically.

BACKPRESSURE:

Unit will operate against static backpressure at air outlet (rear panel) of up to 0.06 inches of water (air inlet at 0 inches of water).

CERTIFICATION:

Unit complies with these requirements:

IEC 348 - Safety Requirements for Electronic Measuring Apparatus.

CSA Electrical Bulletin 556B - Electronic Instruments and Scientific Apparatus for Special Use and Applications.

VDE 0871/0.78 Level A - RFI Suppression of Radio Frequency Equipment for Industrial, Scientific, and Medical (ISM) and Similar Purposes.

VDE 0411 - Electronic Measuring Instruments and Automatic Controls.

DIMENSIONS:

See Figure 2-1.

WEIGHT:

Net: 15 kg (33 lb) Shipping: 16 kg (36 lb)