SECTION I
GENERAL INFORMATION

1-1 DESCRIPTION

1-2 This supply, is designed for applications requiring a constant current source with a high degree of regulation and stability and very low ripple characteristics. The use of a three-position output RANGE switch and a 10-turn output CURRENT control result in resolution down to 0.5μA. Special attention has been given to circuit details so that well regulated performance is maintained down to very low output currents — of the order of 1μA.

1-3 A special guard supply, within the unit, provides a voltage which is used to prevent internal leakage currents which would degrade the regulation characteristics. Since the positive output voltage is held equal to the guard voltage, it is also used to drive the front panel voltmeter effectively isolating the voltmeter from the main supply. This prevents the usual output degradation associated with connecting a voltmeter across a constant current supply.

1-4 The supply is completely transistorized (all-silicon) and is suitable for either bench or rack operation. It is of the Constant Current/Voltage Limiting type that will furnish full rated output current at the maximum rated output voltage or can be continuously adjusted throughout the output range. The front panel VOLTAGE control is used to establish the output voltage limit (ceiling) when the supply is used as a constant current source. This control is continuously variable throughout the entire voltage range. The front panel CURRENT control can be used to establish the output current limit (overload or short-circuit) if the supply is used as a voltage-limited source.

1-5 A single meter is used to measure either output voltage or current. The dual selection is accomplished by a METER switch on the front panel. Output current can be measured in one of three ranges in accordance with the RANGE switch setting on the front panel. Output voltage is measured in only one range.

1-6 The power supply has both front and rear terminals. Either the positive or negative output terminal may be grounded or the power supply can be operated floating at up to a maximum of 300 Volts off ground (added safety precautions should be taken to protect the operator when the supply is used in this mode).

1-7 Terminals at the rear of the unit allow access to various control points within the unit to expand the operating capabilities of the instrument. A brief description of these capabilities is given below:

a. Remote Programming. The power supply can be programmed (controlled) from a remote location by means of an external voltage source or resistance. The output current can be rapidly programmed in the up or down direction using this technique. Remote programming speed is less than 6msec from zero to 99% of maximum rated output with an accuracy of 1%.

b. External Voltage Monitoring. The output voltage of the supply can be externally monitored with an accurate differential or digital voltmeter for applications involving component testing or sorting. Connecting the external meter to the guard voltage prevents output performance degradation when this feature is employed.

c. AC Modulation of Output. An external ac component (or varying dc) can be superimposed on the dc output current of the supply. This feature permits measurement of dynamic impedance, voltage breakdown, and leakage resistance.

1-8 SPECIFICATIONS

1-9 Detailed specifications for the power supply are given in Table 1-1.

1-10 OPTIONS

1-11 Options are factory modifications of a standard instrument that are requested by the customer. The following options are available for the instrument covered by this manual. Where necessary, detailed coverage of the options is included throughout the manual.

Option No.	Description
014	Three Digit Graduated Decadial Current Control: Control that replaces 10-turn current control permitting resettability to within 0.1%.
028	230Vac Operation: Before the supply is shipped from the factory, an internal line voltage selector

switch is set and the proper fuse installed for 230-volt operation. A label on the rear heat sink identifies the line voltage option. (The user can convert an instrument from one line voltage option to the other by following the instructions in Paragraph 2-18.

1-12 ACCESSORIES

1-13 The applicable accessories listed in the following chart may be ordered with the instrument or separately from your local Hewlett-Packard field sales office (refer to list at rear of manual for addresses).

ⓗ Part No.	Description
5060-8764	Rack Kit for mounting one or two units. (Refer to Section II for details.)
5060-8530	Filler panel to block unused half of rack when mounting only one unit.

1-14 INSTRUMENT IDENTIFICATION

1-15 Hewlett-Packard power supplies are identified by a three-part serial number. The first part is the power supply model number. The second part is the serial number prefix, consisting of a number-letter combination denoting the date of a significant design change and the country of manufacture. The first two digits indicate the year (10 = 1970, 11 = 1971, etc.); the second two digits indicate the week (01 through 52); and the letter "A", "G", "J", or "U" designates the U.S.A., West Germany, Japan, or the United Kingdom, respectively, as the country of manufacture. The third part is the power supply serial number; a different 5-digit sequential number is assigned to each power supply, starting with 00101.

1-16 If the serial number prefix on your unit does not agree with the prefix on the title page of this manual, change sheets supplied with the manual define the differences between your instrument and the instrument described by this manual.

1-17 ORDERING ADDITIONAL MANUALS

1-18 One manual is shipped with each instrument. Additional manuals may be purchased from your local Hewlett-Packard field office (see list at rear of this manual for addresses). Specify the model number, serial number prefix, and ⓗ part number provided on the title page.

Table 1-1. Specifications, Models 6177C and 6181C

INPUT:
115Vac ±10%, single phase, 48-63Hz, 0.6 amps, 55 watts (nominal)

OUTPUT CURRENT RANGES:
Model 6177C: 0-500mA, 0-50mA, 0-5mA
Model 6181C: 0-250mA, 0-25mA, 0-2.5mA

OUTPUT VOLTAGE COMPLIANCE
Model 6177C: 50Vdc
Model 6181C: 100Vdc
(For both models, minimum voltage limit is 0.5 volts)

LOAD EFFECT (LOAD REGULATION):
The output current changes less than 25ppm of initial value plus 5ppm of current range switch setting for a load change which causes the output voltage to vary from zero to maximum. (The relative humidity must be less than 50% when measuring load effect.)

SOURCE EFFECT (LINE REGULATION):
The output current changes less than 25ppm of initial value plus 5ppm of range switch setting for any line voltage change within the input rating (104 to 127Vac, or 208 to 254Vac) and at any output current and voltage within rating.

RESOLUTION:
0.03% of range switch setting

PARD (RIPPLE AND NOISE):

Model 6177C:	500mA range	160μA/1mA (rms/p-p, dc to 20MHz)
	50mA range	16μA/200μA
	5mA range	1.6μA/40μA
Model 6181C:	250mA range	80μA/500μA
	25mA range	8μA/100μA
	2.5mA range	0.8μA/20μA

TEMPERATURE RANGES:
Operating: 0 to 40°C ambient. At higher temperatures, maximum output current setting must be reduced linearly to 80% at 55°C.
Storage: -40 to 75°C

TEMPERATURE COEFFICIENT:
Output change per degree Celsius is less than 75ppm of output current plus 5ppm of range switch setting.

DRIFT (STABILITY):
Total output current drift is less than 100ppm of output plus 25ppm of range switch setting. Drift is measured for 8 hours at constant ambient, line, load, and output setting after an initial warm-up of one hour.

LOAD TRANSIENT RECOVERY TIME:
Less than 800μsec for output current recovery to within 1% of the nominal output current following a full load change in output voltage.

Table 1-1. Specifications, Models 6177C and 6181C (Continued)

PROGRAMMING SPEED:
Less than 6 milliseconds are required to program from zero to 99% of the maximum rated output current of each range or from the maximum rated output current of each range to less than 1% of that current.

CONSTANT CURRENT REMOTE PROGRAMMING COEFFICIENTS:

Resistance Programming (Accuracy: 1% of output plus 0.04% of range)

Model 6177C:	500mA range	4Ω/mA
	50mA range	40Ω/mA
	5mA range	400Ω/mA
Model 6181C:	250mA range	20Ω/mA
	25mA range	200Ω/mA
	2.5mA range	2000Ω/mA

Voltage Programming (Accuracy: 0.5% of output plus 0.04% of range)

Model 6177C:	500mA range	2mV/mA
	50mA range	20mV/mA
	5mA range	200mV/mA
Model 6181C:	250mA range	10mV/mA
	25mA range	100mV/mA
	2.5mA range	1V/mA

VOLTAGE LIMIT REMOTE PROGRAMMING COEFFICIENTS:
An external resistance of 870Ω per volt in the Model 6177C or 435Ω per volt in the Model 6181C will program the voltage limit to within ±25% plus 1 volt. A voltage input of 1 volt per volt will program the voltage limit of both models to within 3 volts.

METER RANGES:
Model 6177C: 600mA, 60mA, 6mA, and 60Vdc
Model 6181C: 300mA, 30mA, 3mA, and 120Vdc

OUTPUT IMPEDANCE (Typical; R in parallel with C*)

	Model 6177C	
500mA range	R = 3.3MΩ	C = 0.05μF
50mA range	33MΩ	0.005μF
5mA range	330MΩ	500pF
	Model 6181C	
250mA range	13.3MΩ	1000pF
25mA range	133MΩ	100pF
2.5mA range	1330MΩ	10pF

*The formula $Z = RX_C / \sqrt{R^2 + X_C^2}$ can be used for calculations up to 1MHz. Above 1MHz, the output impedance is greater than the formula would indicate.

DIMENSIONS:
See Figure 2-1

WEIGHT:
4.53kg (10 lbs) net; 5.9kg (13 lbs) shipping