SECTION I
GENERAL INFORMATION

1-1 INTRODUCTION

1-2 This instruction manual contains operating and service instructions for the HP-IB Isolated D/A Power Supply Programmer Model 59501A. Installation instructions and sample programs are also provided. The 59501A allows HP power supplies to be digitally controlled via the Hewlett-Packard Interface Bus (HP-IB) from a calculator, computer, or other controller. The digital format is bit parallel, byte serial, ASCII coded format. The 59501A can also be used on the HP-IB as a digitally programmable low level dc signal source. Since the 59501A can be controlled (programmed) by various control devices such as HP 9800 series calculators or the HP-2100 series computers, hereafter in this manual, the controlling device will be referred to as the "controller", except when specific programming examples are provided.

1-3 DESCRIPTION

1-4 The 59501A is basically a digital-to-analog (D/A) converter that provides an output voltage in response to digital data received on the HP-IB. Two programmable output ranges (1V and 10V) are available. In addition, a switch on the rear panel allows selecting either a unipolar or bipolar output mode. The unipolar mode provides a 0 to .999V or a 0 to 9.99V output range and the bipolar mode provides a −1V to +0.998V or a −10V to +9.98V output range. The 59501A's output can be used as a programming voltage for controlling a wide range of dc voltages and currents from HP power supplies or as a source voltage for testing electronic components such as integrated circuit packages (IC's).

1-5 Isolators within the 59501A protect other instrumentation on the HP-IB from damage that could be caused by power supply outputs. Also, an internal circuit ensures that the output is held near zero until programmed data is received. Power supply programming is accomplished through use of the 59501A's programmable output voltage and its front panel adjustments. By making the appropriate connections between the 59501A's rear terminals and the programming terminals on the supply, the output voltage (or current, if available) of the power supply can be programmed from zero to its full rated output. The 59501A's front panel adjustments provide fast and easy calibration of power supply outputs. The ZERO ADJUST enables the user to correct for small offsets in power supply response to programmed inputs. The POWER SUPPLY FULL SCALE ADJUSTMENT (COARSE and FINE) allows the user to set the maximum output desired from the power supply when the 59501A is programmed to its maximum output. This method of programming is called voltage programming with gain. Power supply programming is described in greater detail in Section III.

1-6 Programming the 59501A is accomplished through the transmission of four consecutive digits (four ASCII characters). The first digit specifies output range and the next three digits specify the magnitude within the selected range. The high/low range capability provides a ten to one improvement in resolution. Internal conversion circuitry enables the 59501A to produce its maximum output voltage in approximately 250μsec from the time the digital data is received. Output current up to 10 milliamps is available and is automatically limited to protect the 59501A and the user equipment.

1-7 HP-IB CAPABILITIES

1-8 The 59501A has "listener" and "acceptor handshake" HP-IB functional capabilities. The LISTENING indicator on the front panel provides a convenient means of monitoring the 59501A's operating status. The 59501A does not have: controller, talker, source handshake, service request, device trigger, extended listener, extended talker, parallel poll, and remote/local HP-IB functional capabilities. All HP-IB functional capabilities are described in IEEE Standard 488-1975.

1-9 SPECIFICATIONS

1-10 Detailed specifications for the 59501A are given in Table 1-1.

1-11 ACCESSORIES

1-12 The System-II cabinet accessories listed below may be ordered with the 59501A unit or separately from your local Hewlett-Packard field sales office (refer to list at rear of manual for addresses). All accessories applicable to System-II modular cabinets are fully described and illustrated in the Hewlett-Packard Electronic Instruments and Systems catalog.

HP Part No.	Description
5061-0088	Two front handles that attach to each side of 3 1/2" high cabinets.
5061-0094	Kit of lock link hardware for joining together cabinets of equal depth. Units can be joined side-by-side or vertically. This kit is required whenever two (or more) sub-module units are to be rack mounted side-by-side.
1460-1345	Tilt stand snaps into standard foot supplied with instrument -- must be used in pairs.
5061-0054	Rack mounting kit for one half module width unit, 3 1/2-inches high. Includes one rack flange (ear) and one half module width extention panel (adapter).
5061-0076	Rack mounting kit for two half module units, 3 1/2" high. Kit includes two rack flanges (ears). Also, lock-together kit (5061-0094) is required for joining the two units together. The cabinets must also be of equal depth.
5061-0055	Rack mounting kit for two units (one half module width and one quarter module width). Kit includes one rack flange and one quarter width extension adapter. Lock-together kit (5061-0094) is required for joining the two units.
5061-0096	Support shelf for mounting one or more 3 1/2" high units which are half module or quarter module width. Cabinet depths need not be equal.
5061-2021	Front filler panel (one quarter module width) for 3 1/2" high support shelf.
5061-2022	Front filler panel (one half module width) for 3 1/2" high support shelf.
1494-0015	Slide kit for support shelves mounted in HP rack enclosures.

1-13 INSTRUMENT AND MANUAL IDENTIFICATION

1-14 Hewlett-Packard instruments 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 indicate the year (10 = 1970, 11 = 1971, etc.), the second two digits indicate the week, and the letter "A" designates the U. S. A. as the country of manufacture. The second part is the instrument serial number; a different sequential number is assigned to each instrument, starting with 00101.

1-15 If the serial number on your instrument does not agree with those on the title page of the manual, Change Sheets supplied with the manual of Manual Backdating Changes define the difference between your instrument and the instrument described by this manual.

1-16 ORDERING ADDITIONAL MANUALS

1-17 One manual is shipped with each instrument. Additional manuals may be purchased from your local Hewlett-Packard field office (see the list at the rear of this manual for addresses). Specify the model number, serial number prefix, and the HP Part Number provided on the title page.

Table 1-1. Specifications, Model 59501A

D/A CONVERTER

DC Output Voltage: Programmable in high or low ranges within the voltage limits shown below. Output mode is unipolar or bipolar and is selectable via rear panel switch.

	High	Low
Unipolar	0 to 9.99 Volts	0 to +.999 Volts
Bipolar	−10 to +9.98 Volts	−1 to +.998 Volts

DC Output Current: 10mA

Resolution:

	High	Low
Unipolar	10mV	1mV
Bipolar	20mV	2mV

Accuracy: Specified at 23° C ± 5°C

	High	Low
Unipolar	.1% + 5mV	.1% + 1mV
Bipolar	.1% + 10mV	.1% + 2mV

* **Stability:** Change in output over 8 hour interval under constant line, load, and ambient following a 30 minute warm-up.

	High	Low
Unipolar	.04% + .5mV	.04% + ,1mV
Bipolar	.04% + 1mV	.04% + .2mV

Temperature Coefficient:

	High	Low
Unipolar	.01%/°C + .5mV/°C	.01%/°C + .1mV/°C
Bipolar	.01%/°C + .5mV/°C	.01%/°C + .1mV/°C

Zero Adjust: Plus or minus 250 millivolts.

D/A Full Scale Adjust: Plus or minus 5%.

Programming Speed: The time required for output to go from zero to 99% of programmed output change is 250μsec (measured with resistive load connected to output terminals).

* Stability is included in accuracy specification measurements over the temperature range indicated.

POWER SUPPLY PROGRAMMING

Programming Network Specifications: In the following specifications, M represents the calibrated full scale value of the supply being programmed and P represents the actual programmed output. Note that the full scale value (M) can be any value within the supply's output range and is calibrated with the 59501A programmed to its maximum high range output.

Accuracy (Does not include power supply errors):
Specified at 23°C ± 5°C.

	High	Low
Unipolar	.05%M + .25%P	.01%M + .25%P
Bipolar	0.1%M + .25%P	.02%M + .25%P

Isolation: 600Vdc between HP-IB data lines and output terminals.

Temperature Coefficient:

High	.005%M/°C + .015%P/°C
Low	.01%M/°C + .015%P/°C

Programming Resolution:

	High	Low
Unipolar	0.1%M	0.01%M
Bipolar	0.2%M	0.02%M

Programming Speed: D/A Conversion Time plus the programming speed of the power supply.

GENERAL

Input Power: Unit has ac power module which is settable to: 100/120/220/240Vac (−13%, +6%), 48-63Hz, 10VA. A 3-wire detachable line cord is supplied.

Temperature Range:
Operating: 0 to 55°C
Storage: −40 to 75°C

Dimensions:
(See Figure 2-1)

Weight:
Net: 1.36kg. (3 lb.)
Shipping: 1.81kg. (4 lb.)

SECTION II
INSTALLATION

2-1 INITIAL INSPECTION

2-2 Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is received, proceed as instructed in the following paragraphs.

2-3 Mechanical Check

2-4 If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken switches or connectors, and dents or scratches on the panel surfaces. If the instrument is damaged, file a claim with the carrier's agent and notify your local Hewlett-Packard Sales and Service Office as soon as possible (see list at rear of this manual for addresses).

2-5 Electrical Check

2-6 Check the electrical performance of the instrument as soon as possible after receipt. Section V of this manual contains procedures which will verify instrument operation on the HP-IB. These procedures are also suitable for incoming quality control inspection. Refer to the inside front cover of the manual for the Certification and Warranty statements.

2-7 REPACKAGING FOR SHIPMENT

2-8 To insure safe shipment of the instrument, it is recommended that the package designed for the instrument be used. The original packaging material is reusable. If it is not available, contact your local Hewlett-Packard field office to obtain the materials. This office will also furnish the address of the nearest service office to which the instrument can be shipped. Be sure to attach a tag to the instrument specifying the owner, model number, full serial number, and service required, or a brief description of the trouble.

2-9 INSTALLATION DATA

2-10 The 59501A is shipped ready for operation on the HP-IB. Before connecting it to a controller and applying power, read paragraph 2-26.

2-11 Outline Drawing

2-12 Figure 2-1 illustrates the outline shape and dimensions of Model 59501A.

2-13 Rack Mounting

2-14 The 59501A can be rack mounted in a standard 19-inch rack panel either by itself or alongside another half (or quarter) System-II module of equal height and depth. All rack mounting accessories for this unit are listed in paragraph 1-11. Also, complete installation instructions are included with each rack mounting kit.

2-15 Equipment Required

2-16 If an HP calculator is used to program the 59501A, the following equipment is required:

HP *** Calculator	I/O Card Package	ROM
9820A	59405A Option 020* HP-IB I/O	Math
9821A	59405A Option 021* HP-IB I/O	Math
9825A	98034A HP-IB I/O	General I/O Extended I/O
9830A	59405A Option 030** HP-IB I/O	

* Includes Peripheral Control II ROM
** Includes Extended I/O ROM
*** If an HP-2100 series computer is used as the controller, the 59310B HP-IB Computer Interface card is required.

2-17 HP-IB Connector

2-19 The HP-IB connector on the rear of the 59501A interfaces directly to the HP-IB. Figure 2-2 illustrates the pin configuration of the HP-IB connector which is a 24-pin,

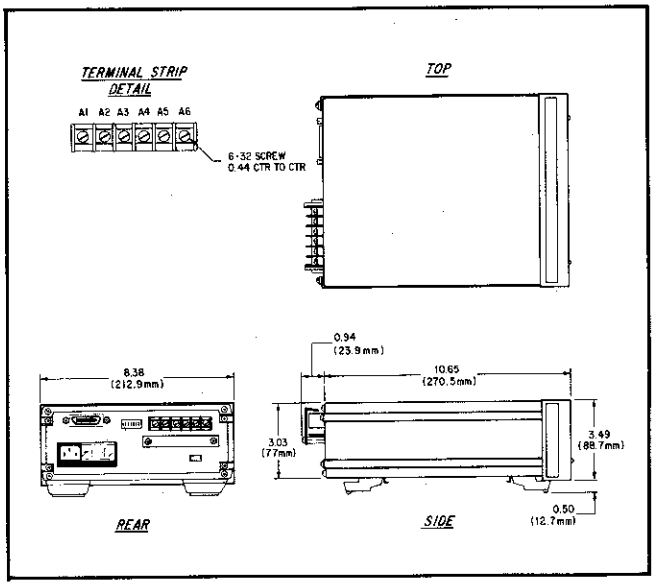

Figure 2-1. 59501A Outline Drawing

type 57 micro-ribbon connector. One HP-IB cable is supplied with each HP computer and calculator I/O card package. Extra cables may be ordered separately.

HP-IB Cable Model No.	Cable Length
10631A	1m (3.3 ft.)
10631B	2m (6.6 ft.)
10631C	4m (13.2 ft.)

NOTE

The HP-IB connector supplied with this unit contains metric fasteners (colored black). If your HP-IB cable connector contains standard mating screws (silver), make a conversion using the hardware and instructions included in Metric Conversion Kit (5060-0138).

2-19 The HP-IB cables use the same piggyback connector on both ends. Up to three connectors may be stacked one upon another. As many as 15 instruments (including the controller) may be connected to the same HP-IB.

2-20 System Connections

2-21 Figure 2-3 illustrates a controller (e. g., a 9825A calculator) and a 59501A unit connected to the HP-IB. In this case, the 98034A interface card provides HP-IB capability for the 9825A calculator and is installed in any one of the three slots in the rear of the calculator. The 98034A card is equipped with the proper cable and connector to mate with the HP-IB connector on the rear of the 59501A. Note that specific connections between the 59501A's output terminals and the user's device (e.g. programmable power supply)

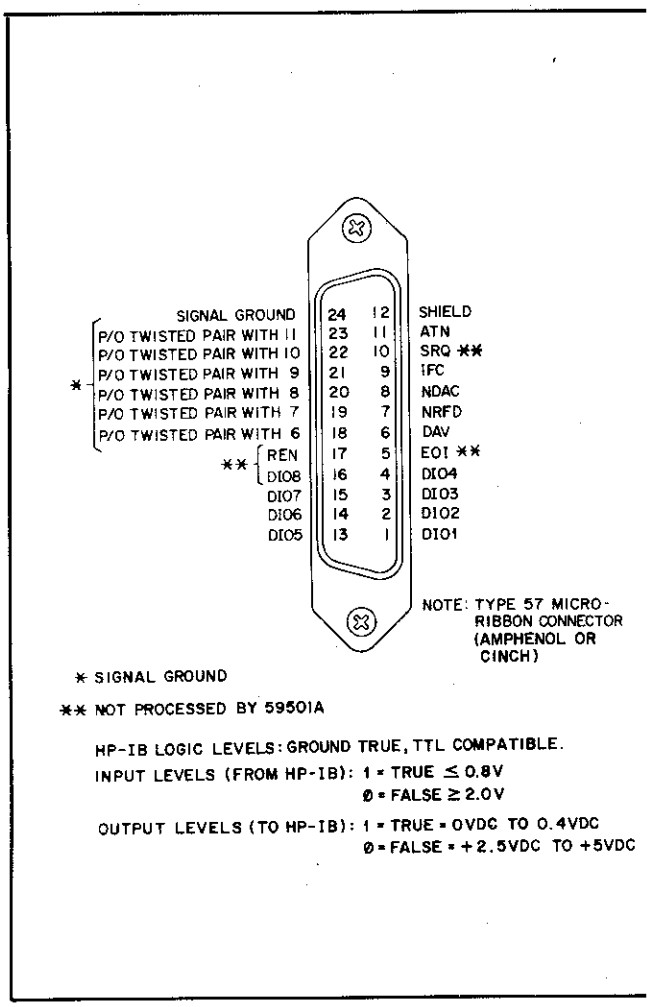

Figure 2-2. HP-IB Connector

are not illustrated on Figure 2-3. These connections depen upon the particular power supply being programmed and the type of control desired (output voltage or current). The connections required to program various HP power supplies are provided in Section III, paragraph 3-45 throug 3-52.

2-22 Setting Addresses

2-23 The listen address for the 59501A is selected by address switches on the rear of the unit. The switches are factory set to the suggested listen address of & when the unit is shipped from the factory. As shown in Figure 2-4, there are seven address switches. The last two switches, 6 and 7 (XX), are ignored (have no affect). Switches 1, 4, and 5 are set to "0" and switches 2 and 3 are set to "1" tc select a listen address of "&". Note that "&" is the sugges listen address and is one of 31 listen address possibilities. The address switch settings for each of the 31 listen addre possibilities are listen in Table 2-1.

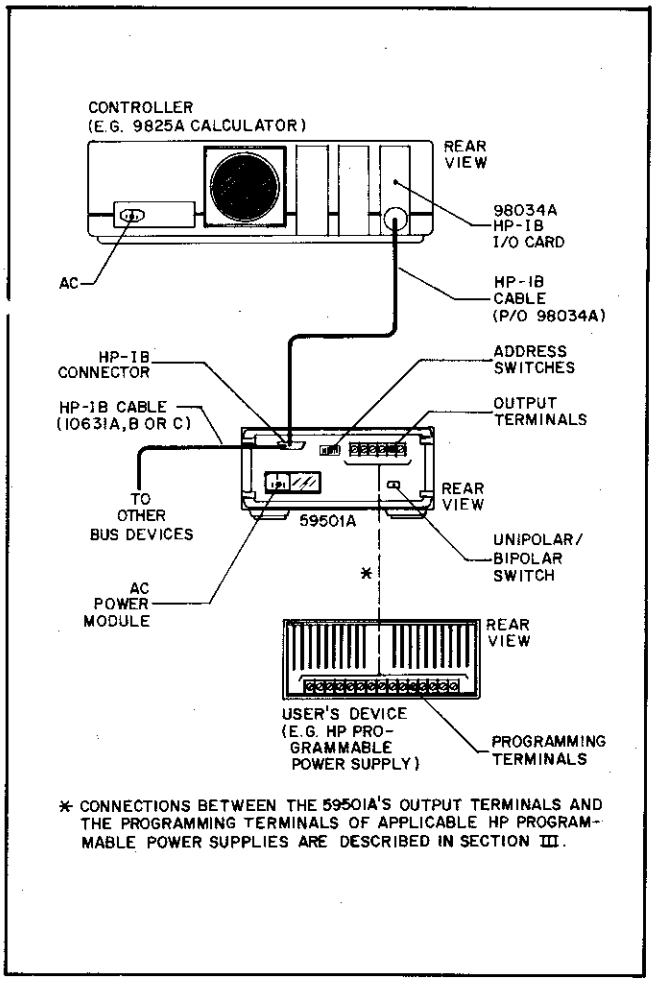

Figure 2-3. System Connections

2-24 The HP-IB bus interface cards for the HP calculators are shipped from the factory with a preset talk address of "U" and a preset listen address of "5". Before programming, write down the listen and/or talk address of all instruments connected to the HP-IB.

2-25 Unipolar/Bipolar Mode Switch

2-26 The UNIPOLAR/BIPOLAR mode switch is a push-in, push-out type switch located on the rear of the unit beneath the output terminal strip. In the UNIPOLAR mode (switch is in), the 59501A provides an output range of 0 to 0.999V or 0 to 9.99V. In the BIPOLAR mode (switch is out), the 59501A provides an output range of −1V to +0.998V or −10V to +9.998V. The switch is set to UNIPOLAR when the unit is shipped from the factory.

2-27 Input Power Requirements And Line Voltage Conversion

2-28 The 59500A may be operated continuously from a nominal 100V, 120V, 220V, or 240V (48-63Hz) power

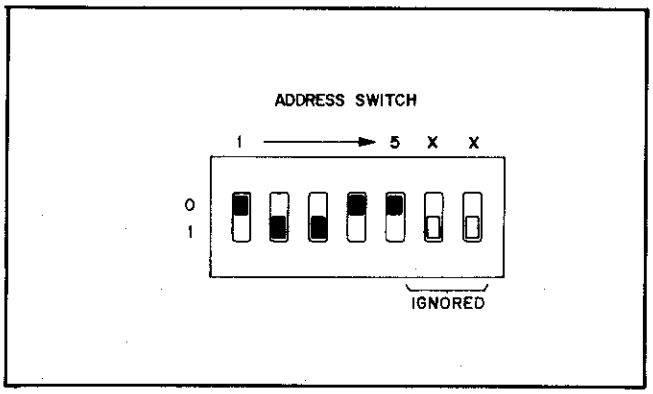

Figure 2-4. Listen Address Switches on Rear of 59501A

Table 2-1. Listen Addresses and Switch Settings

Address Switches					Listen Address Character
5	4	3	2	1	
0	0	0	0	0	SP
0	0	0	0	1	!
0	0	0	1	0	"
0	0	0	1	1	#
0	0	1	0	0	$
0	0	1	0	1	%
0	0	1	1	0	&
0	0	1	1	1	'
0	1	0	0	0	(
0	1	0	0	1	)
0	1	0	1	0	*
0	1	0	1	1	+
0	1	1	0	0	,
0	1	1	0	1	−
0	1	1	1	0	.
0	1	1	1	1	/
1	0	0	0	0	0
1	0	0	0	1	1
1	0	0	1	0	2
1	0	0	1	1	3
1	0	1	0	0	4
1	0	1	0	1	5
1	0	1	1	0	6
1	0	1	1	1	7
1	1	0	0	0	8
1	1	0	0	1	9
1	1	0	1	0	:
1	1	0	1	1	;
1	1	1	0	0	<
1	1	1	0	1	=
1	1	1	1	0	>

source. A printed circuit board located within the ac power module on the rear panel selects the power source. Voltage choices are available on both sides of the PC board. Before connecting the instrument to the power source, check that the PC board selection matches the nominal line voltage of the source. The operating voltage that is selected is the one printed on the lower-left side of the PC board (see Figure 2-5). As shipped from the factory, the PC board in this unit is positioned for 120Vac operation. To select another input voltage proceed as follows:

a. Remove power cable from instrument.
b. Move plastic door on power module aside.
c. Rotate FUSE PULL to the left and remove line fuse F1.
d. Remove PC board from slot. Select operating voltage by orienting PC board to position the desired voltage on top-left side of PC board. Push board firmly into slot.
e. Rotate FUSE PULL back into normal position and re-insert fuse FI in holder using caution to select the correct value for F1 (125mA for 100V or 120V and 62.5mA slo-blo for 220V or 240V).
f. Close plastic door and connect power cable.

2-29 When the instrument leaves the factory, a 125mA fuse is installed for 120V operation. An envelope containing a 62.5mA fuse for 220V/240V operation is attached to the instrument. Make sure that the correct fuse value for F1 is installed if the position of the PC board is changed.

2-30 Power Cable

2-31 This unit is factory equipped with a power cord plug that is the most appropriate for the user's location. The replaceable parts section of this manual lists all of t power cords associated with this unit. If a different po cord is desired, contact your nearest HP Sales Office.

2-32 To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recomm that the instrument panel and cabinet be grounded. Th instrument is equipped with a three conductor power c The third conductor is the ground conductor and when cable is plugged into an appropriate receptacle, the inst ment is grounded. The offset pin on the power cable t prong connector is the ground connection. In no even shall this instrument be operated without an adequate cabinet ground connection.

2-33 To preserve the protection feature when oper the instrument from a two-contact outlet, use a three-t to two-prong adapter (if permitted by local regulation connect the green lead on the adapter to ground.

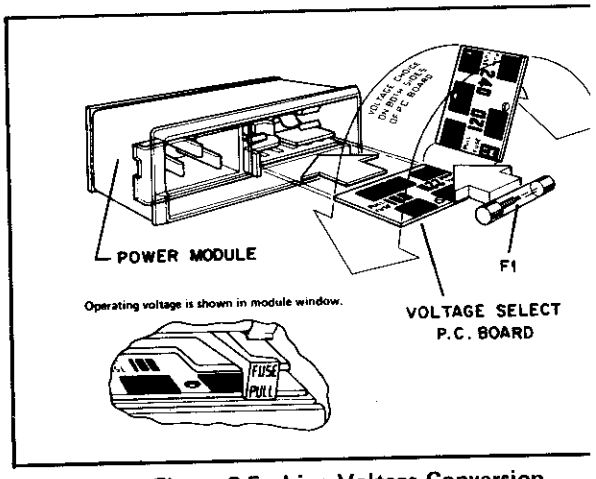

Figure 2-5. Line Voltage Conversion