# SECTION I
# GENERAL INFORMATION

## 1-1 SCOPE

1-2 This instruction manual provides complete operating and service instructions for the 6941B Multiprogrammer Extender. Accessory input/output cards and the 6940B Multiprogrammer, which is the Master unit in a Multiprogrammer System, are covered in separate instruction manuals. Overall system concepts, including system installation, troubleshooting, and operating considerations are covered in the instruction manual for the 6940B Master unit and will not be repeated in this manual.

## 1-3 DESCRIPTION

## 1-4 6941B Multiprogrammer Extender

1-5 This unit is intended for use only as an addition to the 6940B Master and must be controlled through this unit. Up to fifteen Extenders can be operated with one 6940B to extend the maximum capacity of a Multiprogrammer System to 240 input/output channels.

1-6 The 6941B mainframe is similar in construction to the 6940B, having the same basic card cage, rear panel, and dc power supply. The main differences between the two units are in the circuit cards which plug into the mainframe. The plug-in card complement for the 6941B is as follows:

| SLOT | 6941B PLUG-IN CARDS |
|---|---|
| 100 | A1 Input Card (Extender) |
| 200 | A2 I/O Transfer Card |
| 300 | A3 Logic and Timing Card (same as A3 card in 6940B) |
| 400-414 | A4 Input and/or Output Accessory Cards |
| 500 | Vacant (occupied by Unit Select Card in 6940B) |
| 600 | A6 Regulator Card (when used) |

1-7 The programmed data and address bits, 15 unit selection lines, and control and timing signals from the 6940B Multiprogrammer are cabled to input jack J1 of the first 6941B extender unit in the system. Further, when the input mode is selected, extender unit input data is placed on the programmed data lines and on to connector J1 for return along with control signals, to the 6940B Multiprogrammer.

1-8 When the input mode is not selected, the data and address bits are routed through input adapter card A7 to input card A1. After being properly terminated by card A1, the bits are coupled through I/O transfer card A2 in slot 200 to logic and timing card A3. When the input mode is selected, input data bits 0-11 from the A3 card are buffered on the A2 card and selected for return to the 6940B. Since the outputs of the A2 card selection logic are connected to the same lines as the output mode programmed data, the input data is routed to connector J1 in place of programmed data for return to the 6940B.

1-9 The A3 logic and timing card in the 6941B extender unit is identical to the A3 card in the 6940B multiprogrammer. The A3 card selects either programmed data for application to the extender unit output card slots or it selects input card data for application to the A2 card and transmission back to the computer. The selection is based on the input mode control signal supplied to the 6941B from the 6940B. Like the 6940B A3 card, in addition, the 6941B A3 card generates a flag signal which is returned to the 6940B, through the J1 connector and chaining cable, to indicate the busy-ready status of the 6941B extender unit Ø1.

1-10 The unit Ø1 select line of the 15 input unit select lines is wired to all input/output card slots of unit Ø1, while the remaining 14 unit select lines are jumpered directly from input jack J1 to output jack J2 (after being buffered on the A8 output adapter card) and then through a chaining cable to the next extender unit in the system. This process is repeated until at the 15th extender unit all unit select lines have been terminated at their associated unit.

1-11 When unit Ø1 is selected, its 400 through 414 input/output card slots are partially enabled. The next data or address word will enable one input/output card of unit Ø1 to receive programmed data (output) or transmit (input) data. The input/output data, unit select, and control and timing signals at output jack J2 are chain-cabled to input jack J1 of the next 6941B extender unit in the system.

## 1-12 Input/Output Cards

1-13 The function of the output cards is to develop an output quantity proportional to programmed data, and to deliver this quantity to the user's system. The output cards are similar to one another in that each contains address gate, data storage, and output data conversion circuits. The nature

of the output conversion circuits determines the card type.

1-14 Output cards are programmed using a 16-bit data word. Twelve of the bits represent programmed data while the remaining four bits contain the output card slot address. The 12 bits are used in different ways on the various type output cards to develop an output to the user's systems. For digital-type output cards, the 12-output bits can be either identical to or the complement of the 12-programmed bits. For analog-type output cards (voltage, resistance, etc.) the data bits are used to adjust the value of binary-weighted precision resistance networks. The outputs of the networks are then either connected directly to external programmable power supplies (or other devices that can be programmed by a variable resistance) or used on the output card to adjust the gain of an operational amplifier. In the latter case, the operational amplifier will produce a voltage or current output proportional to the programmed data.

1-15 An output card programmed to a particular output value will hold that value until it is readdressed and the programmed data is changed.

1-16 The function of the input cards is to receive data from the user's system and make it available to the computer. The input cards each contain an address gate and input data interface circuits. Further, input cards can be supplied with storage capability so that the user's system need supply input data for a short period of time after which it is maintained on the input card until accepted by the computer. The nature of the user's input; i.e., digital input data versus relay contact closure data, determines the card type.

1-17 Input cards are programmed using a 16-bit address word. The same four bits used to specify an output card slot address are also used to address an input card slot. The remaining 12 bits are not relevant to the input cards. An input card's 12 data bit outputs are transmitted to the computer when an address word selects the associated input card slot and the multiprogrammer has been previously placed in the input mode.

1-18 When an input/output card is plugged into a particular slot of a particular unit, it assumes the address of that slot and unit, and will either receive and store data (output cards) or transmit data (input cards) only when that unit and slot are addressed. Unit selection is accomplished by decoding control words, as described previously, but slot address decoding is accomplished by directly wiring a unique combination of four slot address bits to each of the 15 input/output slots. If a card is moved to a new slot it assumes the address of that slot.

1-19 When one or more D/A voltage converter, D/A current converter or voltage monitor cards are used in a 6940B (or a 6941B), an A6 voltage regulator card must be installed in slot 600 to supply operating power. This card contains four isolated +15 and −15 volt regulated supplies. One of the supplies has a 750mA capability while the remaining three can provide up to 150mA.

1-20 All input/output cards are fabricated on a 4½" x 11" printed circuit card. The inner end of the card contains a dual 24 pin (48 pin total) printed circuit plug that can mate with any connector in slot 400 through 414. For analog-type output cards, the output quantity is taken from a terminal block located on the outer-end of the card; for digital-type input/output cards, the input/output bits are received/taken from a dual 15 pin printed circuit plug on the outer-end of the card. All external device wiring is routed through a false-bottom channel of the multiprogrammer unit to the user's system.

## 1-21 INTERFACING

1-22 Interfacing of the entire Multiprogrammer System with the digital programming device is accomplished by input card A1 in the 6940B Master. Input card A1 in the 6941B merely provides the proper termination for unit-to-unit cabling.

1-23 As supplied from the factory, the 6941B is configured for operation from a 120Vac (+5%, −10%), 48-440Hz power source. The 6941B can also be operated from a 100, 220, or 240Vac (+5%, −10%), 48-440Hz power source by changing the position of the PC board (voltage selection board) within the ac power module on the rear panel (see Paragraph 2-22). Ensure that the proper line fuse (4A for 100V/120V operation or 2A for 220V/240V operation) is installed.

## 1-24 SPECIFICATIONS

1-25 Specifications for the 6941B Multiprogrammer Extender are given in Table 1-1.

## 1-26 ACCESSORIES

1-27 Tables 1-2 and 1-3, respectively, list the accessories furnished with and available for use with the 6941B. The descriptions of the available accessories in Table 1-3 are general and in no way represent complete specifications. Complete specifications are covered in the Instruction Manual for each accessory.

Table 1-1. Specifications

| | |
|---|---|
| INPUT POWER:<br>100Vac (+5%, −10%), 48-440Hz<br>120Vac (+5%, −10%), 48-440Hz<br>220Vac (+5%, −10%), 48-440Hz<br>240Vac (+5%, −10%), 48-440Hz } Selectable<br><br>DATA WORD TRANSFER RATE:<br>20k word/sec. maximum, in the handshake mode.<br><br>DATA RESOLUTION: 12 bits. | TEMPERATURE RANGE:<br>Operating: 0° to +55°C. Storage: -40° to +75°C.<br><br>OPERATING POSITION:<br>30 degrees off horizontal (maximum).<br><br>DIMENSIONS: See Figure 2-1.<br><br>COOLING: Natural convection. |

Table 1-2. Accessories Furnished

| ACCESSORY | DESCRIPTION |
|---|---|
| Data Input Plug P1, Part No. 06936-60009 | Mates with data input connector on 6941B; allows user to fabricate his own chaining cable (up to 100 feet). |
| Rack Mounting Kit, Part No. 5060-8741 | Allows 6941B to be rack mounted. |
| Plug-In Extender Card, Part No. 5060-7901 | Extends plug-in cards out of the unit chassis for troubleshooting. |

Table 1-3. Accessories Available

| ACCESSORY | DESCRIPTION |
|---|---|
| PROGRAMMABLE OUTPUT CARDS: | |
| Programmable Resistance Cards:<br>Model 69500A | A versatile programmable output card that can be configured by the user to provide one 12-bit or two 6-bit output channels. Output resistors are not loaded on this model. The choice of output component values is left to the user. |
| Models 69501A through 69506A | Provides a single 12-bit resistance programming channel; the programming coefficients of these models are compatible with HP Programmable Power Supplies. |
| Models 69510A through 69513A | Provides two 6-bit resistance programming channels; these models are designed for programming the current limit of HP Programmable Power Supplies |
| Bipolar Power Supply/Amplifier Control Cards, Models 69325A through 69328A | Provide resistance outputs to control the voltage programming (69325A), current limit programming (69326A or 69327A), and gain programming (69328A) of HP Bipolar Power Supply/Amplifiers. |
| Relay Output Card, Model 69330A | Provides 12 separate form A (SPST, normally open) mercury-wetted contact outputs that reflect the status of 12 programmed data bits. |
| Relay Output/Readback Card, Model 69433A | Provides same outputs as Model 69330A; also supplies 12 input data lines that can be read by the computer and which indicate the relay coil voltage status. |

Table 1-3. Accessories Available (Continued)

| ACCESSORY | DESCRIPTION |
|---|---|
| D/A Voltage Converter Card Model 69321B | Provides programmable voltage output from +10V to −10V at programming speeds of < 50μsec. |
| D/A Current Converter Card, Model 69370A | Provides programmable current output from 0 to 20mA at programming speeds of <100μsec. |
| Voltage Regulator Card, Model 69351A | Required for use with D/A Voltage Converter, D/A Current Converter, and A/D Voltage Monitor cards. Installed in multiprogrammer slot 600 to provide ±15Vdc operating voltage for these cards. |
| Digital Output Card, Model 69331A | Provides microcircuit logic level outputs on 12 separate output lines. Outputs reflect the status of 12 programmed data bits. |
| Open Collector Output Card, Model 69332A | Provides 12 solid state output switches to control lamps and relay coils using an external dc power source. Each output circuit is rated at up to 30Vdc and 40mA. |
| Stepping Motor Card, Model 69335A | Provides 1 to 2047 pulses from either of two output terminals on receipt of one computer word. These pulses, when applied to the stepping motor translator, are converted to CW and CCW drive pulses for a stepping motor. |
| Breadboard Output Card, Model 69380A | Allows customer to design and build a custom analog or digital output card. Card includes basic address, storage, and control signal buffer circuits. |
| PROGRAMMABLE INPUT CARDS: Digital Input Card, Model 69431A | Accepts 12 bits of TTL, DTL, or contact closure data from user's device. Card includes gate/flag circuits for exchange of control signals with user's device. Outputs to computer reflect the status of 12 input bits. |
| Isolated Digital Input Card, Model 69430A | Accepts 12-bits of input data from user's device. All input lines are isolated from one another and from the multiprogrammer power supply. Eight options of the card are available to accommodate either ground-true or positive-true logic sense inputs and a wide range of input levels. |
| Event Sense Card, Model 69434A | Compares the magnitude of an external 12-bit input word with a stored reference word and generates a computer interrupt for any of four conditions, depending on the placement of a jumper on the card. The four possible conditions are: In=Ref, In≠Ref, In>Ref, In<Ref. The reference word is loaded from the computer. Both the input and reference words can be read back to the computer. |
| Voltage Monitor Card, Model 69421A | Monitors dc voltages in the range of +10.235V to −10.240V and returns a 12-bit binary word to the computer that indicates the magnitude and sign of the measured voltage. An optional version of the card has an input voltage range of +102.35V to −102.40V. |
| Pulse Counter Card, Model 69435A | Counts pulses or contact closures, up or down, in the range of 0 to 4095. It can be preset by the computer to any value in this range and can have its contents read into the computer. When used in conjunction with a Programmable Timer Card or Frequency Reference Card, it can make frequency or time interval measurements. |

Table 1-3. Accessories Available (Continued)

| ACCESSORY | DESCRIPTION |
|---|---|
| Programmable Timer Card, Model 69600A | Generates a single crystal-controlled pulse each time it is commanded by the program. The duration of the pulse can be programmed in the range 1 to 4095 times a jumper-selectable interval that can have any of six decade values ranging from 1μsec to 0.1sec. When used to provide an enable to a Pulse Counter Card for frequency measurements, the 69600A may be armed to request a computer interrupt for the Pulse Counter Card at the end of the programmed time interval. |
| Frequency Reference Card, Model 69601A | Provides crystal-controlled square-wave outputs at fixed frequencies from 1Hz to 100kHz. The 69601A may be used in conjunction with the Pulse Counter Card for time interval measurements. |
| Breadboard Input Card, Model 69480A | Allows customer to design and build a custom input card. Card includes basic address and readback circuits. |
| Process Interrupt Card, Model 69436A | Generates an interrupt whenever any of 12 inputs changes state (1 to 0, 0 to 1, or both). Bit(s) that changed state are readback by the controller. |
| CHAINING CABLE ASSEMBLY, Model 14541A | Interconnects 6940B and 6941B's in expanded Multiprogrammer Systems. |

## 1-28 INSTRUMENT IDENTIFICATION

1-29 Hewlett-Packard instruments are identified by a three-part serial number. The first part is the instrument model number. The second part is the serial number prefix, consisting of a number-letter combination denoting the date of a significant design change. 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 third part is the instrument serial number; a different 5-digit sequential number is assigned to each instrument, starting with 00101.

1-30 If the serial number on your instrument does not agree with those on the title page of this manual, Change Sheets supplied with the manual or Manual Backdating Changes define the differences between your instrument and the instrument described by this manual.

## 1-31 OPTION 001

1-32 Option 001 modifies the 6940B and 6941B so that they are compatible with 6940A/6941A multiprogrammer systems and software. Since 6940A's and 6941A's have been discontinued, Option 001 must be specified by customers ordering a replacement 6940B or additional 6941B's for use in a 6940A/6941A multiprogrammer system. Appendix A in the rear of this manual describes the 6941B Option 001 modifications. The 6940B Option 001 modifications are described in the 6940B instruction manual.

## 1-33 ORDERING ADDITIONAL MANUALS

1-34 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 HP Part number shown on the title page.