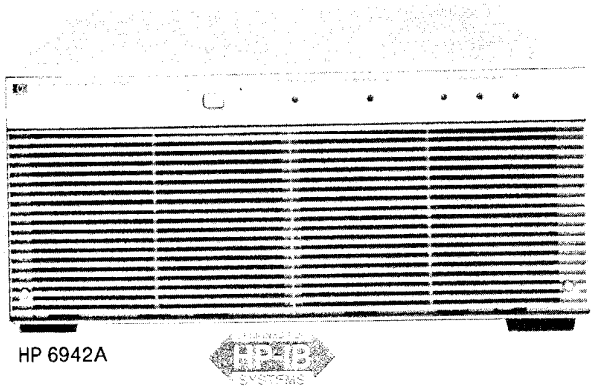
# Multiprogrammer: User Adaptable Instrumentation

## Model 6942A

- Action-oriented instructions
- Isolated analog inputs and outputs
- Built-in self test
- Overlapped input and output
- Internal or external pacing
- Easy to configure



HP 6942A

### The Multiprogrammer Performs Operations In Parallel

With this one instrument you can control several processes at once. And, while you are controlling the processes, the Multiprogrammer can also be watching for interrupt conditions. The internal microprocessor manages all the parallel operations and monitors the alarm lines; when the operations have completed or if an alarm condition occurs, the Multiprogrammer interrupts the controller.

### How does the HP 6942A Connect With Your Controller?

The HP 6942A Multiprogrammer interfaces with your controller (desktop or minicomputer) using the HP-IB, Hewlett-Packard's implementation of IEEE Standard 488 and the identical ANSI Standard MC1.1. Data and status readback make use of the extended bus addressing features of the HP-IB.

### Programming Flexibility

Mnemonic, action-oriented instructions make the HP 6942A Multiprogrammer simple to learn and use. For instance, the output instruction "OP" works with all output cards. When you send an instruction, the internal microprocessor checks which type of card you are addressing and automatically converts the data to the proper format for that card. You select the units with which you want to program each card. Whether you want to use volts, millivolts, amps, degrees, feet, or any other units, the Multiprogrammer does the converting for you.

### Mainframe Memory Unburdens The Controller

The mainframe memory of the HP 6942A will accept up to 76 instructions from the controller at one time. This leaves your controller free for other processing activities while the Multiprogrammer works on the I/O operations. This mainframe memory may also be used to collect up to 1440 data readings and hold them until the controller is free to take them. (For even more data storage, up to 1 Meg words of data may be stored using the HP 69791A and HP 69792A Memory System Cards.

### Real Time Clock

Built-in real-time clock gives you time-of-day readings and pacing of measurements. The clock detects which power line frequency you are using, 50 Hz, or 60 Hz, and automatically synchronizes itself to this frequency. The range of the clock is 65,534 days, with resolution to a tenth of a second.

### Computers and Documentation

The HP 6942A can be operated with a wide variety of computers, including the HP Series 80, Series 200, Series 300, Series 1000, 9825, and 9845 computers. Documentation packages are available for these computers. Each one contains a User's Guide with programming examples, a utility program tape or flexible disc, operating and service manuals, and a binder to hold this material. One no-charge documentation option must be specified to select the documentation appropriate for your computer.

### Accessories

**HP 14700A extender kit:** this kit contains the transmission boards which go into the master mainframe (HP 6942A) and the last extender mainframe (HP 6943A) in the chain.

**HP 14701A intermediate extender kit:** when more than two mainframes are in a chain, the card in this kit must be used in each intermediate extender mainframe.

**HP 14702A chaining cable:** this is the cable which chains together the master and extender mainframes. One cable is required for each extender mainframe. Length: 1.5 m (5 ft).

**HP 14703A card edge connector:** extra connectors for the I/O cards may be ordered in addition to the one supplied with each I/O card.

### HP 6942A/6943A Specifications

**Plug-in I/O card positions:** maximum of 16 plug-in output or input cards per mainframe. Removable rear cover provides access to card slots.

**Computer interface (HP 6942A only):** the Multiprogrammer is connected to a controller via the Hewlett-Packard Interface Bus (HP-IB), Hewlett-Packard's implementation of IEEE Std. 488.

**Real time clock (HP 6942A only):** the built-in real time clock is automatically synchronized with the 50/60 Hz ac power line frequency. The clock is read and set with data in the form of days, hours, minutes and seconds with a resolution of 0.1 second.

**Extender interface kits (HP 6943A only):** each HP 6943A Extender requires one HP 14700A or 14701A Interface Kit and one HP 14702A Chaining Cable for operation with the HP 6942A.

**Maximum number of mainframes per chain:** up to seven HP 6943A Multiprogrammer Extenders may be placed in a chain with one HP 6942A Multiprogrammer.

**Maximum chain length:** a chain of mainframes can be up to 152 meters (500 feet) long. This maximum length is the sum of the lengths of all HP 14702A Chaining Cables used in one chain.

**Power supplies:** all power supplies for up to 16 I/O cards are built-in including three ± 18 V supplies isolated from each other and from the ground.

**Cooling:** built-in forced air cooling draws air in through the front panel and exhausts air through the ventilated rear cover.

**Front panel indicators:** five light emitting diodes on the front panel indicate power supply and self-test status.

**Operating temperature range:** 0°C to 55°C.

**Power:** 100/120/220/240 Vac (selectable), +5%, −10%, 47 to 63 Hz, 600 VA.

**Dimensions:** 177.0 mm high x 425.5 mm wide x 597.0 mm deep, (6.969 in. high x 16.250 in. wide x 23.500 in. deep).

**Weight (without I/O cards):** net, 20 kg (45 lb); shipping, 27 kg (60 lb).

**Accessories furnished:** PC board Extender Card (HP Part No. 5060-2792).

| Ordering Information | Price |
|---|---|
| **Opt 010-233:** One Set Documentation/Software | N/C |
| **Opt 333-499:** Extra Documentation/Software | $103 |
| **Opt 908:** Rack Flange Kit | $41 |
| **Opt 910:** Extra Manual | $51 |
| **Opt W03:** Converts 1 yr return-to-HP warranty to a 90-day on-site warranty | N/C |
| **HP 14700A** Extender Interface Kit | $610 |
| **HP 14701A** Extender Interface Kit | $510 |
| **HP 14702A** Chaining Cable | $305 |
| **HP 14703A** Spare Card Connector | $76 |
| HP 6942A Multiprogrammer | $4500 |
| HP 6943A Multiprogrammer Extender | $3400 |

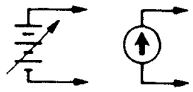
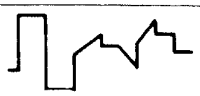
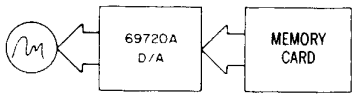
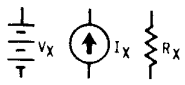
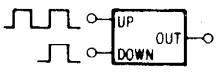
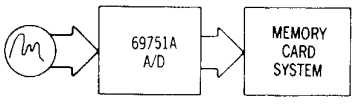
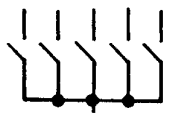
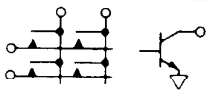
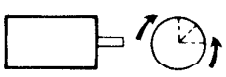
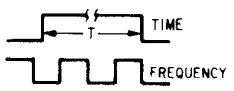
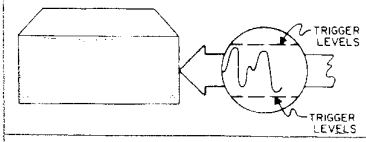
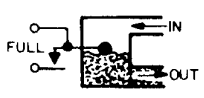
# COMPUTER AIDED TEST

## Multiprogrammer Series II I/O Cards: Broad Functionality with a Unified Approach

### Models 69700A–69793A

### Multiprogrammer Series II I/O Cards for the HP 6954A, 6944A, and 6942A

For a complete description of the Multiprogrammer Series II I/O Cards, ask for publication 5952–4175.

| | Functions | | Applications | Cards Used |
|---|---|---|---|---|
| STIMULUS |  | Programmable DC Voltage and Current | The output voltage (up to 250V) and current (up to 1000A) of forty different HP power supplies can be programmed to provide bias in automatic test systems or control of electromechanical process equipment. | Resistance Output, HP 69700A-69706A; Power Supply Control, HP 69709A. |
| |  | Digital-to-Analog Conversion | Twelve-bit voltage DAC's provide outputs for strip chart, x-y, and analog tape recorders as well as control of analog programmable instruments and stimulus of units under test. Control process equipment with 4–20 mA output. | Voltage DAC, HP 69720A; Current DAC, HP 69721A. |
| |  | Analog Waveform Synthesis | The Memory card can continually supply pre-loaded data to the D/A card at rates of up to 100 kHz. Special waveforms may be loaded into the Memory card from the computer and used as stimuli for test and processes. The analog output is isolated from digital ground. | Memory card, HP 69790B; 69791A, 69792A Voltage DAC, HP 69720A; or Current DAC, HP 69721A. |
| MEASUREMENT |  | Voltage, Current, and Resistance Measurements | A/D converters may be used to measure voltages from ±50μV to ±100 V in the presence of 250 V of common-mode noise. Connecting a resistor across the input permits current measurements for 4–20 mA current loops used in process control. Combine the A/D with the current DAC for resistance measurements. | High Speed ADC, HP 69751A. HP 69759A |
| |  | Frequency Measurements | The Pulse Counter card accumulates counts over a precise time interval when a Timer card is connected to the enable line of the Counter. The program divides the count by the time interval to measure frequencies from 1 MHz to less than 0.001 Hz. | Counter, HP 69775A; Timer HP 69736A. |
| |  | Pulse Counting Preset Up/Down | The Counter may be preset to any value within the count range of 0 to 65,535 and can cause an interrupt when it rolls over. The Counter may be enabled and disabled by pulses or levels. The computer may read the count without disturbing the counting process. | Counter, HP 69775A. |
| |  | Offline Analog Acquisition | Differential or single-ended signals may be digitized at rates up to 500 kHz by the A/D, and stored in the Memory system. Each Memory system can store up to one megawords. The digitizing process can take place independent of other Multiprogrammer activity. | High Speed ADC, 69751A; Memory cards, 69790B, 69791A/69792B. |
| |  | Scanner Systems | Analog measurements from up to 960 channels may be acquired at 25,000 readings per second depending upon the scanner system configuration. Random access to any channel, as well as continuous scanning, are easily accomplished. (See Application Note AN316-3.) | Cards used: Scan Control, HP 69750A; FET Scanners, 69752A or 69755A; Relay Scanner, HP 69754A; High Speed ADC HP 69751A; Memory card HP 69790B, or 69791A/92A |
| CONTROL |  | Digital Output and Switching | Sixteen-bits of data in TTL, open collector, or SPST relay-contact form provide digital control of instruments and indicators. AC power, up to 6, can be switched to 12 loads with a HP 69731B, and HP 14570A AC Power Controller. | Digital Output, HP 69731B; Relay Output, HP 69730A; AC Power Controller, HP 14570A. |
| |  | Digital Input | Digital input cards accept 16-bits of data from digital measuring instruments, push-buttons, switches, relays, and other digital devices in the form of logic levels or contact closures. Digital data sources with more than 16-bits of data use several digital input cards. | Digital Input, HP 69771A; Isolated Digital Input, HP 69770A. |
| |  | Stepping Motor Control | The Stepping Motor card can produce from 1 to 32767 pulses at either of two outputs (CW or CCW) to control motor translators. Output pulses are also used for pulse-train update of supervisory control stations. The pulse rate (motor speed) is also programmable. | Pulse Train/Stepping Motor, HP 69735A. |
| |  | Time and Frequency Reference | Crystal controlled timing pulses, programmable from 1 μs to 18 hours, may be used as a time-base reference for control, measurement, and data acquisition. Period, duty cycle, and number of pulses are all programmable. | Timer, HP 69736A or Pulse Train, HP 69735A. |
| ALARM |  | Level Detecting | When signals cross preset levels, the Digital Input card can trigger the interrupt card to interrupt the computer. The alarm trigger levels can be programmed with the D/A or fixed with resistors. | Digital Input HP 69771A; Interrupt card, HP 69776A. |
| |  | Event Sensing | A digital word may be used to trigger quick computer response with the interrupt card. The computer responds to the interrupt with a software routine. The interrupt may also cause immediate local response by triggering a preloaded output card. | Interrupt card, HP 69776A. |

**HP 69752A 64 Channel FET Scanner Card** $1,235
Scans 64 single-ended channels (± 10.24 V input signal range) at up to 25,000 readings per second. Cards cascadable to 960 channels in a single mainframe.

**HP 69755A 16 Channel FET Scanner Card** $565
Same as 69752A, except scans 16 channels.

**HP 69754A 32 Channel Relay Scanner Card** $930
Scans 32 single-ended (16 double-ended) channels with a ± 100 V input signal range at speeds up to 1000 readings per second (625 readings double-ended). Switches currents up to 50 mA.

**HP 69750A Scan Control/Pacer Card** $670
Provides all pacing and control functions for the scanner cards listed above. One required for each group of scanner cards (maximum of 15 cards—see data sheet for further clarification).

**HP 69709A Power Supply Control Card** $980
Used for full system control of 6024A and 6012A Autoranging Power Supplies.

**HP 14728A Buffered A/D Cable** $255
Used to connect 69751A and 69790B in a buffered A/D configuration.

**HP 69700A-69706A Resistance output cards:** the output of each of these cards is a programmable resistance value. Twelve mercury wetted relay contacts close across binary weighted precision resistors in a series string. The cards are designed to program the voltage or current output of an HP power supply with option 040. $565–615

**HP 69720A D/A voltage converter card:** provides a high speed, bipolar output voltage programmable from −10.240 V to +10.235 V up to 5 mA load current. $720

**HP 69721A D/A current converter card:** provides a bipolar −20.480 mA to +20.475 mA current output. $930

**HP 69730A Relay output card:** provides sixteen independent, normally open, mercury wetted relay contacts. Contacts rated at 100 Vdc; or 1 Amp; and 28 VA. $565

**HP 69731B Digital output card:** provides sixteen TTL or CMOS compatible outputs, or sixteen 100 mA open-collector switches. $415

**HP 69735A Pulse train output/stepping motor control card:** generates up to 32767 pulses at a programmable frequency. $515

**HP 69736A Timer/pacer card:** outputs a programmable pulse from one microsecond to eighteen hours or a programmable square wave. $515

**HP 69751A A/D converter card:** this card measures bipolar dc voltages in one of four ranges, ± 100 mV, ± 1 V, ± 10 V, or ± 100 V, with 12 bit resolution at up to 33,000 readings per second. $980

**HP 69770A Isolated digital input card:** breaks the path of potential ground loops with an optically coupled isolator in each of the sixteen digital input lines. $670

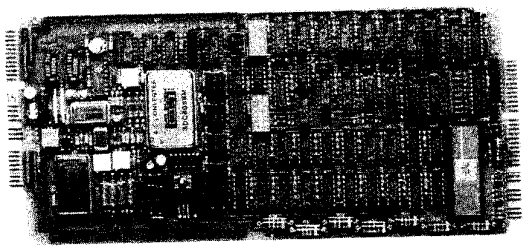
**HP 69771A Digital input/analog comparator card:** monitors up to sixteen contact closures, switches, TTL signals, CMOS signals, or analog signals. The switching threshold can be set to any value between ± 9.5 volts by a screwdriver-adjustable potentiometer on the card or may be externally programmed. $615

**HP 69775A Counter/totalizer card:** counts contact closures, TTL or CMOS logic level pulses, or analog waveform transitions in the range of 0 to 65,535. $745

**HP 69776A Interrupt card:** compares up to sixteen logic level or contact closure inputs with a sixteen-bit reference word and interrupts for $=, \neq, <, >$ conditions. $565

**HP 69790B Memory card** (occupies 2 I/O slots): provides 4096 16-bit words for use with the DAC cards or the ADC cards or for other input/output tasks that need to run independent of other Multiprogrammer or computer tasks. Several Memory cards may be used to implement truly simultaneous operations. $1,010

**HP 69793A Breadboard card:** the generalized grid area on this card may be used for mounting custom circuits. $153

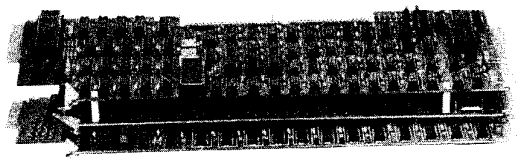


HP 69759A

## HP 69759A - 500 kHz A/D

The HP 69759A 500 - kHz A/D converter measures bipolar voltages in four programmable ranges, ± 100 V, ± 10 V, ± 1 V, and ± 100 mV. The digitized values may be read directly by the controller or transferred into HP 69791A and HP 69792A memory buffer cards available for the Multiprogrammer system. Use of memory buffers permits simultaneous digitization of as many as 40 independent signal channels at rates up to 500 kHz per channel. Scanning subsystems designed specifically to work with the HP 69759A card provide additional measurement flexibility and permit expansion up to 7168 channels. Timebase and triggering functions may be added using other Multiprogrammer cards to form a complete analog measurement system that is precisely tailored to the requirements of the specific application.

Application Note 316-5, Data Capture, describes several ways that the HP 69759A can be used with other Multiprogrammer cards to solve several different applications. These descriptions include cable diagrams and program listings for both the HP 14752A and the HP 6942A native instructions.



HP 69791A

## HP 69791A/92 - Memory System

The HP 69791A and HP 69792A Memory Cards form a buffer used to perform input and output tasks without intervention from the controller. A memory card buffer can be used for inputs or outputs, or both. Data can be acquired at up to 760 kilowords/second or sent at up to 400 kilowords/second.

A memory card buffer has one HP 69791A Memory Card and up to five HP 69792A Memory Expansion Cards for a maximum memory size of 1M (1,048,576 16-bit words). The HP 69791A holds 64k (65,536 16-bit words) and the HP 69792A holds 192k (196,608 16-bit words). The memory card buffer functions as a single memory, regardless of how many HP 69792As are added.

The memory card subsystem can be used with the HP 69751A or HP 69759A A/D cards to input digitized analog measurements. Up to eight HP 69759A A/D Cards can be multiplexed into a single HP 69791A/69792A memory buffer. The A/Ds can be triggered by the same timebase for truly simultaneous readings which are then stored in sequential memory locations. This reduces memory costs and the number of mainframe slots required.

| Ordering Information | Price |
|---|---|
| **HP 69759A** A/D Converter | $2350 |
| **HP 69791A** Memory Card | $1530 |
| **HP 69792A** Memory Card | $1020 |