Low-Cost Data Acquisition/Switch Unit

HP 34970A

- 3-slot data acquisition and switching mainframe
- 6½-digit (22 bit) internal DMM
- 11 built-in measurement functions
- 8 switch and control plug-in modules
- HP BenchLink data logger software included

HP 34970A (Front Panel)

HP 34970A (Back Panel)

HP 34970A Data Acquisition/Switch Unit

The HP 34970A is a high performance, low-cost data acquisition and switching mainframe ideal for data logging, data acquisition, and general-purpose switching and control applications. It consists of a half-rack mainframe with an internal 6½-digit (22 bit) digital multimeter. Three module slots are built into the rear of the unit to accept a combination of switch and control modules. Whether you need a few channels of simple data logging or a hundred channels of ATE performance, the HP 34970A meets your data acquisition needs at a price that meets your budget.

Measurements You Can Trust

The HP 34970A incorporates the measurement engine from our best-selling benchtop digital multimeter (DMM). You get the benefit of proven HP performance, universal inputs with built-in signal conditioning, and modular flexibility, all in a low-cost, compact data acquisition package. The HP 34970A features 6½ digits (22 bits) of resolution, 0.004% basic dcV accuracy, and ultra-low reading noise. Combine that with scan rates of up to 250 channels/sec, and you've got the speed and accuracy you need to get the job done.

Powerful Flexibility

The HP 34970A's unique design allows per-channel configurability for maximum flexibility and quick, easy setup. The internal autoranging DMM measures 11 different functions directly, eliminating the need for expensive external signal conditioning. Temperature conversion routines are built-in to display raw thermocouple, RTD, or thermistor inputs in degrees C, F, or Kelvin. Use Mx+B scaling to convert linear transducer outputs directly into engineering units. You can even set high/low alarm limits to warn you of out-of-tolerance conditions.

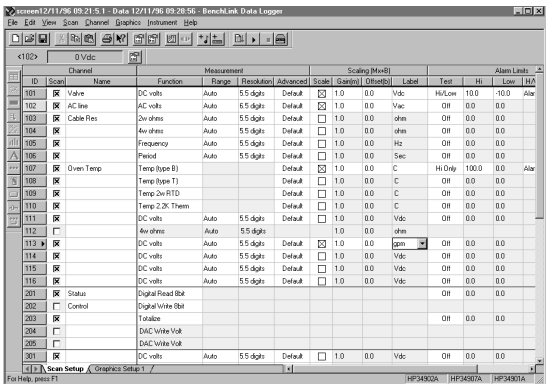
Custom Configurations That Grow With You

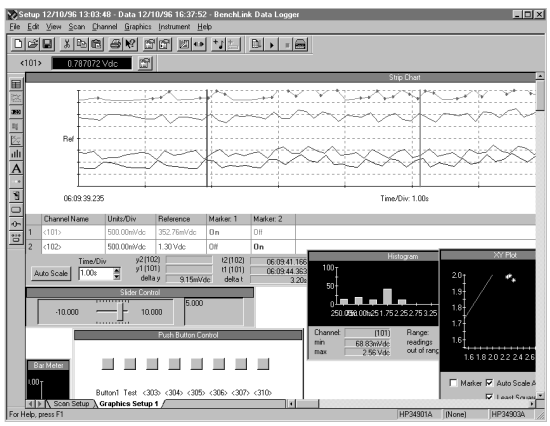
Three module slots and eight switch and control modules allow you to customize the HP 34970A to meet your unique requirements. Buy only what you need, and add more modules later as your application grows. Measure up to 120 inputs with a single half-rack unit.

Free HP BenchLink Software Simplifies Your Data Gathering

If you want PC-based data logging capabilities, but don't want to spend hours programming, HP BenchLink Data Logger is the answer. Use it to set up your test, acquire and archive measurement data, and perform real-time display and analysis of the incoming measurements.

A familiar spreadsheet environment makes it easy to configure and control your tests. A rich set of colorful graphics provides many options for displaying your data—all with point-and-click ease. Set up multiple graphics using strip charts, histograms, X-Y scatter charts, alarm lights and more. Also use HP BenchLink Data Logger to easily move data to other applications for further analysis, or for inclusion in your presentations and reports.





Free HP BenchLink Data Logger makes PC-based setup and analysis easy.

Applications

Data Logging

Configured with the HP 34901A 20-channel relay multiplexer, the HP 34970A becomes a rugged, low-cost data logger that's ideal for quick tests in the lab or in the field. An intuitive front panel with self-guiding menus and a bright, easy-to-read vacuum flourescent display make standalone set-up fast and easy. All readings are automatically time stamped and stored in a 50,000 reading memory — enough memory to hold a week's worth of data (20 channels scanned every five minutes). The non-volatile memory holds your data even after power is removed, so you can use the HP 34970A to collect data at a remote location for later uploading to a PC. The system configuration is also held in non-volatile memory, so in the event of a power failure the unit automatically resumes scanning when power is returned. And for PC-based testing, HP BenchLink Data Logger software is included to simplify your test configurations, data analysis and data managament.

Automated Testing

For automated test and benchtop automation applications, the HP 34970A's three slots and choice of eight plug-in switch and control modules allow easy customization. The 6½-digit internal DMM brings you the power and performance of a world-class standalone DMM, but in a fraction of the space and at a fraction of the cost. Software drivers that support HP VEE and National Instruments LabVIEW are available to make an easy integration of the HP 34970A into your test sytem. Standard RS-232 and GPIB interfaces and SCPI programming language make integration even easier. A three-year warranty is also standard, as is our proprietary relay maintenance system which automatically counts and stores every individual switch closure to help you predict relay end-of-life and avoid costly production line downtime.

Switching

For test applications that don't require the built-in measurements of the HP 34970A, the unit can be ordered without the internal DMM. This provides an ultra low-cost solution for routing test signals to and from your device-under-test and assorted instruments, including external DMMs, scopes, counters and power supplies. Plus, you can add the DMM later if your needs change.

Module Overview

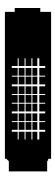
Up to three modules, in any combination, can be inserted into a single mainframe. The HP 34970A's internal DMM connections are accessible only through the HP 34901A, HP 34902A, and HP 34908A multiplexers. The HP 34970A accuracy specifications already include the switching offset and reference junction errors shown in the table below; these errors are listed separately for determining system error with external measurement devices.

The **HP 34901A** 20-channel multiplexer is the most versatile module for general-purpose scanning. It combines dense, multifunction switching with 60 channel/second scan rates to address a broad spectrum of data acquisition applications.

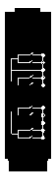
The **HP 34902A** 16-channel high-speed multiplexer employs reed relays to achieve scan rates of up to 250 channels-per-second. This module is ideal for high-throughput automated test applications, as well as high-speed data logging and monitoring tasks.

Use the **HP 34908A** 40-channel single-ended multiplexer for the greatest density in common-low applications, such as battery test, component characterization, and benchtop testing.

Use the **HP 34903A** 20-channel general-purpose switch module to cycle power to products-under-test, control indicator and status lights, actuate external relays requiring large drive signals, and to build custom switch configurations.



The **HP 34904A** is a two-wire, 4x8 full cross-point matrix that gives you the most flexible connection path between your device-under-test and your test equipment, allowing different instruments to be connected to multiple points on your DUT at the same time.



The **HP 34905A** and **HP 34906A** RF multiplexers offer broadband switching capabilities for high-frequency and pulsed signals to 2 GHz. Use them to route test signals between your device-under-test and your signal generator, oscilloscope, spectrum analyzer, video amplifier, or receiver.

The **HP 34907A** multifunction module allows great flexibility for a variety of sense and control applications. It combines two 8-bit ports of digital input and output, a 100 kHz gated totalizer, and two ±12 V analog outputs—all on a single module.

Module Specifications

Module Description	Type	Connects to internal DMM	Speed (ch./sec.)	Maximum Input Voltage	Current	Power	Offset Voltage	Bandwidth	Comments
HP 34901A 20-ch. Multiplexer	2-wire armature (4-wire selectable)	yes	60	300 V	1 A	50 W	< 3 µV	10 MHz	2 current channels (22 ch. total) Built-in cold junction reference
HP 34902A 16-ch. Multiplexer	2-wire reed (4-wire selectable)	yes	250	300 V	50 mA	2 W	< 6 µV	10 MHz	Built-in cold junction reference
HP 34903A 20-ch. Actuator/GP Switch	SPDT / form C	no	120	300 V	1 A	50 W	< 3 µV	10 MHz	—
HP 34904A 4 x 8 Matrix	2-wire armature	no	120	300 V	1 A	50 W	< 3 µV	10 MHz	Full crosspoint
HP 34905A Dual 1: 4 RF Mux, 50 Ω	Common Low (unterminated)	no	60	42 V	0.7 A	20 W	< 6 µV	2 GHz	1 GHz through provided BNC-to-SMB adapter cables
HP 34906A Dual 1: 4 RF Mux, 75 Ω	Common Low (unterminated)	no	60	42 V	0.7 A	20 W	< 6 µV	2 GHz	1 GHz through provided BNC-to-SMB adapter cables
HP 34907A Multifunction Module	Two 8-bit digital I/O ports 26-bit Event Counter Two Analog Outputs	no no no	— — —	42 V 42 V ± 12 V	400 mA — 10 mA	— — —	— — —	— 100 kHz dc	Open drain Gated; selectable input threshold 16-bit, earth referenced
HP 34908A 40-ch. single-ended Mux	1-wire armature (common low)	yes	60	300 V	1 A	50 W	< 3 µV	10 MHz	No 4-wire measurements

These are abbreviated specifications. For more detailed information on the HP 34970A, refer to HP publication number 5965-5290.

Accuracy Specifications ± (% of reading + % of range)[1]

Includes measurement error, switching error and transducer conversion error

Function	Range[2]	Frequency, etc.	1 Year 23° C ±5° C
DC Voltage	100.0000 mV		0.0050 + 0.0040
	1.000000 V		0.0040 + 0.0007
	10.00000 V		0.0035 + 0.0005
	100.0000 V		0.0045 + 0.0006
	300.000 V		0.0045 + 0.0030
True RMS AC Voltage[3]	100.0000 mV to 100.0000 V	3 Hz–5 Hz	1.00 + 0.04
		5 Hz–10 Hz	0.35 + 0.04
		10 Hz–20 kHz	0.06 + 0.04
		20 kHz–50 kHz	0.12 + 0.05
		50 kHz–100 kHz	0.60 + 0.08
		100 kHz–300 kHz[4]	4.00 + 0.50
	300.0000 V	3 Hz–5 Hz	1.00 + 0.08
		5 Hz–10 Hz	0.35 + 0.08
		10 Hz–20 kHz	0.06 + 0.08
		20 kHz–50 kHz	0.12 + 0.12
		50 kHz–100 kHz	0.60 + 0.20
		100 kHz–300 kHz[4]	4.00 + 1.25
Resistance[5]	100.0000 Ω	1 mA current source	0.010 + 0.004
	1.000000 kΩ	1 mA	0.010 + 0.001
	10.00000 kΩ	100 µA	0.010 + 0.001
	100.0000 kΩ	10 µA	0.010 + 0.001
	1.000000 MΩ	5.0 µA	0.010 + 0.001
	10.00000 MΩ	500 nA	0.040 + 0.001
	100.0000 MΩ	500 nA || 10 MΩ	0.800 + 0.010
Frequency and Period[6]	100 mV to 300 V	3 Hz–5 Hz	0.10
		5 Hz–10 Hz	0.05
		10 Hz–40 Hz	0.03
		40 Hz–300 kHz	0.01
DC Current (HP 34901A only)	10.00000 mA	<0.1 V burden	0.050 + 0.020
	100.0000 mA	<0.6 V	0.050 + 0.005
	1.000000 A	<2 V	0.100 + 0.010
True RMS AC Current (HP 34901A only)	10.00000 mA and[3] 1.00000 A	3 Hz–5 Hz	1.00 + 0.04
		5 Hz–10 Hz	0.30 + 0.04
		10 Hz–5 kHz	0.10 + 0.04
	100.0000 mA[7]	3 Hz–5 Hz	1.00 + 0.5
		5 Hz–10 Hz	0.30 + 0.5
		10 Hz–5 kHz	0.10 + 0.5

Temperature	Type	Best Range Accuracy[8]	
Thermocouple	B	1100° C to 1820° C	1.2° C
	E	–150° C to 1000° C	1.0° C
	J	–150° C to 1200° C	1.0° C
	K	–100° C to 1200° C	1.0° C
	N	–100° C to 1300° C	1.0° C
	R	300° C to 1760° C	1.2° C
	S	400° C to 1760° C	1.2° C
	T	–100° C o 400° C	1.0° C
RTD	R_0 from 49 Ω to 2.1 kΩ	–200° C to 600° C	0.06° C
Thermistor	2.2 k, 5 k and 10 k	–80° C to 150° C	0.08° C

Measurement Characteristics[9]

DC Voltage	
Measurement Method	Continuously integrating multi-slope III A–D Converter
A–D Linearity	0.0002% of reading + 0.0001% of range
Input Resistance	
100 mV, 1 V, 10 V ranges	Selectable 10 MΩ or > 10,000 MΩ
100 V, 300 V ranges	10 MΩ ± 1%
Input Bias Current	< 30 pA at 25° C
Input Protection	300 V all ranges
True RMS AC Voltage	
Measurement Method	AC coupled True RMS—measures the AC component of the input with up to 300 Vdc of bias on any range
Crest Factor	Maximum of 5:1 at full scale
Additional Crest Factor Errors (non-sinewave)	Crest Factor 1–2 0.05 % of reading Crest Factor 2–3 0.15 % of reading Crest Factor 3–4 0.30 % of reading Crest Factor 4–5 0.40 % of reading
Input Impedance	1 MΩ ± 2% in parallel with 150 pF
Input Protection	300 Vrms all ranges
Resistance	
Measurement Method	Selectable 4-wire or 2-wire Ohms. Current source referenced to LO input.
Offset Compensation	Selectable on 100 Ω, 1k Ω, 10k Ω ranges
Maximum Lead Resistance	10% of range per lead for 100 Ω and 1 k Ω ranges. 1 kΩ on all other ranges.
Input Protection	300 V on all ranges
Frequency and Period	
Measurement Method	Reciprocal counting technique
Voltage Ranges	Same as AC voltage function
Gate Time	1s, 100 ms, or 10 ms
Measurement Timeout	Selectable 3 Hz, 20 Hz, 200 Hz LF limit
DC Current	
Shunt Resistance	5 Ω for 10 mA, 100 mA; 0.1 Ω for 1 A
Input Protection	1A 250 V fuse on HP 34901A module
True RMS AC Current	
Measurement Method	Direct coupled to the fuse and shunt. AC coupled True RMS measurement (measures the ac component only).
Shunt Resistance	5 Ω for 10 mA; 0.1 Ω for 100 mA, 1 A
Input Protection	1A 250 V fuse on HP 34901A module
Thermocouple	
Conversion Conformity	ITS-90 based software routines
Reference Junction Type	Internal, Fixed, or External
Open Thermocouple Check	Selectable per channel. Open >5k Ω.
RTD	Type α = .00385 (DIN) and α = .00392
Thermistor	44004, 44007, 44006 series
Measurement Noise Rejection 60 (50) Hz[10]	
dc CMRR	140 dB
ac CMRR	70 dB
Integration Time	**Normal Mode Rejection**[11]
200 plc / 3.33s (4s)	110 dB[12]
100 plc / 1.67s (2s)	105 dB[12]
20 plc / 334 ms (400 ms)	100 dB[12]
10 plc / 167 ms (200 ms)	95 dB
2 plc / 33.3 ms (40 ms)	90 dB
1 plc / 16.7 ms (20 ms)	60 dB
< 1 plc	0 dB

[1] Specifications are for 1-hour warm-up and 6½ digits, slow ac filter
[2] 20% over range on all ranges except 300 Vdc and ac ranges and 1 A dc and ac current ranges
[3] For sinewave input > 5% of range. For inputs from 1% to 5% of range and < 50 kHz, add 0.1% of range additional error.
[4] Typically 30% of reading error at 1 MHz, limited to 1 x 108 V Hz
[5] Specifications are for 4-wire ohms function or 2-wire ohms using scaling to remove the offset. Without scaling, add 1 Ω additional error in 2-wire ohms function.
[6] Input > 100 mV. For 10 mV inputs, multipy % of reading error x 10.
[7] Specified only for inputs >10 mA
[8] 1 year accuracy. For total measurement accuracy, add temperature probe error.
[9] 300 Vdc, ac rms isolation voltage (ch-ch, ch-Earth)
[10] For 1 KΩ unbalance in LO lead
[11] For power line frequency ±0.1%
[12] For power line frequency ±1%, use 40 dB or ±3% use 30 dB

Operating Characteristics[1]

Single Channel Measurement Rates[2]

Function	Resolution	Reading/s
dcV, 2-wire resistance	6½ digits (10 plc) 5½ digits (1 plc) 4½ digits (0.02 plc)	6 (5) 57 (47) 600
Thermocouple	0.1° C (1 plc) (0.02 plc)	57 (47) 220
RTD, Thermistor	0.01° C (10 plc) 0.1° C (1 plc) 1° C (0.02 plc)	6 (5) 57 (47) 220
acV	6½ Slow (3 Hz) 6½ Med (20 Hz) 6½ Fast (200 Hz) 6½[3]	0.14 1 8 100
Frequency, Period	6½ digits (1s gate) 5½ digits (100 ms) 4½ digits (10 ms)	1 9 70

System Speeds[4]	Channel/s
INTO Memory	
Single channel dcV	600
34902A scanning dcV	250
34907A scanning digital in	250
34902A scanning dcV with scaling and 1 alarm fail	220
34907A scanning totalize	170
34902A scanning temperature	160
34902A scanning acV[3]	100
34902A scanning dcV/Ohms on alternate channels	90
34901A/34908A scanning dcV	60
INTO and OUT of memory to HP-IB or RS-232 (init/fetch)	
34902A scanning dcV	180
34902A scanning dcV with timestamp	150
OUT of memory to HP-IB	
Readings	800
Readings with timestamp	450
Readings with all format options ON	310
OUT of memory to RS-232	
Readings	600
Readings with timestamp	320
Readings with all format options ON	230
DIRECT to HP-IB or RS-232	
Single channel dcV	440
34902A scanning dcV	200
Single channel MEAS DCV10/MEAS DCV 1	25
Single channel MEAS DCV/ MEAS OHMS	12
HP BenchLink Performance	
Scan and save to disk with 2 strip-charts displayed	100

System Characteristics

Scanning Inputs	
Analog	HP 34901A, 34902A, and 34908A multiplexer channels
Digital	HP 34907A digital in and totalize
Scan list	Scans channels in ascending order
Triggering	
Source	Interval, external, button press, software, or on monitor channel alarm
Scan count	1 to 50,000 or continuous
Scan interval	0 to 99 hours; 1 ms step size
Channel delay	0 to 60 seconds per channel; 1 ms step size
External trig delay	< 2 ms. With monitor on < 200 ms.
External trig jitter	< 2 ms
Alarms	
Analog inputs	Hi, Lo, or Hi + Lo evaluated each scan
Digital inputs	34907A digital in: maskable pattern match or state change 34907A totalize: Hi limit only
Monitor channel	Alarm evaluated each reading
Alarm outputs	4 TTL compatible; selectable TTL logic Hi or Lo on fail
Latency	5 ms (typical)
Memory (Battery backed, 4 year typical life[5])	
Readings	50,000 with timestamp Readable during scan
States	5 instrument states with user label
Alarm queue	Up to 20 events with channel number, reading, and timestamp
System Features	
Per-channel math	Individual Mx + B scaling and Min/Max/Average calculated real time
Power fail recovery	Resumes scanning automatically
Relay maintenance	Counts each relay closure and stores on module. User resettable.
Real time clock	Battery-backed, 4 year typical life[5]

HP BenchLink Data Logger software (not included with Option 001)	
System Requirements[6]	
PC Hardware	486, 66 MHz, 16 MB RAM, 12 MB disk space
Operating Systems	Windows 3.1/95/98, Windows NT 4.0
Computer Interfaces[7]	
HP-IB	HP 82335B, 82340A/B/C, 82341A/B/C/D National Instruments AT-GPIB/TNT, PCI-GPIB
LAN -to- GPIB	HP E2050A (Windows 95 and NT only)
RS-232 (Serial Port)	PC COM 1-4

[1] Reading speeds for 60 Hz and (50 Hz) operation
[2] For fixed range and function, readings to memory, scaling and alarms off, autozero off
[3] Maximum limit with default settling delays defeated
[4] Speeds are for 4½ digits, delay 0, display off, autozero off. Using 115 kB RS-232 setting.
[5] Storage at temperatures above 40° C will decrease battery life
[6] Software provided on CD-ROM and includes utility to create floppy disks for installation
[7] Interface and driver must be purchased separately

General

Power Supply: 100 V/120 V/220 V/240 V ±10%
Power Line Frequency: 45 Hz to 66 Hz automatically sensed
Power Consumption: 12 W (25 VA peak)
Operating Environment:
Full accuracy for 0° C to 55° C
Full accuracy to 80% R.H. at 40° C
Storage Environment: –40° C to 70° C
Weight: Net: 3.6 kg (8.0 lbs)
Safety: Conforms to CSA, UL-1244, IEC 1010 Cat I
RFI and ESD: CISPR 11, IEC 801/2/3/4
Warranty: 3 years

Ordering Information

HP 34970A Data Acquisition/Switch Unit
Includes internal 6½ digit DMM, operating and service manuals, test report, power cord, and Quick Start package (includes HP Benchlink Data Logger software, RS-232 cable, thermo-couple, and screwdriver). Modules are purchased seperately and are required to operate.
Opt 001 Delete Internal DMM
Same as above but deletes DMM and quick start package. Order 34970-80010 to retrofit DMM at a later time.
Opt 1CM Rackmount Kit
Opt 0B0 Delete Manual Set
HP 34901A 20-Channel Armature Multiplexer
HP 34902A 16-Channel Reed Multiplexer
HP 34903A 20-Channel Actuator/General Purpose Switch
HP 34904A 4 x 8 Two-Wire Matrix Switch
HP 34905A Dual 4-Channel RF Multiplexer, 50 Ohms
Includes (10) SMB-to-BNC(f) 50 Ω adapter cables
HP 34906A Dual 4-Channel RF Multiplexer, 75 Ohms
Includes (10) SMB-to-BNC(f) 75 Ω adapter cables
HP 34907A Multifunction Module
HP 34908A 40-Channel Single-Ended Multiplexer
Accessories
HP 34161A Accessory Pouch
HP 34131A Hard Carrying Case
HP 34397A dc-to-ac Inverter
HP E2050A LAN/HP-IB Gateway
34970-80010 DMM Field Installation Kit
Fully calibrated with Test Report and Quick Start Kit

For more information on high-performance data acquisition products from Hewlett-Packard, refer to the Data Acquisition Systems section of this catalog starting on page 530.