HEWLETT PACKARD

PC Instruments

Instruments - Software - Accessories
Models 61010AA - 61017AA

Technical Data, June 1985

The Hewlett-Packard PC Instruments System links test and measurement instrumentation to the personal computer which is fast becoming the workhorse of the technical environment. It represents a cost-effective way to achieve a faster time to solution and more consistent results over a wide range of test and measurement applications including manufacturing, research and development, control and monitoring, and data logging.

The PC Instruments System is compatible with the HP 150 Touchscreen and Touchscreen II, as well as with the IBM PC, PC/XT, or PC/AT. A single PC Instruments Bus (PCIB) Interface card plugged into the backplane of the PC allows control of up to eight instrument modules.

Modular system design.

PC Instruments consist of eight advanced instrumentation modules including a digital I/O, relay multiplexer, dual voltage DAC, digital multimeter, function generator, universal counter, digitizing oscilloscope, and relay actuator.

Each separate, stackable module is located outside your personal computer conserving valuable expansion slots and removing the devices from the noisy environment of the PC. You can add modules to your instrumentation system according to your needs and budget.

Software makes it simple.

PC Instruments System Software makes it easy for you to use the system in both a manual and a programmed mode. For manual mode operation, the soft front panel duplicates the instrument control panels of traditional instruments on your CRT screen. By simply touching the HP Touchscreen or using a mouse with the IBM PC, you can set functions, ranges and values, and take measurements.

Because PC Instruments are programmed in Microsoft® BASIC, it's easy to customize or develop your own application programs. A few easy-to-remember commands, like OUTPUT and MEASURE, control your PC Instruments. And you can use the soft front panel to enter many of the instrument parameters that have been traditionally typed into the system.

An add-on HP-IB Command Library can also turn your PC into a versatile HP-IB instrument controller that controls both PC Instruments and HP-IB programs from the same BASIC program. Optional data acquisition software provides simple menu-driven programs for voltage scanning, temperature measurement, and graphics.

Third party software linkage.

PC Instruments System Software also includes data conversion utilities which format data acquired from PC Instruments into a form compatible with many third-party software packages, such as 1-2-3™ by Lotus™.

PC Instruments packages.

PC Instruments packages offer ordering convenience and dollar savings. The Data Logging Packages give you everything you need to immediately begin logging data, and the Electronic Bench Packages give you the basic tools you need to debug, test, and evaluate changes in design, and to set up automated tests and characterize prototypes. These packages do not include the personal computer or PCIB Interface.

For more information about PC Instruments, consult the PC Instruments Concept Brochure (publication #5952-4126).

Specifications

PC Instruments General Specifications:

The following specifications hold for all PC Instruments modules, except where noted otherwise.

Operating Temperature Range:
0°C to 40°C

Storage Temperature Range:
−40°C to +80°C

Instrument Dimensions:
Length: 295 mm (11.62 in)
Width: 212 mm (8.35 in)
Height: 64.5 mm (2.54 in)

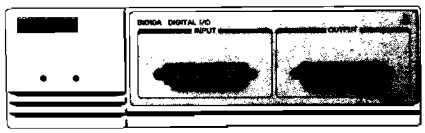
Each instrument comes with a power pack which provides isolated power.

Power Pack Specifications:
Length: 110 mm (4.33 in)
Width: 90 mm (3.54 in)
Height: 64.5 mm (2.54 in)
Weight: 0.87 kg (1.91 lbs)

Input Voltage:
Domestic Power Pack
120 Vac ± 12.5%, 57-63 Hz
25 VA max.
International Power Pack(s)
100, 220 or 240 Vac, ± 12.5%
47-66 Hz 25 VA max.

PC Instruments meet IEC 348 standards.

The HP 61010AA Digital I/O



The 61010AA Digital I/O can be used as both an input and an output device. It has 16 independent input lines and 16 independent output lines, which can be addressed as variable length words up to 16 bits long. The input and output connectors include two data control lines each. Both random asynchronous and synchronous transfers are available.

The instrument comes with two shrouded connectors for solder terminals. Accessory block (HP14802A) allows easy screw termination.

Specifications:

User Connections:
16 Input Data Bits
2 Input Data Control Signals
16 Output Data Bits
2 Output Data Control Signals

Digital Input Data Characteristics:
Input Voltage Range:
± 10 V max.
Input Impedance:
100 k ohm pullup resistor to +5 V.
Input Logic Threshold:
Programmable to ± 10 V
Resolution = 80 mV
Accuracy = ± 160 mV

Digital Output Data Characteristics:
TTL Mode:
V_{ol} = 0.4 V max.
@ I_{ol} = 16 mA max.
V_{oh} = 2.4 V min.
@ I_{oh} = −4 mA max.
Open Collector Mode:
V_{ol} = 0.4 V max.
@ I_{ol} = 16 mA max.
V_{ol} = 0.7 V max.
@ I_{ol} = 40 mA max.
V_{oh} = 12 V max.
(pullup resistor to external supply)

Output Disabled Mode:
I_{oz} = −5μA max.
(with output bit pulled-down to ground.)
I_{oz} = 250μA max.
(with output bit pulled-up to +12V.)

Data Control Signals:
ODAV (Output Data Available):
Same as output data bit
ODAC (Output Data Accepted):
V_{il} = 0.0 V to 0.4 V
V_{ih} = 2.4 V to 5.0 V
(10 k ohm pullup resistor to +5 V)
Minimum pulse width = 10 us.
IDAV (Input Data Available):
V_{il} = 0.0 V to 0.4 V
V_{ih} = 2.4 V to 5.0 V
(10 k ohm pullup resistor to +5 V)
Minimum pulse width = 10 us.
IDAC (Input Data Accepted):
Same as output data bit

Data Transfer Time:
Less than 50 ms (System limit with an OUTPUT or MEASURE statement.)

Weight: 1.26 kg (2.78 lbs)

The HP 61011AA Relay Multiplexer

The HP 61011AA Relay Multiplexer features break-before-make scanning of up to eight double-ended channels. The relays are bi-directional so that they may be used to send up to eight signals to a single destination, or distribute one source among eight output channels. The 61011AA can be teamed with a digital multimeter to provide thermocouple scanning. An onboard temperature reference allows accurate absolute temperature measurement.

The Relay Multiplexer comes with a plug-in screw terminal block for easy connection of user inputs and outputs.

Specifications:

User Connections:
8 Double-ended inputs
1 Temperature reference voltage output
1 Double-ended output

Channel Select Time:
Less than 65 ms (System limit with an OUTPUT statement, including automatic break-before-make.)

Input Switching Characteristics:
Maximum Voltage: 250 Vdc, 250 Vac rms, 350 Vac peak
Maximum Current (Per channel or module): 1 Amp dc, 1 Amp ac rms
Maximum Power (Per channel or module): 50 W dc, 250 VA ac

Resistance (Input to Output):
1 ohm typical

Thermal Offset (Input to Output):
< 6 uV max.

Isolation Voltage Rating:
250 Vdc, 250 Vac rms, 350 Vac peak between any two input terminals or between an input and ground.

DC Isolation Resistance:

	(<40°C, 80% RH)
Open Channel	$>2x10^8$ ohms
Channel-Channel	$>2x10^8$ ohms
Channel-Ground	$>2x10^8$ ohms

AC Characteristics (50 ohm termination):

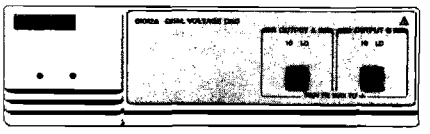
	100 kHz	1 MHz	10 MHz
Crosstalk (input to input) (dB)	< −73	< −53	< −33
Feedthrough (input to output) (dB)	< −73	< −53	< −33
Insertion Loss (input to output) (dB)	<0.2	<0.3	<0.5

Capacitance	
(Open Channel, Channel to Channel)	< 5 pF
(Closed Channel)	<25 pF
(Channel to Chassis)	<50 pF

Reference Junction Compensation Accuracy:
±2°C (+2°C to +40°C ambient)

Weight: 0.95 kg (2.09 lbs)

The HP 61012AA Dual Voltage DAC



The 61012AA Dual Voltage Digital-to-Analog Converter supplies two independently controlled voltage sources in three standard ranges. Each voltage source is electrically isolated.

The Dual Voltage DAC comes with two plug-in screw terminal blocks.

Specifications:

Output Voltage (at up to 5 mA):
−1 V to +1 V with 0.5 mV resolution
−5 V to +5 V with 2.5 mV resolution
−10 V to +10 V with 5.0 mV resolution

Accuracy:

Range	23°C ±5°C	0°C −40°C
±1 V	0.050% ±0.6 mV	0.25% ±0.6 mV
±5 V	0.050% ±3.0 mV	0.25% ±3.0 mV
±10 V	0.025% ±6.0 mV	0.125% ±6.0 mV

Ripple and Noise:
Less than 3 mV p-p, 20 Hz to 20 MHz

Output Protection:
Outputs can withstand a short circuit for unlimited time

Settling Time:
Output voltage settles within 1 LSB of final value in less than 1 ms

Programming Time:
Less than 75 ms (System limit with an OUTPUT statement.)

Isolation Voltage Rating:
250 Vdc, 250 Vac rms or 350 Vac peak between outputs or between either voltage output and ground.

Output Disabled Mode:
100 k ohm resistance across outputs

Weight: 1.11 kg (2.44 lbs)

The HP 61013AA Digital Multimeter

The 61013AA Digital Multimeter measures dc voltages, ac voltages, and ohms. Its features include full programmability, autoranging, and true rms.

The Digital Multimeter comes with two shrouded leads, test probes, and grabber clips.

Specifications:

Digits: 4½

Functions: ± DC Volts, AC Volts (true rms), Ohms.

Programmable Ranges:

DC (±) or AC Volts (rms)

Range	Max Display	Resolution
200 mV	199.99 mV	.01 mV
2 V	1.9999 V	.0001 V (.1 mV)
20 V	19.999 V	.001 V (1 mV)
200 V	199.99 V	.01 V (10 mV)

Resistance

Range	Max Display	Resolution
200 ohms	199.99 ohms	.01 ohms
2 k ohms	1.9999 k ohms	.0001 k ohms (.1 ohms)
20 k ohms	19.999 k ohms	.001 k ohms (1 ohm)
200 k ohms	199.99 k ohms	.01 k ohms (10 ohms)
2 M ohms	1.9999 M ohms	.0001 M ohms (100 ohms)
20 M ohms	19.999 M ohms	.001 M ohms (1 K ohms)

General:

Accuracy (at 23°C ± 5°C, 80% RH):

All ac specifications given for a sinewave.

2.5 readings/seconds:

DC Volts:
± 0.05% of reading ± 4 counts

AC Volts (45 Hz to 500 Hz):
± 0.5% of reading ± 50 counts

AC Volts (30 Hz to 45 Hz, 500 Hz to 1 kHz):
± 1% of reading ± 50 counts

Ohms:
± 0.1% of reading ± 4 counts (200, 2 k, 20 k, 200 k, 2 M ohm ranges).
± 0.35% of reading ± 4 counts (20 M ohm range).

12.5 readings/second:

DC Volts:
± 0.05% of reading ± 10 counts

AC Volts (45 Hz to 500 Hz):
± 0.5% of reading ± 56 counts

AC Volts (30 Hz to 45 Hz, 500 Hz to 1 kHz):
± 1% of reading ± 56 counts

Ohms:
± 0.1% of reading ± 10 counts (200, 2 k, 20 k, 200 k, 2 M ohm ranges).
± 0.35% of reading ± 10 counts (20 M ohm range).

Accuracy (0°C – 40°C, 80% RH):

2.5 readings/second:

DC Volts:
± 0.1% of reading ± 8 counts

AC Volts (45 Hz to 500 Hz):
± 0.75% of reading ± 100 counts

AC Volts (30 Hz to 45 Hz, 500 Hz to 1 kHz):
± 1.5% of reading ± 100 counts

Ohms:
± 0.2% of reading ± 7 counts (200, 2 k, 20 k, 200 k, 2 M ohm ranges).
± 0.5% of reading ± 12 counts (20 M ohm range).

12.5 readings/second:

DC Volts:
± 0.1% of reading ± 14 counts

AC Volts (45 Hz to 500 Hz):
± 0.75% of reading ± 106 counts

AC Volts (30 Hz to 45 Hz, 500 Hz to 1 kHz):
± 1.5% of reading ± 106 counts

Ohms:
± 0.2% of reading ± 13 counts (200, 2 k, 20 k, 200 k, 2 M ohm ranges).
± 0.5% of reading ± 18 counts (20 M ohm range).

Maximum Settling Time:

DC:	150 msec (to 0.01%)
AC:	350 msec (to 0.1%)
Ohms:	75 msec (to 0.01%)

Maximum Measurement Rate:

12.5 readings/second (System limit with a MEASURE statement.)

Programmable Measurement Rates:

2.5 readings/second or 12.5 readings/second

Input Impedance:

10 M ohms minimum all dc ranges
1 M ohms on all ac ranges

Input Overvoltage Protection:

350 V peak (non-destructive)

Common Mode Rejection:

DC Range	50/60 Hz NMR	50/60 Hz ECMRR*	DC CMRR*
2.5/sec	>60dB	>120dB	>120dB
12.5/sec	0dB	>60dB	>120dB

AC Range	DC CMRR*	DC-60Hz CMRR*
2.5/sec or 12.5/sec	>120 dB	>60dB

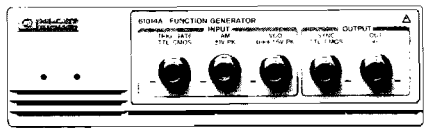
Isolation Voltage Rating:

250 Vdc, 250 Vac rms, 350 Vac peak between any input terminal and ground.

Weight: 1.02 kg (2.25 lbs)

*With 1K in LO lead.

The HP 61014AA Function Generator



The HP 61014AA Function Generator generates sine waves, square waves, triangle waves, ramps and pulses. The function, frequency, amplitude and offset can be set programmatically. The burst feature allows you to program a discrete number of cycles ranging from 1 to 65536. Inputs for VCO and AM modulation are also provided.

Specifications:

All specifications are given at full rated output into a 50 ohm load unless otherwise noted.

Symmetry Range for Sine, Square, Triangle Waves:

20% to 80% of duty cycle up to 500 kHz.
50% of duty cycle up to 5 MHz.

Sine Wave Distortion:

10 Hz to 50 kHz: All harmonics >40 dB below fundamental.
50 kHz to 5 MHz: All harmonics >30 dB below fundamental.

Square Wave Rise Time and Fall Time:

10% to 90% at 1 MHz:
<50 nsec (typical)
<75 nsec (maximum)

Triangle Linearity Error:

<3% at 1 kHz

Output Impedance:

50 ohms ± 10%

Flatness (Measured with respect to a 1 kHz sine wave reference):

10 Hz to 100 kHz: Better than ± 3% (in a single output range)
100 kHz to 5 MHz: Better than ± 18% (in a single output range)

Amplitude Characteristics:

Amplitude range: 8 mV to 10 V p-p
Resolution:
0.8 V to 10 V: 40 mV
Below 0.8 V: 4 mV
Offset: Programmable from – 4 V to 4 V
Offset Accuracy: ± 5% ± 0.2V (Function amplitude > .1V p-p).
± 5% ± 25 mV (Function amplitude < .1V p-p).
Maximum Amplitude including offset: 5 V

Output Frequency Characteristics:
Frequency Range: 0.5 Hz to 5 MHz
Resolution:
0.5 Hz to 50 Hz: 0.1 Hz
50 Hz to 500 Hz: 1 Hz
500 Hz to 5 kHz: 10 Hz
5 kHz to 50 kHz: 100 Hz
50 kHz to 500 kHz: 1 kHz
500 kHz to 5 MHz: 10 kHz
Accuracy: ±4% of the maximum frequency in each of the ranges listed above.

External Modulation Characteristics:

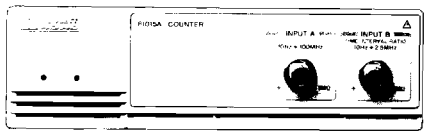
Amplitude Modulation:
Modulating signal: dc to >100 kHz
Carrier Envelope Distortion at 70% sine wave modulation with f_c = 1 MHz and f_m = 1 kHz: <2% typical

VCO:
The output frequency can be decreased from the maximum frequency associated with any given resolution: >100 to 1. The frequency versus voltage curve will be linear to within ±2% of maximum frequency associated with any given resolution.

Output Control Characteristics:
Free Run Mode: Continuous Operation
N-Burst Mode: The burst feature allows you to program a discrete number of cycles ranging from 1 to 65536.
Gate Mode: A logic zero applied to the gate input causes continuous operation. A logic one applied to the gate input will stop the output.
Sync Output: A TTL compatible square wave output at the frequency of operation.
Disable Output Mode: This command opens a relay in series with the output. The sync output remains operational.
Short Circuit Protection: A protection circuit reduces the signal to a safe level if the output is short circuited.

Weight: 1.56 kg (3.44 lbs)

The HP 61015AA Universal Counter



The HP 61015AA Counter is a 100 MHz universal counter. It decodes commands from your computer, measures the input waveform, and returns the 8-digit measurement value back to the computer. Modes include frequency, period, and totalize for Channel A input. Channel B input is provided for frequency ratio and time interval measurement. Additional modes include auto-frequency and auto-period which use a reciprocal counting technique.

Specifications:

Input Frequency Limits:
Input A (positive slope):
10 Hz to 100 MHz with prescaler
10 Hz to 10 MHz without prescaler
Input A (negative slope):
10 Hz to 90 MHz with prescaler
10 Hz to 9 MHz without prescaler
Input B (positive or negative slope)
10 Hz to 2.5 MHz

Input Characteristics:
Sensitivity:
Input A:
40 mV rms (10 Hz to 100 MHz)
Input B:
40 mV rms (10 Hz to 2.5 MHz)
Input Coupling: ac on both inputs
Input Impedance: 1 M ohm (nominal) shunted by 30 pF

Frequency (Input A):
Ranges:
10 Hz to 10 MHz (LSD = 10 Hz with 0.1 second gate time)
10 Hz to 10 MHz (LSD = 1 Hz with 1 second gate time)
10 Hz to 10 MHz (LSD = 0.1 Hz with 10 second gate time)
10 Hz to 100 MHz (LSD = 100 Hz with 0.1 second gate time)
10 Hz to 100 MHz (LSD = 10 Hz with 1 second gate time)
Resolution: ±LSD
Accuracy: ±LSD ±(time base error in ppm) x frequency

Auto-Frequency (Input A):
Range: 10 Hz to 100 MHz

Period (Input A):
Range: 400 ns to 0.1 s
Number of cycles of averaging (N) may be programmed from 1 to 1000 in decade steps.
LSD = 100 ns for 1 cycle averaging
LSD = 10 ns for 10 cycle averaging
LSD = 1 ns for 100 cycle averaging
LSD = 0.1 ns for 1000 cycle averaging
Resolution: ±LSD
Accuracy: ±LSD ±1.4 x [(trigger error)/N] ±(time base error in ppm) x period

Auto-Period (Input A):
Range: 10 Hz to 100 MHz

Time Interval:
Range: 250 ns to 10 s
LSD Displayed: 100 ns
Resolution: ±LSD
Accuracy: ±LSD ±START trigger error ±STOP trigger error ±(time base error in ppm) x (time interval)

Ratio:
Range:
Channel A:
10 Hz to 100 MHz
Channel B:
10 Hz to 2.5 MHz
LSD Displayed:
10 Hz to 10 MHz:
1 part in (A/B) x N
10 Hz to 100 MHz:
1 part in (A/B) x N x 0.1
Resolution: ±LSD
Accuracy: ±1 count of A ± [(B trigger error) x (frequency A)]/N
Where N is the number of cycles of averaging for channel B input, N may be programmed from 1 to 1000 in decade steps.

Totalize (A):
Range: 10 Hz to 100 MHz
Resolution:
10 Hz to 10 MHz: ±1 count
10 Hz to 100 MHz: ±10 counts

Time Base:
Frequency: 10 MHz
Time base error: ±10 ppm

General:
Trigger Error:

$$\frac{\sqrt{(80\ \text{uV})^2 + e_n^2}}{\text{input slew rate at trig. pt. (uV/s)}}\ (\text{rms})$$

Where e_n is the rms noise in mV of the input for a 100 MHz bandwidth in Channel A and 10 MHz bandwidth in Channel B.
Maximum Measurement Rate: 10 readings/second (System limit with a MEASURE statement.)

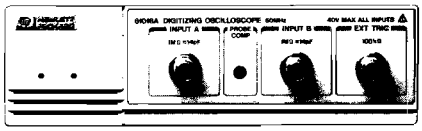
Operating Humidity Range: <80%.

Weight: 0.60 kg (1.31 lbs)

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

The HP 61016AA Digitizing Oscilloscope



The HP 61016AA Digitizing Oscilloscope is fully programmable, providing such features as automatic scaling, auto trigger, self-calibration, and direct readout of delta voltage and delta time. Waveforms captured using sophisticated random repetitive sampling techniques can be saved and recalled for analysis. This 50 MHz scope has an external trigger input and delayed trigger capability. Note: Up to five HP 61016AA oscilloscopes may be connected to a PC Controller if no other instruments are present on the PC Instruments Bus (PCIB). (Optional probes are described on page 7.)

Specifications:

All specifications valid after the instrument has reached a stable temperature, and self-calibration is performed.

Vertical:

Bandwidth: 0 to 50 MHz with dc coupling; 10 Hz to 50 MHz with ac coupling.
Input Coupling: ac, dc
Input RC: 1 Meg ohm ±2% shunted by approx. 18 pF.
Max Input Voltage: ±40 V (dc + peak ac).
Range: 40 mV to 40 V
Resolution:
(trigger level set within vertical range and offset to zero)

Vertical Range	*Resolution*
40 mV - 80 mV	0.67 mV
160 mV - 40 V	range/240

Gain Accuracy: ±3%
Zero Offset Error: ±3% full scale ±3.0 mV.
Offset Range:

Vertical Range	*Offset Range*
40 mV - 4 V	±1.5 x range
8 V - 16 V	±12 volts
40 V	not available

Timebase:

Range: 100 ns to 5 s in 1-2-5 sequence.
Resolution:

Timebase	*Resolution*
100 ns - 200 ns	1 ns
500 ns - 5 s	range/250

Delay Range: −0.5 to 250 x timebase range, with trigger referenced to center.

Trigger:

Source: Either channel, pos or neg slope; or external trigger.
Range: ±2 x vertical range, limited to ±20 V.

	Vertical Range	
Specification	40 mV-1.6 V	4 V-40 V
Sensitivity:		
(<10 MHz)	15 mV	400 mV
(>10 MHz)	40 mV	1.0 V
Level Accuracy:	±3% ±10 mV	±3% ±250 mV

External Trigger: 1 volt rising edge into 100 k ohms, with a risetime <1 us.

Characteristics:

Vertical:

Offset Accuracy: Zero offset error + gain error.
Noise: 1.5% of full scale or 2.4 mV, whichever is larger.
Single Marker Accuracy: Gain accuracy + zero offset error.
Dual Marker Accuracy: Gain accuracy.
Probe Scaling Factors: 1:1, 10:1
Probe Compensation Signal: Approx. 500 mV, 7 kHz square wave.

Trigger:

Modes: Normal, Auto trigger, Auto level. Auto trigger mode will generate internal triggers at a 40 Hz rate in the absence of input trigger. Auto level will continuously adjust the trigger level to track the input signal with duty cycles between 30% and 70%.

Timebase:

Delay Accuracy: ±0.02% ±0.4% of timebase range ±5 ns.
Single Marker Accuracy: Delay Accuracy
Dual Marker Accuracy: ±0.4% of timebase range ±2 ns.

Digitizer:

A/D resolution: 8 bits
Digitizing technique:

Timebase Range	*Acquisition Mode*	*Digitizing Rate*
100 ns - 50 us	Random repetitive	(not applicable)
100 us - 20 ms	Random sequential	5.814 kHz
50 ms - 5 s	Flash acquisition	250/ timebase range

Throughput: 300 samples/s on 100 ns range. 700 samples/s on 200 ns to 100 us ranges, increasing to 2500 samples/s at 50 ms.

Measurements:

Markers are provided for manual timing and voltage measurements. Automated measurements of the following waveform parameters can be made: frequency, period, risetime, falltime, + width, − width, p-p volts, and overshoot. Waveforms can be saved and recalled for comparison.

Displays:

Variable persistence: This mode displays samples for a user set time, then erases them. The display time can be varied or set to infinite.
Average: Provides a display of the average of many samples. The averaging runs continuously, and can be set 1, 2, 4, 16, 32, 64, 128.

Autoscale:

The Autoscale feature will display both channels with the proper vertical, trigger, and timebase setting. The coupling is set to ac, and the delay is set to zero. Requires a duty cycle of 20% to 80%, an amplitude of >20 mV and a frequency >50 Hz.

Self Calibration:

This feature calibrates the vertical, trigger, and timebase to the published specifications. A self-calibration occurs when the instrument is first turned on, and can be requested by the user at any time. Calibration time is typically 3 seconds.

Weight: 1.40 kg (3.09 lbs)

The HP 61017AA Relay Actuator

The HP 61017AA Relay Actuator provides programmable control of eight independent relay switches. Each channel can carry up to 1 Ampere of current, and can switch up to 250 volts dc or ac rms.

The Relay Actuator comes with a plug-in screw terminal block for easy connection of user inputs and outputs.

Specifications:

User Connections:
8 independent single-pole channels

Channel Select Time:
Less than 40 ms (system limit with an OUTPUT statement)

Switching Characteristics:
Maximum Voltage:
250 Vdc, 250 Vac rms, 350 Vac peak
Maximum Current:
Per channel: 1 amp dc, 1 amp ac rms
Per module: 4 amp dc, 4 amp ac rms
Maximum Power:
Per channel: 50 W dc, 250 VA ac
Per module: 200 W dc, 1000 VA ac

Resistance (per channel):
1 ohm typical

Thermal Offset (per channel):
<6 uV maximum

Isolation Voltage Rating:
250 Vdc, 250 Vac rms, 350 Vac peak between any two input terminals or between an input and ground.

DC Isolation Resistance:

	(<40°C, 80% RH)
Open Channel	$>2 \times 10^8$ ohms
Channel-Channel	$>2 \times 10^8$ ohms
Channel-Ground	$>2 \times 10^8$ ohms

AC Characteristics (50 ohm termination):

	100 kHz	1 MHz	10 MHz
Crosstalk (input to input) (dB)	< −73	< −53	< −33
Feedthrough (input to output) (dB)	< −73	< −53	< −33
Insertion Loss (input to output) (dB)	<0.2	<0.3	<0.5

Capacitance:

(Open Channel, Channel to Channel)	< 5 pF
(Closed Channel)	<25 pF
(Channel to Chassis)	<50 pF

Weight: 0.95 kg (2.09 lbs)

Data Acquisition Software

HP 150 Touchscreen Version, HP 14855A IBM PC Version, HP 14856AA

A menu-driven program that performs voltage scanning, thermocouple scanning, and analog recording. It also includes a graphics utility for presenting information in a simple listing, linear graph, or logarithmic plot form; and it can be easily modified to suit specific applications. The following describes the four applications that the package provides:

Voltage Scanner
- Supports up to two Relay Multiplexers and one DMM
- Scans up to 16 channels
- Fastest scan rate
  - List Mode: 8 seconds (for 16 channels)
  - (Tabular display of data collected)
  - Trend Mode
  - (Graphical display of data collected)
  - Post Run: 6 seconds (for 16 channels)
  - (Collects all data and then plots it)
  - Real Time: 2 seconds (for 3 channels)
  - (Collects and plots data at the same time)
- Maximum Channel-to-Channel Delay
  - List Mode: 0.5 seconds
  - Trend Mode
  - Post Run: 0.375 seconds
  - Real Time: 0.667 seconds
- Maximum Number of Samples* = (Number of Scans) × (Number of Channels) ≤3000

Thermocouple Scanner
- Supports up to two Relay Multiplexers and one DMM
- Scans up to 14 thermocouple inputs
- Compensation and linearization for TJERKS type thermocouples
- Fastest Scan Rate
  - List Mode: 25 seconds (for 14 channels)
  - Trend Mode
  - Post Run: 25 seconds (for 14 channels)
  - Real Time: 5 seconds (for 3 channels)
- Maximum Channel-to-Channel Delay
  - List Mode: 1.8 seconds
  - Trend Mode
  - Post Run: 1.8 seconds
  - Real Time: 1.8 seconds
- Maximum Number of Samples* = (Number of Scans) × (Number of Channels) ≤3000
- Temperature Errors (includes reference-junction error, thermal-off voltages, and linearization error; does not include DMM or transducer errors) = ±3.5°C.

Analog Recorder
- Supports up to 3 DMMs
- Measures 1, 2, or 3 channels vs. time
- 1 or 2 channels vs. a third channel
- Fastest Sample Interval

1 channel vs. time	1 second
2 channels vs. time	1.5 second
3 channels vs. time	2 seconds
1 channel vs. Channel 1	1 second
2 channels vs. Channel 1	1.5 seconds

- Maximum Channel-to-Channel Delay (time between successive measurements in one sample interval) = 0.1 second
- Maximum Number of Samples* = 500

Graphics Utility
- 2 Y-axes
- Plots linear, semi-log, log-log graphs

Common to all applications:

Timebase
Range: 1 second to 1800 seconds
Resolution: 1 second

Plotters
Direct support of HP 7470A and HP 7475A plotters.

* Total number of samples with no user modification of program.

Interfaces, HP-IB Software, and Accessories

PC Instruments Interface (HP 150 Touchscreen version), HP 61060AA
Provides a link between the HP 150 Touchscreen and up to eight PC Instruments. The product consists of a PCIB interface card, PC Instruments System Software, PC Instruments System Documentation, and two control cables. The interface card plugs into one of the accessory slots on the HP 150 Touchscreen. Maximum distance between computer and the instruments is 1.8 meters.

PC Instruments Interface (IBM PC version), HP 61061AA
Provides a link between the IBM PC and up to eight PC Instruments. The product consists of a PCIB interface card, PC Instruments System Software, PC Instruments System Documentation, and two control cables. The interface card plugs into one of the long accessory slots on the IBM PC. This product will also work with the IBM PC/XT and the IBM PC/AT. Maximum distance between computer and the instruments is 1.8 meters.

HP-IB I/O Library (HP 150 Touchscreen version), HP 14857AA
Software that allows you to use the HP-IB connector already present on your HP 150 Touchscreen to control HP-IB instruments.

HP-IB Interface and I/O Library (IBM PC version), HP 61062AA
Software and a plug-in card for the IBM PC, IBM PC/XT, and IBM PC/AT allows you to control HP-IB instruments. (For further information refer to HP-IB Command Library Data Sheet, publication #5952-4135.)

System Power Unit, HP 61001A
An optional System Power Unit that provides convenient, space-effective storage for the individual power packs of up to eight PC Instruments. Included in the design are common mode and normal mode line conditioning, a line-spike suppression network, mains fuse, PC Instruments system power switch, and two auxiliary unswitched outlets suitable for powering a personal computer and one peripheral. Used on the bench, the System Power Unit provides an ideal base for PC Instruments. It is also rack mountable.

PC Instruments Rack Shelf, HP 14801A
Rack mounting kit that allows up to four PC Instruments to be mounted in standard 19-inch racks.

Terminal Block, HP 14802A
For use with Digital I/O. Allows easy screw terminations.

Binder and Slipcase, HP 5080-2064
Recommended for systems with more than three instrument modules. Provides neat storage for additional instrument manuals and application software documentation.

Oscilloscope Probes, HP 10040A
Miniature Probe with a 10:1 division ratio and 9 pF shunt capacitance.

HP 10021A
Miniature Probe with a 1:1 division ratio and 36 pF shunt capacitance.
These miniature probes are recommended for use with the HP 61016AA Digitizing Oscilloscope. Each probe comes with a retractable hook tip, an IC probe tip adapter, an alligator clip, a 20 cm (8 in.) ground lead, eight color-coded indicator sleeves, a grounding spring, and an operating note. The probes have a one meter cable.

PC Instruments Packages

PC Instruments Data Logging Packages

PC Instruments packages offer ordering convenience and dollar savings.

These packages, together with your PC and a PCIB Interface, give you everything you need to immediately begin logging data.

Data Logging Package (HP 150 Touchscreen version), HP 61086AA

Consists of the following:
Relay Multiplexer
Digital Multimeter
Data Acquisition Software

Data Logging Package (IBM PC version), HP 61087AA

Consists of the following:
Relay Multiplexer
Digital Multimeter
Data Acquisition Software

PC Instruments Electronic Bench Packages

These packages, together with your PC and a PCIB Interface, give you the basic tools you need to debug, test, and evaluate changes in design, and to set up automated tests and characterize prototypes.

Electronic Bench Package (HP 150 Touchscreen version), HP 61088AA

Consists of the following:
Relay Multiplexer
Digital Multimeter
Function Generator
Universal Counter
Digitizing Oscilloscope
Dual Voltage DAC
System Power Unit
Data Acquisition Software
HP-IB Command Library

Electronic Bench Package (IBM PC version), HP 61089AA

Consists of the following:
Relay Multiplexer
Digital Multimeter
Function Generator
Universal Counter
Digitizing Oscilloscope
Dual Voltage DAC
System Power Unit
Data Acquisition Software
HP-IB Interface and Command Library

Ordering and Configuration Guide

The following guide gives you step-by-step instructions for configuring and ordering your PC Instruments system. Included are descriptions, ordering instructions and prices for individual instruments and accessories, and for bundled packages which offer ordering convenience and dollar savings.

STEP 1:

Refer to the configuration guide on page 11 of this document for a listing of supported computer hardware and software, and order the equipment you need. Below is a partial listing of HP computers, software, and peripherals suitable for use with PC Instruments. Note that MicroSoft® BASIC (GW™ BASIC or BASICA) and a total of 640K RAM memory is required.

To order your Touchscreen PCIB Controller:

	USA LIST PRICE	QTY.	TOTAL
HP 45862A Touchscreen PCIB Controller	**$4935.00**	_____	_____

Includes:
- Touchscreen II Base System
- HP Touch Accessory (user installable bezel)
- 384K RAM Memory Board
- PC Instruments Interface
- GW BASIC

STEP 2:

Choose from the following disc drives:

• 9123D Dual 3½" Microfloppy Disc Drive; 710 KB each drive*	**$ 715.00**	_____	_____
• 9153A 10MB Winchester Disc with one 3½" Microfloppy Disc Drive	**$1940.00**	_____	_____
• 9133H 20MB Winchester Disc with one 3½" Microfloppy Disc Drive	**$2740.00**	_____	_____
• 9133L 40MB Winchester Disc with one 3½" Microfloppy Disc Drive	**$4240.00**	_____	_____

*Can only be used with Touchscreen II due to power requirements. (9123D does not have its own power supply.)

STEP 3:

Select the following flexible discs for your personal computers:

HP 92192A 3.5" Flexible Discs (box of 10)	**$ 69.00**	_____	_____

Double sided microfloppy discs for use with the Touchscreen and Touchscreen II PC's.

HP 92190A 5.25" Flexible Discs (box of 10)	**$ 58.00**	_____	_____

Double sided microfloppy discs for use with the IBM PC, PC/XT and PC/AT.

STEP 4:

Select the correct PC Instruments Interface for your computer. You will not need this step if you have selected the PCIB Controller package unless you want more than eight modules on the system. One interface can control up to eight instrument modules. The System Software is included with the interface:

HP 61060AA PC Instruments Interface (HP 150 Version)	**$ 500.00**	_____	_____
HP 61061AA PC Instruments Interface (IBM PC Version)	**$ 500.00**	_____	_____

Up to two PC Instruments Interfaces can be accommodated by the Touchscreen II, IBM PC, PC/XT, or PC/AT. Only one PC Instruments Interface can be accommodated by the HP 150B Touchscreen. Each interface occupies one long slot in the computer's backplane.

STEP 5:

Select the type and quantity of instrument modules:

	USA LIST PRICE	QTY.	TOTAL
HP 61010AA Digital I/O	**$ 650.00**	_____	_____
HP 61011AA Relay Multiplexer	**$ 650.00**	_____	_____
HP 61012AA Dual Voltage DAC	**$ 800.00**	_____	_____
HP 61013AA Digital Multimeter	**$ 650.00**	_____	_____
HP 61014AA Function Generator	**$1500.00**	_____	_____
HP 61015AA Universal Counter	**$ 900.00**	_____	_____
HP 61016AA Digitizing Oscilloscope*	**$1500.00**	_____	_____
HP 61017AA Relay Actuator	**$ 650.00**	_____	_____

*Up to five HP 61016AA oscilloscopes may be connected to a PC Controller if no other instruments are present on the PC Instruments Bus (PCIB).

STEP 6:

Select from these optional Applications Software packages:

HP 14855AA Data Acquisition Software (HP 150 Version) ..... **$ 400.00** _____ _____

HP 14856AA Data Acquisition Software (IBM PC Version) ..... **$ 400.00** _____ _____

These packages are designed to work with PC Instruments. Each package consists of utilities for thermocouple scanning, voltage scanning, analog recording, and engineering graphics.

STEP 7:

Choose from these optional PC Instruments Accessories:

HP 61001A System Power Unit ..... **$ 400.00** _____ _____

Holds up to eight power packs, filters line current, and provides a central power switch. Can be rack mounted; support rails are recommended.

HP 14801A Rack Shelf ..... **$ 200.00** _____ _____

Allows you to mount up to four PC Instruments and their power supplies in a standard 19″ instrument rack. Includes three blank front panels for use when fewer than four modules are to be racked.

HP 14802A Terminal Block ..... **$ 150.00** _____ _____

Allows easy screw termination of user connections to HP 61010AA Digital I/O.

HP 5080-2064 Binder and Slipcase ..... **$ 15.00** _____ _____

Empty binder and slipcase sized to fit PC Instruments manual pages. Recommended for systems consisting of more than three different PC Instruments modules.

HP 10040A 10:1 Oscilloscope Probe ..... **$ 125.00** _____ _____

HP 10021A 1:1 Oscilloscope Probe ..... **$ 75.00** _____ _____

These miniature probes are recommended for use with HP 61016AA Digitizing Oscilloscope.

PC INSTRUMENTS PACKAGES

You can save over $600 by ordering PC Instruments products in selected combinations. The following packages make it easy to order popular configurations. Just choose the right package for your needs, a PC Instruments Interface, and your computer. The Data Logging Packages have what you need to scan up to eight channels. The Electronic Bench Packages provide enough equipment to outfit an entire lab bench.

	USA LIST PRICE	QTY.	TOTAL
HP 61086AA Data Logging Package (HP 150 Version)	**$1600.00**	_____	_____

This Package includes:

- HP 61011AA Relay Multiplexer
- HP 61013AA Digital Multimeter
- HP 14855AA Data Acquisition Software

	USA LIST PRICE	QTY.	TOTAL
HP 61087AA Data Logging Package (IBM PC Version)	**$1600.00**		

This Package includes:
- HP 61011AA Relay Multiplexer
- HP 61013AA Digital Multimeter
- HP 14856AA Data Acquisition Software

HP 61088AA Electronic Bench Package (HP 150 Version) **$6500.00**

This Package includes:
- HP 61011AA Relay Multiplexer
- HP 61012AA Dual Voltage DAC
- HP 61013AA Digital Multimeter
- HP 61014AA Function Generator
- HP 61015AA Universal Counter
- HP 61016AA Digitizing Oscilloscope
- HP 61001A System Power Unit
- HP 14855AA Data Acquisition Software
- HP 14857AA HP-IB Command Library for MS-DOS (HP Touchscreen Version)
- HP 5080-2064 Binder and Slipcase

HP 61089AA Electronic Bench Package (IBM PC Version) **$6600.00**

This Package includes:
- HP 61062AA HP-IB Command Library for MS-DOS (IBM PC Version)
- HP 61011AA Relay Multiplexer
- HP 61012AA Dual Voltage DAC
- HP 61013AA Digital Multimeter
- HP 61014AA Function Generator
- HP 61015AA Universal Counter
- HP 61016AA Digitizing Oscilloscope
- HP 61001A System Power Unit
- HP 14856AA Data Acquisition Software
- HP 5080-2064 Binder and Slipcase

HP-IB PRODUCTS

Optional HP-IB products are available to turn your PC into an HP-IB instrument controller. HP-IB is Hewlett-Packard's implementation of IEEE-488. For use with or without PC Instruments.

HP 45861A Touchscreen HP-IB Controller **$3430.00**

includes:
- Touchscreen II Base System
- HP Touch Accessory (user installable bezel)
- HP-IB Command Library for MS-DOS

HP 14857AA HP-IB Command Library for MS-DOS (HP 150 Version) . . . . . **$ 300.00**

The HP 14857AA is included in the Touchscreen HP-IB Controller package. You will not need this if you have ordered the HP 45861A.

HP 61062AA HP-IB Command Library for MS-DOS (IBM PC Version) . . . . . **$ 400.00**

The HP 61062AA contains both the software and an interface card which occupies one short slot in the computer's backplane.

HP 10833D HP-IB Cable, 1.6 ft (0.5m) . . . . . **$ 80.00**

HP 10833A HP-IB Cable, 3.3 ft (1.0m) . . . . . **$ 80.00**

HP 10833B HP-IB Cable, 6.6 ft (2.0m) . . . . . **$ 90.00**

HP 10833C HP-IB Cable, 13.2 ft (3.0m) . . . . . **$ 100.00**

These cables are for use with the HP 14857AA and the HP 61062AA. One cable is needed for each HP-IB instrument in your system. Note that these cables are not required for use with any of the PC Instruments modules.

REQUIRED COMPUTER CONFIGURATION and SUPPORTED HARDWARE

COMPATIBLE COMPUTERS:	• HP 150B Touchscreen PC • HP 150B Touchscreen MAX PC • HP 150C Touchscreen II	• IBM PC • IBM PC/XT • IBM PC/AT
AMOUNT OF MEMORY:	• 640K RAM	• 640K RAM
SUPPORTED RAM:	• HP 45632A 384K Memory Expansion Card	• IBM Memory Expansion Card • Quadram Quadboard™ (384K)
SUPPORTED DISC DRIVES:	• HP 9122D Dual 3½" Microfloppy; 710 KB each drive • HP 9123D Dual 3½" Microfloppy; 710 KB each drive • HP 9153D 10 MB Winchester with one 3½" Microfloppy • HP 9133H 20MB Winchester with one 3½" Microfloppy • HP 9133L 40MB Winchester with one 3½" Microfloppy • HP 9133D 14.8MB Winchester with one 3½" Microfloppy	• Dual flexible disc drive • Winchester with flexible disc drive (standard IBM drive)
MONITOR:	• Standard monochrome	• Monochrome or color
SUPPORTED MONITORS:	• N/A	• IBM Color Monitor • Princeton Graphics Systems HX-12 • Sanyo DM8112CX (monochrome)
GRAPHICS ADAPTER:	• N/A	• IBM Color Graphics Monitor Adapter
OPERATING SYSTEM:	• MS-DOS 2.11	• DOS 3.0
BASIC SOFTWARE:	• HP 45450D GW BASIC	• BASICA 2.0 or later version

SUPPORTED COMPUTER PERIPHERALS

PRINTERS:	• HP 2674A Internal Printer • HP 2225A ThinkJet Printer	• IBM Graphics Printer • HP 2225C ThinkJet Printer
PLOTTERS:	• HP 7470A Two pen plotter • HP 7475A Six pen plotter	• HP 7470A Two pen plotter • HP 7475A Six pen plotter

Prices are U.S.A. list prices only.
Prices and specifications are subject to change.

HEWLETT PACKARD

For more information, call your local HP office or nearest regional office: **East** — (301) 258-2000 **Midwest** — (312) 255-9800 **South** — (404) 955-1500 **West** — (818) 506-3700. Or write: Hewlett-Packard, P.O. Box 10301, Palo Alto, CA 94303-0890. In **Canada** — (416) 678-9430. In **Europe** — Hewlett-Packard Netherlands B.V., Central Mailing Dept., P.O. Box 529, 1180 AM Amstelveen, The Netherlands. In **Japan** — Yokogawa-Hewlett-Packard Ltd., 29-21, Takaido-Higashi 3-chome, Suginami-ku, Tokyo 168. **Elsewhere** — Hewlett-Packard Intercontinental, P.O. Box 10495, Palo Alto, CA 94303-0890.

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