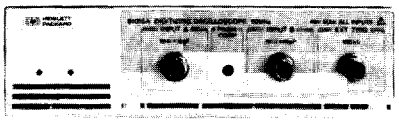


HP 61016AA

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

**Specifications**

All specifications are 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 ±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 Sensitivity:** | 40 mV - 1.6 V | 4 V - 40 V |
| (<10 MHz) | 15 mV | 400 mV |
| (>10 MHz) | 40 mV | 1.0 V |
| **Level Accuracy:** | ±3% | ±3% |
| | ±10% mV | ±250 mV |

**External Trigger:** 1 volt rising edge into 100 k ohms, with a rise-time <1 μs.

**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:** ≈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**

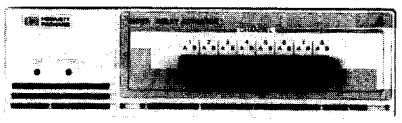
Markers are provided for manual timing and voltage measurements. Automated measurements of the following waveform parameters can be made: Frequency, period, risetime, falltime, +width, −width, p-p volts, and overshoot. Waveforms can be saved and recalled for comparison.

**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,

# PC INSTRUMENTS
## Instrument Modules, Interfaces & Accessories, and Data Acquisition Software



HP 61017AA

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).

### HP 61017AA Relay Actuator

The HP 61017AA Relay Actuator provides programmable control of eight independent relay switches. Each channel can carry up to one 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.

**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).

## PC Instruments Interfaces and Accessories

### HP 61060AA/HP 61061AA PC Instruments Interfaces

These products provide a link between the HP 150 Touchscreen (HP 61060AA) or the HP Vectra PC, IBM PC, PC/XT and PC/AT (HP 61061AA) and up to eight PC Instruments. They consist 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 and one of the long accessory slots on the HP Vectra PC and IBM PC. Maximum distance between computer and the instruments is 1.8 meters.

### HP 61001A System Power Unit

The optional System Power Unit provides convenient, space-effective storage for the individual power packs of up to eight PC Instruments. Included in the unit are common mode and normal mode line conditioning, a line-spike suppression network, main 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.

### HP 14801A PC Instruments Rack Shelf

The rack mounting kit allows up to four PC Instruments and four power packs to be mounted in standard 19-inch racks. Three blank panels are also included for use when racking fewer than four instruments.

### HP 14802A Terminal Block

For use with Digital I/O. Allows easy screw terminations.

### HP 5080-2064 Binder and Slipcase

Recommended for systems with more than three instrument modules. Provides neat storage for additional instrument manuals and application software documentation.

### HP 10040A/HP 10021A Oscilloscope Probes

**General:** 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.

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

**HP 10021A Oscilloscope Probe:** Miniature Probe with a 1:1 division ratio and 36 pF shunt capacitance.

## Data Acquisition Software

### HP 14855AA, HP 150 Touchscreen Version

### HP 14856AA, HP Vectra PC and IBM PC Version

HP's Data Acquisition Software is 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**

The Voltage Scanner supports up to two Relay Multiplexers and one DMM. It scans up to 16 channels.

**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) x (Number of Channels) ≤3000. (Total number of samples with no user modification of program.)

**Thermocouple Scanner**

The Thermocouple Scanner supports up to two Relay Multiplexers and one DMM. It scans up to 14 thermocouple inputs and provides compensation and linearization for T, J, E, R, K & S type thermocouples.

**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) x (Number of Channels) ≤3000. (Total number of samples with no user modification of program.)

**Temperature Errors:** (Includes reference-junction error, thermal-off voltages, and linearization error; does not include DMM or transducer errors) = ±3.5° C.