# FUNCTION GENERATORS & WAVEFORM SYNTHESIZERS
## General Information

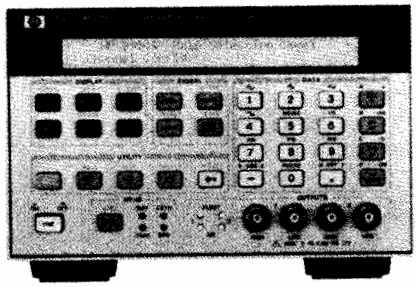
### Introduction
Hewlett-Packard offers a wide variety of signal sources for almost any application, including function generators and frequency or waveform synthesizers. Output frequencies range from 1 μHz to 80 MHz.

For higher frequency applications, refer to the "Signal Generators" and "Sweep Oscillators" sections of this catalog.

### Standard
Standard function generators typically offer a variety of waveforms, such as sine-wave, square, triangle, and ramp.

The HP 8111A also offers pulse capabilities, and the HP 3312A has modulation and sweeping capabilities. Both generators can be used only in manual operation.

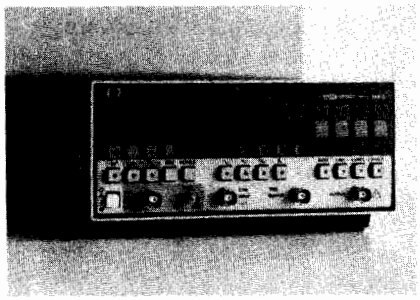
### Multi-Functional
Functionality describes function generators that are capable of more than generating a variety of waveforms. For example, up to 150 vectors can be defined with the HP 3314A for the generation of arbitrary signals.



### Analog/Digital Arbitrary Waveforms
The HP 8175A Digital Signal Generator is a data generator, which provides, with the Option 002, arbitrary signals on two analog channels. Digital pattern and analog signals can also be generated simultaneously.

### Synthesized Arbitrary Waveforms
The HP 8770A, in conjunction with an HP 9000 Series 300 Desktop Computer and the HP 11776A Waveform Generation Software, is a complete system for the generation of most complex arbitrary waveforms with synthesizer accuracy. Waveforms can be created in both the time and frequency domain.

### Multifunction Synthesized Waveforms
The HP 8904A Multifunction Synthesizer digitally creates a multitude of complex signals from six simple waveforms. It begins



with a Synthesizer/Function generator offering standard waveforms, DC, and noise. Option 001 adds three channels that can modulate the first synthesizer; option 002 adds a second independent synthesizer output. Modulation capabilities include AM, FM, PM, DSB, and pulse.

### Fast
These instruments offer all of the standard waveforms over the full frequency range up to 50 MHz. The HP 8116A and HP 8165A combine these features with different modes, modulation, and sweep capabilities. Both instruments can be used as pulse generators. The HP 8165A, with its frequency stability of 1 ppm/day, has synthesizer quality.

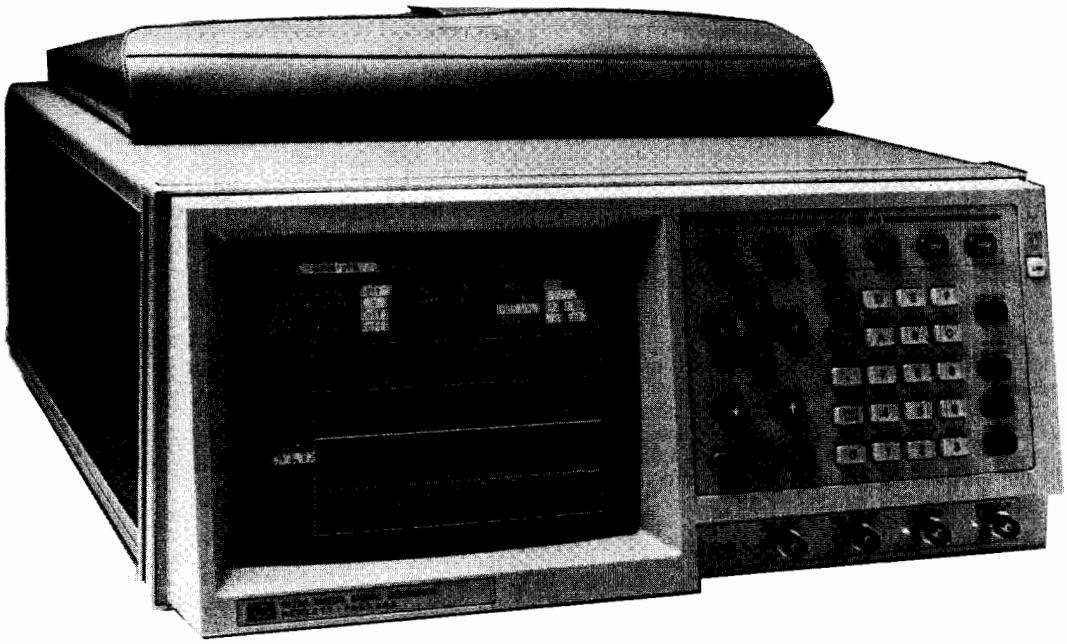
## HP Function Generators Summary I

| | Standard | | Multifunctional | | | | | Fast | |
|---|---|---|---|---|---|---|---|---|---|
| **HP Models** | **HP 8111A** | **HP 3312A** | **HP 3245A** | **HP 3314A** | **HP 8904A** | **HP 8175A** | **HP 8770A** | **HP 8118A** | **HP 8165A** |
| Sine Wave | | | | | | | | | |
| Min. Frequency | 1 Hz | 0.1 Hz | 0 Hz | 1 mHz | 0 Hz | dc | dc | 1 mHz | 1 mHz |
| Max. Frequency | 20 MHz | 13 MHz | 1 MHz | 20 MHz | 600 kHz | 25 MHz | 50 MHz | 50 MHz | 50 MHz |
| Waveforms | | | | | | | | | |
| Square | 1 Hz to 20 MHz | 0.1 Hz to 13 MHz | 0 Hz to 1 MHz | 1 mHz to 20 MHz | 0.1 Hz to 50 kHz | Full | Full | 1 mHz to 50 MHz | 1 mHz to 50 MHz |
| Triange | 1 Hz to 20 MHz | 0.1 Hz to 13 MHz | | 1 mHz to 20 MHz | 0.1 Hz to 50 kHz | Arbitrary | Arbitrary | 1 mHz to 50 MHz | 1 mHz to 50 MHz |
| Ramp | 1 Hz to 20 MHz | 0.1 Hz to 13 MHz | 0 Hz to 1 MHz | | 0.1 Hz to 50 kHz | Waveform | Waveform | 1 mHz to 50 MHz | 1 mHz to 50 MHz |
| Pulse | 1 Hz to 20 MHz | | | | | | | 1 mHz to 50 MHz | 1 mHz to 20 MHz |
| Arbitrary | | | 2048 points | 150 vectors | | | | | |
| Modes | | | | | Creats | Full | Full | | |
| Trigger | ext | int/ext | int/ext | int/ext | signals from | Arbitrary | Arbitrary | ext | ext |
| Gate | ext | int/ext | int/ext | int/ext | six basic | Waveform | Waveform | ext | ext |
| Counted Burst | 1 to 1999 | | int subroutine | 1 to 1999 | Waveforms | | | 1 to 1999 | 1 to 1999 |
| Modulation | | | | | | | | | |
| AM | | int/ext | int subroutine | ext | int | Full | Full | ext | ext |
| FM | | int/ext | Arbitrary | ext | int | Arbitrary | Arbitrary | ext | ext |
| PM | | | | | int | Waveform | ext | | |
| PWM | | | | | | | HP 11776A | ext | |
| Sweep | | | | | | | | | |
| Lin. | | int/ext | int | int | int | Full | Full | ext | |
| Log. | | | int | int | none | Arbitrary | int/ext | int/ext | |
| VCO | ext | int/ext | int subroutine | ext | int | Waveform | Waveform | ext | ext |
| Output (into 50 Ω) | | | | | | | | | |
| Amplitude (p-p) | 16 V | 10 V | 10 V | 10 V | 10 V | 16 V | 2 V | 16 V | 20 V |
| dc Offset | ±8 V | ±4.5 V | ±5 V | ±5 V | ±5 V | ±8 V | | ±8 V | ±10 V |
| Output Impedance-Ω | 50 | 50 | 0150 | 50 | 50 | 50 | 50 | 50 | 50/1000 |
| Programmability | | | HP-IB | HP-IB | HP-IB | HP-IB | HP-IB | HP-IB | HP-IB |
| Notes | | | 2 indepdendent channels, also AC current and 6-digit precision dc voltage or current. | also ½ cycle bursts, phase lock | 4 internal channels. One is modulated or sequenced | 2 analog outputs dig./analog signals simultaneously | HP Series, 300 Controller, plus HP 11776A software recommended | | |
| Catalog page | 488 | 482<br>483 | 484<br>485 | 482<br>483 | 486<br>487 | 489<br>490 | 454 | 491<br>492 | 493 |

# Dual Arbitrary Waveform Generator

## HP 8175A Option 002

- Two analog channels / 1 kpoints ea / 50 MHz ea
- Individual datapoint durations 20 ns to 9.99 s
- Ten-bit amplitude resolution
- Digital and analog signals simultaneously
- Four waveform entry modes; calculator, graphical editing, abs. and rel. levels, various codings
- Up to 32 Vp-p output voltage (into open), separately programmable offset (max ±16 V)



DESIGNED FOR HP-IB SYSTEMS

HP 8175A, Option 002; Data Page: Waveform Setup

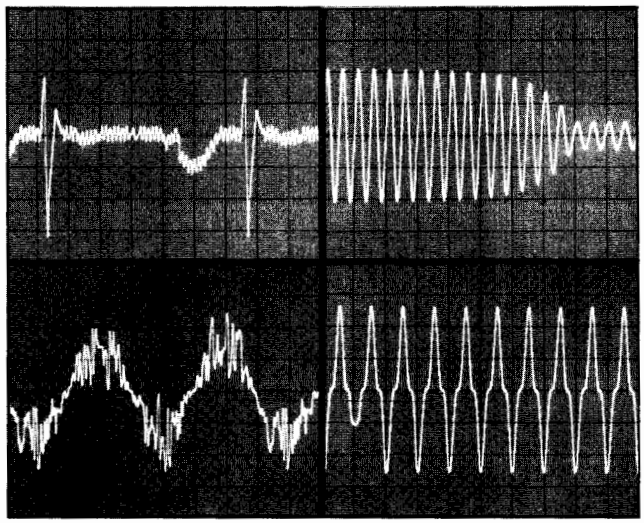
With the Option 002, the Dual Arbitrary Waveform Generator, the HP 8175A offers the new Arbitrary Waveform mode in addition to the existing Parallel and Serial modes. The Arbitrary Waveform mode gives you dual arbitrary waveform channels and simultaneous equivalent digital signals. This means you have the ideal source for such difficult applications as:

— simulation of two dependent variables, such as force and distance, at the same time.
— digital and analog simulation of such devices as programmable filters.
— stimulus and compare signals at the same time for DACs or ADCs.

The arbitrary outputs are 50 Mpoints/s, synchronous, but independent in shape and amplitude (max 16 V peak-to-peak into 50 ohm and max 32 V peak-to-peak into open). The waveforms can be set up by means of algorithms (a fundamental set of mathematical functions are available, including noise); interpolations (linear and spline); graphic or tabular entry of instantaneous level (or amplitude and offset), or tabular entry of equivalent digital pattern. Additionally, any existing waveform can be modified, simply by tabular or graphical editing. A more powerful alternative method is using the Combine feature. This allows you to combine an algorithm arithmetically with any desired part of the current waveform.

For further information about the digital capabilities of the HP 8175A see page 514.

**Application Examples**

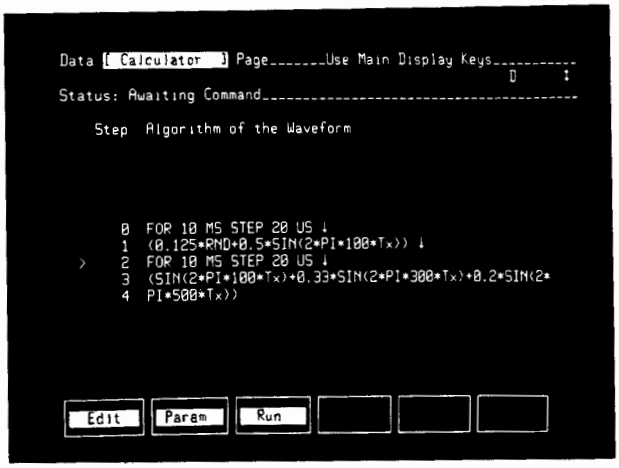


The comprehensive feature set, together with the outstanding memory management and interaction capability, mean that "real-life" simulation for the most exacting circuits is within your grasp.

# FUNCTION GENERATORS & WAVEFORM SYNTHESIZERS

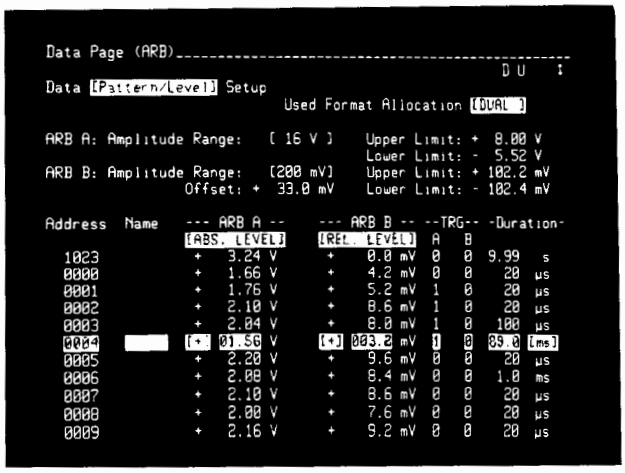
## Dual Arbitrary Waveform Generator (cont'd)

### HP 8175A Option 002




### Data Page: Calculator

The built-in calculator provides a comfortable method of setting up very complex, mathematically definable waveforms by simply entering the formula. Softkeys support most of the fundamental mathematical functions. The Combine capability allows any previously generated function to be combined with the current calculated function. By this means, noise can be introduced into any desired parts of the waveform.




### Data Page: Pattern/Level Set-Up

Data Points of a waveform can be entered and displayed in absolute or relative levels or in various codes. Comprehensive waveform editing support is provided. For instance, segments of data points can be moved or copied to other memory locations, or waveform segments can easily be exchanged between the two analog channels. In this way, it's easy to produce phase shifted signals. Graphical editing of the waveform, including interpolation between data points, is possible on this menu.

## Specifications

Apply for operating temperatures from 0° to 55° C

### Option 002 Dual Arbitrary Waveform Generator (can be retrofitted in HP service office)

**Number of analog outputs:** 2
**Number of bits:** 10
**Number of data points:**
**Horizontal:** 1024 points
**Vertical:** 1000 points with additional 24 points override
800 points for 16 V p-p Output Voltage Range
640 points for 32 V p-p Output Voltage Range
**Differential non-linearity:** ≤1 LSB (monotonic)
**Output impedance:** 50 Ω ±5%

### Output Levels

**Load impedance:** 50 Ω:
**7 output voltage ranges:** 0.2 V to 16 V, Res. 0.2 mV to 20 mV
**2 offset ranges:** ±0.8 V and ±8 V (Output Volt. Range >1 V)
**Load impedance:** ≥50 k Ω
**7 output voltage ranges:** 0.5 V to 32 V, Res. 0.5 mV to 50 mV
**2 offset ranges:** ±1.6 V and ±16 V (Output Volt. R. >2V)

### Accuracy (Output A and Output B)

**Amplitude accuracy:** ±4% ±4 LSB
**Offset accuracy:** ±1% of programmed value
±2% of (progr. High Level of p-p Output Volt. + progr. Low Level of p-p Output Volt.) (If High and Low Level are identical in magnitude, but opposite in sign; this error will be zero).

**plus:**
**into 50 Ω:** ±10 mV for 0.2 V, 0.5 V and 1 V ranges
**or:** ±25 mV for 2 V and 5 V range
**or:** ±50 mV for 10 V and 16 V range
**into ≥50 k Ω:** ±20 mV for 0.5 V, 1 V and 2 V ranges
**or:** ±50 mV for 5 V and 10 V range
**or:** ±100 mV for 20 V and 32 V range

### Timing (for Output A and B)

The maximum sample update rate is 50 MHz.
The Data Point Duration is 20 ns to 9.99 s.
**Trigger output characteristics:**
**Number of trigger output channels:** 2
**Trigger output impedance:** 50 Ω ±5%
**Trigger output levels:** ECL into 50 Ω
TTL into 50 Ω and ≥50 k Ω
**Trigger pulse width:** The trigger can be set for each individual data point to High Level or Low Level. The trigger width depends on the programmed Data Point Duration.

### Ordering Information

| | Price |
|---|---|
| **HP 8175A** Digital/Analog Signal Generator | $12,900 |
| Note: HP 8175A must be ordered with at least option #002 or one of the digital options (refer to page 520). | |
| **Opt. 002** Dual Arbitrary Waveform Generator | $3,950 |
| **Opt. 908** Rack Flange Kit (P/N 5062-3978) | $36 ☎ |
| **Opt. 910** Additional Operating/Programming/Service Manual | $290 |
| **Opt. 916** Additional Programming Manual | $72 |
| **W30** Extended repair service (see page 671) | $280 |

☎ For off-the-shelf shipment, call 800-452-4844.

A typical stimulus-response test setup. The HP 8131A pulse generator in the foreground generates 500 MHz pulses with typically 120 ps transitions (20 to 80% of amplitude). The HP 54120 Series oscilloscope measures device response.

### Stimulus Selection Guide — (Refer to page 504 for pulse adders and inverters)

| Application | Advanced IC development | | | | General electronic evaluation | | | | Digital - communications - radar - automotive | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stimulus type** | **Fast pulse generators** | | | | **General-purpose pulse generators** | | | | **Data generators** | | **Arbitrary** | **Pulse/function generators** | | |
| HP Model | 8131A | 8130A | 8082A | 8161A | 8160A | 214B | 8112A | 8115A | 8118A | 8175A | 8175A#002 | 8111A | 8116A | 8165A |
| Special features | | | | MATE option | MATE option | High-voltage | | | Pulse patterns | Data patterns and arbitrary waveforms | | | | |
| Page | 506 | 508 | 512 | 511 | 511 | 514 | 515 | 516 | 517 | 519 | 493 | 492 | 495 | 497 |
| **Timing** | | | | | | | | | | | | | | |
| Max rate (MHz/Mbit/s) | 500 | 300 | 250 | 100 | 50 | 10 | 50 | 50 | 50 (RZ) 100 (NRZ) | 50 (NRZ) | 50 M samples/s | 20 | 50 | 50 |
| Min transition time (ns) | 0.2 fixed | 1 | 1 | 1.3 | 6 | 15 fixed | 5 | 6.5 | 6.5 | See pod specs | 12 | 10 | 6 | 5 |
| Variable delay | ● | ● | ● | ● | ● | ● | ● | ● | ● | Opt 001 | | | | |
| Min width (ns) | 0.5 | 1 | 2 | 4 | 10 | 25 | 10 | 10 | 10 | 20 | 20 | 25 | 10 | 20% dty |
| Best resolution (ns) | 0.01 | 0.01 | | 0.1 | 0.1 | | 0.1 | 0.1 | 0.1 | 10 | 10 | 0.1 | 0.1 | 1 mHz |
| **Outputs** | | | | | | | | | | | | | | |
| Channels | 2 (Opt) | 2 (Opt) | 1 | 2 (Opt) | 2 (Opt) | 1 | 1 | 2 | 2 | 24 | 2 | 1 | 1 | 1 |
| Vpp into 50 Ω | 5 | 5 | 5 | 5 | 20 | 100 | 16 | 16 | 16 | See pod | 16 | 16 | 16 | 20 |
| Best resolution (mV) | 10 | 10 | | 10 | 10 | | 10 | 10 | 10 | specs | 0.2 | 0.1 | 0.1 | 0.1 |
| Vwindow into 50 Ω | ±5 | ±5 | ±5 | ±5 | ±20 | 0/100 | ±8 | ±8 | ±8 | | ±8 | ±8 | ±8 | ±10 |
| Normal/ complement | Both | Both | Both | Select. | Select. | Pos/neg | Select. | Select. | Select. | Normal | Select. | Select. | Select. | Select. |
| **Modes** | | | | | | | | | | | | | | |
| Trigger, gate modes | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Burst mode | ● | ● | | ● | ● | Opt 001 | ● | | Memory | Memory | Memory | Opt 001 | ● | ● |
| Modulation/ control | Shaper | | | | | | ● | ● | ● | High-level | Algorithm | VCO | ● | ● |
| Sweep | | | | | | | | | | | Algorithm | | Option | Option |
| **Waveforms** | | | | | | | | | | | | | | |
| Pulse, square | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Ramp, triangle | | ● | ● | ● | ● | | ● | ● | ● | | ● | ● | ● | ● |
| Sine, Gaus' pulses | | | | | | | ● | ● | ● | | ● | ● | ● | |
| Multi-level | | | | | | | | ● | ● | | ● | | | |
| **Data patterns** | | | | | | | | | | | | | | |
| Depth (kbit) | | | | | | | | | 16 | 1 | 1 | | | |
| Segments/ loops/jumps | | | | | | | | | 1/ / | 255/255/2 | 255/255/2 | | | |
| **Programmability** | | | | | | | | | | | | | | |
| HP-IB | ● | ● | | CIIL/ ● | CIIL/ ● | | ● | ● | ● | ● | ● | | ● | ● |
| HP ITG driver available | ● | ● | | | | | ● | | | | | ● | | |
| **Suggested oscilloscope or logic analyzer** | HP54120 | HP54120 | HP54120 | HP54110D | HP54110D | HP54501A | HP54503A | HP54503A | HP16530A HP1653B | HP16510B HP1651B | HP16530A HP1653B | HP54501A | HP54503A | HP54503A |

# PULSE GENERATORS & DATA GENERATORS
## General Information (cont'd)

### Compact HP Solutions

Verify your design under real conditions with HP stimulus-response setups. With programmable sources and instruments, you achieve resolution and accuracy for repeatable measurements. When you add the statistical and documentation possibilities of digitizing oscilloscopes, you turn measurements into credible results.

### Digital IC Test

Trigger levels, timing, and output drive, for example, can be measured using an HP 54503A oscilloscope and an HP 8112A pulse generator. Source resolution is 100 ps/10 mV and the measurement accuracy is 1.5% voltage and 50 ps timing. For dynamic devices, dual-channel sources are available.

### Analog and Digital VLSI and Boards

Serial data devices can be function- and parametric-tested by the HP 8118A pulse patterns. Parallel data is the domain of the HP8175A, which tests interactively, and can create arbitrary waveforms at the same time. Combining these with the HP 165x or 165xx logic analyzer/oscilloscopes makes universal testing for analog, digital, and mixed circuits an economic reality.

### High-Speed Characterization

The HP 813x pulse generators provide nano- and subnano-second edges that can be positioned in 10 ps steps. Together with the GHz bandwidths of the HP 54120 Series oscilloscopes, they address some of today's fastest logic. These features are discussed in application note AN 381 (GaAs flip-flop test), and application note AN 381-1 (200 MHz Schmitt trigger test).

### IC Test Head, Computer Backplanes

The HP 8131A with sub-nanosecond filter accessories provides a very smooth calibration pulse. The HP 8130A's variable transitions are ideal for bandwidth and crosstalk tests.

### LAN Devices

The HP 8118A can generate any 2-, 3-, or 4-level code, has plenty of memory for supermessages, variable parameters for waveform mask, and can drive lines direct.

### Automotive Applications

Magnetic sensor pulses can be simulated by several pulse and pulse/function generators with external rate modulation. The HP 8175A arbitrary waveform option allows the signal to be entered as an algorithm, and can also emulate tacho signals. Complex tacho profiles can be simulated by the HP 3324As segmented sweep (see previous section).

### Radar Baseband Signals, Sonar

Delayed pulse bursts, amplitude, and frequency modulated pulse trains are among the very individual signals that pulse and pulse/function generators can generate. Complex bursts can be managed by data sources. Modulation can be real-time on the HP 8118A, or created with the HP 8175A arbitrary waveform.

### Physical Research

As examples, scintillator signals can be simulated by pseudo-random data, and bio and mechanical signals by loading either algorithms or a digitized oscilloscope captures to the HP8175A.

### Analog Circuits and Components

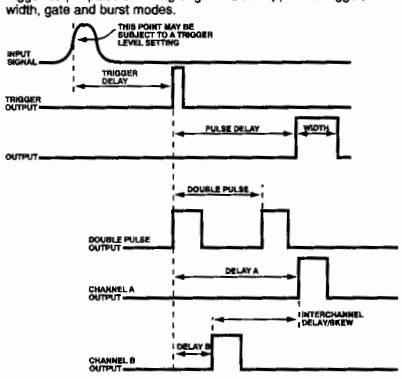
Such measurements as amplifier bandwidth, filter performance, servo step response, and diode reverse recovery time are performed quickly using rectangles or trapezoids from the HP 8112A. For spike immunity or stressing, the HP 214B generates 100 V pulses. Programmable filters, DACs, and ADCs can obtain input and control or compare signals simultaneously from the HP 8175A.

## Pulse Parameter Definitions of Terms Used in Instrument Specifications

**Time Reference Point**: Median (50% amplitude point on pulse edge).

**Pulse Period**: The time interval between the leading edge medians of consecutive trigger output pulses.

**Trigger Delay**: Interval between trigger point of input signal and the trigger output pulse's leading edge median. Applies in trigger, external width, gate and burst modes.




**Pulse Delay**: Interval between leading edge medians of trigger output pulse and output pulse.

**Double Pulse**: Interval between leading edge medians of the double pulse.

**Interchannel Delay/Skew**: Interval between corresponding leading edge medians.

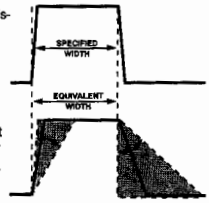
**Pulse Width**: Interval between leading- and trailing-edge medians.

Additional Information for Pulse Generators with Variable Transition Times

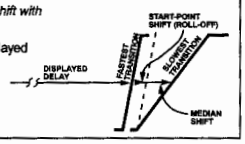
**Pulse Width**: The specified and displayed value is that obtained with fastest edges; essentially equal to the interval from the start of the leading edge to the start of the trailing edge.

By designing so that the pulse edges turn about their start points, the interval from leading edge start to trailing edge start stays unchanged* when transition times are varied. This is more convenient for programming and the width display is easy to interpret.

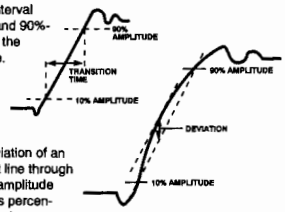
*In practice, start points may shift with changes in transition time.*




**Delay**: The specified and displayed value is that obtained with the fastest leading edge. For a slower edge, the actual delay exceeds the displayed delay by the combined shift of start-point and median.




**Transition Time**: Interval between the 10%- and 90%-amplitude points on the leading/trailing edge.




**Linearity**: Peak deviation of an edge from a straight line through the 10%- and 90%-amplitude points, expressed as percentage of pulse amplitude.

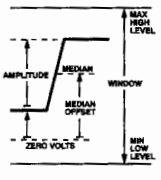
**Jitter**: Short-term instability of one edge relative to a reference edge. Usually specified as rms value, which is one standard deviation or "sigma." If distribution is assumed Gaussian, six sigma represents 99.74% of the peak-peak jitter.

The reference edge for period jitter is the previous leading edge. That for delay jitter is the leading edge of the trigger output. Width jitter is the stability of the trailing edge with regard to the leading edge.

**Stability**: Long-term average instability over a specific time, for example, hour, year.

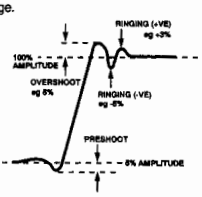
Jitter is excluded.

Pulse output is specified as pulse top and pulse base (usually referred to as high level and low level), or as peak-to-peak amplitude and median offset. A "window" specification shows the limits within which the pulse can be positioned.

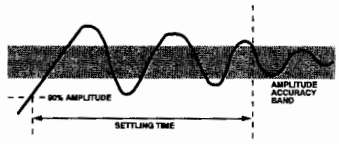



**Preshoot, Overshoot, Ringing:**: Preshoot and overshoot are peak distortions preceding/following an edge. Ringing is the positive peak and negative peak distortion, excluding overshoot, on pulse top or base. A combined preshoot overshoot, ringing specification of e.g. ±5% implies:

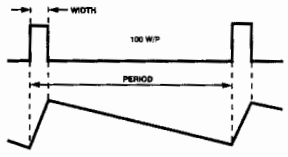
- Overshoot/undershoot <5%
- Largest pulse-top oscillation <±5%, of pulse amplitude.




**Settling Time**: Time taken for pulse levels to settle within level specification, measured from 90% point on leading edge.



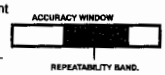

**Duty Cycle**: Percentage ratio of pulse width to period. In pulse/function generators, this term is also used to define sine and triangle symmetry. Note that, in pulse generators, this is a secondary parameter derived from period and width settings. The duty cycle achieved is therefore subject to width and period accuracies.




**Output Impedance/Resistance**: Effective pulse source impedance/dc resistance.

**Reflection Coefficient**: Reflection at pulse generator output expressed in percent of incident pulse amplitude. (Test pulse edges correspond to generator's fastest transitions).

**Repeatability**: When an instrument operates under the same environmental conditions, and with the same settings, the value of a parameter will lie within a band inside the accuracy window. Repeatability defines the width of this band.




**HP-IB Programming Times**

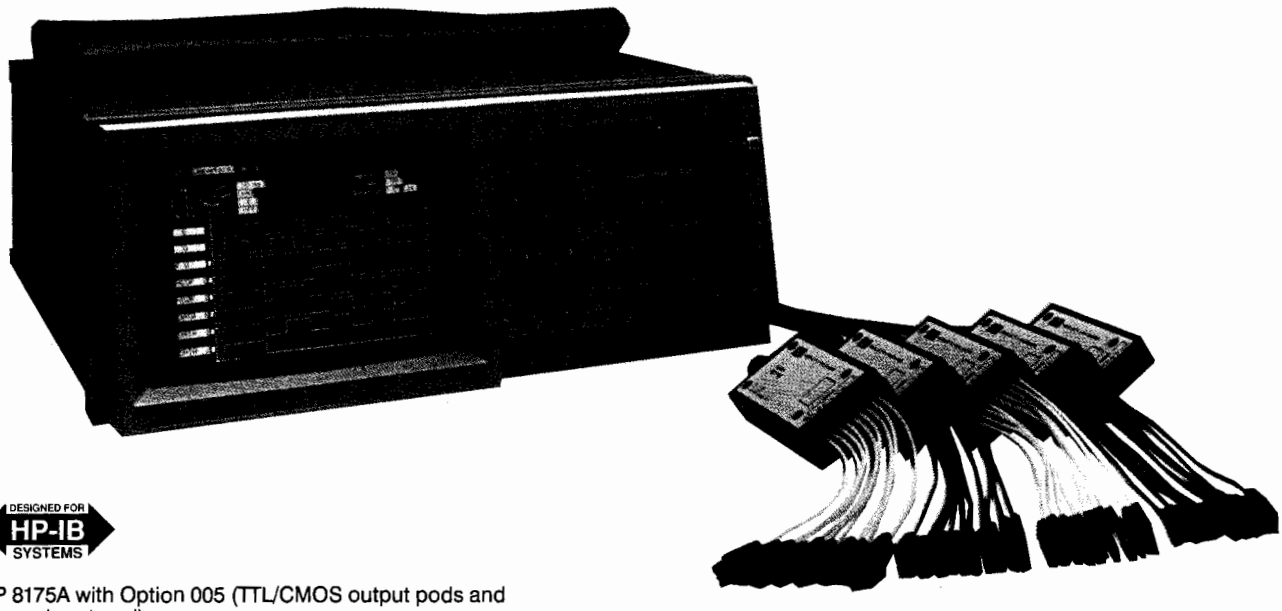
**Listen Time**: The time an instrument occupies the bus to receive and verify a message. The NRFD signal is active during this period.
**Settling Time**: The time taken by the instrument to execute an HP-IB message, and for the output to settle within the accuracy specification. NRFD inactive.
**Execution Time**: The sum of Listen Time and Settling Time.
**Talk Time**: The time an instrument occupies the bus to output a specified string. Output data is typically instrument error status, or current or stored parameters.

# PULSE GENERATORS & DATA GENERATORS

## Interactive Digital/Analog Stimulus

### HP 8175A

- 24 data channels
- 2 arbitrary channels
- Agile memory
- Interactive Test



DESIGNED FOR HP-IB SYSTEMS

HP 8175A with Option 005 (TTL/CMOS output pods and trigger input pod)

## HP 8175A Digital Signal Generator

### Test Under Real, Repeatable Conditions

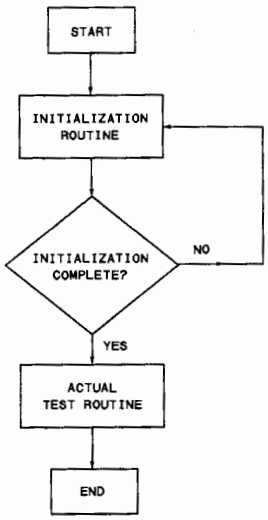
Whether your device needs analog or digital signals or—like programmable filters—both, the HP8175A helps you emulate the real environment. This is because programmable data patterns and arbitrary waveforms can be made available at the same time. Repeatable timing and voltage settings let you test the device's limits with confidence.

### Signal Quality at the Device

The HP8175A's 24 data outputs are connected to your device or test head by active pods. This reduces distortion because the connections between pod and device can be kept very short.

Each pod supports 8 channels so, if you are working with mixed logic, you can use any combination of the available ECL, TTL, or variable-level TTL/CMOS pods.

The two analog channels of the Option 002 arbitrary waveform generator have 50-ohm outputs.



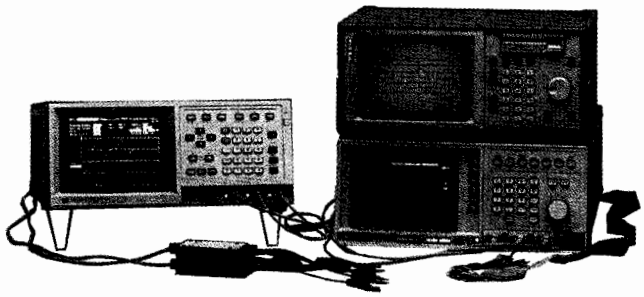

### Interactive Test

An agile, segmentable memory makes it possible for the HP 8175A to jump to different routines as needed by a test procedure. In the example on the left, an initial data pattern or waveform is output until the DUT changes state. This change is sensed by the HP 8175A's 8-line trigger pod, which then implements a user-defined jump.

Start, stop, continue, and tristate can also be implemented from the DUT in this way.

### Designed for Stimulus-Response Test

In addition to the 24 data outputs, there are also 8 flag outputs. These depend directly on DUT status, and so can make sure that a measuring device captures the right information.



HP 8175A starts HP 1650A logic analyzer and HP 54110D oscilloscope signal capture.

### Capture/Playback Applications

Data patterns or analog signals captured by your HP logic analyzer can be read into the HP 8175A's memory. Thus critical once-in-a-while occurrences that cause device problems are available for detailed evaluation. To help you move captured information into the HP 8175A, a program[1] is available that converts HP 165x(x) files to HP 8175A-readable form. The transfer can take place online via HP-IB, or offline with 3½ inch disks.

### Convenient Bench and System Implementation

Internal storage plus support of external disk drive and printer make manual setups very convenient. For automation, binary learn strings speed updates over HP-IB from the computer. In racked systems, temperatures can get fairly high; to ensure reliable results under these conditions, the HP 8175A is fully specified up to 55° C.

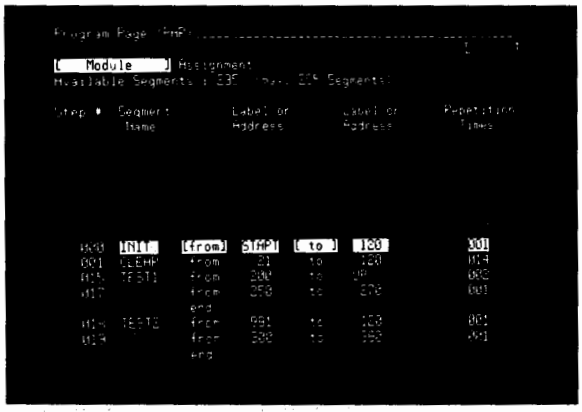
[1]This and other HP 8175A programs are available to users on request. The programs run on HP Basic 5.1 or HP Pascal 3.1 platforms. The programs are not supported.

## Built-in Editor

The HP 8175A's internal processor lets you set up counter and random patterns in a few keystrokes. It offers copy, insert, and cursor editing on tables and graphics plus special features for arbitrary waveforms[2].

## Memory Segments Sequenced in Real Time

For long data sequences with repeating elements, the memory can be segmented so that only unique data need be entered. The menu below shows how the segments are set up: the first four lines produce a continuous data stream, reusing areas of memory with common data. A command from the device can cause a real-time jump to the line "TEST 2."

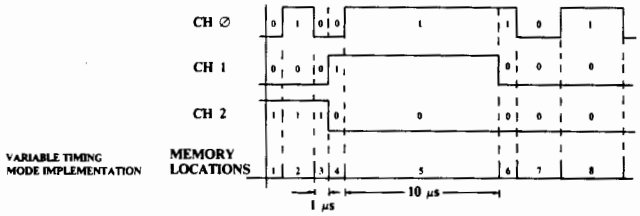



User-defined memory segments

## Flexibility Through Bit-by-Bit Timing

Long wait periods in a data stream or constant levels in an arbitrary waveform can use many k of memory. This is seldom a problem for the HP 8175A because each data pattern or sampling point can be given its own unique duration, from 0.02 $\mu$s up to 9.99 s.

Variable Pattern timing gives the user flexibility when programming long, asyrchronous data systems. Note that the long, unchanging pattern in this example is implemented by a single 10 $\mu$s duration, thus saving 9 addresses.




Each memory location has its own individual duration.

## Extra Clock Output for Dynamic Devices

Devices that need a continuous clock do not force you to abandon the HP 8175A's variable timing feature because a clock with independent frequency is available. It is locked to the HP 8175A master crystal so that clock and data remain synchronized.

## High-Resolution Edge Placement

All edges can be placed with 20 ns resolution. For critical clock/data or data/data adjustment, option 001 provides 100 ps resolution delay on four channels.

[2]More information about the Option 002 arbitrary waveform generator is available on page 489.

## Specifications

(Please request data sheet for complete specifications.)

**Outputs**

**Data channels:** 24, each 1024 bits

**Max data rate:** 50 Mbit/s, NRZ format

(If Serial Mode is selected, two 8-kbit channels are available, max data rate 100 Mbit/s, NRZ format.)

**Levels:** ECL, TTL, or variable-level TTL/CMOS pods. Different pods can be installed for mixed logic applications (each pod handles 8 channels). Variable level from 2.4 V to 9.9 V, programmable from HP8175A or external pod input. Fanout: 5 ECL/ 15 LSTTL/ 10/ LSTTL loads, depending on pod. Transitions: 3/ 6/ 9 ns into 22 pF, depending on pod. Tristate: implemented from HP8175A or by external signal to each pod.

**Analog channels (Option 002):** 2 arbitrary waveform channels, each 10-bit vertical resolution with 1024 sample points. Max sample rate: 50 MHz.

**Level ranges:** 7. From 0.2 Vpp max (0.2 mV resolution) to 16 Vpp max (20 mV resolution), into 50 Ω

**Source resistance:** 50 Ω

**Flag and clock channels:** 8 flags, or 7 flags and one clock. Flags are set by external status, see Trigger Pod. Clock period can be set from 20 ns to 99 $\mu$s, independent of bit duration. Levels: depends on pods, see data channels.

**Timing**

**Bit duration:** 0.02 $\mu$s to 9.99 s, individual or global

**Resolution:** 3 digits

**Option 001:** 100 ps independent edge positioning on four channels in a 20.0 to 40.0 ns window

**Memory**

**Size:** 24 × 1024 bit

**Segments:** As required up to 255

**Capabilities:** Start, stop, continue, restart, jump A, jump B, and loop

**Inputs**

**Trigger pod:** 8 lines to set flags and/or implement start, jump, output disable, stop and continue

**BNC inputs:** For external clock, external 1 MHz reference and start/stop

| Ordering Information | Price |
|---|---|
| **HP 8175A** Digital/Analog Stimulus | $12,900 |
| Note: HP 8175A must be ordered with at least one of the following options: 002, 003, 004, or 005—or with individual pods. | |
| **Opt 001** Fine Timing, 100 ps Resolution on 4 Channels | +$1,500 |
| **Opt 002** Dual Arbitrary Waveform Generator | +$3,950 |
| **Opt 003** 4 ECL Pods Model HP 15461A and 1 Trigger Pod Model HP 15463A | +$5,020 |
| **Opt 004** 4 TTL Pods Model HP 15464A and 1 Trigger Pod Model HP 15463A | +$3,420 |
| **Opt 005** 4 TTL/CMOS Pods Model HP 15462A and 1 Trigger Pod Model HP 15463A | +$7,620 |
| **Opt 908** Rack Flange Kit (PN 5062-3978) | +$36 ☎ |
| **Opt 910** Operating/Programming and Service Manual | +$290 |
| **Opt 916** Additional Operating/Programming Manual | +$72 |
| **Opt W30** Extended Repair Service. See page 671. | +$280 |
| **Supplied Accessories** | |
| **HP 15429A** set of 5 double receptacles with each output pod for soldering into printed circuit boards. | $55 |
| Set of leads and clips with each Trigger Pod HP 15463A for replacements, order: | |
| **HP 15463-63201** Set of 11 Leads | $125 |
| **HP 5959-0288** Set of 20 Clips | $20 |
| **Available Accessories** | |
| **HP 15408A** Set of 5 Grabbers | $100 |
| **HP 15409A** Set of 5 BNC Adapters | $100 |
| **HP 15410A** Set of 5 SMB Adapters | $100 |
| **HP 15411A** 5 Open Coax Adapters | $65 |
| **HP 15415A** Set of 5 Mini-Probes | $100 |
| **HP 15430A** Cable, for Master/slave Operation of 2 HP 8175As | +$85 |
| **HP 10062A** Cover, for Protecting Front Panel | +$75 |

**for Output Pods HP 15461/62/64A**

☎ For off-the-shelf shipment, call 800-452-4844.