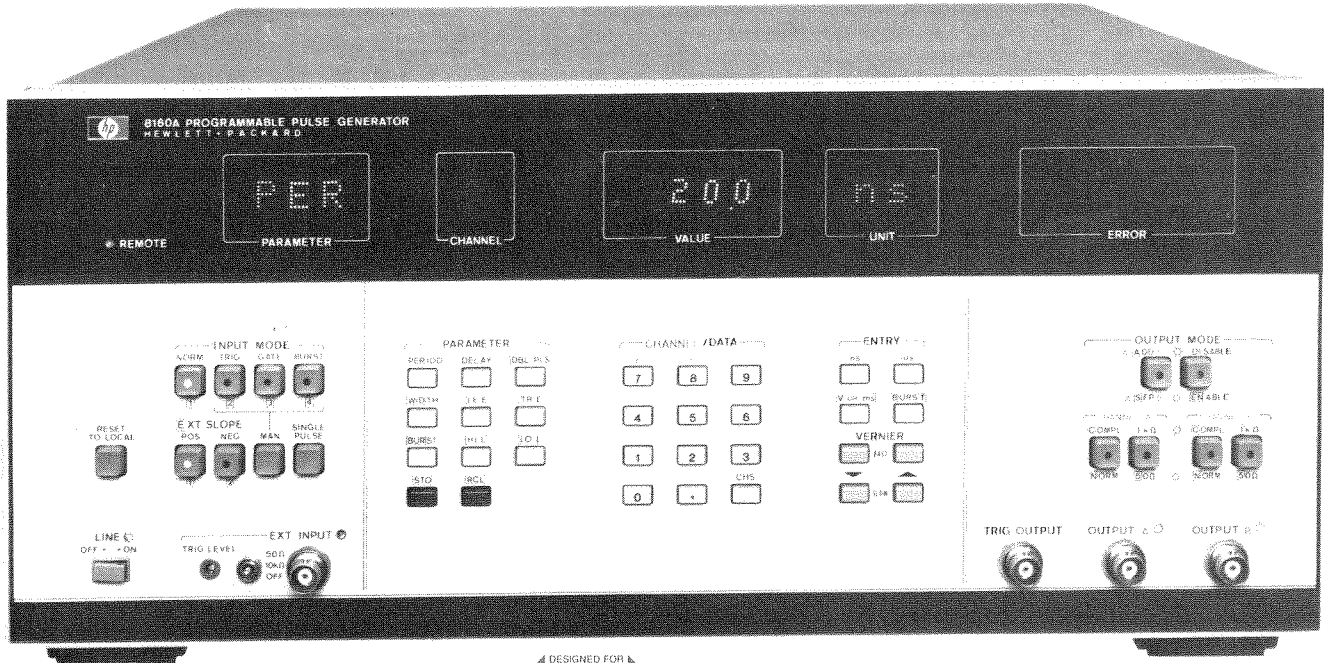


# PULSE GENERATORS

## Programmable Precision Pulse Generators

### Models 8160A, 8161A

- 50 MHz repetition rate
- 6.0 ns variable transition time
- 20 V output amplitude
- 1-3% pulse parameter accuracy
- Full dual channel capability (option 020)
- 1 year recalibration period

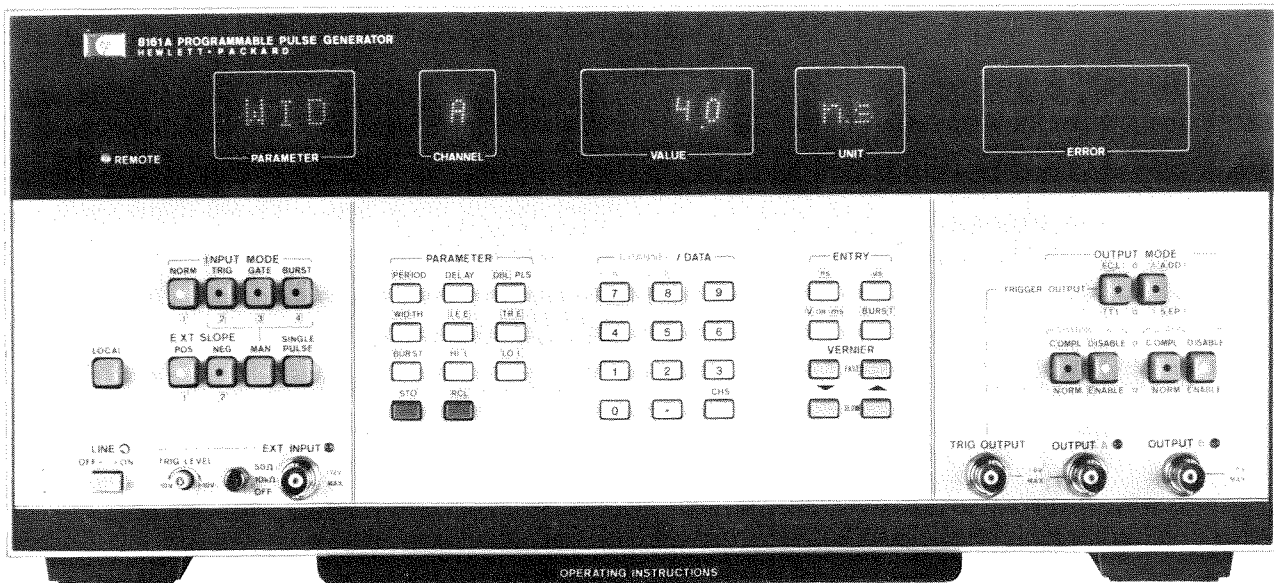


Designed For  
MATE  
Systems



Picture shows 8160A  
with Option 020, Dual Channel  
with Option 700, MATE/CIIL compatibility

- 100 MHz repetition rate
- 1.3 ns variable transition time
- 5 V amplitude
- 1-3% basic timing accuracy
- Full dual channel capability (option 020)
- 1 year recalibration period

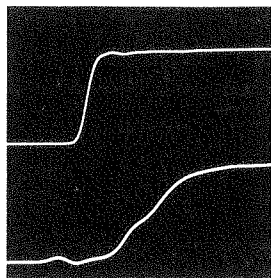


Designed For  
MATE  
Systems



Picture shows 8161A  
with Option 020, Dual Channel  
with Option 700, MATE/CIIL compatibility

The HP 8160A and 8161A are fully programmable pulse generators designed for high performance applications on the bench and in automatic test systems. Operation is made easy because the pulse parameters are controlled independently and do not inter-react. Dual channel options permit synchronous or complex waveforms to be generated. With its 50 MHz repetition rate, 20 V output, and 6 ns variable transition times, the HP 8160A is a general purpose pulse generator. The HP 8161A covers the high end of technology with its 100 MHz, 5 V and 1.3 ns variable transition times. Measured between the 20% to 80% amplitude points, these transitions are faster than 1 ns and meet ECL requirements.



HP 8161A input pulse (upper) and ECL memory output pulse (lower).

Combining high programming accuracy with microprocessor-based control capabilities, pulses can be set up without a measuring instrument. Pulse parameters are entered and displayed numerically, and generated with a basic timing accuracy of 1-3%, depending upon parameter.

An easy-to-use IIP-IB interface brings high-accuracy pulses to automatic test. All parameters and operating modes are remotely programmable using straight-forward command sequences. Faster, easier program generation and reduced software costs are direct benefits.

### Precision Pulse Generation

Both models provide precision control over all parameters of their output pulses. The HP 8160A's leading and trailing edge transition times may be independently programmed down to 6 ns. The HP 8161A's transitions have a common control from 1.3 ns to 5 ns, and are independent above 5 ns. Variable transition times are indispensable when digital IC's need to be characterized: either the IC's data sheeted input transition time is required, or the IC's functioning range with various transitions needs to be evaluated.

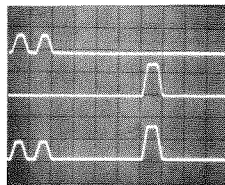
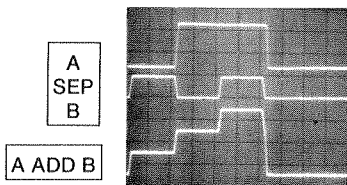
Direct entry of the high and low levels of the output pulse enables easy adjustment to the logic levels concerned. Pulse width is variable from 4 ns (HP 8161A) or 10 ns (HP 8160A) to 1 s, giving a wide range of duty cycle programmability. Delay shifts the output pulse in relation to the trigger output or, in double pulse mode, defines the pulse spacing.

In the dual-channel versions, double pulse can be selected in either or both channels. This means, for example, that simultaneous clock and data signals can be generated.

### Complex Signals

Independent pulse parameters plus individual programmability of the Option 020's dual outputs are augmented by the A ADD B mode. Summation allows complex signals to be precisely and easily set up. Here are some examples:

Applications such as radar coincidence circuits and special codes in communications require 3- and 4-level signals. These are conveniently generated by combining channel A and channel B pulses.



A  
SEP  
B

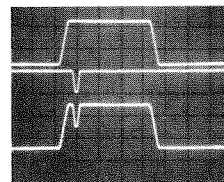
A ADD B

Transponder circuits need accurate delays, often with respect to a double-pulse interrogation signal. In the HP 8160A, this is arranged by operating one channel in double pulse mode and setting up the transponder delay in the other.

A critical test for digital circuits and IC's is its glitch and noise sensitivity, which can be easily performed with the A ADD B mode.

A  
SEP  
B

A ADD B



### Counted Burst

Using Burst Mode, a predetermined number of pulses is generated independent of frequency. Bursts from 0 to 9999 pulses in length may be produced, and can be triggered via an external signal manually or with an HP-IB command.

### Wide Temperature Range for System Reliability

The HP 8160A's and 8161A's 0-50°C operating range ensures calculable performance. Indeed, temperatures will generally be between 20-40°C where there is no derating factor.

### User Features

#### Fast, Reliable Setup

Microprocessor control promotes highly accurate pulses. Parameters are directly entered via the instrument's keyboard, and are then displayed on numeric LED's with 3-digit resolution.

In bench applications, the vernier controls give a fine adjust capability to "tweak-in" any pulse parameter. You can increment or decrement the selected parameter either in single steps or at speed.

Error detection by the microprocessor further simplifies pulse setup by solving the old problem of incompatible settings. Should pulse width exceed pulse period, for example, the microprocessor indicates a TIMING error. All possible mis-settings are detected and the type of error is indicated to aid rapid correction.

#### HP-IB Programming

Microprocessor control over all interface functions makes remote programming as easy and straight-forward as manual control. The instruments employ keystroke programming so that data entry via the HP-IB is an exact simulation of manual entry. Bus commands for each front panel key simply replace manual keystrokes.

#### Parameter Storage

Complete parameter and mode information for 9 independent instrument set-ups can be stored. Waveforms may be stored and recalled either manually or via the HP-IB.

By utilizing a single command to recall an entire instrument set-up, controller time is saved. In simple repetitive testing applications, storage of test waveforms gives a high degree of user convenience without an external controller.

# PULSE GENERATORS

## Programmable Precision Pulse Generators (cont'd)

### Models 8160A, 8161A

#### Learn Mode

When interrogated by the system controller, the instruments output a character string to the interface bus. This string completely describes the pulser's current set-up or any one of its stored parameter sets. Using Learn Mode, you can enter and try out waveforms manually and then automatically transfer them via the HP-IB to the controller for storage in a program.

#### Verification Software for the 8160A

Test system accuracy is guaranteed by accessory software which verifies the HP 8160A's performance standards. The software is fully documented and comes recorded on a cassette suitable for HP Model 9825A Desktop Computer.

In the event of a failure, downtime is minimized because the software also delivers diagnostic information to accelerate repair and calibration.

#### Specifications

(50-ohm source into 50-ohm load). Standard instruments are single channel. Option 020 provides independent dual channels with common pulse period.

Timing (with minimum transitions)	HP Model 8160A	HP Model 8161A
<b>Period</b> Range: Accuracy: Max Jitter:	20 ns to 999 ms. ±3% of progr value ±0.3 ns (period < 100 ns); ±2% of progr value (period ≥ 100 ns). 0.1% of progr value + 50 ps.	10 ns to 980 ms. ±3% of progr value ±0.5 ns (period < 100 ns); ±2% of progr value (period ≥ 100 ns). 0.1% of progr value + 50 ps.
<b>Delay, Double Pulse, Width</b> Delay Range: Double Pulse Range: Width Range: Accuracy: Max Jitter:	0.0 ns to 999 ms. 20.0 ns to 999 ms. 10.0 ns to 999 ms. ±1% of progr value ±1 ns. 0.1% + 50 ps (≤999 ns); 0.05% (999 ns < -≤9.99 μs); 0.005% (>9.99 μs).	0.0 ns to 990 ms. 8.0 ns to 990 ms. 4.0 ns to 990 ms. ±1% of progr value ±1 ns. 0.1% + 50 ps (≤999 ns); 0.05% (999 ns < -≤9.99 μs); 0.005% (>9.99 μs).
<b>Output Characteristics</b>  <b>Output Levels</b> High Level Range: Low Level Range: Amplitude: Level Accuracy:  Settling Time:	<b>50 Ω into 50 Ω</b> -9.89 V to 9.99 V. -9.99 V to 9.89 V. 0.10 V min, 9.99 V max. ±1% of progr value ±1% of ampl ±50 mV. 40 ns.	<b>50 Ω into open or 1 kΩ into 50 Ω</b> -19.7 V to 19.9 V -19.9 V to 19.7 V 0.2 V min, 19.9 V max -4.95 V to 5.00 V. -5.00 V to 4.95 V. 0.06 V min, 5.00 V max. ±1% of progr value ±3% of ampl ±25 mV. 20 ns plus transition time.
<b>Transition Times (10 - 90% amplitude)</b> Leading Edge: Trailing Edge: Accuracy: Linearity:	6.0 ns to 9.99 ms. 6.0 ns to 9.99 ms. ±3% of progr value ±1 ns. ±3% for transitions > 30 ns.	1.3 ns to 900 μs. 1.3 ns to 900 μs. ±10% of progr value ±1 ns. ±5% for transitions > 30 ns.
<b>Preshoot, Overshoot, Ringing:</b>	±5% of ampl ±10 mV.	±5% of ampl ±10 mV (may increase to ±10% of ampl ±10 mV for transitions < 2.5 ns).
<b>A ADD B:</b>	Adds channel A and B outputs (Opt 020 only).	Adds channel A and B outputs (Opt 020 only).
<b>Output Format:</b>	Normal/Complement Selectable. (Independently selectable in each channel in Option 020.)	Simultaneous Normal and Complement Outputs. (Independently selectable in each channel in Option 020.)
<b>Source Impedance:</b>	50 ohm/1 kohm selectable.	50 ohm.

**Operating modes:** Normal, Trigger, Gate, Ext Burst (0-9999 pulses).

**HP-IB capability:** all modes and parameters can be programmed. Talk mode for status, error messages, stored parameters.

**Memory:** 9 programmable locations\*,  
1 location for active operating state\*,  
1 location with fixed parameter set.

**Capacity:** 1 complete operating state per location.  
\*Battery back-up for power-off storage

#### General

**Recalibration period:** 1 year.

**Repeatability:** factor 2 better than specified accuracy.

**Operating temperature:** 0°C to 50°C (Specifications apply from 20°C to 40°C. Accuracy derating factors for 0°C to 20°C and 40°C to 50°C).

**Power:** 115/230 V ac + 10%, -22%, 48-66 Hz; 675 VA max.

**Weight:** net 20.8 kg (46 lbs). Shipping 25 kg (55 lbs).

**Size:** 178 H x 426 x 530 mm D (7" x 16.8" x 20.9").

#### Ordering Information

##### HP 8160A/8161A Programmable Pulse Generator\*

**Opt. 001:** Rear panel inputs and outputs

**Opt. 020:** Second channel (Rate common)

**Opt. 700:** Built-in MATE/CHL compatibility

**Opt. 907:** Front handle kit (P/N HP 5061-9690)

**Opt. 908:** Rack flange kit (P/N HP 5061-9678)

**Opt. 909:** Opt 907, 908, combined (P/N HP 5061-9684)

**Opt. 910:** Set of Operating/Progr. and Service manuals

**Opt. W30:** Two additional years of HP service

\* HP-IB cables not supplied, see page 569

☞ Fast-Ship product—see page 734