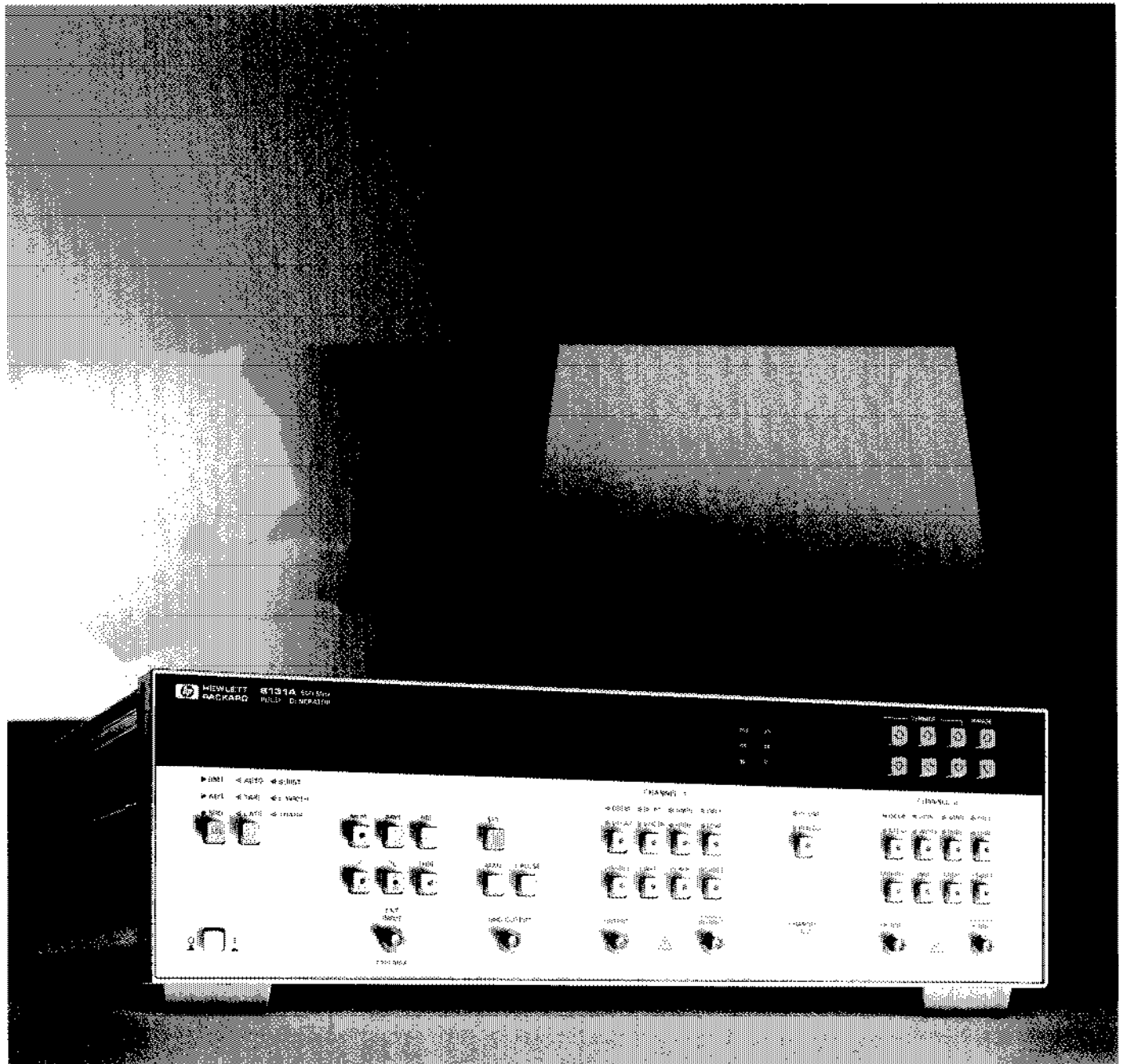


500 MHz PULSE GENERATOR



MODEL HP 8131A

TECHNICAL DATA MARCH 1989



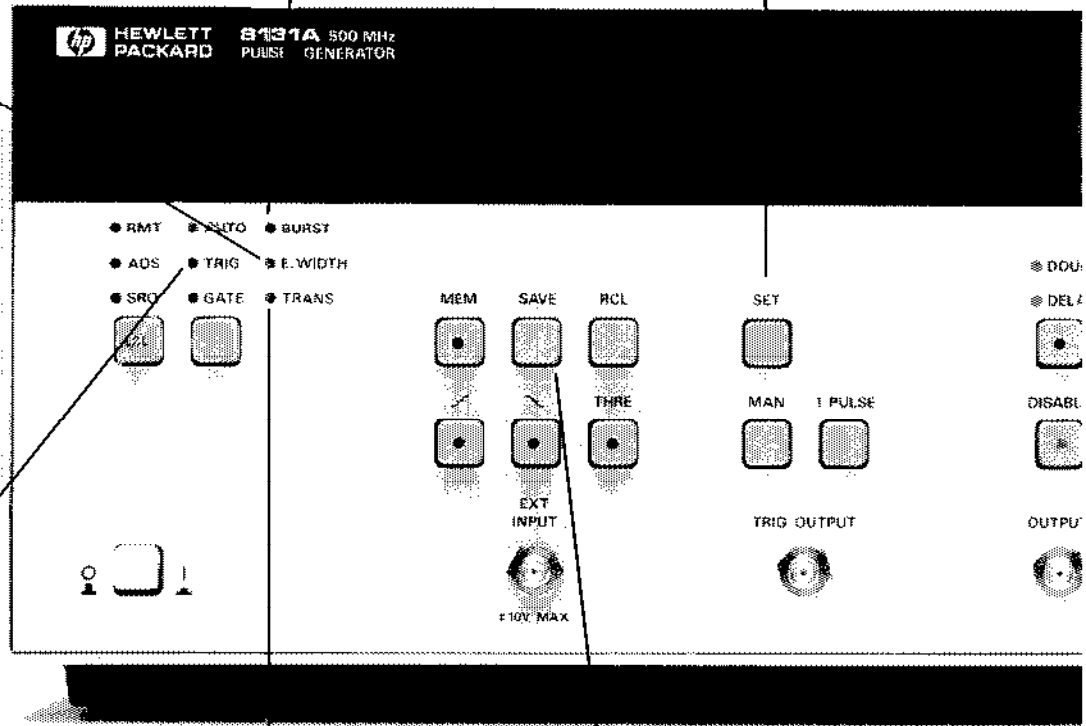
200 ps EDGES, 5 V SWING...ALL THE POWER AND SPEED YOU NEED

FAST AND FLEXIBLE...

External Width:
for reshaping of noisy
or degraded pulse signals

Burst:
up to 9999 pulses for
testing sequential
circuits like counters

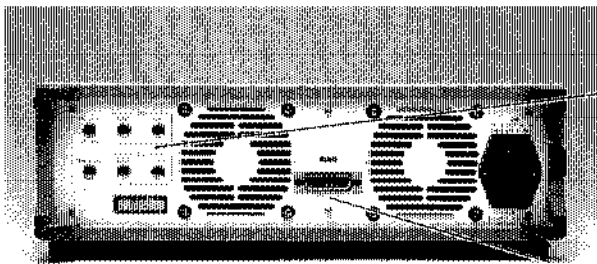
Set:
immediate, valid signal
at any desired period



Trigger Modes:
Full trigger capabilities
offered

Save/Recall keys:
up to 19 complete
settings can be stored in a
non-volatile memory

Transducer Mode:
extends operating range up
to 1 GHz squarewave



Option 001:
optional rear panel
connections, suitable for
use in ATE operation

HP-IB:
easy programming of all
parameters and modes is
offered by the HP 8131A

...PROGRAMMABLE AND RELIABLE

On-duration:
definable as duty-cycle
or pulse-width

Best case resolutions:
timing: 10 ps
voltage: 10 mV

Output voltage:
can be programmed in terms
of amplitude and offset,
or high and low level

Rapid parameter entry:
with Range key and
individual Vernier key for
each display digit

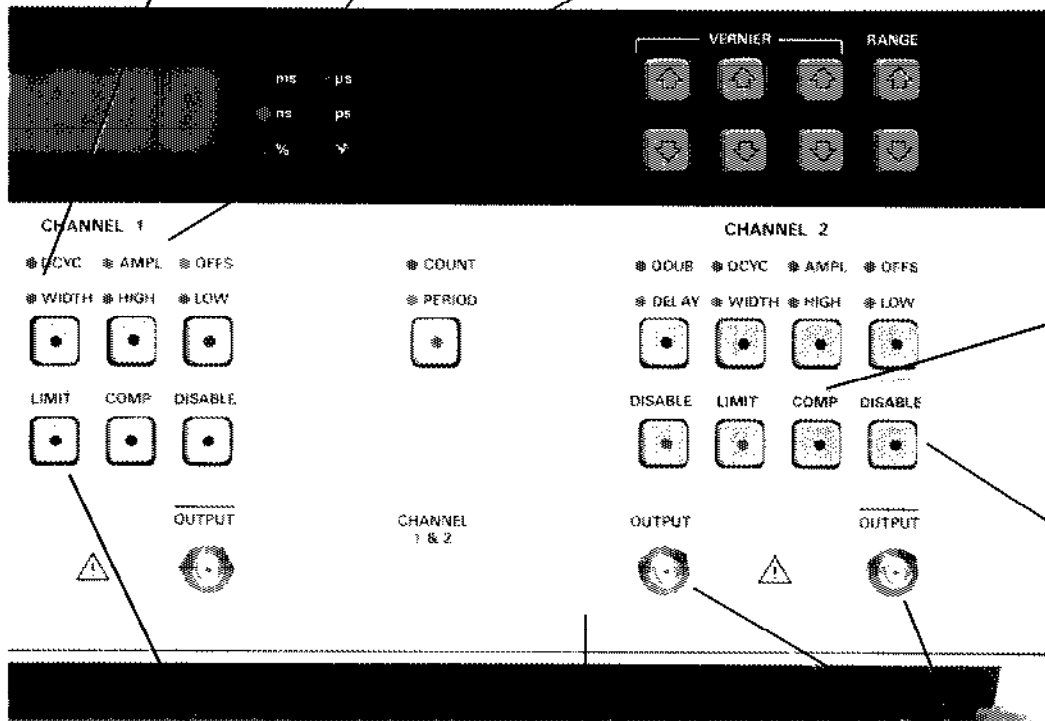
Complement key:
transposes outputs at the
touch of a key

Disable key:
disconnects output

Limit key:
declares present levels
as limits to protect
the device-under-test

Second channel:
Option 020 adds a full
synchronous channel.

Output and Output bar:
Simultaneous normal and
complement outputs for
each channel

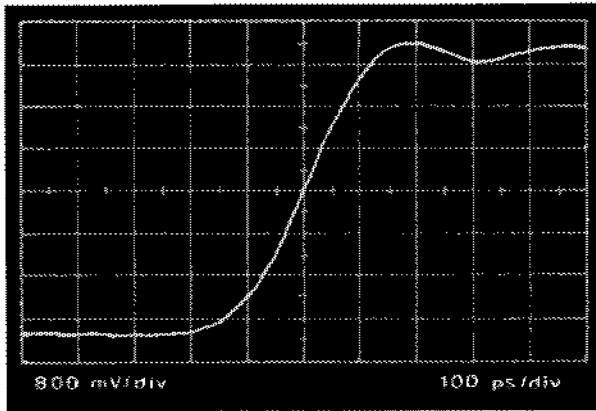


HP 8131A one channel version

Key Specifications

- * 200 ps fixed transition times
- * 500 MHz repetition rate
- * 5 V p-p amplitude into 50 Ω
- * second channel (optional)
- * fully HP-IB programmable

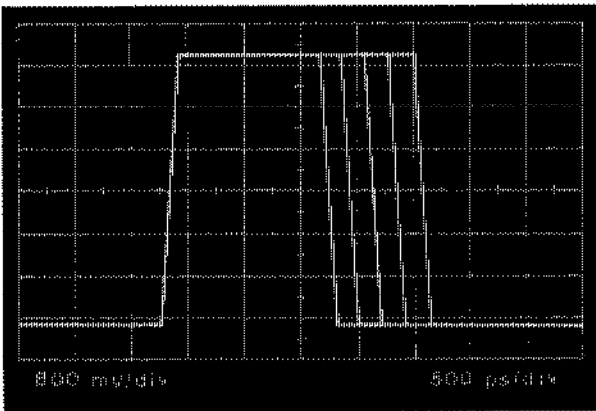
EXCELLENT PERFORMANCE AND PRECISION...



200 ps fixed leading and trailing edge

200 ps Transition Time

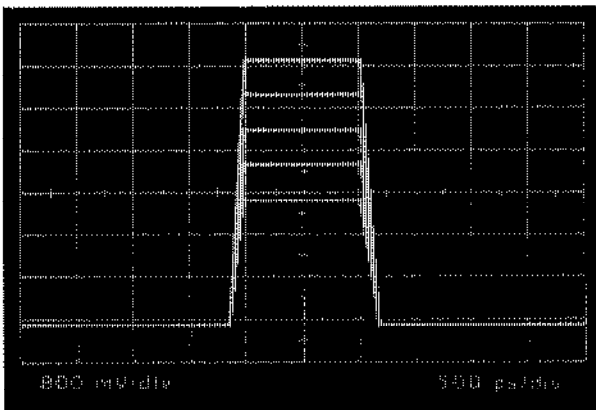
Transition times of 200 ps from the 10% to 90% points, or 150 ps (typical) from the 20% to 80% points enable repeatable and reliable timing measurements on high speed digital circuits. Since compromises in edge-speed directly affect your measurement accuracy, the clean, sharp transitions offered by the HP 8131A minimize errors due to threshold uncertainties. Matching the requirements of the most advanced CMOS, BICMOS, 10kH-ECL and GaAs devices, you now can characterize components and circuits with repetition rates up to the order of 1 GHz (in Transducer Mode).



10 ps minimum timing resolution

10 ps Timing Resolution

With a timing resolution of about an order of magnitude higher than typical ECL-gate delays, timing relationships can be easily and reliably examined because time-window uncertainties are eliminated. Thus, you can analyze time or energy related events caused by spikes down to 500 ps. Even precise setup-and hold-time measurements are no problem because individual channels (HP 8131A with Option 020 Second Channel) simulate the required clock and data waveforms.



10 mV minimum amplitude resolution

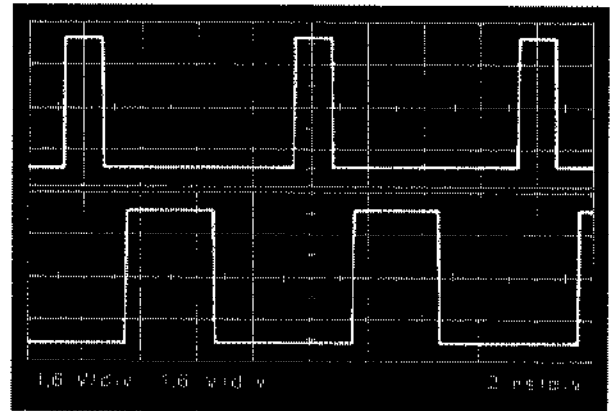
5V Amplitude and 10 mV Resolution

With 5 V pulse amplitude into 50 ohm you can drive high speed technologies, such as advanced CMOS, BICMOS, 10kH-ECL, and GaAs. In addition, you now can test the excess-voltage immunity of your high speed components and evaluate crosstalk caused by 5 V, 200 ps transitions. Threshold measurements are improved because the useful 10 mV resolution means that you can close in gradually. Minimum signal sensitivity down to 100 mV can be tested using a direct connection to the HP 8131A. Naturally, attenuators can be inserted for smaller signal amplitudes.

...TO MEET YOUR HIGH-SPEED REQUIREMENTS

500 MHz Repetition Rate

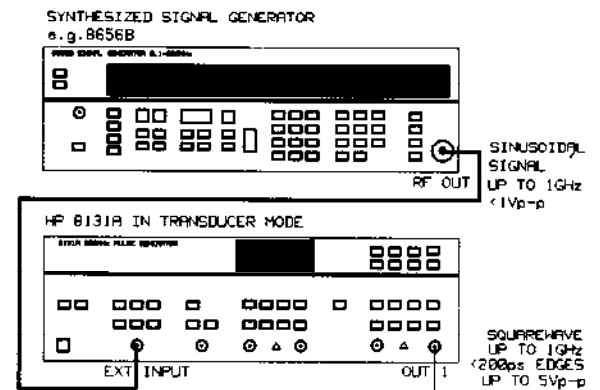
The 500 MHz repetition rate of the HP 8131A establishes a new class of high-speed programmable pulse generator, letting you test the maximum toggle rate of your BICMOS, 10kH-ECL, and even complex GaAs devices. Now, it is possible to perform functional and parametric tests of fast digital circuits under program control. For engineering evaluations, this means more reliable tests under repeatable conditions, plus easy documentation of test results. In many cases, the HP 8131A will allow at-speed testing for the first time, thus increasing your confidence in the performance of your device and ensuring high quality of your product.



different pulse-widths, channel 2 delayed

1 GHz Transducer Mode

If you need to functionally test your component at frequencies beyond 500 MHz, the 1 GHz transducer mode can convert an external sinewave into a squarewave with transition times of 200 ps, and amplitudes up to 5 V swing into 50 ohm. Especially if you need a very fast, programmable clock source, the combination of the HP 8131A and a microwave signal generator is ideal.



HP 8131A in Transducer Mode

Fully HP-IB Programmable

The HP 8131A is the first product that offers 200 ps edge speed in a fully programmable product which makes it extremely usefull not only in R&D environments but also in income inspection, e.g., testing high speed components, and in high-speed production test applications. In production, the programmability opens new possibilities to functionally test high-speed digital components with significantly higher throughput under well-defined conditions, and to do detailed analysis of critical level and timing conditions in ATE (Automatic-Test-Equipment) applications.

```

10 'Programming example for the HP8131A
20 'set-up number: 7
30 'Test signals for set-up and hold time measurement
40
50 Pq=718
60
70 OUTPUT Pq::PULS:TIM:PER 4.00E-09
80 OUTPUT Pq::PULS:TIM:DEL 1.00E-10:WIDT 2.00E-09
90 OUTPUT Pq::PULS:LEV:AMPL 5.0:OFFS 0.0
100 OUTPUT Pq::PULS2:TIM:DEL 0.0E-09:WIDT 2.20E-09
110 OUTPUT Pq::PULS2:LEV:HIGH 2.5:LOW -2.5
120 OUTPUT Pq::OUTP1:PULS:STAT 1:OUTP2:PULS:STAT 1
130
140
150 'Delay and Width loop
160
170 I=1+1
180 WAIT 2
190 Vdel=[*1.00E-11
200 Wwid=2.20E-9-(I*2.00E-11)
210 OUTPUT Pq::PULS2:TIM:DEL:Vdel
220 OUTPUT Pq::PULS2:TIM:WIDT:Wwid
230 IF I<10 THEN GOTO 170
240 END
    
```

device commands in a BASIC program

SPECIFICATIONS

Specifications describe the instruments warranted performance. Non-warranted values are described as 'typical'. All specifications apply after a 30 minute warm-up phase with 50 ohm load resistance at all outputs, and are valid at 0°C to 55°C ambient temperature.

Timing Parameters

(Specifications are measured at 50% of amplitude).

Common Specifications

Resolution: 3 digits, best case: 10 ps
 Repeatability: factor 4 better than accuracy
 RMS-jitter: 0.025% of programmed value + 15 ps
 (0.05% of programmed value + 15 ps
 for range 10 ns to 100 ns)

Period

Range: 2 ns to 99.9 ms
 Accuracy: $\pm 5\%$ of programmed value ± 100 ps

Delay (measured between trigger out and main out)

Fixed delay (trigger to main out): 20 ns
 Variable range: from 0 ns to 99.9 ms
 Accuracy: $\pm 5\%$ of programmed value ± 1.5 ns

Double Pulse (period ≥ 5 ns, double pulse and delay are mutually exclusive)

Range: 2 ns to 99.9 ms
 Accuracy: $\pm 5\%$ of programmed value ± 250 ps

Width

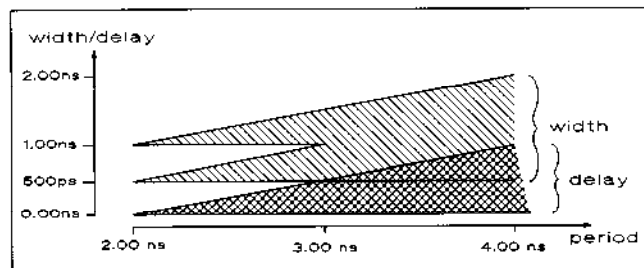
Range: 500 ps to 99.9 ms
 Accuracy: $\pm 5\%$ of programmed value ± 250 ps

Maximum values versus Period (Table 1)

PERiod (ns)	Width	Delay	PERiod (ns)	Double Pulse
2.00	500ps or 1ns	0ns	2.00 ... 4.99	n/a
2.01 ... 2.99	50% of PER *	50% of PER - 1ns	5.00 ... 9.99	50% of PER **
3.00 ... 4.99	50% of PER	70% of PER - 1ns	≥ 10.0	90% of PER - 4ns
5.00 ... 19.99	70% of PER - 1ns	70% of PER - 2ns		
≥ 20.0	90% of PER - 5ns	90% of PER - 6ns		

* for width < 1 ns: max width is 50% of PER - 0.5 ns

** PER < 5.72 ns, DOUB is less than 50% of PER



Transition Times (for leading and trailing edges)

10% - 90% of amplitude: < 200 ps, 300 mV to 3 V range
 20% - 80% of amplitude: < 200 ps, 100 mV to 5 V range

Error Detection:

Incompatible programmed values are indicated by flashing parameter buttons and the word "error". In order to allow hardware tolerances to be fully exploited, the outputs are not disabled. An extinguished error display is a certain indication of valid outputs. Table 1 gives values above which an error will be indicated.

Output Levels

(Output levels double when driving into open circuits. Instrument disables outputs if voltage exceeds ± 6.5 V)

High Level: - 4.90 V to + 5.00 V

Low Level: - 5.00 V to + 4.90 V

Resolution: 3 digits, best case: 10 mV

Accuracy: $\pm 1\%$ of programmed value $\pm 3\%$ of amplitude ± 40 mV

Repeatability: factor 4 better than accuracy

Settling time: 10 ns

Pulse Performance

Overshoot: $< 15\%$ of amplitude ± 20 mV

Ringing: $< 15\%$ of amplitude ± 20 mV

Reflections: $< 10\%$ at 1 GHz

Supplemental Performance Characteristics

(Values describe typical, non-warranted performance)

Duty Cycle (width and duty cycle are mutually exclusive)

Range: 1% to 90%

Resolution: 1%

Subject to width and period specifications

Inputs and Outputs

All inputs and outputs have SMA connectors on the front panel. Rear panel connectors are optional.

Main Outputs (differential outputs)

Amplitude: 100 mV p-p to 5 V p-p into 50 Ω

Offset: - 4.95 V to 4.95 V into 50 Ω

Source impedance: 50 $\Omega \pm 1\%$

Max external voltage: ± 5 V

Short circuit current (I_{SC}): $- 200$ mA $\leq I_{SC} \leq + 200$ mA

Skew between differential outputs of same channel: < 100 ps

External Input

a) Trigger, Gate, Burst, and Ext Width mode:

Trigger slopes can be selected positive or negative.

Input impedance: 50 $\Omega \pm 5\%$

Threshold: - 5 V to + 5 V

Resolution: 100 mV

Max input voltage: ± 10 V

Input transition: < 50 ns

Input frequency: dc to 500 MHz

Min pulse width: 1 ns

Input sensitivity: ≥ 300 mV p-p

b) Transducer mode

Input signal ac coupled, signals with 50% duty cycle required

Input impedance: 50 $\Omega \pm 5\%$

Input transition: < 50 ns

Input frequency: 10 MHz to 1 GHz

Input sensitivity: ≥ 600 mV p-p

Trigger Output

Levels: high at 0 V, low at - 0.6 V

Source impedance: 50 $\Omega \pm 10\%$

Delay from external input to trigger output: < 16 ns

Max external voltage: ± 5 V

SUPPLEMENTAL PERFORMANCE CHARACTERISTICS

Values describe typical, non-warranted performance

Trigger Modes

Auto: continuous pulse stream.

Trigger: each active input transition generates a single output pulse or double pulse.

Gate: external signal enables period generator. First output pulse synchronous with active edge. Last pulse always completed.

External Burst: each active input transition generates a preprogrammed number of pulses (1 to 9999), minimum burst period is 5 ns.

External Width: pulse recovery (external edges toggle output). Output levels are selectable.

Transducer: external sinewave (up to 1 GHz) toggles output. Output levels are selectable.

Manual: simulates an external input signal.

1 Pulse: in Trigger, Gate and Burst mode one pulse or double pulse is generated.

Output Capabilities

Limit: maximum high and low levels into 50 ohm can be limited to protect the device under test. Pushing the limit key declares present levels as limits which then cannot be exceeded as long as the mode is active.

Complement: normal/complement selectable.

Disable: relays connect/disconnect outputs.

Set: sets parameters to fixed ratio relative to period (delay = 0 ns, width = 50% of period; period, high level, and low level = current values).

Additional Features

HP-IB Capabilities

All modes and parameters are programmable, downloadable and uploadable. ASCII and binary formats are supported.

Programming times (ms)

Code 8131A version	Binary download of a complete parameter set				ASCII* download of parameters		
	upload transfer	download transfer	implemen- tation	total	one transfer + implementation	two	three
1 channel	110	30	140	170	<60	<90	<110
2 channel	110	30	190	220	-	-	-

* Add 25 ms for "enable output" statements

HP-IB Interface Function Code: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0

Non-volatile Memory

Current settings are saved on power-down. Additionally, 19 complete set-ups can be stored.

Store: stores complete setting in displayed location.

Recall: recalls complete setting from displayed location.

General

Environmental

Storage temperature: -40°C to +65°C

Operating temperature: 0°C to 55°C

Humidity (0°C to 40°C): 95% R.H.

Power

100-120/220-240 V rms, ±10%, 250 VA max., 48-66 Hz

Weight

Net: 20 kg (44.4 lb)

Shipping: 28 kg (62.2 lb)

Dimensions (H*W*D*)

145mm * 426 mm * 525 mm

(5.70 in * 16.75 in * 20.65 in)

Recalibration Period: 1 year recommended

HP 8131A ORDERING INFORMATION

HP 8131A Pulse Generator

Options

- 001 Rear Panel Connectors
- 020 Second Channel
- 908 Rack Mount Flange Kit (P/N 5062-3977)
- 910 Set of Operating/Programming and Service Manuals
- 915 Service Manual (P/N 08131-90001)
- 916 Additional Operating and Programming Manual (P/N 08131-90011)
- W30 Two additional years of return-to-HP service

Accessories

- HP 8493A #010, #020 10, 20 dB Attenuator
required for sensitivity testing below 100 mV
- P/N 8120-4948 Cable, Coax (SMA)
- P/N 1250-1200 SMA-BNC Adaptor
- P/N 15432A 300 ps Transition Time Converter
- P/N 15433A 500 ps Transition Time Converter
- P/N 15434A 1 ns Transition Time Converter

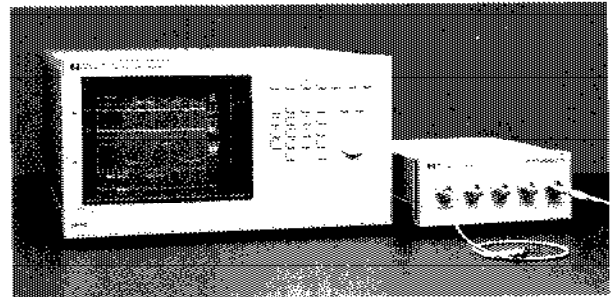
Other recommended equipment

Receiving end:

- HP 54121T 20 GHz Digitizing Oscilloscope
- HP 54122T 12.4 GHz Digitizing Oscilloscope

1-GHz Source:

- HP 8656B 990 MHz Synthesized Signal Generator
- HP 8642A 1057.5 MHz Synthesized Signal Generator
- HP 8662A 1280 MHz Synthesized Signal Generator



For more information, call your local HP sales office listed in the telephone directory white pages. Ask for the electronic Instruments Department or write to Hewlett-Packard; U.S.A.-P.O.Box 10301, Palo Alto, CA 94303-0890. Europe/Middle East/Africa-Central Mailing Department, P.O.Box 529, 1180 AM Amstelveen, the Netherlands. Canada-6877 Goreway Drive, Mississauga, L4V1M8, Ontario. Japan-Yokogawa-Hewlett-Packard Ltd.,3-29-21, Takaido-Higashi, Suginami-ku Tokyo 168. Elsewhere in the world, write to Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, CA 94304.

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