HEWLETT PACKARD

HP 81110A 330/165 MHz Pulse/Pattern Generator
HP 81104A 80 MHz Pulse/Pattern Generator

Technical Specifications

Compatible family

The HP 81110A and HP 81104A pulse/pattern generators belong to the HP 81100 family. All members have the same programming/user interfaces, which are compatible with the well-established HP 8110A. Migration is therefore easy and cost-effective.

Signals for testing digital designs and components

The HP 81110A and HP 81104A generate all the standard pulses and digital patterns needed to test current logic technologies (CMOS, TTL, LVDS, ECL, etc.). With the optional second channel, multi-level and multi-timing signals up to 60 MHz can be obtained using the internal channel addition feature.

- Variable pulse parameters in pattern mode as well as in pulse mode.
- Synchronously triggerable.
- Simulation of reflections/ distortions.
- Three/four-level codes.

Glitch-free timing changes

Now you can sweep your timing values without the danger of spurious pulses or dropouts that could cause measurement errors. (Applies to continuous mode, values < 100 ms, consecutive values between 0.5 and twice the previous value).

Reliable measurements

Both models provide clean, accurate pulses with excellent repeatability thus contributing to measurement integrity.

The HP 81110A features self-calibration for more accuracy. It also offers a choice of output modules: the HP 81111A 165 MHz, 10 V module with variable transitions and the HP 81112A 330 MHz, 3.8 V module which has differential outputs and two selectable transition times.

Easy-to-use

Features such as the clear graphical display, autoset, help, store/recall, preset TTL/ECL levels, selectable units (such as current/voltage, width/duty-cycle), and load compensation ensure a high level of convenience.

Smooth integration into automated test systems

The HP 81110A and HP 81104A can be integrated easily into all phases of test system development. The HP 81104A features 100% upward compatibility, ensuring that growth with future needs is as easy as just exchanging the instruments physically. This results in low integration costs, in addition to low costs of ownership through proven hardware reliability.

HP 81100 Family of Pulse/Pattern Generators

Key Features

- 1 or 2 output channels.
- HP 8110A user interface.
- Variable transitions.
- Up to 10 Vpp (20 Vpp) into 50 Ω at 165 MHz.
- 5 ps timing resolution.
- 0.01% frequency accuracy.
- 16 kbit patterns per channel.
- Analog channel addition.
- Fully SCPI programmable.
- Board range of trigger and synchronization capabilities.
- Dropout-and glitch-free change of any timing parameters.
- 8.9 cm height, full rack width.
- Graphical display.
- Modular and user-upgradable.

Specifications

Specifications describe the instrument's warranted performance. Non-warranted values are described as typical. All specifications apply after a 30 minute warm-up phase with 50 Ω source/load resistance and separate channels. All specifications are valid from 0°C to 55°C ambient temperature.

Timing Characteristics

Measured at 50% amplitude at fastest transitions in continuous mode and 50 Ω source impedance.

Mainframe Output module	HP 81104A HP 81105A	HP 81110A HP 81111A	HP 81110A HP 81112A
Frequency range from 1 KΩ [1]	1 mHz to 80 MHz Up to 50 MHz typ.	1 mHz to 165 MHz Up to 60 MHz typ.	1 mHz to 330 MHz N/A
Timing resolution	3.5 digits, 5 ps best case		
RMS jitter (period, width, delay) With PLL With VCO [2]	 ± 0.001% ± 15 ps ± 0.01% ± 15 ps		
Period range	12.5 ns to 999.5 s	6.06 ns to 999.5 s	3.03 ns to 999.5 s
Accuracy with PLL	± 0.01% (± 5%) [2]	± 0.01% (± 0.5% typ. after self-cal., ± 3% without self-cal.) [2]	
Width range	6.25 ns to (period - 6.25 ns)	3.03 ns to (period - 3.03 ns)	1.515 ns to (period - 1.515 ns)
Accuracy	± 5% ± 250 ps	± 0.5% ± 250 ps typ. [3] ± 3% ± 250 ps [4]	
Add. variable delay range [5]	0 ns to (period - 12.5 ns)	0 ns to (period - 3.03 ns)	
Accuracy [6]	± 5% ± 0.5 ns	± 0.5% ± 0.5 ns typ. [3] ± 3% ± 0.5 ns [4]	
Double pulse delay range	(width + 6.25 ns) to (period - width - 6.25 ns)	(width + 3.03 ns) to (period - width - 3.03 ns)	(width + 1.5 ns) to (period - width - 1.5 ns)
Min. period	25 ns (40 MHz) typ.	12.2 ns (82 MHz) typ.	6.06 ns (165 MHz) typ.
Accuracy	± 5% ± 250 ps	± 0.5% ± 150 ps typ. [3] ± 3% ± 150 ps [4]	
Transition time range (10/90)	3 ns to 200 ms variable	2 ns to 200 ms variable	0.8 ns or 1.6 ns selectable
Minimum (with overprogramming)	≤ 3 ns	≤ 2 ns/1.4 ns typ. for ECL levels (20/80) 5 ns typ. for 1 KΩ source imped.	≤ 600 ps for Vpp ≤ 1 V 450 ps typ. for ECL levels (20/80) ≤ 900 ps for Vpp > 1 V
Accuracy	± 10% ± 200 ps		
Linearity	3% typ. for transitions > 100 ns		N/A

Notes:

[1] Source impedance is selectable from 50 Ω or 1 KΩ for the HP 81105A and HP 81111A.
[2] If the startable oscillator (VCO) is used (PLL not active).
[3] After self-calibration.
[4] Without self-calibration.
[5] 0 ns to (period - 17.6 ns) in ext. width mode.
[6] Changing of amplitude may add 0.5 ns.

Burst count: 2 to 65536 (single or double pulses).
Delay: delay, phase, or % of period.
Double pulse and delay: mutually exclusive.
Duty cycle: set between 0.1% and 95% (subject to width limits. 99.9% with overprogramming).
Transition times: leading/trailing edge or % of width. Leading and trailing edges are independent (HP 81111A/HP 81105A) within one of the following overlapping segments (1:20 ratio): 2 ns (3 ns) - 20 ns, 10 ns - 200 ns, 100 ns - 2 ms, 1 µs - 20 µs, 10 µs - 200 µs, 100 µs - 2 ms, 1 ms - 20 ms, 10 ms - 200 ms.
Output timing fidelity: period, delay, and width are continuously variable without any output glitches or dropouts.
Repeatability: is typ. four times better than accuracy.
Overprogramming: all parameters of the HP 81110A, except transitions, can be set to whatever the 330 MHz timing system will allow. This applies also when the HP 81111A output module is used.

Level/Pulse Performance Characteristics

Level specifications are valid after a 5 ns (HP 81112A) or 30 ns (HP 81111A/HP 81105A) typical settling time.

Mainframe Output module	HP 81104A HP 81105A	HP 81110A HP 81111A	HP 81110A HP 81112A
Amplitude 50 Ω into 50 Ω 1 KΩ into 50 Ω	100 mVpp to 10.0 Vpp 200 mVpp to 20.0 Vpp		100 mVpp to 3.8 Vpp N/A
Level window 50 Ω into 50 Ω 1 KΩ into 50 Ω	-10.0 V to +10.0 V -20.0 V to +20.0 V		-20 V to +3.8 V N/A
Accuracy 50 Ω into 50 Ω 1 KΩ into 50 Ω	± (3% + 75 mV) ± (5% + 150 mV) [1]	± (1% + 50 mV) ± (1% + 100 mV) [1]	± (2% + 50 mV) N/A
Resolution 50 Ω into 50 Ω 1 KΩ into 50 Ω	10 mV 20 mV		10 mV N/A
Output connectors	BNC single-ended		BNC differential
Source impedance	Selectable 50 Ω or 1 KΩ		50 Ω only
Accuracy	Typ. ± 1%		
Max. external voltage	± 24 V		-2.2 V to +5.5 V
Short circuit current	± 400 mA max. (doubles for channel addition)		-84 mA to +152 mA
Dynamic crosstalk	< 0.1% typ.		
Baseline noise	10 mV RMS typ.		4 mV RMS typ.
Overshoot/preshoot/ringing	± 5% of amplitude ± 20 mV		± 5% of amplitude ± 50 mV

Note:
[1] In ± 19 V level window.

Level parameters: voltage or current, high or low level, offset or amplitude.
Load compensation: the actual load value can be entered (for loads ≠ 50 Ω) to display actual output values. (Applies to the HP 81105A and HP 81111A only).
On/off: relays connect/disconnect output (HiZ).
Normal/complement: selectable.
Limit: programmable high and low levels can be limited to protect the device-under-test.

Channel Addition

If the instrument is equipped with 2 output modules, channel 2 can be added to channel 1 internally. In this case the second output is disabled. The additional fixed delay on the second channel is typ. 2.5 ns. The following parameters differ from the above specifications if two output modules (HP 81105A/HP 81111A) are added.

Mainframe	HP 81104A with two HP 81105A output modules	HP 81110A with two HP 81111A output modules
Amplitude 50 Ω into 50 Ω 1 KΩ into 50 Ω	100 mVpp to 20.0 Vpp 200 mVpp to 20.0 Vpp	
Source impedance	Selectable from 50 Ω or 1 KΩ	
Level window 50 Ω into 50 Ω 1 KΩ into 50 Ω	-20.0 V to +20.0 V -20.0 V to +20.0 V	
Max. frequency 50 Ω channel 1 KΩ channel	60 MHz typ. 15 MHz typ.	
Min. transitions 50 Ω channel 1 KΩ channel	2 ns typ. (channel one) 5 ns typ. (channel two) 20 ns typ. both channels	

Pattern Mode

Pattern length: 16 kbit/channel and strobe output.
Output format: RZ (return to zero), NRZ (non-return to zero), DNRZ (delayed non-return to zero).
Random pattern:
PRBS 2^n-1, n = 7,8,...,14.

Trigger Modes

Continuous: continuous pulses, double pulses, bursts (single or double pulses), or patterns.
External triggered: each active input transition (rising, falling or both) generates a single or double pulse, burst, or pattern.
External gated: the active input level (high or low) enables pulses, double pulses, bursts, or patterns. The last single/double pulse, burst, or pattern is always completed.
External width: the pulse shape can be recovered. Period and width of an external input signal is maintained. Delay, levels, and transitions can be set.
Manual: simulates an external input signal.
Internal triggered: internal PLL replaces an external trigger source. Pulses, double pulses, bursts, or patterns can be set.

Inputs and Outputs

Clock input/PLL reference and external input

PLL reference: (BNC connector at rear panel). The internal PLL is locked to an external 5 MHz or 10 MHz reference frequency.
Clock input: (BNC connector at rear panel). The output period is determined by the signal at CLK input.
Ext. input: used for trigger, gate or external width.
Input impedance: 50 Ω/10 kΩ selectable.
Threshold: -10 V to +10 V.
Max. input voltage: ± 15 Vpp.
Sensitivity: ≤ 300 mVpp typical.
Transitions: < 100 ns.
Frequency: dc to max. frequency of output module.
Min. pulsewidth: 1.5 ns (as width of output module in external width mode).

Strobe output and trigger output

Strobe output: user-defined, 16 kbit pattern (NRZ) when in pattern mode.
Trigger format: one pulse per period with 50% duty cycle typical.
External mode: 1.5 ns typ. for HP 81110A. 5.9 ns typ. for HP 81104A.
Level: TTL or ECL selectable.
Output impedance: 50 Ω typical.
Max. external voltage: -2 V/+7 V.
Transition times: 1.0 ns typical for TTL, 600 ps typical for ECL.

User Interface

Overprogramming: all parameters can be overprogrammed (exceeding specifications) to fully exploit the hardware limits.
Setting check: warning messages indicate potentially conflicting parameters due to inaccuracy. Error messages indicate conflicting parameters.
Help key: displays a context-sensitive message.
Autoset key: resolves all timing conflicts.
Non-volatile memory: current setting is saved on power-down. Up to nine user settings and one fixed default setting can be stored in the instrument.
Clear memory: clears all nine user settings.
Memory card: 99 settings can be stored on a 1 MB PCMCIA card (MS-DOS®).

Remote Control

Operates according to IEEE standard 488.2, 1987 and SCPI 1992.0.
Function Code: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0.
Programming times: all checks and display off.

Typical delay (HP 81110A with HP 81111A output module) [1]			
Instrument mode	From	To	Typ. value
External width	EXT. INPUT	STROBE/TRIGGER OUT OUTPUT 1/OUTPUT 2	8.5 ns 19.5 ns
All other modes	EXT. INPUT/CLK INPUT	STROBE/TRIGGER OUT OUTPUT 1/OUTPUT 2	12.0 ns 26.0 ns
	STROBE/TRIGGER OUT	OUTPUT 1/OUTPUT 2	14.0 ns

Note:
[1] Subtract 4 ns from the typ. delay value when referring to OUTPUT1/2 for the HP 81112A output module and add 1 ns when referring to OUTPUT1/2 for the HP 81104A with the HP 81105A output module.

ASCII command	Typ. exec. time
One parameter or mode	30 ms typ.
Recall setting	250 ms typ.
16 k pattern transfer	600 ms typ.

General

Operating temperature:
0°C to +55°C.
Storage temperature:
-40°C to +70°C.
Humidity: 95% r.h. up to 40°C ambient temperature.
EMC: conforms to EN50082-1, EN 55011, Class A.
Noise emission: 5.7 bel typical.
Battery: Lithium CR2477-N.
Safety: IEC1010, CSA1010.
Power requirements:
100-240 Vac, ± 10%, 50-60 Hz;
100-120 Vac, ± 10%, 400 Hz.
Power consumption:
300 VA max.
Max. dimensions (H * W * D):
89 mm * 426 mm * 521 mm.
Weight: 9.2 kg net, 13.8 kg shipping.
Recalibration period: one year recommended.
Warranty: three years standard.

Ordering Information

The minimum configuration for a working instrument consists of a mainframe and one output module. The second output module can be added later. Output modules can be exchanged and retrofitted by the user.

The English Quick Start Guide (81110-91010) and Reference Guide (81110-91011) are supplied with each mainframe for all configurations. A memory card is not included.

HP 81104A 80 MHz Pulse/Pattern Generator Mainframe
Output module:
HP 81105A 80 MHz, 10 V

HP 81110A 330/165 MHz Pulse/Pattern Generator Mainframe
Output modules:
HP 81111A 165 MHz, 10 V
HP 81112A 330 MHz, 3.8 V

Note: Only add together output modules of the same module number. A combination of the HP 81111A and HP 81112A in one HP 81110A is not possible.

All options are orderable with the HP 81104A and HP 81110A mainframes.

Accessories

Opt UN2 Rear Panel Connectors (instead of front panel)
Opt 1CP Rack Mount and Handle Kit (5063-9219)
Opt 1CN Handle Kit (5063-9226)
Opt 1CM Rack Mount Kit (5063-9212)
Opt 1CR Rack Slide Kit (1494-0059)
Opt UFH 1 MB SRAM Memory Card (0950-3380)
HP 15104A Pulse Adder/Splitter

Quick Start Guide Language Options

Opt ABF French Guide (81110-91210)
Opt ABJ Japanese Guide (81110-91510)
Opt AB0 Taiwan Chinese Guide (81110-91610)
Opt AB1 Korean Guide (81110-91710)
Opt AB2 Chinese Guide (81110-91810)

Additional Documentation Options

Opt 0BW Service Manual (81110-91021)
81110-91031 Service Documentation (Component Level)

Support Options

Opt 1BP MIL Std. 45662A Calibration with Test Data
Opt UK6 Commercial Cal. Certificate
Opt W32 3 year Customer Return Calibration Coverage
Opt W34 3 year MIL Calibration Service
Opt W50 5 year Customer Return Repair Coverage
Opt W52 5 year Customer Return Calibration Coverage
Opt W54 5 year Customer Return Calibration Coverage

Related HP Literature

HP 81100 Family of Pulse/Pattern Generators, brochure, p/n 5967-6236E.

HP 81100 Family of Pulse/Pattern Generators, flyer, p/n 5968-0212E.

HP 81101A Pulse Generators, technical specifications, p/n 5967-6274E (Q4/98).

HP 81130A Pulse/Data Generator, technical specifications, p/n 5967-6237E (Q4/98).

For more information about the products see:

http://www.hp.com/go/dvt

For more information about Hewlett-Packard test & measurement products, applications, services, and for a current sales office listing, visit our web site, http://www.hp.com/go/tmdir. You can also contact one of the following centers and ask for a test and measurement sales representative.

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Englewood, CO 80155-4026
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Hewlett-Packard Canada Ltd.
5150 Spectrum Way
Mississauga, Ontario
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P.O. Box 999
1180 AZ Amstelveen
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