Agilent 81100 Family of Pulse Pattern Generators

Data Sheet – Version 1.3

Agilent 81110A

Signals for testing digital designs and components

The Agilent 81101A, 81104A, 81110A and 81130A generate all the standard pulses and digital patterns needed to test current logic technologies (CMOS, TTL, LVDS, ECL, etc.).

With the optional second channel on all of the models from 80 MHz to 660 MHz, multi-level and multi-timing signals can be obtained using the internal channel addition feature.

- Variable pulse parameters in pattern mode as well as in pulse mode (not on the 81130A)
- Synchronously triggerable
- Simulation of reflections/distortions
- (81104A, 81110A)
- Three/four-level codes (81104A, 81110A)

Flexible Pulses or Patterns for Digital Designs – Key Features

- Pattern mode on all models from 80 MHz to 660 MHz, including pseudo-random binary sequence
- The outputs of dual-channel instruments can be added (analog or EXOR, depending on model)
- User-retrofittable channels for most models
- Upward compatibility
- Individual solutions for frequencies up to 50, 80, 165, 330, 400 and 660 MHz
- 100% form/fit compatibility

Agilent Technologies

Glitch-free timing changes

Timing values can now be swept without the danger of misleading 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 on the 81101A, 81104A, 81110A).

Reliable measurements

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

The Agilent 81110A features self-calibration for more accuracy. It also offers a choice of output modules. The Agilent 81111A 165 MHz 10 V module with variable transitions.

Along with the Agilent 81112A 330 MHz 3.8 V module, which has differential outputs and two selectable transition times.

The Agilent 81130A offers a choice of output modules: the Agilent 81131A 400 MHz, 3.8 V module and the Agilent 81132A 660 MHz, 2.5 V module which has complementary outputs.

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.

Stimulate the device's environment

Today's devices can require very complex stimuli. To meet this, the Agilent 81130A can sequence and loop its memory for very deep patterns. RZ (return-to-zero), NRZ (non-return-to- zero) and R1 (return-to-one) formats are available. Digital channel addition allows the generation of signals with two different pulse widths and delays or of data rates up to 1.32 Gbit/s in one single channel.

Frequency range

The Agilent 81130A is designed and recommended for an operation in the frequency range of 170 kHz to 400/ 660 MHz. However it can be operated in the extended range down to 1 kHz.

Agilent 81100 - Family of Pulse Pattern Generators

Mainframes	81101A	81104A	81110A	81110A	81130A	81130A
Channel model	81101A	81105A	81111A	81112A	81131A	81132A
# of channels	1	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
Frequency range	1 mHz - 50 MHz	1 mHz - 80 MHz	1 mHz - 165 MHz	1 mHz - 330 MHz	1 kHz - 400 MHz	1 kHz - 660 MHz
Variable delay range	20 ns - 999.5 s	12.5 ns - 999.5 s	6.06 ns - 999.5 s	1.515 - 999.5	2.5 ns - 1 ms	1.5 ns - 1 ms
Period RMS - jitter	0.00 s - 999.5 s	0.00 s - 999.5 s	0.00 ns - 999.5 s	0.00 ns - 999.5 s	0.00 ns to 3.00 µs	0.00 ns to 3.00 µs
Width range	10 ns to 9.995 s	6.25 ns - 9.995 s	3.03 ns - 999.5 s	1.515 ns - 999.5 s	1.25 ns - (period-1.25 ns)	750 ps - (period - 750 ps)
Amplitude range	100 mV - 20.0 V[1]	100 mV - 20.0 V[1]	100 mV - 20.0 V[1]	100 mV to 3.8 V	100 mV to 3.8 V	100 mV - 2.5 V
Transition time range (10/90)	5.00 ns - 200 ms	3.00 ns - 200 ms	2.00 ns - 200 ms	800 ps or 1.6 ns selectable	800 ps or 1.6 ns selectable	500 ps typ. fixed
Dropout and glitch free timing change	Yes	Yes	Yes	Yes	No	No
Source impedance	50 Ω or 1 kΩ	50 Ω or 1 kΩ	50 Ω or 1 kΩ	50 Ω	50 Ω	50 Ω

1. Depends on selected impedance (all other values for 50 Ω source impedance into 50 Ω load).

2. 0.001% +15 ps with internal PLL as clock source.

3. Also avalable as VXI pulse pattern generators E8311A and E8312A.

81101A Specifications

Timing Characteristics

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

Mainframe	Agilent 81101A
Frequency range	1 mHz to 50 MHz
Timing resolution	3.5 digits, 5 ps best case
Period RMS jitter • With PLL • With VCO	 0.001% + 15 ps 0.01% + 15 ps
Period range • Accuracy with PLL /VCO	20 ns to 999.5 s ± 0.01% (±5%) (similar to RMS jitter)
Width range Accuracy	10.0 ns to (period - 10.0 ns) ±5% ±250 ps [1]
RMS jitter • Additional variable delay range • Accuracy [2]	0.01% + 15 ps 0 ns to (period -20 ns) ±5% ±1 ns
RMS jitter • Double pulse delay range	0.01% + 15 ps (width + 10.0 ns) to (period- width - 10.0 ns)
Accuracy	±5% ± 500 ps
Transition time range (10/90)	5 ns to 200 ms variable
Accuracy	±10% ±200 ps
Linearity	3% typ. for transitions > 100 ns

1. Changing of amplitude may add 0.5 ns.

2. Width accuracy specification is valid up to 5.5 Vpp amplitude. Above this amplitude, the width will typically increase up to 300 ps.

Burst Count: 2 to 65536 (single or double pulses).

Delay: Delay, phase or % of period.

Double pulse delay: Double pulse and delay are mutually exclusive.

Duty cycle: Set between 0.1% and 95% (subject to width limits. 99.9% with overprogramming).

Transition times: These can be entered as leading/trailing edge or % of width. Leading and trailing edges are independent within one of the following overlapping segments (1:20 ratio):

• 5 ns - 20 ns
• 10 ns - 200 ns
• 100 ns - 2 μs
• 1μs - 20 μs
• 10 μs - 200 μs
• 100 μs - 2 ms
• 1 ms - 20 ms
• 10 ms - 200 ms

Repeatability: Is typically four times better than accuracy

Output timing fidelity: Period, delay and width are continuously variable without any output glitches or dropouts.

Level/Pulse Performance Characteristics

Level specifications are valid after a 30 ns typical settling time.

		Agilent 81101A
Amplitude	50 Ω into 50 Ω	100 mV$_{pp}$ to 10.0 V$_{pp}$
	1 kΩ into 50 Ω	200 mV$_{pp}$ to 20.0 V$_{pp}$
Level window	50 Ω into 50 Ω	-10.0 V to +10.0 V
	1 kΩ into 50 Ω	-20.0 V to +20.0 V
Accuracy	50 Ω into 50 Ω	± (3% + 75 mV)
	1 kΩ into 50 Ω	± (3% + 150 mV) [1]
Resolution	50 Ω into 50 Ω	10 mV
	1 kΩ into 50 Ω	20 mV
Output connectors		BNC single-ended
Source impedance		Selectable 50 Ω or 1 kΩ
Accuracy		Typ. ± 1%
Max. external voltage		± 24 V
Short circuit current		± 400 mA max.
Base line noise		10 mV RMS typ.
Overshoot/preshoot/ ringing		± 5% of amplitude ± 20 mV

1. *In ±19 V level window*

Trigger modes

Continuous: Continuous pulses, double pulses or bursts (single or double pulses).

External triggered: Each active input transition (rising, falling or both) generates a single or double pulse or burst.

External gated: The active input level (high or low) enables pulses, double pulses or bursts. The last single/double pulse or burst is always completed.

External width: The pulse shape can be recovered whilst the period and width of an external input signal are maintained. Levels and transitions can be set.

Manual: Simulates an external input signal.

Internal triggered: Internal PLL replaces an external trigger source.

Inputs and outputs

Clock input/PLL reference and external input: One input (BNC connector at rear panel) is used for clock input or alternatively for the PLL.

PLL reference: The internal PLL is locked to an external 5 MHz or 10 MHz reference frequency.

Clock input: The output period is determined by the signal at CLK input.

Ext. input: Used for trigger, gate or external width.

Level parameters: Can be entered as voltage or current, as high and low level, or as offset and amplitude.

Load compensation: The actual load value can be entered (for loads ≠ 50 Ω) to display actual output values.

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.

Input impedance: 50 Ω/10 kΩ selectable.

Threshold: -10 V to +10 V.

Max. input voltage: ±15 Vpp.

Sensitivity: 300 mVpp typical.

Input transitions: < 100 ns.

Frequency: Dc to 50 MHz.

Minimum pulse width: 10 ns

Strobe output and trigger output trigger format: One pulse per period with 50% duty cycle typical.

External mode: 9 ns typ.

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.

Typical delay times Agilent 81101A

Instrument mode	From	To	Typ. value
External width	Ext. input	Strobe/trigger out	8.5 ns
		Output 1/output 2	22.5 ns
All other modes	Ext. input/clk input	Strobe/trigger out	12.0 ns
		Output 1/output 2	29 ns
	Strobe/trigger out	Output 1/output 2	17 ns

81104A and 81110A Specifications

Timing characteristics

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

Mainframe output module	Agilent 81104A Agilent 81105A	Agilent 81110A Agilent 81111A	Agilent 81110A Agilent 81112A
Frequency range • From 1 KΩ	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	3.5 digits, 5 ps best case	3.5 digits, 5 ps best case
Period range	12.5 ns to 999.5 s	12.5 ns to 999.5 s	12.5 ns to 999.5 s
Period RMS jitter • With PLL • With VCO	0.001% + 15 ps 0.01% + 15 ps	0.001% + 15 ps 0.01% + 15 ps	0.001% + 15 ps 0.01% + 15 ps
Accuracy • With PLL • With VCO	0.001% +15 ps ± 0.01% (± 5%)	± 0.01% (± 0.5% typ. after self-cal., ± 3% without self-cal.)	± 0.01% (± 0.5% typ. After self-cal., ± 3% without self-cal.)
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. After self-cal. ±3% ± 250 ps	± 0.5% ± 250 ps typ. After self-cal. ±3% ± 250 ps
Jitter (RMS)	0.01% +15 ps	0.01% +15 ps	0.01% +15 ps
Add. variable delay range	0 ns to (period -12.5)	0 ns to (period -3.03 ns)	0 ns to (period -3.03 ns)
Accuracy	± 5% ± 0.5 ns	± 0.5% ± 0.5 ns typ. ± 3% ± 0.5 ns after self-cal.	± 0.5% ± 0.5 ns typ. ± 3% ± 0.5 ns after self-cal.
Jitter (RMS)	0.01% +15 ps		
Double pulse delay range Min period	12.5 ns to (period - width - 6.25 ns) 25 ns (40 MHz) typ.	6.06 ns to (period -width - 3.03 ns) 12.2 ns (82 MHz) typ.	3.03 ns to (period - width - 1.5) 6.06 ns (165 MHz) typ. ± 0.5% ± 150 ps typ. ± 3% ± 150 ps after self-cal.
Accuracy	± 5% ± 250 ps	± 0.5% ± 150 ps typ. ± 3% ± 150 ps after self-cal.	± 0.5% ± 150 ps typ. ± 3% ± 150 ps after self-cal.
Transition time range (10/90) Minimum (with overprogramming)	3 ns to 200 ms variable ≤ 3 ns 5 ns typ. For 1 KW	2 ns to 200 ms variable ≤ 2ns/1.4 ns typ. For ELC levels (20/80) Source impeded	0.8 ns or 1.6 ns selectable ≤ 600 ps for Vpp ≤ 1 V 450 ps typ. for ELC levels (20/80) ≤ 900 ps for Vpp > 1 V
Accuracy	± 10% ± 200 ps typ. ± 10% ± 400 ps	± 10% ± 200 ps typ. ± 10% ± 400 ps	± 10% ± 200 ps typ. ± 10% ± 400 ps
Linearity	3% typ. For transitions > 100 ns	3% typ. for transitions > 100 ns	N/A

1. *Source impedance is selectable from 50 Ω to 1 KΩ for the Agilent 81111A.*

2. *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 over-programming).

Repeatability: Is typ. four times better than accuracy.

Transition times: leading/ trailing edge or % of width. Leading and trailing edges are independent Agilent 81111A/Agilent 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
• 1µs - 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.

Overprogramming: All parameters of the Agilent 81110A, except transitions, can be set to whatever the 330 MHz timing system will allow. This applies also when the Agilent 81111A (165 MHz) output module is used.

Level/Pulse Performance Characteristics

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

Mainframe		Agilent 81101A Agilent 81105A	Agilent 81110A Agilent 81111A	Agilent 81110A Agilent 81112A
Amplitude	50 Ω into 50 Ω	100 mV$_{pp}$ to 10.0 V$_{pp}$	100 mV$_{pp}$ to 10.0 V$_{pp}$	100 mV$_{pp}$ to 3.8 V$_{pp}$
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	-10.0 V to +10.0 V -20.0 V to +20.0 V	- 2.0 V to 3.8 V N/A
Accuracy	50 Ω into 50 Ω 1 kΩ into 50 Ω	± (3% + 75 mV) ± (3% + 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 20 mV	10 mV N/A
Output connectors		BNC single-ended	BNC single-ended	BNC differential
Source impedance		Selectable 50 Ω or 1 kΩ	Selectable 50 Ω or 1 kΩ	50 Ω only
Accuracy		Typ. ± 1%	Typ. ± 1%	Typ. ± 1%
Max. external voltage		± 24 V	± 24 V	-2.2 V to +5.5 V
Short circuit current		±400 mA max. (doubles for channel addition)	±400 mA max. (doubles for channel addition)	-84 mA to + 152 mA
Dynamic crosstalk		< 0.1% typ.	< 0.1% typ.	< 0.1% typ.
Base line noise		10 mV RMS typ. 4 mV RMS typ.	10 mV RMS typ. 4 mV RMS typ.	10 mV RMS typ. 4 mV RMS typ.
Overshoot/preshoot/ringing		± 5% of amplitude ± 20 mV	± 5% of amplitude ± 20 mV	± 5% of amplitude ± 50 mV

1. In ± 19 V level window.

Level parameters: voltage or current, high or low level, offset or amplitude.

On/off: relays connect/ disconnect output (HiZ).

Load compensation: the actual load value can be entered (forloads ≠ 50 Ω) to display actual output values. (Applies to the Agilent 81105A and Agilent 81111A only).

Normal/complement: selectable.

Limit: programmable high and low levels can be limited to protect the device-under-test.

Channel Addition (with Agilent 81105A or Agilent 81111A output channels)

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 (Agilent 81105A/Agilent 81111A) are added.

Mainframe		Agilent 81104A with two Agilent 81105A output modules	Agilent 81110A with two Agilent 81111A output modules
Amplitude	50 Ω into 50 Ω 1 kΩ into 50 Ω	100 mVpp tp 20.0 Vpp 200 mVpp to 20.0 Vpp	100 mVpp tp 20.0 Vpp 200 mVpp to 20.0 Vpp
Source impedance		Selectable from 50 Ω or 1 kΩ	Selectable from 50 Ω or 1 kΩ
Level window	50 Ω into 50 Ω 1 kΩ into 50 Ω	-20.0 V +20.0 V -20.0 V to +20.0 V	-20.0 V +20.0 V -20.0 V to +20.0 V
Max. frequency	50 Ω into 50 Ω 1 kΩ into 50 Ω	60 MHz typ. 15 MHz typ.	60 MHz typ. 15 MHz typ.
Min. transitions	50 Ω into 50 Ω 1 kΩ into 50 Ω	2 ns typ. (channel one) 5 ns typ. (channel two) 20 ns typ. both channels	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. pulse width: 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 Agilent 81110A. 5.9 ns typ. for Agilent 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.

Typical delay (Agilent 81110A with Agilent 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

1. Subtract 4 ns from the typ. delay value when referring to OUTPUT 1 / 2 for the Agilent 81112A output module and add 1 ns when referring to OUTPUT 1 / 2 for the Agilent 81104A with the Agilent 81105A output module.

81130A Specifications

Timing characteristics

Measured at 50% amplitude at fastest transitions in continuous mode and 50 Ω source impedance. The Agilent 81130A is designed and recommended for an operation in the frequency range of 170 kHz to 400/660 MHz. However it can be operated in the extended range down to 1 kHz. Changes in specifications below 170 kHz are marked.

Mainframe Output module	Agilent 81130A Agilent 81131A	Agilent 81130A Agilent 81132A
Frequency range	170 kHz (1 kHz) to 400 MHz	170 kHz (1 kHz) to 660 MHz
Frequency resolution	4 digits, (2 ps best case)	
Period range	2.5 ns to 5.9 µs 1.50 ns to 5.9 µs (f < 170 kHz: 2.5 ns to 1 ms)	(f < 170 kHz: 1.5 ns to 1.0 ms)
Accuracy	± 100 ppm	
RMS jitter (int ref, int clk)	0.001% + 15 ps	
Width range	1.25 ns to period - 1.25 ns)	750 ps to period - 750 ps
Width resolution	4 digits (2 ps best case) (f < 170 kHz: 0.05% of period)	4 digits (2 ps best case) (f < 170 kHz: 0.05% of period)
Width accuracy	± (100 ppm + 200 ps) (f < 170 kHz: 0.06% of period)	± (100 ppm + 200 ps) (f < 170 kHz: 0.06% of period)
Width jitter	0.001% + 15 ps	0.001% + 15 ps
Add, variable delay range	0 to 3.00 µs independent of period (> 3 µs: one to 1 period)	0 to 3.00 µs independent of period (> 3 µs: one to 1 period)
Delay resolution	4 digits (2 ps best case) (f < 170 kHz: ± 0.05% of period)	4 digits (2 ps best case) (f < 170 kHz: ± 0.05% of period)
Delay accuracy	± (0.01% + 100 ps) relative to zero delay (f < 170 kHz: ± 0.035% of period)	± (0.01% + 100 ps) relative to zero delay (f < 170 kHz: ± 0.035% of period)
Delay jitter	0.001% + 15 ps	0.001% + 15 ps
Fixed delay • Clk in to out • Ext. in to out	53 ns 54 ns + 0 to 1 period [1]	53 ns 54 ns + 0 to 1 period [1]
Transition time range (10/90)	800 ps or 1600 ps	Fixed
Minimum transition (10/90)	≤ 600 ps for Vpp ≤ 1 V ≤ 900 ps for Vpp ≤ 1 V	500 ps typ.
At ELC levels (20/80)	450 ps typ.	< 500 ps (400 ps typ.)
Deskew range	± 25 ns	± 25 ns

1. *The uncertainty of 1 period can be eliminated if an external clock and the following setup and hold times are upheld. setup time: 0.3 ns to 4.3 ns; hold time: -2.8 ns to 4.0 ns.*

Burst count: 2 to 65504.

Delay: Delay, phase or % of period.

Duty cycle: Set between 0.1% and 99,9% (subject to width limits).

Repeatability: Is typ. four times better than accuracy.

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Level/Pulse Performance Characteristics

Level specifications are valid after a 30 ns typical settling time (50 Ω into 50 Ω terminated to ground).

Mainframe Output module	81130A 81131A (400 MHz)	81130A 81132 A (660 MHz)
Amplitude	0.10 Vpp to 3.80 Vpp	0.10 Vpp to 2.50 Vpp
Level		
• Window	-2.00 V to +3.80 V	-2 .00 V to +3.00 V
• Accuracy	± (5% +150 mV)	± (5% +150 mV)
• Resolution	3 digits (10 mV best case)	3 digits (10 mV best case)
Output impedance	50 Ω ± 1% typ.	50 Ω ± 5% typ.
Max. external voltage	-2.2 to +5.5V	-2.0 to +4.0 V
Short circuit current	-80 mA to +152 mA.	-80 mA to +120 mA
Baseline noise	4 mV RMS typ.	8 mV RMS typ.
Overshoot/preshoot/ringing	± (5% + 50 mV) of amplitude typ.	± (5% + 100 mV) of amplitude typ.

Level parameters: Voltage or current, high and low level, or offset and amplitude.

Pattern and sequencing

Pattern length: 65504 bit/channel. If PRBS is used: (65503-RBLength).

Pattern formats: NRZ (non-return-to-zero), DNRZ (delayed non-return-to-zero), RZ (return-to-zero) and R1 (return-to-one) can be selected (see Figure 1).

On/off: Relays connect/disconnect output (HiZ).

Sequencing: A sequence is a succession of segments. One outer loop running once or continuous, and one nested loop can be applied. The nested loop can be set from 1 to 2 ^ 20 repetitions.

Segment: The memory can be divided into maximal 4 segments.

Segment length resolution: This is the resolution for which the segment can be set dependent on the maximum data rate. See Table 1.

Limit: Programmable high and low levels can be limited to protect the device-under-test.

Segment types: Pattern, PRBS, high and low segments ("0" or "1" levels segments selectable).

Note: If one channel is set to PRBS the other channel can only be high or low segments, or PRBS type.

Random pattern: PRBS 2 ^ n - 1, n = 7,8,...,15 (CCITT 0.151).

Output pattern formats

		1	2	1	1	
Non-return-to-zero	NRZ					Width is a multiple of clock periods.
Delayed non-return-to-zero	DNRZ					The signal can be delayed as required.
Return-to-zero	RZ					Width and delay can be set as required.
Return-to-one	R1					Width and delay can be set as required.

1 bit period
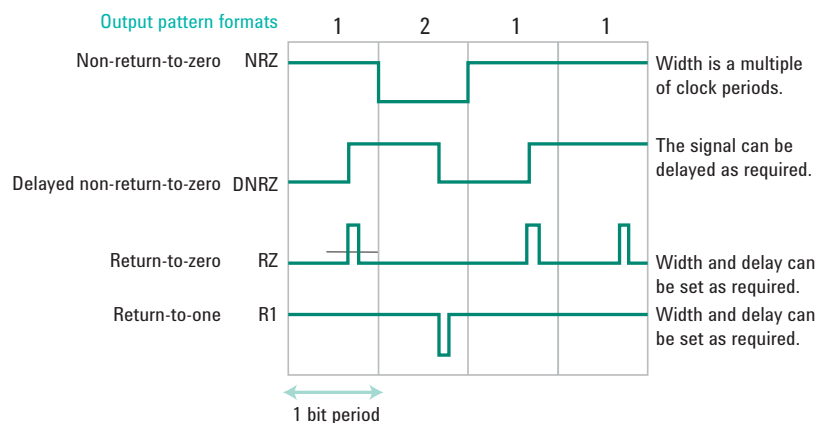
Segment length resolution trade-offs

Required segment length resolution [1]	Maximum data rate, Mbits/s
1 bit	41.67
2 bits	83.88
4 bits	166.67
8 bits	333.33
16 bits	660

1. *The minimum length in the first segment of a nested loop is two times that of the segment length resolution.*

Digital channel addition

Channel 1 can be logically combined with channel 2 (XOR) as shown in Figure 2. The source impedance remains 50 Ω. Output 2 is still available in this case.
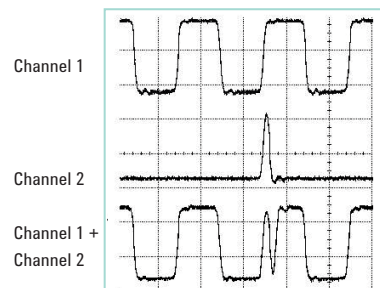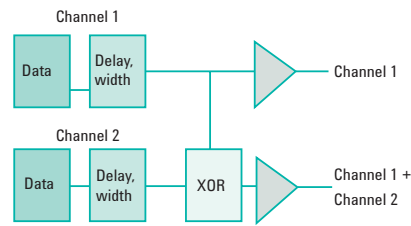

Figure 2: Channel addition

Trigger modes

Continuous: Continuous pulses, bursts or patterns.

External started: Each active input transition (rising, falling edge) generates pulses, bursts or patterns.

External gated: The active input level (high or low) enables pulses, bursts or patterns. On an external gate signal the output is immediately stopped, that means the last cycle will not be completed.

Manual: Simulates an external input signal with push of a front panel button.

Inputs and outputs

Clock input/PLL reference and external input

Connectors: SMA (f) 3.5 mm
Input impedance: 50 Ω
Termination voltage: -2.10 V to 3.30 V
Input sensitivity: < 400 mV typ.
Max. input voltage: -3 V to + 6 V
Input transitions: < 20 ns

Only valid for clock input/PLL reference One input is used for clock input or for the PLL reference alternatively.

Reference: The internal PLL is locked to the 1,2,5 or 10 MHz. The output frequency of the instrument must be larger than the clock input/PLL reference frequency.

External clock: The output period is determined by the signal at clock input.

Clock input frequency: 170 kHz to 660 MHz (at 50% ±10% duty cycle).

Delay from input trigger output: 21 ns.

Delay from input to output: 53 ns.

Threshold: ac coupled. Only valid for external input.

External input: Used for external started or gated.

Input frequency: DC to 330MHz.

Delay from external input to trigger output: 22ns + 0 to 1 period.

Delay from external input to output: 54 ns + 0 to 1 period.

Threshold: -1.4 V to +3.7 V.

Trigger output

Trigger format: One pulse per period with 50% duty cycle typical. In pattern mode the trigger pulse can be set to mark the start of any segment.

Output impedance: 50 Ω typical.

Level: TTL/ETTL (for frequency < 180 MHz), 1 V to GND, ECL 50 Ω to GND/-2 V, PECL 50 Ω to + 3 V.

Max. external voltage: -2 V/+3 V.

Transition times: 1.0 ns typical for TTL, 600 ps typical for ECL.

Delay from external input to trigger output: 32 ns typical.

Programming times: (measured at display off)

ASCII command	Typical execution time
Width, delay, transition times	40 ms to 70 ms
Period within one range [1]	100 ms to 260 ms
Period between different ranges:[1] • In pulse/burst mode • in pattern mode	140 ms to 300 ms 100 ms to 5.05 s
Levels	43 ms
Trigger modes	< 75 ms
Input parameters	28 ms
Save setting	200 ms
Recall setting: a) In pulse/burst mode b) In pattern mode with data and PRBS (depends on setting)	515 ms to 800 ms 1.15 s to 5.5 s
65504 bit pattern transfer	1.25 s
Pattern and sequencing (depends on setting)	190 ms to 5.1 s

1. *Range depends on segment length resolution, see previous table.*

Common Specifications

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.

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.

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:
Three years recommended.

Complementary products - pulse pattern generator and oscilloscopes (real time or sampling)

- DSO 80804B/80604B
- DSO 80404B
- DSO 80304B
- D/MSO 6100/8104A
- D/MSO 6050/8064A
- D/MSO6030
- D/MSO 601x
- DSO 3000

Inputs and outputs

Clock input/PLL reference and external input.

Connectors: SMA (f) 3.5 mm.

Input impedance: 50 Ω.

Termination voltage: -2.10 V to 3.30 V.

Input sensitivity: < 400 mV typ.

Max. input voltage: -3 V to + 6 V.

Input transitions: < 20 ns.

Only valid for clock input/PLL reference. One input is used for clock input or for the PLL reference alternatively.

Reference: The internal PLL is locked to the 1, 2, 5 or 10 MHz.

External clock: The output period is determined by the signal at clock input.

Clock input frequency: 170 kHz to 660 MHz (at 50% ±10% duty cycle).

Delay from input trigger output: 21 ns.

Delay from input to output: 53 ns.

Threshold: ac coupled. Only valid for external input.

External input: Used for external started or gated.

Input frequency: DC to 330 MHz.

Delay from external input to trigger output: 22 ns + 0 to 1 period.

Delay from external input to output: 54 ns + 0 to 1 period.

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. All specifications are valid from 0 °C to 55 °C ambient temperature.

Ordering Information - 81100 Family

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 Reference Guide (811xx-91021) is supplied with each mainframe for all configurations. A memory card is not included.

Each Agilent 81101A mainframe includes one output channel (in comparison to the other models of the Agilent 81100 family). The output module of the 81101A does not need to be ordered separately.

Agilent 81101A

50 MHz one channel pulse generator, 10 V

Quick start guide language options

Opt OBI *Engish Guide*
(811xx-91021)
Opt ABF *French Guide*
(81101-91210)
Opt ABJ *Japanese Guide*
(81101-91510)
Opt AB0 *Taiwan Chinese Guide*
(81101-91610)
Opt AB1 *Korean Guide*
(81101-91710)
Opt AB2 *Chinese Guide*
(81101-91810)

Additional documentation options

Opt 0BW *Service Manual*
(81101-91021)

All options are orderable with the 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 UFJ 1 MB SRAM memory card (0950-3380)
Opt UK6 Commercial cal. certificate with test data

Agilent 81104A

80 MHz pulse/pattern generator mainframe

Output module:

Agilent 81105A   80 MHz, 10 V

Agilent 81110A
330/165 MHz pulse/pattern generator mainframe

Output modules:

Agilent 81111A   165 MHz, 10 V
Agilent 81112A   330 MHz, 3.8 V
Note: Only use output modules of the same module number. A combination of the Agilent 81111A and Agilent 81112A in one Agilent 81110A is not possible.

Quick start guide language options

Opt OBI   *Engish Guide*
(811xx-91021)
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)

Agilent 81130A

400/660 MHz pulse/data generator mainframe

Output modules:

Agilent 81131A   400 MHz, 3.8 V
Agilent 81132A   660 MHz, 2.4 V
Note: Only use output modules of the same module number. A combination of the Agilent 81131A and Agilent 81132A in one Agilent 81130A is not possible.

Quick start guide language options

Opt OBI   *Engish Guide*
(811xx-91021)
Opt ABF   *French Guide*
(81130-91220)
Opt ABJ   *Japanese Guide*
(81130-91520)
Opt AB0   *Taiwan Chinese Guide*
(81130-91620)
Opt AB1   *Korean Guide*
(81130-91720)
Opt AB2   *Chinese Guide*
(81130-91820)

Additional documentation options

Opt 0BW *Service Manual*
(81130-91021)
Opt 0B1 *English Quick Start Guide (includes English Referemce Guide)*
Opt ABJ *Japanese Quick Start Guide (includes English Referecnce Guide)*
Opt 0B0 Does not include any Quick Start Guide (includes English Reference Guide)

Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment throughout its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements. For information regarding self maintenance of this product, please contact your Agilent office.

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For more information on repair and calibration services, go to:

www.agilent.com/find/removealldoubt

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