

40 Gb/s PatternPro® Programmable Pattern Generator

PPG4001 Datasheet



The Tektronix PPG4001 PatternPro® programmable pattern generator provides stressed pattern generation for high-speed Datacom testing.

Key performance specifications

- Low inherent jitter (typical RJ 200 fs @40 Gb/s)
- 8 ps typical 20% to 80% rise/fall times
- Low frequency, high amplitude jitter insertion range of 10 Hz to 10 MHz at up to 5000 UI (with Option LFJIT)
- High frequency jitter insertion, including SR, RJ, and BUJ with amplitudes up to 50 ps (with Option HFJIT)

Key features

- DC coupled differential data outputs
- Adjustable data output skew
- Full rate and sub-rate multiple clock outputs
- Pattern trigger output
- Built-in adjustable clock source
- PRBS and user defined patterns
- Front panel touch screen GUI and USB computer control

Applications

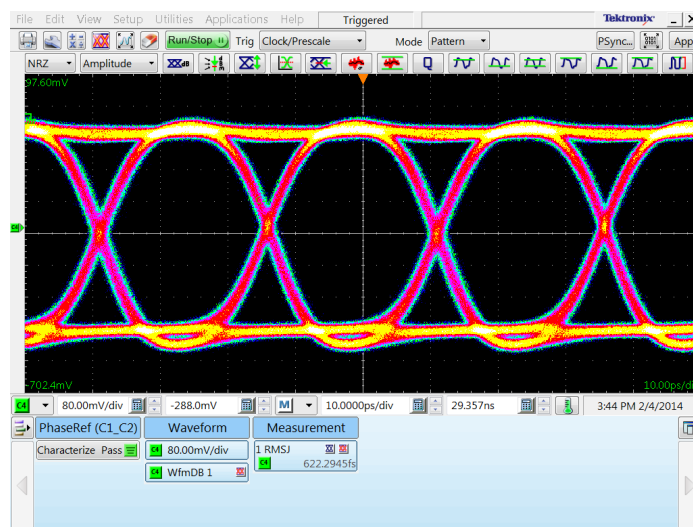
- Semiconductor device testing
- Optical component testing
- Transceiver module testing

Product description

The Tektronix PPG4001 PatternPro® programmable pattern generator provides an unparalleled combination of industry leading performance, features, and ease of use. Design validation of today's demanding high-speed applications requires instruments that produce the highest quality signals and enable programmable controls while being simple and easy to use.

Fast rise time and low jitter are critical performance parameters and the PPG4001 delivers typical 200 fs inherent RJ with 8 ps rise time. Within seconds of powering up the instrument, a first time user can be creating high-performance programmable patterns to test a DUT. In addition, the PPG4001 offers comprehensive jitter insertion for stressed receiver testing and similar applications.

The PPG4001 may be paired with the PED4001 40 Gb/s programmable error detector to provide a complete BERT system that includes control and analysis software.



Typical 40 Gb/s eye diagram

Specifications

Data outputs

Amplitude	DC coupled. Each side of the differential pair swings from -500 mV to 0 V. Ground-referenced CML. Terminated 50 Ω to ground.
Single-ended	500 mV, typical
Differential	1.0 V, typical
Rise/fall time	Scope bandwidth can impact the measured signal rise time.
20 to 80%	8 ps, typical
10 to 90 %	12 ps, typical
Data output jitter	Measured at 40 Gb/s with 2 ¹¹ -1 PRBS
Total jitter (1E-12)	7 ps _{p-p} , typical
Random jitter	200 fs, RMS, typical
Connector type	2.4 mm
Output impedance	
50 Ω	Single-ended
100 Ω	Differential

Clock outputs

Full rate clock output	AC coupled, single-ended
Frequency	20 GHz to 40 GHz
Amplitude	500 mV _{p-p} , typical
Connector type	2.4 mm
Half rate clock output	AC coupled, differential
Amplitude	500 mV _{p-p} , typical
Connector type	2.4 mm
/n clock output	AC coupled, single ended
Programmable divider	n = 2, 4, 8, 16
Amplitude	500 mV _{p-p} typical
Connector type	2.4 mm
Trigger output	Programmed as pattern trigger or clock/n (with n = multiples of 128)
Amplitude	-500 mV to 0 V, DC coupled
Connector type	SMA

Data patterns

Pattern type	Data (from memory) or PRBS
Data rate	Programmable/adjustable
Range	4 Gb/s to 40 Gb/s
Resolution	10 kb/s
Accuracy	±5 ppm
PRBS pattern lengths	
2⁷ - 1 bits	Polynomial = $X^7 + X^6 + 1$
2⁹ - 1 bits	Polynomial = $X^9 + X^5 + 1$
2¹¹ - 1 bits	Polynomial = $X^{11} + X^9 + 1$
2¹⁵ - 1 bits	Polynomial = $X^{15} + X^{14} + 1$
2²³ - 1 bits	Polynomial = $X^{23} + X^{18} + 1$
2³¹ - 1 bits	Polynomial = $X^{31} + X^{28} + 1$
Data pattern depth	
Range	2 to 4,194,304 bits
Resolution	1 bit
Programmable error insertion	Error insertion can be enabled with either single bit error insertion or at a programmable rate.
Single bit errors	Yes
Programmable bit errors	10 ⁻³ to 10 ⁻¹⁵ BER

Jitter insertion

High frequency jitter insertion option	Add-on option for the instrument. Sum of external, internal sine, internal noise, and BUJ. Exceeding the range can generate errors.
Total modulation range	50 ps _{p-p}
Built-in sine source	Programmable from either the front panel touch screen or remote control.
Frequency range	5 kHz to 100 MHz
Amplitude range	0 to 50 ps _{p-p}
Accuracy	±10%, typical
Built-in random noise source	Programmable from either the front panel touch screen or remote control.
Amplitude range	0 to 5 _{RMS}
Accuracy	±10% typical
Built-in BUJ source	Programmable from either the front panel touch screen or remote control.
Amplitude range	0 to 50 ps _{p-p}
Modulation data rates	100 Mb/s to 2.5 Gb/s
PRBS sequences	7,9,11,15,23,31
Filter values	25/50/100 MHz filters
External modulation input	DC coupled, 3 dB bandwidths
Frequency range	DC to 100 MHz
Amplitude range	0 to 50 ps _{p-p}
Maximum input	5 V _{p-p}

Jitter insertion

Low frequency jitter insertion
(Option LFJIT)

Add-on option.

SJ modulation range curve
points

Parameter	Value
10 Hz f_{mod}	5000 UI _{p-p}
100 Hz f_{mod}	2000 UI _{p-p}
1 kHz f_{mod}	2000 UI _{p-p}
10 kHz f_{mod}	2000 UI _{p-p}
100 kHz f_{mod}	100 UI _{p-p}
1 MHz f_{mod}	10 UI _{p-p}
2 Mz f_{mod}	1 UI _{p-p}
10 MHz f_{mod}	0.5 UI _{p-p}

Trigger system

Trigger waveform

Pattern mode

1 pattern per trigger for pattern length = multiple of 128

128 patterns per trigger for other pattern lengths

Clock/n mode

128 through ($2^{32} - 128$), n= any multiple of 128 in that range

Duty cycle

50%, for either Pattern or Clock/n

High level

0 V, typical

Low level

-500 mV, typical

Output impedance

50 Ω , DC-coupled

Connector type

SMA

Clock inputs

Frequency range

10 GHz to 20 GHz, half rate

Input signal

500 mV_{p-p}, typical, AC coupled

Maximum input signal

800 mV_{p-p}

Input impedance

50 Ω , AC-coupled

Reference clock

Input frequency range

100 MHz

Input signal

1 V_{p-p}, typical, 50% duty square wave

Maximum input signal

5 V_{p-p}, ± 10 V DC, Damage threshold

Input impedance

50 Ω , AC-coupled

Output signal

1.2 V_{p-p}, typical, Square wave

10 MHz reference input/output

Yes, BNC connector

Control interfaces

Front panel touchscreen GUI	Yes, edit all instrument settings.
Computer programmable interface	USB TMC, program all instrument settings.

Physical characteristics

Front panel width (with mounting tabs)	48.3 cm (19.0 in)
Height	13.3 cm (5.25 in)
Width	45.1 cm (17.75 in)
Depth (rack mount)	35.1 cm (13.8 in)
Weight	11.1 kg (24.5 lbs)
Operating temperature	0 °C to 40 °C (32 °F to 104 °F)

Ordering information

Models

PPG4001	40 Gb/s programmable pattern generator, 1 channel
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Options

PPG4001 LFJIT	Low frequency jitter option for the PPG4001
PPG4001 HFJIT	High frequency jitter option for the PPG4001

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A99	No power cord

Manuals

071-3413-xx	Printed PPG/PED Installation & Safety instructions
077-1089-xx	PPG4001 User manual, PDF-only, downloadable from Tektronix.com



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Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ASEAN / Australasia (65) 6356 3900	Austria 00800 2255 4835*	Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Belgium 00800 2255 4835*	Brazil +55 (11) 3759 7627	Canada 1 800 833 9200
Central East Europe and the Baltics +41 52 675 3777	Central Europe & Greece +41 52 675 3777	Denmark +45 80 88 1401
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* European toll-free number. If not accessible, call: +41 52 675 3777

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