

PicoSource[®] PG900 Series

USB differential pulse generators



0 s 200 ns/div

Three PicoSource models Integrated 60 ps pulse outputs: PG911 Tunnel diode 40 ps pulse heads: PG912 Both output types: PG914

> Integrated pulse outputs Differential with deskew 60 ps transition time 2.5 V to 6 V amplitude

Tunnel diode pulse heads Differential with deskew 40 ps transition time 200 mV amplitude

Advanced features

Output deskew with 1 ps resolution Low-jitter trigger input and output User-variable pulse width Internal trigger clock Trigger hold-off

Configuration USB 2.0 connected Microsoft Windows® compatible

Applications

TDR/TDT network and match analysis Spectral and flatness measurements Timing, jitter, and crosstalk determination Semiconductor testing Impulse ultra-wideband radars Laser diode drivers

www.picotech.com

PicoSource[®] PG900 Series

USB differential pulse generators

The fast-transition pulse can stimulate a transmission path, device, or network with a broad-spectrum signal in a single instant. These signals, combined with differential capability, are valuable for making high-speed broadband measurements in many fields such as time domain reflectometry, semiconductor testing, gigabit interconnect and port testing, and in radar systems.

High-speed differential data is becoming the dominant measurement challenge in digital, computing, interconnect and telecommunications systems. Despite this need, cost-effective, fast-transition differential pulse generators were hard to find ... until now.



Key specifications

PicoSource PG911 and PG914

- Integrated 50 Ω SMA(f) step recovery diode outputs
- < 60 ps single-ended pulse transition time
- Two 2.5 V to 6 V variable amplitude outputs
- ±1 ns timing deskew in 1 ps steps
- 20 dB 10 GHz SMA(m-f) attenuators supplied fitted to SRD pulse outputs

PicoSource PG912 and PG914

- External 50 Ω N(m) positive and negative tunnel diode pulse heads
- < 40 ps pulse transition time
- Fixed 200 mV output amplitude
- ±500 ps timing deskew in 1 ps steps
- Inter-series N(f)-SMA(m) adaptors included with pulse heads

All PicoSource PG900 models

- Differential outputs
- 200 ns to 4 µs pulse width
- Adjustable 1 µs to 1 s internal clock period
- Typical 3.0 ps RMS jitter relative to external trigger

A versatile, portable pulse generator

The PicoSource PG900 Series of low-jitter triggered differential USB pulse generators offer a range of advanced features:

- The pulse outputs are optimized for broad spectral content (fastest transition time) to best suit spectral and time-domain transmission and reflectometry measurements
- The internal clock provides stand-alone, self-triggered operation
- Trigger input and output allow the pulse generators to source or respond to system triggers
- Differential outputs ensure that the proliferation of gigabit differential interconnects and systems (such as SATA, USB3, HDMI, Ethernet) can all be addressed

Essential to any differential measurement is the ability to adjust for small but significant velocity and path length differences that are bound to exist in any measurement setup. The PicoSource PG900 pulse generator outputs can each be adjusted (time-skewed) by 1 ns (integrated pulse outputs) or 200 ps (tunnel diode pulse heads) in 1 ps increments to deskew path differences before the measurement, or to deliberately stress a transmission path with timing skew.

Despite their small size and portability, PicoSource pulse generators have plenty of drive capability, with integrated step recovery diode outputs of up to 6 V pk each into 50 Ω . That's a powerful 12 V pk differential pulse amplitude to drive lossy paths or stress system ports. Outputs are adjustable in 10 mV steps down to 2.5 V pk. An adjustable amplitude limit is provided to protect sensitive devices, and 20 dB attenuators are supplied fitted to the pulse outputs for small-signal optimal match applications.

Step recovery diode variable-amplitude pulse



The positive (fast rise) and negative (fast fall) pulses are both groundreferenced and each pulses in opposite polarity to its selected amplitude. This amplitude (the 'mark') is held for the selected pulse width and then returns to ground. Further pulses are prevented for the selected hold-off period and thereafter repeat at 40 ns after the next received trigger. When the internal clock is selected, the pulse repeats at the selected period and hold-off is inactive. An output trigger is generated 40 ns before every pulse, however initiated.

Pulse transition time is typically 55 ps and spectral content extends to 12 GHz.

The negative (fast fall) pulse can be selected for even faster transition time by selecting 'fast' rather than 'smooth' mode. Pulse aberration is compromised but transition time is typically 45 ps and spectral content extends to around 14 GHz.

Tunnel diode head fixed-amplitude pulse



The positive (fast rise) and negative (fast fall) pulses are both DC offset referenced and each pulses in opposite polarity by its independent fixed amplitude. This amplitude (the 'mark') is held for the selected pulse width and then returns to ground. Further pulses are prevented for the selected hold-off period and thereafter repeat at 40 ns after the next received trigger. When the internal clock is selected, the pulse repeats at the selected period and hold-off is inactive. An output trigger is generated 40 ns before every pulse, however initiated.

Pulse transition time is typically 40 ps and spectral content extends to 14 GHz.



Typical pulse shapes are shown below:



Connection diagrams

The following diagrams demonstrate differential and single-ended TDR and TDT setup options for a PicoSource pulse generator, PicoScope 9300 Series sampling oscilloscope, and the device under test (DUT). In all setups shown, the PG911 or PG912 pulse generator can be replaced by a PicoSource PG914.

TDR applications

PicoSource pulse generators can be used to realize time domain reflectometry with a PicoScope 9300 Series sampling oscilloscope without that function (PicoScope 9301, 9302, 9321 and 9341).





TDT applications

PicoSource pulse generators can also be used to realize time domain transmission (TDT) with a PicoScope 9300 sampling oscilloscope without that function (PicoScope 9301, 9302, 9321, and 9341). They also offer the versatility of a remotely-placed signal generator for long line or installed system testing when used with any of the PicoScope 9300 models.





TDT and crosstalk application

PicoSource pulse generators can be used with a PicoScope 9341 four-channel sampling oscilloscope for simultaneous time domain transmission and crosstalk assessment.



Single-ended measurements

Single-ended measurements can be performed with a two-channel sampling oscilloscope. Differential measurements can also be tackled by first measuring transmission and then changing connections for crosstalk measurement. Unconnected ports should be correctly terminated in this case.

PicoSource PG900 pulse control software for Windows

PicoSource pulse generators are connected by USB, and controlled by the supplied PicoSource PG900 software. This straightforward application runs on Microsoft Windows and features a clear graphical display of the pulse, limits and trigger settings as they are applied. Default and user pulse settings can be saved for future use, and the software can be tested in demonstration mode.



PicoSource PG900 software can be downloaded from **www.picotech.com**.

PicoSource[®] PG900 Series

PicoSource® PG900 Series pulse generator specifications

PICOSOURCE PG911 AND PG914

INTEGRATED STEP RECOVERY DIODE PULSE OUTPUTS

Pulse outputs	Positive-going (fast rise) and negative-going (fast fall) outputs returning to 0 V. Adjustable amplitude and timing parameters. Fast transition on leading edge.	
Output impedance	50 Ω	
Output connector	SMA(f)	
Output amplitude	Adjustable 2.5 V to 6 V in 10 mV steps	
Output accuracy	±10%	
Output amplitude limit	2.5 V to 6 V, adjustable in 100 mV increments	
Duty cycle limit	50% maximum (for 2.5 V to 4 V amplitude) 20% maximum (up to 6 V amplitude)	
Differential deskew range	Adjustable in 1 ps steps over 2 ns range	
	Positive or negative-going, smooth mode	Negative-going, fast mode
Pulse transition time	< 60 ps (10% to 90%)	< 50 ps (10% to 90%)
Pulse aberrations	< +20%, -10% for first 2 ns < ±7% to 10 ns < ±2% to (pulse width-50 ns)	< +40%, –10%
Trailing edge transition time	< 8 ns (10% to 90%)	

PICOSOURCE PG912 AND PG914

DRIVE OUTPUTS WITH TUNNEL DIODE PULSE HEADS

	Positive-going (fast rise) output on < 70 mV pedestal.
Positive tunnel diode pulse head	Fixed amplitude and adjustable timing parameters.
	Fast transition on leading edge.
	Negative going (fast fall) output on < -70 mV pedestal.
Negative tunnel diode pulse head	Fixed amplitude and adjustable variable timing parameters.
	Fast transition on leading edge.
Output impedance	50 Ω, ±2 Ω
Output connector	N(m)
Output amplitude	Fixed 200 mV
Output accuracy	±25%
Differential deskew range	Adjustable in 1 ps steps over 200 ps minimum, 300 ps typical
Pulse transition time	< 40 ps (10 % to 90%)
	< ±20%, for first 2 ns
Pulse aberrations	< ±7% to 15 ns
	$< \pm 2\%$ to (pulse width – 50 ns)
Trailing edge transition time	< 8 ns (10% to 90%)
Dimensions (each pulse head)	80 mm x 28 mm x 25 mm
Weight (each pulse head)	125 g

ALL MODELS AND OUTPUTS

PULSE TIMING

Pulse trigger source
Jitter relative to leading edge
Post-trigger delay to pulse leading edge
Pulse width and accuracy
Pulse width jitter
External trigger hold-off
INTERNAL CLOCK SPECIFICATION
Period and accuracy

External input, manual single shot event or internal clock
3.0 ps RMS typical. 3.5 ps RMS maximum.
Fixed 42 ns ±2 ns Allows leading-edge capture on sampling oscilloscopes
200 ns to 4 µs ±10% ±50 ns, adjustable in steps of 25 ns
< 150 ppm of width RMS
Adjustable 1 μ s to 1.3 ms in steps of 200 ns, to maximum of 345 ms in steps of < 15 ppm

Adjustable 1 μs to 1 s, ±100 ppm ±10 ns in steps of 200 ns

PicoSource® PG900 Series pulse generator specifications continued

EXTERNAL TRIGGER INPUT SPECIFICATION

Impedance	50 Ω ±1%
Connector	SMA(f)
Maximum input level	+16 dBm, or ±2 V DC or AC pk
Bandwidth	1 GHz, DC coupled
Trigger polarity	Selectable rising or falling edge
Trigger level	Selectable –1 V to +1 V in steps of 1 mV
Sensitivity	< 50 mV pk-pk DC to 100 MHz, rising linearly to 100 mV pk-pk at 1 GHz
Minimum pulse width	500 ps at 100 mV pk-pk
EXTERNAL TRIGGER OUTPUT SPECIFICATION	
Trigger output pulse	Fixed amplitude and timing parameters, positive edge polarity, trigger is leading edge
Impedance	50 Ω, ±0.5 Ω
Connector	SMA(f)
Amplitude and offset	> 700 mV fixed, on logic low of 0 V \pm < 100 mV
Pulse width	500 ns, ±100 ns
Trigger to trigger output delay	4 ns, ±1 ns
Trigger to trigger output jitter	2.5 ps RMS typical. 3 ps RMS maximum.
Transition time	< 400 ps (10% to 90%)
GENERAL SPECIFICATIONS	
AC to DC adaptor	5 V \pm 5% at 1.6 A, 8 W, universal plug (adaptor included)
PC connection	USB 2.0 (USB 1.1 and USB 3.0 compatible), 1.8 m USB 2.0 lead included
PC requirements	Windows XP SP3 to Windows 8
Operating temperature range	+5 °C to +35 °C
Storage temperature range	–20 °C to +50 °C
Temperature range for stated specifications	+15 °C to +25 °C or $T_{_{CAL}}$ (temperature of calibration) ±5 °C
Operating humidity range	< 85% RH (non-condensing) at +25 °C
Storage humidity range	< 95% RH (non-condensing)
Dimensions (instrument)	190 mm W x 180 mm D x 40 mm H
Weight (instrument)	560 g

Specifications describe guaranteed performance over the stated temperature range and apply after the instrument's temperature has been stabilized in 1 hour of continuous operation. All specifications are subject to change without notice.

PicoSource PG914

Factory calibration cycle. For optimum performance, the instrument should have a complete verification of specifications once every 12 months.

Front and rear panels

PicoSource PG911



Optional accessories

MODEL	DESCRIPTION	
TA237	 14 GHz 25 ps TDR kit 18 GHz 50 Ω SMA(m-m) within-series adaptor 18 GHz SMA(f) reference short 18 GHz SMA(f) reference load 	
TA238	 14 GHz power divider kit 18 GHz 50 Ω SMA(f-f-f) 3-resistor 6 dB power divider 2 x 10 cm precision coaxial SMA(m-m) cable For use with PicoScope 9300 Series 	
TA181	Attenuator 3 dB 10 GHz 50 Ω SMA (m-f)	
TA261	Attenuator 6 dB 10 GHz 50 Ω SMA (m-f)	
TA262	Attenuator 10 dB 10 GHz 50 Ω SMA (m-f)	
TA173	Attenuator 20 dB 10 GHz 50 Ω SMA (m-f)	
TA172	18 GHz, 50 Ω N(f) -SMA(m) inter-series adaptor	
TA170	18 GHz 50 Ω SMA(m-f) connector saver adaptor	
TA263	60 cm precision high-flex unsleeved coaxial cable SMA(m-m) < 1.7 dB loss @ 10 GHz	(Contraction of the second seco
TA264	30 cm precision high-flex unsleeved coaxial cable SMA(m-m) < 1.1 dB loss @ 10 GHz	6. And
TA265	30 cm precision sleeved coaxial cable SMA(m-m) < 1.1 dB loss @ 10 GHz	C. C



PicoSource PG911

PicoSource PG912

PicoSource PG914

KIT CONTENTS

All kits contain:

PicoSource PG900 software disk • Quick Start Guide • AC to DC adaptor 5 V DC at 2 A, universal input USB 2.0 cable 1.8 m • SMA/PC3.5/2.92 wrench • Storage and carry case

DESCRIPTION	ORDER CODE	PG 911	PG912	PG 914
Positive 40 ps tunnel diode pulse head (attached to the device)	not available separately		•	•
Negative 40 ps tunnel diode pulse head (attached to the device)	not available separately		•	•
12 GHz N(f) to SMA(m) adaptor (2 pack)	TA172		•	•
10 GHz 20 dB SMA(m-f) attenuator (2 pack)	TA173	•		•
50 Ω coaxial SMA(m-m) pulse drive cable 60 cm (2 pack)	not available separately		•	•

Ordering information

MODEL	ORDER CODE	PULSE GENERATOR
PicoSource PG911	PP977	50 Ω SMA(f) < 60 ps differential pulse outputs, 2.5 V to 6 V variable amplitude
PicoSource PG912	PP978	50 Ω N(m) < 40 ps positive and negative tunnel diode pulse heads, > 200 mV fixed amplitude
PicoSource PG914	PP979	Dual-mode generator with both of the above outputs

UK headquarters:	US headquarters:		
Pico Technology	Pico Technology		
James House	320 N Glenwood Bly		
Colmworth Business Park	Tyler		
St. Neots	Texas 75702		
Cambridgeshire	United States		
PE19 8YP			
United Kingdom			
🖀 +44 (0) 1480 396 395	🖀 +1 800 591 279		
📇 +44 (0) 1480 396 296	📇 +1 620 272 098		
⊠ sales@picotech.com	sales@picotech.		

2	+1	800	591	2796
-	+1	620	272	0981

sales@picotech.com

*Prices correct at the time of publication. Please contact Pico Technology for the latest prices before ordering.

Errors and omissions excepted. Windows is a registered trade mark of Microsoft Corporation in the United States and other countries. Pico Technology, PicoSource and PicoScope are internationally registered trade marks of Pico Technology Ltd. MM070.en-1. Copyright © 2015 Pico Technology Ltd. All rights reserved.



......

www.picotech.com