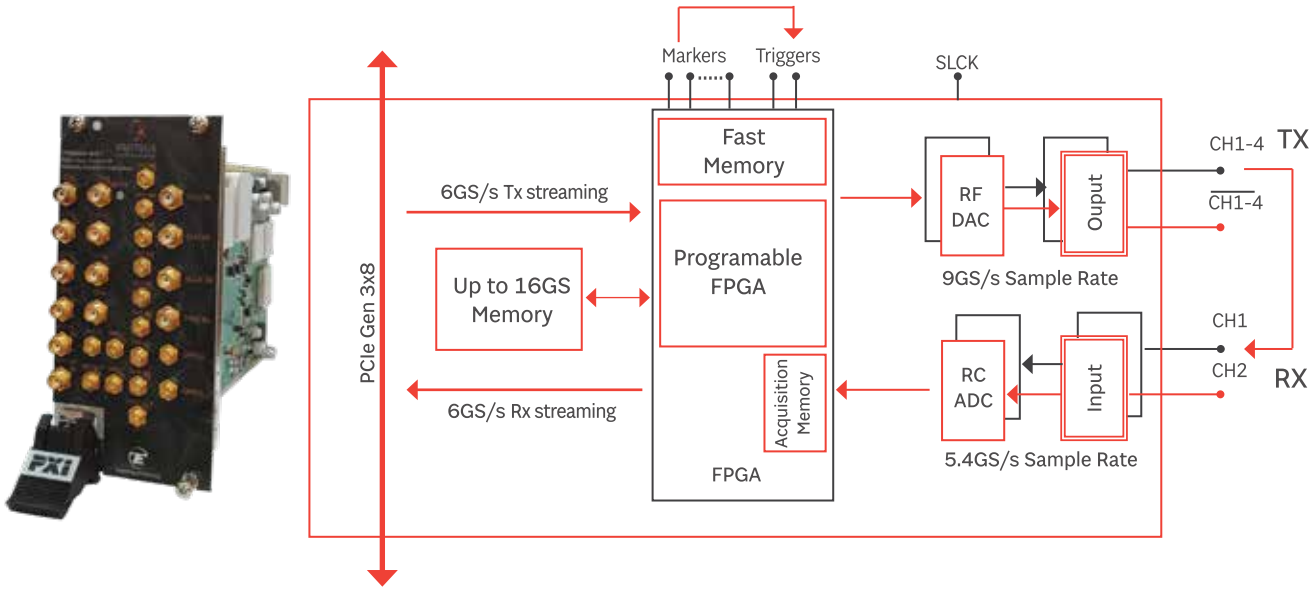
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Arbitrary Waveform Generator/Transceiver

The Proteus Arbitrary Waveform Generator (AWG) is ideal for applications in Quantum Computing, Electronic Warfare, Radar, and next generation communications such as 5G, 6G, Ultrawide Bandwidth (UWB), Wi-Fi 6, 7, and more. Built on the latest RF DAC and RF ADC technology, this versatile product platform has sample rates up to 9GS/s that allows for multiple Nyquist zone operation providing frequency ranges more than 10GHz. It has an innovative hardware based (FPGA) task oriented programming and signal processing environment. When used in combination with its optional RF Digitizer it becomes an Arbitrary Waveform Transceiver (AWT) giving you the ability to change waveforms in real-time; making it ideal for improving the coherence time of a Qubit, characterizing an RF amplifier, or responding to an EW (Electronic Warfare) threat.

Modular Scalable Architecture

Proteus is a modular design based on the industry standard PXIe format. Each module can be configured to have up to four RF/µW differential outputs and two digitizer inputs. Hardware based user programming is facilitated by the easy-to-use FPGA based DSP programming system, large waveforms and acquisitions can use its large 16GS onboard memory and fast data transceiver is facilitated through its PCIe Gen 3 x 8 interface.

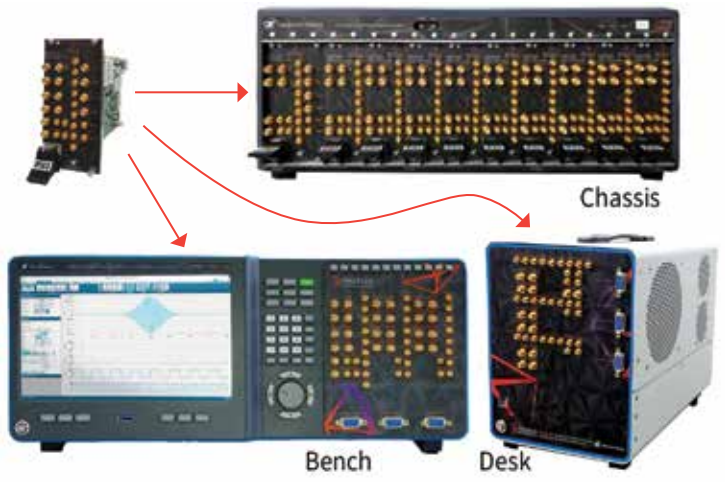


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Multiple Formfactors

For high density applications such as a high Qubit count Quantum Computers, Massive MIMO or phased array Radar and Electronic Warfare Systems the PXIe Chassis system allows you to scale. It is compatible with the industry standard PXIe modular architecture, providing custom systems capability alongside other PXIe compatible instrumentation such as the Tabor A10200 20GHz Amplifier.

The benchtop version of the Proteus series offers up to 12 channels in a 4U, 19" box. With a 9" touch display and on-board PC that can run Tabor, Python and MATLAB applications. The desktop is identical to the bench, but has the screen and keyboard omitted.



Applications

Generate any Imaginable Scenario - Proteus has an innovative hardware-based task-oriented programming system for complex waveform sequences. You can generate and download waveforms simultaneously, stream data directly to the FPGA (by-passing the memory) at speeds of up to 6GS/s, a full and easy-to-program digital subsystem of digital up and down converters, finite impulse response filters, FFT, and multiple real-time averaging blocks. This makes the Proteus AWT the most comprehensive measurement solution available.

Radar and Electronic Warfare - Proteus is an ideal platform for real-time waveform generation and analysis. Its transceiver incorporates Digital RF Memory (DRFM), providing radar target generation and adaptive electronic warfare capabilities. Pulse Descriptor Words (PDWs) support scalable, multi-channel, coherent, and deterministic waveform playback, facilitating Angle of Arrival (AOA) measurements across multiple simultaneous emitters.

Next Generation Wireless Communications Systems – When designing, developing, and manufacturing new wireless systems based on technologies such as Multiple In and Multiple Out (MIMO) antenna matrices and Orthogonal Frequency Division Multiplex (OFDM) modulation, Proteus is built on a multi-channel, scalable wide bandwidth (2GHz) architecture, utilizing high-performance RF DAC/ADC technology.

Quantum Physics - Proteus plays a part in many Quantum Physics Experiments. Its unique AWT architecture allows for the generation and analysis of pulses in real-time, with fast measurement response and feedback provided with its FPGA-based decision block architecture. Applications include NMR/EPR, Device Characterization, Computing, Communications, and Sensing.

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Proteus Series Specifications

CHANNEL CHARACTERISTICS	P908xy[1]	P258xy[1]	P128xy[1]	P948xy[1][2]
FORM FACTOR[1]	M/B/D	M/B/D	M/B/D	M/B/D
NUMBER OF CHANNELS	M=2, B=2/4/6, D=2/4/6	M=2/4, B=2/4/8/12, D=2/4/8/12	M=2/4, B=2/4/8/12, D=2/4/8/12	M=2/4, B=2/4/8/12, D=2/4/8/12
INITIAL SKEW				
BETWEEN CHANNELS	<50ps typ., 1 SCLK max.			
BETWEEN MODULES	<100ps typ., 1 SCLK or 300ps max.			
FINE DELAY				
RANGE	0 to 3ns			
RESOLUTION	5ps			
ACCURACY	±5ps			
COARSE DELAY				
RANGE	0 to wavelength			
RESOLUTION	1 sample point			

ARBITRARY MODE	P908xy	P258xy	P128xy	P948xy[2]
MAX. SAMPLE RATE	9GS/s	2.5GS/s	1.25GS/s	9GS/s
RESOLUTION	8-bit	16-bit		
MAX. MEMORY SIZE	Up to 16GS	Up to 8GS		
NUMBER OF SEGMENTS	64k			
MINIMUM SEGMENT LENGTH				
NORMAL	2048 points	1024 points		
FAST SEGMENT	224 points	64 points		
WAVEFORM GRANULARITY				
STANDARD	64 points	32 points		
OPTIONAL	32 points	16 points		

TASK MODE	
TASK TABLE LENGTH	64K tasks per channel
TASK LOOPS	1M
SEQUENCE	A sequence is defined as a continuous and looped series of tasks
MAX. NUMBER OF SEQUENCES	32k sequences
SEQUENCE LOOPS	1M
SCENARIO	A scenario is defined as a continuous series of tasks/sequences
MAX. NUMBER OF SCENARIOS	1k scenarios

TX/RX STREAMING (STM OPTION)	
MAX. STREAM RATE	Up to 6GS/s
MINIMUM PC REQUIREMENTS	
CPU	i7 or greater
MEMORY	>32GB
OPERATING SYSTEM	Windows 10/11
SOURCE	PXI Express Bus

SIGNAL PURITY	DC OUTPUT	DIRECT OUTPUT
HARMONIC DISTORTION [3]		
fout = 10 MHz - 200 MHz, Measured @ DC to 2 GHz	<-70 dBc (typ.)	<-70 dBc (typ.)
fout = 200 MHz - 1.5 GHz, Measured @ DC to 4.5 GHz	<-60 dBc (typ.)	<-60 dBc (typ.)
fout = 1.5 GHz - 4.5 GHz, Measured @ DC to 4.5 GHz	<-50 dBc (typ.)	<-50 dBc (typ.)
SFDR [4]		
fout = 10 MHz…500 MHz, Measured @ DC to 1.5 GHz	-80 dBc (typ.)	<-85 dBc (typ.)
fout = 500 MHz…4.5 GHz , Measured @ DC to 4.5 GHz	-70 dBc (typ.)	<-75 dBc (typ.)
PHASE NOISE (@10kHz offset)		
fout = 140.625MHz	-134 dBc/Hz	
fout = 280.25MHz	-128 dBc/Hz	
fout = 562.5MHz	-122 dBc/Hz	
fout = 1.125GHz	-116 dBc/Hz	
fout = 2.25GHz	-110 dBc/Hz	
fout = 4.5GHz	-104 dBc/Hz	

(1) x = Number of channels, y=M/B/D=Module/Benchtop/Desktop.
(2) When sample rate exceeds 2.5 GS/s and no interpolation is used, only the odd-numbered channels remain active. Only P948xy.
(3) SCLK=Max sample rate, amplitude = 400mVpp, direct mode, measured using balun.
(4) SCLK=Max sample rate, amplitude = 400mVpp, excluding SCLK/2-fout, measured using balun.

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DC OUTPUT	
OUTPUT TYPE	Single-ended or differential, DC-coupled
IMPEDANCE	50 Ω (nom)
AMPLITUDE	50 mVp-p to 1.3 Vp-p
AMPLITUDE RESOLUTION	1mV
AMPLITUDE ACCURACY	±(3% of amplitude ±2 mV)
VOLTAGE WINDOW	±1.15V
DC OFFSET	±0.5V
OFFSET RESOLUTION	10mV
DC OFFSET ACCURACY	±(3% of setting ±15 mV)
SKEW BETWEEN NORMAL AND COMPLEMENT OUTPUTS	0ps
RISE/FALL TIME (20% TO 80%)	< 130ps (typ.)
INSTANTANEOUS BANDWIDTH P128xy | P258xy | P908xy | P948xy	 625MHz | 1.25GHz | 4.5GHz | 4.5GHz
MAX. USABLE FREQUENCY P128xy | P258xy | P908xy | P948xy	1st/2nd Nyquist 1.25GHz | 2.5GHz | 4.5GHz | 4.5GHz
JITTER (PEAK-PEAK)	<1ps (typ.)
OVERSHOOT	<5% (typ.)
CONNECTOR	SMA (female)

DIRECT OUTPUT (OPTIONAL, STANDARD for P948xy)	
OUTPUT TYPE	Single-ended or differential, AC coupled
IMPEDANCE	50Ω (nom)
AMPLITUDE SINGLE-ENDED DIFFERENTIAL	 1mVpp to 550mVpp, single-ended into 50Ω 1mV to 1.1Vpp
AMPLITUDE RESOLUTION	1mV
AMPLITUDE ACCURACY	±(3% of amplitude ±2 mV)
RISE/FALL TIME (20% TO 80%)	< 60ps (typ.)
INSTANTANEOUS BANDWIDTH P128xy | P258xy | P908xy | P948xy	 625MHz | 1.25GHz | 4.5GHz
MAX. USABLE FREQUENCY P128xy | P258xy | P908xy | P948xy	3rd Nyquist 1.25GHz | 2.5GHz | 10GHz | 10GHz
SKEW BETWEEN NORMAL AND COMPLEMENT OUTPUTS	0 ps
JITTER (PEAK-PEAK)	<1ps (typ.)
CONNECTOR	SMA (female)

SYNC CLOCK OUTPUT	
AMPLITUDE	500mVpp, typ.
FREQUENCY P908xy P128xy, P258xy P948xy	 SCLK/32 SCLK/8 SCLK/8 (standard), SCLK/32 (x1 mode)
WAVEFORM	Square
RISE/FALL TIME (20% TO 80%)	<150ps
IMPEDANCE	LVCMOS
CONNECTOR	SMP (male)

MARKER OUTPUTS	
NUMBER OF MARKERS	Refer to ordering information
OUTPUT TYPE	Single ended
OUTPUT IMPEDANCE	50Ω (nom.)
AMPLITUDE	
VOLTAGE WINDOW	±1.15V
LEVEL	32mVpp to 1.2Vpp (32 discrete levels)
RESOLUTION	10mVpp
ACCURACY	±7%
RISE/FALL TIME (20% TO 80%)	<200ps
MARKER LENGTH	0 - waveform length
RESOLUTION P128xy, P258xy P9082y P948xy	 2 pts 8 pts 2 pts (standard) 8 pts (x1 mode)
MARKER DELAY	
COARSE DELAY	
RANGE	0 to 2048 points
RESOLUTION P128xy, P258xy P9082y P948xy	 8 points 32 points 8 pts (standard), 32 pts (x1 mode)
FINE DELAY	
RANGE	0 to 1.2ns
RESOLUTION	1ps
ACCURACY	15ps
CONNECTOR	SMP (male)

TTL MARKER OUTPUTS (OPTION)	
NUMBER OF MARKERS	8
OUTPUT TYPE	Single ended
OUTPUT IMPEDANCE	50Ω or 10kΩ factory configured
OUTPUT HIGH LEVEL	3.3V typ., 2.4V min.
OUTPUT LOW LEVEL	0.1V typ., 0.25V max.
RISE/FALL TIME (20% TO 80%)	<1ns
RESOLUTION	2ns
MIN PULSE WIDTH	2ns
CONNECTOR	SMP (male)

DIGITAL RF MEMORY (DRFM)	
FREQUENCY RANGE	8GHz
MIN, MAX RANGE	400m – 300Km
CAPTURE BW	675MHz
RECEIVER SENSITIVITY	-60dBm

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REFERENCE CLOCK INPUT	
SOURCE	Internal TCXO
WAVEFORM	Square
FREQUENCY	100MHz or REF IN
STABILITY	+/- 2.5 PPM
AGING	+/- 1 PPM @ +25°C (per year)
CONNECTOR	SMP (male)

REFERENCE CLOCK INPUT	
INPUT FREQUENCIES	10MHz / 100MHz selectable
LOCK RANGE	± 1MHz
INPUT LEVEL	0.6 Vp-p to 1.7 Vp-p
IMPEDANCE	50Ω, AC coupled (nom.)
CONNECTOR	SMP (male)

SAMPLE CLOCK OUTPUT	
SOURCE	Selectable, internal synthesizer or sample clock input
FREQUENCY RANGE	SCLK range
OUTPUT AMPLITUDE	0.5V to 1V depending on SCLK
IMPEDANCE	50Ω (nom.), AC coupled
CONNECTOR	SMA (female)

TRIGGER INPUTS	
RANGE	–5V to +5V
THRESHOLD	±5V
RANGE	–5V to +5V
RESOLUTION	100mV
SENSITIVITY	200mV
JITTER STANDARD P128xy, P258xy,P908xy P948xy LOW TRIGGER JITTER OPT.	 8 SCLK periods 32 SCLK periods 8 SCLK periods (standard), 32 SCLK periods (x1 mode) SQRT(SCLK period^2 + 150e-12^2)
LATENCY / SYSTEM DELAY P128xy, P258xy, P948xy STANDARD P908xy, P948xy x1 MODE	 <900 SCLK periods <2700 SCLK periods
POLARITY	Positive or negative
SOURCE	Selectable between channels
INPUT IMPEDANCE	10kΩ or 50Ω (nom.), DC coupled, factory configured
MAX TOGGLE FREQUENCY	10MHz (50MHz optional)
MINIMUM PULSE WIDTH	50ns (5ns optional)
CONNECTOR	SMP (male)

REAL TIME GENERATOR (RTG)	
PULSE TYPE	Symmetrical user pulses definition
MAX SQUARE PULSE	~240 µs

FAST SEGMENT DYNAMIC CONTROL INPUT (OPTIONAL)	
INPUT SIGNALS	Data 10bit, channel select 2 bit, valid 1 bit
SEGMENTS / SEQUENCES	1024 (128 fast)
DATA RATE	35MHz
MINIMUM LATENCY (Dynamic control input to direct out)	
FAST SEGMENT	<250ns
NORMAL SEGMENT	<1µs
INPUT LEVEL	LVTTL
CONNECTOR	MDR (Benchtop D-Sub)

DIGITIZER (AWT OPTION)	
NUMBER OF CHANNELS	1 or 2
INPUT VOLTAGE RANGE	500 mVpp (full scale)
INPUT VOLTAGE OFFSET	-2V to +2V
INPUT FREQUENCY RANGE	9GHz
RESOLUTION	12 bits
ACQUISITION MEMORY	Up to max. arbitrary memory
SAMPLE CLOCK SOURCES	Internal or external
INTERNAL CLOCK SOURCE	Internal, external reference
MAX SAMPLING RATE	5.4GS/s in single channel mode 2.7Gs/s in dual channel mode
MIN SAMPLING RATE	800Ms/s
CLOCK ACCURACY	<2 ppm
IMPEDANCE	50Ω
COUPLING	DC or AC (factory configured)
TRIGGER SYSTEM	
TRIGGER MODES	Positive, negative edge
TRIGGER SOURCES	External, software, channel
COUPLING	DC
IMPEDANCE	50Ω (nominal)
LEVEL RANGE	>± 2.5 V (nominal)
FREQUENCY RANGE	DC to 65MHz
CONNECTOR	SMA (female)

FPGA PROGRAMMING	
FPGA TYPE	Xilinx Kintex UltraScale XCKU060 upgradeable to XCKU115
MODES	
STANDARD	Tabor standard built-In functionality
DECISION BLOCKS	Built-in library of mathematical functions, modulation & digital filters
SHELL	Open core providing all interfaces and configuration path to the user

PULSE DESCRIPTOR WORDS (PDW)	
MAX PDW SCENARIO	Infinite continuous feed, 1024 per channel Internal Fast Memory,
RESOLUTION	<1 degree, < 1dB

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DIGITAL UPCONVERTER			
MODES P258xy, P948xy ALL OTHER MODELS	NCO / interpolation / IQ modulation NCO only		
SAMPLING RATE	1GS/s to max. sample rate		
CARRIER FREQUENCY			
RANGE	0 to 40% of sampling rate		
RESOLUTION	48 bit		
PHASE RANGE	0 to 360°		
PHASE RESOLUTION	16 bit		
INTERPOLATION FACTORS	x2, x4, x8		
IQ FORMAT P258xy	x2 mode		
IQ PAIR PER CHANNEL	1		
MAX INPUT RATE	1,250MS/s		
NUMBER OF CHANNELS	2		
IQ FORMAT P948xy	x2 mode	x4 mode	x8 mode
IQ PAIR PER CHANNEL	1	1	1 or 2
MAX INPUT RATE	2,500MS/s	2,500MS/s	1,125MS/s
NUMBER OF CHANNELS	2	2	4
SFDR AND HARMONICS	Same as Arbitrary		
MEMORY	Same as Arbitrary		

GENERAL DESKTOP	
INPUT VOLTAGE RANGE	100VAC to 264VAC
INPUT FREQUENCY RANGE	47Hz to 63Hz
POWER CONSUMPTION:	550W max.
BUILT-IN PC CPU MEMORY STORAGE OPERATING SYSTEM	 Intel Pentium 3M Cache, 2.20GHz 8GB (Upgradeable) 120GB (Removable/Upgradeable) Windows 10
INTERFACES	
USB	Front panel 1 x USB 3 host (type A) Rear panel 2 x USB 3 host, (type A) Rear panel 1 x USB 3 device, (type C)
THUNDERBOLT (OPTIONAL)	Rear panel 1 x Thunderbolt 3
LAN (1000BASE-T)	Rear panel 1 x RJ45 1000/100/10
SFP+ (OPTIONAL, REPLACES RJ45)	Rear panel 1 x SFP+ 10G optical
GPIB (OPTIONAL)	IEEE 488.2 – GPIB
HDMI	HDMI type A
DIMENSIONS WITH FEET WITHOUT FEET	 175 X 221 x 316 mm (W x H x D) 175 X 235 x 316 mm (W x H x D)
WEIGHT WITHOUT PACKAGE SHIPPING WEIGHT	 7.5 kg 9 kg

GENERAL BENCHTOP	
INPUT VOLTAGE RANGE	100VAC to 264VAC
INPUT FREQUENCY RANGE	47Hz to 63Hz
POWER CONSUMPTION:	550W max.
EMBEDDED PC CPU MEMORY STORAGE OPERATING SYSTEM	 Intel Pentium 3MB cache, 2.20GHz 8GB (Upgradeable) 120GB (Removable/Upgradeable) Windows 10 IoT
DISPLAY	9" TFT touch LCD 1024x600
INTERFACES	
USB	Front panel 1 x USB 3 host (type A) Rear panel 2 x USB 3 host, (type A) Rear panel 1 x USB 3 device, (type C)
LAN (1000BASE-T)	Rear panel 1 x RJ45 1000/100/10
HDMI	HDMI type A
DIMENSIONS WITH FEET WITHOUT FEET	 440 X 175 x 330 mm (W x H x D) 440 X 190 x 330 mm (W x H x D)
WEIGHT WITHOUT PACKAGE SHIPPING WEIGHT	 7.5 kg 9 kg

GENERAL MODULE	
INTERFACE	PXIe Gen3 x8 lanes
POWER CONSUMPTION	50W max. per slot
CURRENT CONSUMPTION	+3.3V 4A max., +12V 4A max.
DIMENSIONS	3U, 8HP PXIe (2 slots) Add 4HP (1 slot) for each AWT/MRK option

GENERAL	
TEMPERATURE OPERATING STORAGE	 0°C to +40°C -40°C to +70°C
WARM UP TIME	15 minutes
HUMIDITY	85% RH, non-condensing
SAFETY	CE Marked, EC61010-1:2010
EMC	IEC 61326-1:2013
CALIBRATION	2 years
WARRANTY	3 years

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Proteus Series Specifications

ORDERING INFORMATION BENCHTOP	
MODEL	**DESCRIPTION**
P1282B	1.25 GS/s, 16-bit, 1 GS memory, 2 channels, 4 markers, benchtop RF AWG
P1284B	1.25 GS/s, 16-bit, 1 GS memory, 4 channels, 4 markers, benchtop RF AWG
P1288B	1.25 GS/s, 16-bit, 2 GS memory, 8 channels 8 markers, benchtop RF AWG
P12812B	1.25 GS/s, 16-bit, 2 GS memory, 12 channels 12 markers, benchtop RF AWG
P2582B	2.5 GS/s, 16-bit, 2 GS memory, 2 channels, 8 markers, benchtop RF AWG
P2584B	2.5 GS/s, 16-bit, 2 GS memory, 4 channels, 8 markers, benchtop RF AWG
P2588B	2.5 GS/s, 16-bit, 2 GS memory, 8 channels 16 markers, benchtop RF AWG
P25812B	2.5 GS/s, 16-bit, 2 GS memory, 12 channels, 24 markers, benchtop RF AWG
P9082B	9 GS/s, 8-bit, 4 GS memory, 2 channels, 8 markers, module RF AWG
P9084B	9 GS/s, 8-bit, 4 GS memory, 4 channels, 16 markers, benchtop RF AWG
P9086B	9 GS/s, 8-bit, 4 GS memory, 6 channels, 24 markers, benchtop RF AWG
P9482B	9 GS/s, 16-bit, 8 GS memory, 2 channels, 8 markers, benchtop RF AWG
P9484B	9 GS/s, 16-bit, 8 GS memory, 4 channels, 8 markers, benchtop RF AWG
P9488B	9 GS/s, 16-bit, 8 GS memory, 8 channels, 16 markers, benchtop RF AWG
P94812B	9 GS/s, 16-bit, 8 GS memory, 12 channels, 24 markers, benchtop RF AWG

ORDERING INFORMATION DESKTOP	
MODEL	**DESCRIPTION**
P1282D	1.25 GS/s, 16-bit, 1 GS memory, 2 channels, 4 markers, desktop RF AWG
P1284D	1.25 GS/s, 16-bit, 1 GS memory, 4 channels, 4 markers, desktop RF AWG
P1288D	1.25 GS/s, 16-bit, 2 GS memory, 8 channels, 8 markers, desktop RF AWG
P12812D	11.25 GS/s, 16-bit, 2 GS memory, 12 channels, 12 markers, desktop RF AWG
P2582D	2.5 GS/s, 16-bit, 2 GS memory, 2 channels, 8 markers, desktop RF AWG
P2584D	2.5 GS/s, 16-bit, 2 GS memory, 4 channels, 8 markers, desktop RF AWG
P2588D	2.5 GS/s, 16-bit, 2 GS memory, 8 channels 16 markers, desktop RF AWG
P25812D	2.5 GS/s, 16-bit, 2 GS memory, 12 channels, 24 markers, desktop RF AWG
P9082D	9 GS/s, 8-bit, 4 GS memory, 2 channels, 8 markers, module RF AWG
P9084D	9 GS/s, 8-bit, 4 GS memory, 4 channels, 16 markers, desktop RF AWG
P9086D	9 GS/s, 8-bit, 4 GS memory, 6 channels, 24 markers, desktop RF AWG
P9482D	9 GS/s 16-bit, 8 GS memory, 2 channels, 8 markers, desktop RF AWG
P9484D	9 GS/s 16-bit, 8 GS memory, 4 channels, 8 markers, desktop RF AWG
P9488D	9GS/s 16-bit, 8 GS memory, 8 channels, 16 markers, desktop RF AWG
P94812D	9 GS/s 16-bit, 8 GS memory, 12 channels, 24 markers, desktop RF AWG

ORDERING INFORMATION MODULE	
MODEL	**DESCRIPTION**
P1282M	1.25 GS/s, 16-bit, 1 GS memory, 2 channels, 4 markers, module RF AWG
P1284M	1.25 GS/s, 16-bit, 1 GS memory, 4 channels, 4 markers, module RF AWG
P2582M	2.5 GS/s, 16-bit, 2 GS memory, 2 channels, 8 markers, module RF AWG
P2584M	2.5 GS/s, 16-bit, 2 GS memory, 4 channels, 8 markers, module RF AWG
P9082M	9 GS/s, 8-bit, 4 GS memory, 2 channels, 8 markers, module RF AWG
P9482M	9 GS/s, 16-bit, 8 GS memory, 2 channels, 8 markers, module RF AWG
P9484M	9 GS/s, 16-bit, 8 GS memory, 4 channels, 8 markers, module RF AWG

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Options

ORDERING INFORMATION OPTIONS [1]		
MODEL	**DESCRIPTION**	**MODEL**
4M1	4 GS memory	P1282y, P2582y
4M2	4 GS memory	P1284y, P2584y
4M3[2]	4 GS memory option	P1288y, P2588y, P9084y
4M4[2]	4 GS memory	P12812y, P25812y, P9086y
8M1	8 GS memory	P1282y, P2582y
8M2	8 GS memory	P1284y, P2584y, P9082y
8M3[2]	8 GS memory	P1288y, P2588y, P9084y
8M4[2]	8 GS memory	P12812y, P25812y, P9086y
16M1	16 GS memory	P9082y
16M2	16 GS memory	P9084y
16M3[2]	16 GS memory	P9086y
DO1	9 GHz BW direct output	P1282y, P2582y
DO2	9 GHz BW direct output	P1284y, P2584y, P9082y
DO3[2]	9 GHz BW direct output	P1288y, P2588y, P9084y
DO4[2]	9 GHz BW direct output	P12812y, P25812y,P9086y
DC1	DC output for IQ baseband applications	P9482y
DC2	DC output for IQ baseband applications	P9484y
DC3[2]	DC output for IQ baseband applications	P9488y
DC4[2]	DC output for IQ baseband applications	P94812y
DJ1	Dynamic jump input, occupies an additional slot	P1282y, P2582y, P9482y
DJ2	Dynamic jump input, occupies an additional slot	P1284y, P2584y, P9082y, P9484y
DJ3[2]	Dynamic jump input, occupies an additional slot	P1288y, P2588y, P9084y, P9488y
TTL1	TTL 8 markers output (replaces the 1.3 Vpp default markers). Specify at order if 50Ω/10kΩ	All models
MRK1	4 extra markers	P1282y
MRK2[2]	8 extra markers	P1288y
MRK3[2]	12 extra markers	P12812y
LTJ1	Ultra-low trigger jitter (200 ps typ.)	P1282y, P2582y, P9482y
LTJ2	Ultra-low trigger jitter (200 ps typ.)	P1284y, P2584y, P9082y, P9484y
LTJ3[2]	Ultra-low trigger jitter (200 ps typ.)	P1288y, P2588y, P9084y, P9488y
LTJ4[2]	Ultra-low trigger jitter (200 ps typ.)	P12812y, P25812y, P9086y, P94812y

ORDERING INFORMATION OPTIONS CONTINUATION [1]		
OPTION	**DESCRIPTION**	**MODEL**
G1	Low waveform granularity	P1282y, P2582y, P9482y
G2	Low waveform granularity	P1284y, P2584y, P9082y, P9484y
G3[2]	Low waveform granularity	P1288y, P2588y, P9084y, P9488y
G4[2]	4 GS memory	P12812y, P25812y, P9086y
DUC	Digital up-converter	P258xy
SEC[2]	Removable SSD	All models
SSD[2]	Extra factory duplicated SSD disk for SEC	All models
TRG	Fast trigger input (50 MHz instead of 10 MHz)	All models
AWT	5.4 GS/s single, 2.7 GS/s dual channel 12-bit digitizer, occupies an additional slot	All models
STM	TX/RX streaming up to 6 GS/s (P908xy/P948xy), 2.5 GS/s (P258xy), 1.25 GS/s (P128xy)	All models
PROG	FPGA programming capability with built in demodulation and digital filters	All models
SHELL	Integration to allow simple FPGA control and programming IP (includes 50 hours support pack)	All models
FPGA -KU115	Kintex UltraScale KU115 FPGA upgrade for advanced real-time and DSP capabilities	P9484M
DRFM[3]	Real-time delay, Doppler shift, and coherent replay of RF signals for propagation and channel simulation applications	P9484M
PDW[3]	Pulse descriptor–based real-time signal generation and scheduling for radar and electronic warfare emitter simulation.	P9484M
RTG[3]	Real-time waveform generation directly from on-board FPGA execution engines	P9484M
WE	1 year warranty extension	All models

[1] x = Number of channels, y=M/B/D=Module/Benchtop/Desktop
[2] Only for Benchtop/Desktop
[3] Must be ordered with option FPGA-KU115

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