



# PROTEUS

Infinite possibilities

## Module Platform

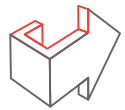
Based on a PXIe platform, the system integrates the ability to transmit, receive and perform digital signal processing all in a single instrument. The modular, compact and cost effective system offers industry leading performance, various configuration options, an innovative task oriented programming, and user programmable FPGA. So whether it is for aerospace and defense, telecommunications, automotive, medical or high-end physics applications Proteus opens the door to a world of infinite possibilities.

## Leading Features:



Dual or Four channel 1.25GS/s & 2.5GS/s 16 bit, or Dual channel 9GS/s having 16 bit AWG & AWT configurations

Real time data streaming directly to the FPGA for continuous and infinite waveform generation.

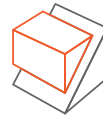


Excellent phase noise and spurious performance



Integrated NCO for digital upconverting to microwave frequencies

9GHz Bandwidth, 2.7GS/s 12 bit digitizer option for feedback control system and conditional waveform generation

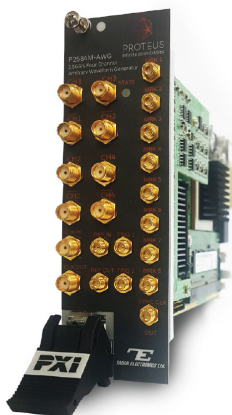


User customizable FPGA for demodulation, digital filtering and application specific

Innovative task oriented sequence programming for maximum flexibility to generate any imaginable scenario



High speed PCIe GEN3x8 lanes communication interface



Up to 16GS/s waveform memory with the ability to simultaneously generate and download waveforms.



Modular and space efficient PXI Express platform, easily scalable to hundreds of channels.

## Modular, scalable and compact

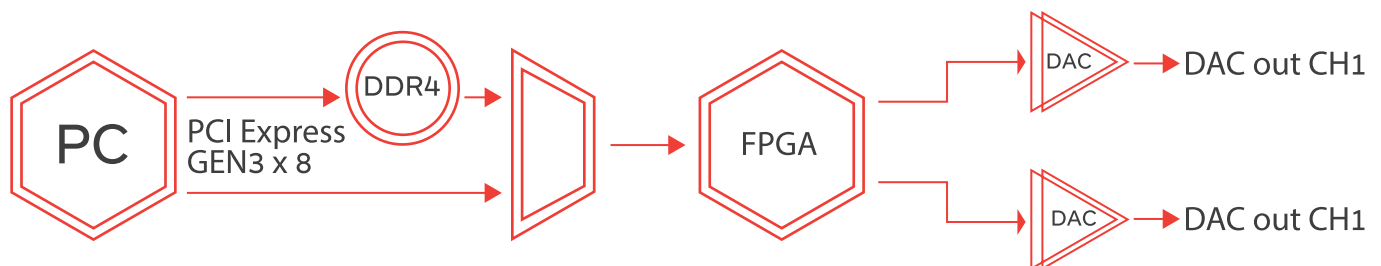
Based on PXI Express industry standard the modular architecture can easily scale to hundreds of channels, while keeping the required space to a minimum. The compact form size enables up to 4 generator output channels and 2 digitizer input channels to occupy only 3 PXI slots. So for synchronized, phase coherent, multi-channel applications such as quantum physics and radar applications the Proteus arbitrary waveform transceiver is an

## Ultra-fast communication interface

Spending more time setting up your generated scenario than actually running it? The PCI Express Gen 3 x8 lanes connection enables up to 64Gb/s of data transfer speed. This enables the Proteus arbitrary waveform transceiver to offer the fastest waveform download available on the market today, saving you one of your most valuable resources, time.

## Feedback control system

Many of today's applications, require conditional waveform generation depending on input signals from the environment. The Proteus arbitrary waveform transceiver flawlessly integrates both DAC and ADC in one system, controlled by a single FPGA for optimal synchronization and minimum latency. This high speed control system provides a feedback loop for fast decision making on the fly with minimum latency.



## Generate any imaginable scenario

The new series offers an innovative task oriented sequence programming where user can change the full instrument set up at every line of the task table. In addition, not only can users of the Proteus series instruments generate and download waveforms simultaneously, they can stream data directly to the FPGA without the need to use the built in memory. This enables generating random, unique and infinitely long scenarios directly from the controlling PC at DAC speeds of up to 9GS/s. So no matter whether your scenario is extremely complex, infinite or even dynamic you can generate it with the Proteus series model.

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CHANNELS CHARACTERISTICS	P9082M	P2582M   P2584M	P1282M   1284M
NUMBER OF CHANNELS	2	2   4	2   4
INITIAL SKEW	<20ps		
FINE DELAY			
RANGE	0 to 5 ns		
RESOLUTION	5ps		
ACCURACY	±5ps		
COARSE DELAY			
RANGE	0 to wavelength		
RESOLUTION	1 sample point		

ARBITRARY MODE	P9082M	P2582M   P2584M	P1282M   1284M
MAX. SAMPLE RATE	9GS/s	2.5GS/s	1.25GS/s
RESOLUTION	Up to 16-bit (Depending on model and mode)		
MAX. MEMORY SIZE	Up to 16GS	Up to 8GS	
NUMBER OF SEGMENTS	64k		
MINIMUM SEGMENT LENGTH NORMAL FAST SEGMENT	2048 points 224 points	1024 points 64 points	
WAVEFORM GRANULARITY STANDARD OPTIONAL	64 points 32 points	32 points 16 points	32 points 16 points
INTERPOLATION MODES	x1	x1, x2 and x4	

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

STREAMING (STM OPTION)	
MAX. STREAM RATE	6GS/s
MINIMUM PC REQUIREMENTS	
CPU	i7
MEMORY	32G
OPERATING SYSTEM	WINDOWS 10
SOURCE	PXI Express Bus

SIGNAL PURITY	DC OUTPUT	DIRECT OUTPUT
<b>HARMONIC DISTORTION <sup>(1)</sup></b>		
f <sub>out</sub> = 10 MHz - 200 MHz, Measured @ DC to 2 GHz	<-70 dBc (typ.)	<-70 dBc (typ.)
f <sub>out</sub> = 200 MHz ... 1.5 GHz, Measured @ DC to 4.5 GHz	<-60 dBc (typ.)	<-60 dBc (typ.)
f <sub>out</sub> = 1.5 GHz ... 4.5 GHz, Measured @ DC to 4.5 GHz	<-50 dBc (typ.)	<-50 dBc (typ.)
<b>SFDR <sup>(2)</sup></b>		
f <sub>out</sub> = 10 MHz...500 MHz, Measured @ DC to 1.5 GHz	-80 dBc (typ)	<-85 dBc (typ)
f <sub>out</sub> = 500 MHz...4.5 GHz , Measured @ DC to 4.5 GHz	-70 dBc (typ)	<-75 dBc (typ)
<b>PHASE NOISE (@10kHz offset)</b>		
f <sub>out</sub> = 140.625MHz	-134 dBc/Hz	
f <sub>out</sub> = 280.25MHz	-128 dBc/Hz	
f <sub>out</sub> = 562.5MHz	-122 dBc/Hz	
f <sub>out</sub> = 1.125GHz	-116 dBc/Hz	
f <sub>out</sub> = 2.25GHz	-110 dBc/Hz	
f <sub>out</sub> = 4.5GHz	-104 dBc/Hz	

<sup>(1)</sup> SCLK=Max sample rate, amplitude = 400mVpp, Direct mode, measured using balun

<sup>(2)</sup> SCLK=Max sample rate, amplitude = 400mVpp, excluding SCLK/2-fout, measured using balun

DC OUTPUT	
OUTPUT TYPE	Single-ended or differential, DC-coupled
IMPEDANCE	50Ω (nom)
AMPLITUDE	50 mVp-p to 1.3 Vp-p
AMPLITUDE RESOLUTION	1mV
DC 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%)	< 130 ps (typ)
INSTANTANEOUS BANDWIDTH P128xM   P258xM   P9082M	625MHz   2.25GHz   4.5GHz
MAX. USABLE FREQUENCY P128xM   P258xM   P9082M	2nd Nquist 1.25GHz   2.5GHz   4.5GHz
JITTER (PEAK-PEAK)	<15 ps (typ)
OVERSHOOT	<5% (typ)
CONNECTOR TYPE	SMA

DIRECT OUTPUT (OPTIONAL)	
OUTPUT TYPE	Single-ended or differential, AC coupled
IMPEDANCE	50Ω (nom)
AMPLITUDE	600mVpp, single-ended into 50Ω
AMPLITUDE RESOLUTION	1mV
AMPLITUDE ACCURACY	±(3% of amplitude ±2 mV)
RISE/FALL TIME (20% TO 80%)	< 60 ps (typ)
INSTANTANEOUS BANDWIDTH P128xM   P258xM   P9082M	625MHz   2.25GHz   4.5GHz
MAX. USABLE FREQUENCY P128xM   P258xM   P9082M	2nd Nquist 1.25GHz   2.5GHz   9GHz
CONNECTOR TYPE	SMA

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

SYNC CLOCK OUTPUT	
AMPLITUDE	500mVpp, typ.
FREQUENCY P9082M P128xM, P258xM	SCLK/32 SCLK/8
WAVEFORM	Square
RISE/FALL TIME (20% TO 80%)	<150ps
IMPEDANCE	LVC MOS
CONNECTOR	SMP

MARKER OUTPUTS	
NUMBER OF MARKERS P1282M, P1284M P2582M, P2584M, P9082M	4 (extra 8 Optional) 8 (extra 8 Optional)
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%
OFFSET	
RANGE	±0.5V
RESOLUTION	10mV
ACCURACY	±(3% of setting ±15 mV)
RISE/FALL TIME (20% TO 80%)	<200ps
RANGE	0 - waveform length
RESOLUTION P128xM, P258xM P9082M	2 pts 8 pts
MARKER DELAY	
COARSE DELAY	
RANGE	0 to 2048 points
RESOLUTION P128xM, P258xM P9082M	8 points 32 points
FINE DELAY	
RANGE	0 to 1.2ns
RESOLUTION	1ps
ACCURACY	15ps
CONNECTOR TYPE	SMP

## REFERENCE CLOCK OUTPUT

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

## 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 TYPE	SMP

## SAMPLE CLOCK INPUT

FREQUENCY RANGE	SCLK Range
INPUT POWER RANGE	0 to 1V
DAMAGE LEVEL	<0.5V or >1.5V
INPUT IMPEDANCE	50Ω nom, AC coupled
CONNECTOR TYPE	SMA

## TRIGGER INPUTS

INPUT RANGE	±5 V
THRESHOLD	±5 V
RANGE	-5 V to +5 V
RESOLUTION	100 mV
SENSITIVITY	200 mV
JITTER Standard P128xM, P258xM P9082M Low Trigger Jitter Opt.	8 SCLK periods 32 SCLK periods SQRT(SCLK period <sup>2</sup> + 150e-12 <sup>2</sup> )
LATENCY / SYSTEM DELAY P128xD, P258xD P908xD	<900SCLK periods <2700 SCLK Periods
POLARITY	Pos or Neg
SOURCE	Selectable between channels
INPUT IMPEDANCE	10 kΩ or 50Ω (nom), DC coupled, factory configured
MAX TOGGLE FREQUENCY	50MHz
MINIMUM PULSE WIDTH	5ns
CONNECTOR TYPE	SMP

## 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	<1μ
INPUT LEVEL	LVTTL
CONNECTOR	Mini D-SUB

## DIGITIZER CHARACTERISTICS (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	<2GS/ch
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	1GS/s
CLOCK ACCURACY	<2 ppm
IMPEDANCE	50Ω
COUPLING	DC or AC (factory configured)
CONNECTOR	SMA
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

## 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

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DIGITAL UPCONVERTER	
<b>MODES</b>	NCO Only / Digital Upconverter
<b>SAMPLING RATE</b>	1GS/s to Max sample rate
<b>CARRIER FREQUENCY</b>	
RANGE	0 to 40% of Sampling rate
<b>RESOLUTION</b>	48 bit
<b>PHASE RANGE</b>	0 to 360°
<b>PHASE RESOLUTION</b>	16 bit
<b>ALL IQ PARAMETERS</b>	Same as Arbitrary mode

GENERAL	
<b>Interface:</b>	PXle Gen3 x8 Lanes
<b>Power Consumption:</b>	50W max per slot
<b>Current Consumption:</b>	+3.3V 4A max. +12V 4A max.
<b>Dimensions:</b>	Base – 8HP PXle (2 Slots) AWT/MRK Opt. add 4HP ea.
<b>Weight:</b> Without Package Shipping Weight Approx.	Approx. 1 Kg 1.5 Kg
<b>Temperature:</b> Operating Storage	0°C to +40°C -40°C to +70°C
<b>Warm up time:</b>	15 minutes
<b>Humidity:</b>	85% RH, non-condensing
<b>Safety:</b>	CE Marked, EC61010-1:2010
<b>EMC:</b>	IEC 61326-1:2013
<b>Calibration:</b>	2 years
<b>Warranty:</b>	1/3year warranty plan

ORDERING INFORMATION	
MODEL	DESCRIPTION
P1282M	1.25GS/s, 16Bit, AWG, 1GS/s Memory, 2CH, 4 Markers
P1284M	1.25GS/s, 16Bit, AWG, 1GS/s Memory, 4CH, 4 Markers
P2582M	2.5GS/s, 16Bit, 2GS Memory 2CH, 8 Markers
P2584M	2.5GS/s, 16Bit, 2GS Memory, 4CH, 8 Markers
P9082M	9GS/s 16Bit, 4GS Memory 2CH, 8 Markers
OPTIONS	
4M1	4GS/s Memory option for models P1282M & P2582M
4M2	4GS/s Memory option for models P1284M & P2584M
8M1	8GS/s Memory option for models P1282M & P2582M
8M2	8GS/s Memory option for models P1284M, P2584M & P9082M
16M1	16GS/s Memory option for models P9082M
DO1	9GHz BW Direct Output option for models P1282M & P2582M
DO2	9GHz BW Direct Output option for models Pxx84M & P9082M
FS1	Fast Segment Control option for models P1282M & P2582M
FS2	Fast Segment Control option for P1284M, P2584M & P9082M
LTJ1	Ultra Low Trigger Jitter (200ps typ.) option for models P1282M & P2582M
LTJ2	Ultra Low Trigger Jitter (200ps typ.) option for models P1284M, P2584M & P9082M
G1	Low Waveform Granularity option for models P1282M & P2582M
G2	Low Waveform Granularity option for P1284M, P2584M & P9082M
AWT	5.4GS/s Single, 2.7GS/s Dual Channel 12 Bit Digitizer option for models P1284M, P2584M & P9082M
STM	6GS/s Streaming option
PROG	High level FPGA programming capability through desicion blocks of built-in Demodulation & digital Filters
Shell	Open core integration to allow simple FPGA control & programming

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