PROTEUS
Infinite possibilities

AWG&AWT Models

TABOR ELECTRONICS

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 ideal, space efficient and cost effective solution.

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.
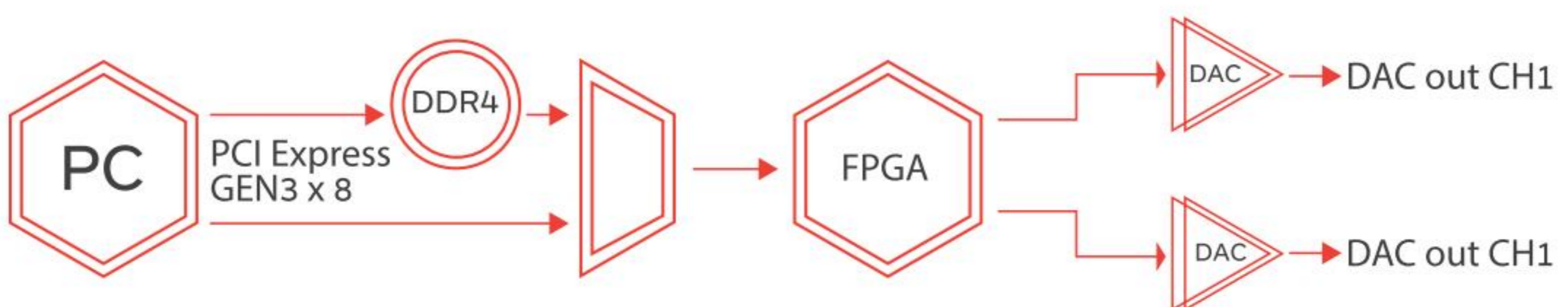
Generate any imaginable scenario

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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Desktopt Platform

In a compact desktop platform, the system integrates the ability to transmit, receive and perform digital signal processing all in a single instrument. The small footprint system, that can generate up to 12 channels in a single box, 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.
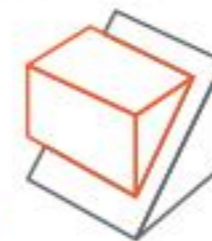
Leading Features:

Dual, four, eight or twelve channel 1.25GS/s & 2.5 GS/s 16 bit, or dual, four or six channel 9GS/s 16 bit, AWG & AWT configurations

Integrated NCO for digital up-converting to microwave frequencies

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

8GHz Bandwidth, 2.7GS/s 12 bit digitizer option for feedback control system and conditional waveform generation

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

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

Excellent phase noise and spurious performance

User customizable FPGA for application specific solutions

Space efficient desktop platform, with USB 3.0, 10G Ethernet and thunderbolt high speed interfaces.

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CHANNELS CHARACTERISTICS	P9082/4/6D	P2582/4/8/12D	P1282/4/8/12D
NUMBER OF CHANNELS	2/4/6	2/4/8/12	2/4/8/12
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	P9082/4/6D	P2582/4/8/12D	P1282/4/8/12D
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	Internal / Rear panel interfaces

SIGNAL PURITY	DC OUTPUT	DIRECT OUTPUT
HARMONIC DISTORTION [1]		
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 [2]		
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	

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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 P128xD | P258xD | P908xD	625MHz | 2.25GHz | 4.5GHz
MAX. USABLE FREQUENCY P128xD | P258xD | P908xD	2nd q 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 P128xD | P258xD | P908xD	625MHz | 2.25GHz | 4.5GHz
MAX. USABLE FREQUENCY P128xD | P258xD | P908xD	2nd nyquist 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 P908xD P128xD, P258xD	SCLK/32 SCLK/8
WAVEFORM	Square
RISE/FALL TIME (20% TO 80%)	<150ps
IMPEDANCE	LVCMOS
CONNECTOR	SMP

MARKER OUTPUTS

NUMBER OF MARKERS P1282D, P1284D P1288,P2582,P2584, P9082D P12812D P2588D, P9084D P25812D, P9086D	4 8 12 16 24
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 P128xD, P258xD P908xD	2 pts 8 pts
MARKER DELAY	
COARSE DELAY	
RANGE	0 to 2048 points
RESOLUTION P128xD, P258xD P908xD	8 points 32 points
FINE DELAY	
RANGE	0 to 1.2ns
RESOLUTION	1ps
ACCURACY	15ps
CONNECTOR TYPE	SMP

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REFERENCE CLOCK OUTPUT

SOURCE	Internal TCXO
WAVEFORM	Square
FREQUENCY	100MHz or REF IN
STABILITY	+/- 2.5 PPM
AGING	+/- 1 PPM @ +25℃ (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
    P128xD, P258xD
    P908xD
    Low Trigger Jitter Opt.
	
	8 SCLK periods
	32 SCLK periods
	SQRT(SCLK period^2 + 150e-12^2)

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

DIGITAL UPCONVERTER	
MODES	NCO Only / Digital Upconverter
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
ALL IQ PARAMETERS	Same as Arbitrary mode

GENERAL

GENERAL	
VOLTAGE RANGE:	
FREQUENCY RANGE:	47Hz to 63Hz
POWER CONSUMPTION:	550W max.
INTERFACE: USB	1 x front panel USB host (type A) 2 x rear panel USB host, (type A) 1 x front panel USB Device (type C)
Thunderbolt (Optional)	1 x rear panel Thunderbolt3
LAN (BASE-T)	1 x rear panel RG45 1000/100/10
SFP+ (LAN replacement Opt.)	1 x rear panel SFP+ 10G Optical
GPIB (Option)	IEEE 488.2 – GPIB
STORAGE	120GB removable
WEIGHT Without Package Shipping Weight	7.5 Kg 9 Kg
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)
TEMPERATURE: OPERATING STORAGE WARM UP TIME	0°C to +40°C -40°C to +70°C 15 minutes
HUMIDITY:	85% RH, non-condensing
SAFETY:	CE Marked, EC61010-1:2010
EMC:	IEC 61326-1:2013
CALIBRATION:	2 years
WARRANTY:	1/3 year warranty plan

ORDERING INFORMATION

MODEL	DESCRIPTION
P1282D	1.25GS/s, 16Bit, AWG, 1GS Memory, 2CH, 4 Markers
P1284D	1.25GS/s, 16Bit, AWG, 1GS Memory, 4CH, 4 Markers
P1288D	1.25GS/s, 16Bit, 2GS Memory, 8CH 8 Markers
P12812D	1.25GS/s, 16Bit, 2GS Memory, 12CH 12 Markers
P2582D	2.5GS/s, 16Bit, 2GS Memory 2CH, 8 Markers
P2584D	2.5GS/s, 16Bit, 2GS Memory, 4CH, 8 Markers
P2588D	2.5GS/s, 16Bit, 2GS Memory, 8CH 16 Markers
P25812D	2.5GS/s, 16Bit, 2GS Memory, 12CH, 24 Markers
P9082D	9GS/s 16Bit, 4GS Memory 2CH, 8 Markers
P9084D	9GS/s 16Bit, 4GS Memory 4CH, 16 Markers
P9086D	9GS/s 16Bit, 4GS Memory 6CH, 24 Markers

OPTIONS

OPTIONS	
4M1	4GS Memory option for models P1282x & P2582x
4M2	4GS Memory option for models P1284x & P2584x
4M3	4GS Memory option for models P1288x, P2588x & P9084x
4M4	4GS Memory option for models P12812x, P25812x&P9086x
8M1	8GS Memory option for models P1282x & P2582x
8M2	8GS Memory option for models P1284x, P2584x & P9082x
8M3	8GS Memory option for models P1288x, P2588x & P9084x
8M4	8GS Memory option for models P12812x, P25812x & P9086x
16M1	16GS Memory option for models P9082x
16M2	16GS Memory option for models P9084x
16M3	16GS Memory option for models P9086x
DO1	9GHz BW Direct Output option for models P1282x & P2582x
DO2	9GHz BW Direct Output option for models Pxx84x & P9082x
DO3	9GHz BW Direct Output option for models Pxx88x & P9084x
DO4	9GHz BW Direct Output option for models Pxx812x & P9086x
FS1	Fast Segment Control option for models P1282x & P2582x
FS2	Fast Segment Control option for P1284x, P2584x & P9082x
FS3	Fast Segment Control option for P1288x, P2588x & P9084x
MRK1	x8 Extra Markers option for models P1282D and P2582D
MRK2	x8 Extra Markers option for models P1284D, P2584D and P9082D
MRK3	x16 Extra Markers option for models P1288D, P2588D and P9084D
LTJ1	Ultra Low Trigger Jitter (200ps typ.) option for models P1282x & P2582x
LTJ2	Ultra Low Trigger Jitter (200ps typ.) option for models P1284x, P2584x & P9082x
LTJ3	Ultra Low Trigger Jitter (200ps typ.) option for models P1288x, P2588x & P9084x
LTJ4	Ultra Low Trigger Jitter (200ps typ.) option for models P12812x, P25812x & P9086x
G1	Low Waveform Granularity option for models P1282x & P2582x
G2	Low Waveform Granularity option for P1284x, P2584x & P9082x
G3	Low Waveform Granularity option for P1288x, P2588x & P9084x
G4	Low Waveform Granularity option for P12812x, P25812x&P9086x
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 decision blocks of built-in Demodulation & digital Filters
Shell	Open core integration to allow simple FPGA control & programming
TBolt	Rear panel Thunderbolt3 USB (type C)
SFP+	Rear panel 10G optical SFP+ connectivity (replace the LAN)