



# PROTEUS

Infinite possibilities

## RF AWG Benchtop Platform

Introducing Tabor's new addition to its industry leading Proteus, Arbitrary Waveform generators/Transceivers series. The new RF AWG/AWT offers a built in IQ modulator with advanced capabilities for multi-channel RF signal generation. In its benchtop platform, with a 9" touch display and on-board PC the system integrates the ability to transmit, receive and perform digital signal processing all in a single instrument. The fully standalone operated 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:



Twelve channels 9GS/s 16 bit, AWG & AWT configurations



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

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

Standalone 4U, 19" wide benchtop platform, with 9" touch display, USB 3.0, 10G Ethernet and Thunderbolt high speed interfaces

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

Integrated digital up-converter to RF frequencies for coherent multi-channel RF applications

Customizable FPGA for user embedded IP and application specific requirements

Excellent phase noise and spurious performance

8GHz Bandwidth, 5.4GS/s 12 bit digitizer option for feedback control system and conditional waveform generation



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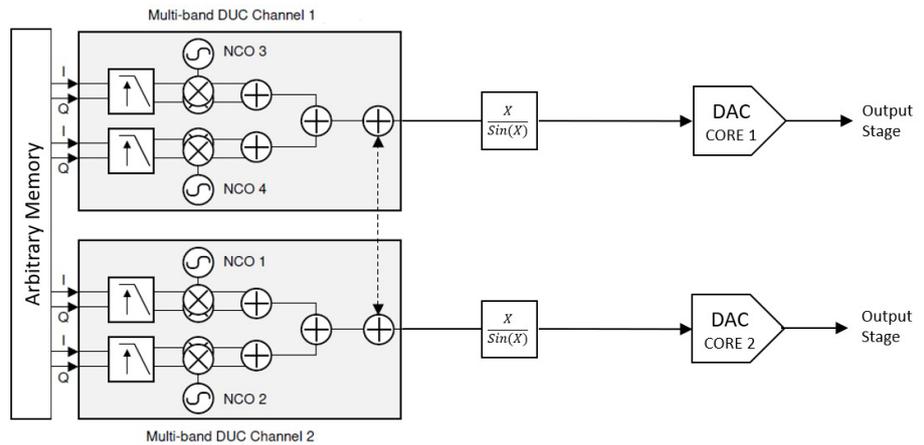
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## STANDALONE AND EASY TO USE

The benchtop version of the Proteus series offers up to 12 channels in a 4U, 19" benchtop box. With a 9" touch display and on-board PC the benchtop platform enables users to program the instrument without the need of an external PC. Users can program the instrument from the on-board PC using various programming environments such as MATLAB, LabView, Python and more. So for synchronized, phase coherent, multi-channel applications such as quantum physics and radar applications the Proteus arbitrary waveform transceiver is an ideal, high performance and cost effective solution.

## DIRECT GENERATION OF COMPLEX RF SIGNALS

The new addition to the Proteus series offers an integrated Numerically Controlled Oscillator (NCO), digital interpolator and IQ modulator for generation of complex RF signals directly from the Proteus instrument. The internal digital-up-converter enables direct generation of IQ modulation signals eliminating limitations such as IQ mismatch, and in-band carrier feed-through that are present with external IQ modulators and mixers. Also, by reducing the waveform size with up to x8 interpolation factor it saves on critical processing and compilation times present in many test and simulation systems. Coherent multiple-channel RF signal generation across multiple modules for applications such as Phase-Array Radar, Massive MIMO and Beamforming, or Quantum Computing can be easily implemented.



## ULTRA-FAST COMMUNICATION INTERFACE

Spending more time setting up your generated scenario than actually running it? The Proteus Benchtop platform utilizes PCI express Gen 3 x4 lanes connection that enables up to 32Gb/s of data transfer speed. This enable 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

The Proteus AWT 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.

## GENERATE ANY IMAGINABLE SCENARIO

Innovative task oriented sequence programming where you can change the full instrument setup at every line of the task table. Not only can you generate and download waveforms simultaneously, you can stream data directly to the FPGA without the need to use the built in memory. This enables generating random, complex, unique and infinitely long scenarios directly from the controlling PC at DAC speeds of up to 3GS/s.

GENERAL CHARACTERISTICS		P9484/8/12B
NUMBER OF CHANNELS		4/8/12
MAX. SAMPLE RATE		9GS/s
MAX. INPUT DATA RATE		2.5GS/s
Standard		9GS/s
x1 Mode		
RESOLUTION		16-bit
ANALOG BANDWIDTH		8GHz
MAX. MEMORY SIZE		Up to 16GS

INTER-CHANNEL SKEW CONTROL	
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		
NUMBER OF SEGMENTS	64k	
MINIMUM SEGMENT LENGTH	<u>x1 Mode</u>	<u>Standard</u>
NORMAL	2048 points	1024 points
FAST SEGMENT	224 points	64 points
WAVEFORM GRANULARITY	<u>x1 Mode</u>	<u>Standard</u>
STANDARD	64 points	32 points
OPTIONAL	32 points	16 points

TASK MODE	
TASK TABLE LENGTH	64K tasks per channel
TASK LOOPS	1M
SEQUENCE <sup>(1)</sup>	
MAX. NUMBER OF SEQUENCES	32K sequences
SEQUENCE LOOPS	1M
SCENARIO <sup>(2)</sup>	
MAX. NUMBER OF SCENARIOS	1K scenarios

STREAMING (STM OPTION)	
MAX. STREAM RATE	Up to 3GS/s
MINIMUM PC REQUIREMENTS	
CPU	i7
MEMORY	32GB
OPERATING SYSTEM	WINDOWS 10
SOURCE	Internal / Rear panel interfaces

SIGNAL PURITY	
<b>HARMONIC DISTORTION <sup>(3)</sup></b>	
f <sub>out</sub> = 10 MHz - 200 MHz, Measured @ DC to 2 GHz	< -70 dBc (typ.)
f <sub>out</sub> = 200 MHz ... 1.5 GHz, Measured @ DC to 4.5 GHz	< -60 dBc (typ.)
f <sub>out</sub> = 1.5 GHz ... 4.5 GHz, Measured @ DC to 4.5 GHz	< -50 dBc (typ.)
<b>SFDR <sup>(4)</sup></b>	
f <sub>out</sub> = 10 MHz...500 MHz, Measured @ DC to 1.5 GHz	< -85 dBc (typ)
f <sub>out</sub> = 500 MHz...4.5 GHz , Measured @ DC to 4.5 GHz	< -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

DIRECT OUTPUT	
OUTPUT TYPE	AC coupled
IMPEDANCE	50Ω (nom)
AMPLITUDE <sup>(5)</sup>	
Single-ended	1mV to 550mVpp
Differential	1mV to 1.1Vpp
AMPLITUDE RESOLUTION	1mV
AMPLITUDE ACCURACY	±(3% of amplitude ±2 mV)
RISE/FALL TIME (20% TO 80%)	< 60 ps (typ)
INSTANTANEOUS BANDWIDTH	
Standard	1.25GHz
x1 Mode	4.5GHz
MAX. USABLE FREQUENCY	2nd Nyquist, 8GHz
SKEW BETWEEN NORMAL AND COMPLEMENT OUTPUTS	0ps
JITTER (PEAK-PEAK)	< 15 ps (typ)
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

(1) A sequence is defined as a continuous and looped series of tasks

(2) A scenario is defined as a continuous series of tasks/sequences

(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

(5) Double into open impedance

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SYNC CLOCK OUTPUT	
AMPLITUDE	500mVpp, typ.
FREQUENCY Standard x1 Mode	SCLK/8 SCLK/32
WAVEFORM	Square
RISE/FALL TIME (20% TO 80%)	<150ps
IMPEDANCE	LVC MOS
CONNECTOR	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

MARKER OUTPUTS		P9484/8/12B
NUMBER OF MARKERS		8/16/24
OUTPUT TYPE		Single Ended
OUTPUT IMPEDANCE		50Ω (nom)
AMPLITUDE		
VOLTAGE WINDOW		±1.15V
RESOLUTION		10mVpp
ACCURACY		±7%
OFFSET		
RANGE		±0.5V
RESOLUTION		10mV
ACCURACY		±(3% of setting+1% of amp ±15 mV)
RISE/FALL TIME (20% TO 80%)		<200ps
MARKER LENGHT		0 - waveform length
RESOLUTION Standard x1 Mode		2 pts 8 pts
MARKER DELAY		
COARSE DELAY		
RANGE		0 to 2048 points
RESOLUTION Standard x1 Mode		8 points 32 points
FINE DELAY		
RANGE		0 to 1.2ns
RESOLUTION		1ps
ACCURACY		15ps
CONNECTOR TYPE		SMP

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	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)
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

TRIGGER INPUTS	
RANGE	-5 V to +5 V
THRESHOLD	±5 V
RESOLUTION	100 mV
SENSITIVITY	200 mV
JITTER Standard x1 Mode Low Trigger Jitter Opt.	8 SCLK periods 32 SCLK periods SQRT(SCLK period <sup>2</sup> + 150e-12 <sup>2</sup> )
LATENCY / SYSTEM DELAY Standard x1 Mode	<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	10MHz (50MHz optional)
MINIMUM PULSE WIDTH	50ns (5ns optional)
CONNECTOR TYPE	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

FAST SEGMENT DYNAMIC CONTROL INPUT (OPTIONAL)	
INPUT SIGNALS	Data 6 bit, Channel select 2 bit, Valid 1 bit
SEGMENTS / SEQUENCES	64 fast
DATA RATE	35MHz
MINIMUM LATENCY (Dynamic control input to direct out)	
FAST SEGMENT	<250ns
NORMAL SEGMENT	<1μ
INPUT LEVEL	LVTTL
CONNECTOR	D-SUB 9-Pin

DIGITAL UPCONVERTER	
MODES	NCO / Interpolation / IQModulation
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	<u>x2 Mode</u> <u>x4 Mode</u> <u>x8 Mode</u>
IQ PAIR PER CHANNEL	1                      1                      1 or 2
MAX INPUT RATE	2,500MS/s   2,250MS/s   1,125MS/s
NUMBER OF CHANNEL	2                      2                      4
SFDR AND HARMONICS	Same as Arbitrary
MEMORY	Same as Arbitrary

GENERAL	
VOLTAGE RANGE:	100 VAC to 264 VAC
FREQUENCY RANGE:	47Hz to 63Hz
POWER CONSUMPTION:	550W max.
FPGA TYPE	Xilinx Kintex UltraScale XCKU060 upgradeable to XCKU115
INTERNAL PROCESSING CPU MEMORY STORAGE OPERATING SYSTEM	Intel Pentium 3M Cache, 2.20GHz 8GB (Upgradeable) 120GB (Upgradeable) WINDOWS 10 IoT
INTERFACE: USB	1 x front panel USB host (type A) 2 x rear panel USB host, (type A) 1 x rear panel USB Device (type C)
Thunderbolt (Optional)	1 x rear panel Thunderbolt3
LAN (BASE-T)	1 x rear panel RJ45 1000/100/10
SFP+ (Optional, Replaces RJ45)	1 x rear panel SFP+ 10G Optical
GPIB (Optional)	IEEE 488.2 – GPIB
DISPLAY Built-in External	9" TFT touch LCD 1024x600 1 x rear panel HDMI
WEIGHT Without Package Shipping Weight	7.5 kg 9 kg
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)
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 or 3 year warranty plan

ORDERING INFORMATION	
MODEL	DESCRIPTION
P9484B	9GS/s 16Bit 8GS Mem 4CH 8 Markers RF AWG Benchtop
P9488B	9GS/s 16Bit 8GS Mem 8CH 16 Markers RF AWG Benchtop
P94812B	9GS/s 16Bit 8GS Mem 12CH 24 Markers RF AWG Benchtop

OPTIONS	
16M	16GS Memory
DJ	Dynamic Jump Input
MRK	x8 Extra Markers
LTJ	Ultra Low Trigger Jitter (200ps typ.)
G2	Low Waveform Granularity option for models P9484M
AWT	5.4GS/s Single, 2.7GS/s Dual Channel 12 Bit Digitizer
STM	3GS/s Streaming
Trig	Fast trigger option
Shell	Programmable FPGA with open core for user embedded IP

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