PROTEUS
Infinite possibilities

RF AWG Desktop 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. 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:

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

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

Space efficient Desktop platform, with 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

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

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
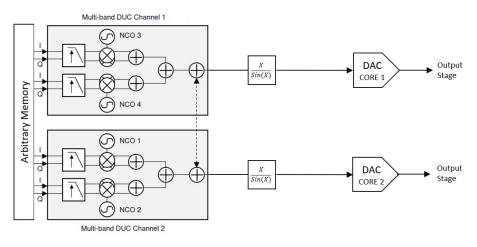
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COMPACT AND SPACE EFFICIENT

The desktop version of the Proteus series offers up to 12 channels in a 4U, half 19" dedicated chassis. The compact form size and small footprint saves valuable bench space. 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.

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 desktop platform offers an embedded PC with PCIe Gen3 x4 lanes interface as well as the fastest standardized communication interfaces commonly available in PCs today. These include USB3.0 and 10GE interfaces as well as, a thunderbolt 3 interface which enables up to 40Gb/s of data transfer speed. These enable the user to easily connect to the Proteus arbitrary waveform transceiver and still offer some of 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	P9484/8/12D
NUMBER OF CHANNELS	4/8/12
MAX. SAMPLE RATE	9GS/s

MAX. INPUT DATA RATE
    Standard
    x1 Mode
	2.5GS/s
	9GS/s

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
    NORMAL
    FAST SEGMENT
	__x1 Mode__
	2048 points
	224 points
		__Standard__
		1024 points
		64 points

WAVEFORM GRANULARITY
    STANDARD
    OPTIONAL
	__x1 Mode__
	64 points
	32 points
		__Standard__
		32 points
		16 points

TASK MODE	
TASK TABLE LENGTH	64K tasks per channel
TASK LOOPS	1M
SEQUENCE [1]	
MAX. NUMBER OF SEQUENCES	32K sequences
SEQUENCE LOOPS	1M
SCENARIO [2]	
MAX. NUMBER OF SCENARIOS	1K scenarios

STREAMING (STM OPTION)	
MAX. STREAM RATE	Up to 3GS/s

MINIMUM PC REQUIREMENTS
    CPU
    MEMORY
    OPERATING SYSTEM
	i7
	32GB
	WINDOWS 10

SOURCE	Internal / Rear panel interfaces

SIGNAL PURITY	
HARMONIC DISTORTION [3]	
fout = 10 MHz - 200 MHz, Measured @ DC to 2 GHz	<-70 dBc (typ.)
fout = 200 MHz ... 1.5 GHz, Measured @ DC to 4.5 GHz	<-60 dBc (typ.)
fout = 1.5 GHz ... 4.5 GHz, Measured @ DC to 4.5 GHz	<-50 dBc (typ.)
SFDR [4]	
fout = 10 MHz...500 MHz, Measured @ DC to 1.5 GHz	<-85 dBc (typ)
fout = 500 MHz...4.5 GHz , Measured @ DC to 4.5 GHz	<-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

DIRECT OUTPUT	
OUTPUT TYPE	AC coupled
IMPEDANCE	50Ω (nom)

AMPLITUDE [5]
    Single-ended
    Differential
	1mV to 550mVpp
	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
    x1 Mode
	1.25GHz
	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

SYNC CLOCK OUTPUT	
AMPLITUDE	500mVpp, typ.
FREQUENCY Standard x1 Mode	SCLK/8 SCLK/32
WAVEFORM	Square
RISE/FALL TIME (20% TO 80%)	‹150ps
IMPEDANCE	LVCMOS
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	P9484/8/12D
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^2 + 150e-12^2)
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	**x2 Mode**	**x4 Mode**	**x8 Mode**
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 to 264VAC
FREQUENCY RANGE:	47Hz to 63Hz
POWER CONSUMPTION:	550W max.
FPGA TYPE	Xilinx Kintex UltraScale XCKU060 upgradeable to XCKU115
INTERNAL PROCESSING	
CPU	Intel Pentium 3M Cache, 2.20GHz
MEMORY	8GB (Upgradeable)
STORAGE	120GB (Upgradeable)
OPERATING SYSTEM	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	1 x rear panel HDMI
WEIGHT	
Without Package	7.5 kg
Shipping Weight	9 kg
DIMENSIONS:	
With feet	175 X 221 x 316 mm (W x H x D)
Without feet	175 X 235 x 316 mm (W x H x D)
TEMPERATURE:	
OPERATING	0°C to +40°C
STORAGE	-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:	1 or 3 year warranty plan

ORDERING INFORMATION

MODEL	DESCRIPTION
P9484D	9GS/s 16Bit 8GS Mem 4CH 8 Markers RF AWG Desktop
P9488D	9GS/s 16Bit 8GS Mem 8CH 16 Markers RF AWG Desktop
P94812D	9GS/s 16Bit 8GS Mem 12CH 24 Markers RF AWG Desktop

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