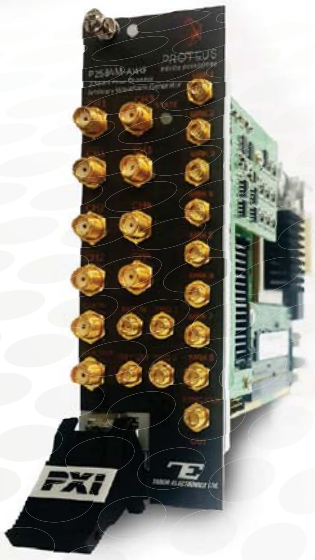
# PROTEUS

Infinite possibilities

## AWG&AWT Models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# Proteus AWG Models & Options Selection Guide

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| **P9086B** | 9GS/s 16Bit 4GS/s Mem 6CH 24 Markers | 12-15 |

| Options | |
|---|---|
| **4M2** | 4GS/s Memory option |
| **8M2** | 8GS/s Memory option |
| **16M1** (1) | 16GS/s Memory option |
| **DO2** | 9GHz BW Direct Output |
| **Fast Seg** | Fast Segment Control (256 per pair card) |
| **FS2** | Fast Segment Control (256 per pair card) |
| **MRK2** | x8 Extra Markers |
| **LJ2** | Ultra Low Trigger Jitter (200ps typ.) |
| **G2** | Low Waveform Granularity |
| **AWT2** | 9GHz BW, 2.7GS/s 12 Bit Digitizer |
| **FPGA PROG** | FPGA Programming Capability with built-in Demodulation and digital Filters |

(1) Available for model P9082M only.

## Modular, scalable and compact

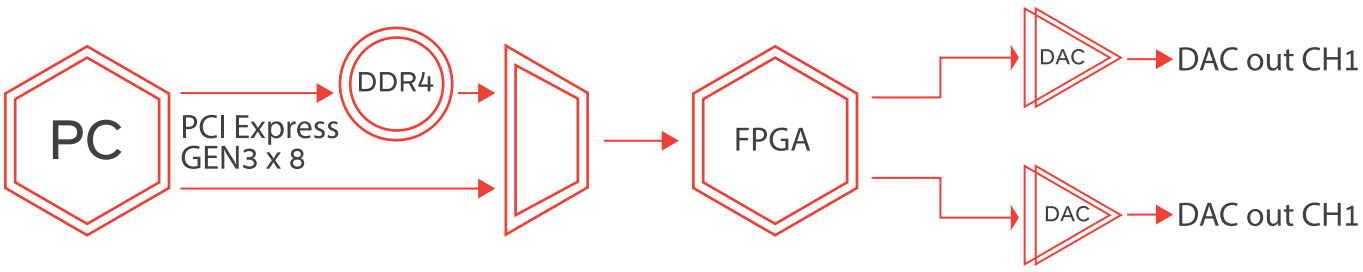
Based on PXI Express industry standard the modular architecture can easily scale to hundreds of channels, while keeping the required space to a minimum. The compact form size enables up to 4 generator output channels and 2 digitizer input channels to occupy only 3 PXI slots. So for synchronized, phase 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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## 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

Integrated NCO for digital upconverting to microwave frequencies

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

9GHz 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 demodulation, digital filtering and application specific

High speed PCIe GEN3x8 lanes communication interface

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

| GENERAL CHARACTERISTICS | P9082M | P2582M | P2584M | P1282M | P1284M |
|---|---|---|---|---|---|
| MAX. SAMPLE RATE | 9GS/s | 2.5GS/s | | 1.25GS/s | |
| RESOLUTION | 16-bit(1) | | | | |
| ENOB AT MAX. FREQUENCY | TBD | | | | |
| NUMBER OF CHANNELS | 2 | 2 | 4 | 2 | 4 |
| BANDWIDTH | 9GHz(2)<br>4.5GHz(3) | 5GHz(2)<br>2.5GHz(3) | | 2.5GHz(2)<br>1.25GHz(3) | |
| MEMORY | Up to 16GS | Up to 8GS | | Up to 4GS | |
| INTERFACE | PXI Express Gen.3 x8 lanes | | | | |
| LATENCY / SYSTEM DELAY | 200ns | | | | |
| FINE DELAY | -5ns to 5ns | | | | |
| DELAY RESOLUTION | 5ps resolution | | | | |
| COARSE DELAY | 0 to wavelength in 1 sample point resolution | | | | |
| INITIAL SKEW BETWEEN CHANNELS | 0ps | | | | |

(1) Depending on sampling mode (2) Direct output option (3) DC output option

| ARBITRARY / TASK TABLE | P9082M | P2582M | P2584M | P1282M | P1284M |
|---|---|---|---|---|---|
| MINIMUM SEGMENT LENGTH<br>NORMAL<br>FAST SEGMENT | 2048 points<br>128 points | 1024 points<br>64 points | | 1024 points<br>64 points | |
| WAVEFORM GRANULARITY<br>STANDARD<br>OPTIONAL | 64 points<br>32 points | 32 points<br>16 points | | 32 points<br>16 points | |
| SEGMENTS | 2^15 | | | | |
| SEGMENT LOOPS | 2^20 | | | | |
| SEQUENCES | 2^15 | | | | |
| SEQUENCE TABLE ENTRIES | 2^15 | | | | |
| SEQUENCE LOOPS | 2^20 | | | | |
| ADVANCED SEQUENCES TABLE ENTRIES | 1024 | | | | |

| SIGNAL PURITY | DC OUTPUT | DIRECT OUTPUT |
|---|---|---|
| HARMONIC DISTORTION | | |
| fout = 100 MHz | <-75 dBc (typ) | <-80 dBc (typ) |
| fout = 10 MHz - 500 MHz, DC to 2 GHz | <-70 dBc (typ) | <-75 dBc (typ) |
| fout = 10 MHz ... 3 GHz, DC to 4.5 GHz | <-65 dBc (typ) | <-70 dBc (typ) |
| fout = 10 MHz ... 7 GHz, 5 to 10 GHz | | TBD |
| SFDR | | |
| fout = 10 MHz...1 GHz DC to 1 GHz | -85 dBc (typ) | <-85 dBc (typ) |
| fout = 1 GHz...3 GHz , DC to 3 GHz | -75 dBc (typ | <-75 dBc (typ) |
| fout = 3 GHz...4.5 GHz , DC to 4.5 GHz | -65 dBc (typ) | <-65 dBc (typ) |
| fout = 3 GHz...4.5 GHz , DC to 4.5 GHz | 100us Full bandwidth | -<70 dBc (typ) |
| fout = 7 GHz, 6 to 8 GHz (2nd Nyquist) | <6us Narrow bandwidth<br>(<10% BW) | -<70 dBc (typ) |
| PHASE NOISE (@10kHz offset) | | |
| fout = 187.5MHz | -130 dBc/Hz | |
| fout = 375MHz | -125 dBc/Hz | |
| fout = 750MHz | -120 dBc/Hz | |
| fout = 2GHz – 5GHz | -110 dBc/Hz | |
| fout = 5GHz - 7GHz | -105 dBc/Hz | |

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| DC OUTPUT | |
|---|---|
| OUTPUT TYPE | Single-ended or differential, DC-coupled |
| IMPEDANCE | 50 Ω (nom) |
| AMPLITUDE | 100 mVp-p to 1.2 Vp-p |
| AMPLITUDE RESOLUTION | ±(3% of amplitude ±2 mV) |
| VOLTAGE WINDOW | ±2V |
| OFFSET RESOLUTION | 1mV |
| DC OFFSET ACCURACY | ±(2.0% of offset±10 mV) |
| SKEW BETWEEN NORMAL AND COMPLEMENT OUTPUTS | 0 ps |
| RISE/FALL TIME (20% TO 80%) | <150 ps (typ) |
| JITTER (PEAK-PEAK) | <15 ps (typ) |
| OVERSHOOT | <5% (typ) |
| CONNECTOR TYPE | SMA |

| DIRECT OUTPUT (OPTIONAL) | |
|---|---|
| OUTPUT TYPE | Single-ended or differential, AC coupled |
| IMPEDANCE | 50 Ω (nom) |
| AMPLITUDE | 600mVpp, single-ended into 50 Ω |
| AMPLITUDE RESOLUTION | 1mV |
| AMPLITUDE ACCURACY | ±(3% of amplitude ±2 mV) |
| BANDWIDTH<br>-3dB analog BW<br>2ND Nyquist zone BW | <br>100 kHz to 4.5 GHz (typ)<br>Up to 9GHz |
| CONNECTOR TYPE | SMA |

| REFERENCE CLOCK OUTPUT | |
|---|---|
| FREQUENCY | 10MHz / 100MHz selectable |
| CONNECTOR | SMP |

| MARKER OUTPUTS | P9082M | P2582M | P2584M | P1282M | P1284M |
|---|---|---|---|---|---|
| NUMBER OF MARKERS | 8 | 8 | 8 | 4 | 4 |
| OUTPUT TYPE | Single Ended | | | | |
| OUTPUT IMPEDANCE | 50 Ω (nom) | | | | |
| LEVEL | 100 mVp-p to 1.2 Vp-p with 40mV resolution | | | | |
| RISE/FALL TIME (20% TO 80%) | <400ps | | | | |
| MARKER TO DIRECT/DC OUT | <1SCLK | | | | |
| WIDTH | User defined, in points | | | | |
| DELAY CONTROL | Position control in points | | | | |
| RANGE | 0 - waveform length | | | | |
| RESOLUTION | 8 points | 2 points | | | |
| CONNECTOR TYPE | SMP | | | | |

| SYNC CLOCK OUTPUT | |
|---|---|
| FREQUENCY | 1/64 of the sample clock frequency |
| CONNECTOR | SMP |

| SAMPLE CLOCK OUTPUT | |
|---|---|
| SOURCE | Selectable, internal synthesizer or sample clock input |
| FREQUENCY RANGE | SCLK Range |
| OUTPUT AMPLITUDE | 400 mVpp (nom), fix |
| INPUT IMPEDANCE | 50 Ω (nom), AC coupled |
| AMPLITUDE ACCURACY | ±(3% of amplitude ±2 mV) |
| TRANSITION TIME (20% TO 80%) | 20 ps (typ) |
| CONNECTOR | SMA |

| TRIGGER/GATE AND EVENT INPUT | |
|---|---|
| INPUT RANGE | ±5 V |
| THRESHOLD<br>RANGE<br>RESOLUTION<br>SENSITIVITY | <br>−5 V to +5 V<br>100 mV<br>200 mV |
| JITTER @ MAX CLOCK | 3.2ns (200ps optional) |
| POLARITY | Pos or Neg |
| DRIVE | Selectable channel 1, channel 2 or both |
| INPUT IMPEDANCE | 1 k or 50 Ω (nom), DC coupled |
| MAX TOGGLE FREQUENCY | TBD |
| MINIMUM PULSE WIDTH | TBD |
| CONNECTOR TYPE | SMP |

| FAST SEGMENT DYNAMIC CONTROL INPUT (OPTIONAL) | |
|---|---|
| NUMBER OF ADDRESSABLE SEGMENTS OR SEQUENCES | 256 |
| DATA RATE | TBD |
| SET-UP TIME | TBD |
| HOLD TIME | TBD |
| INPUT RANGE<br>LOW LEVEL<br>HIGH LEVEL | <br>0 V to +0.7 V<br>+1.6 V to +3.6 V |
| IMPEDANCE | TBD |
| CONNECTOR | TBD |

| REFERENCE CLOCK INPUT | |
|---|---|
| INPUT FREQUENCIES | 10MHz / 100MHz selectable |
| LOCK RANGE | ± 1MHz |
| INPUT LEVEL | 0.2 Vp-p to 3.0 Vp-p |
| IMPEDANCE | 50 Ω, AC coupled (nom) |
| CONNECTOR TYPE | SMP |

| SAMPLE CLOCK INPUT | |
|---|---|
| FREQUENCY RANGE | SCLK Range |
| INPUT POWER RANGE | +0 dBm to +7 dBm |
| DAMAGE LEVEL | +8 dBm |
| INPUT IMPEDANCE | 50 Ω nom, AC coupled |
| CONNECTOR TYPE | SMA |

| GENERAL | |
|---|---|
| Interface: | PXIe Gen3 x8 Lanes |
| Power Consumption: | 50W max per slot |
| Current Consumption: | +3.3V 4A max.<br>+12V 4A max. |
| Dimensions: | Base – 8HP PXIe (2 Slots) |
| With Options: | 12HP PXIe (3 Slots) |
| Weight:<br>Without Package<br>Shipping Weight Approx. | <br>Approx. 1 Kg<br>1.5 Kg |
| Temperature:<br>Operating<br>Storage | <br>0°C to +40°C<br>-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: | 1/3year warranty plan |

| TRIGGER/GATE AND EVENT INPUT | |
|---|---|
| INPUT RANGE | ±5 V |
| THRESHOLD<br>RANGE<br>RESOLUTION<br>SENSITIVITY | <br>–5 V to +5 V<br>100 mV<br>200 mV |
| JITTER @ MAX CLOCK | 3.2ns (200ps optional) |
| POLARITY | Pos or Neg |
| DRIVE | Selectable channel 1, channel 2 or both |
| INPUT IMPEDANCE | 1 k or 50 Ω (nom), DC coupled |
| MAX TOGGLE FREQUENCY | TBD |
| MINIMUM PULSE WIDTH | TBD |
| CONNECTOR TYPE | SMP |

| ORDERING INFORMATION | |
|---|---|
| MODEL | DESCRIPTION |
| P1282M | PXIe 1.25GS/s, 16Bit, AWG, 1GS Memory, 2CH, 4 Markers |
| P1284M | PXIe 1.25GS/s, 16Bit, AWG, 1GS Memory, 4CH, 4 Markers |
| P2582M | PXIe 2.5GS/s, 16Bit, AWG, 1GS Memory, 2CH,8 Markers |
| P2584M | PXIe 2.5GS/s, 16Bit, AWG, 1GS Memory, 4CH, 8 Markers |
| P9082M | PXIe 9GS/s, 16 Bit AWG, 4GS Memory, 2CH, 8 Markers |
| **OPTION** | **DESCRIPTION** |
| 4M1 | 4GS Memory option for models P1282Mand P2582M |
| 4M2 | 4GS Memory option for models P1284M and P2584M |
| 8M1 | 8GS Memory option for models P1282Mand P2582M |
| 8M2 | 8GS Memory option for models P1284M, P2584M and P9082M |
| 16M1 | 16GS Memory option for models P9082M |
| DO1 | 9GHz BW Direct Output option for models P1282M and P2582M |
| DO2 | 9GHz BW Direct Output Opt. for models P1284M, P2584M & P9082M |
| FS1 | Fast Segment Control option for models P1282M & P2582M |
| FS2 | Fast Segment Control Opt. for models P1284M, P2584M & P9082M |
| MRK1 | x8 Extra Markers option for models P1282M & P2582M |
| MRK2 | x8 Extra Markers Opt. for models P1284M, P2584M & P9082M |
| LTJ1 | Ultra Low Trigger Jitter (200ps typ.) Opt. for models P1282M &P2582M |
| LTJ2 | Ultra Low Trigger Jitter (200ps typ.) Opt. for models P1284M, P2584M & P9082M |
| G1 | Low Waveform Granularity Opt. for models P1282M & P2582M |
| G2 | Low Waveform Granularity Opt. for models P1284M, P2584M & P9082M |
| AWT1 | 9GHz BW, 2.7GS/s 12 Bit 1CH Digitizer option for models P128xx & P258xx & P9082x |
| FPGA PROG | FPGA Programming capability with high level code through decision blocks |
| FPGA Shell | FPGA full control & programming |

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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

9GHz 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.

| GENERAL CHARACTERISTICS | P9082/4/6D | P2582/4/8/12D | P1282/4/8/12D |
|---|---|---|---|
| MAX. SAMPLE RATE | 9GS/s | 2.5GS/s | 1.25GS/s |
| RESOLUTION | 16-bit (1) | | |
| ENOB AT MAX. FREQUENCY | TBD | | |
| NUMBER OF CHANNELS | 8/6/24 | 8/8/16/24 | 4/4/8/12 |
| BANDWIDTH | 9GHz(2)<br>4.5GHz(3) | 5GHz(2)<br>2.5GHz(3) | 2.5GHz(2)<br>1.25GHz(3) |
| MEMORY | Up to 16GS | Up to 8GS | Up to 4GS |
| INTERFACE | USB 3.0, 10GE, Thunderbolt 3 | | |
| LATENCY / SYSTEM DELAY | 200ns | | |
| FINE DELAY | -5ns to 5ns | | |
| DELAY RESOLUTION | 5ps resolution | | |
| COARSE DELAY | 0 to wavelength in 1 sample point resolution | | |
| INITIAL SKEW BETWEEN CHANNELS | 0ps | | |

(1) Depending on sampling mode (2) Direct output option (3) DC output option

| ARBITRARY / TASK TABLE | P9082/4/6D | P2582/4/8/12D | P1282/4/8/12D |
|---|---|---|---|
| MINIMUM SEGMENT LENGTH<br>NORMAL<br>FAST SEGMENT | 2048 points<br>128 points | 1024 points<br>64 points | |
| WAVEFORM GRANULARITY<br>STANDARD<br>OPTIONAL | 64 points<br>32 points | 32 points<br>16 points | 32 points<br>16 points |
| SEGMENTS | 2^15 | | |
| SEGMENT LOOPS | 2^20 | | |
| SEQUENCES | 2^15 | | |
| SEQUENCE TABLE ENTRIES | 2^15 | | |
| SEQUENCE LOOPS | 2^20 | | |
| ADVANCED SEQUENCES TABLE ENTRIES | 1024 | | |

| SIGNAL PURITY | DC OUTPUT | DIRECT OUTPUT |
|---|---|---|
| HARMONIC DISTORTION | | |
| fout = 100 MHz | <-75 dBc (typ) | <-80 dBc (typ) |
| fout = 10 MHz - 500 MHz, DC to 2 GHz | <-70 dBc (typ) | <-75 dBc (typ) |
| fout = 10 MHz ... 3 GHz, DC to 4.5 GHz | <-65 dBc (typ) | <-70 dBc (typ) |
| fout = 10 MHz ... 7 GHz, 5 to 10 GHz | | TBD |
| SFDR | | |
| fout = 10 MHz...1 GHz DC to 1 GHz | -85 dBc (typ) | <-85 dBc (typ) |
| fout = 1 GHz...3 GHz , DC to 3 GHz | -75 dBc (typ | <-75 dBc (typ) |
| fout = 3 GHz...4.5 GHz , DC to 4.5 GHz | -65 dBc (typ) | <-65 dBc (typ) |
| fout = 3 GHz...4.5 GHz , DC to 4.5 GHz | 100us Full bandwidth | -<70 dBc (typ) |
| fout = 7 GHz, 6 to 8 GHz (2nd Nyquist) | <6us Narrow bandwidth<br>(<10% BW) | -<70 dBc (typ) |
| PHASE NOISE (@10kHz offset) | | |
| fout = 187.5MHz | -130 dBc/Hz | |
| fout = 375MHz | -125 dBc/Hz | |
| fout = 750MHz | -120 dBc/Hz | |
| fout = 2GHz – 5GHz | -110 dBc/Hz | |
| fout = 5GHz - 7GHz | -105 dBc/Hz | |

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| DC OUTPUT | |
|---|---|
| OUTPUT TYPE | Single-ended or differential, DC-coupled |
| IMPEDANCE | 50 Ω (nom) |
| AMPLITUDE | 100 mVp-p to 1.2 Vp-p |
| AMPLITUDE RESOLUTION | ±(3% of amplitude ±2 mV) |
| VOLTAGE WINDOW | ±2V |
| OFFSET RESOLUTION | 1mV |
| DC OFFSET ACCURACY | ±(2.0% of offset±10 mV) |
| SKEW BETWEEN NORMAL AND COMPLEMENT OUTPUTS | 0 ps |
| RISE/FALL TIME (20% TO 80%) | <150 ps (typ) |
| JITTER (PEAK-PEAK) | <15 ps (typ) |
| OVERSHOOT | <5% (typ) |
| CONNECTOR TYPE | SMA |

| DIRECT OUTPUT (OPTIONAL) | |
|---|---|
| OUTPUT TYPE | Single-ended or differential, AC coupled |
| IMPEDANCE | 50 Ω (nom) |
| AMPLITUDE | 600mVpp, single-ended into 50 Ω |
| AMPLITUDE RESOLUTION | 1mV |
| AMPLITUDE ACCURACY | ±(3% of amplitude ±2 mV) |
| BANDWIDTH<br>-3dB analog BW<br>2ND Nyquist zone BW | <br>100 kHz to 4.5 GHz (typ)<br>Up to 9GHz |
| CONNECTOR TYPE | SMA |

| REFERENCE CLOCK OUTPUT | |
|---|---|
| FREQUENCY | 10MHz / 100MHz selectable |
| CONNECTOR | SMP |

| MARKER OUTPUTS | P9082/4/6D | P2582/4/8/12D | P1282/4/8/12D |
|---|---|---|---|
| NUMBER OF MARKERS | 8/16/24 | 8/8/16/24 | 4/4/8/12 |
| OUTPUT TYPE | Single Ended | | |
| OUTPUT IMPEDANCE | 50 Ω (nom) | | |
| LEVEL | 100 mVp-p to 1.2 Vp-p with 40mV resolution | | |
| RISE/FALL TIME (20% TO 80%) | <400ps | | |
| MARKER TO DIRECT/DC OUT | <1SCLK | | |
| WIDTH | User defined, in points | | |
| DELAY CONTROL | Position control in points | | |
| RANGE | 0 - waveform length | | |
| RESOLUTION | 8 points | 2 points | |
| CONNECTOR TYPE | SMP | | |

| SYNC CLOCK OUTPUT | |
|---|---|
| FREQUENCY | 1/64 of the sample clock frequency |
| CONNECTOR | SMP |

| SAMPLE CLOCK OUTPUT | |
|---|---|
| SOURCE | Selectable, internal synthesizer or sample clock input |
| FREQUENCY RANGE | SCLK Range |
| OUTPUT AMPLITUDE | 400 mVpp (nom), fix |
| INPUT IMPEDANCE | 50 Ω (nom), AC coupled |
| AMPLITUDE ACCURACY | ±(3% of amplitude ±2 mV) |
| TRANSITION TIME (20% TO 80%) | 20 ps (typ) |
| CONNECTOR | SMA |

| TRIGGER/GATE AND EVENT INPUT | |
|---|---|
| INPUT RANGE | ±5 V |
| THRESHOLD<br>RANGE<br>RESOLUTION<br>SENSITIVITY | <br>−5 V to +5 V<br>100 mV<br>200 mV |
| JITTER @ MAX CLOCK | 3.2ns (200ps optional) |
| POLARITY | Pos or Neg |
| DRIVE | Selectable channel 1, channel 2 or both |
| INPUT IMPEDANCE | 1 k or 50 Ω (nom), DC coupled |
| MAX TOGGLE FREQUENCY | TBD |
| MINIMUM PULSE WIDTH | TBD |
| CONNECTOR TYPE | SMP |

| FAST SEGMENT DYNAMIC CONTROL INPUT (OPTIONAL) | |
|---|---|
| NUMBER OF ADDRESSABLE SEGMENTS OR SEQUENCES | 256 |
| DATA RATE | TBD |
| SET-UP TIME | TBD |
| HOLD TIME | TBD |
| INPUT RANGE<br>LOW LEVEL<br>HIGH LEVEL | <br>0 V to +0.7 V<br>+1.6 V to +3.6 V |
| IMPEDANCE | TBD |
| CONNECTOR | TBD |

| REFERENCE CLOCK INPUT | |
|---|---|
| INPUT FREQUENCIES | 10MHz / 100MHz selectable |
| LOCK RANGE | ± 1MHz |
| INPUT LEVEL | 0.2 Vp-p to 3.0 Vp-p |
| IMPEDANCE | 50 Ω, AC coupled (nom) |
| CONNECTOR TYPE | SMP |

| SAMPLE CLOCK INPUT | |
|---|---|
| FREQUENCY RANGE | SCLK Range |
| INPUT POWER RANGE | +0 dBm to +7 dBm |
| DAMAGE LEVEL | +8 dBm |
| INPUT IMPEDANCE | 50 Ω nom, AC coupled |
| CONNECTOR TYPE | SMA |

| GENERAL | |
|---|---|
| Voltage Range: | |
| Frequency Range: | 47Hz to 63Hz |
| Power Consumption: | 550W max. |
| Interface:<br>USB<br><br><br>LAN<br><br><br>GPIB | <br>1 x front, USB host (type A)<br>2 x rear USB host, (type A)<br>1 x rear Thunderbolt 3 USB (type C) – Option TBolt<br>1 (or 2 optional) x RG45 x rear 1000/100/10 BASE-T<br>1 or 2 optional SFP+ 10G Optical<br>IEEE 488.2 – Option GPIB |
| Storage | 128GB removable |
| Dimensions:<br>Without Package<br>Shipping Weight | <br>7.5 Kg<br>9 Kg |
| Weight:<br>Operating<br>Storage | <br>0°C to +40°C<br>-40°C to +70°C |
| Temperature:<br>Operating<br>Storage<br>Warm up time | <br>0°C to +40°C<br>-40°C to +70°C<br>15 minutes |
| Humidity: | 85% RH, non-condensing |
| Safety: | CE Marked, EC61010-1:2010 |
| EMC: | IEC 61326-1:2013 |
| Calibration: | 2 years |
| Warranty: | 1/3year warranty plan |

| ORDERING INFORMATION | |
|---|---|
| MODEL | DESCRIPTION |
| P1282D | 1.25GS/s, 16Bit, AWG, 1GS/s Memory, 2CH, 4 Markers |
| P1284D | 1.25GS/s, 16Bit, AWG, 1GS/s 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 |
| OPTION | |
| 4M1 | 4GS Memory Opt. for models P1282D,& P2582D |
| 4M2 | 4GS Memory Opt. for models P1284D & P2584x |
| 4M3 | 4GS Memory Opt. for models P1288D, P2588D & P9084D |
| 4M4 | 4GS Memory Opt. for models P12812D, P25812D & P9086D |
| 8M1 | 8GS Memory Opt. for models P1282D & P2582D |
| 8M2 | 8GS Memory Opt. for models P1284D, P2584D & P9082D |
| 8M3 | 8GS Memory Opt. for models P1288D, P2588D & P9084D |
| 8M4 | 8GS Memory Opt. for models P12812D, P25812D & P9086D |
| 16M1 | 16GS Memory option for models P9082D |
| 16M2 | 16GS Memory option for models P9084D |
| 16M3 | 16GS Memory option for models P9086D |
| DO1 | 9GHz BW Direct Output Opt. for models P1282D & P2582D |
| DO2 | 9GHz BW Direct Output Opt. for models P1284D, P2584D & P9082D |
| DO3 | 9GHz BW Direct Output Opt. for models P1288D, P2588D & P9084D |
| DO4 | 9GHz BW Direct Output Opt. for models P12812D, P25812D & P9086D |
| FS1 | Fast Segment Control Opt.for models P1282D & P2582D |
| FS2 | Fast Segment Control Opt.for models P1284D, P2584D & P9082D |
| FS3 | Fast Segment Control Opt. for models P1288D, P2588D & P9084D |
| MRK1 | x8 Extra Markers Opt. for models P1282D& P2582D |
| MRK2 | x8 Extra Markers Opt. for models P1284D,P2584D & P9082D |
| MRK3 | x16 Extra Markers Opt. for models P1288D, P2588D & P9084D |
| LTJ1 | Ultra Low Trigger Jitter (200ps typ.) Opt.for models P1282D & P2582D |
| LTJ2 | Ultra Low Trigger Jitter (200ps typ.) Opt.for models P1284D, P2584D & P9082D |
| LTJ3 | Ultra Low Trigger Jitter (200ps typ.) Opt. for models P1288D, P2588D & P9084D |
| LTJ4 | Ultra Low Trigger Jitter (200ps typ.) Opt. for models P12812D, P25812D & P9086D |
| G1 | Low Waveform Granularity Opt. for models P1282D & P2582D |
| G2 | Low Waveform Granularity Opt. for models P1284D, P2584D & P9082D |
| G3 | Low Waveform Granularity Opt. for models P1288D, P2588D & P9084D |
| G4 | Low Waveform Granularity Opt. for models P12812D, P25812D & P9086D |
| AWT1 | 9GHz BW, 2.7GS/s 12 Bit 1CH Digitizer Opt. for models P1282D & P2582D |
| AWT2 | 9GHz BW, 2.7GS/s 12 Bit 1CH Digitizer Opt. for models P1284D, P2584D & P9082D |
| AWT3 | 9GHz BW, 2.7GS/s 12 Bit 2CH Digitizer Opt. for models P1288D,P2588D & P9084D |
| FPGA PROG | FPGA Programming Capability with built-in Demodulation & digital Filters |
| ARTIQ Core | ARTIQ Core integration to allow simply FPGA control & programming |

# PROTEUS

Infinite possibilities

## Benchtop Platform

Introducing Tabor's all new Proteus series, the world's first Arbitrary Waveform Transceiver. 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:

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

9GHz 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

Excellent phase noise and spurious performance

User customizable FPGA for application specific solutions

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

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

| GENERAL CHARACTERISTICS | P9082/4/6B | P2582/4/8/12B | P1282/4/8/12B |
|---|---|---|---|
| **MAX. SAMPLE RATE** | 9GS/s | 2.5GS/s | 1.25GS/s |
| **RESOLUTION** | 16-bit(1) | | |
| **ENOB AT MAX. FREQUENCY** | TBD | | |
| **NUMBER OF CHANNELS** | 2/4/6 | 2/4/8/12 | 2/4/8/12 |
| **BANDWIDTH** | 9GHz(2)<br>4.5GHz(3) | 5GHz(2)<br>2.5GHz(3) | 2.5GHz(2)<br>1.25GHz(3) |
| **MEMORY** | Up to 16GS | Up to 8GS | Up to 4GS |
| **INTERFACE** | USB 3.0, 10GE, Thunderbolt 3 | | |
| **LATENCY / SYSTEM DELAY** | 200ns | | |
| **FINE DELAY** | -5ns to 5ns | | |
| **DELAY RESOLUTION** | 5ps resolution | | |
| **COARSE DELAY** | 0 to wavelength in 1 sample point resolution | | |
| **INITIAL SKEW BETWEEN CHANNELS** | 0ps | | |

(1) Depending on sampling mode (2) Direct output option (3) DC output option

| ARBITRARY / TASK TABLE | P9082/4/6B | P2582/4/8/12B | P1282/4/8/12B |
|---|---|---|---|
| **MINIMUM SEGMENT LENGTH**<br>NORMAL<br>FAST SEGMENT | 2048 points<br>128 points | 1024 points<br>64 points | |
| **WAVEFORM GRANULARITY**<br>STANDARD<br>OPTIONAL | 64 points<br>32 points | 32 points<br>16 points | |
| **SEGMENTS** | 2^15 | | |
| **SEGMENT LOOPS** | 2^20 | | |
| **SEQUENCES** | 2^15 | | |
| **SEQUENCE TABLE ENTRIES** | 2^15 | | |
| **SEQUENCE LOOPS** | 2^20 | | |
| **ADVANCED SEQUENCES TABLE ENTRIES** | 1024 | | |

| SIGNAL PURITY | DC OUTPUT | DIRECT OUTPUT |
|---|---|---|
| **HARMONIC DISTORTION** | | |
| fout = 100 MHz | <-75 dBc (typ) | <-80 dBc (typ) |
| fout = 10 MHz - 500 MHz, DC to 2 GHz | <-70 dBc (typ) | <-75 dBc (typ) |
| fout = 10 MHz ... 3 GHz, DC to 4.5 GHz | <-65 dBc (typ) | <-70 dBc (typ) |
| fout = 10 MHz ... 7 GHz, 5 to 10 GHz | | TBD |
| **SFDR** | | |
| fout = 10 MHz...1 GHz DC to 1 GHz | -85 dBc (typ) | <-85 dBc (typ) |
| fout = 1 GHz...3 GHz , DC to 3 GHz | -75 dBc (typ | <-75 dBc (typ) |
| fout = 3 GHz...4.5 GHz , DC to 4.5 GHz | -65 dBc (typ) | <-65 dBc (typ) |
| fout = 3 GHz...4.5 GHz , DC to 4.5 GHz | 100us Full bandwidth | -<70 dBc (typ) |
| fout = 7 GHz, 6 to 8 GHz (2nd Nyquist) | <6us Narrow bandwidth<br>(<10% BW) | -<70 dBc (typ) |
| **PHASE NOISE (@10kHz offset)** | | |
| fout = 187.5MHz | -130 dBc/Hz | |
| fout = 375MHz | -125 dBc/Hz | |
| fout = 750MHz | -120 dBc/Hz | |
| fout = 2GHz – 5GHz | -110 dBc/Hz | |
| fout = 5GHz - 7GHz | -105 dBc/Hz | |

# PROTEUS

Infinite possibilities

| DC OUTPUT | |
|---|---|
| OUTPUT TYPE | Single-ended or differential, DC-coupled |
| IMPEDANCE | 50 Ω (nom) |
| AMPLITUDE | 100 mVp-p to 1.2 Vp-p |
| AMPLITUDE RESOLUTION | ±(3% of amplitude ±2 mV) |
| VOLTAGE WINDOW | ±2V |
| OFFSET RESOLUTION | 1mV |
| DC OFFSET ACCURACY | ±(2.0% of offset±10 mV) |
| SKEW BETWEEN NORMAL AND COMPLEMENT OUTPUTS | 0 ps |
| RISE/FALL TIME (20% TO 80%) | <150 ps (typ) |
| JITTER (PEAK-PEAK) | <15 ps (typ) |
| OVERSHOOT | <5% (typ) |
| CONNECTOR TYPE | SMA |

| DIRECT OUTPUT (OPTIONAL) | |
|---|---|
| OUTPUT TYPE | Single-ended or differential, AC coupled |
| IMPEDANCE | 50 Ω (nom) |
| AMPLITUDE | 600mVpp, single-ended into 50 Ω |
| AMPLITUDE RESOLUTION | 1mV |
| AMPLITUDE ACCURACY | ±(3% of amplitude ±2 mV) |
| BANDWIDTH<br>-3dB analog BW<br>2ND Nyquist zone BW | <br>100 kHz to 4.5 GHz (typ)<br>Up to 9GHz |
| CONNECTOR TYPE | SMA |

| REFERENCE CLOCK OUTPUT | |
|---|---|
| FREQUENCY | 10MHz / 100MHz selectable |
| CONNECTOR | SMP |

| MARKER OUTPUTS | P9082/4/6B | P2582/4/8/12B | P1282/4/8/12 B |
|---|---|---|---|
| NUMBER OF MARKERS | 8/16/24 | 8/8/16/24 | 4/4/8/12 |
| OUTPUT TYPE | Single Ended | | |
| OUTPUT IMPEDANCE | 50 Ω (nom) | | |
| LEVEL | 100 mVp-p to 1.2 Vp-p with 40mV resolution | | |
| RISE/FALL TIME (20% TO 80%) | <400ps | | |
| MARKER TO DIRECT/DC OUT | <1SCLK | | |
| WIDTH | User defined, in points | | |
| DELAY CONTROL | Position control in points | | |
| RANGE | 0 - waveform length | | |
| RESOLUTION | 8 points | 2 points | |
| CONNECTOR TYPE | SMP | | |

| SYNC CLOCK OUTPUT | |
|---|---|
| FREQUENCY | 1/64 of the sample clock frequency |
| CONNECTOR | SMP |

| SAMPLE CLOCK OUTPUT | |
|---|---|
| SOURCE | Selectable, internal synthesizer or sample clock input |
| FREQUENCY RANGE | SCLK Range |
| OUTPUT AMPLITUDE | 400 mVpp (nom), fix |
| INPUT IMPEDANCE | 50 Ω (nom), AC coupled |
| AMPLITUDE ACCURACY | ±(3% of amplitude ±2 mV) |
| TRANSITION TIME (20% TO 80%) | 20 ps (typ) |
| CONNECTOR | SMA |

| TRIGGER/GATE AND EVENT INPUT | |
|---|---|
| INPUT RANGE | ±5 V |
| THRESHOLD<br>RANGE<br>RESOLUTION<br>SENSITIVITY | <br>−5 V to +5 V<br>100 mV<br>200 mV |
| JITTER @ MAX CLOCK | 3.2ns (200ps optional) |
| POLARITY | Pos or Neg |
| DRIVE | Selectable channel 1, channel 2 or both |
| INPUT IMPEDANCE | 1 k or 50 Ω (nom), DC coupled |
| MAX TOGGLE FREQUENCY | TBD |
| MINIMUM PULSE WIDTH | TBD |
| CONNECTOR TYPE | SMP |

| FAST SEGMENT DYNAMIC CONTROL INPUT (OPTIONAL) | |
|---|---|
| **NUMBER OF ADDRESSABLE SEGMENTS OR SEQUENCES** | 256 |
| **DATA RATE** | TBD |
| **SET-UP TIME** | TBD |
| **HOLD TIME** | TBD |
| **INPUT RANGE**<br>LOW LEVEL<br>HIGH LEVEL | <br>0 V to +0.7 V<br>+1.6 V to +3.6 V |
| **IMPEDANCE** | TBD |
| **CONNECTOR** | TBD |

| REFERENCE CLOCK INPUT | |
|---|---|
| **INPUT FREQUENCIES** | 10MHz / 100MHz selectable |
| **LOCK RANGE** | ± 1MHz |
| **INPUT LEVEL** | 0.2 Vp-p to 3.0 Vp-p |
| **IMPEDANCE** | 50 Ω, AC coupled (nom) |
| **CONNECTOR TYPE** | SMP |

| SAMPLE CLOCK INPUT | |
|---|---|
| **FREQUENCY RANGE** | SCLK Range |
| **INPUT POWER RANGE** | +0 dBm to +7 dBm |
| **DAMAGE LEVEL** | +8 dBm |
| **INPUT IMPEDANCE** | 50 Ω nom, AC coupled |
| **CONNECTOR TYPE** | SMA |

| GENERAL | |
|---|---|
| **Voltage Range:** | 90VAC to 264VAC |
| **Frequency Range:** | 47Hz to 63Hz |
| **Power Consumption:** | 550W max. |
| **Display Type:** | 9" touch screen LCD |
| **Interface:**<br>**USB**<br><br><br>LAN<br><br>GPIB | <br>1 x front, USB host (type A)<br>2 x rear USB host, (type A)<br>1 x rear Thunderbolt 3 USB (type C) – Option TBolt<br>1 (or 2 optional) x RG45 x rear 1000/100/10 BASE-T<br>1 or 2 optional SFP+ 10G Optical<br>IEEE 488.2 – Option GPIB |
| **Storage** | 128GB removable |
| **Dimensions:**<br>With feet<br>Without feet | <br>440 X 176 x 425 mm (W x H x D)<br>440 X 190 x 425 mm (W x H x D) |
| **Weight:**<br>Without Package<br>Shipping Weight | <br>8.5 Kg<br>10 Kg |
| **Temperature:**<br>Operating<br>Storage<br>Warm up time | <br>0°C to +40°C<br>-40°C to +70°C<br>15 minutes |
| **Humidity:** | 85% RH, non-condensing |
| **Safety:** | CE Marked, EC61010-1:2010 |
| **EMC:** | IEC 61326-1:2013 |
| **Calibration:** | 2 years |
| **Warranty:** | 1/3year warranty plan |

| ORDERING INFORMATION | |
|---|---|
| **MODEL** | **DESCRIPTION** |
| P1282B | 1.25GS/s, 16Bit, AWG, 1GS/s Memory, 2CH, 4 Markers |
| P1284B | 1.25GS/s, 16Bit, AWG, 1GS/s Memory, 4CH, 4 Markers |
| P1288B | 1.25GS/s, 16Bit, 2GS Memory, 8CH 8 Markers |
| P12812B | 1.25GS/s, 16Bit, 2GS Memory, 12CH 12 Markers |
| P2582B | 2.5GS/s, 16Bit, 2GS Memory 2CH, 8 Markers |
| P2584B | 2.5GS/s, 16Bit, 2GS Memory, 4CH, 8 Markers |
| P2588B | 2.5GS/s, 16Bit, 2GS Memory, 8CH 16 Markers |
| P25812B | 2.5GS/s, 16Bit, 2GS Memory, 12CH, 24 Markers |
| P9082B | 9GS/s 16Bit, 4GS Memory 2CH, 8 Markers |
| P9084B | 9GS/s 16Bit, 4GS Memory 4CH, 16 Markers |
| P9086B | 9GS/s 16Bit, 4GS Memory 6CH, 24 Markers |
| 4M1 | 4GS Memory option for models P1282B & P2582B |
| 4M2 | 4GS Memory option for models P1284B& P2584B |
| 4M3 | 4GS Memory option for models P1288B,P2588B&P9084B |
| 4M4 | 4GS Memory option for models P12812B,P25812B & P9086B |
| 8M1 | 8GS Memory option for models P1282B &P2582B |
| 8M2 | 8GS Memory option for models P1284B,P2584B & P9082B |
| 8M3 | 8GS Memory option for models P1288B, P2588B & P9084B |
| 8M4 | 8GS Memory option for models P12812B, P25812B & P9086B |
| 16M1 | 16GS Memory option for models P9082B |
| 16M2 | 16GS Memory option for models P9084B |
| 16M3 | 16GS Memory option for models P9086B |
| DO1 | 9GHz BW Direct Output option for models P1282B & P2582B |
| DO2 | 9GHz BW Direct Output Opt. for models P1284B, P2584B & P9082B |
| DO3 | 9GHz BW Direct Output Opt. for models P1288B, P2588B &P9084B |
| DO4 | 9GHz BW Direct Out. option for P12812B, P25812B&P9086B |
| FS1 | Fast Segment Control option for models P1282B & P2582B |
| FS2 | Fast Segment Control opt. for models P1284B, P2584B & P9082B |
| FS3 | Fast Segment Control Opt. for models P1288B, P2588B & P9084B |
| MRK1 | x8 Extra Markers Opt. for models P1282B & P2582B |
| MRK2 | x8 Extra Markers Opt. for models P1284B, P2584B & P9082B |
| MRK3 | x16 Extra Markers option for models P1288B, P2588B & P9084B |
| LTJ1 | Ultra Low Trigger Jitter (200ps typ.) Opt.for models P1282B &P2582B |
| LTJ2 | Ultra Low Trigger Jitter (200ps typ.) Opt. for models P1284B, P2584B & P9082B |
| LTJ3 | Ultra Low Trigger Jitter (200ps typ.) Opt. for models P1288B, P2588B & P9084B |
| LTJ4 | Ultra Low Trigger Jitter (200ps typ.) Opt. for P12812B, P25812B &P9086B |
| G1 | Low Waveform Granularity Opt. for models P1282B and P2582B |
| G2 | Low Waveform Granularity Opt. formodels P1284B, P2584B & P9082B |
| G3 | Low Waveform Granularity Opt. for models P1288B, P2588B & P9084B |
| G4 | Low Waveform Granularity Opt. for models P12812B, P25812B & P9086B |
| AWT1 | 9GHz BW, 2.7GS/s 12 Bit 1CH Digitizer Opt. for models P1282B & P2582B |
| AWT2 | 9GHz BW, 2.7GS/s 12 Bit 1CH Digitizer Opt. for models P1284B, P2584B & P9082B |
| AWT3 | 9GHz BW, 2.7GS/s 12 Bit 2CH Digitizer Opt. for P1288B, P2588B &P9084B |
| FPGA PROG | FPGA Programming capability with high level code through decision blocks |
| FPGA Shell | FPGA full control & programming |

# PROTEUS

Infinite possibilities

## MODULE PLATFORM 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.

## DESKTOP PLATFORM 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.

## BENCHTOP PLATFORM 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.

TABOR ELECTRONICS

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