

Specifications	9200	9200+	9250	9420	9520	9530
<b>Timing Resolution</b>						
<b>Width</b>	10ns	5ns	5ps	1ns	250ps	250ps
<b>Delay</b>	10ns	5ns	5ns	1ns	250ps	250ps
<b>Rep Rate</b>	5MHz	20MHz	25MHz	5MHz	10MHz	10MHz
<b>Jitter, Ch-to-Ch*</b>	250ps	250ps	15ps	400ps	50ps	50ps
<b>Pulse Width Range</b>	10ns-1000s	10ns-1000s	8ns-4000s	10ns-1000s	10ns-1000s	10ns-1000s
<b>Rise Time*</b>	2n @5v	2n @5v	2n @5v	3ns @5v	3ns @5v	3ns @5v
<b>Output Level*</b>	3.3 – 5.0V	3.3 – 5.0V	3.3 – 5.0V	4V	4V	4V
<b>Adjustable Output</b>	null			2 - 20V	2 - 20V	2 - 20V
<b>Number of Channels</b>	2 or 4	2 or 4	4 only	2, 4 or 8	2, 4 or 8	2, 4 or 8
<b>Virtual Channels</b>			+ "4"			
<b>Communication</b>	USB	USB	USB	RS232,USB	RS232, USB	RS232, USB
<b>Optional Ethernet/GPIB</b>					Yes	Standard
<b>Options:</b>						
<b>50ohm Impedance</b>		YES	YES		YES	YES
<b>High Voltage</b>		null	null	null	YES	
<b>Optical Outputs or Inputs</b>	null	null	null	null	YES	
<b>Dual Trigger</b>					YES	YES
<b>Bluetooth</b>	YES	YES	YES			



**Sapphire Series**

# The Sapphire

## Digital Delay Pulse Generator

The sapphire series is the most affordable Digital Delay Pulse Generator in our family of products. Despite its low cost, this robust model offers a full range of features, making it ideally suited for the budget sensitive user.

- 2 or 4 Independent Channel Outputs
- 10 ns Resolution
- < 500 ps RMS Jitter
- Output Multiplexer
- Fast Rise Time, < 2 ns
- Small Form Factor
- DC Wall Mount or USB Powered
- Wireless Option Via Bluetooth
- Full Customer Support
- 2 Year Warranty



Quantum Composers, Inc.  
P.O. Box 4248  
Bozeman, MT 59772

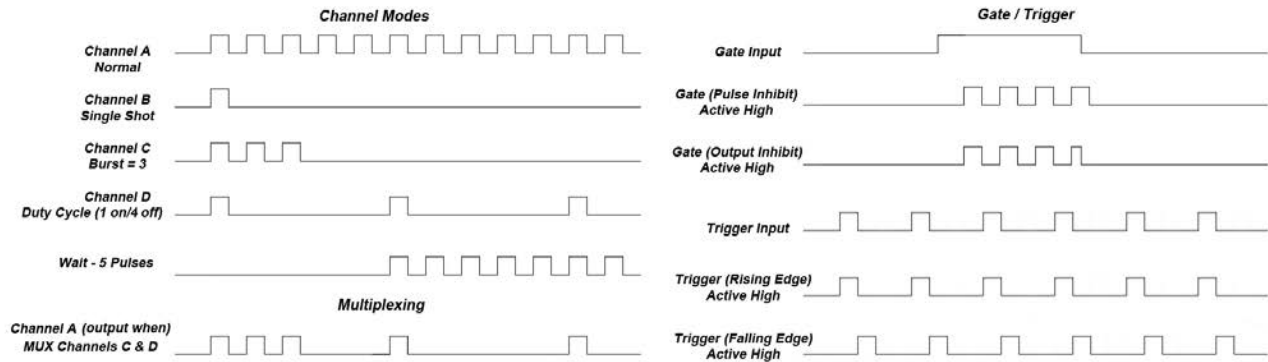
**Phone** (406) 582-0227  
**Fax** (406) 582-0237  
**Toll Free** +1.800.510.6530

[www.quantumcomposers.com](http://www.quantumcomposers.com)  
[sales@quantumcomposers.com](mailto:sales@quantumcomposers.com)

# The Sapphire Pulse Generator

The Sapphire Series Digital Delay Pulse Generator with 2 or 4 independent outputs is our most affordable digital delay/pulse generator. It's ideal for applications that require moderate precision and multi-channel capability. The instrument offers a complete set of channel operating modes including continuous, single shot, burst, and duty cycle. When combined with an external trigger/gate input and output multiplexer, this allows for a full range of complex output waveforms. With intuitive, streamlined GUI (Graphical User Interface) control of timing parameters and quick recall of up to 6 system configurations, the instrument is instantly ready for use. Complete control of the Sapphire is provided through the standard USB interface and optional Bluetooth connectivity.

## Digital Delay Output Modes



## Special Features

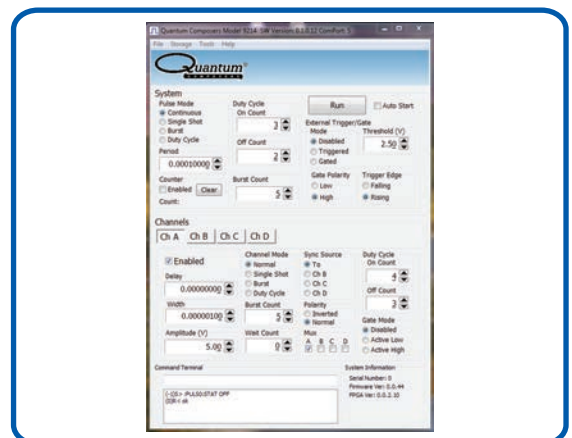
### Bluetooth Wireless Connectivity

The Bluetooth wireless capabilities are truly unique with this unit. With the Bluetooth option, you can control the instrument wirelessly using the included software application, Comm Terminal or other terminal program. This unique feature allows you to communicate with Bluetooth equipped devices, such as laptops and some tablets or smartphones.



### Graphical User Interface

The Sapphire uses an included software application as the primary means of communication. The software allows simple and easy control of the unit via USB or optional Bluetooth wireless, enabling the user to create complex pulse trains and save them for future recall. The software also allows users to manually input SCPI (Standard Commands for Programmable Instruments) based commands via the Command Terminal Section.



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
Web www.quantumcomposers.com

## SPECIFICATIONS

## Sapphire Series

MODEL 9212	2 independent channel outputs
9214	4 independent channel outputs

Standard Communications: USB Port  
Configurations: 6 Memory Slots

### INTERNAL RATE GENERATOR

Rate (To period)	0.001 Hz to 5.000 MHz (200 ns – 1000 s)
Resolution	10 ns
Accuracy	5 ns + (0.0001 x period)
Jitter	< 500 ps RMS
Burst / Duty Cycle Mode	1 to 1,000,000 pulses
Timebase	100 MHz, low jitter PLL
Oscillator	50 MHz, 50 ppm crystal oscillator
Pulse Control Modes	Internal rate generator, external trigger / gate
System Output Modes	Single, continuous, burst, duty cycle

### PULSE / DELAY GENERATION

Width / Delay Resolution	10 ns
Width Range	10 ns - 1000 s
Width Accuracy	10 ns + 0.0001 x (width + delay)
Delay Range	±1000 s
Delay Accuracy	10 ns + (0.0001 x delay)
Output Multiplexer	Timing of any / all channels may be OR'd to any / all outputs.
Channel Output Modes	Single Shot, normal, burst, duty cycle
Channel Control Modes	Internally triggered or externally gated. Each channel may be set to any of the modes.
Jitter (Channel to Channel)	< 250 ps RMS
TZ50 (Optional)	3.3 - 4VDC into 50ohm

### EXTERNAL GATE / TRIGGER INPUT

Threshold	0.2 to 15 VDC
Max Input Voltage	30 V Peak
Gate Polarity	Active high / active low
Gate Control Modes	Pulse inhibit / output inhibit
Trigger Edge	Rising or falling
Trigger Rate	DC to 5 MHz
Trigger Input Jitter	< 20 ns RMS
Trigger Minimum Pulse Width	20 ns
Trigger Insertion Delay	< 150 ns
Pulse Inhibit Delay	< 150 ns
Output Inhibit Delay	< 100 ns

### OUTPUTS

Output Impedance	50 ohm
Output Level	3.3 – 5 VDC into ≥ 1 K ohm, 1.7 – 2.5 VDC into 50 ohm
Resolution	20 mV
Current	5 mA into 1 K ohm, 50 mA into 50 ohm
Rise Time	< 2ns @ 5 V (high impedance), < 1ns @ 2.5 V (50 ohm)
Overshoot	< 100 mV + 10 % of pulse amplitude

### COMMUNICATIONS

USB (Standard)	USB 2.0
Bluetooth (Optional)	Bluetooth 2.1
Antenna sensitivity	Class II Radio, 4 dBm output transmitter, - 80 dBm typical receiver
Range	Typically 20 meters in open air (line-of-sight)
Baud Rate	115200 bits / second

### GENERAL

Dimension	7.125 x 5.1 x 1.5 inches (18.1 x 13 x 3.8 cm)
Weight	1 lb
Power	Provided by USB
Voltage	+ 5 VDC ± 250 mVDC
Current	< 470 mA



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
Web www.quantumcomposers.com

V1.2 8/3/16



**Sapphire Plus**

# The Sapphire Plus

## Digital Delay Pulse Generator

The Sapphire Plus is an upgrade to our standard Sapphire, with this enhanced version you will have better performance and higher specifications. This unit is perfect for those on a budget but looking for more precise resolution and jitter.

- 2 or 4 Independent Channel Outputs
- 5 ns Resolution
- < 50 ps RMS Jitter
- "Virtual" channel timers
- Up to 20MHz external trigger rate
- Fast Rise Time, <2ns
- Optional 1ppm Clock
- Wireless Option Via Bluetooth
- Full Customer Support
- 2 Year Warranty



Quantum Composers, Inc.  
P.O. Box 4248  
Bozeman, MT 59772

**Phone** (406) 582-0227  
**Fax** (406) 582-0237  
**Toll Free** +1.800.510.6530

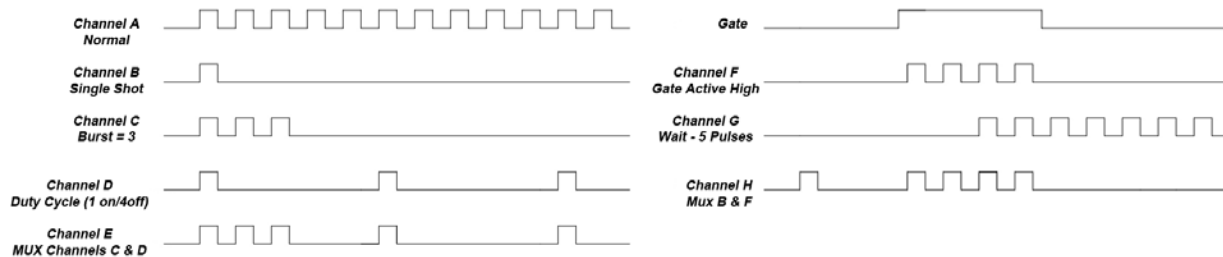
[www.quantumcomposers.com](http://www.quantumcomposers.com)  
[sales@quantumcomposers.com](mailto:sales@quantumcomposers.com)



# The Sapphire Plus Pulse Generator

The Sapphire Plus, with 2 or 4 independent outputs, gives you features and spec's not found on our standard 9200. The resolution and accuracy of the width, delays, and period counters improves to 5ns. This allows for finer adjustments (5ns) on the widths, delays and period. Virtual Channels- 2 channel adds 2 "virtual" channels and the 4 channel adds 4 "virtual" channels - this effectively doubles the number of channel timers the unit may utilize. A "Period Counter" has been added which measures the time between incoming external trigger pulses - this can help in adding greater accuracy. The Sapphire Plus also has an optional 1ppm crystal oscillator for improved performance. With intuitive, streamlined GUI control of timing parameters and quick recall of up to 6 system configurations, the instrument is instantly ready for use. Complete control of the Sapphire is provided through the standard USB interface and optional Bluetooth connectivity.

## Digital Delay Output Modes



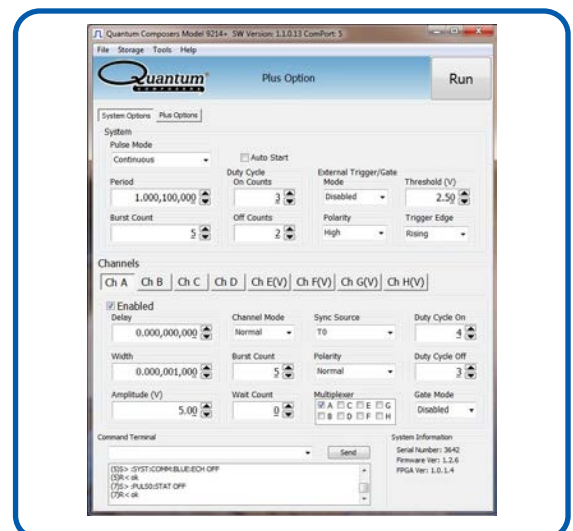
## Special Features

### Bluetooth Wireless Connectivity

The Bluetooth wireless capabilities are truly unique with this unit. With the Bluetooth option, you can control the instrument wirelessly using the included software application, Comm Terminal or other terminal program. This unique feature allows you to communicate with Bluetooth equipped devices, such as laptops and some tablets or smartphones.

### Graphical User Interface

The Sapphire uses an included software application as the primary means of communication. The software allows simple and easy control of the unit via USB or optional Bluetooth wireless, enabling the user to create complex pulse trains and save them for future recall. The software also allows users to manually input SCPI (Standard Commands for Programmable Instruments) based commands via the Command Terminal Section.



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email  
Web

sales@quantumcomposers.com  
www.quantumcomposers.com

# Sapphire Plus Specifications

MODEL	9212+ 2 independent channel outputs	Standard Communications: USB Port
	9214+ 4 independent channel outputs	Configurations: 6 Memory Slots

## INTERNAL RATE GENERATOR

Rate (To period)	0.001Hz to 20MHz (1000s to 50ns)
Resolution & Accuracy	5 ns
Jitter	< 50 ps RMS
Burst / Duty Cycle Mode	1 to 1,000,000 pulses
Timebase	100 MHz, low jitter PLL
Oscillator	50 MHz, 50 ppm crystal oscillator, optional 1ppm clock
Pulse Control Modes	Internal rate generator, external trigger / gate
System Output Modes	Single, continuous, burst, duty cycle, cycle counts
Pulse & Period Counter	32 Bit
Synchronized Update Mode	Updates widths and delays on command

## PULSE / DELAY GENERATION

Width / Delay Resolution	5 ns
Width Range	10 ns - 1000 s
Width Accuracy	10 ns + 0.0001 x (width + delay)
Delay Range	±1000 s
Delay Accuracy	5 ns + (0.0001 x delay)
Multiplexer	Any/All channels may be OR'd to any/ALL outputs. 2x the number of outputs via virtual channels for muxing.
Channel Output Modes	Single Shot, normal, burst, duty cycle
Channel Control Modes	Internally triggered or externally gated. Each channel may be independently set to any of the modes.
Jitter (Channel to Channel)	< 250 ps RMS

## EXTERNAL GATE / TRIGGER INPUT

Threshold	0.2 to 15 VDC
Max Input Voltage	30 V Peak
Gate Polarity	Active high / active low
Gate Control Modes	Pulse inhibit / output inhibit
Trigger Edge	Rising or falling
Trigger Rate	DC to 20 MHz
Trigger Input Jitter	< 5 ns RMS
Trigger Minimum Pulse Width	20 ns
Trigger Insertion Delay	< 100 ns
Pulse Inhibit Delay	< 150 ns
Output Inhibit Delay	< 100 ns
Trigger Input Function	System can generate a single, burst or duty cycle response of pulses for every external trigger pulse.

## OUTPUTS

Output Impedance	50 ohm
Output Level	3.3 – 5 VDC into ≥ 1 K ohm, 1.7 – 2.5 VDC into 50 ohm
Current	20 mA
Rise Time	5 mA into 1 K ohm, 50 mA into 50 ohm
Overshoot	< 2ns @ 5 V (high impedance), < 1ns @ 2.5 V (50 ohm) < 100 mV + 10 % of pulse amplitude

## GENERAL

USB	Standard USB 2.0
Antenna	Class II Radio, 4 dBm output transmitter, - 80 dBm typical receiver sensitivity 115200 bits / second
Baud Rate	7.125 x 5.1 x 1.5 inches (18.1 x 13 x 3.8 cm). 1lb
Dimensions/Weight	+ 5 VDC ± 250 mVDC
Voltage	< 470 mA
Current	

OPTIONS	3.3 - 4VDC into 50ohm
TZ50	1ppm Crystal Oscillator (this option is not field upgradable)
1ppm Clock	Bluetooth 2.1
Bluetooth Wireless Communications	



**Toll Free Phone** (800) 510-6530  
**Fax Phone Line** (406) 582-0237

**Email** sales@quantumcomposers.com  
**Web** www.quantumcomposers.com

V1.1 8/15/16



# The Emerald

## Digital Delay Pulse Generator

The Emerald 9250 series pulse generator was designed to meet the growing demand for an affordable yet high resolution system synchronizer. This precision delay generator comes standard with a 280 ppb TCXO oscillator and 5ps timing resolution for high performance in a compact packaging.

- 4 Independent Channel Outputs
- 5 ps Delay Resolution
- TCXO 280 ppb oscillator
- < 15 ps RMS Jitter
- “Virtual” Channel Timers
- Fast Rise Time, < 2 ns
- 8 Independent Pulses (width & delay) with the virtual timers
- Up to 20MHz External Trigger Rate
- Wireless Option Via Bluetooth
- Full Customer Support



Quantum Composers, Inc.  
P.O. Box 4248  
Bozeman, MT 59772

**Phone** (406) 582-0227  
**Fax** (406) 582-0237  
**Toll Free** +1.800.510.6530

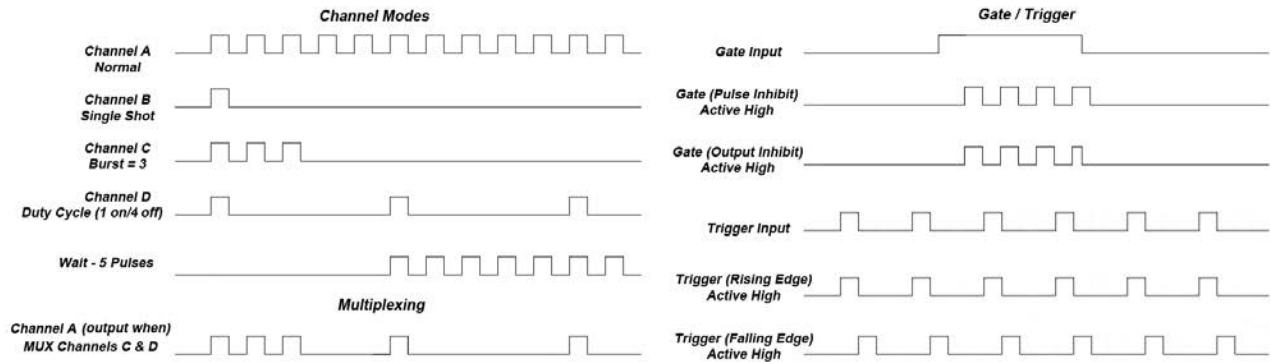
[www.quantumcomposers.com](http://www.quantumcomposers.com)  
[sales@quantumcomposers.com](mailto:sales@quantumcomposers.com)



# The Emerald Pulse Generator

The Emerald comes standard with 4 independent outputs and a TCXO 280ppb oscillator. The resolution and accuracy of the width, delays, and period counters is improved over previous instruments and allows for finer adjustments and more precise synchronization. This model also features virtual channels adding 4 "virtual" channels which effectively double the number of channel timers the unit may utilize and a "Period Counter" which measures the time between incoming external trigger pulses. The Emerald also offers an optional (TZ50), for driving 50 ohm loads & adjustable output module. With intuitive, streamlined GUI control of timing parameters and quick recall of up to 6 system configurations, the instrument is instantly ready for use. Complete control of the Emerald is provided through the standard USB interface or optional Bluetooth connectivity.

## Digital Delay Output Modes



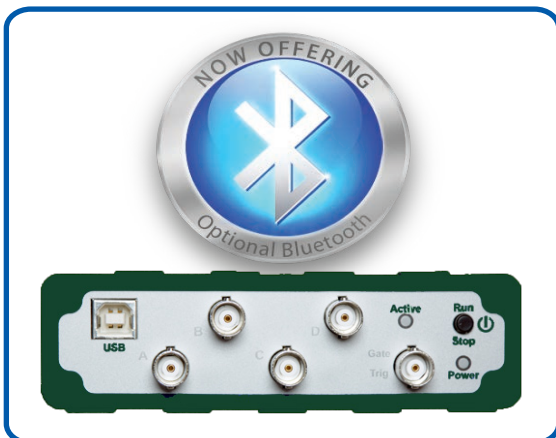
## Special Features

### Bluetooth Wireless Connectivity

The 9250 will feature a unique Bluetooth wireless option. This allows the pulse generator to communicate with Bluetooth enabled devices such as laptops, tablets, or smartphones. The included GUI software can be paired with the Bluetooth device to program or control the instrument wirelessly.

### Simple Graphical User Interface

The Emerald uses an included custom software application as the primary means of communication. The software allows simplified control of the unit via USB or optional wireless, enabling the user to create complex pulse trains and save them for future recall. The software also allows users to manually input SCPI (Standard Commands for Programmable Instruments) based commands via the Command Terminal Section.



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
Web www.quantumcomposers.com

## SPECIFICATIONS

## Emerald Series

MODEL 9254 4 independent channel outputs  
(up to 8 independent pulses with virtual timers)

Standard Communications: USB Port  
Configurations: 6 Memory Slots

### INTERNAL RATE GENERATOR

Rate (To period)	0.00025 Hz to 25Mhz (40ns - 4000s)
Resolution & Accuracy	4 ns
Jitter	< 500 ps RMS
Burst / Duty Cycle Mode	1 to 1,000,000 pulses
Timebase	250 MHz, low jitter PLL
Oscillator	25 MHz, 280 ppb crystal oscillator
Pulse Control Modes	Internal rate generator, external trigger / gate.
System Output Modes	Single, continuous, burst, duty cycle.
Synchronized Update Mode	Updates width and delays on command.

### PULSE / DELAY GENERATION

Width Resolution	4 ns
Width Range	8 ns - 4000 s
Width Accuracy	10 ns + 0.0001 x (width + delay)
Jitter (Channel to Channel)	15 ps RMS + (1e -8x delay)
Delay Resolution	5 ps
Delay Range	±4000 s
Delay Accuracy	1ns + (0.0001 x delay)
Output Multiplexer	Any / all channels may be OR'd to any / all outputs.
Channel Output Modes	Single Shot, normal, burst, duty cycle
Channel Control Modes	Internally triggered or externally gated. Each channel may be independently set to any of the modes.
TZ50 (Optional)	3.3 – 5.0 VDC into ≥ 1K ohm , 2.8 – 4.4 VDC into 50 ohm

### EXTERNAL GATE / TRIGGER INPUT

Threshold	0.2 to 15 VDC
Max Input Voltage	30 V Peak
Gate Polarity	Active high / active low
Gate Control Modes	Pulse inhibit / output inhibit
Trigger Edge	Rising or falling
Trigger Rate	DC to 20 MHz
Trigger Input Jitter	< 6 ns RMS
Trigger Minimum Pulse Width	20 ns
Trigger Insertion Delay	< 75 ns
Pulse Inhibit Delay	< 150 ns
Output Inhibit Delay	< 100 ns
Trigger Input	Function System will generate a To pulse for every external trigger pulse.

### OUTPUTS

Output Impedance	50 ohm
Output Level	3.3 – 5 VDC into ≥ 1 K ohm, 1.7 – 2.5 VDC into 50 ohm
Resolution	20 mV
Current	5 mA into 1 K ohm, 50 mA into 50 ohm
Rise Time (10%-90%)	< 2ns @ 5 V (high impedance), < 1ns @ 2.5 V (50 ohm)
Overshoot	< 100 mV + 10 % of pulse amplitude

### COMMUNICATIONS

Bluetooth (Optional)	Bluetooth 2.1
Antenna	Class II Radio, 4 dBm output transmitter, - 80 dBm typical receiver sensitivity
Range	Typically 20 meters in open air (line-of-sight)
Baud Rate	115200 bits / second

### GENERAL

Dimensions/Weight	7.125 x 5.1 x 1.5 inches (18.1 x 13 x 3.8 cm), 1lb
Power & Std. Communications	Power is provided only by an external wall adapter power supply (included)
Voltage	+ 5 VDC ± 250 mVDC
Current	< 1.5A



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
Web www.quantumcomposers.com

V1.3 8/3/16



# 9420 Series

## Digital Delay Pulse Generator

The 9420 series pulse generator was designed to meet the growing demand for an affordable yet flexible system synchronizer. This benchtop, lab ready, delay generator comes standard with a 10ns timing resolution and a low jitter of less than 400ps. The simple programming, high functionality, and easy memory recall makes this model ideal for multiple projects and a wide variety of applications.

- 2, 4, or 8 Independent Channel Outputs
- 10 ns Timing Resolution
- < 400 ps RMS Jitter
- RS232, USB, and GPIB
- 12 Memory Recall Slots
- Full Customer Support
- 2 Year Warranty



Quantum Composers, Inc.  
P.O. Box 4248  
Bozeman, MT 59772

**Phone** (406) 582-0227  
**Fax** (406) 582-0237  
**Toll Free** +1.800.510.6530

[www.quantumcomposers.com](http://www.quantumcomposers.com)  
[sales@quantumcomposers.com](mailto:sales@quantumcomposers.com)

## SPECIFICATIONS

## 9420 Series

MODEL 9422	2 independent channel outputs
9424	4 independent channel outputs
9428	8 independent channel outputs

Standard Communications: GPIB, USB, & RS232 ports  
 Configurations: 12 Memory Slots  
 Inputs: 2 Inputs (1 Trigger & 1 Gate Input)

### INTERNAL RATE GENERATOR

Rate (T0 period)	0.0002 Hz to 5Mhz
Resolution	10 ns
Accuracy	1ns + (0.0001 x Period)
T0 Period Jitter (RMS)	< 250 ps
Timebase	100 MHz, low jitter PLL
Oscillator	50 MHz, 20 ppm crystal oscillator
System Output Modes	Single, continuous, burst, duty cycle, external gate/trigger
Burst Mode	1 to 1,000,000 pulses
Duty Cycle Mode	1 to 1,000,000 pulses
Pulse Control Modes	Internal rate generator, external trigger/gate

### CHANNEL TIMING GENERATOR

Pulse Width Range	10 n-1,000 s
Width Accuracy	1.5 ns + [0.0001 x (width+delay)]
Width Resolution	1 ns
Pulse Delay Range	-999.999999999 to 1000 s
Delay Accuracy	1.5 ns + (0.0001 x delay)
Delay Resolution	1 ns
Jitter (Channel to Channel RMS)	< 400 ps
Channel Modes	Single Shot, normal, burst, duty cycle
Control Modes	Internally triggered or externally gated. Each channel may be independently set.

Trigger Edge	Rising/Falling
Threshold	0.2 to 15 V
Max Input Voltage	30 V
Resolution	10 mV
Trigger Rate	DC to 5 MHz
Trigger Input Jitter (RMS)	2.5 ns
Trigger Input Insertion Delay	180 ns
Trigger Input Minimum Pulse Width	2 ns
Gate Pulse Inhibit Delay	120 ns
Gate Output Inhibit Delay	50 ns

### OUTPUT MODULE

#### TTL/CMOS MODE

Output Impedance	50 Ohms
Output Level	4.0 VDC into $\geq 1$ K ohm
Rise Time (10%-90%)	< 3ns typical into $\geq 1$ K ohm
Output Current	5 mA typical into 1 K ohm 50 mA typical into 50 ohm

#### ADJUSTABLE MODE

Output Level	2.0 to 20 VDC into $\geq 1$ K ohm, 1.0 to 10 VDC into $\geq 50$ ohms
Resolution	10 mV
Output Current	200 mA typical, 400 mA (short pulses)
Rise Time (10%-90%)	15 ns typical @ 20 V (High Imp) 25 ns typical @ 10 V (50 ohm)
Overshoot	< 100 mV + 10% of pulse amplitude

### GENERAL

Communications	GPIB, USB 2.0, RS232
Dimensions	10.5 x 8.25 x 5.5 inches (25.7 x 21 x 14 cm)
Weight	8 lbs
Power	Power is provided by an external wall adapter power supply (included)
Voltage	100 to 240 VAC
Current	3A
Memory	12 Slot



**Toll Free Phone** (800) 510-6530  
**Fax Phone Line** (406) 582-0237

**Email** sales@quantumcomposers.com  
**Web** www.quantumcomposers.com

V1.0 3/7/18





# 9520 Series

## Digital Delay Pulse Generators

The model 9520 series heightens the capabilities of pulse generation and digital delay to new levels. Cost effective, yet extremely capable, this instrument provides solutions to generate and synchronize multiple pulses and triggers for a wide variety of applications from simple to complex. The 9520 series has the unique capability of offering differing rates for all the channels using new clock-divider functions, and provides up to eight independent digitally controlled channels with width, delay, rate, and amplitude control on each output.

### Key Features

- 250 ps Timing Resolution
- < 50 ps Channel to Channel Jitter
- 2, 4, or 8 Fully Independent Channel Outputs
- Benchtop Design
- Wide Variety of Channel Output Options
- Free LabVIEW Drivers
- 2 Year Warranty



Quantum Composers, Inc.  
P.O. Box 4248  
Bozeman, MT 59772

**Phone** (406) 582-0227  
**Fax** (406) 582-0237  
**Toll Free** (800) 510-6530

[www.quantumcomposers.com](http://www.quantumcomposers.com)  
[sales@quantumcomposers.com](mailto:sales@quantumcomposers.com)



# 9520 Series Details

## Basic Functions

The 9520 Series Pulse Generator offers dual inputs, functioning as dual triggers or trigger/gating through BNC or optical connections.. The user also has per channel modes options and can keep specific channels free-running and other channels triggered.

Modular output boards provide a variety of output options allowing the user to customize their own instrument from stock. The output modules selection array includes both TTL/CMOS with adjustable amplitude, 35 V high voltage electrical, and optical at either 820 nm or 1300 nm. For those working with optical triggering, optical inputs are available.

The 9520 Series is equipped with standard USB and RS-232 unit and a GPIB and Ethernet module as an option. Our standard programming protocols are backwards compatible and complimentary NI certified LabVIEW™ drivers are available.

Advanced features include an Increment option which provides incrementing delay times and pulse widths after each trigger or internal burst count. Illuminated channel buttons denote if the channel is enabled not a pulse condition. Clock-In functionality gives the user the ability to synchronize using a master clock from 10 MHz to 100 MHz.

## New Unique Features

**Field programmability** – The instrument can now have functions upgraded in the field, such as special or custom feature upgrades and software fixes via a fully programmable FPGA.

**User selectable clock reference** – The instrument provides additional in/outputs for external clock synchronizing functions. The user can specify their input and output reference frequency from the front panel in discrete values from 10 MHz to 100 MHz. This also allows multiple pulse generators to be phase-locked together running under a common clock.

**Individual channel rates** – Each channel can have individual channel rates (either To or Tx... where Tx is the alternate channel rate for that specific channel... e.g. T1 for Channel 1). This is similar to having a separate clock for each output.

**Settings saved on power down** – Users no longer have to save their current settings to a bin before powering down to retain the current settings. The unit will power back up with the last known settings when powered down from the front panel.

**Dual Inputs** – The 9520 series Pulse Generator now offers dual trigger BNC or optical inputs. The user can specify trigger/trigger, or gate/trigger.

## Modular Output and Input Channels

(Outputs come in sets of 2 , 4 or 8 )

- High Voltage Outputs (35 V or 45 V)
- Optical Outputs (820 nm or 1300 nm)
- Optical Inputs (820 nm or 1300 nm)
- High Impedance Outputs- 50 Ohm Impedance Matched (4 v)
- High Impedance & High Voltage Outputs (35 v)

### Example Setup- 9528 (8 Channels)

- 2 AT45 High Voltage Outputs
- 2 TZ50 High Impedance Outputs
- 2 Standard Electrical Outputs
- 2 Standard Electrical Outputs
- 2 Standard Inputs



### Mix Your Output Types

Modular output channels come in sets of two and can be combined with standard or other output channels on the same unit.



**Toll Free Phone** (800) 510-6530  
**Fax Phone Line** (406) 582-0237

**Email** sales@quantumcomposers.com  
**Web** www.quantumcomposers.com

## SPECIFICATIONS

## 9520 Series

### MODELS

9522- 1 Module, 2 independent outputs  
 9524 - 2 Modules, 4 independent outputs  
 9528 - 4 Modules, 8 independent outputs

Input Modules- 2 inputs ( 1 trigger input/ 1 gate input)  
 Configuration Storage Slots- 12 Memory Slots  
 (Automatically saves current configuration on front panel power down.)

### CHANNEL OUTPUT CHOICES (comes in sets of 2 channels/module)

AT20 (standard)	TTL/ 2-20 V output
AT35 (optional)	TTL/35 V high voltage output module
AT45 (optional)	4-45 V high voltage, long PW, output module (Limited to 4 channels)
L82 (optional)	820 nm optical output module
L130 (optional)	1300 nm optical output module
TZ50 (optional)	high current TTL/CMOS (for driving 50 ohm loads) & adjustable output module
TZ35 (optional)	dual channel, high current TTL/CMOS (for driving 50 ohm loads) & 35 V high voltage output module

### INPUT MODULES

IA15 (standard)	dual channel, 1 trigger / 1 gate input module optional
IL82 (optional)	dual channel, 820 nm optical input module
IL130 (optional)	dual channel, 1300 nm optical input module

### INTERNAL RATE GENERATOR

rate	0.0002 Hz to 20.000 MHz
resolution	10 ns
accuracy	1 ns + .0001 x period
jitter	<50 ps channel to channel
settling	1 period
burst mode	1 to 9,999,999 pulses
timebase	100 MHz, low jitter PLL
oscillator	50 MHz, 25 ppm
system output modes	single shot, burst, duty cycle, continuous
pulse control modes	internal rate generator, external trigger, external gate

### PROGRAMMABLE TIMING GENERATOR

channel output modes	single shot, burst, duty cycle, normal
control modes	internally triggered, externally triggered and external gate
	each channel may be independently set to any of the modes
output multiplexer	timing of any/all channels may be multiplexed to any/all outputs
wait function	0 to 9,999,999 pulses
timebase	same as internal rate generator
delays	
range	0 - 1000 s
accuracy	1 ns + .0001 x setpoint
resolution	250 ps
pulse inhibit delay	< 120 ns typical
output inhibit delay	< 50 ns typical

### MODULE SPECIFICATIONS

#### TTL /ADJUSTABLE DUAL CHANNEL OUTPUT MODULE (standard)

output impedance	50 ohm
TTL /CMOS MODE	
output level	4.0 V typ into 1 kohm
rise time	3 ns typ
slew rate	>0.5 V/ns (10% - 90%)
jitter	50 ps RMS channel to channel



Toll Free Phone (800) 510-6530  
 Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
 Web www.quantumcomposers.com

## SPECIFICATIONS

## 9520 Series (Continued)

### MODULE SPECIFICATIONS (CONTINUED)

#### ADJUSTABLE MODE

output level	2.0 to 20 VDC into 1 kohm 1.0 to 10 VDC into 50 ohms
rise time	15ns typ @ 20V (high impedance) 25ns typ @ 10V (50 ohm) (10% - 90%)
output resolution	10 mV
current	200 mA typical, 400 mA max (short pulses)
slew rate	> 0.1 V/ns
overshoot	< 100 mV + 10 % of pulse amplitude

#### TRIGGER/GATE DUAL INPUT MODULE (standard)

Standard dual channel input module, providing one trigger input and one gate input. May be used with the dual trigger firmware option to provide two independent trigger sources.

threshold	0.2 to 15 VDC
maximum input voltage	60 V peak
impedance	1.5 K ohm + 40 pF

#### TRIGGER INPUT

slope	rising or falling
insertion delay	< 160 ns
jitter	< 800 ps
minimum pulse width	2 ns

#### GATE INPUT

polarity	active high/active low
function	pulse inhibit or output inhibit
channel behavior	global w/ individual channel
pulse inhibit delay	< 120 ns
output inhibit delay	< 50 ns

#### OPTICAL OUTPUT MODULE (opt. L82 / opt. L130)

Dual channel fiber optic output module for use as a fiber optic test signal or a trigger source in high noise environments.

wavelength	820 nm or 1300 nm
max signal rate	5 MBd
max link distance	1.5 km
connector type	ST

#### OPTICAL INPUT MODULE (opt. IL 82 / opt. 130)

Dual channel fiber optic input module for fiber optic test signals or trigger inputs for high noise environments.

wavelength	820 nm or 1300 nm
max signal rate	5 MBd
max link distance	1.5 km
connector type	ST
insertion delay	< 300 ns
RMS jitter	< 1.4 ns RMS

#### STANDARD FEATURES/FUNCTIONS

communications	USB/RS232
modular design	Units may be specified with any combination of output modules and with a
variety of available.	Input modules. Custom modules also
external clock in	10 MHz - 100 MHz user selectable in discrete values
external clock out	10 MHz - 100 MHz user selectable in discrete values To or Ref out (10 MHz - 100 Mhz) user selectable in discrete values

#### OPTIONS

- I - Pulse Incrementing (Provides automatic high speed incrementing/decrementing of delay and/or pulsewidth for each channel.)
- DT15 - Dual Trigger Logic - provides additional trigger via gate input
- COM - Extended Communications - Adds Ethernet & GPIB
- SRM - 19" Rackmount (Single)



**Toll Free Phone** (800) 510-6530  
**Fax Phone Line** (406) 582-0237

**Email** sales@quantumcomposers.com  
**Web** www.quantumcomposers.com

V1.2 8/5/16



# 9530 Series

## Digital Delay Pulse Generator

Our 9530 Pulse Generator provides the latest in laser timing and synchronization. Offering a unique 1U 19" rackmount package with all rear panel connections, it is well suited for integration into your rack timing and control systems.

### Key Features

- 250 ps Timing Resolution
- < 50 ps Channel to Channel Jitter
- 1U Rackmount Ready
- Easy Programming Interface
- 4 or 8 Independent Channel Outputs
- Free LabVIEW Driver
- Ethernet, USB, RS232 Standard
- Full Customer Support
- 2 Year Warranty



**Quantum Composers, Inc.**  
**P.O. Box 4248**  
**Bozeman, MT 59772**

**Phone** (406) 582-0227  
**Fax** (406) 582-0237  
**Toll Free** (800) 510-6530

[www.quantumcomposers.com](http://www.quantumcomposers.com)  
[sales@quantumcomposers.com](mailto:sales@quantumcomposers.com)

# 9530 Digital Delay/ Pulse Generator

The Model 9530 Digital Delay / Pulse Generator represents the latest in timing and synchronizing capabilities. With a unique 19" 1U form factor, the model 9530 is clearly our most innovative instrument to accurately synchronize any series of events.

The 9530's eight independent outputs, dual trigger/ gate inputs and external clock reference input make it ideal for laser system timing applications. The system can directly phase lock to an external timebase up to 100 MHz in frequency and down to 20 mV in amplitude. This allows synching directly to a laser photodiode signal and provides complete system timing relative to the laser timing with low jitter. The 9530 also provides a

clock output that is capable of driving a 50 ohm load and can be used to provide a master timebase to other delay generators or equipment.

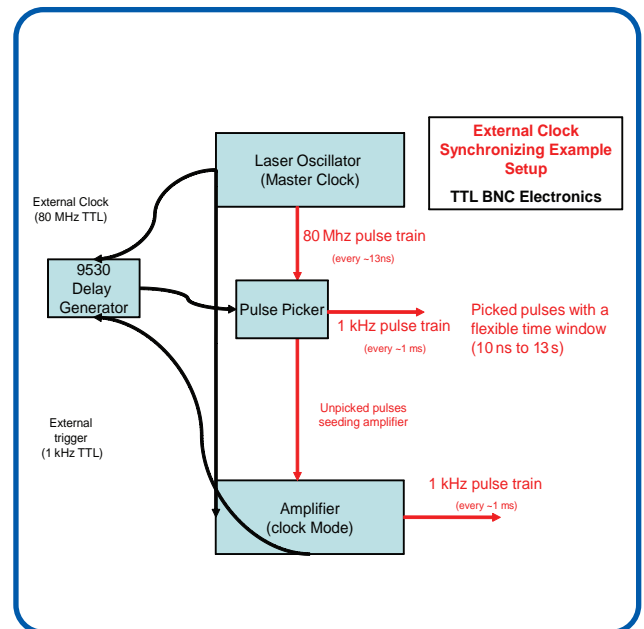
The core technology in precision timing of the 9530 offers 250 ps Delay & Width resolution and 50 ps internal jitter. Ethernet / USB interface, complex burst sequences, Divide-by-N, Setting Profiles, Clock Divider, Pulse Picking and Negative Delays allow users great flexibility in setting up an experiment or synchronizing multiple events. Complimentary NI certified LabVIEW drivers available.

## Advanced Features/Options

- Clock input/output – allows master clock input from 10 MHz to 100 MHz with complete system timing relative to that signal with low jitter
- Field programmability–custom features, upgrades and fixes via fully programmable FPGA
- Settings / Programming saved on front panel power down

## Channel Properties / Advanced Programming Modes

- Multiplexing - selectively combine the timing of any or all channels to one output
- Burst - Each channel can have a separate number
- Duty Cycle - N pulses on, M pulses off
- Channel Referencing - Any or all channels can reference the timing of any channel rather than T0
- Wait - The system will wait for a specified number of cycles before producing pulses





## SYSTEM SPECIFICATIONS

### I/O CONFIGURATION

Models/Outputs	9534 - 4 independent channel outputs 9538 - 8 independent channel outputs
Inputs	2 inputs - 1 trig input / 1 gate input
Memory	24 configuration storage slots

### INTERNAL RATE GENERATOR

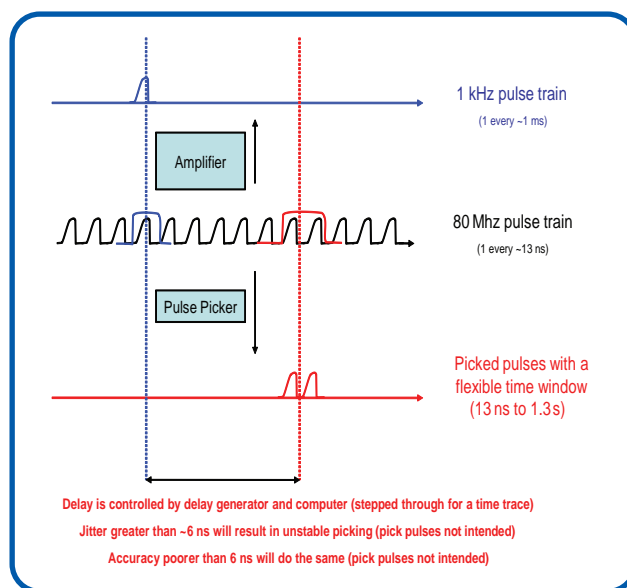
rate	0.0002 Hz to 10.000 MHz
resolution	10 ns
accuracy	1 ns + .0001 x period
jitter	50 ps RMS
settling	1 period
burst mode	1 to 9,999,999 pulses
timebase	100 MHz, low jitter PLL
oscillator	50 MHz, 25 ppm
system output modes	single shot, burst, duty cycle, continuous
pulse control modes	internal rate generator, external trigger, external gate

### PROGRAMMABLE TIMING GENERATOR

channel output modes	single shot, burst, duty cycle, normal
control modes	internally triggered, externally triggered and external gate each channel may be independently set to any of the modes
output multiplexer	any/all channels may be multiplexed to any/all outputs
delayed output	0 to 9,999,999 pulses
timebase	same as internal rate generator

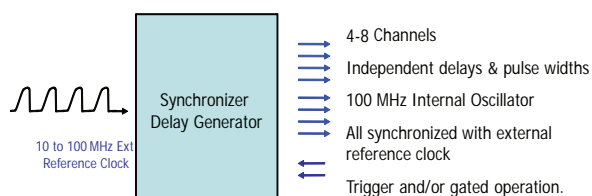
### DELAY

range	0 - 1000 s
accuracy	1 ns + .0001 x setpoint
resolution	250 ps



- Independent Channel Enable/Disable
- Delayed Channel Enable - allows flashlamp/ diodes to be fired, stabilizing the laser before the Q-switch or shutter is enabled.
- Single shot or Burst mode laser pulse bursts, controlling either just the Q-switch or entire laser.
- Duty cycle mode allows firing laser at an optimal rate, but picking pulses out at the user required rate.
- Output multiplexer allows the timing of any combination of channels to be output on any of the output ports, providing very complex pulse trains.

### 9530 EXTERNAL SYNC'D OPERATION



External reference clock input of 50 mV to 2.5 V allows direct syncing to photo diode or high speed logic outputs.

Sync'd operation provides very low external jitter operation.

All modes (internal & external trigger, etc.) are available with the external clock.



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
Web www.quantumcomposers.com

## MODULE SPECIFICATIONS

### TTL/ADJUSTABLE CHANNEL OUTPUTS

output impedance	50 ohm
------------------	--------

### TTL/CMOS MODES

output level	4.0 V typ into 1 kohm
rise time	3 ns typ
slew rate	0.5 V/ns
jitter	50 ps RMS

### ADJUSTABLE MODE

output level	2.0 to 20 VDC into 1 kohm 1.0 to 10 VDC into 50 ohm
output resolution	10 mV
current	200 mA typical, 400 mA max (short pulses)
slew rate	> 0.1 V/ns
overshoot	< 100 mV + 10 % of pulse amplitude
rise time	15 ns typ @ 20 V (high imp) 25 ns typ @ 10 V (50 ohm) (10 % - 90 %)

### TRIGGER/GATE DUAL INPUT (STANDARD)

Standard dual channel input, providing one trigger input and one gate input. May be used with the dual trigger firmware option to provide two independent trigger sources.

threshold	0.2 to 15 VDC
maximum input voltage	60 V peak
resolution	10 mV
input impedance	1 Mohm + 40 pF or 50 ohm
insertion delay	< 180 ns
pulse inhibit delay	< 120 ns
output inhibit delay	< 50 ns
jitter	< 800 ps RMS

\*Other custom modules available. Call with your request.

### SYSTEM EXTERNAL TRIGGER/GATE INPUT(S) TRIGGER INPUT

function	generate individual pulses, start a burst or continuous stream
rate	DC to 1/(200 ns + longest active pulse)
slope	rising or falling (maximum of 5 MHz)
behavior	used to control the internal rate

### GATE INPUT

function	pulse inhibit or output inhibit
polarity	active high / active low
behavior	used to control the internal rate generator

### STANDARD FEATURES & FUNCTIONS

communications	USB/RS232/Ethernet
external clock in	10 MHz - 100 MHz in 1 MHz increments
external clock out	5 MHz - 40 MHz
configuration storage	T0, Rate, Chan, 2x ExtPLL, 1 ExtPLL, ½ ExtPLL, ½ Ext, 40MHz, 20MHz, 10MHz, 5MHz, and Disabled

### STANDARD OUTPUT MODULES

AT20	quad channel, TTL/CMOS & adjustable output module
------	---

### OPTIONAL MODULE

TZ50	quad channel, high current TTL/CMOS (for driving 50 ohm loads) & adjustable output module
------	---

### SYSTEM OPTIONS

I	incrementing (provides automatic high speed incrementing/decrementing of delay and/or pulsewidth for each channel)
DT15	dual trigger logic – provides additional trigger via gate input



Toll Free Phone (800) 510-6530  
Fax Phone Line (406) 582-0237

Email sales@quantumcomposers.com  
Web www.quantumcomposers.com

V1.4 8/5/16