A leading manufacturer of pulse generator and laser technology.

Product Guide

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V1.1 3/1/12

Contents

Quantum Composers Inc.

Since 1993, Quantum Composers has been a leader in custom designed scientific based technologies and concepts. A privately held company based in Bozeman Montana, an accelerating high-tech center for electro-optic startups in the northern Rocky Mountain region, Quantum is an internationally recognized pioneer in the Test and Measurement marketplace, specializing in the design and production of laser systems and precision pulse generator instrument lines. Quantum developed a strong foot hold in the electro-optics market with the design and development of a precision pulse generator line as well as providing custom laser systems for micromachining applications.

Quality, creativity and innovation fuel the future growth of Quantum Composers. Today, Quantum's employees grow and thrive in an environment where engineering ideas and customer relationships drive R&D and manufacturing, which is demonstrated in the expansion of Quantum's innovative new products and custom systems for the electro-optics and laser industry.

Quantum Composers continues its legacy of custom product development for academia, laboratories, government and private industry by designing custom electronics, instrumentation, and software, in parallel with providing design, manufacturing consulting, and training services.

Quantum Composers Product Lines

Digital Delay Pulse Generators

Quantum Composers provides innovation and value to customers with a diverse family of Precision Pulse Generators. Our wide range of pulse generator technology has been created to fit the needs of any budget and application. The pulse generator lines provide a cost-effective method to create and synchronize multiple sequences, delayed triggering, or any precisely timed series of events.

Board Level Pulse Generators

Quantum Composers now provides board level digital delay generators. The 8000 series boards retain most of the functionality of the standard pulse generators in an easy to integrate package. These boards provide a cost-effective method to create and synchronize multiple sequences, delayed triggering, or any precisely timed series of events. We offer optional computer interfaces for programming and integration support.

High Current Pulse Generators

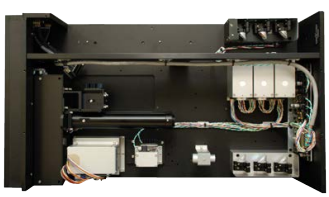
Quantum Composers is a recognized industry leader for High Current Pulsers and Firesets. We specifically design our units for use in pyrotechnic applications such as Aerospace, Defense, Propulsion, Automotive Safety and Squib testing. Our instruments are used throughout the world in demanding and harsh testing environments where quality, reliability, and safety are paramount.

Laser Autofocus Sensor

The Quantum Composers Auto Focus sensor is a turn-key, cost-effective solution for vision systems used in the fields of laser micromachining, industrial micromilling, medical component devices, wafer dicing, rapid surface pattern and thin-filmed scribing. These systems can also be customized for OEM and fully integrated laser systems.

Laser Modules & Systems

The Quantum Composers laser division provides expertise in creating complex laser systems and laser beam manipulation modules for both medical and industrial applications. We offer a full line of laser modules including attenuators, video microscope modules and motorized aperture slits. Our laser systems and modules provide simple, robust solutions to the most complex and demanding applications.



Custom & OEM Systems

Quantum Composers has more than 15 years of custom system development experience. Our design team offers a wide range of services, including personally developed electronics, custom software and specification modification of our pulse generator or laser products. We also assist customers in developing fully integrated systems for specific applications at a fraction of the competition's cost.

Digital Delay | Pulse Generator Lines

9500+ Series

2, 4 or 8 independent outputs
1 ns resolution
RS232, USB, GPIB (standard)

9520 Series

2, 4 or 8 independent outputs
250 ps resolution
RS232 & USB (standard)
GPIB & Ethernet (optional)

9600+ Series

2, 4 or 8 independent outputs
10 ns resolution
RS232 (standard)
GPIB (optional)

9530 Series

4 or 8 independent outputs
250 ps resolution
Clock input for fast laser integration
RS232, USB, & Ethernet (standard)

8000 Series Boards

2 ,4 or 8 independent outputs
1 ns or 250 ps resolution
Optional power supply
Full integration support

Quantum® COMPOSERS

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- » **Specifically engineered for demanding applications**
- » **Multi-channel, menu-driven**
- » **Digitally controlled pulse generator sources**
- » **Synchronize multiple pulses**
- » **Front panel display allows navigation via touch keys**
- » **Access a variety of menus for custom test setups**

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Pulse Generator Product Comparison




SPECIFICATIONS	9600+	9500+	9520	9530
PULSE GENERATION				
Channels	2, 4, or 8	2, 4, or 8	2, 4, or 8	4 or 8
Resolution	10 ns	1 ns	250 ps	250 ps
Accuracy (width and delay)	10 ns + .0001 x setpoint	1.5 ns + .0001 x setpoint	1 ns + .0001 x setpoint	1 ns + .0001 x setpoint
RMS Jitter (channel to channel)	< 5 ns	< 400 ps	< 50 ps	< 50 ps
Memory Storage Slots	6	12	12	24
INTERNAL RATE GENERATOR				
System Modes	Continuous, single shot, burst, duty cycle			
Rate	.001 Hz to 5 MHz	.0002 Hz to 5 MHz	.0002 Hz to 20 MHz	.0002 Hz to 10 MHz
Resolution	10 ns	10 ns	10 ns	10 ns
Accuracy	10 ns + .0001 x period	1.5 ns + .0001 x period	1 ns + .0001 x period	1 ns + .0001 x period
RMS Jitter	< 500 ps	< 250 ps	< 50 ps	< 50 ps
External Clock In	N/A	Optional	10 MHz to 100 MHz[1]	10 MHz to 100 MHz[1]
External Clock Out	N/A	Optional	10 MHz to 100 MHz[1]	5 MHz to 40 MHz[1]
EXTERNAL TRIGGER				
Rate	DC to 2 MHz	DC to 5 MHz	DC to 5 MHz	DC to 5 MHz
RMS Jitter	< 25 ns	< 5 ns	< 800 ps	< 800 ps
Insertion Delay	< 250 ns	< 150 ns	< 160 ns	< 160 ns
Threshold	200 mV - 15 V	200 mV - 15 V	200 mV - 15 V	200 mV - 15 V
EXTERNAL GATE				
Mode(s)	Pulse Inhibit	Pulse Inhibit	Pulse inhibit/Output inhibit	Pulse inhibit/Output inhibit
Threshold	200 mV - 15 V	200 mV - 15 V	200 mV - 15 V	200 mV - 15 V
Insertion delay (Pulse Inhibit)	< 250 ns	< 150 ns	< 120 ns	< 120 ns
Insertion delay (Output Inhibit)	N/A	N/A	< 50 ns	< 50 ns
OUTPUT CHANNELS				
Amplitude	2-20 V	TTL/2-20 V	TTL/2-20 V	TTL/2-20 V
Channel Modes	Normal, single shot, burst, duty cycle			
Multiplexing	Combine the timing of any channels			
Rise Time - TTL/CMOS	N/A	3 ns	3 ns	3 ns
- Adjustable (Hi Z)	22 ns @ 20V	15 ns @ 20 V	15 ns @ 20 V	15 ns @ 20 V
- Adjustable (50 Ohm)	25 ns @ 10V	25 ns @ 10 V	25 ns @ 10 V	25 ns @ 10 V

[1] See manual for more details

Laser Products & Laser Systems

» The Quantum Composers laser division provides expertise in developing complex laser systems and laser beam manipulation modules for both medical and industrial applications.

Custom Laser Systems

Quantum Composers' experience in the design and manufacture of custom laser systems and modules allows us to design and produce custom systems or components for your specific application at a fraction of the competitor's cost.

Laser Attenuator

Laser Attenuator Modules provide linearized control of laser energy.

Video Microscope

The Video Microscope Module is designed to integrate an infinity corrected microscope objective, video camera, and multi-wavelength laser source.

Motorized Aperture

The X-Y Theta Aperture Module is a motorized device designed to control laser beam size and shape for applications requiring precise patterning.

New Instruments Available Now

AF910 Laser Autofocus Sensor

The AF910 Laser Auto Focus sensor is a turn-key, cost-effective solution for vision systems used in the fields of laser micromachining, industrial micromilling, medical component devices, wafer dicing, rapid surface pattern and thin-filmed scribing. Our AF910 Auto Focus combines a proprietary optical configuration with flexible interface architecture to provide a robust autofocus for OEM applications utilizing infinity corrected objectives.

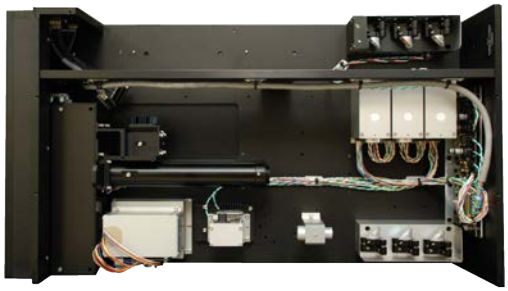
1550 Laser Diode Driver Controller

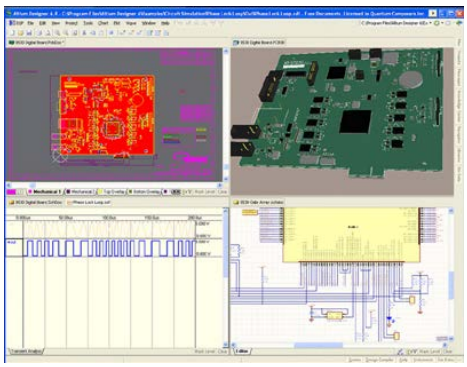
The model 1550 Laser Diode Driver Controller (LDDC) provides an easy to use method of controlling popular laser diode driver supplies. It provides a convenient way to control your laser diode driver without having to create your own controller.

Custom & OEM Development

OEM Products

Quantum Compsers offers complete OEM branding, packaging and custom design solutions derived from our Pulse Generator, High Current Pulse Generator, and Laser product lines and technology. Whether you need company branding with logo and color scheme or complete repackaging and specification modification, we can help. You can rely on Quantum Composers for full OEM support and development for your next project.





Custom Systems & Software

As a top-tier manufacturer of digital delay/pulse generators and custom laser technology, Quantum Composers provides experience and skill to customers with innovative designs and forward thinking functionality. Our team of designers and engineers offer a range of services including customized electronics, software, and design.

Quantum Composers
Product Datasheet Index

- 9520 Series Pulse Generators
- 9530 Series Pulse Generators
- 9500+ Series Pulse Generators
- 9600+ Series Pulse Generators
- 8000 Series Board Level Pulse Generators
- AF910 Laser Autofocus Sensor
- 1550 Series Laser Diode Driver Controller

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 cabapility 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**

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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.

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SPECIFICATIONS 9520 Series

MODELS

9522- 1 Module, 2 independent outputs	Input Modules- 2 inputs (1 trigger input/ 1 gate input)
9524 - 2 Modules, 4 independent outputs	Configuration Storage Slots- 12 Memory Slots
9528 - 4 Modules, 8 independent outputs	(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

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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 Input modules. Custom modules also available.
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)
DRM - 19" Rackmount (Double)

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

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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.

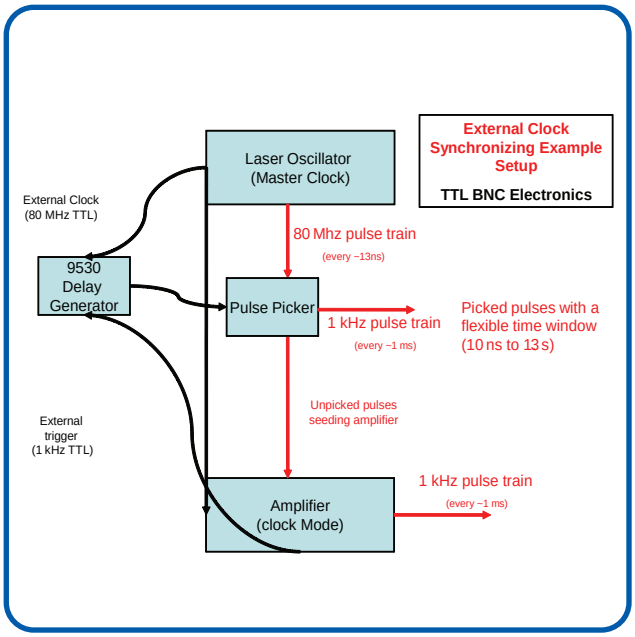
The core technology in precision timing of the 9530 offers 250 ps Delay & Width resolution and 50 ps internal jitter. Ethernet / USB interface, complex burst sequences, Divide-by-N, Setting Profiles, Clock Divider, Pulse Picking and Negative Delays allow users great flexibility in setting up an experiment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



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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

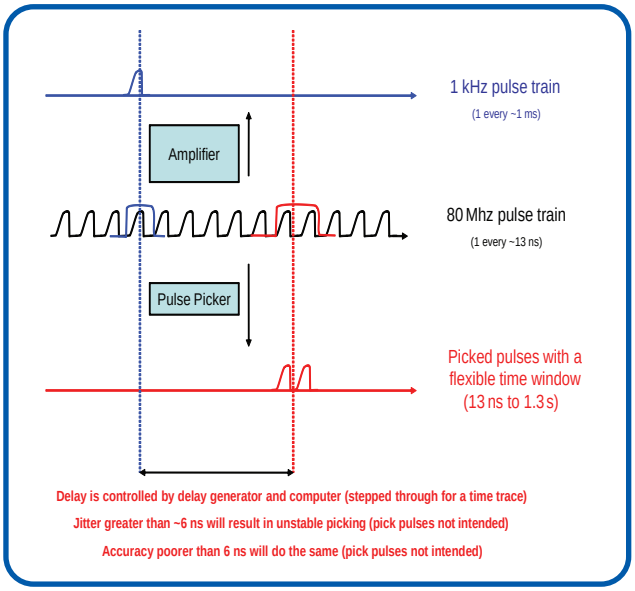
rate	0.0002 Hz to 10.000 MHz
resolution	10 ns
accuracy	1 ns + .0001 x period
jitter	50 ps RMS
settling	1 period
burst mode	1 to 9,999,999 pulses
timebase	100 MHz, low jitter PLL
oscillator	50 MHz, 25 ppm
system output modes	single shot, burst, duty cycle, continuous
pulse control modes	internal rate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

PROGRAMMABLE TIMING GENERATOR

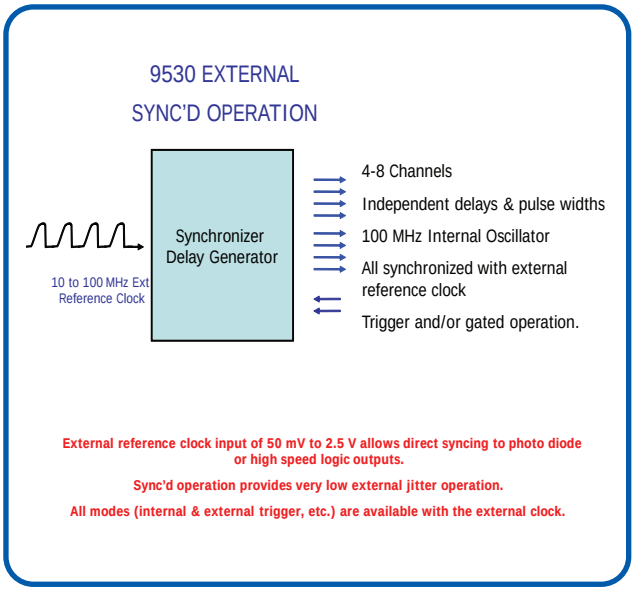
channel output modes	single shot, burst, duty cycle, normal
control modes	internally triggered, externally triggered and external gate each channel may be independently set to any of the modes
output multiplexer	any/all channels may be multiplexed to any/all outputs
delayed output	0 to 9,999,999 pulses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



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MODULE SPECIFICATIONS

TTL/ADJUSTABLE CHANNEL OUTPUTS

oputput 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

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9510+ Series

Digital Delay Pulse Generators

Our 9500+ series of pulse generators provides a cost-effective yet highly flexible and functional approach for your synchronization and timing needs.

Key Features

- 1 ns Timing Resolution
- < 400 ps Channel to Channel Jitter
- Benchtop Design
- Easy Programming Interface
- 2, 4 or 8 Independent Channel Outputs
- Free LabVIEW Driver
- USB, RS232, GPIB Standard
- Ethernet Available
- Full Customer Support
- 2 Year Warranty

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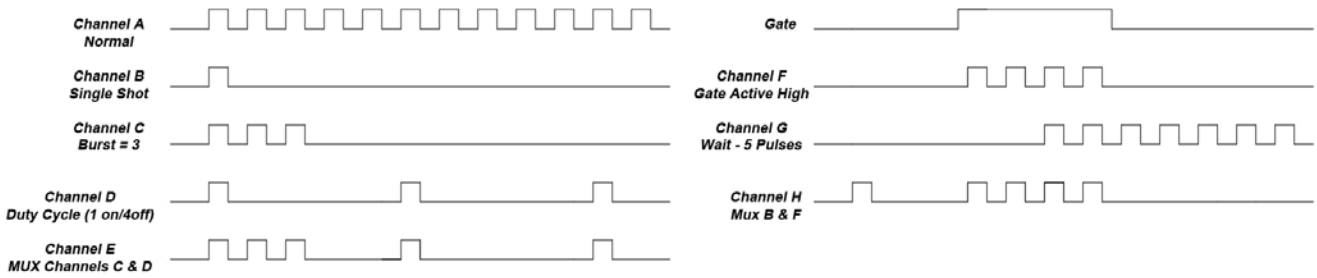
9510+ Series
Pulse Generator

The Model 9500 Plus Series Digital Delay-Pulse Generator with 2, 4 or 8 independent outputs is designed to provide cutting edge, yet cost-effective solutions to generate and synchronize multiple pulses for a variety of applications. The delay and pulse width for each channel are independent and digitally controlled which makes the instrument ideal for situations that require synchronizing a number of different events. Flexible operating modes allow complete control of pulseoutputs, including continuous, duty cycle, burst and single shot with external trigger/gate. More advance features such as multiplexing allow the timing of all or several channels to be combined for complex pulse patterns. For automated test equipment, complete control of the instrument is provided through the standard RS232, USB and GPIB interface. Ethernet is optional and LabVIEW® drivers are available.

Digital Delay Output Modes



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SPECIFICATIONS — 9510+ Series

MODELS

9512+ 2 independent channel outputs
9514+ 4 independent channel outputs
9518+ 8 independent channel outputs

Standard Communications: USB, RS232 & GPIB
Configurations: 12 Memory Slots

PULSE GENERATION

channel modes	single shot, burst, normal, duty cycle.
multiplexer	combine any channel
delay	0 to 1000 s
negative delay	0 to -1000 s
pulsewidth	10 ns to 1000 s
resolution	1 ns
accuracy	1.5 ns + 0.0001 setpoint
time base	50 MHz, 25 PPM crystal oscillator
RMS jitter	< 400 ps channel to channel
burst mode	1 to 1,000,000

EXTERNAL TRIGGER/GATE

rate	DC to 5 MHz
threshold	200 mV to 15 V
input range	0 - 200 mV
trigger slope	rising or falling edge
RMS jitter	< 5 ns
insertion delay	< 150 ns

INTERNAL RATE GENERATOR

system modes	single shot, burst, continuous, duty cycle
rate (T0 period)	200 ns to 5000 sec. (0.0002 Hz to 5 MHz)
resolution	10 ns
accuracy	1.5 ns + 0.0001 x period
RMS jitter	< 250 ps channel to channel
burst mode	1 to 1,000,000 pulses

OUTPUTS

outputs	TTL/CMOS, adjustable 2 - 20 V
impedance	50 Ohms
slew rate	> 0.5 V/ns
overshoot	< 100 mV + 10% of pulse amplitude
amplitude (adjustable mode)	1 - 10 V into 50 Ohm load 2 - 20 V into high impedance load
rise time	3 ns typ TTL 15 ns typ @ 20 V (high imp) adj. 25 ns typ @ 10 V (50 ohm) adj. (10% - 90%)

GENERAL

dimensions	10.5" x 8.25" x 5.5"
weight	8 lbs.
power	20 W, 100 - 240 VAC, 50/60 Hz <1 A

OPTIONS

E - Ethernet Computer Interface (Replaces the USB)
T - Extended time base (10 MHz PLL / 20 MHz PRF)
I - Pulse incrementing
X - Separate gate and trigger inputs

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9600+ Series

Digital Delay Pulse Generators

The 9600+ series is our 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.

- 10 ns Timing Resolution
- < 5 ns Channel to Channel Jitter
- Benchtop Design
- Easy Programming Interface
- 2, 4 or 8 Independent Channel Outputs
- Free LabVIEW Drivers
- RS232 Standard
- Full Customer Support
- 2 Year Warranty

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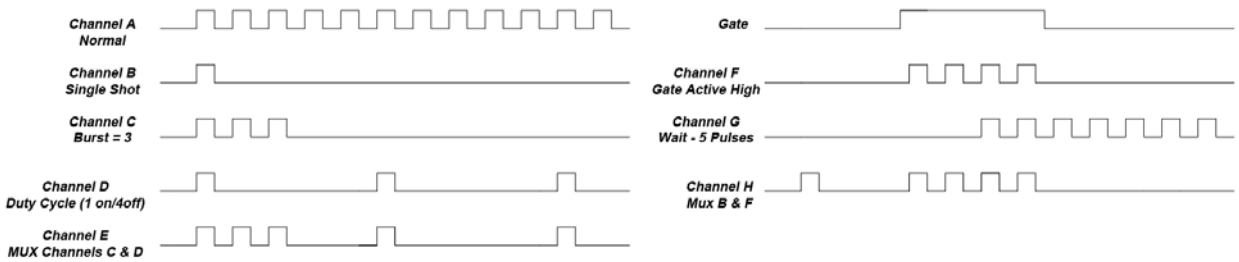
9600+ Series
Pulse Generator

The Model 9600+ Series Digital Delay Pulse Generator with 2, 4 or 8 independent outputs is our most affordable digital delay/pulse generator, it's ideal for applications that require moderate precision and multi-channel capability. The delay and pulse width for each channel are independent with 2-20 volt output range, allowing the user to drive a wide range of load circuitry. The instrument offers several operating modes including continuous, burst, single shot and external trigger/gate, allowing complete control of the pulse outputs. With precise control of the delay periods and quick recall of up to 6 system configurations, the instrument is instantly ready for use. For automated test equipment, complete control of the instrument is provided through the standard RS232 interface. GPIB interface is optional.

Digital Delay Output Modes



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SPECIFICATIONS — 9600+ Series

MODELS 9612+ 2 independent channel outputs
9614 + 4 independent channel outputs
9618+ 8 independent channel outputs

Standard Communications: RS232
Configurations: 6 Memory Slots

PULSE GENERATION	
channel modes	single shot, burst, normal, duty cycle.
multiplexer	combine the timing of any channel
delay	0 to 1000 s
negative delay	0 to -1000 s
pulsewidth	10 ns to 1000 s
resolution	10 ns
accuracy	10 ns + 0.0001 setpoint
time base	50 MHz, 50 PPM crystal oscillator
RMS jitter	< 5 ns channel to channel
burst mode	1 to 1,000,000
EXTERNAL TRIGGER/GATE	
rate	DC to 2 MHz
threshold	200 mV to 15 V
input range	0 - 30 V
trigger slope	rising or falling edge
RMS jitter	< 25 ns
insertion delay	< 250 ns
INTERNAL RATE GENERATOR	
system modes	single shot, burst, continuous, duty cycle
rate (T0 period)	200 ns to 999.99999 s (0.001 Hz to 5 MHz)
resolution	10 ns
accuracy	10 ns + 0.0001 x period
RMS jitter	< 500 ps
burst mode	1 to 1,000,000 pulses
OUTPUTS	
outputs	adjustable 2 - 20 V
slew rate	> 0.2 V/ns
rise time	22ns typ @ 20V (high impedance) 25ns typ @ 10V (50 ohm)
overshoot	< 100 mV + 10 % of pulse amplitude up to 4 independently adjustable outputs; 8 channel units 1 & 6, 2 & 7, etc. share the same output voltage
amplitude (adjustable mode)	1 - 10 V into 50 ohm load 2 - 20 V into high impedance load
GENERAL	
dimensions	7.5" x 9" x 4"
weight	6 lbs.
power	20 W, 100 - 240 VAC, 50 - 60 Hz

OPTIONS

G - GPIB Computer Interface
9600_SRM - 19" Single Rack Mount
9600_DRM - 19" Double Rack Mount

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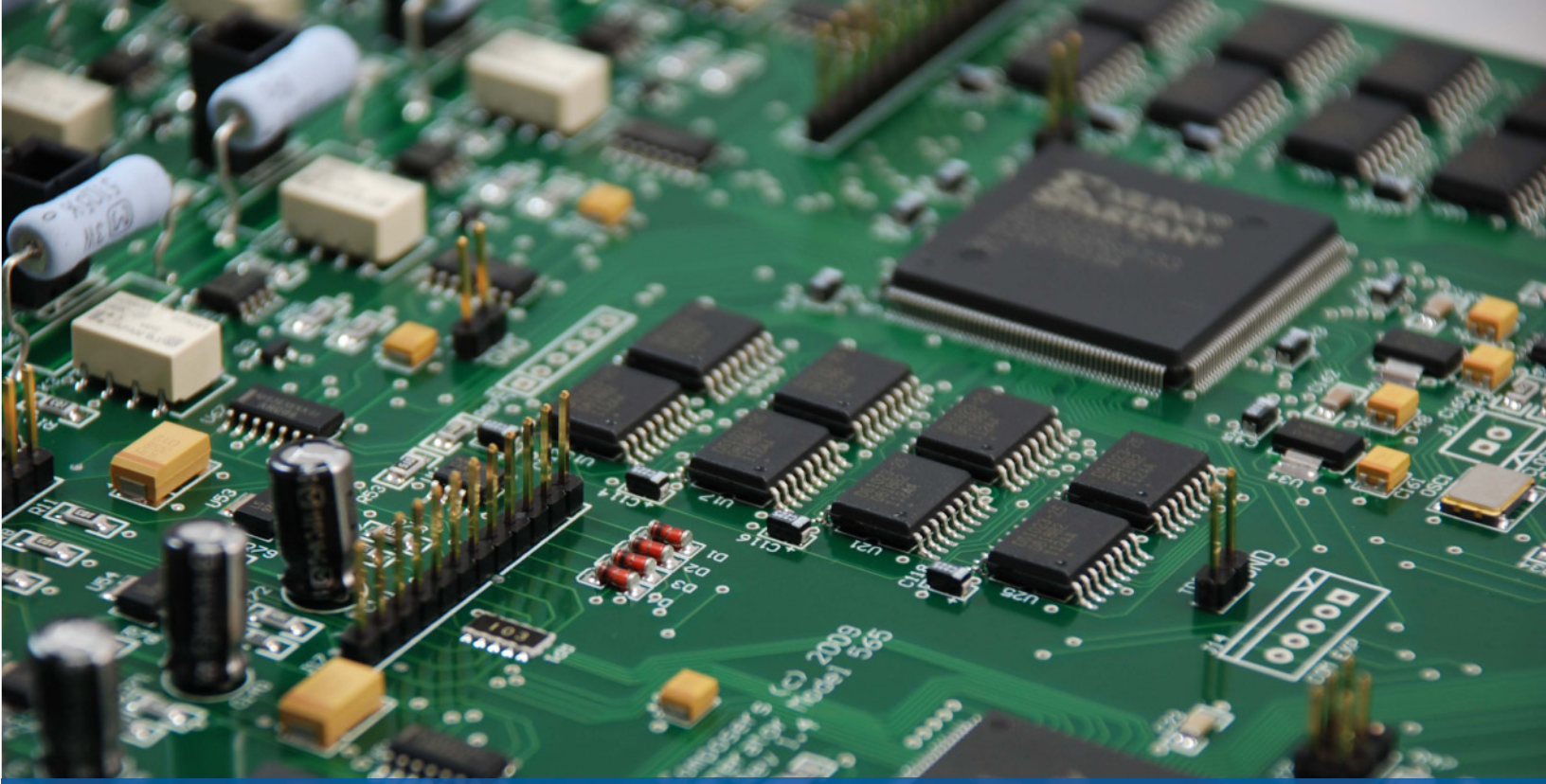

8000 Series

Board Level Digital Delay Pulse Generators

Quantum Composers now provides board level digital delay pulse generators. The 8000 series board products retain all functionality of the standard pulse generators in an easy to integrate package. These boards provide a cost-effective method to create and synchronize multiple sequences, delayed triggering, or any precisely timed series of events. We offer computer interfaces for ease of programming and full integration support.

Key Features
- **Board Level Product for Easy Integration**
- **1 ns or 250 ps Timing Resolution Available**
- **2, 4 or 8 Fully Independent Channel Outputs**
- **Full Integration Support**
- **2 Year Warranty**

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8510 Series
Pulse Generator Boards

Standard Features

- 1 ns timing resolution
- < 400 ps channel to channel RMS jitter
- Independent control of width and delay on 2, 4 or 8 channels
- Standard RS232, GPIB & USB communication interfaces
- Advanced programming - multiplexing, channel referencing, burst, wait, duty cycle.

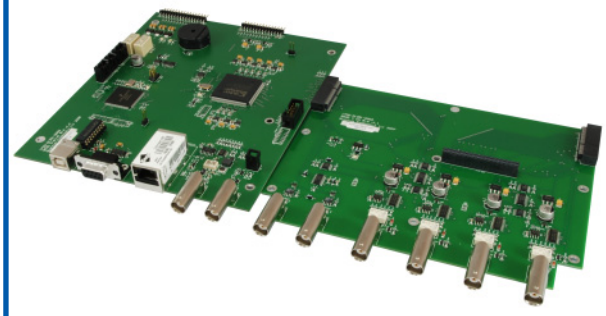
The Model 8510 Series Board Level Pulse Generator comes with 2, 4 or 8 independent outputs and is designed to provide cutting edge, cost-effective solutions to generate and synchronize multiple pulses for a variety of applications. The delay and pulse width for each channel are independent and digitally controlled which makes the instrument ideal for situations that require synchronizing a number of different timed events. Flexible operating modes allow complete control of pulse outputs, including continuous, duty cycle, burst and single shot with external trigger/gate. More advanced features such as multiplexing allow the timing of all or several channels to be combined for complex pulse patterns. Control of the instrument is provided through the standard RS232, USB and GPIB Interfaces.

8530 Series
Board Level Pulse Generator

Key Features

- 250 ps timing resolution
- < 50 ps channel to channel RMS jitter
- 4 or 8 independent channel outputs
- Internal rate generator 10 ns period resolution over entire frequency range (10 MHz)
- Standard Computer Interfaces RS232, USB and Ethernet
- Dual inputs (gate and trigger)

The Model 8530 Series Board Level Digital Delay Pulse Generator represents the latest in timing and synchronizing capabilities. The 8530 comes with four or eight independent outputs, dual trigger / gate inputs and external clock reference input, making 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, which provides complete system timing relative to the laser with low jitter. The 8530 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.



SPECIFICATIONS — 8510 Series

MODELS 8512 - 2 independent channel outputs
8514 - 4 independent channel outputs
8518 - 8 independent channel outputs

Communications: RS232, GPIB & USB Ports
Configuration Storage: 12 memory slots

PULSE GENERATION	
channel modes	single shot, burst, normal, duty cycle
delay	0 to 1000 s
negative delay	0 to -1000 s
pulsewidth	10 ns to 1000 s
resolution	1 ns
accuracy	1.5 ns + 0.0001 delay
time base	50 MHz, 25 PPM crystal oscillator
RMS jitter	< 400 ps channel to channel
burst mode	1 to 1,000,000

EXTERNAL TRIGGER/GATE	
rate	DC to 5 MHz
threshold	500 mV to 15 V
input range	0 - 200 mV
trigger slope	rising or falling edge
RMS jitter	< 5 ns
insertion delay	< 150 ns

INTERNAL RATE GENERATOR	
system modes	single shot, burst, continuous, duty cycle
rate (T_0 period)	200 ns to 5000 sec. (0.0002 Hz to 5 MHz)
resolution	10 ns
accuracy	5 ns + 0.0001 x period
RMS jitter	< 400 ps channel to channel
burst mode	1 to 1,000,000 pulses

OUTPUTS	
outputs	TTL/CMOS, adjustable 2 - 20 V,
impedance	50 ohms
slew rate	> 0.5 V/ns
overshoot	< 100 mV + 10% of pulse amplitude

OPTIONS

I - Incrementing (provides automatic high speed incrementing/decrementing of delay and/or pulsewidth for each channel)
PS - Power Supply

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SPECIFICATIONS — 8530 Series

MODELS 8534 - 4 independent channel outputs
8538 - 8 independent channel outputs

Communications: USB, RS232 & Ethernet Ports
Configuration Storage: 12 memory slots

PROGRAMMABLE TIMING GENERATOR	
channel modes	single shot, burst, normal, duty cycle.
control modes	internally triggered, externally triggered and external gate
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
DELAYS	
range	0 - 1000 s
accuracy	1.5 ns + 0.0001 delay
resolution	250 ps
RMS jitter	< 400 ps
pulse inhibit delay/output inhibit delay	120 ns / 50 ns
INTERNAL RATE GENERATOR	
timebase	100 MHz, low jitter PLL
rate	0.0002 Hz to 10.000 MHz
resolution	10 ns
accuracy	same as timebase
RMS jitter	50 ps
burst mode	1 to 9,999,999 pulses
oscillator	50 MHz, 25 ppm
TTL /ADJUSTABLE CHANNEL OUTPUT IMPEDANCE	50 ohm
TTL /CMOS Mode	
output Level	4.0 V typ into 1 kohm
rise time	3 ns typical
slew rate	> 0.5 V/ns
jtter	50 ps RMS
ADJUSTABLE MODE	
output level	2.0 to 20 VDC into 1 kohm, 1.0 to 10 VDC into 50 ohms
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, 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
trigger insertion delay	< 180 ns
trigger jitter	< 800 ps RMS
external clock in/out	10 MHz - 100 MHz

OPTIONS

I - Incrementing (provides automatic high speed incrementing/decrementing of delay and/or pulsewidth for each channel)
TZ50 - Quad Channel, High Current TTL/CMOS (for driving 50 ohm loads) & Adjustable Output Module
DT15 -Dual Trigger Logic – provides additional trigger via gate input
PS - Power Supply

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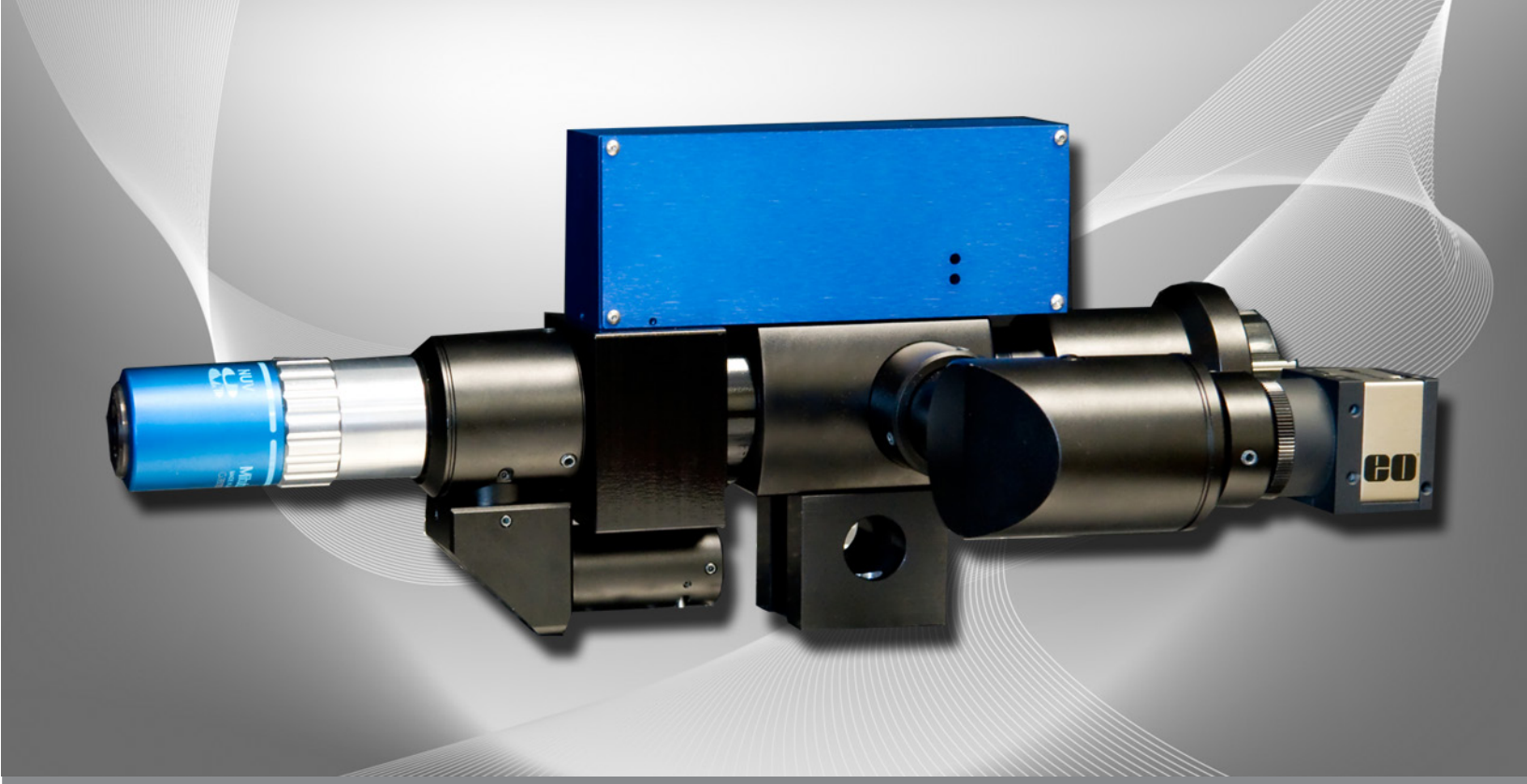

Autofocus AF910

The Quantum Composers Autofocus AF910 combines a proprietary optical configuration with flexible interface architecture to provide a robust autofocus for OEM applications utilizing infinity corrected objectives.

The AF910 can be used on most surfaces:
- Low and high reflectivity
- Specular and diffuse
- Transparent and opaque

Includes patterned surfaces such as TFT arrays, semiconductors and PCBs.

The AF910 provides various interface options:
- RS 232
- Analog output
- Step/ Direction motor drive control
- In focus, in range status, edge detect status

An optional interface adapter may be included which allows for custom electrical interfaces. The sensor I/O signals can be broken out into separate connectors, allowing for integration into existing systems.

Serial communications provides configuration, status and control of the sensor. The sensor can store up to 7 configurations, each optimized for a different objective.

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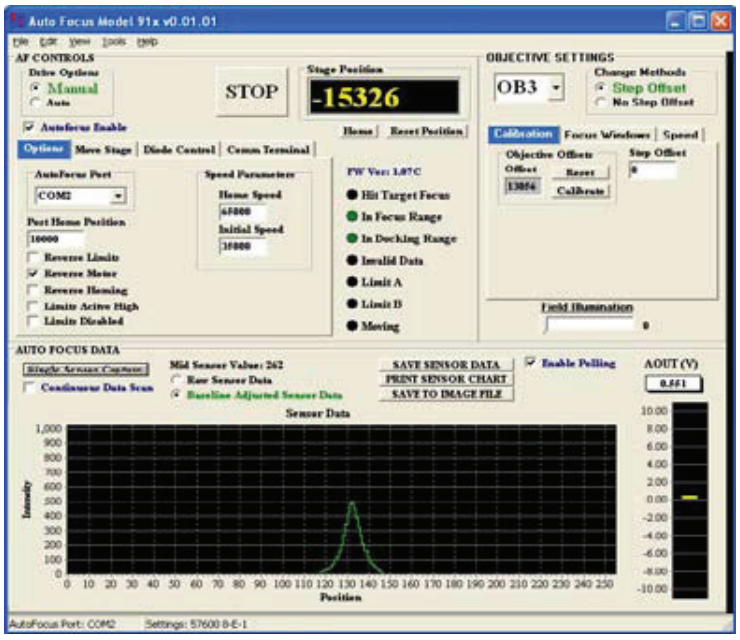
TECHNICAL SPECIFICATIONS

Objective	2x	5x	10x	20x	50x	100x
Focus Repeatability (um)	+/- 6.0	+/- 2.5	+/- 0.5	+/- 0.4	+/- 0.3	+/- 0.2
Focus Accuracy (um)	+/- 20.0	+/- 5.0	+/- 1.0	+/- 0.8	+/- 0.5	+/- 0.3
Resolution (um)	2.00	1.00	0.50	0.20	0.10	0.06
Linear Range (um)	+/- 500	+/- 500	+/- 250	+/- 100	+/- 40	+/- 15
Capture Range (um)	+/- 5000	+/- 3000	+/- 1500	+/- 600	+/- 240	+/- 40

*Preliminary Specifications

Inputs	
Synch	TTL
EMO	TTL
Laser Disable	TTL
Limit A	TTL
Limit B	TTL
Autofocus Control Outputs	
Analog Output	+/- 10 V
Analog Update Rate	1.2 kHz
In Range	Open Collector
In Focus	Open Collector
AF Status	TTL
Motor Control Outputs	
Direction	TTL
Step	TTL
Control Update Rate	1.2 kHz
Max Step Rate	50 kHz
Sensor Unit	
Wavelength	685 nm
Power	+12 VDC 500 mA
Size	51 mm X 37 mm X 132 mm
Communications	
RS-232	Standard



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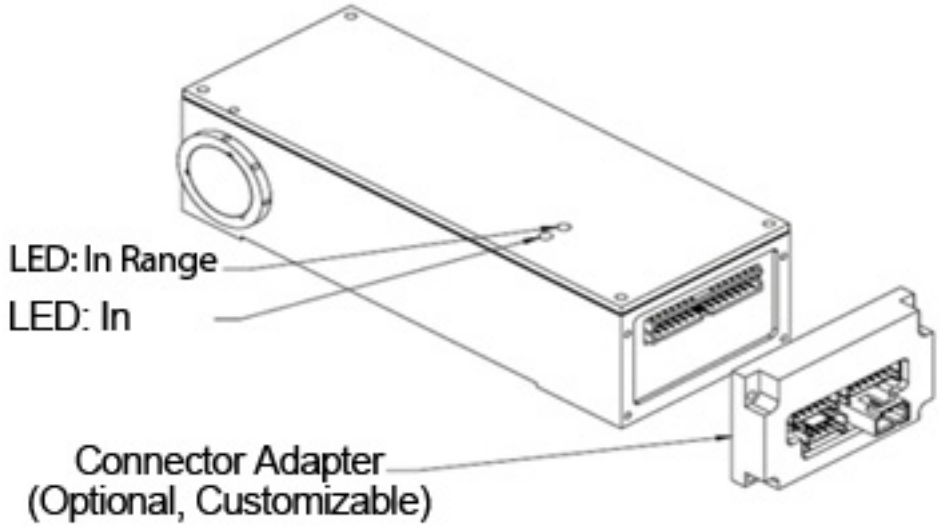
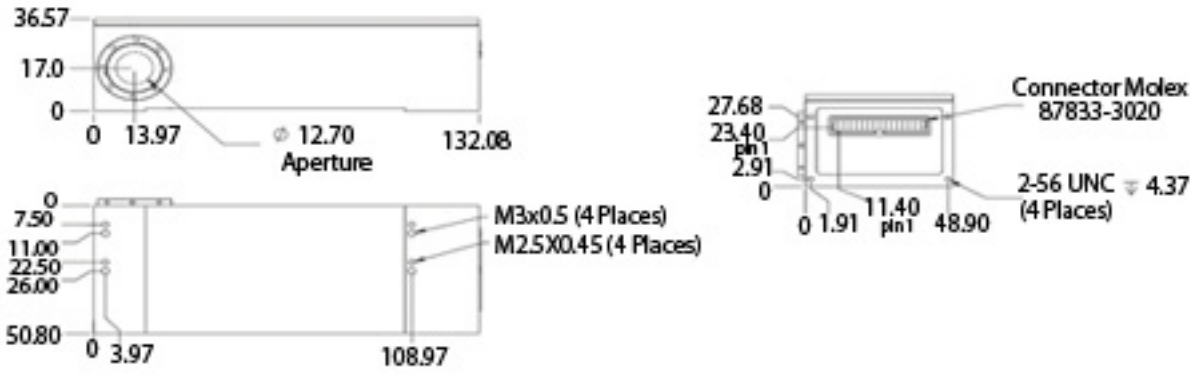
Pin	Definition	Pin	Definition
1	+12VDC	16	GND
2	GND	17	SPARE
3	+12VDC	18	SPARE
4	GND	19	SPARE
5	PH/B	20	+5VDC Ref
6	PHB	21	/LASER_DIS
7	PH/A	22	SYNCH
8	PHA	23	AF_STATUS
9	GND	24	EMO
10	LIMITB	25	GND
11	LIMITA	26	IN RANGE
12	SPARE	27	IN FOCUS
13	SPARE	28	ANALOG OUT
14	RX	29	STEP
15	TX	30	DIR





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1550 Series

Handheld Laser Diode Driver Controller

The model 1550 Laser Diode Driver Controller (LDDC) provides an easy to use method of controlling popular laser diode driver supplies. The LDDC provides all the features needed to fully monitor and control various diode drivers on the market. The LDDC comes in a compact hand-held package that can be powered by an external supply (wall mount) or in some cases can be powered directly from the diode driver supply itself. The unit comes standard with a USB interface for computer control, an easy to read LCD display and a keypad with encoder for parameter adjustments. The interface to the diode driver is a standard density 15 pin d-sub connector.

Base Specifications

- 12 bit resolution on current setting
- Single shot, continuous, burst and CW modes
- Burst shots from 1- 65535
- Repetition rates from 0.1 Hz to 100 KHz
- Adjustable pulse widths from 100 ns to 90 % of period
- 10 bit measurement resolution for compliance voltage and current monitor

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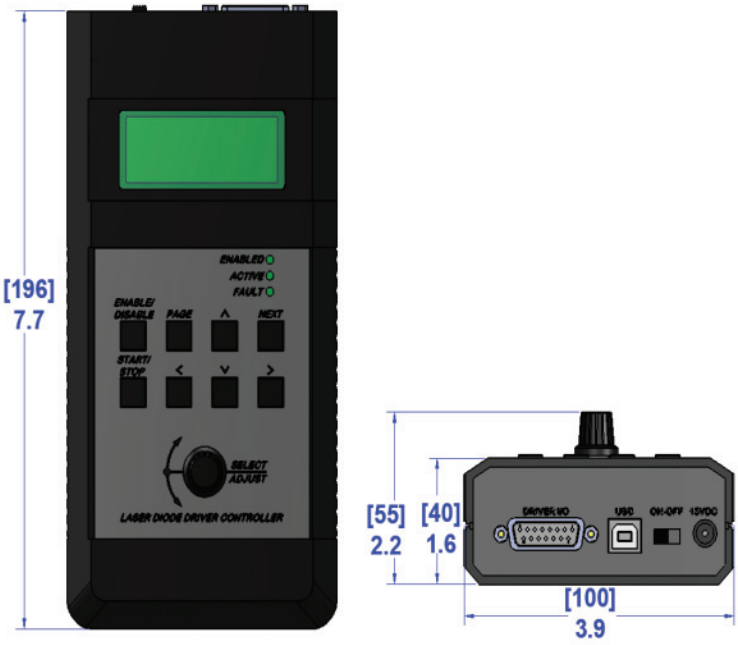

Interface Connection:

- DB15 male standard density

Communication:

- USB 2.0 type B

Power Input:

- +15-24 VDC, 200 ma. from either external wall type or powered from driver

User Interface:

- 8 button keypad
- rotary encoder

Readout Display:

- 16X4 LCD backlit display
- 3 LED status indicators

Driver Compatibility:

- Standard diode drivers with digital and analog control interfaces

*Future options include: board level for OEM integration, ethernet communications, thermistor measurement, photodiode measurement and external trigger with adjustable synch.

#	Name	Type	Description	Range
1	Enable	Output	TTL output to enable diode driver output section	0 V = Off 5 V= On
2	Status Crowbar	Input	Indicates status of crowbar shorting clamp on output.	0 V= Crowbar Off 5 V= Crow On
3	Interlock Control	Output	Open collector output pulled to ground when activated	15 V max @100 mA sourcing.
4	GND	Ground	Signal Ground	
5	V Monitor	Input	Analog input corresponding to driver compliance voltage level	0-10 Vwith 0.01 V resolution.
6	I Monitor	Input	Analog input corresponding to driver current output	0-10 Vwith 0.01 V resolution.
7	I Program	Output	Current level adjustment	0-10 Vwith 0.0024 V resolution.
8	Pulse Control	Output	Pulsing control	0 V = On 5 V= Off
9	GND	Ground	Signal Ground	
10	N/C	Reserved – No connection		
11	Over Temperature	Input	Over temp input from driver.	0 V = Ok 5 V= High Temp
12	N/C	Reserved – No connection		
13	+15 VDC Input*	Power Input		+15 V @ 200 ma
14	+15 VDC Input*	Power Input		+15 V @ 200 ma
15	GND	Ground	Power Ground	