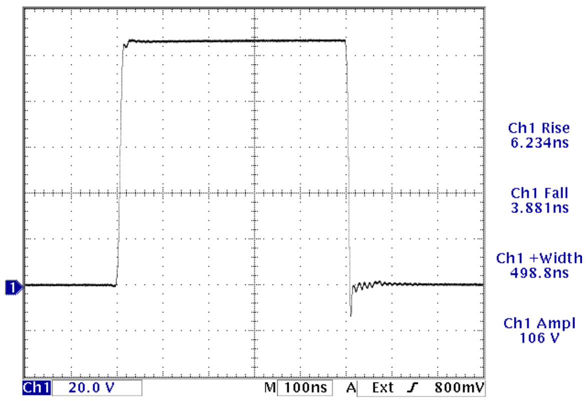


100 kHz, 500 ns, > +100V into 50Ω

- **0 to ±30 V, ±50 V, or ±100 Volts into 50 Ohms**
- **0.5, 2 and 10 ns rise time models**
- **Up to 10 MHz for 50V, and 1 MHz for 100V**
- **2 Amps to a laser diode load (or 4 or 8 Amps with accessory transformers)**
- **General-purpose workhorses**
- **Variable baseline option available**
- **IEEE-488.2 GPIB and RS-232 computer control ports**
- **Ethernet port for VXI-11.3 support**

The AV-1015-B is Avtech's general-purpose ±50V pulse generator, and the AV-1010-B is the general-purpose ±100V model. These models will operate into loads of 50 Ω or higher, and they offer 10 ns rise and fall times (20%-80%).

The more-specialized AV-1011B1-B and AV-1011B3-B models offer faster rise and fall times (100V / 2 ns for the AV-1011B1-B, and 30V / 0.5 ns for the AV-1011B3-B). These faster models *require* a 50 Ω load.

Model AV-1010-B is a fully-featured general-purpose instrument that can be controlled from the user-friendly front-panel keypad and LCD, or by the IEEE-488.2 GPIB, RS-232, and Ethernet computer-control ports. The amplitude of the AV-1010-B can be varied up to ±100V, and the pulse width is adjustable from 20 ns to 10 ms. The output impedance (i.e., the internal resistance in series with the output) can be switched between 2 Ω and 50 Ω (regardless of the output impedance setting, the load impedance must be 50Ω or higher). The rise and fall times are fixed at less than 10 ns (20%-80%).

The AV-1010-B can be triggered four ways: by the internal oscillator (variable from 1 Hz to 1 MHz), by an external TTL pulse applied to a rear-panel BNC connector, by a front-panel pushbutton, or by computer command. In the external trigger mode, the pulse width may be set by the front-panel controls (or the computer interface), or it may be set to track the input trigger pulse width. The maximum duty cycle (100% × Pulse Width / Period) is 10%.

The AV-1015-B has a lower maximum amplitude (±50 Volts), but operates to repetition rates as high as 10 MHz, and duty cycles as high as 25%. The rise and fall times are 10 ns, and the pulse width is variable from 20 ns to 10 ms.

In many applications, the AV-1010-B will serve well as a replacement or alternative for discontinued high-voltage pulse generators from HP, Agilent, Datapulse, and others, including the HP 214A, 214B, HP/Agilent 8114A, and Systron-Donner Datapulse 114A. Avtech also offers higher-voltage models suitable as replacements for Velonex models. Please see the table at the end of this datasheet, and our application brief at:

http://www.avtechpulse.com/appnote/tb18

The 100V model AV-1011B1-B offers much faster rise times (2 ns, instead of 10 ns), with a reduced maximum pulse repetition frequency of 100 kHz and a maximum duty cycle of 5%. The AV-1011B3-B offers even faster rise times (< 500 ps), at lower amplitudes (up to 30V, into 50 Ω). These model require a 50 Ohm load; they will not operate correctly into high-impedance loads.

To allow easy integration into automated test systems, the programming command set is based on the SCPI standard, and LabView drivers are available for download (http://www.avtechpulse.com/labview). All models include memory to store up to four complete instrument setups. The operator may use the front-panel or the computer interface to store a complete "snapshot" of all key instrument settings, and recall this setup at a later time.

All models include IEEE-488.2 GPIB and RS-232 computer-control ports. A standard rear-panel Ethernet connector allows the instrument to be remotely controlled using the VXI-11.3, ssh, telnet, and web protocols. In particular, the VXI-11.3 features allows software like LabView to control an instrument using standard VISA communications drivers and network cabling, instead of using older-style GPIB cabling and GPIB controller cards. For details, see http://www.avtechpulse.com/options/vxi.

The output stages will safely withstand any combination of front-panel control settings, output open or short circuits, and high-duty cycles. An internal power supply monitor removes the power to the output stage for five seconds if an average power overload exists. After that time, the unit operates normally for one second, and if the overload condition persists, the power is cut again. This cycle repeats until the overload is removed. With a 50Ω load the AV-1010-B will operate at duty cycles as high as 10%, but with high impedance loads the duty cycle may be as high as 50%. The output will source up to 2.5A (1.2A for the AV-1015-B) and will automatically shut down if the load current exceeds this value.

All models include a delay feature. The output can be advanced or delayed up to 1 second relative to the SYNC output (the delay must be less than 75% of the period, however). In the Double Pulse mode, the delay setting control the separation between the double pulses, with a minimum pulse separation of 1 us.

A gate input is provided. This input can be set active high or active low, and it can be set to act synchronously or asynchronously.

The AV-1010-B is offered with an offset option, allowing the pulses to be shifted up to ±20V. When generating a pulse with positive amplitude, the offset plus amplitude must remain between 0 and +100V, and when generating a pulse with negative amplitude, the offset plus amplitude must remain between 0 and -100V.

The AV-1010-B may also be used as 2, 4 or 8 Ampere laser diode drivers (1, 2, or 4 Amps for the AV-1015-B) using the methods illustrated on the following page. To supply 2 Amps to a diode load from the AV-1010-B, simply add a 50 Ohm resistor in series with the diode to limit the current and terminate the transmission line. For 4 Amp and 8 Amp applications, Avtech pulse transformers can be used, although the transformers will limit the maximum pulse width. (In general, better waveforms are obtained by using higher voltage pulsers with 50 Ohm resistances, rather than using transformers.) See Technical Brief 7 at http://www.avtechpulse.com/appnote/techbrief7 for typical current-boosted waveforms. Several other relevant application notes (AN-1A, AN-2A, AN-3A, TB2, TB7, TB12) are available for online reading at http://www.avtechpulse.com/appnote.

For high voltage operation into high impedance loads, see the AVR-G and AVR-GHV familes. For higher voltage operation into 50 Ohm loads, see the AVR-3-B, AVR-4-B, AVR-5B-B, AVR-7B-B, and AVR-8A-B families. For higher duty cycles and average powers, consider the AVR-2 series. Please see the selection guide at:

http://www.avtechpulse.com/medium

A parametric search engine at is available online at http://www.avtechpulse.com/pick to assist you in selecting the best pulser for your application.

Model AV-1010-B replaces the older discontinued AV-1011-B model. It is essentially identical to the earlier model, but the AV-1010-B provides an improved pulse width range.

AV-1015-B, FRONT PANEL

AV-1015-B, REAR PANEL

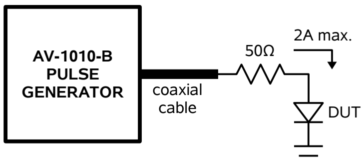
SPECIFICATIONS AV-1010,1011,1015 SERIES

Model[1]:	AV-1015-B	AV-1010-B	AV-1011B1-B	AV-1011B3-B
Amplitude[2,6], with Z_{OUT} = 2Ω: with Z_{OUT} = 50Ω:	≤5 to 50 V ≤1 to 25 V	≤10 to 100 Volts ≤1 to 50 Volts	≤10 to 100 Volts ≤2 to 50 Volts	≤3 to 30 Volts ≤1 to 15 Volts
Pulse width, PW (FWHM)[3]:	20 ns to 10 ms	20 ns to 10 ms	100 ns to 1 ms	100 ns to 10 ms
Rise time (20%-80%)[10]:	≤ 10 ns	≤ 10 ns	≤ 2 ns	≤ 0.5 ns
Fall time (80%-20%)[10]:	≤ 10 ns	≤ 10 ns	≤ 2 ns for ≤ 100 us PW ≤ 8 ns for > 100 us PW	≤ 0.5 ns for ≤ 100 us PW ≤ 5 ns for > 100 us PW
Pulse repetition frequency, PRF:	1 Hz to 10 MHz	1 Hz to 1 MHz	1 Hz to 100 kHz	
Maximum duty cycle:	25% into 50Ω loads 50% into >200Ω[8]	10% into 50 Ω loads, 50% into > 1 kΩ loads	5%	
Output impedance (Z_{OUT})[5]:	≈ 2 Ω or 50 Ω, switchable			
Required load impedance:	≥ 50 Ω		50 Ω	
Output polarity:	Positive or negative, switchable			
DC offset:	0 V, fixed	0V, fixed (Optional[4]: 0 to ±20V, 0.4A max)	0 V, fixed	
Leading edge overshoot (into a non-inductive 50 Ω load):	≤ 8% of maximum rated amplitude for all amplitudes. Typically < 3% at maximum amplitude. Settles to ±3% of stable amplitude within 60 ns.			
Typical pulse-top droop:	dV/dt ≈ I_{OUT}÷4000uF	dV/dt ≈ I_{OUT}÷4000uF	≈ 5% worst-case	
Double pulse mode spacing:	1 us to 1 second (measured between the two leading edges of the pulse doublet). Must not exceed one-half of the period. There must be at least (PW + 100 ns) of "dead time" (no pulsing) between the trailing edge of the first pulse and the leading edge of the second pulse. For instance, if the pulse width is 1 us, the programmed delay between leading edges must be greater than 1 us (the pulse width) + 1.1 us (the minimum dead time) = 2.1 us, and the period must be greater than 4.2 us.			
Sync output:	+3V, >30ns, to ≥50Ω	> +3 Volts, > 50 ns, will drive 50 Ohm loads		
Gated operation:	TTL, synchronous or asynchronous, active high or low, switchable.			
Trigger modes:	Internal trigger, external trigger (TTL-level pulse, > 10 ns, 1 kΩ input impedance), front-panel "Single Pulse" pushbutton, or single pulse trigger via computer command. In the external trigger mode, the pulse width may be set by the instrument, or it may be set to track the input pulse width.			
Variable delay:	Sync to main output: 0 to ±1.0 seconds, for all trigger modes (including external trigger).			
Propagation delay:	≤ 150 ns (Ext trig in to pulse out)			
Jitter:	≤ ± 35ps ± 0.015% of sync delay (sync out to pulse out)			
GPIB and RS-232 control[1]:	Yes, standard feature on all -B units.			
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Included. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.			
LabView drivers:	Available for download at http://www.avtechpulse.com/labview.			
Settings resolution:	The resolution of the timing parameters (pulse width, delay, period) varies, but is always better than 0.15% of (|set value| + 20 ns). The amplitude resolution is < 0.1% of the maximum amplitude.			
Settings accuracy:	Typically ± 3% (plus ±1V or ± 2 ns) after 10 minute warmup, at low duty cycles[7]. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope[9].			
Output protection:	The output is protected against short circuits, open circuits, and high duty cycle			
Connectors, Main output: Other:	BNC female BNC female			SMA female BNC female
Power requirements:	100 - 240 Volts, 50 - 60 Hz			
Dimensions:	100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")			
Chassis material, weight:	Anodized aluminum with blue-gray plastic trim. ≤ 10 kg / 22 lbs. Designed & assembled in North America.			
Temperature range:	+5°C to +40°C			
Optional rack-mount kit:	Add the suffix "-R5" to the model number to include 19" rack mount kit			

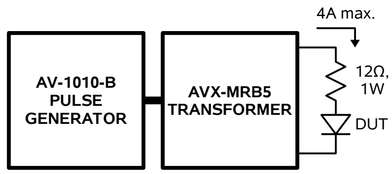
1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude and frequency. See http://www.avtechpulse.com/gpib for details.
2) The output amplitude may also be controlled by applying 0 to +10 V DC to a rear-panel BNC connector.
3) The output pulse width may also be controlled externally by applying a TTL-level trigger of the desired width to a rear-panel BNC connector (PWIN = PWOUT mode).
4) For adjustable (0 to ±20V) DC offset, add -OT to the model number (e.g., AV-1010-B-OT). When generating a pulse with positive amplitude, the offset plus amplitude must remain between 0 and +100V, and when generating a pulse with negative amplitude, the offset plus amplitude must remain between 0 and -100V.
5) This is the *internal* resistance *in series* with the output. It is *not* the load resistance.
6) The output can be set at lower values, but the overshoot may become significant relative to the pulse amplitude at low amplitudes.
7) The amplitude may decrease ~10% relative to the programmed setting if the instrument is operating at or near the maximum specified duty cycle.
8) Subject to the additional limitation that there must be at least 75 ns of "dead time" (no pulsing) between the trailing edge of one pulse and the leading edge of the next pulse.
9) These instruments are provided with a basic calibration checksheet, showing a selection of measured output parameters. These measurements are performed with equipment that is calibrated on a regular basis by a third-party ISO/IEC 17025:2005 accredited calibration laboratory. However, Avtech itself does not claim any accreditation. For applications requiring traceable performance, use a calibrated measurement system rather than relying on the accuracy of the pulse generator settings.
10) Valid into a 50 Ohm load.

Laser Diode Driver Applications

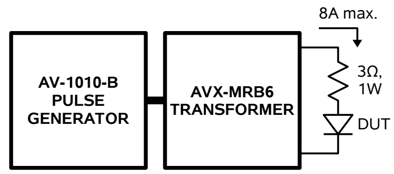
The AV-1010-B can be used as a 2, 4 or 8 Ampere laser diode driver using these configurations:



Use a 50 Ohm resistor to match the laser diode to the AV-1010-B. This limits the current to a safe level for the AV-1010-B, and terminates the coaxial cable to minimize ringing.



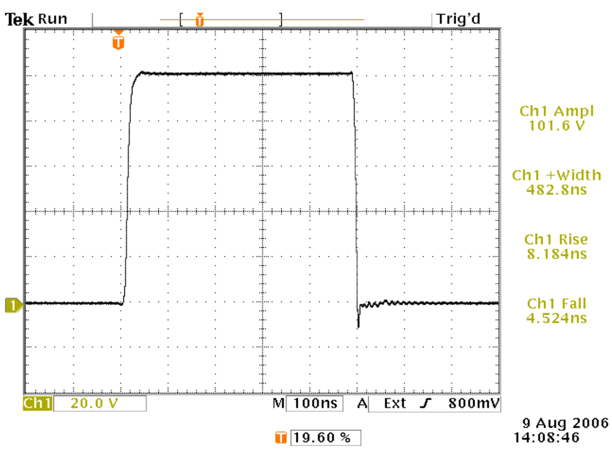
The AVX-MRB5 transformer can be used to double the output current to a maximum of 4 Amps. The load impedance must be reduced by a factor of 4, to 12 Ohms. The maximum pulse width is limited to 10 us.



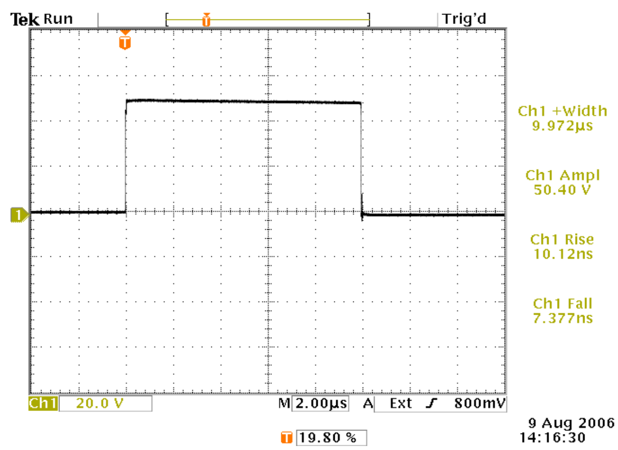
The AVX-MRB6 transformer can be used to quadruple the output current to a maximum of 8 Amps. The load impedance must be reduced by a factor of 16, to 3 Ohms. The maximum pulse width is limited to 10 us.

Similarly, the AV-1015-B can be used as 1, 2 or 4 Ampere laser diode driver using these techniques.

Typical Waveforms



Output of an AV-1010-B into 50 Ohms.
20 V/div, 100 ns/div.



AVX-MRB5 output waveform into 12.5Ω
(50V / 12.5Ω = 4A), when driven by a +100V pulse
from an AV-1010-B. 20 V/div, 2 us/div.

The table below compares the models in this series to the Agilent 8114A. Please also see our application brief at http://www.avtechpulse.com/appnote/tb18.

Avtech AV-1010-B / AV-1015-B, compared to the AGILENT 8114 A

(This is a summary - see page 3 for the definitive detailed specifications of the AV-1010-B, AV-1015)

Model:	AV-1010-B	AV-1015-B	Agilent 8114 A
Pulse output amplitude: (R_L = 50 Ohms)	≤ 10 to 100 Volts (for Z_{out} = 2 Ω) ≤ 1 to 50 Volts (for Z_{out} = 50 Ω)	≤ 5 to 50 Volts (for Z_{out} = 2 Ω) ≤ 1 to 25 Volts (for Z_{out} = 50 Ω)	≤ 2 to 100 Volts (for "HI Z" mode) ≤1 to 50 Volts (for "50 Ohm" mode)
Max load current:	2 Amps (8 Amps possible with AVX-MRB6 Pulse Transformer)	1 Amp (4 Amps possible with AVX-MRB6 Pulse Transformer)	2 Amps
Pulse width (FWHM):	20 ns to 10 ms	20 ns to 10 ms	10 ns to 150 ms
Rise & fall time:	≤ 10 ns, 20%-80%		≤ 12 ns, 10%-90% (for "HI Z" mode) ≤ 7 ns, 10%-90% (for "50 Ohm"mode)
Pulse repetition rate:	1 Hz to 1 MHz	1 Hz to 10 MHz	1 Hz to 15 MHz
Maximum duty cycle:	10% into 50 Ω loads, 50% into > 1 kΩ loads	25% into 50 Ω loads, 50% into > 200Ω loads	16% for maximum output into a 50 Ohm load in "50 Ohm" mode.
Output impedance:	≈ 2 Ω or 50 Ω, switchable		High Impedance or 50 Ω, switchable
Required load impedance:	≥ 50 Ω		50 Ω is required
Output stage configuration:	Voltage source which is highly tolerant to load mismatches, providing for user-friendly operation.		Current source. A 50 Ω load is mandatory, either internally or externally. Will not operate into a high impedance due to the current-source configuration of the output.
Maximum average output power:	20 Watts	12.5 Watts	30 Watts
Output protection:	The output is protected against short and open circuits, and high duty cycles		Protected against power dissipation.
Output polarity:	Positive or negative, switchable		Positive or negative, switchable
DC offset:	0 V, fixed (0 to ± 20 V option)	0 V, fixed	Option, 25 Volts
Jitter:	≤ ± 35ps ± 0.015% of sync delay		Not specified
Pulse aberrations:	Leading edge overshoot ≤ 8% of maximum amplitude. Settles to ±3% of stable amplitude within 60 ns.		< 5% of amplitude
Double pulse mode spacing (leading edges):	100 ns to 1 second		20 ns to 999 ms
Sync to main out delay:	0 to ± 1 second		0 to 999 ms
Sync output:	+3V, 100 ns (R_L > 50Ω)		+2.5V, ~50% duty cycle (R_L > 50Ω)
Gated operation:	TTL, synchronous or asynchronous, active high or low, switchable.		TTL, inhibit on edge or level
External trigger:	TTL (Low = 0V, High = +3V to +5 Volt) pulse, 50 ns or wider.		Adjustable level, +/- 50V
External trigger propagation delay:	< 150 ns		?
Burst mode	Option, 1-500 pulses (see http://www.avtech.com/options/br)		Standard, 1-65536 pulses
GPIB & RS-232 control:	Yes		Yes
Ethernet control:	Included. See http://www.avtechpulse.com/options/vxi.		No
Connectors:	BNC female		BNC female
Power requirements:	100 - 240 Volts, 50 - 60 Hz		100 - 240 Volts, 50 - 60 Hz
Dimensions:	100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")		5.2" x 16.3" x 16.6"
Chassis:	Aluminum, ≤ 10 kg (22 lbs).		?, 14 kg
Temperature range:	+5°C to +40°C	+5°C to +40°C	0°C to +50°C
Optional rack-mount kit:	Yes, -R5 option	Yes, -R5 option	Yes, option 1 CM