

The models in the AV-1010, AV-1011 and AV-1015 series are general-purpose  $\pm 50\text{V}$  and  $\pm 100\text{V}$  pulse generators which, depending on the exact model, can generate pulse widths as narrow as 20 ns or as wide as 10 ms.

Model AV-1011-B is a fully-featured general-purpose instrument that can be controlled from the user-friendly front-panel keypad and liquid-crystal display, or by the IEEE-488.2 GPIB and RS-232 computer-control ports. An Ethernet port for Telnet-based control is optional (-TNT option, <http://www.avtechpulse.com/options/tnt>) on all -B units. The amplitude of the AV-1011-B can be varied from 0 to  $\pm 100\text{V}$ , and the pulse width is adjustable from 100 ns to 1 ms. The output impedance (i.e., the internal resistance in series with the output) can be switched between 2 Ohms and 50 Ohms. The rise and fall times are fixed at less than 10 ns. The AV-1011-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 a computer command. In the external trigger mode, the output 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 ( $100\% \times \text{Pulse Width} / \text{Period}$ ) is 10%.

Model AV-1010-B is identical to the AV-1011-B, except that it operates over a wider pulse width range of 25 ns to 10 ms.

Model AV-1011B1-B offers much faster rise and fall 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-1011B1-B requires a 50 Ohm load (it will not operate correctly into high-impedance loads). Like the AV-1011-B, the AV-1011B1-B includes IEEE-488.2 GPIB and RS-232 computer interfaces.

The AV-1015-B has a lower maximum amplitude ( $\pm 50\text{ Volts}$ ), 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.

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 from the Avtech web site at <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. This simplifies the setup of frequently performed experiments.

The MOSFET 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

- 0 to  $\pm 50\text{ V}$  or  $\pm 100\text{ Volts}$  into 50 Ohms
- 2 ns 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 Telnet control optional

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  $50\Omega$  load the AV-1010-B or AV-1011-B will withstand duty cycles as high as 10%, but with high impedance loads the duty cycle may be as high as 80%. 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. Model AV-1011B1-B is different due to its high speed nature, and it requires a  $50\Omega$  load - it will not function properly into higher or lower impedances.

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 the period, however). In the Double Pulse mode, the delay setting controls the separation between the double pulses (with a minimum pulse separation of 100 ns).

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-1011-B is offered with an offset option, allowing the pulses to be shifted up to  $\pm 20\text{V}$ . (When generating a pulse with positive amplitude, the offset plus amplitude must remain between 0 and  $+100\text{V}$ , and when generating a pulse with negative amplitude, the offset plus amplitude must remain between 0 and  $-100\text{V}$ .) The maximum operating frequency is reduced to 500 kHz when the set offset is greater than  $\pm 10\text{V}$ .

Most models are available with a burst mode option. This allows a burst of 1-500 pulses to be generated in response to a single trigger event. (Normally, a single output pulse is generated in response to each trigger event). More information about this option is available at <http://www.avtechpulse.com/options/br>.

The models in this series 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-1011-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. (The transformers will limit the maximum pulse width.) See Avtech Technical Brief 7 online at (<http://www.avtechpulse.com/appnote/techbrief7>) for typical current boosted waveforms. Several other application notes (AN-1A, AN-2A, AN-3A, TB2, TB7, TB12) directly relevant to this series are available at <http://www.avtechpulse.com/appnote>.

For high voltage operation into high impedance loads, see the AVR-G series (<http://www.avtechpulse.com/medium/avr-g1>). A parametric search engine at <http://www.avtechpulse.com/pick> is available to assist you in selecting the best pulser for your application.



AV-1011-B

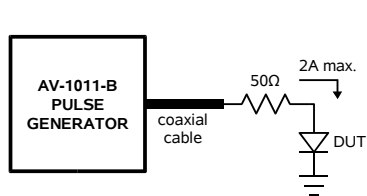
Model <sup>1</sup> :	AV-1015-B	AV-1010-B	AV-1011-B	AV-1011B1-B
Pulse output amplitude <sup>2</sup> : (R <sub>L</sub> = 50 Ohms)	0 to 50 V (for Z <sub>out</sub> =2Ω) 0 to 25 V (for Z <sub>out</sub> =50Ω)	0 to 100 Volts (for Z <sub>out</sub> = 2 Ω) 0 to 50 Volts (for Z <sub>out</sub> = 50 Ω)		
Pulse width (FWHM) <sup>3</sup> :	20 ns to 10 ms	25 ns to 10 ms	100 ns to 1 ms	100 ns to 1 ms
Rise time, fall time (20%-80%):	≤ 10 ns	≤ 10 ns		≤ 2 ns
Pulse repetition rate <sup>6</sup> :	1 Hz to 10 MHz	1 Hz to 1 MHz		1 Hz to 100 kHz
Maximum duty cycle:	25% into 50 Ω loads, 80% into >10 kΩ loads	10% into 50 Ω loads, 80% into >10 kΩ loads		5%
Output impedance:	2 Ω or 50 Ω, switchable			
Required load impedance:	≥ 50 Ω	≥ 50 Ω		50 Ω
Output polarity:	Positive or negative, switchable			
DC offset:	0 V, fixed	0 V, fixed	0V, fixed (Optional <sup>4,5</sup> : 0 to ±20V, 0.4A max)	0 V, fixed
Jitter:	± 35ps ± 0.015% RMS (sync out to pulse out)			
Pulse aberrations:	≤ ± 1V ± 10% of amplitude			
Double pulse spacing:	100 ns to 1 second			
Sync to main output delay:	0 to ± 1 second			
Sync output:	+ 3V, 50 ns (R <sub>L</sub> > 50Ω)	+ 3V, 100 ns (R <sub>L</sub> > 50Ω)		
Burst mode:	Optional <sup>6</sup> . Generates 1-500 pulses per trigger.			
Gated operation:	TTL, synchronous or asynchronous, active high or low, switchable.			
External trigger:	TTL (Low = 0V, High = +3V to +5 Volt) pulse, 50 ns or wider. Input impedance is ≥ 1 kΩ.			
Minimum propagation delay, external trigger modes:	Advance: 200 ns Double pulse: 200 ns Delay: 200 ns PW <sub>IN</sub> = PW <sub>OUT</sub> : 120 ns			
GPB and RS-232 control <sup>1</sup> :	Yes, standard feature on all -B units.			
Telnet / Ethernet control <sup>7</sup> :	Optional. See <a href="http://www.avtechpulse.com/options/tnt">http://www.avtechpulse.com/options/tnt</a> for details.			
Output protection:	The output is protected against short circuits, open circuits, and high duty cycle			
Connectors:	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).			
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			

- B suffix indicates IEEE-488.2 GPB and RS-232 control of amplitude and frequency. See <http://www.avtechpulse.com/gpb> for details.
- The output amplitude may also be controlled by applying 0 to +10 V DC to a rear-panel BNC connector.
- 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 ( $PW_{IN} = PW_{OUT}$  mode).
- For adjustable (0 to  $\pm 20V$ ) DC offset, add -OT to the model number. When generating a pulse with positive amplitude, the offset plus

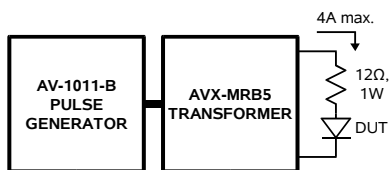
- amplitude must remain between 0 and +100V, and when generating a pulse with negative amplitude, the offset plus amplitude must remain between 0 and -100V.
- The maximum operating frequency is reduced to 500 kHz when the set offset is greater than  $\pm 10V$ .
- Add the suffix -BR to the model number to specify the burst mode option. See <http://www.avtechpulse.com/options/br> for details about this option.
- Add the suffix -TNT to the model number to specify the Telnet / Ethernet control option.

### Laser Diode Driver Applications

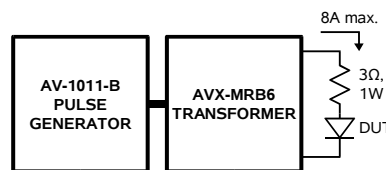
The AV-1010-B, AV-1011-B, or AV-1011B1-B can be used as 2, 4 or 8 Ampere laser diode drivers using these configurations:



Use a 50 Ohm resistor to match the laser diode to the AV-1011-B. This limits the current to a safe level for the AV-1011-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.

See our Applications Notes area of the Avtech web site:  
<http://www.avtechpulse.com/appnote>.