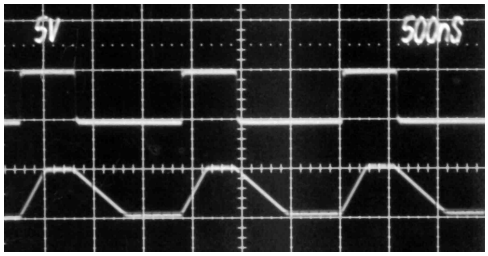
AV-1000-C

50 MHz GENERAL-PURPOSE LAB PULSE GENERATOR WITH 5 ns TO 1 ms VARIABLE RISE TIME



- PRF to 50 MHz
- ±10 Volt output (TTL and ECL outputs also)
- Variable pulse width, 10 ns to 1 sec
- Variable rise & fall times, 5 ns to 1 ms
- Variable delay, to 1.0 sec
- Variable DC offset to ±10 Volts
- Low jitter
- User-friendly front panel

The Avtech model AV-1000-C is a 50 MHz general-purpose laboratory pulse generator providing amplitudes of up to ±10V into loads of 50Ω or higher. It also includes a DC offset function, variable rise and fall times, low jitter, and operating convenience.

In addition to the main output, ECL and TTL outputs (and their complements) are also provided, making the AV-1000-C an ideal pulse source for both digital and analog applications, and for triggering those Avtech instruments which require an external trigger source.

The front panel features simple self-explanatory controls. The output amplitude is controlled by a six-position range switch (±1, ±5 and ±10 Volt ranges) and a one-turn vernier control. 50 Ohm back-matching is provided for the ±1 and ±5 Volt ranges. A one-turn control allows the variation of the base-line or DC offset from 0 to ±10 Volts. The output stages will safely withstand any combination of front panel control settings.

The main output rise and fall times are variable from 5 ns up to 1 ms using a common five-position decade range switch and separate one-turn vernier controls. Similar arrangements control the output pulse width from 10 ns to 1.0 sec and the relative delay between the outputs and the SYNC output from ±25 ns to ±1.0 s. The delay jitter for this model is exceptionally low (≤ ±25 ps). The pulse repetition frequency is variable from 1 Hz to 50 MHz in eight ranges.

An externally-generated TTL-level pulse may also be used to trigger the instrument. A "SINGLE PULSE" push button is also provided. A double pulse mode is available, and a GATE input is provided to enable/disable triggering.

The AV-1000-C requires 100-240V, 50-60 Hz AC power.

Model:	AV-1000-C
PRF:	1 Hz to 50 MHz
Amplitude (to 50 Ohms):	Main output: up to ±10 Volts (adjustable) TTL outputs (normal and inverted): low: 0 to +0.8V, high: +3 to +5V (fixed) ECL outputs (normal and inverted): low: -1.6V, high: -0.8V (fixed)
Pulse width (FWHM):	10 ns to 1.0 sec
Rise time, fall time (20%-80%):	Main: 5 ns to 1 ms, TTL: 5 ns, ECL: 2 ns
Jitter (Sync out to pulse out):	≤ ± 35 ps ± 0.01% of sync delay
DC offset:	±10 Volt range: 0 to ±10 Volts. (Total output voltage can not exceed ±10V.) ±1, ±5 Volt ranges: 0 to ±5 Volts. (Total output voltage can not exceed ±5V.)
Source impedance (main output):	50 Ohms (±1 and ±5 Volt ranges) 2 Ohms (±10 Volt range)
Polarity (main output):	Positive or negative (switch-selectable)
Duty cycle (max):	PRF ≤ 10 MHz: 80% , ≤ 40 MHz: 60%, 50 MHz: 40%
Waveform aberrations:	Overshoot, undershoot, and ringing are < ± 5% at amplitudes of > 300 mV, with outputs terminated in 50 Ohms.
Trigger required (Ext trig mode):	TTL levels (low: 0 to +0.8V, high: +3 to +5V), 4 ns or wider. 1 kΩ input impedance.
Trigger required (Gate in):	0 to +0.8 V (or grounded): No output +3V to +5 V (or open): Normal output
Propagation delay:	< 75 ns (Ext trig in to main out, with sync delay set to minimum)
Sync delay:	±25 ns to ±1.0 sec (Sync out to main out)
Sync output:	+3 Volts, 10 ns, will drive 50 Ohm loads
Single pulse mode:	manual push-button
Signal connectors:	BNC
Power requirement:	100 - 240 Volts, 50 - 60 Hz
Dimensions (H x W x D):	100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")
Chassis, temperature range:	Anodized aluminum, with blue plastic trim. +5°C to +40°C

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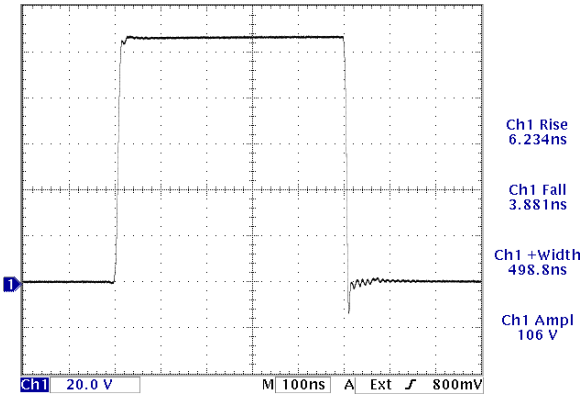
AVTECH

GPIB
IEEE-488

AV-1010, AV-1011, AV-1015 SERIES

30 / 50 / 100 VOLT, 0.5 / 2 / 10 ns RISE TIME GENERAL-PURPOSE PULSE GENERATORS AND LASER DIODE DRIVERS



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**
- **Optional 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 and RS-232 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 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-1011B3-B offers even faster rise and fall 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. The -VXI option adds a rear-panel Ethernet connector, allowing an 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 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-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

GPIB IEEE-488

SPECIFICATIONS AV-1010,1011,1015 SERIES

Model[1]:	AV-1015-B	AV-1010-B	AV-1011B1-B	AV-1011B3-B
Amplitude[2,7], 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 (FWHM)[3]:	20 ns to 10 ms	20 ns to 10 ms	100 ns to 1 ms	100 ns to 10 ms
Rise & fall time (20%-80%):	≤ 10 ns	≤ 10 ns	≤ 2 ns	≤ 0.5 ns
Pulse repetition rate:	1 Hz to 10 MHz	1 Hz to 1 MHz[5]	1 Hz to 100 kHz	
Maximum duty cycle:	25% into 50Ω loads 50% into >200Ω	10% into 50 Ω loads, 50% into > 1 kΩ loads	5%	
Output impedance (Z_{OUT})[6]:	≈ 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[4,5]: 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:	100 ns to 1 second (measured between the two leading edges of the pulse doublet)[8]			
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:	Optional[5]. 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[9]. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.			
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) Add the suffix -VXI to the model number to specify the Ethernet port.
6) This is the *internal* resistance *in series* with the output. It is *not* the load resistance.
7) The output can be set at lower values, but the overshoot may become significant relative to the pulse amplitude at low amplitudes.
8) The time between the trailing edge of the first pulse and the leading edge of the second pulse (the "dead time" when the output voltage is zero) must be equal to or greater than the set pulse width plus 100 ns. 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.
9) The amplitude may decrease ~10% relative to the programmed setting if the instrument is operating at or near the maximum specified duty cycle.

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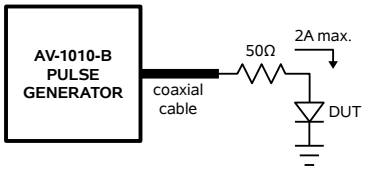
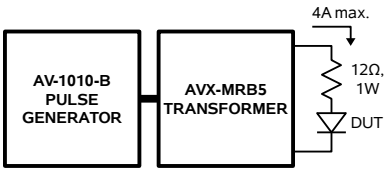
Laser Diode Driver Applications

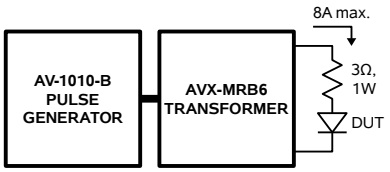
The AV-1010-B can be used as a 2, 4 or 8 Ampere laser diode driver using these configurations:



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.



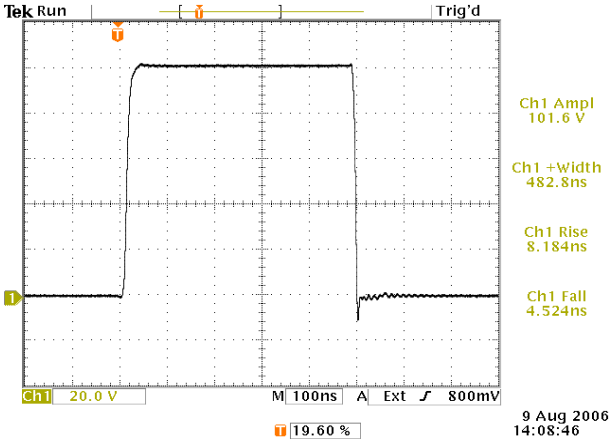
The AVX-MRB5 transformer can be used to double the output current to a maximum of 4 Amps. The load impedance must be reduced by a factor of 4, to 12 Ohms. The maximum pulse width is limited to 10 us.



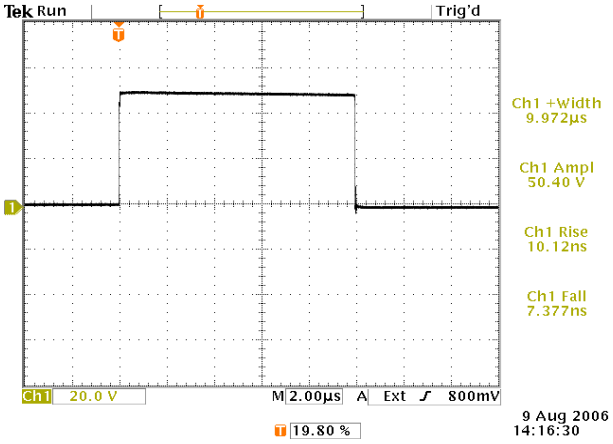
The AVX-MRB6 transformer can be used to quadruple the output current to a maximum of 8 Amps. The load impedance must be reduced by a factor of 16, to 3 Ohms. The maximum pulse width is limited to 10 us.

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.

Avtech has been in business since 1975, and in that time many large companies have discontinued all or part of their pulse generator offerings. Fortunately, Avtech can provide alternatives for many discontinued models from HP, Agilent, Velonex, Systron-Donner, and other manufacturers!

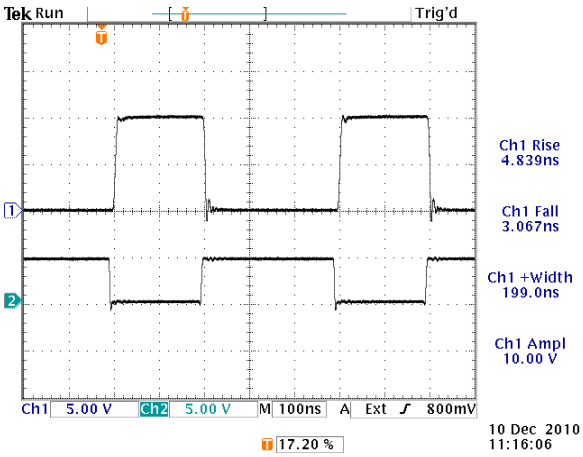
The table below compares the models in this series to the Agilent 8114A. Please also see our application brief at http://www.avtechpulse.com/appnote/tb18.

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

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:	Optional. 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

AV-1020-C SERIES

10 MHz, ±10 VOLT
GENERAL-PURPOSE
LAB PULSE-DELAY GENERATORS



Top: Main OUT, +10V, 2 MHz, 200 ns, into 50Ω.
Bottom: NOT-TTL out.
Both: 5 V/div, 100 ns/div.

- ± 10 Volt output (TTL and ECL also) into 50Ω
- Variable DC offset to ± 10 Volts
- 10 ns rise and fall times
- Low jitter and variable delay
- User-friendly front panel

Model AV-1020-C is a full-featured, 10 MHz high-performance general-purpose lab pulse generator providing 0 to ±10 Volts, 10 ns rise time, single and double-pulse modes, variable DC offset, variable delay, ECL and TTL outputs (and their complements!), self-explanatory front panel controls and a heavy-duty metal chassis for low emissions and decades of trouble-free service. This is a versatile, cost-effective pulse source for many digital and analog applications in industrial and academic fields.

The output amplitude is controlled by a 3 position range switch (1, 5 and 10 Volts) and a one-turn control. Output polarity is controlled by a two-position switch. 50 Ohm back-matching is provided for the 1 and 5 Volt ranges.

A one-turn control allows the variation of the base line or DC offset from 0 to ±10 Volts.

The output pulse width (and delay) is variable from 50 ns to 0.5 sec via a seven-position range switch and a one-turn control. The pulse width may also be set to the "DC" mode, allowing the AV-1020-C to be used as a variable ±10 Volt, 200 mA DC power supply.

The pulse repetition frequency is variable from 1 Hz to 10 MHz in seven ranges. An externally applied TTL level pulse may also be used to control the output PRF and in addition the unit includes a “SINGLE PULSE” push button. A double pulse mode is available and a GATE input is provided for synchronous control of the internal triggering.

The logic and logic-complement outputs provide either TTL or ECL signals, depending on the TTL/ECL switch position.

The AV-1020-C operates from 100-240V, 50-60 Hz AC power.

For customers in the USA, a narrower-width version is also available (model AV-1020X-C), until stocks are depleted. At that time, it will be superseded by the full-width AV-1020-C.

See the AV-1023-C for a dual-channel version (http://www.avtechpulse.com/general/av-1023).

See the AV-1021-B for a GPIB-equipped version (http://www.avtechpulse.com/general/av-1021).

Avtech's full line of general-purpose pulse generators is summarized here:

http://www.avtechpulse.com/general

AV-1020X-C

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GPIB IEEE-488

SPECIFICATIONS AV-1020-C SERIES

Model:	AV-1020-C[1]	AV-1020X-C[2]
Number of channels out:	One main output, plus 4 logic outputs: TTL, NOT TTL, ECL, NOT ECL	
PRF:	1 Hz to 10 MHz	
Amplitude (to 50 Ohms):	Main out: ±0.25 to ±10 Volts TTL low: 0 to +0.7V, high: +3V to +5V ECL low: -1.6V approx., high: -0.8V approx.,	
Pulse width (FWHM):	50 ns to 0.5 sec, or DC	
Rise, fall times (20%-80%):	Main: ≤ 10 ns, TTL: ≤ 5 ns, ECL: 2 ns	
DC offset:	10 Volt range: 0 to ± 10 V 1, 5 Volt ranges: 0 to ± 5 V	
Source impedance (main output):	50Ω (1, 5 V ranges), 1Ω (10 V range)	
Polarity (main output):	Positive or negative (two-position selector switch)	
Duty cycle (max):	80% (100% in PW DC mode)	
Waveform aberrations:	Overshoot, undershoot, ringing and slope aberration are less than the larger of ±5% or 100 mV at amplitudes of 500 mV and higher with outputs terminating in 50 Ω.	
Propagation delay:	70 ns to 0.5 sec (Ext trig in to pulse out)	
Trigger required: (Ext trig mode)	+ 5 Volts, ≥ 4 ns (TTL). Trigger input impedance: 50 Ω	
Gate input:	0 to +0.7 V: No output +3 to +5 V (or open): normal out	
Sync delay, jitter:	35 ns to 0.5 sec, ≤ ± 50 ps or ± 0.05% (sync out to pulse out)	
Sync output:	+2 Volts, 50 ns, will drive 50 Ohm loads	
Single pulse mode:	Manual push button	
Signal connectors:	BNC	
Power requirement:	100 - 240 Volts, 50 - 60 Hz	120/240 Volts (switchable), 50 - 60 Hz
Dimensions (H x W x D):	100 x 430 x 375 mm (3.9" x 17" x 14.8")	100 mm x 215 mm x 375 mm (3.9" x 8.5" x 14.8")
Rack-mount kit option:	Add -R5 to model number	N/A
Weight & chassis material:	4.5 kg (10 lbs), anodized aluminum, with blue-grey plastic trim	
Temperature range:	+5°C to +40°C	

1) In full production. Supersedes models AV-1020X-C and AV-1022-C.
2) Limited availability at reduced pricing while existing stocks are depleted. The "half-rack-width" (8.5 inches) chassis style is being phased out. Only available in USA. For other countries, consider the "full-rack-width" (17 inches) AV-1020-C or AV-1002-C models.

AV-1020-C

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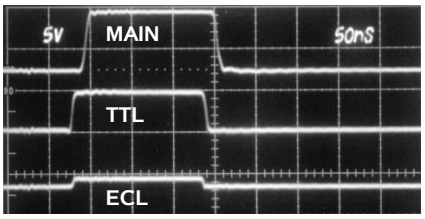
AV-1021, AV-1041 SERIES

±10V AND ±20V
SINGLE AND DUAL CHANNEL
GENERAL-PURPOSE PULSE GENERATORS



- IEEE-488.2 GPIB (and RS232) control standard
- Ethernet is optional
- AV-1021-B: ±10 Volt / 5 MHz / 10 ns rise time
- AV-1041-B: ±20 Volt / 100 kHz / 100 ns rise time
- Variable DC offset
- Variable delay with low jitter
- Dual channel versions

Model AV-1021-B is a general-purpose 5 MHz lab pulse generator which includes IEEE-488.2 GPIB (and RS-232) computer control of amplitude, polarity, DC offset, pulse width, pulse repetition frequency, trigger mode and delay.

This instrument features a front panel keyboard and adjust knob control of the output pulse parameters along with a four line by 40 character back-lit LCD display of the output amplitude, polarity, pulse width, pulse repetition frequency, DC offset and delay.

The output pulse amplitude and the DC offset are both variable up to ±10V. The output impedance can be set at 50Ω (for transmission-line backmatching) or at 2Ω for maximum output voltage. (The amplitude and offset are reduced by a factor of two when the 50Ω setting is used with a 50Ω load.) The instrument can be triggered by its own internal clock, by an external TTL-level signal, by the front-panel "Single Pulse" pushbutton, or by a computer command. The internal clock is variable from 1 Hz to 5 MHz. A double pulse mode is available and a gate input is provided for synchronous or asynchronous control of the triggering. The output pulse width is variable from 20 ns to 0.5 sec, and the delay is variable up to 1 second. The rise time of the main output is less than 10 ns (or less than 5 ns with the -TR option). The unit also provides logic and logic-complement outputs, which may be set to operate at TTL or ECL logic levels (into 50 Ohms or higher).

Model AV-1021D-B is similar to the AV-1021-B, but provides two independent 0 to ±10 Volt output channels. The two channels have separate pulse width, amplitude and polarity controls. One channel has adjustable delay, and one channel is synchronous with the sync output.

The AV-1041-B and AV-1041D-B offer higher amplitudes (up to ±20V) at PRFs up to 100 kHz, with 100 ns rise and fall times. The AV-1041D-B is the dual-channel version.

All models can be triggered by the internal oscillator, by an external TTL pulse, by a front-panel pushbutton, or by computer command. All models include a gate input that can be used to inhibit triggering. A SYNC output is provided for oscilloscope triggering purposes.

The -VXI option adds a rear-panel Ethernet connector, allowing an 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 more details, see http://www.avtechpulse.com/options/vxi.

For applications requiring sub-nanosecond rise times, consider the AV-1030 series described at:

http://www.avtechpulse.com/general/av-1030

For applications not requiring GPIB computer control, see the general-purpose models AV-1000-C, AV-1020-C, or AV-1023-C at:

http://www.avtechpulse.com/general

AV-1021D-B

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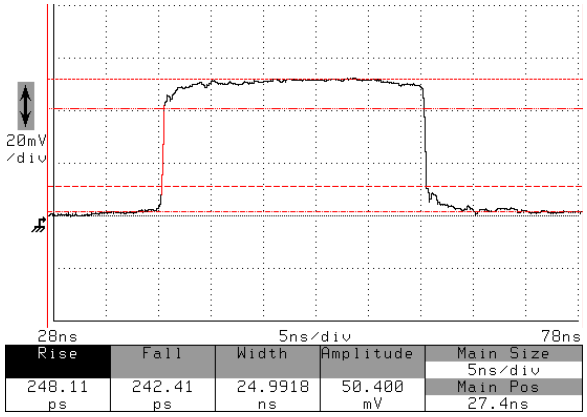
Model[1]:	AV-1021-B	AV-1021D-B	AV-1041-B	AV-1041D-B
Number of main output channels:	1	2	1	2
Auxiliary logic-level outputs (for each channel):	Two: Logic and Logic-Inverted. May be set to operate at TTL or ECL levels.			
Amplitude and peak output (to 50 Ohms)[2]:	Main output (when Z_{OUT}=2Ω): < ±0.5 to ±10 V Main output (when Z_{OUT}=50Ω): < ±0.25 to ±5 V Logic outputs (nominally): TTL: 0 and +5V, ECL: -0.8V and -1.6V.		Main output (when Z_{OUT}=2Ω): < ±1 to ±20 V Main output (when Z_{OUT}=50Ω): < ±0.5 to ±10 V Logic outputs (nominally): TTL: 0 and +5V, ECL: -0.8V and -1.6V.	
Pulse repetition frequency (PRF):	1 Hz to 5 MHz		1 Hz to 100 kHz	
Pulse width (FWHM):	20 ns to 0.5 sec, or DC	30 ns to 0.5 sec	200 ns to 0.5 sec, or DC	200 ns to 0.5 sec
Rise and fall times: (20%-80%)	Main: ≤ 10 ns standard, 5 ns optional[4] TTL: ≤ 5 ns ECL: ≤ 2 ns		Main: ≤ 100 ns TTL: ≤ 5 ns ECL: ≤ 2 ns	
Adjustable DC offset[2]:	0 to ±10 V for Z_{OUT}=2Ω, 0 to ±5 V for Z_{OUT}=50Ω		0 to ±20 V for Z_{OUT}=2Ω, 0 to ±10 V for Z_{OUT}=50Ω	
Parasitic DC offset:	< ±100 mV		< ±200 mV	
Source impedance Z_{OUT}:	Main output: 2Ω or 50Ω, switchable[2]. This is the impedance in series with the output internally (not the load impedance).			
Required load impedance:	≥ 50Ω			
Duty cycle (maximum):	70% (100% in PW DC mode, if applicable)			
Waveform aberrations:	Overshoot and ringing are less than ≤ 15% at amplitudes of 1 V and higher with outputs terminating in 50Ω.			
Propagation delay:	< 150 ns (Ext trig in to pulse out, with delay set to zero)			
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.			
Trigger required (Gate in):	TTL, synchronous or asynchronous, active high or low	TTL, synchronous, active high or low	TTL, synchronous or asynchronous, active high or low	TTL, synchronous, active high or low
Delay jitter:	≤ ± 35ps ± 0.015% RMS (sync out to pulse out)			
Delay:	0 to ±1 sec (sync out to pulse out)	Channel 1: follows sync pulse by 0 to 1 sec Channel 2: synchronous with sync pulse	0 to ±1 sec (sync out to pulse out)	Channel 1: follows sync pulse by 0 to 1 sec Channel 2: synchronous with sync pulse
Sync output:	> +3 Volts, > 50 ns, will drive 50 Ohm loads			
Double pulse mode:	Yes	Channel 1 only	No	
Signal connectors:	BNC. Main outputs and Sync are on the front panel. Logic outputs & Gate & Trig inputs are on the rear.			
GPIB and RS-232 control:	Included. See http://www.avtechpulse.com/gpib for details.			
LabView Drivers:	Check http://www.avtechpulse.com/labview for availability and downloads			
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	Optional[3]. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.			
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 ±0.1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.			
Power requirement:	100 - 240 Volts, 50 - 60 Hz			
Dimensions, Weight, Chassis:	100 x 430 x 375 mm (3.9” x 17” x 14.8”), 10 kg (22 lbs), anodized aluminum with blue-gray plastic trim			
Temperature range:	+5°C to +40°C			

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) Peak output = amplitude + offset. The amplitude and offset can not be set to maximum at the same time, or the peak output rating will be exceeded.
3) Add the suffix -VXI to the model number to specify the Ethernet port.
4) Add the suffix -TR to the model number to specify the 5 ns rise time option.

AV-1030 SERIES

300 ps RISE TIME
GENERAL PURPOSE
LAB PULSE GENERATORS



Rise	Fall	Width	Amplitude	Main Size 5ns/div
248.11 ps	242.41 ps	24.9918 ns	50.400 mV	Main Pos 27.4ns

A +5V, 25 ns waveform

- PRF to 10 MHz
- Amplitudes to ±5 Volts
- 300 ps rise time, 350 ps fall times
- Low jitter and variable delay
- IEEE-488.2 GPIB and RS-232 control, or manually controlled instruments
- Optional ethernet port for VXI-11.3 support

The AV-1030 family of pulse generators offer very high performance in an easy-to-use general-purpose lab instrument format. The AV-1030-C uses front-panel range switches and analog dials to control all settings. The AV-1030-B has a front-panel keypad and liquid crystal display, and IEEE-488.2 GPIB and RS-232 computer-control ports. Settings can be changed using the front-panel menus, or by computer commands sent over the GPIB or RS-232 ports.

Models AV-1030-C and AV-1030-B are both high-performance pulse generators providing 300 ps rise time, repetition rates to 10 MHz, amplitudes of 0 to ±5 Volts, pulse widths of 10 ns to 1 ms, low jitter, variable delay, and a sturdy metal chassis.

The amplitude of the AV-1030-C is controlled by a six-position range switch (±0.5, ±1.5 and ±5 Volts) and a one-turn fine control. The output impedance in the lower ranges is 50 Ohms, providing transmission-line back-matching for low distortion. The output pulse width is variable using a five-position range switch and a one-turn fine control. The pulse repetition frequency is variable from 1 Hz to 10 MHz in seven decade ranges.

Both models include logic-level outputs. These outputs share the same timing as the main output, but have fixed logic-level amplitudes. Both can drive 50 Ω loads.

The AV-1030-B includes a complete computer control interface (see http://www.avtechpulse.com/gpib). This provides GPIB and RS-232 computer control, as well as front-panel keypad and adjust knob control of the output pulse parameters. A large backlit LCD displays the output amplitude, polarity, frequency, pulse width, and delay. To allow easy integration into automated test systems, the programming command set is based on the SCPI standard. A LabView driver is available for download at www.avtechpulse.com/labview.

The -VXI option for the AV-1030-B adds a rear-panel Ethernet connector, allowing an 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 more details, see http://www.avtechpulse.com/options/vxi.

Both models can be triggered by the internal oscillator, by an external TTL pulse, or by a front-panel pushbutton. The AV-1030-B may also be triggered by computer command. Both models include a gate input that can be used to inhibit triggering. A SYNC output is provided for oscilloscope triggering purposes. The delay between the main output and the SYNC output is variable. The SYNC output may be set to precede or to lag the main output.

The maximum duty cycle for both models is 10%, and the outputs are AC-coupled. A 50Ω load is required. To add a DC offset to the output, consider using the AVX-T series (http://www.avtechpulse.com/bias) of bias tees.

For higher duty cycle or lower speed applications, consider the AV-1000-C, AV-1020-C, and AV-1021-B families (http://www.avtechpulse.com/general).

AV-1030-B

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GPIB IEEE-488

SPECIFICATIONS AV-1030 SERIES

Model:	AV-1030-C	AV-1030-B
GPIB and RS-232 control:	no	yes
Amplitude (main output)[1]:	±0.2 to ±5 Volts, adjustable	±0.05 to ±5 Volts, adjustable
Logic outputs:	One TTL[5], and one ECL[6] (both non-inverted)	One non-inverted and one inverted. TTL[5] and ECL[6] modes (switchable).
Required load impedance:	50 Ohms[4].	
Output impedance:	At amplitudes of < ±1.5V: 50 Ω, approximately At amplitudes of > ±1.5V: << 50 Ω.	
Rise time (20%-80%):	≤ 300 ps	
Fall time (80%-20%):	≤ 350 ps	
PRF:	1 Hz to 10 MHz	
Pulse width (FWHM)[2]:	10 ns to 1 ms	
Jitter:	≤ ± 25 ps ± 0.01 % of Sync delay (SYNC out to main OUT)	
Polarity (main output):	Positive or negative, switchable	
Duty cycle (max):	10 %	
Waveform aberrations:	Overshoot, undershoot, and ringing are less than ±20% at amplitudes of 0.5V and higher[1] with outputs terminating in 50 Ohms.	
Droop:	≤ 10% at maximum pulse width	
Trigger required:	External trigger mode: TTL levels[5], ≥ 4 ns width	
Gate input:	TTL low: No output. TTL high (or unconnected): Normal output	
Propagation delay:	< 100 ns (Ext Trig to Out)	
Sync delay:	± 50 ns to ± 1 ms	0 to ± 1 second
Sync output:	+3 Volts, 50 ns, will drive 50 Ohm loads	
Single pulse mode:	Yes, push-button controlled	
Signal connectors:	Main output: SMA. Other: BNC	
LabView Drivers:	AV-1030-B only: Check http://www.avtechpulse.com/labview for availability	
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:	AV-1030-B only: Optional[3]. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.	
Settings resolution: (AV-1030-B only)	The resolution of the timing varies, but is always better than 0.15% of the set value. The amplitude resolution is typically 0.02% of the maximum amplitude.	
Settings accuracy: (AV-1030-B only)	Typically ±3% (plus ±50mV or ±2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope.	
Power requirement:	100 – 240 V, 50 - 60 Hz	
Dimensions (H x W x D):	100 mm x 430 mm x 375 mm (3.9” x 17” x 14.8”)	
Chassis material:	Anodized aluminum, with blue plastic trim	
Temperature range:	+5°C to +40°C	
Optional rack-mount kit:	Add the suffix "-R5" to the model number to include the 19" rack mount kit	
Optional accessory kit:	Add the suffix "-AK1" to the model number to include the recommended accessory kit. Consists of three SMA, 18 GHz, 2 Watt attenuators (10, 20 & 30 dB) for use on the output, and two 50 Ohm, 1 GHz, 1 Watt feed-through terminators (one SMA, one BNC) for use on external trigger inputs.	

1) For operation at lower amplitudes, best results will be obtained by setting the amplitude near maximum and using external attenuators on the output. Suitable attenuators are available in the optional accessory kit.
2) The pulse width may vary by ± 5 ns as the amplitude is varied.
3) Add the suffix -VXI to the model number to specify the Ethernet port.
4) A 50 Ohm load is required. Other loads may damage the instrument. Consult Avtech (info@avtechpulse.com) if you need to drive other load impedances.
5) TTL levels: low = 0 to +0.8V, high = +3 to +5V (fixed)
6) ECL levels: low = -1.6V high: -0.8V (fixed)

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